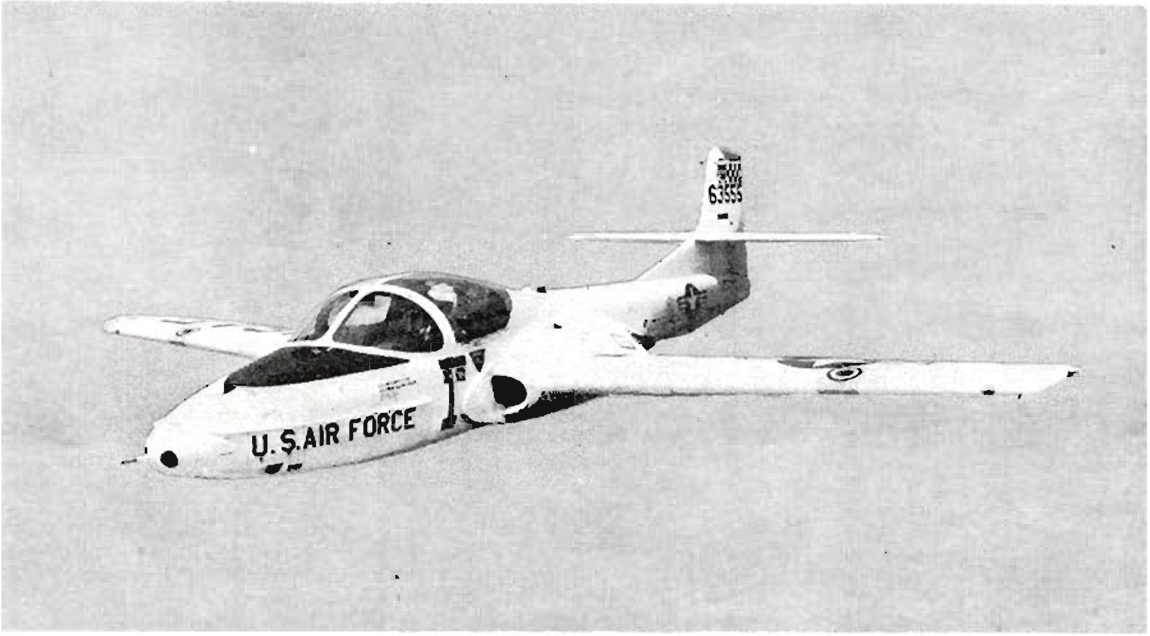
USAF SERIES T-37B AIRCRAFT

CONTRACT F33657-67-C-0822
CONTRACT F41608-82-D-A097

FLIGHT MANUAL



BASIC AND ALL CHANGES HAVE BEEN MERGED TO MAKE THIS A COMPLETE PUBLICATION.

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

REFER TO BASIC INDEX T.O. 0-1-1-5 AND SUPPLEMENTS THERETO FOR THE CURRENT STATUS OF FLIGHT MANUALS, SAFETY AND OPERATIONAL SUPPLEMENTS AND FLIGHT CREW CHECKLIST.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

1 JULY 1982

CHANGE 2 – 1 JULY 1984

LIST OF EFFECTIVE PAGES

Insert latest changed pages; dispose of superseded pages in accordance with applicable regulations.

NOTE: On a changed page, the portion of the text affected by the latest change is indicated by a vertical line, or other change symbol, in the outer margin of the page. Changes to illustrations are indicated by miniature pointing hands. Changes in wiring diagrams are indicated by shaded areas.

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USAF

CURRENT FLIGHT CREW CHECKLIST
T.O. 1T-37B-1CL-1
1 JULY 1982
CHANGE 2 — 1 JULY 1984

...table of contents......

DON'T GAMBLE WITH YOUR LIFE

SCOPE

This manual contains information which will provide you with a general knowledge of the aircraft, its characteristics and specific, normal and emergency operating procedures. Your flying experience is recognized; therefore, basic flight principles are avoided. More detailed technical information on aircraft systems is contained in the T.O. 1T-37B-2 series technical orders.

SOUND JUDGEMENT

Instructions in this manual are for a pilot inexperienced in the operation of these airplanes. This manual provides the best possible operating instructions under most circumstances, but it is not a substitute for sound judgment. Multiple emergencies adverse weather, terrain, etc. may require modification of the procedures.

PERMISSIBLE OPERATIONS

The flight manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations which exceed the limitations specified in this manual are prohibited. Clearance must be obtained from San Antonio ALC/MMSRE, Kelly AFB, Texas 78241, through the respective major command before any questionable operation is attempted.

HOW TO BE ASSURED OF HAVING LATEST DATA

Refer to T.O. 0-1-1-5 for a listing of all current flight manuals, safety supplements, operational supplements, and checklist. Also, check the flight manual cover page and status pages attached to formal safety and operational supplements.

STANDARDIZATION AND ARRANGEMENT

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

SAFETY AND OPERATIONAL SUPPLEMENTS

Safety and Operational Supplements are used to get information to you in a hurry. Safety supplements concern safety of flight items. Operational supplements are issued as an expeditious means of reflecting information when mission essential operational procedures are involved. Supplements are issued by teletype (interim) or by printed copy (formal) depending upon the urgency. Supplements are numbered consecutively. File supplements in reverse numerical order in the front of the Flight Manual.

CHECKLISTS

The flight manual contains amplified normal and emergency procedures. A checklist, containing abbreviated or condensed procedures, has been issued as a separate technical order. See the A page of this manual and the latest supplement flyleaf for the current applicable checklist. If an interim safety or operational supplement affects a checklist, write in the applicable change on the affected checklist. Within 10 days, a formal supplement will be issued with the revised checklist page attached.

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 will result in damage to equipment if not carefully followed.

Note

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

SHALL, WILL, SHOULD AND MAY

In technical orders, the words "shall" or "will" are to be used to indicate a mandatory requirement. The word "should" is to be used to indicate a nonmandatory desire or preferred method of accomplishment. The word "may" is to indicate an acceptable or suggested means of accomplishment.

YOUR RESPONSIBILITY - TO LET US KNOW

Every effort is made to keep the Flight Manual current. However, we cannot correct an error unless we know of its existence. It is essential that you do your part. Any comments, questions, or recommendations should be forwarded on AF Form 847 through your Command Headquarters, to: San Antonio ALC/MMSRE, Kelly AFB, Texas 78241.

HOW TO GET PERSONAL COPIES

Each flight crew member is entitled to personal copies of the flight manual, supplements, and checklist. Contact your publication distribution officer to fill your technical order request.

CHANGE SYMBOLS

Changes to text and tables in the manual are indicated by a vertical black line in the margin which extends along the entire length of the area affected.

Changes to illustrations, charts and tables are indicated by miniature pointing hands. Change symbols are not shown for:

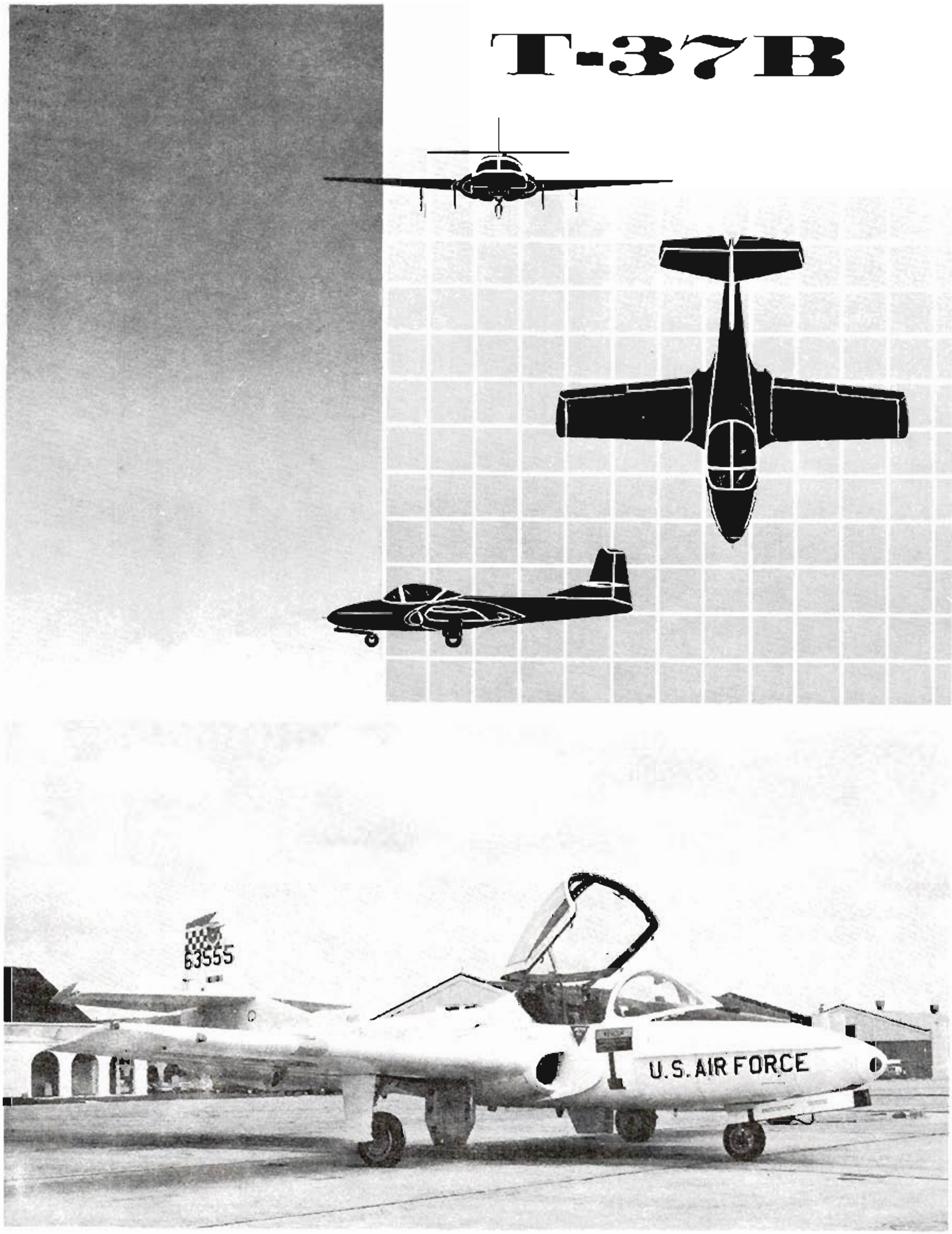
1. Introductory material, indexes and tabular data.
2. Blank spaces which are the result of text, illustration or table deletion.
3. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless such a correction changes the meaning of instructive information and procedures.

AIRCRAFT DESIGN CODES

Major differences between aircraft covered in this manual are designated by triangular number symbols which appear in the text or on illustrations. When a code symbol appears, the information applies only to that group of aircraft represented by the symbol. Symbol designations are as follows:

△1 Aircraft 55-4302 thru 57-2352
△2 Aircraft 58-1862 thru 68-8084

T-37B



SECTION I

DESCRIPTION AND OPERATION

TABLE OF CONTENTS

THE AIRCRAFT

The T-37B is a low-wing dual control trainer with side by side seating, manufactured by the Cessna Aircraft Company and powered by two Continental turbojet engines. The aircraft is equipped with a two-position speed brake, spoilers for artificial stall warning, thrust attenuators, a jettisonable canopy and ejection seats. Other noteworthy features include full instrumentation and lighting for day and night flying, oxygen equipment, and an air conditioning and defrosting system. Aircraft are equipped with bird-resistant windshields. The aircraft is designed for utility, ruggedness and safety, and to provide a medium for pilot transition to heavier and faster jet aircraft.

DIMENSIONS

The overall dimensions of the aircraft, under normal conditions of gross weight, tire and strut 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 nominal takeoff gross weight of the aircraft is 6625 pounds. This includes two pilots and full internal fuel. Refer to Section V for additional information.

ENGINES

Thrust is supplied by two Continental J69-T-25 engines (see figure 1-2). The engine is a centrifugal flow gas turbine engine. It has a single air inlet and a single stage turbine directly connected to the compressor on a common rotor shaft. Military power rating for the engine is approximately 1025 pounds.

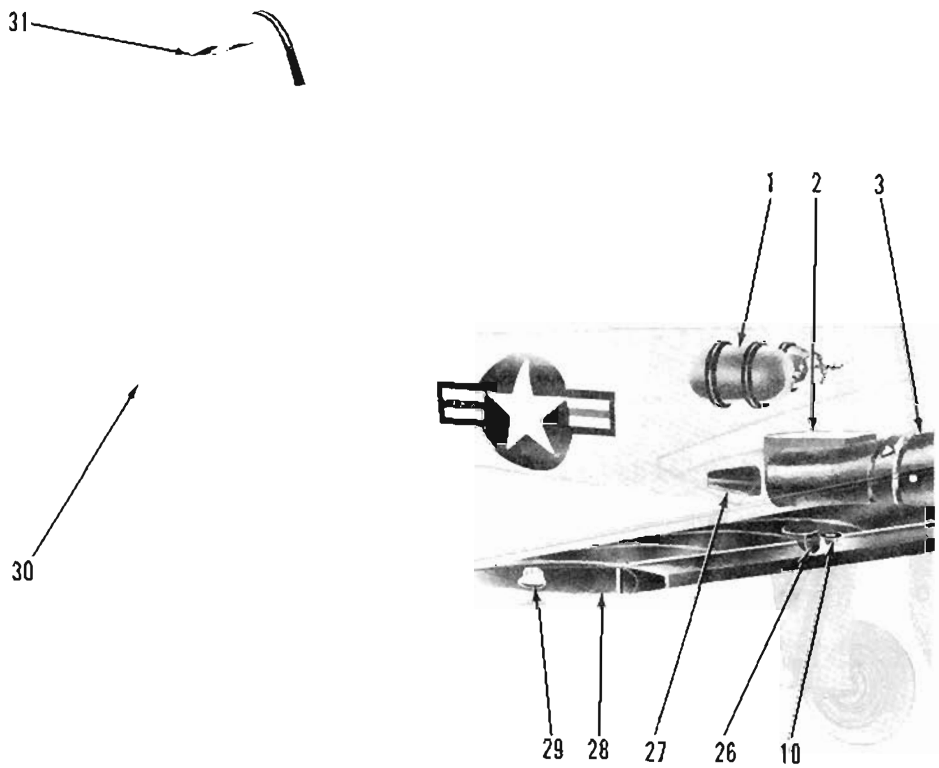
ENGINE FUEL CONTROL SYSTEM

Fuel flow requirements are established by throttle movement, 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

Each engine-driven fuel pump unit consists of a centrifugal pump and two gear-type pumps (figure 1-3), and supplies the fuel pressure required for operation of the fuel control unit. Fuel which first passes through the centrifugal pump, acts as a suction pump in case of boost pump failure and pressurizes the fuel to prevent the possibility of cavitation 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.

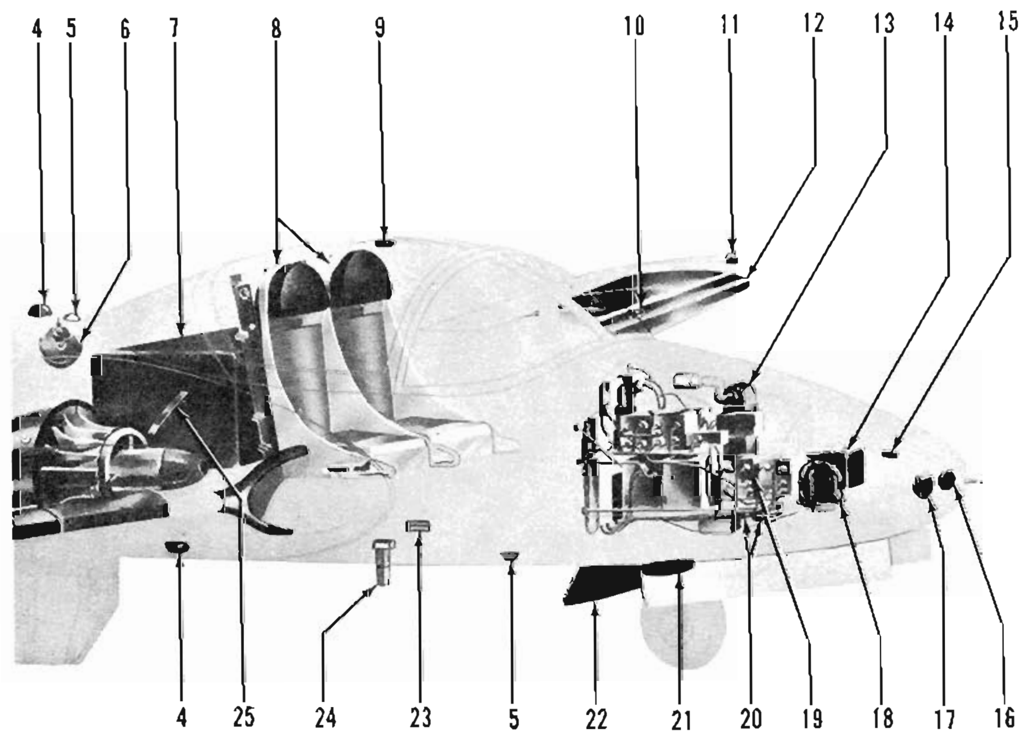
GENERAL



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

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. MARKER BEACON ANTENNA
22. SPEED BRAKE
23. STEP WELL
24. UHF COMMUNICATION ANTENNA
25. RIGHT SPOILER
26. RIGHT LANDING LIGHT
27. RIGHT THRUST ATTENUATOR
28. RIGHT WING FUEL TANK
29. RIGHT POSITION LIGHT
30. TAIL POSITION LIGHT
31. VOR/ILS ANTENNA

Figure 1-1 (Sheet 2 of 2)

J69-T-25 ENGINE

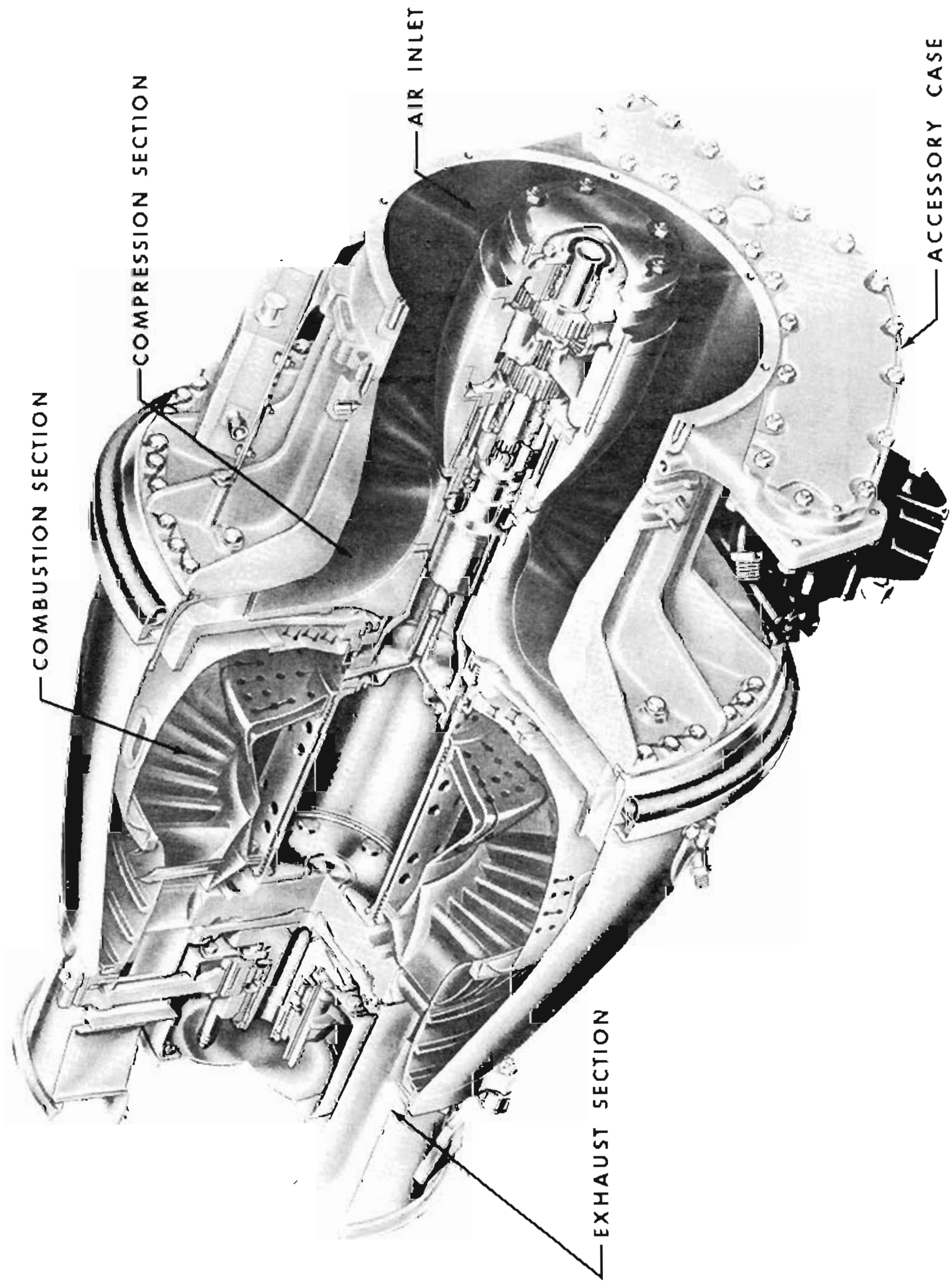


Figure 1-2

ENGINE FUEL CONTROL SYSTEM

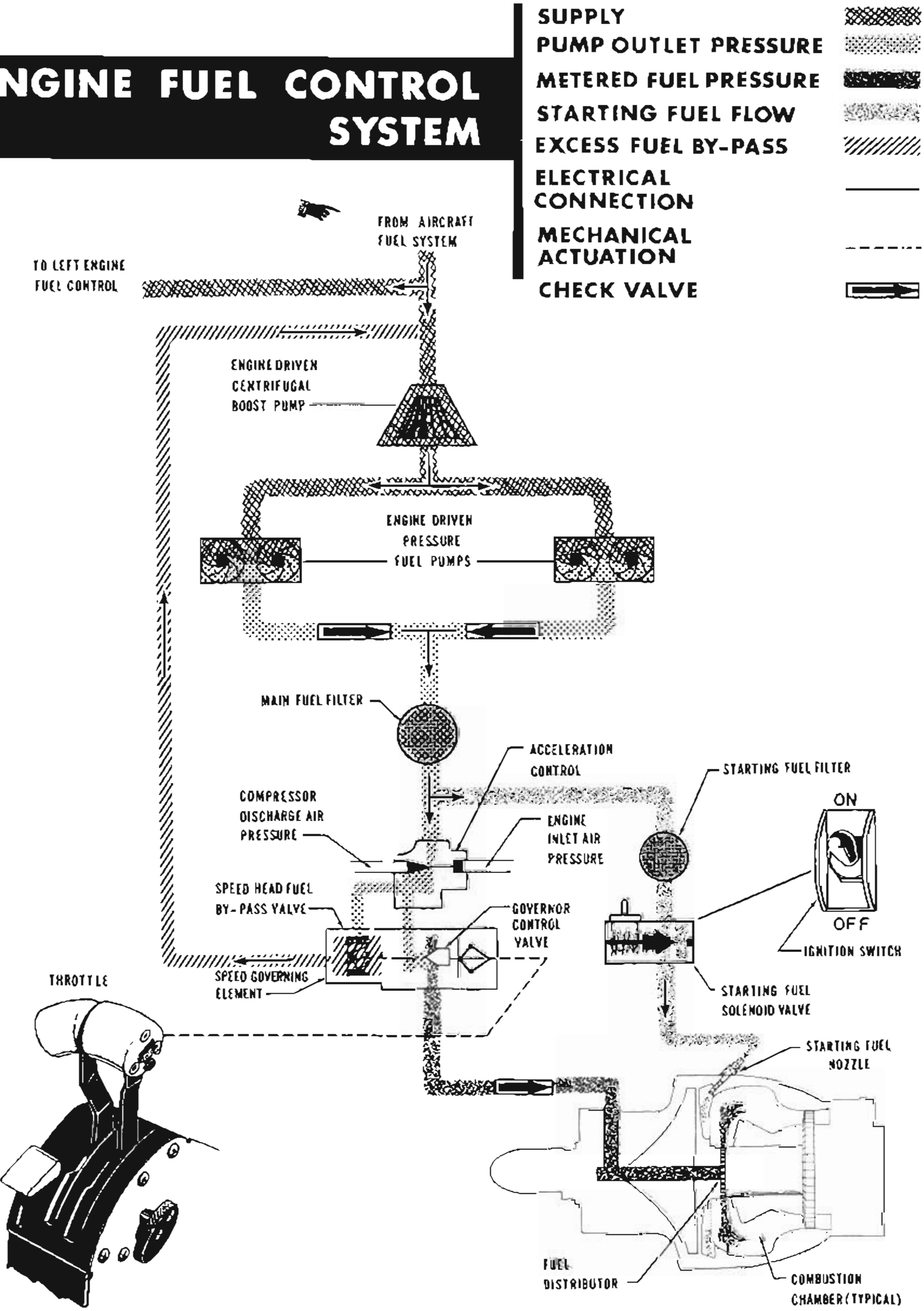


Figure 1-3

Fuel Control

The fuel control unit (figure 1-3) regulates the fuel flow to the engine. It 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 position 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 overtemperature and engine surge during rapid throttle movements. Normally, 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 the IDLE position.

CAUTION

Engine surges and/or bangs above 95% RPM and 15,000 feet MSL are results of too rapid throttle movement and do not indicate an abnormal engine condition. If surges/bangs occur at any other time, it is abnormal. Write it up in the Form 781 at the completion of the mission.

Note

- The most effective way to achieve acceleration is to move the throttles forward rapidly. Use this procedure only in a time critical thrust deficient situation.
- At or above 25,000 feet, 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.
- 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).
- An engine surge may occur at high altitudes. This is not hazardous unless allowed to continue, in which case it may result in flameout. To correct an engine surge, reduce the power on the affected engine.

Note

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 a change in RPM. However, unusual engine noises or roughness noticed in flight that cannot be eliminated with a change of engine speed or altitude, indicate some mechanical failure. Engine shutdown may be required.

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% (100% is synonymous with military power). The two sets of throttles are interconnected and mechanically actuate each engine fuel control unit. Lift-type idle detents are included on the instructor's quadrant to prevent inadvertent engine shutdown. These idle detents affect both sets of throttles. Lift the instructor's throttles past the idle detent to shutdown the engine. Use instructor's throttles for all engine starts in order to have the cut-off feature available.

WARNING

A mechanical failure of the throttle interconnect linkage could disconnect the instructor's throttle(s) from the interconnect system. This will subsequently result in the loss of the idle stop feature in both throttle quadrants and significantly increase the potential for an inadvertent engine shutdown. If you suspect such a malfunction, be extremely careful when reducing throttle(s) to IDLE.

CAUTION

To prevent damage to quadrant components, avoid hard blows to the idle stop when moving a throttle to idle.

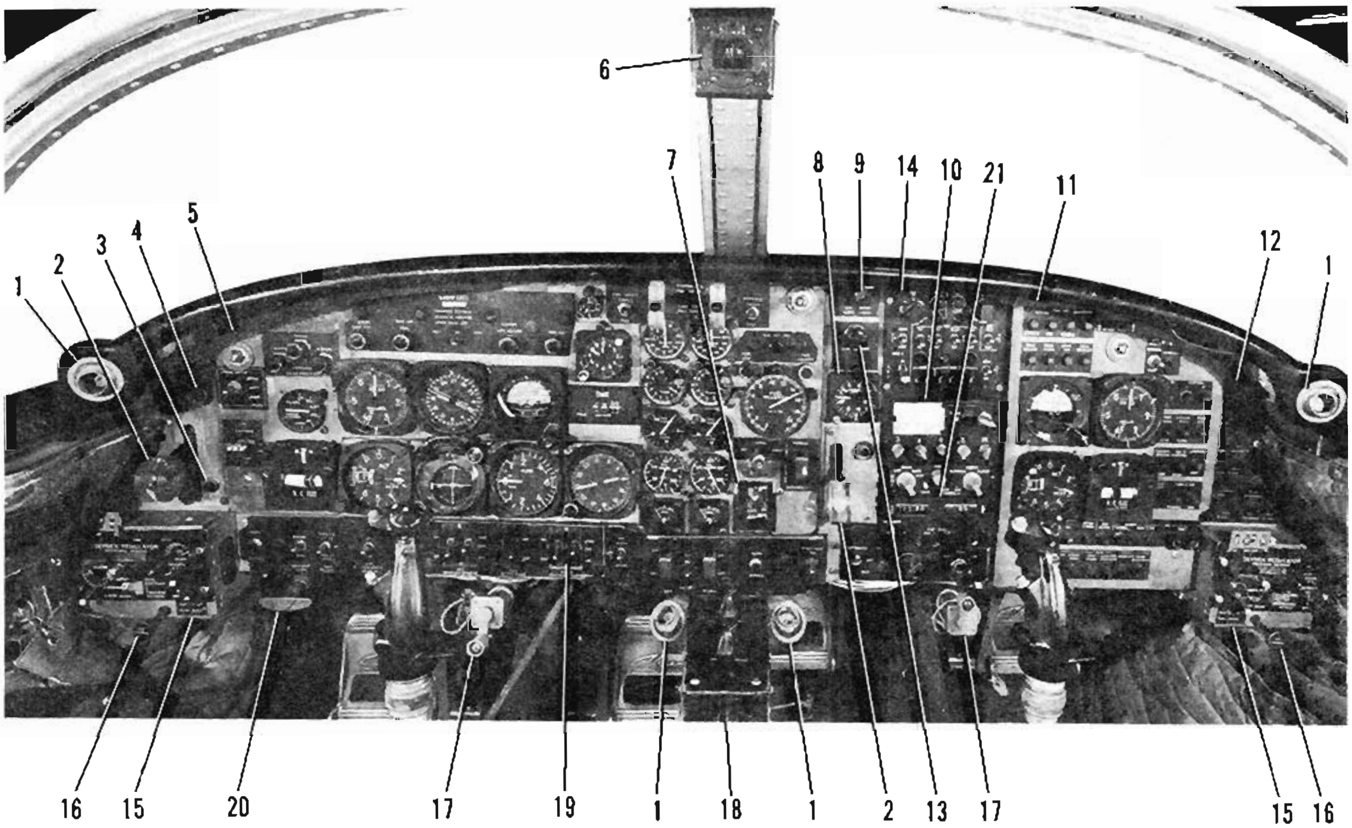
Throttle Friction Knob

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 (11, figure 1-6) is amber and illuminates when ice forms on the ice detect probe 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 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 DC bus.

TYPICAL COCKPIT forward view



1. AIR OUTLET
2. LANDING GEAR HANDLE
3. LANDING GEAR WARNING LIGHT TEST SWITCH
4. LANDING GEAR EMERGENCY OVERRIDE SWITCH
5. LEFT INSTRUMENT PANEL
6. MAGNETIC COMPASS
7. MAGNETIC COMPASS CORRECTION CARD
8. ACCELEROMETER
9. RADIO LIGHTS RHEOSTAT
10. UHF COMMAND RADIO
11. RIGHT INSTRUMENT AND CIRCUIT BREAKER PANEL
12. AC FUSE PANEL
13. DEFROST KNOB
14. IFF TRANSPONDER
15. OXYGEN REGULATOR
16. AIR CONTROL KNOB
17. RUDDER PEDAL ADJUSTMENT CRANK
18. INSTRUCTOR'S QUADRANT
19. SWITCH PANEL
20. LANDING GEAR EMERGENCY T-HANDLE
21. NAV/DME CONTROL PANEL

Figure 1-4

Note

- Retarding the left throttle rapidly may cause the engine ice warning light to illuminate due to negative pressure in the ice detect probe.
- During left engine shutdown, the engine ice warning light should illuminate, indicating the engine ice warning system is working properly. The light will illuminate after the left throttle is placed in CUTOFF and before the left engine rpm reaches zero.

IGNITION SYSTEM

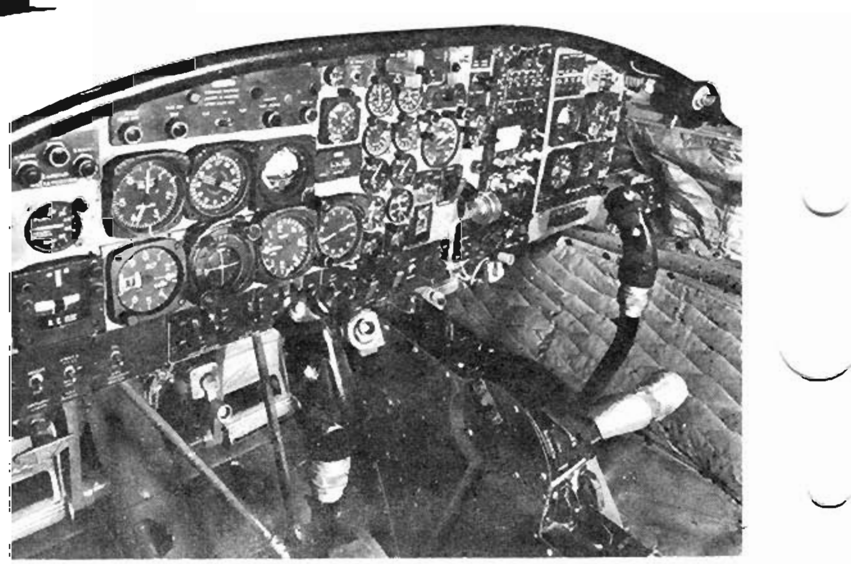
An ignition system, operating on DC current from the bus, is provided for each engine. Each ignition system is comprised of an ignition coil, two fuel ignitors and a two-position channel guarded ignition switch. Ignition is used for all ground starting, but is not used to sustain combustion once the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

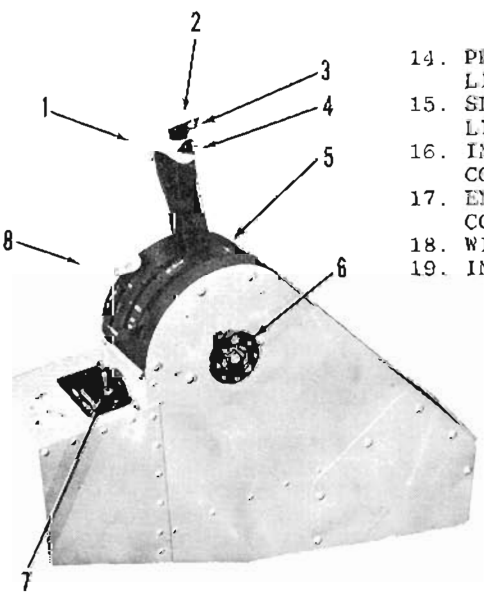
Ignition Switches

The ignition switches (5, 8, figure 1-8) actuate ignition and starting fuel to the engines. The switches are channel guarded and are marked Ignition and have positions ON and OFF. They are spring-loaded to OFF. Positioning an ignition switch to ON, with the respective starter switch in GND provides starting fuel and ignition. Once the engine has sustained combustion, the ignition switch should be released and checked in OFF.

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 HANDLE
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. INTERNAL CANOPY CONTROL SWITCH
17. EMERGENCY CANOPY CONTROL SWITCH
18. WING FLAP HANDLE
19. INSTRUCTOR'S QUADRANT

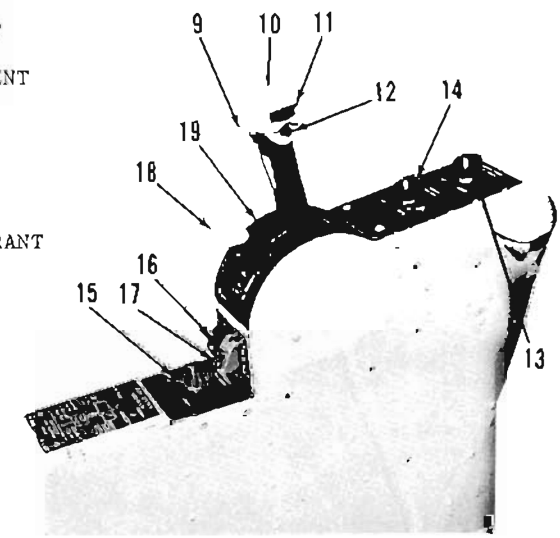
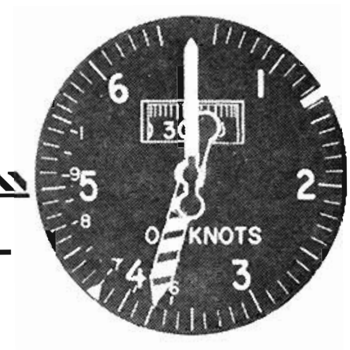
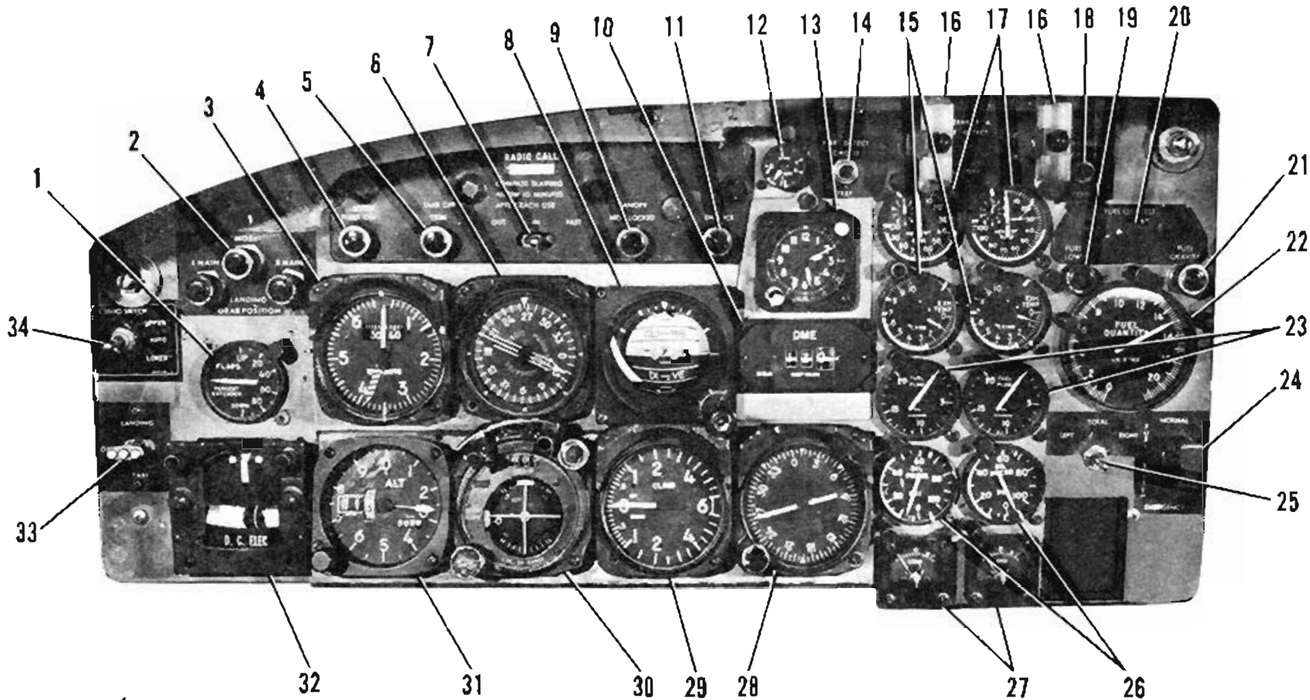


Figure 1-5

Left Instrument Panel



TYPICAL

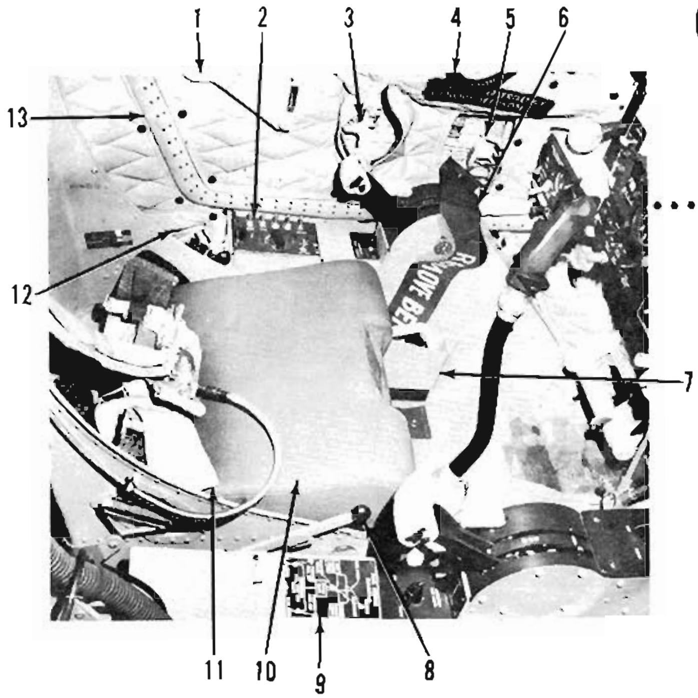


1. WING FLAP POSITION INDICATOR
2. LANDING GEAR POSITION INDICATOR LIGHTS
3. AIRSPEED INDICATOR
4. FUEL BOOST PUMP WARNING LIGHT
5. ELEVATOR TRIM TAB POSITION INDICATOR LIGHT
6. RADIO MAGNETIC INDICATOR
7. HEADING INDICATOR CUT-OUT AND FAST SLAVE SWITCH
8. ARU-44/A ATTITUDE INDICATOR
9. CANOPY NOT LOCKED WARNING LIGHT
10. DME INDICATOR
11. ENGINE ICE WARNING LIGHT
12. HYDRAULIC PRESSURE INDICATOR
13. CLOCK
14. ENGINE FIRE DETECT TEST SWITCH
15. EXHAUST GAS TEMPERATURE INDICATORS
16. FUEL SHUTOFF T-HANDLES
17. TACHOMETERS
18. ENGINE OVERHEAT DETECT TEST SWITCH
19. FUEL LOW LEVEL WARNING LIGHT
20. FUEL QUANTITY INDICATOR TEST SWITCH
21. FUEL GRAVITY FEED LIGHT
22. FUEL QUANTITY INDICATOR
23. FUEL FLOW INDICATORS
24. FUEL SYSTEM SWITCH
25. FUEL GAGING SELECTOR SWITCH
26. OIL PRESSURE INDICATORS
27. LOADMETERS
28. HEADING INDICATOR
29. VERTICAL VELOCITY INDICATOR
30. COURSE INDICATOR
31. ALTIMETER
32. TURN AND SLIP INDICATOR
33. LANDING-TAXI LIGHT SWITCH
34. TRANSPONDER ANTENNA LOBING SWITCH

Figure 1-6

COCKPIT
TYPICAL

Left Side



1. CANOPY DOWNLOCK HANDLE
2. INTERPHONE CONTROL PANEL
3. CANOPY DECLUTCH T-HANDLE
4. UTILITY LIGHT
5. CANOPY JETTISON T-HANDLE
6. CANOPY JETTISON T-HANDLE SAFETY PIN
7. HANDGRIP GUARD
8. SEAT ADJUSTMENT LEVER
9. MAP CASE
10. PILOT'S SEAT
11. SAFETY BELT
12. SAFETY PIN STOWAGE COMPARTMENT
13. PICCOLO TUBE

Right Side

14. UTILITY LIGHT
15. CANOPY DOWNLOCK HANDLE
16. PICCOLO TUBE
17. SAFETY PIN STOWAGE COMPARTMENT
18. SEAT ADJUSTMENT LEVER
19. SAFETY BELT
20. SHOULDER HARNESS LOCKING LEVER
21. INSTRUCTOR'S SEAT
22. HANDGRIP GUARD
23. INTERPHONE CONTROL PANEL

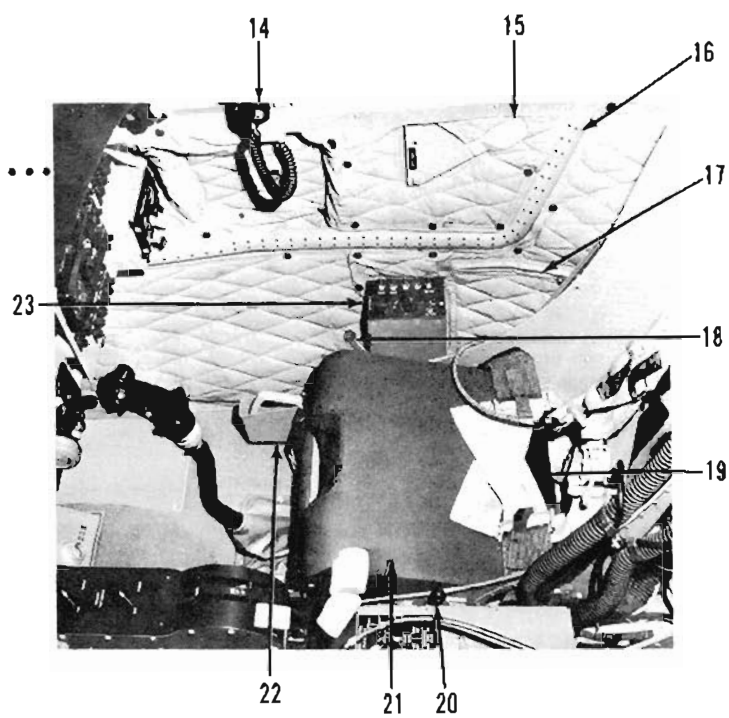


Figure 1-7

STARTING SYSTEM

A starting system, operating on 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. External power is not required for starting the engine.

Starter Switches

The starter switches (6, 9, figure 1-8) are marked Starter, with positions GND, OFF and AIR. The switches are channel guarded and are spring-loaded to OFF. 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 placed in AIR and released, a time delay relay is actuated which supplies ignition and starting fuel for approximately 30 to 45 seconds. This provides an airstart capability. Once initiated, this sequence will continue, regardless of throttle or starter switch position, as long as DC power is available.

CAUTION

- Use of the AIR position on the starter switch may burn clips on the outer combustor, resulting in engine damage.
- Do not place the starter switch(es) to AIR during ground operations. Doing so may result in engine damage.

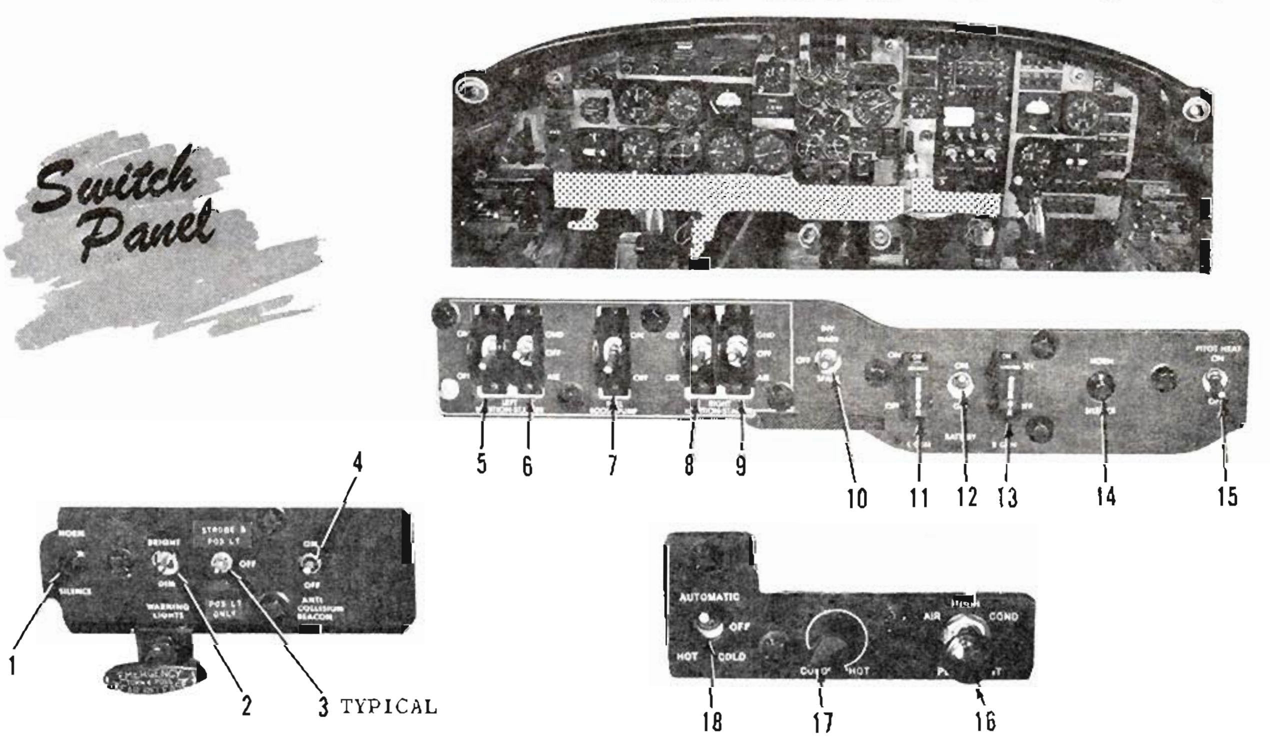
ENGINE INSTRUMENTS

Tachometers

The tachometers (17, 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.

Exhaust Gas Temperature Indicators

The exhaust gas temperature indicators (15, figure 1-6) are self-generating instruments that indicate temperature in degrees centigrade. Electrical current is supplied by six



1. GEAR AUDIBLE SILENCING SWITCH
2. WARNING LIGHTS DIM SWITCH
3. POSITION LIGHTS SWITCH
4. ANTI-COLLISION BEACON SWITCH
5. LEFT IGNITION SWITCH
6. LEFT STARTER SWITCH
7. FUEL BOOST PUMP SWITCH
8. RIGHT IGNITION SWITCH
9. RIGHT STARTER SWITCH
10. MAIN-SPARE INVERTER SWITCH
11. LEFT GENERATOR SWITCH
12. BATTERY SWITCH
13. RIGHT GENERATOR SWITCH
14. GEAR AUDIBLE SILENCING SWITCH
15. PITOT HEAT SWITCH
16. COCKPIT AIR LEVER
17. AIR TEMPERATURE CONTROL RHEOSTAT
18. AIR TEMPERATURE CONTROL SWITCH

Figure 1-8

AIRCRAFT FUEL SYSTEM

Note

Actual position of the wing tanks in relation to the fuselage tank is not depicted in this schematic due to space restrictions. Actually portions of the wing tanks are located slightly lower than the fuselage tank.

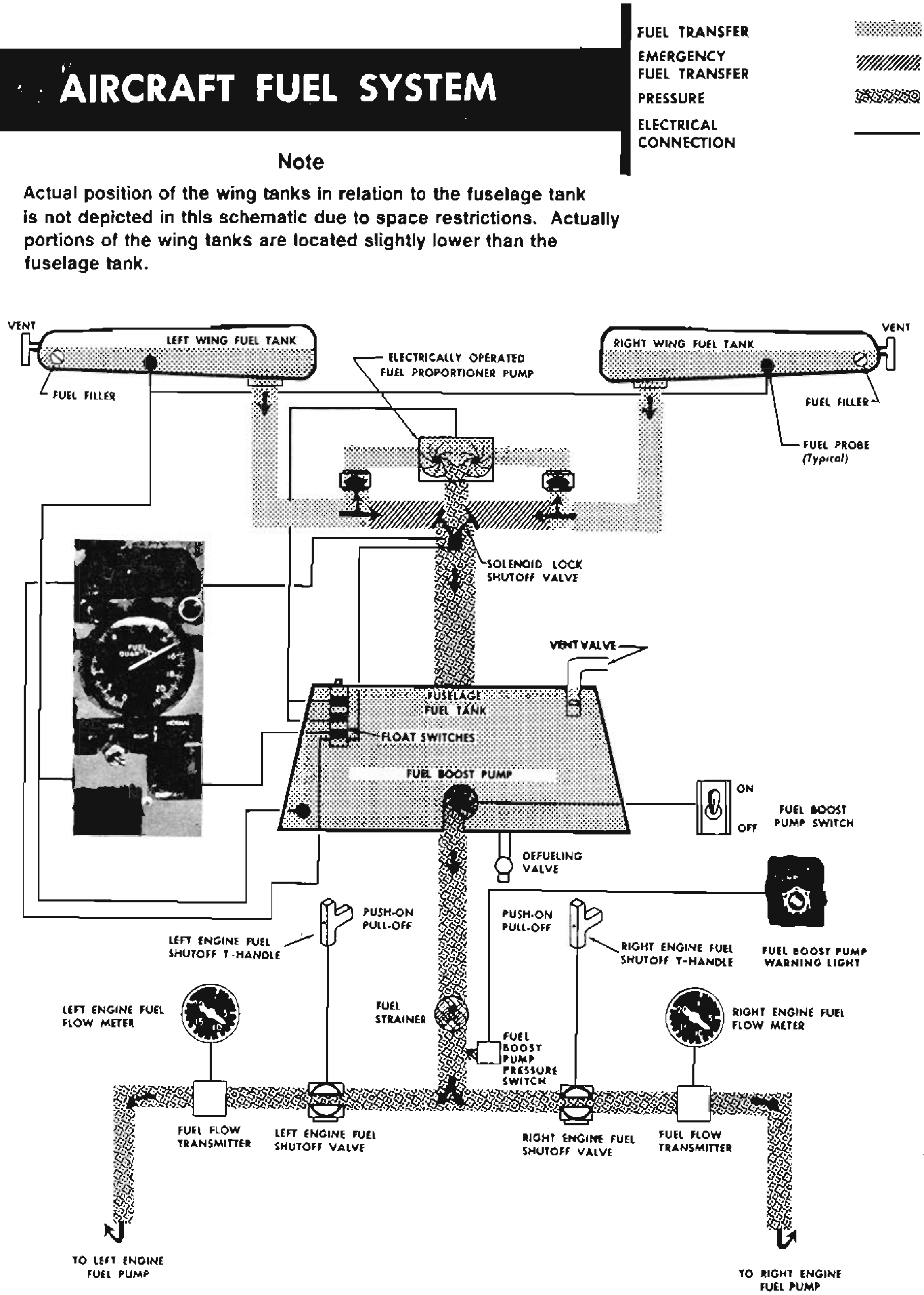


Figure 1-9

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 (23, figure 1-6). They are powered from the 26-volt single-phase AC bus.

Oil Pressure Indicators

The oil pressure indicators (26, figure 1-6) are powered by the 26-volt, single-phase AC bus. They 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 which 4.5 quarts are usable. See figure 1-40 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 1-9). 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. Fuel is then supplied to the engines from the fuselage tank by an electrical fuel boost pump. The aircraft is refueled by means of two filler points located in the outboard leading edge of each wing. See figure 1-40 for fuel specifications.

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).

Fuel Boost Pump Switch

The fuel boost pump switch (7, figure 1-8) has ON and OFF positions. The switch is always ON for normal flight conditions. Power for the switch is supplied by the DC bus.

Fuel Boost Pump Warning Light

An amber fuel boost pump warning light (4, figure 1-6) provides the pilot with an indication that the 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 DC bus.

Note

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

FUEL SHUTOFF T-HANDLES

A fuel shutoff T-handle (16, figure 1-6) for each engine is located on the top of the instrument panel. It has two positions: PUSH-ON and PULL-OFF. In PUSH-ON, the fuel shutoff valve is open permitting fuel flow from the fuel boost pump to the engine fuel control. When the T-handle is in PULL-OFF, the fuel shutoff valve is closed. For all normal operating conditions, the fuel shutoff T-handle should be in PUSH-ON. Use PULL-OFF only in an emergency. Each T-handle also contains a red light which flashes whenever an overheat or fire condition exists or is steady whenever a fire condition exists in a respective engine nacelle.

Note

The fuel shutoff T-handles are electrical switches and movement is restricted to a very short travel. When in idle it takes up to 10 seconds for an engine to stop running after a fuel shutoff T-handle has been positioned to PULL-OFF.

FUEL QUANTITY INDICATOR

A fuel quantity indicator (22, figure 1-6) indicates the quantity, in pounds, of 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 is a three-position toggle switch: LEFT, TOTAL and RIGHT. The switch uses power from the DC bus. When placed in TOTAL, total fuel is read on the fuel quantity indicator. Fuel remaining in the left or right wing tank can be gaged by placing the switch in LEFT or RIGHT, respectively, until the reading on the fuel quantity indicator stabilizes.

Note

After checking fuel remaining in the left or right wing tank, the selector switch should be returned to TOTAL to avoid misinterpretation of a low fuel state during a subsequent fuel check.

Fuel Quantity Indicator Test Switch

The fuel quantity indicator test switch (20, figure 1-6) is used for an 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 (24, 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. In NORMAL, the solenoid lock fuel shutoff valves (gravity feed valves) are closed and the fuel proportioner circuit is energized. With the switch in EMERGENCY, the fuel proportioner pump circuit and the shutoff valves are de-energized. This opens the shutoff valves and illuminates the amber gravity feed light indicating that the fuel system is operating in the emergency mode. The fuel system receives its power from the DC bus.

FUEL LOW LEVEL WARNING LIGHT

The fuel low-level warning light (19, figure 1-6) will illuminate when fuel in the fuselage tank reaches a level of 380 ±20 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 DC bus.

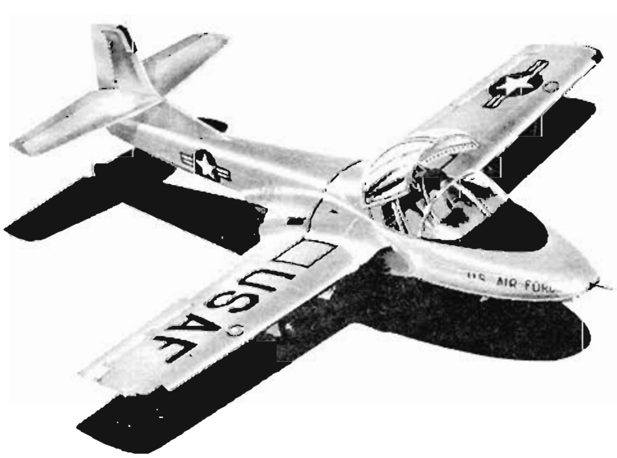
FUEL GRAVITY FEED LIGHT

An amber light (21, 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 DC bus through the operation of the solenoid lock fuel shutoff valve and the fuel tank float switches.

FUEL SYSTEM MANAGEMENT

Operation of the fuel system is essentially automatic, requiring no action from the pilot during flight. The fuel system switch should be in NORMAL for all normal operation. Normal operation of the fuel transfer system will maintain the fuel level in the fuselage tank between 415 and 565 pounds until the wing tanks are depleted.

If any fuel transfer malfunction is suspected, the fuel system switch should immediately be placed to EMERGENCY. Portions of the wing



FUEL QUANTITY *Data*

POUNDS OR
U S GALLONS

TOTAL USABLE FUEL	GALLONS 309
	POUNDS 2008.5

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

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

Figure 1-10

tanks are located slightly lower than the fuselage tank. Therefore, the fuel in the wing tanks may not immediately decrease when the fuel system switch is placed in EMERGENCY. This fuel may initially appear trapped; however, after the fuel level in the fuselage tank drops below the inlet vent from the wing tanks, the wing tanks will begin to feed. Depending on when the fuel system switch is placed in EMERGENCY, the low level light may illuminate with greater than 380 ±20 pounds of fuel on board. However, all the fuel on board is useable if the wing tanks are feeding.

The fuel system will automatically convert to emergency operation (gravity feed) under the following conditions:

1. 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 deenergizes the solenoid locked shutoff valve. The amber gravity feed light will be turned on when the solenoid-locked fuel shutoff valve has opened. If a malfunction exists with useable fuel remaining in the wing tanks, gravity feed will raise the fuel level in the fuselage tank above the low-level float switch and both the red low-level warning light and the amber gravity feed light will extinguish.

Note

Extended operation above 95% RPM at low altitude may result in premature actuation of the low-level warning light. Temporarily retard the throttles to correct the situation.

2. 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.

3. If an electrical or mechanical failure occurs in the proportioner pump, the fuel system will convert to gravity feed when the fuel level in the fuselage tank descends below the low-level float switch, (as described in 1. above) 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. Place the fuel system switch to EMERGENCY to insure continued gravity flow, and land as soon as conditions permit.

WARNING

When performing fuel checks or in the event of a fuel system malfunction, check the total fuel, wing tank balance, and fuselage tank quantity to determine the distribution of fuel on board. Both engines may flameout due to fuel starvation in the fuselage tank if the fuel transfer system has malfunctioned.

4. A complete loss of electrical power will convert the fuel system to gravity feed, but the red low-level warning light and the amber gravity feed light cannot be illuminated.

Note

If an excessive drop in fuel quantity is indicated on the fuel quantity indicator, the high-level float switch may be malfunctioning and pumping fuel overboard through the fuselage tank vent valve. Place the fuel system switch to EMERGENCY and check for a normal drop in fuel quantity for the remainder of the flight. Enter the malfunction in Form 781.

FUEL IMBALANCE

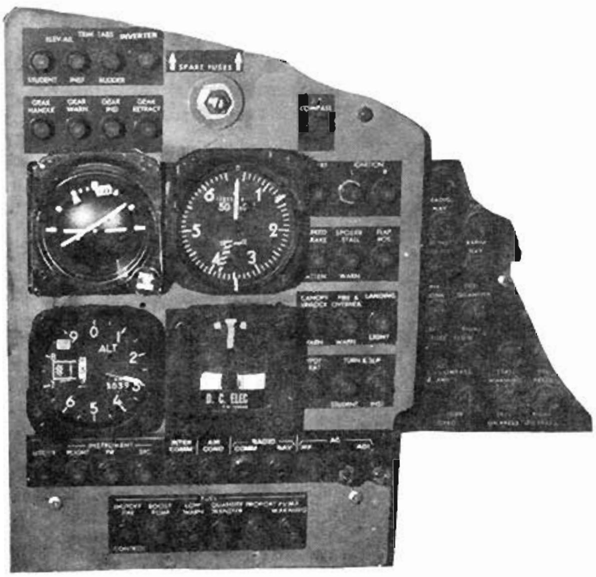
Imbalance in wing fuel quantities may result from ground refueling if the lateral axis of the aircraft is sloping (due to ramp, unequal shock struts, etc.). Fuel imbalance because of improper fueling may not be noticed until approximately 10 minutes after takeoff because of unsensed fuel in the tanks. Additionally wing tank fuel quantity should be checked for a decrease as soon as practical to determine if both tanks are feeding. For these reasons, a fuel balance check should be made between 1600-1700 pounds of fuel regardless of whether the aircraft is on the ground or is airborne. In order to insure accuracy make the balance check only during coordinated flight.

An imbalance of 160 pounds can exist with no malfunction of the system. If the imbalance exceeds 160 pounds, place the fuel system switch in EMERGENCY. Make checks at frequent intervals to ascertain if the EMERGENCY position is functioning. If the imbalance becomes more pronounced, land as soon as conditions permit. Enter the condition in Form 781.

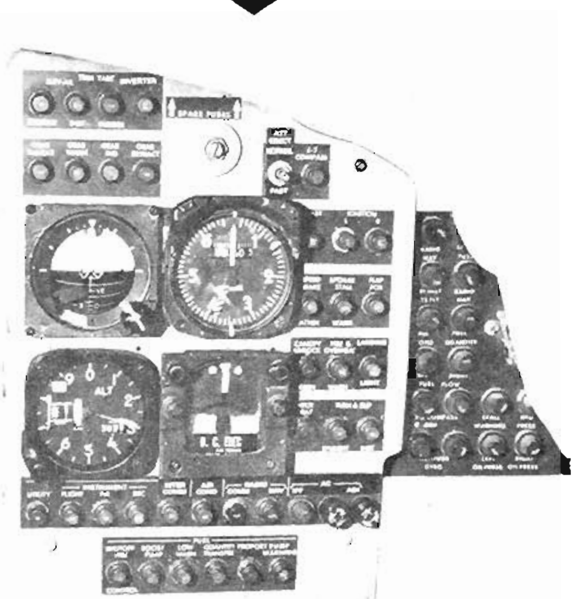
WARNING

Under normal conditions, full control of the aircraft can be maintained under any imbalance condition. Anticipate a wing heavy condition at traffic pattern airspeeds. However, a fuel imbalance accompanied by a full unsymmetric flap condition may result in insufficient aileron control at final approach airspeeds. Refer to Section III, Unsymmetrical Flap Condition.

Right Instrument
CIRCUIT BREAKER
and AC FUSE PANEL
TYPICAL

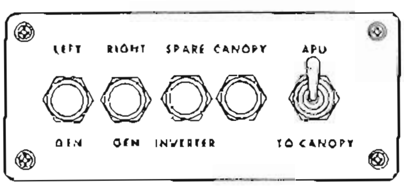


WITH J-8 ATTITUDE INDICATOR

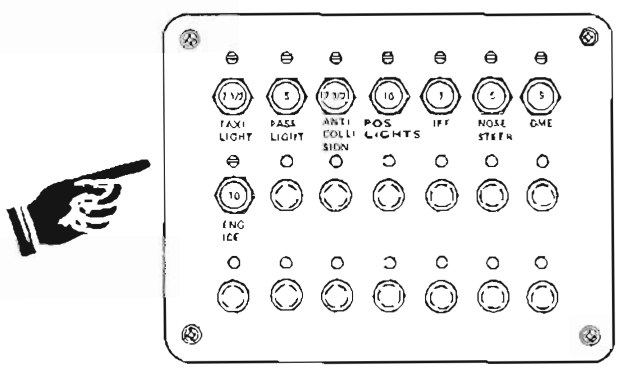


WITH MM-3 ATTITUDE INDICATOR

LEFT HAND NOSE SECTION



RIGHT HAND NOSE SECTION



ARU-42A ATTITUDE INDICATOR
(After T.O. 1T-37B-561)

Figure 1-11

Note

- Avoid confusion between an actual fuel system malfunction and a fuel imbalance caused by improper aileron and/or rudder trim.
- If the fuel quantity in either wing tank does not decrease, 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 usable fuel remaining.
- A slight amount of yaw can sometimes cause or aggravate a fuel imbalance when operating fuel system in EMERGENCY. A small application of rudder trim into the heavy wing may alleviate this condition.

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

All equipment uses only DC power with the following exceptions.

AC Operated	AC/DC Operated
Attitude indicators (except ARU-42A)	Heading system
Primary flight instrument lights	Air conditioner system
Hydraulic pressure indicator	IFF system
Fuel flow indicators	VOR/ILS system
Oil pressure indicators	Stall warning system
Fuel quantity indicator	

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 circuit breakers (figure 1-11) mounted on three separate panels. Circuit breakers for the generators, canopy and the spare inverter are located in the left-hand nose section and are not accessible during flight. Circuit breakers for the taxi light, passing light, anticollision light, position lights, IFF, nosewheel steering, DME and engine anticing are located in the right-hand nose section and are not accessible during flight. The remaining circuit breakers are located on the right instrument panel.

The circuit breakers 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 pushing it in. A DC circuit can also be opened manually by pulling out on the respective circuit breaker.

CAUTION

Circuit breakers should not be pulled or 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. Do not reset a circuit breaker more than once.

BATTERY SWITCH

The battery switch (12, figure 1-8), has two positions, ON and OFF. When the switch is turned on, the battery is connected directly to the DC bus thru a relay provided a minimum of 17-18 volts is available. The relay will open when the battery switch is turned off or if the DC bus is deenergized and battery voltage falls below 10 volts.

Note

Because of the position of this relay, it may be possible for the relay to open and prevent power from the DC bus to go to either the spare inverter or canopy.

GENERATOR SWITCHES

The guarded DC generator switches (11, 13, figure 1-8), have two positions, ON and OFF and function to connect generator output to the DC bus.

Electrical Power

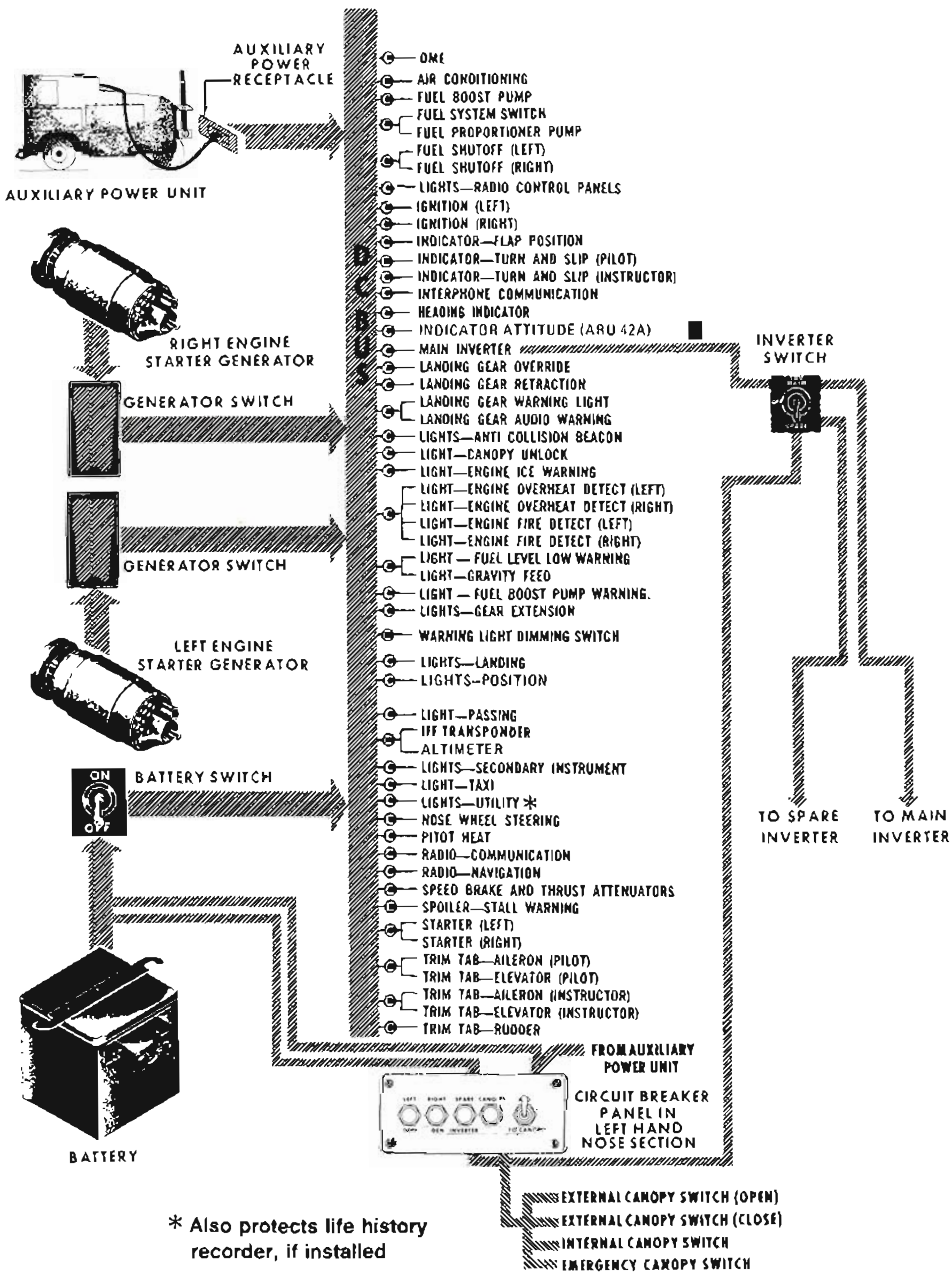


Figure 1-12 (Sheet 1 of 2)

Supply System

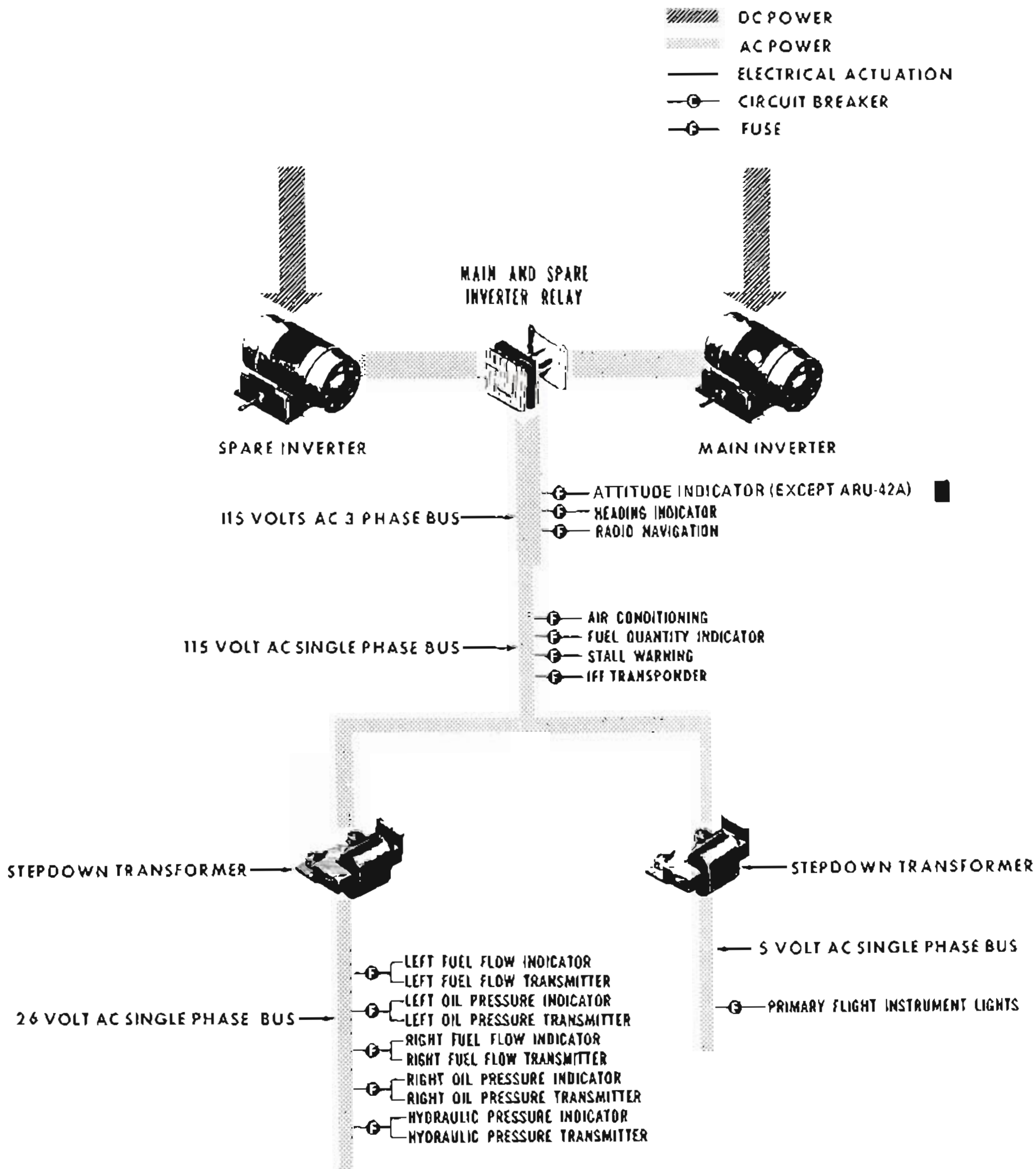


Figure 1-12 (Sheet 2 of 2)

Hydraulic Power

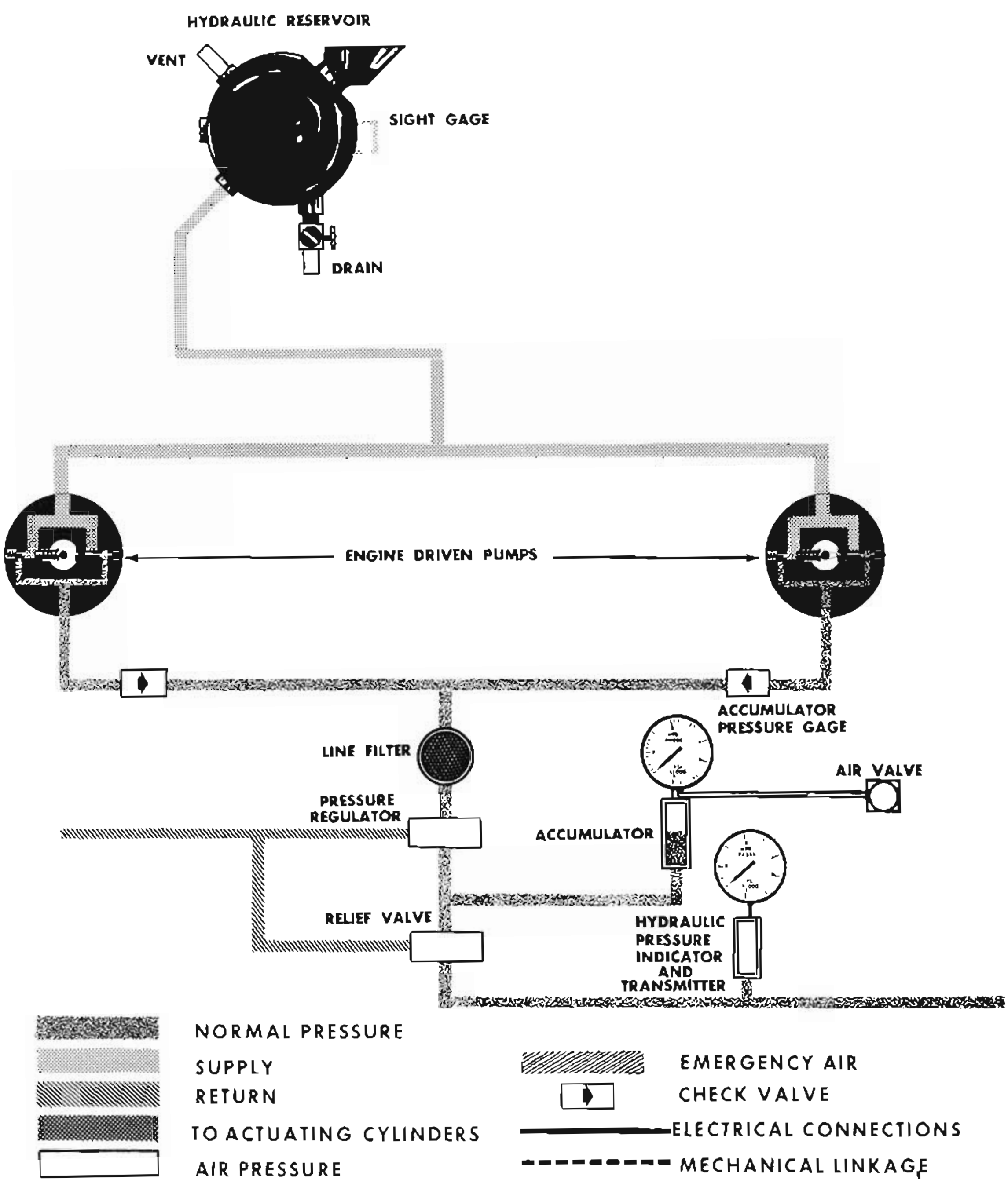


Figure 1-13 (Sheet 1 of 2)

Supply System

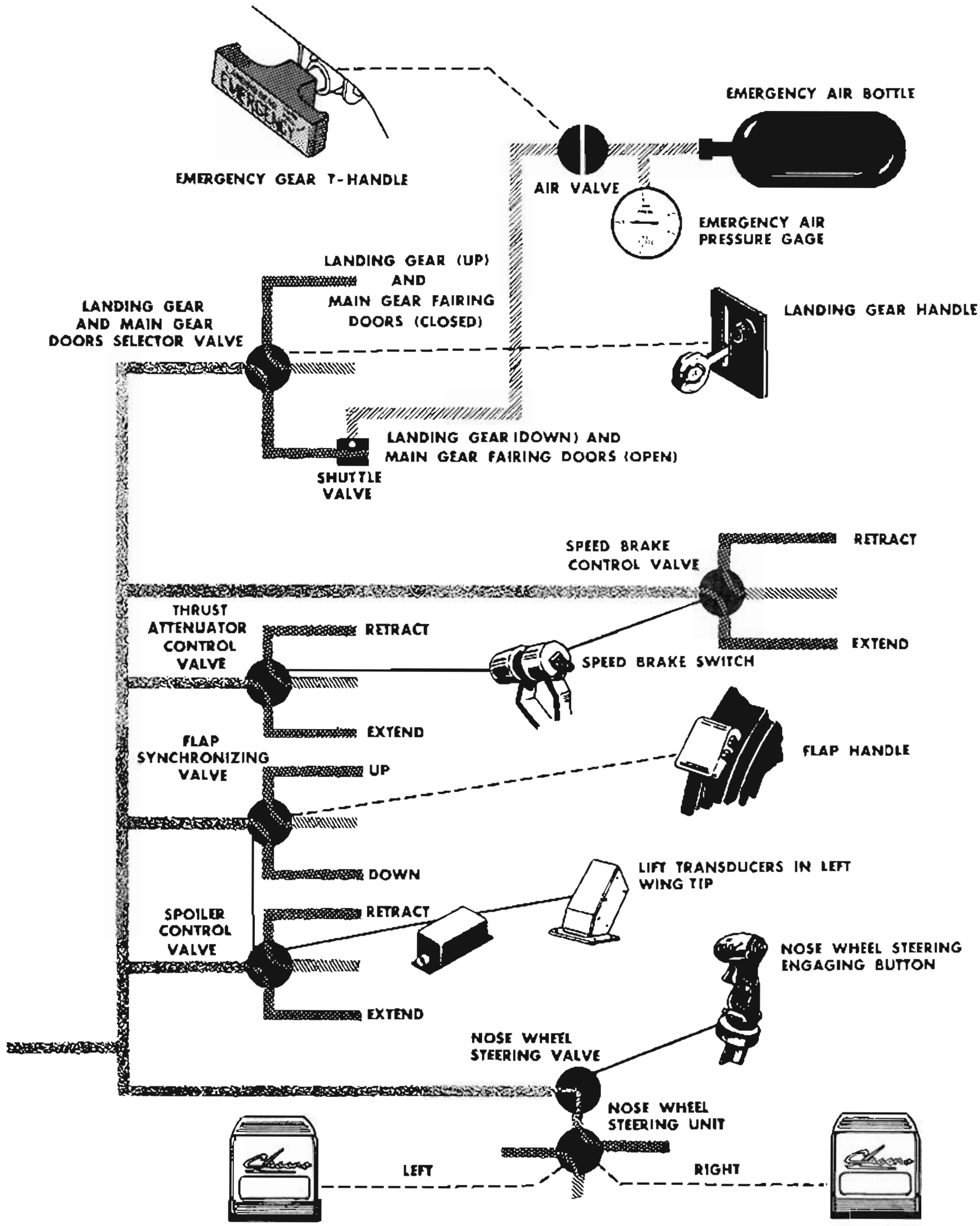


Figure 1-13 (Sheet 2 of 2)

LOADMETERS

The loadmeters (27, 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 rotary inverter. Aircraft modified with T.O. 1T-37B-559 have the 250 va main rotary inverter replaced by a 500 va solid state inverter. A 250 va spare inverter is provided as a safety feature and when manually selected will assume the AC load of the aircraft. Alternating current is distributed through four bus networks, and by the use of a transformer, supplies separate voltage systems. Power for the inverters is supplied by the aircraft's DC system.

INVERTER SWITCH

The inverter switch (10, figure 1-8) 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 SPARE, power to the inverter will be supplied directly from the battery if the battery switch is off. However, if the battery switch is ON and the DC bus is energized by the generators, power to the spare inverter is from the DC bus through the battery.

Note

- Inverter failure can be detected by observing the instruments receiving AC power. In addition, mechanical failure of the rotary inverter may be preceeded by vibrations that may be detected in the cockpit. If instrument flying must be continued with the battery and generator off, or if the main inverter fails, the spare inverter should be selected.
- Electrical power from the DC bus will not be available to the spare inverter if the battery is inoperative and the battery relay has opened.

AC FUSES

All of the AC circuits are protected by fuses (figure 1-11) which are replaceable during flight. Three spare fuses (one 2 amp and two 1 amp) are located above the DC circuit breaker panel on the underside of the glare shield. An additional spare 2 amp fuse is located in the upper right corner of the fuse panel. The 2 amp fuses are used for the two radio NAV fuses, the left J-2 compass fuse or any ADI fuse (except ARU-42A). All other fuses shown on the panel are 1 amp.

CAUTION

While replacing a fuse, the inverter should be turned off, if practical, to prevent the crew member from receiving a shock.

HYDRAULIC POWER SUPPLY SYSTEM

The hydraulic power supply system (figure 1-13) consists of two engine-driven hydraulic pumps, one on each engine. Either pump is capable of maintaining full system pressures; however, the time for component actuation will be longer. 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. A pressure regulator maintains a pressure of 1250 to 1550 PSI. 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 nosewheel well is used for emergency landing gear extension in case of hydraulic power failure. See figure 1-40 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.

HYDRAULIC SYSTEM PRESSURE INDICATOR

The hydraulic pressure indicator (12, figure 1-6) is a remote indicating instrument that is operated by the 26-volt, single-phase, 400-cycle AC bus. The indicator displays hydraulic pressure in pounds per square inch.

LANDING GEAR SYSTEM

The 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 handle. 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 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

Figure 1-14

the uplock 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 gear is faired by split-type doors. The nosewheel doors are actuated by mechanical linkages which are connected to the nose gear. Landing gear and door retraction time is approximately 10 seconds, while extension requires about eight seconds.

LANDING GEAR HANDLES

The landing gear handles (2, figure 1-4) consist of two interconnected handles with clear plastic wheel-shaped knobs. Each landing gear handle has two marked positions, UP and DOWN. Positioning either landing gear handle to UP or DOWN causes the landing gear to retract or extend when the weight of the aircraft is off the gear. The instructor's landing gear handle incorporates a locking device which holds the handle down until there is no weight on the landing gear. The pilot's landing gear handle is indirectly held down by the same device.

LANDING GEAR EMERGENCY OVERRIDE SWITCH

The landing gear emergency override switch (4, figure 1-4) provides electrical power to the solenoid lock which holds the landing gear handles down. Pressing the override switch and simultaneously lifting the landing gear handle will allow the landing gear to collapse while the weight of the aircraft is on the landing gear if hydraulic pressure is available. (See figure 3-1, Landing Gear Override Switch). The landing gear emergency override switch receives its power from the DC bus.

Note

> If an attempt is made to raise the landing gear handle prior to depressing the emergency override switch, the solenoid lock pin can bind making it impossible to raise the landing gear handle. If this occurs, push the landing gear handle down, then depress the emergency override switch followed by raising the landing gear handle.

LANDING GEAR EMERGENCY EXTENSION SYSTEM

The aircraft is equipped with a landing gear emergency extension system. The system will enable you to fully extend the gear should the aircraft lose hydraulic pressure or if existing pressure is insufficient (less than normal operating range) to fully lower gear. The system consists of an emergency gear T-handle (20, figure 1-4) and an emergency air bottle located in the nose compartment. The system contains approximately 2000 $\pm$250 PSI of air which is indicated on the pressure gage near the air bottle. When the landing gear handle is placed down and the emergency gear T-handle is turned and pulled, air is directed to the shuttle valve and gear lowering hydraulic lines, to open the gear doors and lower the landing gear.

CAUTION

- Do not attempt to return the T-handle to IN after actuation of the emergency system. To do so will cause the air pressure to bleed off from the down side of the gear.
- When this system is used, do not attempt to retract the gear; the hydraulic reservoir may rupture.

Note

If the landing gear will not fully extend when normal hydraulic pressure is available, the emergency extension system will not provide sufficient additional pressure to help lower gear. In this situation, the emergency system should not be used. Refer to FAILURE OF GEAR TO EXTEND, Normal Hydraulic Pressure Available, in Section III.

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 DC bus.

LANDING GEAR WARNING LIGHT AND AUDIBLE SYSTEM

A red warning light, located inside each wheel-shaped knob on the landing gear handle will illuminate upon gear extension whenever any landing gear is not in a fully down and locked position and electrical power is available. During gear retraction, the light is extinguished when the nose gear strut and both inboard main gear doors are up and locked. When a throttle is retarded to between idle and 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 (3, figure 1-4). The landing gear audible warning is silenced by the silencing switch but is automatically reset each time the retarded throttle is advanced past approximately 70%. Power to operate the switches is received from the DC bus.

Note

It is possible for gear sequencing malfunctions during landing gear retraction to go undetected in the cockpit except for abnormal aircraft performance, i.e., airspeeds well below normal for a given power setting or unusual airframe vibrations.

NOSEWHEEL STEERING SYSTEM

The nosewheel steering system provides directional control during taxiing and portions of the takeoff and landing roll. 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 nosewheel steering unit will position the nosewheel within approximately 40 degrees of each side of center when the aircraft is on the ground. The nosewheel 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; it steers the nosewheel, during power controlled operations and it serves as a shimmy damper with power on or off.

Nosewheel steering may be selected at any time while the weight of the aircraft is on the nosewheel, and hydraulic and electrical power are available. The nose gear centering spring centers the nose gear strut during retraction and extension operations.

CAUTION

During ground operations when the nose gear steering switch is actuated, the nose gear will turn to correspond to the position of the rudder pedals. Center the rudder pedals before engaging nose wheel steering.

In the event of a complete hydraulic or electrical failure, steering is controlled by rudder movement and aircraft brakes. All electrical components used to operate the nosewheel steering mechanisms are powered by the DC bus.

NOSEWHEEL STEERING SWITCH

When the nosewheel steering switch (4, figure 1-17) is held in the depressed position, power from the DC bus actuates a solenoid shutoff valve, which permits hydraulic pressure to be supplied to the nosewheel steering system. A limit switch on the nose gear prevents nosewheel turning 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.

Thrust

ATTENUATORS

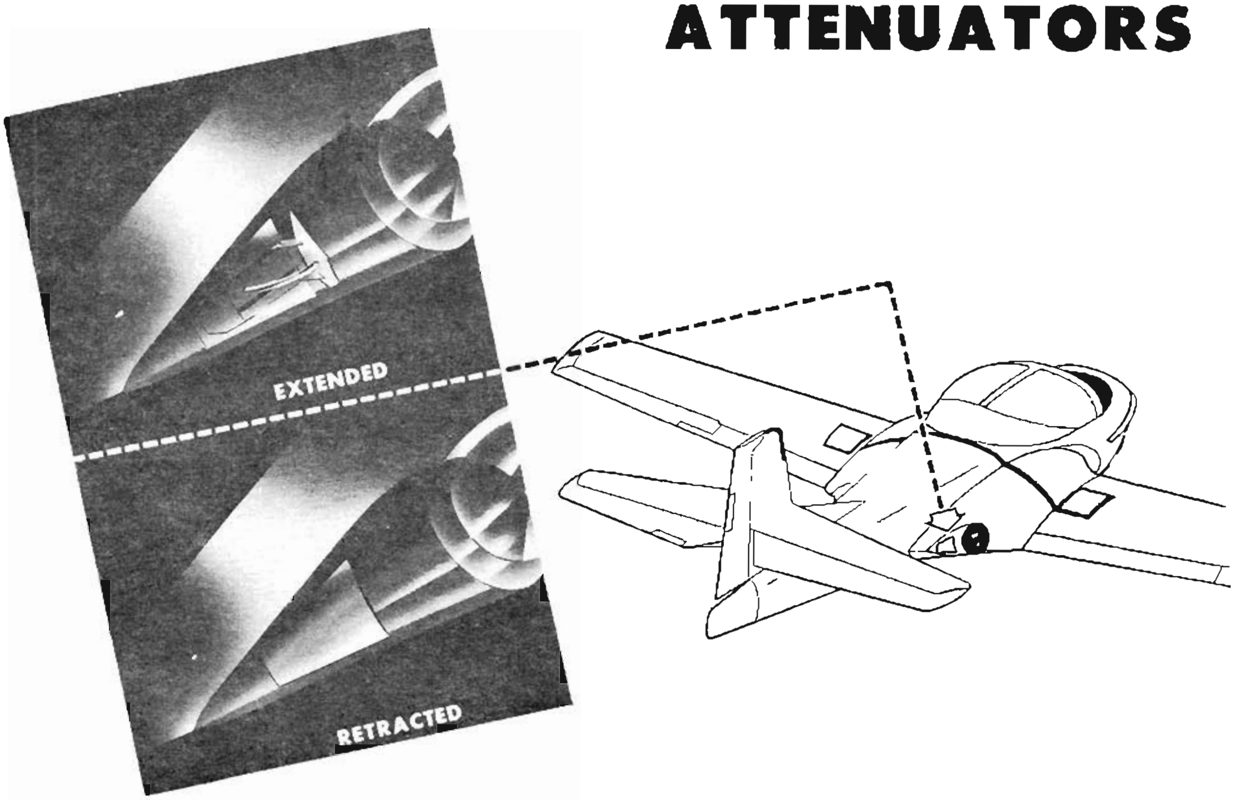


Figure 1-15

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 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 nosewheel 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 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 SOLO.

THRUST ATTENUATORS

The function of the thrust attenuator (figure 1-15) is to reduce effective thrust while maintaining an engine RPM that will allow more rapid engine acceleration. As an example, the effective thrust reduction is equivalent to reducing engine speed from 60% RPM to approximately 50% RPM with thrust

SPOILERS

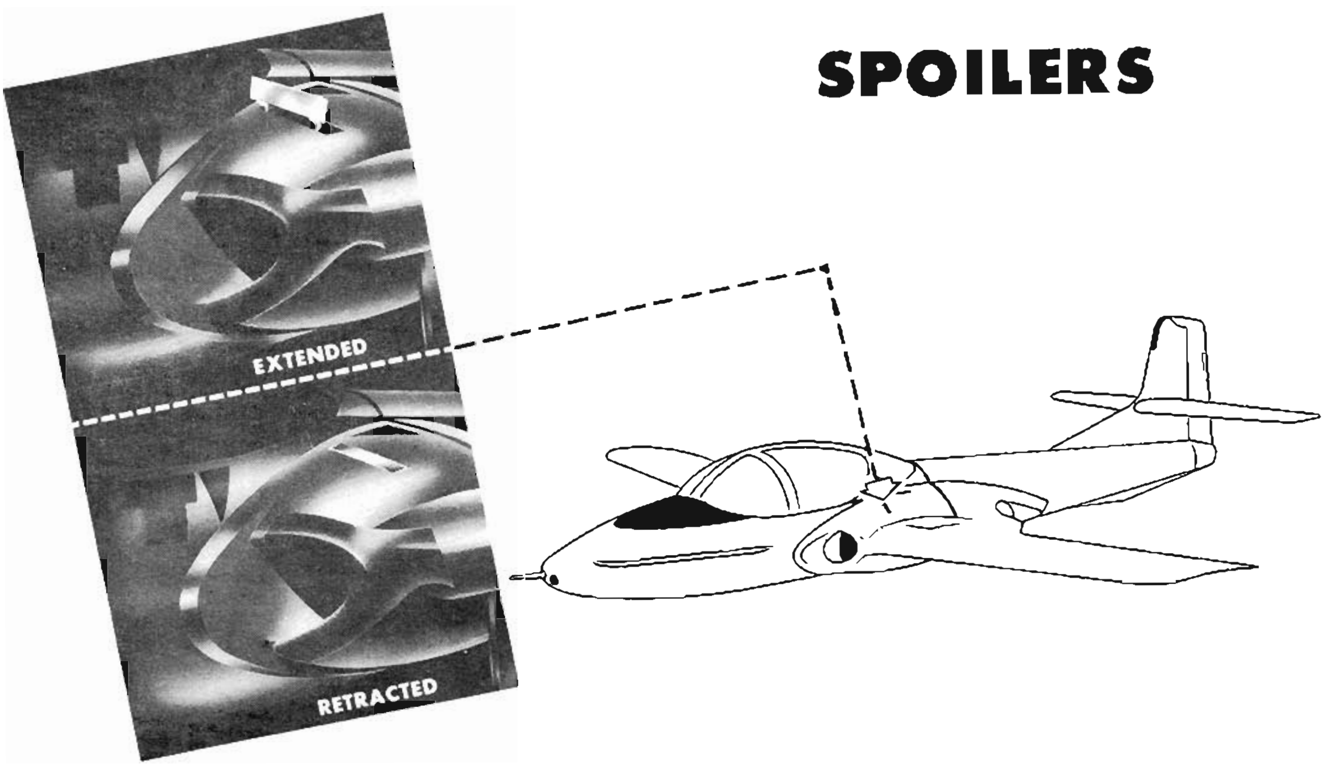


Figure 1-16

attenuator extended. 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.

Note

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

WING FLAP SYSTEM

The hydraulically operated wing flaps extend from the aileron to the engine nacelle on each wing. Wing flap handles actuate the wing flaps 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. When the speed brake and landing gear are retracted, flap blow-up will begin at no less than 115 KIAS. At 135 KIAS, a positive indication of flap blow-up (approximately 3% blow-up) will occur, resulting in approximately 97% extension. A synchronizing unit insures the extension of both flaps at the same rate with a maximum divergence of three degrees.

WING FLAP HANDLES

The wing flap handles (8, 18, 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 handles are mechanically connected to a flap selector valve. The flap selector valve governs the position of the flaps.

WING FLAP POSITION INDICATOR

A DC operated wing flap position indicator (1, figure 1-6) shows the position of the wing flaps. The indicator is marked in 10% increments from zero to 100% with 40 degrees of flap extension being 100% deflection.

SPOILER SYSTEM

The spoilers (figure 1-16) provide stall warning when the flaps are extended. When the flaps are extended 25% or more, and the aircraft speed is reduced to 72 KIAS or lower in level flight (or proportionately higher speeds in accelerated and turning flight), a transducer vane on the bottom of the left wing tip electrically extends the hydraulically operated spoilers. When in the extended position, the spoilers create a turbulent airflow which is felt as aircraft buffet. This occurs between four and 10 knots above the stall speed. Either increasing the speed above 72 KIAS (or higher in accelerated and turning flight) or retracting the wing flaps to less than 25% will cause the spoilers to retract.

FLIGHT CONTROL SYSTEM

The flight control system is comprised of two groups of control surfaces, primary and secondary. The primary control surface group includes ailerons, elevators and rudder. The function of the primary control surface group is to provide the pilot with a means of controlling the aircraft. All primary control surfaces are manually operated, through a system of cables, pulleys, bell cranks and push-pull rods.

The secondary control surface group includes trim tabs for left aileron, left elevator and rudder. The trim tabs provide a balancing or trimming of the aircraft for any normal attitude of flight. All trim tabs are electrically operated and controlled from the cockpit. In addition, fixed tabs on the ailerons are available for ground maintenance adjustment.

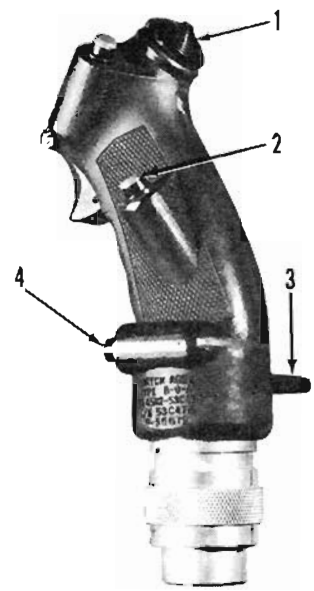
CONTROL STICK GRIP

Aileron and elevator control is maintained by dual control sticks which are interconnected. Each control stick has a control stick grip (figure 1-17), with a switch controlling the aileron and elevator trim tabs and a switch controlling the nosewheel 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.

RUDDER PEDALS

Fore and aft movement on the rudder pedals controls the rudder position through mechanical linkage; toe pressure on the pedals operates the brakes. Each set of pedals is equipped with rudder pedal adjustments (17, figure 1-4).

CONTROL STICK GRIP



1. ELEVATOR AND AILERON TRIM TAB SWITCH
2. RADIO INTERRUPT CALL SWITCH (instructor's only)
3. HAND REST
4. NOSEWHEEL STEERING SWITCH

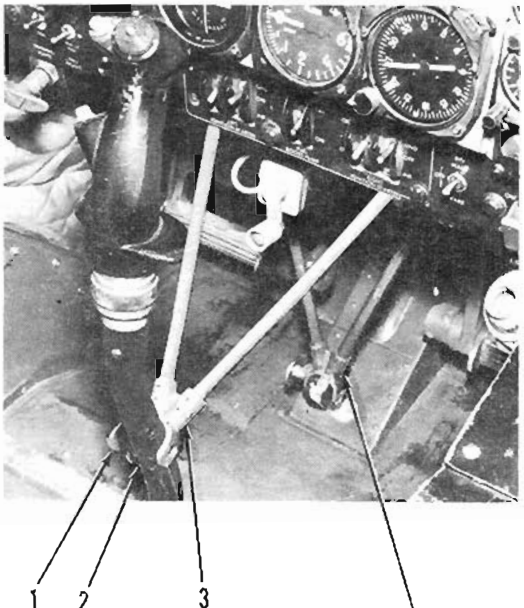
Figure 1-17

AILERON AND ELEVATOR TRIM TAB SWITCH

Normal trim of the aileron and elevator trim tabs is provided through a five-position, switch (1, figure 1-17). It receives power from the 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 actuates a push-pull rod which in turn positions the aileron trim tab up or down. 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. When the elevator trim tab is in the neutral position, and the battery switch is ON, a green elevator trim tab position light (5, figure 1-6) will be illuminated.

CONTROL LOCK



CONTROL LOCK IN STOWED POSITION

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

Figure 1-18

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), aft of the pilot's quadrant. The switch is held to LEFT or RIGHT for corresponding rudder trim and spring-loaded to OFF. The rudder trim tab switch receives its power from the DC bus.

CONTROL LOCK

Primary flight control surfaces can be locked in the neutral position by a control lock (figure 1-18), 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 controls are locked in neutral including the throttles which are locked in the IDLE through CUT-OFF range.

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 DC bus which is controlled by a pitot heat switch (15, figure 1-8). The switch has two positions, ON and OFF.

INSTRUMENTS

Note

This paragraph covers the information on flight instruments peculiar 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). A turn and slip indicator, altimeter, attitude indicator and airspeed indicator are also mounted on the right instrument and circuit breaker panel (figure 1-11).

AIMS

The term "AIMS" is an acronym of acronyms. The A stands for ATCRBS, which is taken from Air Traffic Control Radar Beacon System; I stands for IFF; M represents the Mark XII identification system; and S for System. These reflect the many diverse AIMS configurations.

The AIMS system in the aircraft consists of an IFF transponder, altimeter encoder, controls, and other associated equipment. This equipment is capable of automatically reporting a coded altitude and aircraft identification signal to ground stations upon interrogation by the station in order to maintain positive identification and control of air traffic and vertical separation.

ALTIMETER

There are two altimeters installed on the instrument panel. One on the left instrument panel, the other on the right instrument panel. The altimeter provides altitude information (31, figure 1-6).

An AAU-21/A altimeter-encoder (figure 1-19) is installed on the right instrument panel and an AAU-27/A altimeter is installed on the left instrument panel. The AAU-21/A altimeter-encoder is a component of the AN/APX-72 IFF system. The counter-drum pointer altimeter-encoder is a sensitive, self-contained altimeter with encoding capability. When desired, the altimeter-encoder

AAU-21/A ALTIMETER

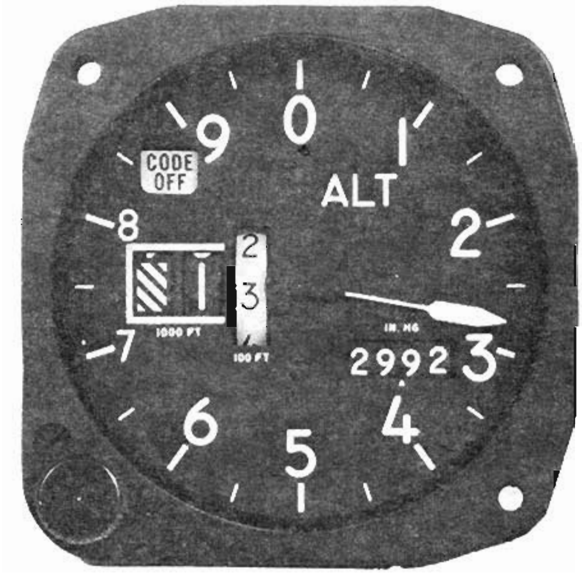


Figure 1-19

furnishes altitude information to the AN/APX-72 IFF system for transmittal to a station appropriately equipped to interrogate.

The indicator has four read-out windows, one pointer, an altitude dial and an adjustment knob. The left read-out window indicates feet in 1000 foot increments, and the adjacent read-out window indicates feet in 100 foot increments which are indicated simultaneously by the pointer. The altimeter-encoder displays altitude over the range of -1000 to 38,000 feet and encodes this range to the transponder.

Below an altitude of 10,000 feet, a diagonal warning symbol will appear on the 10,000-foot counter. A barometric pressure setting knob is provided to insert the desired altimeter setting in inches of Hg. A third read-out window indicates barometric pressure in inches of Hg, ranging from 28.1 to 31.0. When power is off, a CODE OFF flag is visible in the fourth read-out window on the dial and the instrument functions as a conventional altimeter. When power is applied, the encoder will become operative as the CODE OFF flag retracts from view. The AAU-27/A operates the same as the AAU-21/A, except that the AAU-27/A does not have encoding capability.

Operating Characteristics

The AAU-21/A altimeter employs a unique operating feature. The 10,000-foot and 1000-foot counters remain fixed during altitude changes while the 100-foot drum and pointer rotate continuously. When each 1000-foot increment is nearly completed, the counter(s) abruptly index to the next correct digit making readings simpler to observe.

The altimeter mechanism which provides this feature also causes a noticeable pause or hesitation of the pointer due to additional friction of turning over the counter wheel. This pause is followed by a noticeable acceleration as the altimeter mechanism overcomes the load and rolls the dial over to the next thousand-foot digit. This effect will be more pronounced at ten-thousand-foot intervals where both counters are turned over simultaneously. The pause occurs during the "9" to "1" portion of the scale. The pause-and-accelerate behavior is more pronounced at high altitudes and high rates of climb and descent. During normal rates of descent at low altitudes, the effect will be minimal.

WARNING

If the altimeter's internal vibrator is inoperative, the pause-and-accelerate effect may be exaggerated. Watch for this when the minimum approach altitude lies within the "8" to "2" sector of the scale, e.g., 800-1200 feet, 1800-2200 feet, etc.

Operation

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

Pre-Flight Check

Set the local barometric pressure into the altimeter. Each altimeter should agree within ±75 feet of field elevation. If errors exceed these limits, do not fly the aircraft until the altimeter is re-zeroed or replaced.

CAUTION

When using the baroset knob, momentary locking of the barocounters may occur. Application of force may cause internal gear disengagement and result in excessive altitude errors. If locking occurs, rotate the knob a full turn in the opposite direction and approach the setting again slowly.

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

The J-8 attitude indicator (figure 1-11) gives a visual indication of the flight attitude of the aircraft in pitch and roll. Within a range of 27 degrees in a climb or dive, the pitch attitude of the aircraft is indicated by displacement of the horizon bar in relation to the miniature aircraft indicator. When the pitch attitude of the aircraft exceeds 27 degrees, the horizon bar remains in the extreme position and the sphere then serves as the reference. If the climb or dive angle is further increased with the aircraft approaching a vertical position, the attitude is indicated by graduations on the sphere. A controlled precession of 180 degrees occurs when the aircraft approaches 90 degrees in pitch.

In a bank, the attitude of the aircraft is shown by the angle of the horizon bar with respect to the miniature aircraft indicator and by the relation of the bank index to the degree markings on the instrument case.

The indicator may be manually caged with the caging knob on the lower right side of the instrument. Caging should be used only when the aircraft is in straight and level flight as determined by visual reference to a true horizon, since the indicator cages to the attitude of the aircraft.

A knob on the lower left side of the instrument permits the miniature aircraft indicator to be aligned with the horizon bar. The attitude indicator receives its power from the 115 volt three phase AC bus and is protected by a fuse (figure 1-12). An OFF flag appears when power is not applied.

MM-3 ATTITUDE INDICATOR

The MM-3 remote attitude indicator (figure 1-11) gives visual indication of the flight attitude of the aircraft in pitch and roll. It is a completely automatic system, having the control gyro and rate switching gyro located above the fuselage fuel tank.

The system is powered by the 115 Volt, three phase AC bus and protected by two fuses. Gyro erection can be observed by the disappearance of an OFF flag. The OFF flag will appear in case of a complete AC power failure, or failure of some of the electrical components.

WARNING

The OFF flag may not be visible with a slight electrical power reduction or failure of other com-ponents within the system. This can result in erroneous or complete loss of pitch and bank presentations without the OFF flag appearing. Therefore, other flight instruments should be cross-checked to insure accuracy of the MM-3.

The instrument operates through 360 degrees of roll, 87 degrees of climb and 87 degrees of dive. A controlled precession of 180 degrees occurs when the aircraft approaches 90 degrees in pitch.

As level flight pitch attitude of the aircraft varies with different loadings and speeds, a pitch trim knob is provided on the indicator for the pilot to center the sphere with the fixed reference aircraft after the aircraft has been trimmed for level flight.

MM-3 Attitude Indicator Fast Erection Switch

The MM-3 attitude indicator fast erection switch (figure 1-11) 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 FAST longer than two minutes. Allow five minutes between actuations.

Note

The fast erection switch is to be actuated only in straight and level unaccelerated flight to prevent erection to a false level flight indication.

ARU-44/A Attitude Indicator

The ARU-44/A Attitude Indicator (8, figure 1-6) receives its power from the 115-volt, three-phase AC bus. It is a self-contained attitude indicator that displays precise attitude information through 360° of bank and ±85° of pitch.

Clockwise rotation of the caging knob, when fully extended, locks the gyro. Rotation of the caging knob, when retracted, adjusts the position of the miniature aircraft to a minimum of five degrees in climb and dive.

The erection system works automatically but errors of greater than 10 degrees must be eliminated by caging the indicator.

CAUTION

- To avoid damage to the gyro system, ensure the gyro is caged and locked (knob pulled out and rotated fully clockwise) prior to applying power and prior to turning off AC power during engine shutdown. Avoid snap-releasing the pitch/trim knob after uncaging to prevent damage to the indicator and gyro.
- Do not fly with the attitude indicator caged, as damage to the gyro mechanism may occur.

The gyro wheel speed and the unique nature of the erection system combine to provide a minimum of 9 minutes of attitude information with total loss of power. This attitude information will be accurate within ±5 degrees in pitch and bank. The OFF flag being in view during these conditions does not invalidate attitude information.

ARU-42A ATTITUDE INDICATOR (T.O.1T-37B-561)

The ARU-42A attitude indicator (figure 1-11) is self-contained and provides a visual indication of the bank and pitch of the aircraft. The pitch limits are 92 degrees in climb and 78 degrees in dive. The roll capability is a full 360 degrees.

The instrument has a pitch/trim knob to adjust the miniature aircraft and cage the indicator. Rotating the knob adjusts the miniature aircraft. Pulling the knob out to the fully extended position cages the indicator. With the knob fully extended and rotated fully clockwise the indicator remains caged until the knob is rotated counter-clockwise and released.

Approximately 3 minutes are required to erect to true vertical after power is applied to the system. The indicator should be uncaged and set after applying electrical power, and left uncaged for the remainder of the flight. When power is interrupted or the indicator is caged, the OFF warning flag appears on the face of the indicator. The indicator will provide a minimum of 9 minutes of useful attitude information after power failure. Power is supplied by the DC bus.

WARNING

The indicator may precess following sustained acceleration or deceleration periods and may tumble during maneuvering flight near the vertical.

CAUTION

To avoid damage to the gyro system, ensure the gyro is caged and locked (knob pulled out and rotated fully clockwise) prior to applying power and prior to turning off electrical power during engine shutdown. Avoid snap-releasing the pitch/trim knob after uncaging to prevent damage to the indicator.

J-2 HEADING INDICATOR SYSTEM

The J-2 heading indicator system consists of the J-2 and RMI heading indicators and the course indicator heading pointer (6, 28, 30, figure 1-6). The system receives inputs from 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 DC bus and the 115 AC, three-phase bus.

Note

Should either the DC or AC power supply fail, the 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, compare the indication with that of the magnetic compass. If you note a difference of more than 5° by the time you complete the LINEUP check, the heading system is not operating properly and should be checked for malfunction.

A compass card set knob on the lower left side of the heading indicator permits the compass card to be rotated to a preselected heading.

Heading Indicator Cut-out and Fast Slave Switch

The switch (7, figure 1-6) has three positions: OUT, IN and FAST. When the switch is IN, 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. With the switch in FAST, it provides a means of stabilizing the gyro after it has been upset by overbanking or acrobatics. Momentarily holding the switch in FAST interrupts DC power to the indicator. When the switch is released, it will return to IN, power will be restored, and the fast slaving cycle is initiated to permit faster gyro recovery to the corrected heading. The fast slaving cycle continues for approximately 3 minutes, regardless of the amount of error to be corrected. Airspeed and heading should be held constant while the gyro mechanism is in the 3 minute cycle, even if the heading is corrected before the 3 minute cycle is complete.

CAUTION

To avoid damage to the slaving torque motor, the switch should not be positioned to FAST too frequently. Allow 10 minutes between actuations, and hold switch no longer than two seconds.

Note

If a turn is required before the end of the 3 minute fast slave cycle, the heading-indicator cut-out switch should be placed in OUT to avoid inducing a heading error. The 3 minute cycle is computed from the time of original activation. Returning the switch to IN will finish out the remaining time which includes the period the switch was in OUT.

Note

- If using OUT to make turns after the heading error has been corrected, heading information remains accurate, provided small bank angles (standard rate turns or less) are used. To minimize the effect of gyro drift return the switch to IN when the turn is complete.
- With the switch in OUT, the magnetic function of the heading indicator is discontinued by shutting off the power supply to the slaving torque motor. OUT is designed to navigate in polar areas where the dip of the earth's magnetic field causes indications to become inaccurate.
- Since there is no means of resetting the heading 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 OUT.

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. Refer to AFM 51-37 for additional information.

CLOCK

The clock (13, 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 1-11) receive their power from the DC bus. They operate whenever DC power is supplied to the aircraft.

Engine Fire And Overheat Detect System

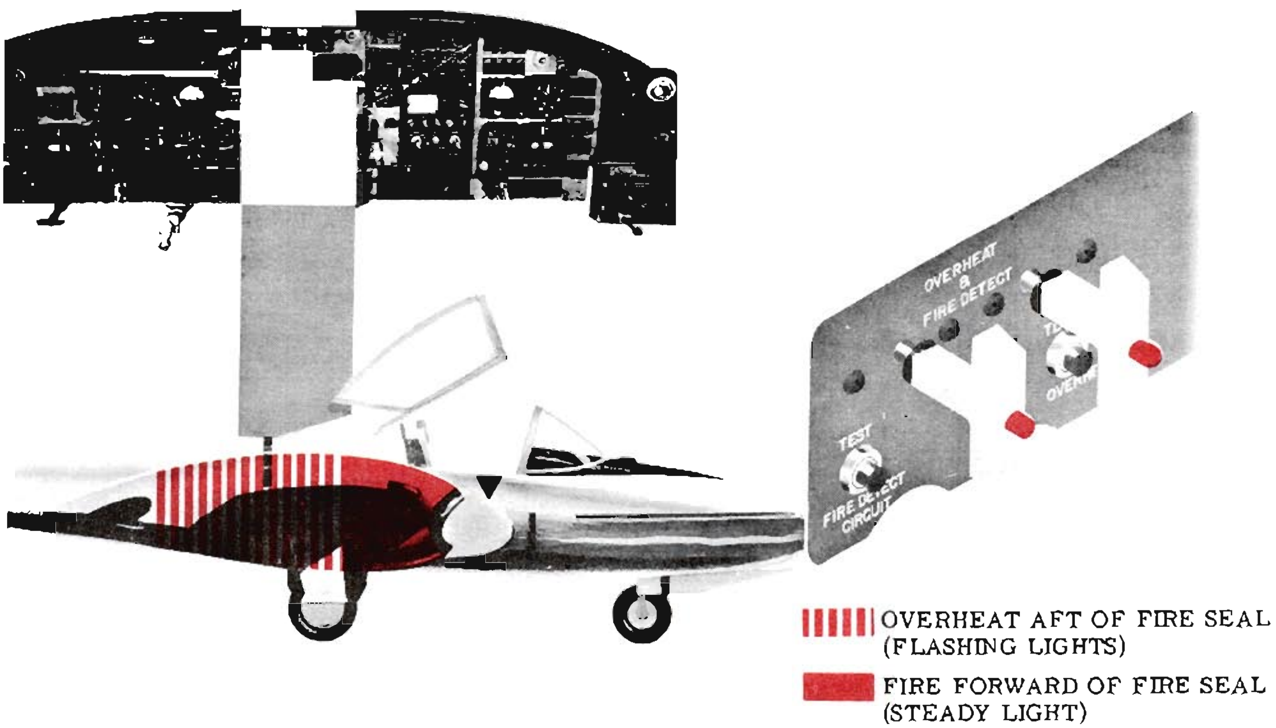


Figure 1-20

PITOT STATIC INSTRUMENTS

Five flight instruments operate from the pitot static system. They include two air-speed indicators (3, figure 1-6 and figure 1-11); two altimeters (31, figure 1-6 and figure 1-11) and a vertical velocity indicator (29, figure 1-6).

EMERGENCY EQUIPMENT

ENGINE FIRE AND OVERHEAT DETECT SYSTEM

The engine fire and overheat detect system (figure 1-20) shows: a fire in either engine nacelle forward of the fire seal, or 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, while a flashing red light indicates an overheat or fire condition aft of the fire seal in the corresponding engine nacelle compartments. Operation of the system and lights can be checked by the system test switches. The lights use DC power.

Note

With an electrical failure, the system will be inoperative. Monitor the EGT.

Engine Fire and Overheat Detect Switches

The engine fire detect test switch (14, 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 engine overheat detect switch (18, 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 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.

Communications and Associated Electronic Equipment

DESIGNATION	TYPE	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-164	AIRCRAFT-TO-AIRCRAFT AIRCRAFT-TO-GROUND COMMUNICATION	PILOT OR INSTRUCTOR	LINE-OF-SIGHT	STATIONARY INSTRUMENT PANEL
IDENTIFICATION TRANSPONDER	AN/APX-72	AUTOMATIC AND SELECTIVE IDENTIFICATION	PILOT OR INSTRUCTOR	LINE-OF-SIGHT	STATIONARY INSTRUMENT PANEL
DME RECEIVER	AVQ-75	DISTANCE MEASUREMENT	PILOT OR INSTRUCTOR	LINE-OF-SIGHT	STATIONARY INSTRUMENT PANEL
VOR/ILS RECEIVER	AN/ARN-127	NAVIGATION	PILOT OR INSTRUCTOR	LINE-OF-SIGHT	STATIONARY INSTRUMENT PANEL

Figure 1-21

COMMUNICATIONS AND ASSOCIATED ELECTRONIC SYSTEMS

INTERPHONE SYSTEM AN/A1C-10

The interphone system (intercom) controls communication from one crewmember to the other and between crewmembers and outside agencies. It is a master control for all the communication/navigation radios, as all incoming signals pass through it.

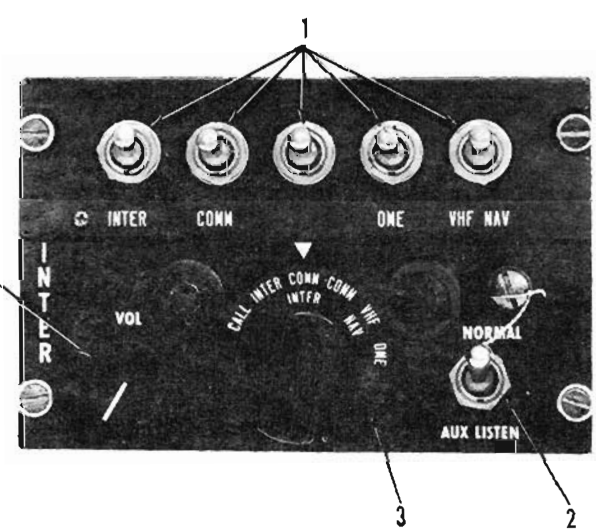
The system normally uses power from the DC bus, but can operate on battery power alone. There is no on-off switch; the system is on any time DC power is available and the circuit breaker is pushed in.

The control panels (figure 1-22) are located on the side panels (2, 23, figure 1-7). The components are:

1 - Toggle switches. When placed outboard you can monitor the appropriate incoming signal. The center toggle switch is not used.

2 - Normal-auxiliary listen switch. This is usually safety-wired to NORMAL. In AUX-LISTEN you will be able to monitor only one incoming signal, the one controlled by the first toggle switch from the left that is outboard. For example, to monitor VOR, all four of the other switches must be inboard.

INTERPHONE CONTROL PANEL



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

Figure 1-22

3 - Rotary selector switch:

COMM-INTER. Allows one crewmember to talk to the other without pressing the microphone button. Pressing the microphone button allows radio transmissions.

COMM. Restricts communication to the UHF radio only, and the microphone button must be pressed.

INTER. Restricts communication to intercom only. Microphone button must be pressed.

CALL. Immediately contacts other crewmember, regardless of how the panels are set up. Used for urgent contact.

VHF NAV and DME. Permit monitoring of VOR/ILS and DME identification signals.

4 - Volume. Controls volume of all incoming signals selected by the toggle switches.

A radio interrupt switch on the instructor's stick grip cuts out all incoming signals, to allow unhampered cockpit communication and cockpit transmissions.

Interphone Operation

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

UHF COMMAND-RADIO AN/ARC-164

Note

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

The AN/ARC-164 UHF Command Radio set (figure 1-23) provides line-of-sight voice and tone transmission and reception on 7000 frequencies within the 225.0 to 399.975 megahertz range. The control panel is located on the stationary instrument panel.

Function Control Switch (1, figure 1-23)

MAIN: permits normal operation on the selected frequency.

BOTH: permits normal operation on the selected frequency and simultaneous reception on guard channel.

ADF: inoperative.

Mode Control Switch (2, figure 1-23)

MANUAL: permits operation on the frequency selected by manual frequency selector knobs (3, figure 1-23).

PRESET: permits operation on any of the 20 preset channels as selected by the channel selector knob (4, figure 1-23).

GUARD: permits operation on the emergency frequency (243.0)

Tone Button (5, figure 1-23)

Provides a continuous wave for homing operations.

Volume (6, figure 1-23)

Self explanatory.

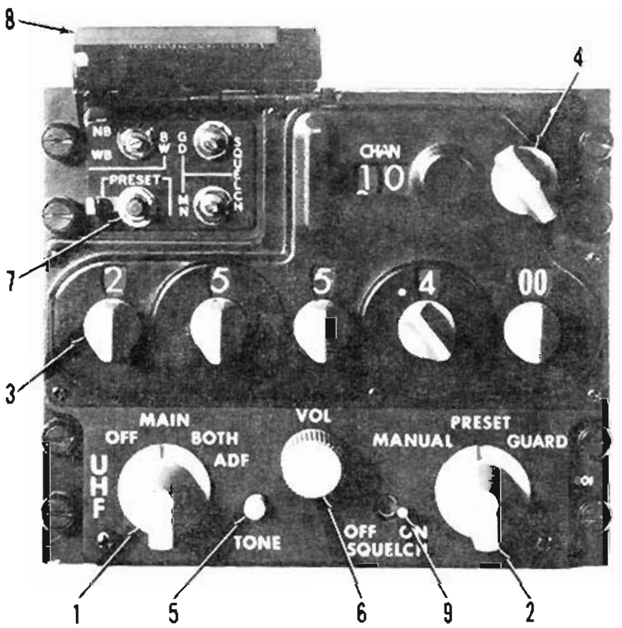
Preset Button (7, figure 1-23)

Permits any frequency to be set into a given channel. Place the function control switch in MAIN or BOTH; place the mode control switch in PRESET; select the desired channel with the channel selector knob; set the desired frequency with the manual frequency selector knobs; press the preset button.

Channel Frequency Card (8, figure 1-23)

Provides a list of frequencies corresponding to channels.

UHF COMMAND RADIO, AN/ARC-164 CONTROL PANEL



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

Figure 1-23

Squelch Switch (9, figure 1-23)

ON: allows normal reception without background static.

OFF: disables squelch, allowing background noise in absence of a signal.

The 20 preset frequencies are normally standardized and set by communications personnel. The set is powered by the DC bus. It can operate on as little as 18 volts and will operate on battery power if both generators fail.

Operation of UHF Command Radio

1. Select PRESET position with the mode control switch.
2. Rotate function control switch to BOTH.
3. Select the desired channel. Set is now ready for use.
4. Adjust volume control.
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 until the numerals indicating the desired frequency appear in the windows. (The function control switch must be in MAIN or BOTH)

Note

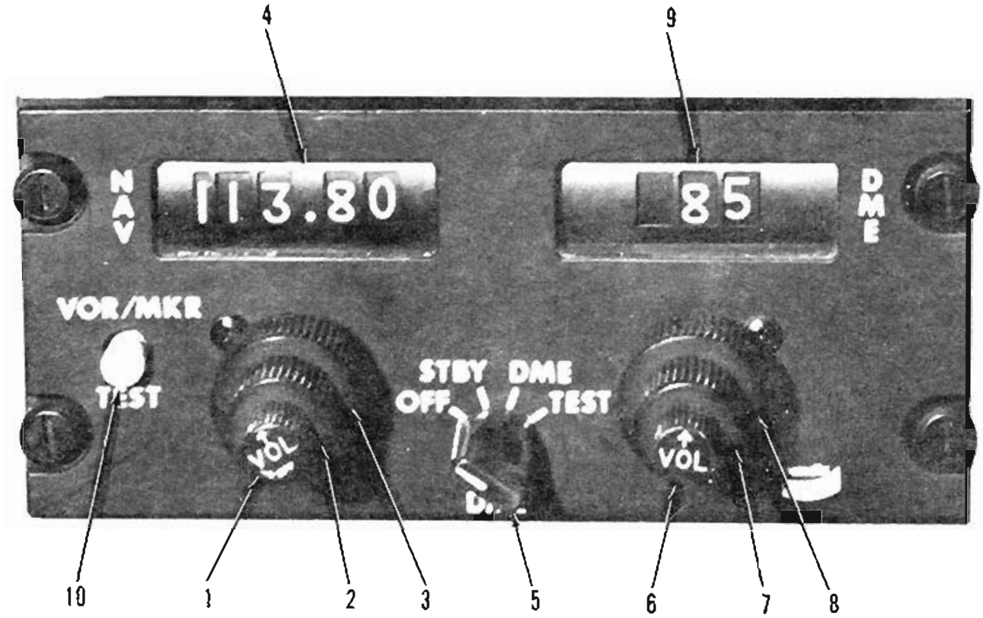
If a stuck mike button is suspected, proceed as follows: Position the rotary selection switch to INTER. If you can transmit over the interphone without depressing the mike button, you have a stuck mike button. If operation of the interphone or UHF radio is necessary from the affected crew position, set the interphone control panel to AUX LISTEN. To receive, place AUX LISTEN switch to AUX LISTEN and rotary selector switch to INTER. Ensure all toggle switches, except COMM, are placed inboard. To transmit, turn the rotary selection switch to COMM-INTER and then back to INTER when transmission is complete. Operation of the UHF radio is normal for the other crewmember as long as the rotary selection switch is set on INTER at the affected position.

6. To transmit and receive on guard frequency, move mode control switch to GUARD.
7. To turn off receiver-transmitter, move function control switch to OFF.

VOR/ILS RECEIVER - AN/ARN 127

The VOR/ILS Receiver (AN/ARN-127) consists of a remotely installed VOR, Localizer (LOC), Glide Slope (GS) and Marker Beacon (MB) Receiver. It provides outputs for visual display of course and glide path deviation and marker beacon passage as well as audio outputs for station identification and voice reception. The presentation is displayed on the Course Indicator (figure 1-26) and the Radio Magnetic Indicator (figure 1-27).

NAV/DME CONTROL PANEL



1. VOR/ILS ON/OFF/VOLUME CONTROL KNOB.
2. VOR/ILS WHOLE MEGAHERTZ FREQ. SEL. KNOB
3. VOR/ILS FRACTIONAL MEGAHERTZ FREQ. SEL. KNOB
4. VOR/ILS FREQ. INDICATOR WINDOW
5. DME MODE CONTROL SELECTOR
6. DME VOLUME CONTROL KNOB
7. DME UNITS SEL. KNOB
8. DME TENTHS-HUNDREDS SEL. KNOB
9. DME (TACAN) CHANNEL INDICATOR WINDOW
10. VOR/MKR TEST BUTTON

Figure 1-24

The system is capable of receiving all VOR stations and all compatible ILS localizer and glide slope transmitter combinations between 108.0 and 117.95 MHz in 0.05 MHz. increments. With an ILS frequency selected, the glide slope receiver is automatically tuned to a matching frequency for ILS operation. The system is powered by the DC bus and the 115 volt AC, three phase bus.

NAV/DME CONTROL PANEL

Controls for the VOR/ILS receiver are located on the left side of the NAV/DME control panel (figure 1-24). The panel also shares the controls for the DME (AVQ-75) which are located on the right side.

VOR/ILS TEST BUTTON

The VOR/ILS test button tests system display functions. Depressing the test button will cause the course deviation indicator (CDI) to deflect and the marker beacon to illuminate, if a valid VOR/ILS frequency is received.

VOR/ILS Test

1. Turn volume control knob out of OFF.
2. Select localizer frequency and check for no OFF flags, absence of TO/FROM indication and proper needle deflection in relation to aircraft position. The RMI bearing pointer should park at the 4 o'clock position. Pressing the VOR/ILS test button will illuminate the marker beacon light.
3. Select VOR frequency and check for TO/FROM indication. The RMI bearing pointer should indicate approximate direction to VOR station. Set 315° in the course selector window and press the VOR/ILS test button. The RMI bearing pointer will indicate 315° and the CDI will center within ±2°.

VOR/ILS Operation

1. Turn volume control knob out of OFF.
2. Select desired frequency.

Note

If the RMI needle(s) start to spin rapidly, turn off the VOR until the spinning stops, then return to ON. Repeat if necessary.

3. Refer to AFM 51-37 for VOR/ILS operational procedures.
4. To turn equipment off, turn volume control knob to OFF.

Note

The RMI bearing pointer will park at the 4 o'clock position when the equipment is tuned to a localizer frequency, an unreliable VOR frequency or when 25.5 volts DC is lost.

DME NAVIGATION SYSTEM - AVQ-75

The DME navigation system consists of an interrogator, a distance indicator, a shared NAV/DME control panel and an antenna. It continuously measures the slant-range distance between an aircraft in flight and a TACAN station, and displays this information to the pilot in the form of nautical miles on the DME indicator. The digital readout will continuously change as the aircraft moves closer to or farther from the ground station.

The maximum operating range is 196 nautical miles and is limited to line-of-sight. An altitude of 17,000 feet or more over flat terrain is normally necessary to achieve the full range. The system uses DC power, through a circuit breaker located in the right hand nose section.

The DME operates on the TACAN channel numbers 17 through 59 and 70 through 126. When the aircraft is directly above the ground station, slant range and aircraft altitude become equal, and the DME then gives an indication of altitude in nautical miles. Plotting the DME reading on an aeronautical chart will indicate the aircraft's ground position on the radial from the TACAN station on which the aircraft is flying. For reporting ETA, the readings of the DME can be used to establish actual ground speed.

Controls for the DME system are located on the NAV/DME control panel (figure 1-24). The DME mode control selector (5, figure 1-24), marked OFF, STBY, DME and TEST, controls operation of the DME. In DME the system is operative. STBY is used to warm up the DME system. Holding the switch in TEST causes the DME to momentarily go into search, concluding with a display of approximately 196.0 nautical miles on the DME indicator (figure 1-25). Releasing the switch places the system in DME. The DME channel selector control knobs (7, 8, figure 1-24) are used to select the ground station's channel number. If a TACAN channel number below 17 is selected, the control panel will automatically select TACAN channel number 17. If a TACAN channel number above 126 is selected, the control panel will automatically select TACAN channel number 120.

The DME indicator (10, figure 1-6), located on the left instrument panel, displays distance in nautical miles. A red flag alarm covers the display whenever the reading is not valid, but is deflected from sight when the indicator reading is usable. When the mode selector (5, figure 1-24) is in DME, and a suitable TACAN channel is received, the indicator numerals will quickly rotate behind the flag alarm until the correct distance is displayed. When the correct distance is indicated, the DME locks on, or ends the search, and the flag alarm deflects from view, exposing the distance reading. The numerals then begin to rotate slowly, or track, reflecting the aircraft's continuously changing distance from the ground station.

DME INDICATOR

Figure 1-25

CAUTION

DME should remain in STBY for one minute prior to operating or performing checks.

The ground station is identified by its Morse code signal, which is transmitted approximately every 30 seconds. To receive the code, the DME monitor switch on the interphone control panel is positioned to ON or the rotary selector switch is positioned to DME.

When locked onto a signal, the DME stays locked on, even if the signal is momentarily interrupted. If the signal is lost, the DME continues to display the last known distance from the ground station. This display continues for the duration of the memory (about ten seconds). Thus, tracking can continue uninterrupted if the signal is regained.

If the signal is lost for more than ten seconds, the flag alarm is reset and the DME goes into search if usable signals are present, or into standby if no usable signals are present.

The DME automatically goes into standby if no usable signal is returned from the ground station. This feature makes it possible for the pilot to preset the DME before flying into range of one of the ground stations without having the DME search needlessly until a usable signal is detected.

If the interrogator fails to track, there could be several reasons, each of which should be investigated before it is assumed that the DME has failed. The proper channel may not have been selected, or the ground station selected may be out of range; the aircraft may be flying too low for proper reception or the ground station may be malfunctioning, in which case, other ground stations within range should be interrogated.

Operation of DME System - AVQ-75

1. DME mode control selector - STBY. Allow one minute for the set to warm up.
2. DME channel selectors - SET.
3. DME mode control selector - DME.
4. To identify ground station signal - Position DME monitor switch on the interphone control panel to ON or position the rotary selector knob on the interphone control panel to DME.
5. To turn equipment off - Set DME mode control selector OFF.

COURSE INDICATOR

Refer to AFM 51-37 for the indications, operations and preflight checks of the course indicator (figure 1-26).

WARNING

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

RADIO MAGNETIC INDICATOR

Refer to AFM 51-37 for indications and operations of the radio magnetic indicator (figure 1-27). In the T-37B, the number 1 bearing pointer has been removed. The number 2 bearing pointer indicates VOR magnetic bearing.

COURSE INDICATOR

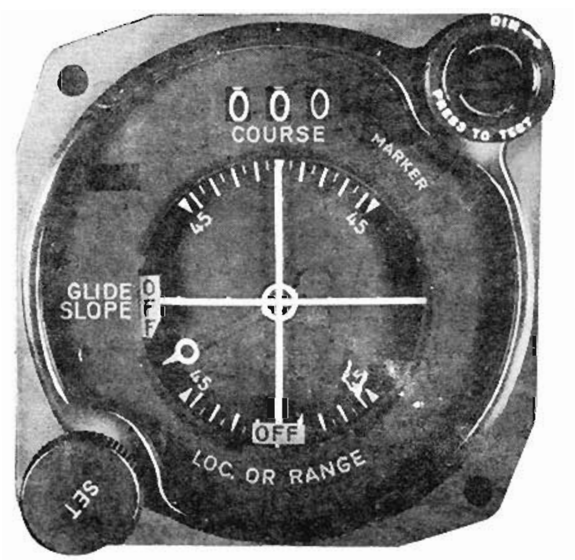


Figure 1-26

RADIO MAGNETIC INDICATOR

Figure 1-27

IDENTIFICATION TRANSPONDER-AN/APX-72

The AN/APX-72 identification transponder system (figure 1-28) provides automatic radar identification and altitude reporting information. The responses will also identify the aircraft as friendly within a group of specific aircraft. Supplementary purposes of the transponder system are to provide momentary identification of position upon request and to transmit a specially coded response to indicate an emergency. In addition, the signals returned from the transponder can be used at the interrogating station to determine range and azimuth information.

Power to the transponder system is provided by the DC bus and the 115-volt AC single-phase bus. The transponder system is protected by circuit breakers and a fuse.

The AN/APX-72 is transistorized for lighter weight and less current drain. Warmup time does not exceed one minute under standard conditions or two minutes under extreme conditions. If properly warmed up, there will be no delay in response to interrogations.

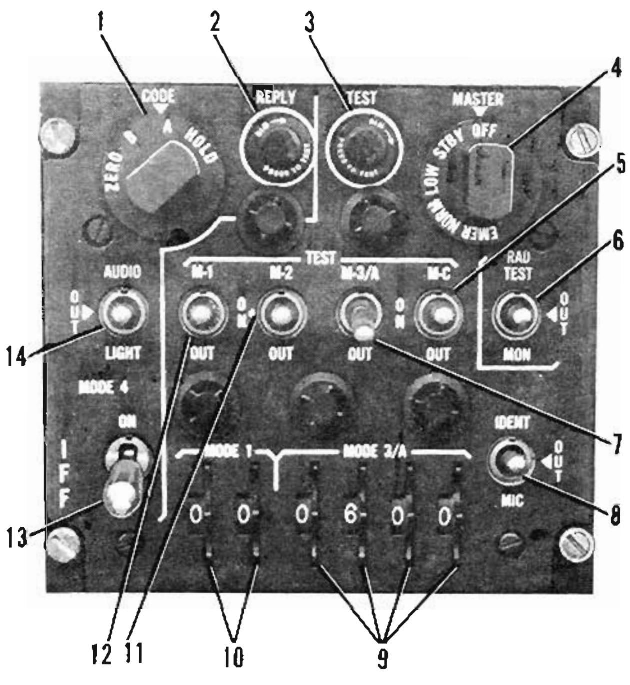
The antenna system is comprised of two antennas and a switching circuit. The system is controlled by a switch located on the left instrument panel (34, figure 1-6). This switch has three positions: UPPER, AUTO and LOWER.

With the switch in AUTO, the switching circuit determines which antenna is receiving the stronger interrogation and routes the response signal through the same antenna. The manual switching feature can be enabled by selecting either UPPER or LOWER with the antenna select switch.

Tests have shown that the lower antenna will give the best radar return when the aircraft is flying away from the ground radar antenna. The upper antenna will give the best return when inbound, during a VOR penetration and holding. Normally AUTO will select the proper antenna and should be used unless a malfunction is suspected. Either UPPER or LOWER may be used in the event of an AUTO malfunction.

The transponder system is capable of using five operational modes (Modes 1, 2, 3/A, C and 4) and can superimpose four special signals on the mode replies. Modes of operation are selected on the identification transponder control panel (figure 1-28), however only modes 3/A and C are used in the T-37.

AN/APX-72 TRANSPONDER CONTROL PANEL



1. MODE 4 CODE SWITCH (inoperative)
2. MODE 4 REPLY LIGHT (inoperative)
3. TEST LIGHT
4. MASTER CONTROL SWITCH
5. MODE C SELECT SWITCH
6. RAD TEST-MON SWITCH
7. MODE 3/A SELECT SWITCH
8. IDENTIFICATION SWITCH
9. MODE 3/A CODE SELECT SWITCHES
10. MODE 1 CODE SELECT SWITCHES
11. MODE 2 SELECT SWITCH
12. MODE 1 SELECT SWITCH
13. MODE 4 ON-OUT SWITCH (inoperative)
14. MODE 4 AUDIO-LIGHT SWITCH (inoperative)

Figure 1-28

Identification Transponder Control Panel

The identification transponder control panel (figure 1-28) is located on the lower right portion of the instrument panel. The panel provides cockpit control of all modes of operation.

The MASTER control switch (4, figure 1-28) is a five-position rotary switch. The switch turns the transponder system on and off, selects the desired receiver sensitivity, and provides for emergency operation. In OFF, the transponder system is inoperative. In STBY, the transponder is placed in a warm-up condition. In LOW, power is applied to the transponder, but operation sensitivity is reduced and replies are transmitted only in the presence of strong interrogation. In NORM, power is applied to the transponder for operation at normal receiver sensitivity. In EMER (the knob must be pulled out before it can be turned to EMER), the transponder automatically transmits emergency reply signals.

The Modes 1, 2, 3/A and C select switches (5, 7, 11, 12 figure 1-28), are marked, ON, OUT and TEST. In ON, the transponder replies to the selected Mode interrogations. OUT disables the transponder replies to these interrogations. In TEST, the transponder may be locally interrogated while also replying. When the reply is satisfactory, the green TEST light (3, figure 1-28) will illuminate.

The Mode 1 code select switches (10, figure 1-28) select and indicate the Mode 1 two-digit reply code number.

The Mode 3/A code select switches (9, figure 1-28) select and indicate the Mode 3/A four-digit reply code number.

The Mode C select switch controls the altitude reporting function of the identification transponder.

The Mode 4 audio-light switch (14, figure 1-28) is inoperative.

The Mode 4 code switch (1, figure 1-28) is inoperative.

The RAD TEST and MON switch (6, figure 1-28) is a three-position, toggle-type switch marked RAD TEST, OUT and MON. The switch is spring-loaded from RAD TEST to OUT. In RAD TEST, the output power of the individual modes can be tested. Other functions of this switch are classified. In MON, the receiver sensitivity can be checked. The green TEST light (3, figure 1-28) will illuminate when the function being checked is acceptable.

The identification switch (8, figure 1-28), marked IDENT, OUT and MIC, is spring-loaded from IDENT to OUT. IDENT, when momentarily actuated, initiates I/P reply code operation for approximately 20 seconds. In MIC, with the microphone button depressed, approximately 20 seconds of I/P reply code will be transmitted. OUT disables IDENT reply from the transponder system.

The TEST light (3, figure 1-28) illuminates when the transponder properly responds to a Mode 1, 2, 3/A or C test.

Modes of Operation:

1. For Mode 1 operation, select NORM or LOW on the master control switch and set the Mode 1 select switch to ON. Depending on the selection of the Mode 1 code select switches, a total of 32 different reply code combinations are available.
2. For Mode 2 operation, select NORM or LOW on the master control switch and set the Mode 2 select switch to ON. Mode 2 can be preset to select any one of 4096 possible reply code combinations for discrete identification of the aircraft.
3. For Mode 3/A operation, select NORM or LOW on the master control switch and set the Mode 3/A select switch to ON. Depending on the selection of the Mode 3/A code select switches, a total of 4096 reply code combinations are available. Mode 3/A operation provides Air Traffic Control (ATC) correlation of aircraft radar targets with their individually filed flight plans.
4. For Mode C operation, select NORM or LOW on the master control switch and set the Mode C select switch to ON. The altitude digitizer selects one of 2048 reply code combinations to be transmitted.

Special Signal Mode of Operation:

1. A special I/P (Identification of Position) reply code can be selected by the pilot for transmission to permit the ground controller to distinguish between two aircraft displaying identical coding or to establish the position of any given aircraft. The reply code is transmitted for approximately 20 seconds each time the identification switch is placed in IDENT. In MIC, with the microphone button depressed, approximately 20 seconds of I/P reply code will be transmitted. For I/P operation, the MASTER control switch must be in NORM or LOW and the Mode 1, 2 or 3/A select switches in ON.
2. A special emergency code may be selected for transmission when an aircraft is in distress. Placing the master control switch in EMER causes automatic transmission of emergency reply signals that enable the interrogating radar to single out the aircraft in an emergency condition from within a group of aircraft.

Self Test Feature of AN/APX-72

There are three operational tests that may be completed on the AN/APX-72; they are tests for operation, output power and receiver sensitivity of the four modes. All tests are performed with aircraft power available and the master control switch (4, figure 1-28) in NORM.

1. Operational test of modes. Place all mode switches in the modes not being tested in OUT. Then select TEST on the mode being tested. If the particular mode in question is operational, the test light (3, figure 1-28) will illuminate.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

Exterior lighting for inflight and ground operation is provided by position lights, landing lights, a taxi light, anti-collision beacons, a passing light and wing tip strobe lights.

The position lights are controlled by a switch (3, figure 1-8) located on the cockpit switch panel. One white position light is located on the upper centerline of the fuselage aft of the canopy, and the other is located on the lower centerline of the fuselage. One position light is located on each wing tip; a green light on the right and a red light on the left. A single white tail position light is located on the tailcone stinger.

The landing and taxi lights are controlled by a switch (33, figure 1-6), located on the left instrument panel. One landing light is flush mounted on the underside of each wing, aft of the landing gear. The taxi light is mounted in the nose section.

The anti-collision beacons and passing light are controlled by a switch (4, figure 1-8), located on the cockpit switch panel. One red anti-collision beacon is located on the upper surface of the fuselage, aft of the canopy, and the other is located on the lower surface of the fuselage. When operating, the anti-collision beacons display a red rotating light. The red passing light, located in the nose section, indicates the position of the landing gear and also operates as a frontal anti-collision beacon when the landing gear obscures vision of the lower anti-collision beacon. If the landing gear is down and locked, the passing light will be flashing. If the landing gear is not down and locked, the passing light will be steadily illuminated.

Position Lights Switch

The position lights switch (3, figure 1-8) has three positions: STROBE & POS LT, OFF, and POS LT ONLY. In STROBE & POS LT, the strobe lights are controlled by a flasher and will flash intermittently. The lights receive their power from the DC bus and are protected by a circuit breaker.

Anti-Collision Beacon Lights Switch

The anti-collision beacon lights switch (4, figure 1-8), controls the operation of, the two red anti-collision beacons and the red passing light. The lights receive their power from the DC bus and are protected by a circuit breaker.

Landing and Taxi Lights Switch

The landing and taxi lights switch (33, figure 1-6) has three positions: LANDING, OFF and TAXI. The flush-mounted landing light in each wing is extended and turned on when the switch is in LANDING. In OFF, the landing lights are retracted flush with the wings and are automatically turned off. In TAXI, the taxi light in the nose section is turned on. The landing and taxi lights receive their power from the DC bus and are protected by a circuit breaker.

INTERIOR LIGHTING

Interior lighting equipment includes two utility 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 utility 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 on aircraft ▲2. The rheostat receives its power from the 5 volt AC, single-phase bus.

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 ▲2, course indicator on aircraft ▲1, flap position indicator, both oxygen regulators, accelerometer and all the engine and pressure instruments. Power comes from the DC bus.

Secondary Instrument Lights Rheostat

The secondary instrument lights rheostat (15, figure 1-5) controls the intensity of the five lights under the glare shield that illuminate the instrument panel. Power comes from the 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, NAV/DME control panel and the interphone control panels located on either side of the cockpit. Power is supplied by the 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 (2, figure 1-8), has three positions: BRIGHT, DIM and NEUTRAL. It is spring-loaded to NEUTRAL. 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 DC bus, and on aircraft ▲1, is protected by the same circuit breaker that protects the primary flight instrument lights circuit, and on aircraft ▲2, 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 feed and gear handle warning light will illuminate dim when pressed-to-test.
- The primary flight instrument light rheostat must be on before the dimming circuit will function. An interruption in DC power (such as turning the battery and generator switches OFF) will return the warning lights to bright.

UTILITY LIGHT

Two utility lights (4, 14, figure 1-7) provide a portable light source for each pilot. They can be used as either a source of white or red light, and are adjustable as either a spot or a floodlight.

CANOPY

A clear plastic canopy covers the entire cockpit area. During taxiing operation, the canopy may be left open but must be down and locked prior to takeoff. The canopy can be jettisoned in flight or while the aircraft is on the ground.

CAUTION

The canopy must be down and locked before takeoff and during flight. To prevent damage or accidental jettisoning, the canopy must not be opened after landing until the aircraft has slowed below 40 KIAS.

The canopy is opened or closed electrically by an internal canopy control switch (16, figure 1-5) or by an external canopy switch (6, figure 1-29).

During canopy jettisoning, gas pressure automatically unlocks the down locks. To jettison the canopy, pull the external canopy ejection handle (2, figure 1-29) located on the left wall, aft of the pilot's oxygen regulator. The canopy is also jettisoned during the ejection sequence.

WARNING

If the canopy is jettisoned by use of the hand grips and triggers, the seat will eject approximately 1/3 of a second after the canopy.

Note

The thruster quick-disconnects must be properly mated or the canopy may fail to jettison due to a loss of gas pressure.

EXTERNAL CANOPY CIRCUIT SWITCH

The external canopy circuit switch (5, figure 1-29) has two positions: EXTERNAL and INTERNAL. EXTERNAL disconnects the internal canopy switch from the circuit and allows normal operation of the external canopy switch. INTERNAL allows canopy operation through the internal canopy control switches. In this position, the canopy will move to the full open position if the canopy is unlocked and battery power, APU power, or aircraft power is available. This switch must be in INTERNAL for all normal operations.

INTERNAL CANOPY CONTROL SWITCH

The internal canopy control switch (16, figure 1-5) has two positions: OPEN and CLOSED, and is spring-loaded to OPEN. With the canopy closed and locked, moving either canopy downlock handle fully aft will automatically open the canopy. To close and lock the canopy, this switch must be held in CLOSED 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. The switch is deactivated by a microswitch on the canopy downlock handles whenever they are moved from the full aft position, and by a microswitch on the right main landing gear whenever the gear is off the ground. The switch receives power directly from the battery when the battery switch is off. The switch receives power from the DC bus through the battery when the battery switch is on and the DC bus is energized by the generators.

EMERGENCY CANOPY CONTROL SWITCH

The emergency canopy control switch (17, figure 1-5), is located on the center control quadrant. The switch has two positions, OFF (down-cover closed) and ON (up-cover open). A guard, marked EMERGENCY CANOPY, covers the switch. The guard is safety wired in the closed position. The switch receives power from the battery.

Emergency canopy opening is accomplished by releasing the canopy downlock handles and placing the emergency canopy control switch ON. The canopy will then electrically open regardless of the position of any other switch in the canopy control system.

Note

- The emergency canopy control switch may also be used to open the canopy, if normal canopy opening procedures are ineffective.
- The emergency canopy control switch and the internal canopy switch are protected by the same circuit breaker which is not accessible from the cockpit. Therefore, if the canopy does not open when the downlock handle is placed aft, the emergency canopy switch may also be inoperative.

CANOPY DOWNLOCK HANDLES

The canopy downlock handles (1, 15, figure 1-7) are interconnected to permit manually locking and unlocking the canopy from either the pilot's or instructor's seat. Moving either handle fully forward locks the canopy. Before the canopy can be opened or closed normally, the canopy downlock handles must be moved fully aft.

CANOPY-NOT-LOCKED WARNING LIGHT

The red, canopy-not-locked warning light (9, figure 1-6) illuminates when the DC bus is energized and the canopy downlock handles are not fully forward.

CAUTION

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

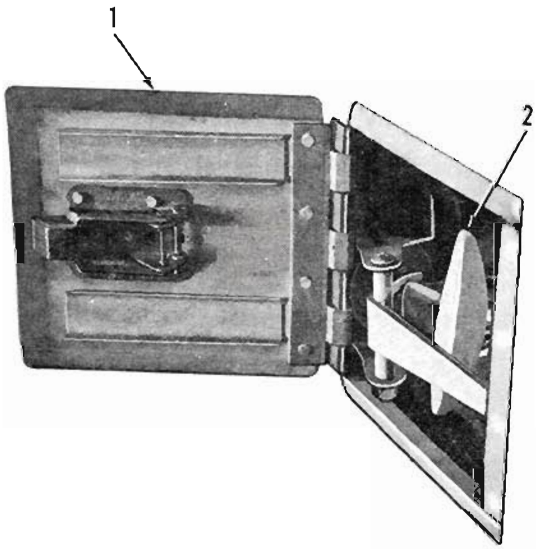
EXTERNAL CANOPY SWITCHES

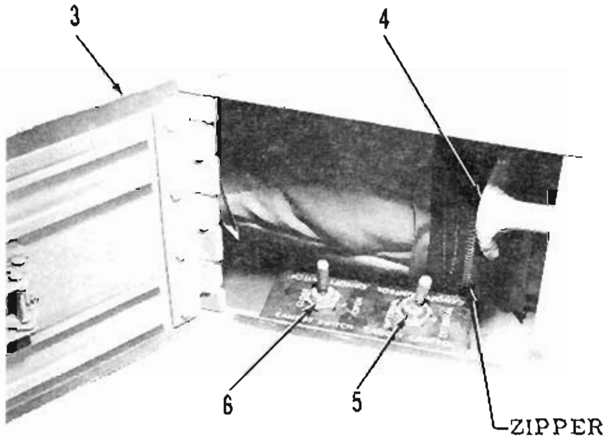
A single three position toggle switch (6, figure 1-29) adjacent to the external canopy circuit switch (5, figure 1-29), is used to open and close the canopy. The toggle switch is spring-loaded to the center (OFF) position and must be held in OPEN or CLOSE until

EXTERNAL CANOPY CONTROLS

EMERGENCY CANOPY JETTISON
OPEN DOOR
PULL HANDLE

MANUAL CANOPY OPERATION
OPEN DOOR—UNZIP LINING
RELEASE CANOPY LOCKS
PULL HANDLE & LIFT CANOPY





1. EXTERNAL JETTISON DOOR
2. EXTERNAL CANOPY JETTISON T-HANDLE
3. MANUAL CANOPY RELEASE DOOR
4. DECLUTCH T-HANDLE
5. EXTERNAL CANOPY CIRCUIT SWITCH
6. EXTERNAL CANOPY SWITCH

Figure 1-29

the canopy has traveled to the desired position. If the external circuit switch (5, figure 1-29) is in INTERNAL, the external canopy control switch is inoperative. The switch uses DC power from the battery.

CANOPY JETTISON T-HANDLE

The canopy jettison T-handle (2, figure 1-29 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. The canopy jettison T-handle will function regardless of the position of the canopy or downlock handles.

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.

Note

This system is normally a maintenance function.

CANOPY DE-CLUTCH T-HANDLE

The canopy declutch T-handle (4, figure 1-29 and 3, figure 1-7) is provided for use when DC power is not available or when electrical opening or jettisoning is not desired. Use the canopy declutch T-handle in the following manner:

CAUTION

If time and conditions permit, install seat and canopy jettison T-handle safety pins before opening the canopy with the de-clutch system. This will prevent inadvertently actuating the canopy jettison T-handle or the ejection seat handgrips during de-clutch operations.

1. Open the manual canopy release door.
2. Position the external canopy circuit switch to EXTERNAL.
3. Place downlock handles fully aft.
4. Pull and hold declutch T-handle located just inside the canopy manual release door and lift canopy open.

CAUTION

Do not confuse the canopy DECLUTCH T-handle with the canopy JETTISON T-handle.

5. Release declutch T-handle to hold canopy open.
6. To close the canopy manually, hold canopy and pull the declutch T-handle gently lowering canopy until closed.

WARNING

Due to the weight of the canopy, two crewmembers are normally required to open and close the canopy manually.

COCKPIT AIRCONDITIONING, VENTILATING AND DEFROSTING SYSTEM

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.

The air conditioning system (figure 1-31) uses bleed air from the engine compressors 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 at a preselected temperature through air outlets on the glare shield. These air outlets are located in the area just forward of the feet along each side of the cockpit and on each side of the instructor's quadrant. The air conditioning system is powered by the DC bus and the 115-volt AC single-phase bus.

CAUTION

- With high outside air temperature an engine overtemperature can occur, if air conditioning is used when one engine is flamed out and the other engine is at military power.
- The refrigeration turbine bearing may fail in flight. This is usually recognized by noise, vibrations and smoke in the cockpit. Selecting vent will alleviate the condition.

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 (5, figure 1-30).

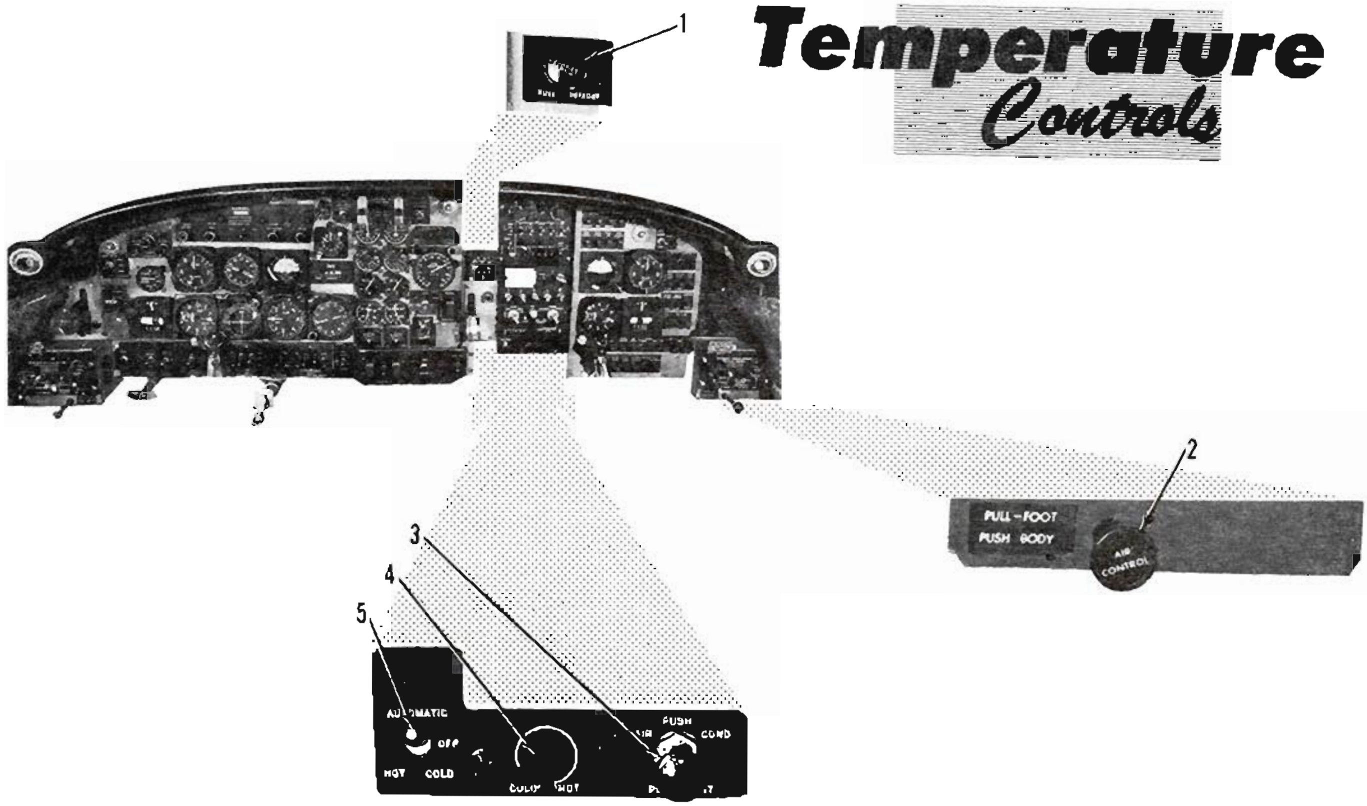
AUTOMATIC: temperature is controlled with the rheostat.

OFF: modulating valve is fixed; temperature cannot be changed.

HOT: increases temperature.

COLD: decreases temperature.

Temperature Controls



1. WINDSHIELD AND CANOPY DEFROST KNOB
2. AIR CONTROL KNOB
3. COCKPIT AIR LEVER
4. COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT
5. COCKPIT AIR TEMPERATURE CONTROL SWITCH

Figure 1-30

The switch is spring-loaded to OFF from HOT or COLD. The switch receives power from the DC bus.

Note

If AC power is lost the automatic temperature control system will be inoperative, and the manual HOT or COLD position must be selected to maintain desired cockpit temperature.

Cockpit Air Temperature Control Rheostat

The rheostat (4, figure 1-30) controls cockpit air temperature only when the cockpit air temperature switch is in AUTOMATIC and AC power is available.

Cockpit Air Lever

With the lever in AIR COND bleed air enters the air conditioning system. If air conditioning is not desired, position the cockpit air lever (3, figure 1-30) to VENT. This shuts off the bleed air to the air conditioning system and opens the ram air system. Ram air and conditioned air cannot be selected at the same time.

WARNING

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

Note

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

airconditioning, ventilation and defrosting system

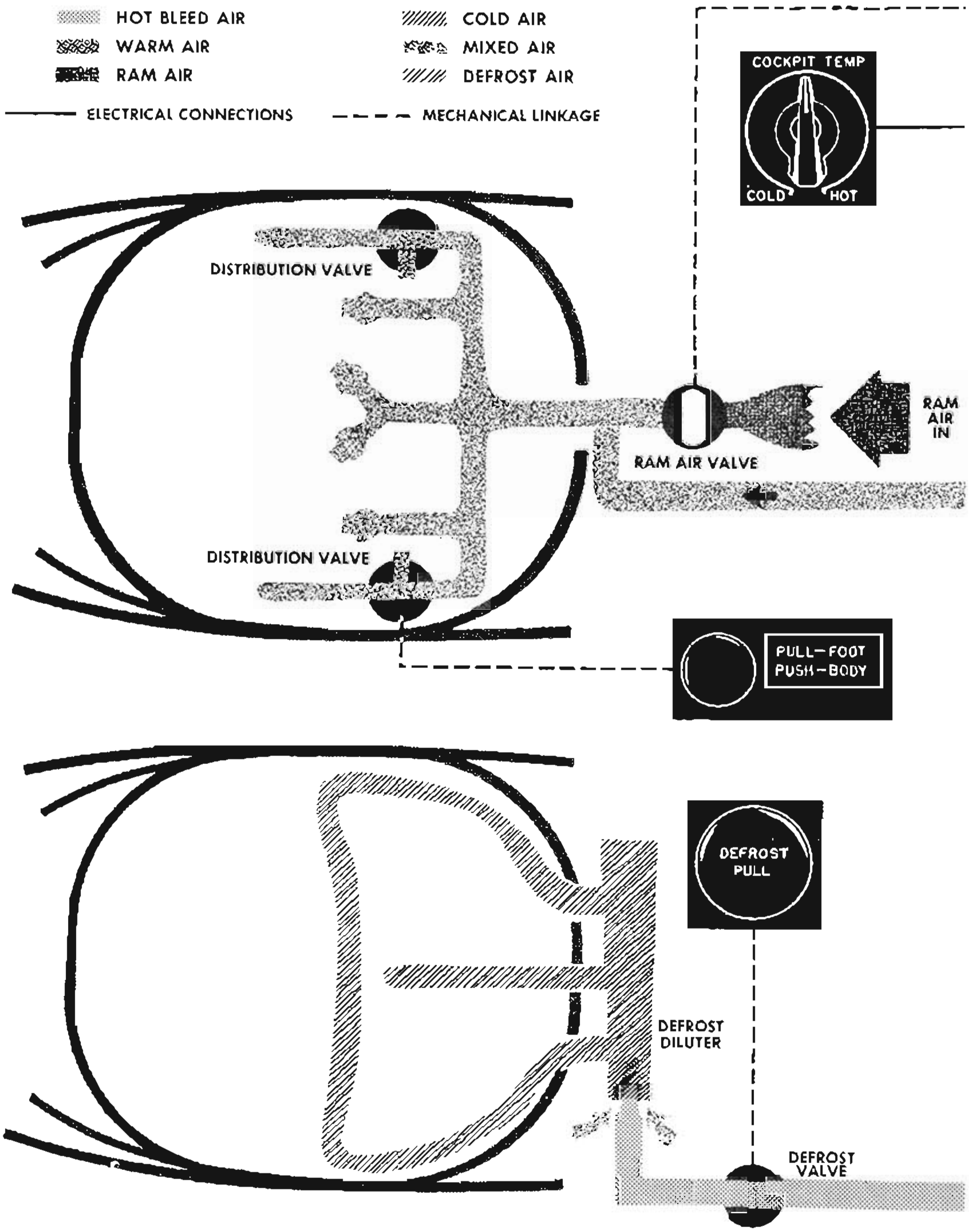


Figure 1-31 (Sheet 1 of 2)

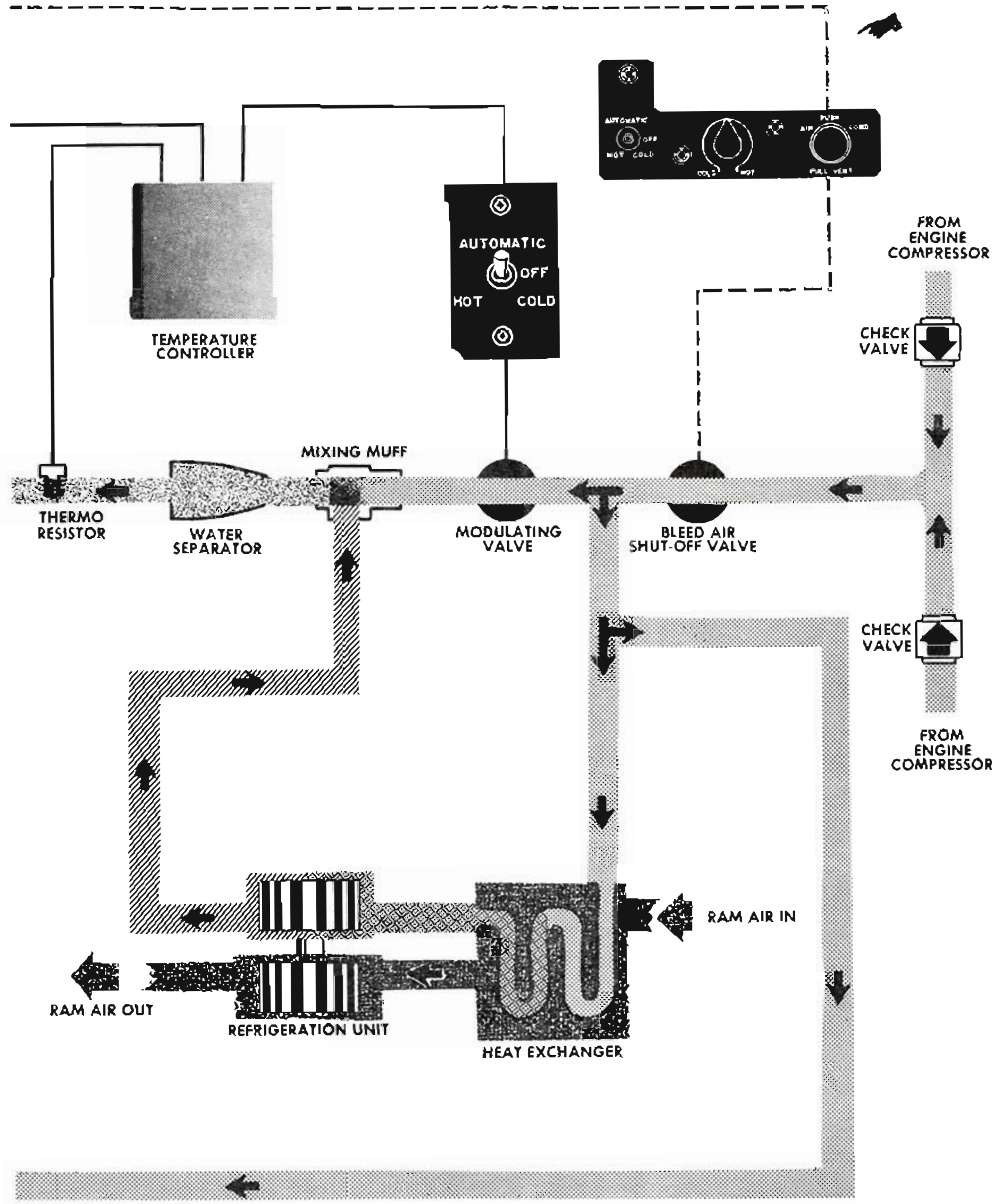


Figure 1-31 (Sheet 2 of 2)

Air Control Knob

A manually operated air control knob (2, figure 1-30), 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.

AIR OUTLETS

The swivel-type air outlets (1, figure 1-4) can be adjusted to direct air in any direction. Each duct can be regulated or shut off completely by a valve located in each air outlet.

DEFROSTING SYSTEM

Part of the bleed air from the engines is used for windshield and canopy defrosting (figure 1-31). The bleed air enters the defrosting system through a manually controlled defrost shutoff valve. Cockpit air is then mixed with the hot 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 (1, figure 1-30), 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 AIR COND.

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 - DESIRED TEMPERATURE.
4. Air control knob - DESIRED POSITION.

WARNING

If cockpit temperature cannot be controlled and the cockpit becomes excessively hot, place the cockpit air lever to VENT. If this action does not maintain the temperature within tolerable limits, it may be necessary to jettison the canopy.

CAUTION

Placing the cockpit air lever in AIR COND 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 VENT.

OXYGEN SYSTEM

The oxygen system has two supply cylinders with an original charge pressure of 425 $\pm$25 PSI (full). They are located in the forward part of the tailcone. 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 is used to replenish the supply. Refer to servicing diagram, figure 1-40. Approximate duration of the oxygen supply is shown in figure 1-32.

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.

Note

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 in NORMAL, 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.

OXYGEN

• duration chart– HOURS

CABIN ALTITUDE FEET / GAGE PRESSURE (PSI)	400	350	300	250	200	150	100
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**

• LIGHT FIGURES INDICATE DILUTER LEVER - NORMAL

• BOLD FIGURES INDICATE DILUTER LEVER-100%

EMERGENCY

BELOW

100

PSI

DESCEND TO

ALTITUDE NOT

REQUIRING OXYGEN

2 CREW MEMBERS

Figure 1-32

OXYGEN REGULATORS

The demand oxygen regulators (figure 1-33) mix air with oxygen in varying amounts according to cockpit altitude and deliver a quantity of mixture each time the users inhale. The regulators supply positive pressure breathing above approximately 28,000 feet. This pressure automatically changes with altitude.

Note

Pressure breathing may occur below 28,000 feet MSL. Enter this condition in Form 781.

OXYGEN SYSTEM REGULATOR LEVERS

Diluter Lever

Each oxygen regulator panel incorporates a diluter lever. The lever (3, figure 1-33) is located on the lower portion of the regulator. This lever is used to select NORMAL OXYGEN or 100% OXYGEN. NORMAL allows the normal flow of air and oxygen to the mask at all altitudes. When the lever is in 100% OXYGEN, cockpit air is shut off and only 100% oxygen enters the mask.

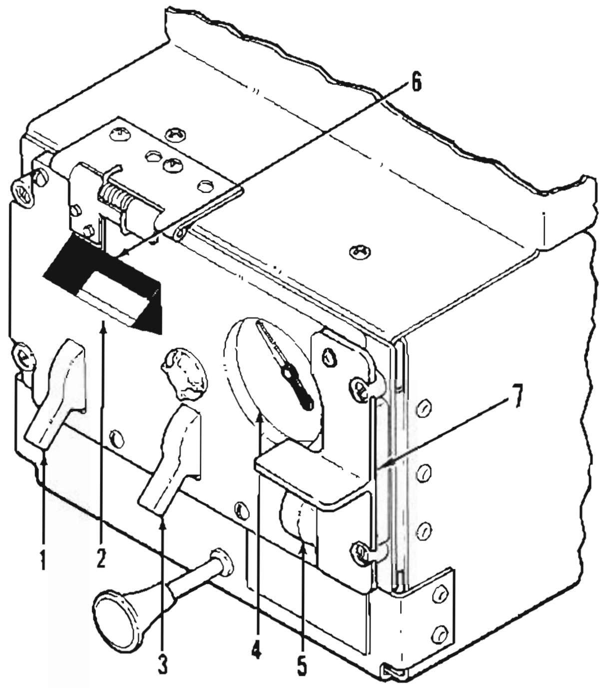
Note

- Whenever an oxygen regulator is not used, the diluter lever for that regulator should be in 100% OXYGEN. This closes the mixer port on the regulator helping to keep it clean.
- For extended solo flight above FL 200, the right oxygen supply lever must be off.

Emergency Lever

The emergency lever (1, figure 1-33) is marked EMERGENCY, NORMAL and TEST MASK. The lever is spring-loaded from TEST MASK only. In TEST MASK, positive pressure will be delivered to the mask. The lever will automatically return to NORMAL when released. Positioning the lever to EMERGENCY causes continuous positive pressure to be delivered to the mask. Moving the lever to NORMAL will return the system to normal operation.

OXYGEN REGULATORS



1. EMERGENCY LEVER
2. FLOW INDICATOR
3. DILUTER LEVER
4. PRESSURE GAGE
5. SUPPLY LEVER
6. PRISM
7. SWITCHGUARD

Figure 1-33

Note

The oxygen masks can be tested at any altitude by placing the emergency lever to EMERGENCY.

Prism

A prism (6, figure 1-33) is installed to present the pilot and instructor the flow indicator at eye level. This enables the pilots to see the flow indicator without lowering their heads.

Supply Lever

The supply lever (5, figure 1-33) has two positions, ON and OFF. When the lever is ON, oxygen may enter the regulator; in OFF, the oxygen supply is cut off.

The left seat oxygen regulator has a metal guard installed above the ON-OFF supply lever. This guard prevents inadvertent shutoffs of the lever when moving the landing gear lever down.

Note

If the supply lever is turned OFF with the diluter lever in 100% OXYGEN, the flow of both aircraft oxygen and ambient air is cut off. On aircraft modified with the CRU-73A regulator there is an interlock between the supply lever and the diluter lever. If the supply lever is inadvertently turned OFF, the diluter lever is automatically positioned to 100% OXYGEN.

OXYGEN SYSTEM REGULATOR INDICATORS

Pressure Gage and Flow Indicator

With MD-1 regulators, the oxygen pressure gage (4, figure 1-33) and the flow indicator (2, figure 1-33) are separate. As oxygen flows from the regulator, the flow indicator blinks.

OXYGEN HOSE HOOK UP

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

1. The oxygen hose does not become accidentally disconnected during flight resulting in loss of oxygen supply to a crew member.
2. The oxygen hose does not prevent quick separation from the seat during ejection.
3. The oxygen hose does not flail during ejection causing injury to the crew member.

WARNING

The oxygen hose should be routed under the right shoulder harness. This helps to keep the shoulder harness clear of the connector and prevents the harness from being snagged between the connector and its mounting plate during seat separation.

OXYGEN SYSTEM PREFLIGHT CHECK

Refer to figure 1-34 for the correct method of oxygen hose attachment. Both crew members should complete the following preflight check.

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

Note

Oxygen quantity requirements will be established by the using command.

OXYGEN HOSE HOOKUP CRU 60/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 BAYONET CONNECTOR ON THE END OF THE OXYGEN MASK, INTO THE RECEIVING PORT OF THE CRU-60/P CONNECTOR. TURN BAYONET CONNECTOR TO LOCK PRONGS INTO THE RECESS IN THE LIP OF RECEIVING PORT.
3. COUPLE THE AIRCRAFT OXYGEN HOSE TO THE LOWER PORT OF THE CONNECTOR.
4. ATTACH THE EMERGENCY OXYGEN CYLINDER HOSE (IF AVAILABLE) TO THE SWIVELING PORT OF THE CONNECTOR BY INSERTING THE COUPLING OF THE EMERGENCY OXYGEN CYLINDER HOSE AND TURNING IT CLOCKWISE AGAINST THE SPRING-LOADED COLLAR.

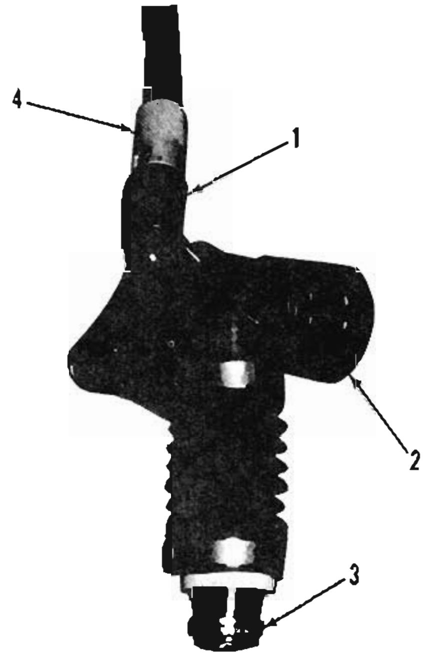


Figure 1-34

R - REGULATOR - Check Regulator ON and the diluter lever in 100% OXYGEN. Hook up your mask and perform a pressure check. Place the emergency lever to EMERGENCY, 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 regulator, hose, or valve is not holding pressure and the cause of the leak should be corrected. Return the emergency lever 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, check blinker for normal operation.

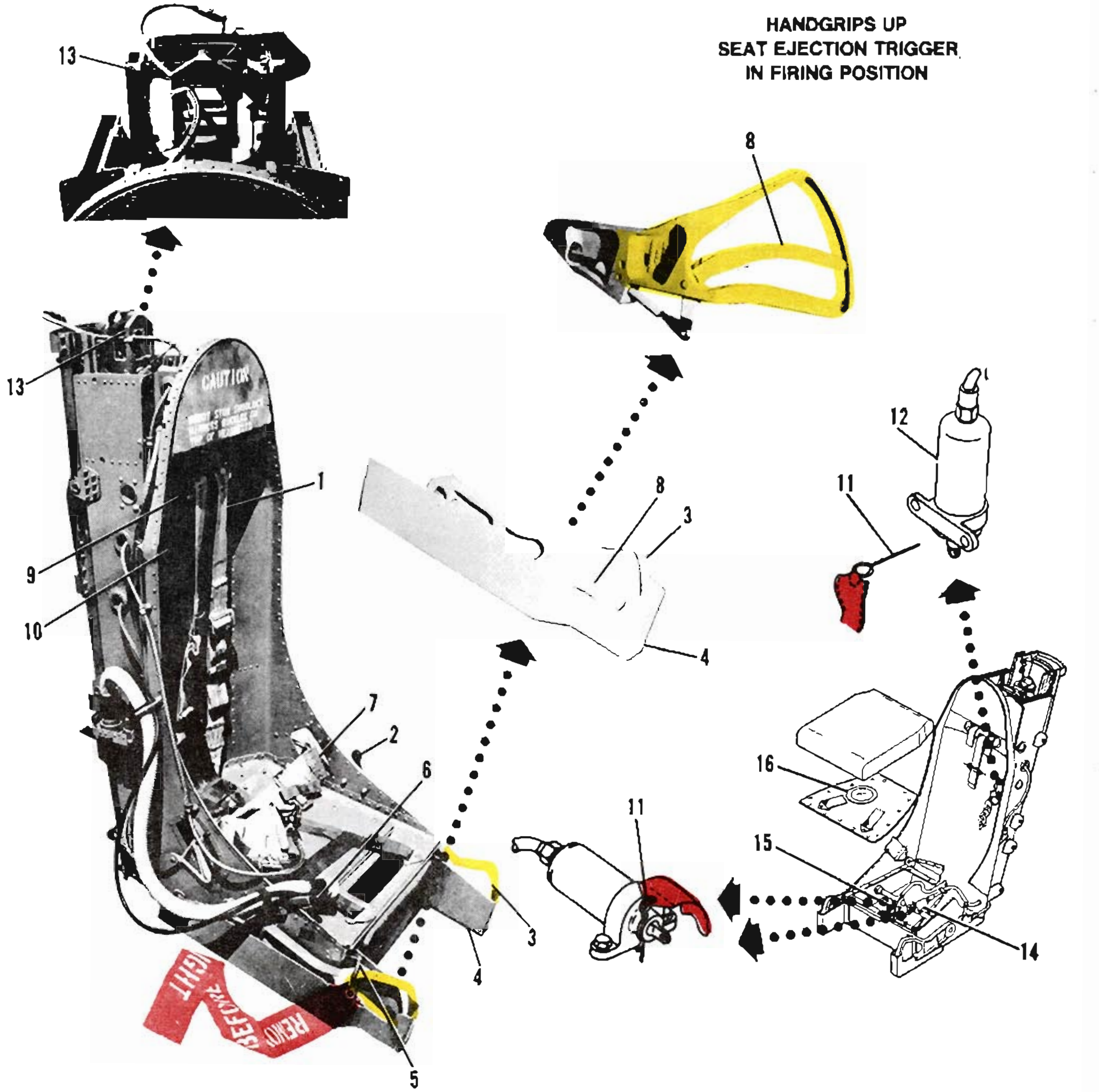
C - CONNECTIONS - Check connection secure at the seat. Check regulator hose for kinks, cuts or cover fraying. Check that the quick-disconnect is not warped and the rubber gasket is in place. A 12 to 20 pound pull should be required to separate the two parts. Check mask hose properly installed to connector.

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

EJECTION SEATS

Ejection seats (figure 1-35) are installed in the aircraft. The ejection seats will catapult the occupants clear of the aircraft at any speed, altitude or attitude. Each seat accomodates 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 1-35). Each seat has an emergency disconnect unit on the lower right side, containing a communication lead and the oxygen hose and a quick disconnect plate on the left side containing the canopy initiator hose. Both automatically disconnect at the time of seat ejection. All seats have a canopy piercer on top of the seat to break the canopy for through-the-canopy ejection capability.

EJECTION SEAT TYPICAL



1. SHOULDER HARNESS
2. SHOULDER HARNESS LOCKING LEVER
3. HANDGRIP
4. HANDGRIP GUARD
5. HANDGRIP SAFETY PIN
6. SEAT ADJUSTMENT LEVER
7. SAFETY BELT
8. SEAT EJECTION TRIGGER
9. SEAT-MAN SEPARATOR
10. SEAT-MAN SEPARATOR STRAP GUIDE
11. SAFETY PIN
12. SAFETY BELT AND SEAT-MAN SEPARATOR INITIATOR
13. CANOPY PIERCER
14. SEAT INITIATOR
15. CANOPY INITIATOR
16. INSPECTION WINDOW

Figure 1-35

WARNING

- Safety pins are inserted above the right handgrip of each seat and in the canopy initiator on the left side of the cockpit when the aircraft is on the ground. During extensive maintenance, ground crews also install safety pins for seat and canopy initiators under the seat, the safety belt/man-seat separator initiator behind the seat and the canopy remover at the top of the canopy activator mechanism. If any of the pins are left in place, canopy jettisoning and/or seat ejection are prevented.
- The handgrip safety pins do not safety the canopy jettison system if the canopy jettison T-handle is pulled.
- You must 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, 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 handgrips from lowering with seat, resulting in arming of the seat.
- After the handgrips have been raised, purposely or otherwise, no attempt should be made to place the handgrips back down. The handgrips are held in the up position by means of a mechanical lock. In the event of damaged firing devices, any movement of the handgrips or trigger might jettison the seat or cause injury.

EJECTION SEAT HANDGRIPS

When the handgrips (3, figure 1-35) are raised to the full up position, they lock there exposing the seat ejection triggers and locking the shoulder harness. Both handgrips are interconnected and will raise together.

SEAT EJECTION TRIGGER

The seat ejection triggers (8, figure 1-35) are located within both ejection seat handgrips on each seat and are accessible only when the handgrips are in the full up position. Squeezing either trigger initiates canopy jettisoning and seat ejection. The seat will eject approximately one-third of a second after the trigger(s) are squeezed. Should the canopy fail to jettison, no injury should result because of a through-the-canopy ejection provided the visor is down.

WARNING

Both triggers should be squeezed simultaneously when possible. If only one trigger is squeezed, the fingers of the opposite hand must not be between the handgrip and the trigger since this may cause the seat to fail to fire.

SHOULDER HARNESS LOCKING LEVER

The locking lever (2, figure 1-35) provides for manual control of the shoulder harness locking feature. When the shoulder harness is UNLOCKED, 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 LOCKED 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.

SEAT-MAN SEPARATOR

A seat-man separator (9, figure 1-35) 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 (12, figure 1-35), mounted on the seat back. After ejection, the separator winds up the strap attached to the separator and seat bottom, separating the seat and occupant. A guide (10, figure 1-35), ensures proper alignment of the strap to prevent jamming of the separator.

AUTOMATIC OPENING SAFETY BELTS AND AUTOMATIC OPENING PARACHUTES

AUTOMATIC OPENING SAFETY BELTS

In order to provide a quick 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, ballistics tubing, and an automatic opening safety belt. The safety belt initiator 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. 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 to the seat, leaving the occupant free to separate from the seat. The automatic opening feature of the parachute is activated by the occupant's separation from the seat. Figure 1-36 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.

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

HBU-12 AUTOMATIC LAP BELT

The HBU-12 Automatic Lap Belt consists of two halves. The left half contains the manual release assembly. The right half contains the automatic-disconnect link assembly which is used to couple the shoulder harness straps and gold key to the lap belt.

CAUTION

The gold key, with its metal tabs, can easily become entangled with various parts of the aircraft and could result in accidentally deploying the parachute. When entering and exiting the aircraft, assure the gold key is secured to the parachute strap.

Automatic Operation

Automatic operation of the Lap Belt is accomplished by gas pressure supplied at ejection from an automatically controlled initiator to disconnect the belt link tongue from the right half of the seat belt. The belt link tongue remains engaged with the manual release assembly (left half of belt) as it separates from the right half of the belt. The shoulder harness loops slip off the link end of the belt link tongue and the gold key remains locked in the manual release assembly to initiate automatic parachute opening via the parachute arming lanyard.

Manual Operation

Manual operation is accomplished by squeezing together the black and silver grips on the handle of the manual release assembly while lifting it. This action will disengage the belt link tongue.

WARNING

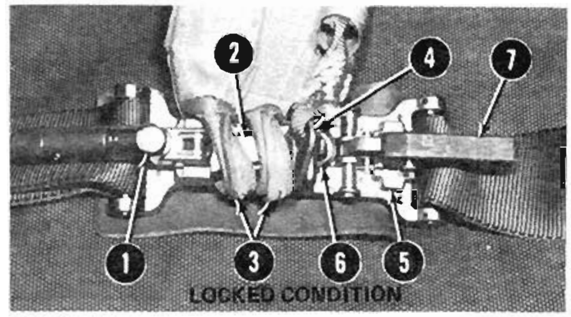
Manual operation of the automatic lap belt during ejection will override the automatic opening feature upon seat separation.

Refer to Figure 1-36A for detailed illustration.

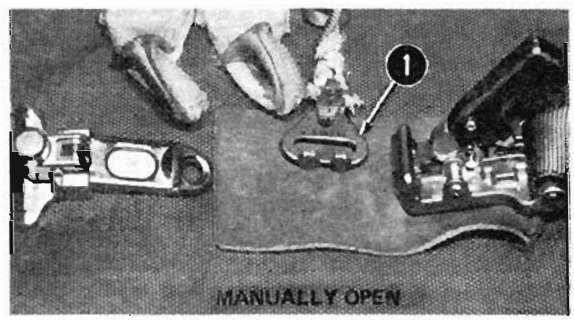
SAFETY BELT

AUTOMATIC LAP BELT

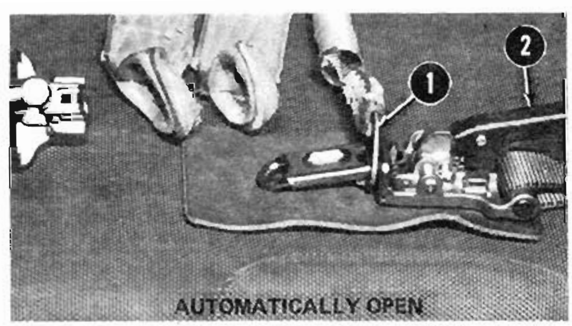
TYPE HBU-12



1. AUTOMATIC DISCONNECT LINK ASSEMBLY
2. BELT LINK TONGUE
3. RIGHT AND LEFT SHOULDER HARNESS LOOPS
4. GOLD KEY FROM PARACHUTE ARMING LANYARD
5. MANUAL RELEASE ASSEMBLY
6. BELT LINK TONGUE ENGAGED IN MANUAL RELEASE ASSEMBLY
7. MANUAL RELEASE HANDLE



1. PARACHUTE ARMING LANYARD ANCHOR FREE



1. PARACHUTE ARMING LANYARD ANCHOR RETAINED BY SHOULDER ON SWIVEL LINK
2. MANUAL RELEASE HANDLE LOCKED

Figure 1-36 Deleted

Figure 1-36A

TO LOCK THE SAFETY BELT, PROCEED AS FOLLOWS:

1. Insert the belt link tongue successively through the right and left shoulder harness loops and the slot in the gold key above the flange.

WARNING

The parachute arming lanyard must be routed outside the parachute harness and not fouled in any equipment to permit clean separation from the seat.

Note

The gold key must be slipped over the belt link tongue last and pressed into the manual release assembly base in order to lock the latch.

2. Insert the belt link tongue fully into the Manual Release Assembly to unlock the handle which must be pressed all the way down to lock the belt halves together.

3. Manual Release Assembly - Locked and Checked.

Ensure positive locking by exerting an upward pull under the release handle without depressing the black portion of the handle. The locked belt is shown in figure 1-36A.

TO MANUALLY UNLOCK SAFETY BELT, PROCEED AS FOLLOWS:

1. Squeeze and raise the latching handle to release the belt link tongue from the Manual Release Assembly.

2. Gold key and shoulder harness loops slip off the belt link tongue.

WARNING

If belt is released manually during ejection, automatic parachute opening will not occur upon seat separation.

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 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 mechanism to pull the ripcord when the preset altitude is reached. The parachute timer is preset for the number of seconds delay. The aneroid device is set according to instructions contained in applicable technical publications and as aircraft flight areas dictate.

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, activating the release mechanism. When activated above the preset altitude, the parachute will remain closed until the preset altitude is reached then 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.
- Either the parachute ripcord handle or the parachute arming knob must be pulled to open the parachute. Use the ripcord handle below 14,000 feet and the parachute arming knob above 14,000 feet.

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 1-37) 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 bypassed 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.

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.

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

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 approach fix for penetration descent, or prior to 10,000 feet pressure altitude during enroute descent.

ONE AND ZERO EJECTION SYSTEM

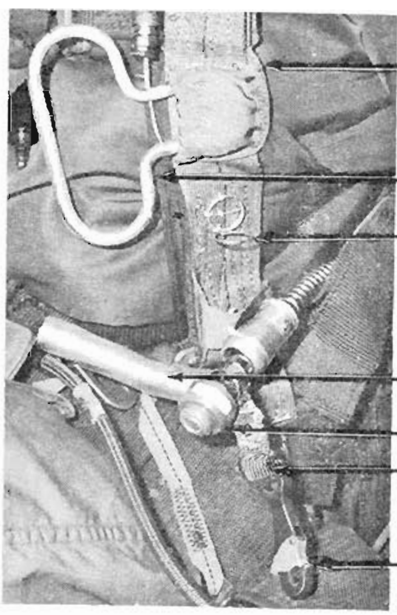


Figure 1-37

NOTE

If operating above terrain over 8000 feet high, the zero-delay lanyard should be connected any time the aircraft is within 2000 feet of the terrain.

EMERGENCY EQUIPMENT SURVIVAL KIT

In some aircraft a survival kit is used in lieu of the seat cushion. The kit contains such items as flares, radio, first aid kit, whistle, insect repellent and space blanket.

MISCELLANEOUS EQUIPMENT

MAP CASE

A map case (9, figure 1-7), is located between the ejection seats just aft of the instructor's quadrant. An additional compartment is provided on the right side of the cockpit. Safety pin storage compartments are located on both sides of the cockpit as 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.

CANOPY BREAKER

Figure 1-38

CANOPY BREAKER

A canopy breaker knife (figure 1-38) is mounted in a bracket on the canopy bow. This knife is used for breaking through the canopy during an emergency, such as when the canopy fails to jettison. To remove the knife, first pull the pin at the end of the knife handle.

PARACHUTE SUPPORT BLOCKS

Parachute support blocks are provided to support the parachute when the pilot or instructor is seated in the ejection seat. Any number of parachute support blocks may be used in a seat to adjust the parachute height to the seat occupant's comfort.

MXU-553/A LIFE HISTORY RECORDER SYSTEM

T.O. 1T-37B-528 authorizes the installation of a life history recorder in the right hand nose compartment. This airborne recording system will record specific flight parameters and events that affect airframe structural integrity. The recorded data will be processed and analyzed by structural engineers for airframe service life predictions, modifications and inspections. Crew members are responsible for manually setting the Documentary Data Encoder in accordance with T.O. 1T-37B-101.

FUELS

Primary Fuel

The fuel recommended for normal operation is JP-4 (MIL-T-5624 or NATO Symbol F-40). This fuel operates satisfactorily under all conditions and contains an icing inhibitor to prevent fuel filter icing. Performance data is based on the use of JP-4 fuel.

Alternate Fuel

Alternate fuels are approved for use when the primary fuel is not available. The same engine limitations for primary fuels apply to the use of alternate fuels. Alternate fuels have freezing points higher than JP-4 and may not contain icing inhibitors that retard the formation of ice at fuel temperatures below 32 degrees Fahrenheit. Aircraft altitude is limited to that at which the outside air temperature is above the freeze point of the fuel containing icing inhibitors. Aircraft using alternate fuels not containing an icing inhibitor are restricted to altitudes below the freezing level. The fuel weight differential plus the fuel quantity system and flow indication errors are not significant and may be disregarded. Approved alternate fuels are listed in servicing chart, figure 1-40.

CAUTION

- When fuels are mixed, the operating restrictions are determined by the fuel making up the majority of the mix.
- Ground starts and air starts may be more difficult at low temperatures.
- Rapid throttle movements may cause engine to be more susceptible to flameout and EGT/RPM limits to be exceeded.

Emergency Fuel

Aviation gasoline (any grade) is approved as an emergency fuel and is limited to one-time ferry missions only. Use of AVGAS causes undesirable lead deposits in the engine and may damage the fuel control and fuel pump because of its poor lubricating properties. The same general operating limitations and cautions apply during use of emergency fuels as during use of alternate fuels.

Note

- Engine inspection is necessary if engine has been operated for 10 hours on aviation gasoline.
- Slightly higher EGT readings may be expected with aviation gasoline.
- Lubrication oil (MIL-L-22851, Type II) must be added to aviation gasoline. Mixture should be 3% oil by volume.

SERVICING DIAGRAM

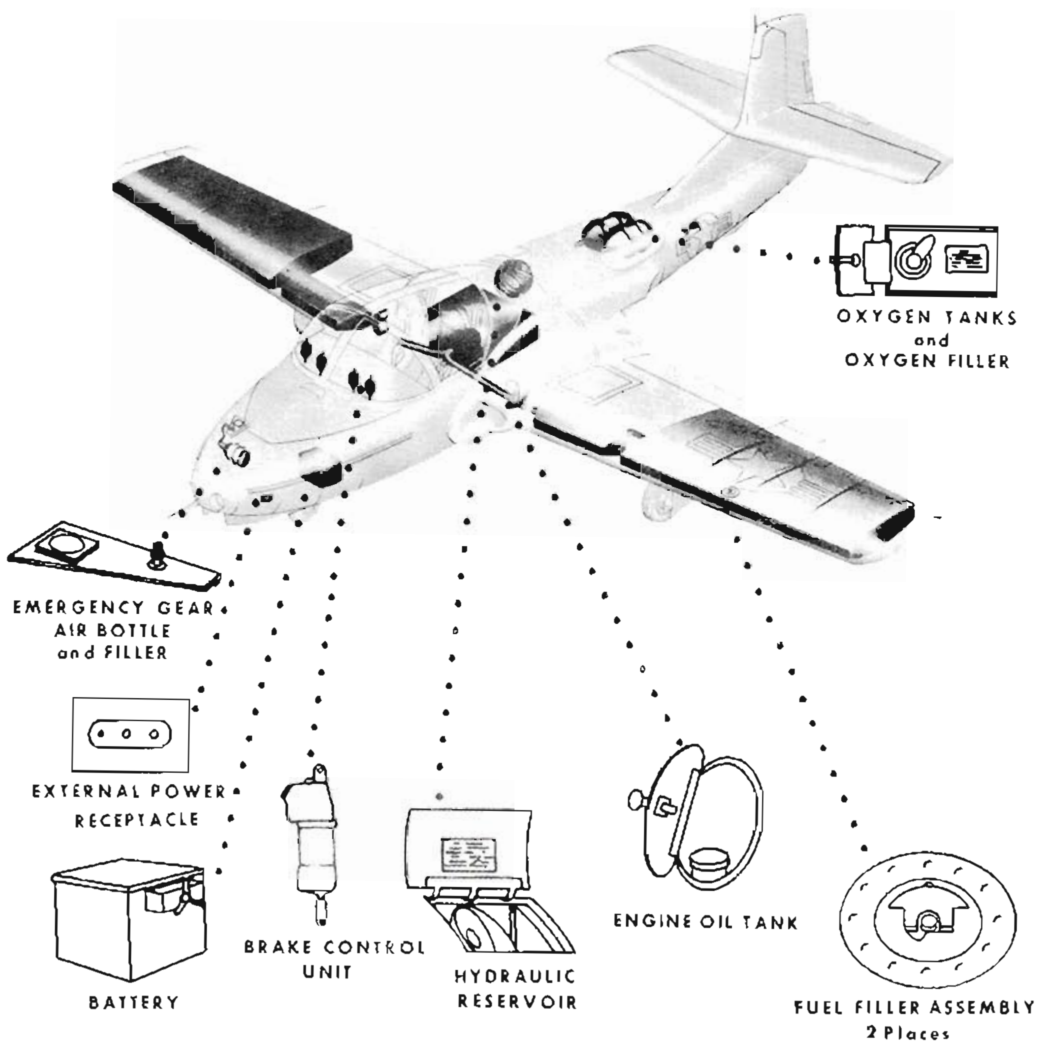


Figure 1-39

SERVICING

CHART

GRADE	MIL SPEC	COMMERCIAL DESIGNATION	NATO SYMBOL	CONTAINS ICING INHIBITOR	FREEZE POINT
FUEL					
RECOMMENDED FUEL					
JP-4	MIL-T-5624	. . .	F-40	YES	-57.8°C
ALTERNATE FUEL					
JP-5	MIL-T-5624	. . .	F-44	YES	-46°C
JP-8	MIL-T-83133	. . .	F-34	YES	-50°C
. . .	. . .	JET B		OPTIONAL	-50°C
. . .	. . .	JET A-1	F-35	OPTIONAL	-47°C
. . .	. . .	JET A		OPTIONAL	-40°C
EMERGENCY FUEL					
. . .	MIL-G-5572	AVGAS	F-22	. . .	-60.0°C
HYDRAULIC					
. . .	MIL-H-5606	. . .	H-515	. . .	. . .
. . .	MIL-H-83282	. . .	H-537	. . .	. . .
OIL					
. . .	MIL-L-7808	. . .	0-148	. . .	. . .
OXYGEN					
. . .	MIL-O-27210	. . .	. . .	. . .	. . .
EMERGENCY AIR BOTTLE					
NITROGEN OR AIR	. . .	. . .	. . .	. . .	. . .

NOTE

Check IFR supplement for more information on specific fuels.

Figure 1-40

SECTION II

NORMAL PROCEDURES

TABLE OF CONTENTS

Note

Checklist items preceded by an asterisk (*) are challenge/response items.

PREFLIGHT

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 VII for additional weather information. During normal operation, proceed as follows:

1. Canopy downlock handle - FORWARD (locked).
2. Canopy jettison and seat ejection system - Check before entering aircraft.
   a. Canopy jettison T-handle safety pin - INSTALLED. (See figure 1-7.)
   b. Seat handgrip safety pins - INSTALLED.
   c. Seat ground safety pins (2) - REMOVED.
   d. Seat-man separator - CHECK for cuts, frays and security of strap guide.
   e. Seat cushions - SECURE.
   f. Check safety belt and shoulder harness for cuts or frayed edges.
   g. Canopy ground safety pin - REMOVED.
   h. Check upper and lower breakaway couplings secured and safetied together on the left side of both seats.

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.

3. Form 781 - CHECK.
   Check for status, exceptional release, fuel, oxygen, oil and remarks pertaining to the condition of the aircraft.
4. Oxygen - Check quantity and insure supply lever on right cockpit regulator is safetied ON. Check line connection secure.
5. Flight controls - UNLOCK.
6. Landing gear handle - DOWN.

CAUTION

- Only a small amount of landing gear handle movement is required to actuate the landing gear selector valve to the UP position which will cause the landing gear to retract when an engine is started.
- If the handle is up, do not push it down. Call maintenance personnel to check it.

Note

Landing gear handles must be fully down in order to allow the solenoid pin to retract from the landing gear handle.

7. Canopy de-clutch T-handle access zipper - CLOSED.
8. External canopy circuit switch - INTERNAL.

EXTERIOR

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

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

B. Nose Section.
   1. Pitot tube - CHECK.
      Remove pitot tube cover, check that tube is not bent and is free of obstructions.
   2. Wheel well - CONDITION.
      Inspect for general condition and fluid leaks.
   3. Tire - CONDITION.
      Check tire for proper inflation, excessive wear, cuts and blisters.
   4. Strut - EXTENSION (minimum one inch).

CAUTION

A nose strut extension of less than the minimum may result in failure of the nose gear to extend after retraction.

5. Torque link - CONDITION.
   Check that torque link pin is installed.
6. Gear safety pin - REMOVE.
7. Access door - CLOSED and LOCKED.

C. Fuselage Forward Right Side.
1. Nose compartment door - SECURE. (Set Documentary Recorder Data if applicable.)
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 regulator.
      (1) Oxygen diluter lever - 100% OXYGEN.
      (2) For extended flight above FL200: Oxygen supply lever - OFF.

D. Right Engine Nacelle (Intake Section).
1. Oil filler door - SECURE.
2. Air inlet duct - CHECK.
   Check that duct is free of foreign objects. If oil is present, check with maintenance personnel prior to flight.
3. Engine access panels - SECURE.

E. Right Main Landing Gear.
1. Wheel well - CONDITION.
2. Strut - EXTENSION (minimum one and five-eighths inches).
3. Gear doors - CONDITION.
4. Tire - CONDITION.
5. Gear safety pin - REMOVE.

F. Right Wing.
1. Fuel tank - CHECK CAP SECURE.

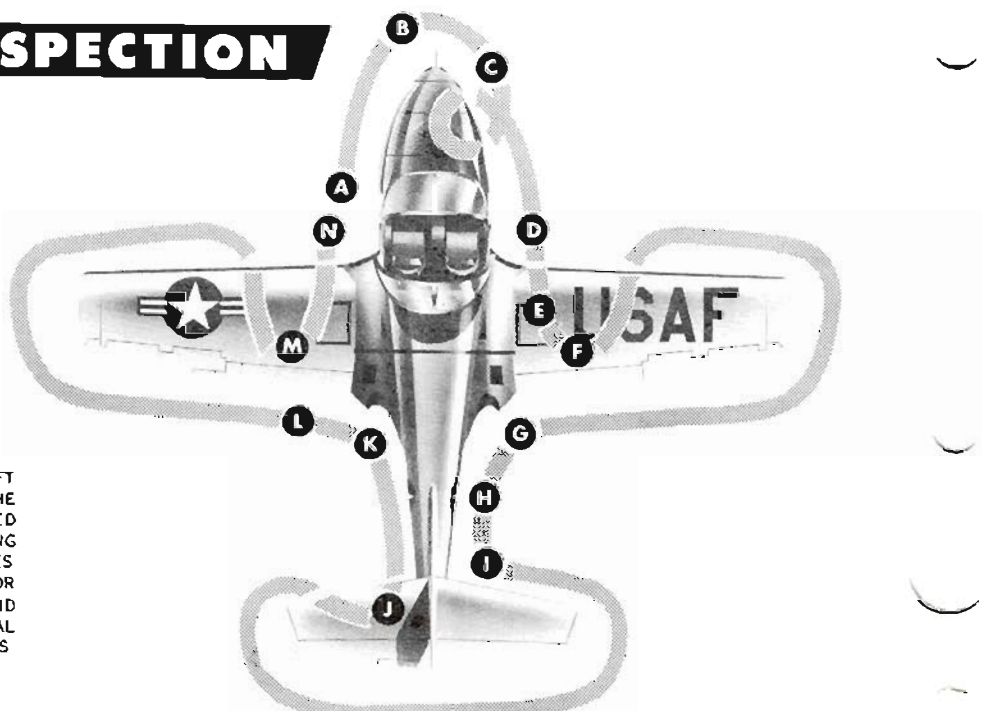
WARNING

Removal of the fuel caps is not required for a normal preflight. However, if the cap is removed, be extremely careful. Insure that skin contact is made with the aircraft before attempting to remove the fuel cap. This will remove any static electricity present in the aircrews' clothing. Thermally expanded fuel vapor may cause the caps to blow off with considerable force.

Note

Check that probe moves up when cap is removed. If probe is stuck down, the outboard fuel cells may not have been filled, yet the wing tank may show a visual indication of full.

EXTERIOR INSPECTION



STARTING AT THE FORWARD LEFT SIDE OF THE AIRCRAFT, PERFORM THE EXTERIOR INSPECTION AS OUTLINED IN THE TEXT IN ADDITION TO CHECKING THE AIRCRAFT SURFACES FOR WRINKLES DENTS, LOOSE RIVETS, OIL FUEL OR HYDRAULIC LEAKS, ACCESS DOOR AND PLATES FOR SECURITY, AND REMOVAL OF ALL GROUNDING WIRES/TIEDOWNS

Figure 2-1

Note

Install the cap so that the handle folds rearward. If the handle is folded forward, the slipstream may lift it and loosen the cap, causing fuel siphoning and loss of the cap.

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

CAUTION

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 Tailpipe - CONDITION.
Check the general condition of the tailpipe, thermocouples and the thrust attenuator. There should be no large accumulation of oil or excessive amount of fuel in the tailpipe. In unmodified engines a small accumulation of oil is acceptable. However, if you have any doubts concerning the presence of oil, check with a qualified maintenance technician before accepting the aircraft.

CAUTION

No oil leakage is acceptable on engines modified by TO 2J-J69-550 until cleared by a qualified maintenance technician. Modified engines are identifiable in AFTO Form 781K, Block B, Engine Data; modified engine serial numbers end with the letter alpha. They may also be identified by the absence of a one inch hole in the aft center of the tailpipe cone.

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. DME dust plug - CHECK REMOVED.
2. Hydraulic Filler Door - CHECK SECURE.
3. Static port - CLEAR OF OBSTRUCTIONS.

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 and trim tabs for security.

CAUTION

When checking condition of elevator and rudder hinges, avoid manhandling control surface trailing edges and elevator horn. At no time should the rudder be checked for vertical play while deflected full left or right nor should excessive force be used.

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

WARNING

Avoid contact in area around oxygen filler door with greasy or oily 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 Tailpipe - CONDITION.
Check the general condition of the tailpipe, thermocouples and the thrust attenuator. There should be no large accumulation of oil or excessive amount of fuel in the tailpipe. In unmodified engines a small accumulation of oil is acceptable. However, if you have any doubts concerning the presence of oil, check with a qualified maintenance technician before accepting the aircraft.

CAUTION

No oil leakage is acceptable on engines modified by TO 2J-J69-550 until cleared by a qualified maintenance technician. Modified engines are identifiable in AFTO Form 781K, Block B, Engine Data; modified engine serial numbers end with the letter alpha. They may also be identified by the absence of a one inch hole in the aft center of the tailpipe cone.

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

M. Left Main Landing Gear.
1. Wheel well - CONDITION.
2. Strut - EXTENSION (minimum one and five-eighths inches).
3. Gear doors - CONDITION.
4. Tire - CONDITION.
5. Gear safety pin - REMOVE.

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

INTERIOR (ALL FLIGHTS)

1. Control lock - STOWED.
2. Required publications - ON BOARD.
*3. Leg and chest straps, safety belt, shoulder harness, parachute arming lanyard anchor, emergency oxygen cylinder, zero delay lanyard, zippers and helmet chin strap - CHECK.

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.
- Ensure positive locking by exerting an upward pull under the release handle without depressing the black portion of the handle. The locked belt is shown in figure 1-36A.

4. Seat - ADJUST.

WARNING

- Check handgrips safety pin installed and area under seat clear of foreign objects before adjusting seat to prevent inadvertently raising the handgrips.
- Improper routing of personal leads may cause inadvertent opening of the safety belt latch during ejection.
- Survival kit must be connected to parachute harness prior to fastening lap belt and the kit attach straps must be properly stowed and adjusted to prevent possible entanglement. Insure survival kit straps are routed under and not over or through lap belt.
- After adjusting seat to proper height, ensure engagement of the seat catches by simultaneously pressing forward on the seat adjustment lever and jiggling the seat vertically until the catches are fully engaged.

5. Rudder pedals - ADJUST.
6. Flight controls - CHECK for free and correct movement.
7. Speed brake switch - IN.

CAUTION

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

8. IP switch - SOLO.
9. Air vents - AS DESIRED.
10. Landing and taxi light switch - OFF.
11. IFF antenna select switch - AUTO.
11A. ARU-44A - CAGED and LOCKED.
12. Vertical velocity - READS ZERO.
13. Clock - SET.
14. Fuel shutoff T-handles - PUSH-ON.
15. Fuel system switch - EMERGENCY.

CAUTION

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

16. Defrost knob - AS REQUIRED.
17. Accelerometer - RESET.
18. DME, IFF, UHF and VOR/ILS - OFF.
19. Air conditioner - SET.
    a. Cockpit air lever - VENT.
    b. Cockpit air temperature control switch - AUTOMATIC.
    c. Cockpit air temperature control rheostat - AS DESIRED.
20. Circuit breakers - IN.
    On aircraft not modified with 500 VA inverters (T.O. 1T-37B-559) leave J-2 compass circuit breaker OUT.

20A. ARU-42A - CAGED and LOCKED (if installed).

21. Fuel boost pump switch - OFF.
22. Inverter switch - OFF.
23. Generator switches - ON.
24. Pitot heat switch - OFF.

WARNING

Failure to accomplish this step can result in severe burns to ground crew members.

25. Throttles - CUT-OFF.
*26. Oxygen system - PRICE, refer to Section I.

26A. Interphone control panel switches - SET (as desired).

27. Auxiliary power - CONNECTED (if required).
28. Battery - 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.

29. Pitot heater - CHECK (as required).
    If visible moisture or icing conditions are anticipated, the pitot heat will be checked in coordination with the ground crewman.
30. Inverter switch - SPARE then MAIN.

Note

During ground operations, do not leave the inverter switch in SPARE for more than 10 seconds. On aircraft modified by TCTO 1T-37B-559 prolonged use of the spare inverter may cause the J-2 compass circuit breaker to pop.

31. Interior lights - AS REQUIRED.
32. Emergency canopy control switch - COVER CLOSED.
33. Exterior lights - AS REQUIRED.
    a. Position lights - POS LT ONLY.
    b. Anti-collision beacons - OFF.
34. Landing gear handle - CHECK DOWN.
35. Landing gear warning lights and horn - CHECK OPERATION.

    Press warning light test switch - lights should come on in both handles. With the warning light switch depressed, place each throttle in idle, one at a time. The horn should sound.
36. Landing gear position indicator lights - CHECK ON.
37. Fuel boost pump warning light - CHECK ON.
38. Elevator trim - CHECK OPERATION AND NEUTRAL (green light on).
39. Aileron trim - CHECK OPERATION AND NEUTRAL (check visually).
40. Canopy-not-locked warning light - CHECK ON.
41. Engine ice warning light - PRESS-TO-TEST.
42. Engine fire detect circuit - TEST.
43. Engine overheat detect circuit - TEST.

44. Fuel low level warning light - PRESS-TO-TEST.
45. Gravity fuel light - CHECK ON.
46. Fuel quantity - CHECK TOTAL fuel.
47. Heading indicator slaving switch - IN.
48. Attitude indicator:

   a. J-8 - CAGE AND ADJUST.
   Cage by pulling caging knob and adjust miniature aircraft to coincide with horizon bar.

   Note

   The indicator should be energized for approximately 60 seconds prior to caging.

   b. MM-3 - CHECK and ADJUST.
   Check for proper operation and adjust miniature aircraft to coincide with horizon bar.

   c. ARU-44A and ARU-42A (if installed) - UNCAGE and ADJUST.
   Uncage by pulling out and rotating caging knob counterclockwise and releasing gently. Adjust miniature aircraft to coincide with horizon bar.

   Note

   The indicator should be energized for approximately 60 seconds prior to uncaging.

49. Fuel quantity - CHECK RIGHT and LEFT wing tanks.

Note

To determine the correct amount of fuel in the right and left wing tanks, place the fuel gaging selector switch in the RIGHT and LEFT position until the fuel quantity needle stabilizes.

*50. Loose items - STOWED.

STARTING ENGINES

1. Fuel boost pump - ON.
2. 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.

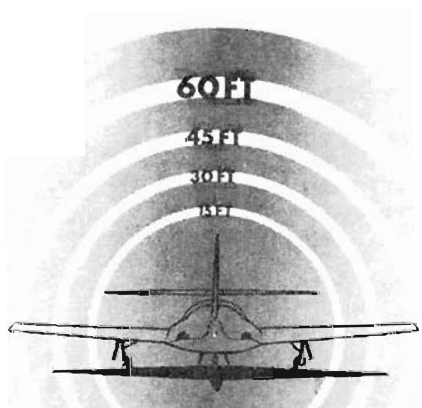
3. Left engine start:
   a. Starter - GND and hold.

CAUTION

Use caution to avoid placing the starter switch to AIR during ground engine starts, as this may result in engine damage. Should you inadvertently select AIR while starting engines, interrupt all DC power to the aircraft. Make an appropriate entry in the AFTO Form 781.

Danger Areas

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



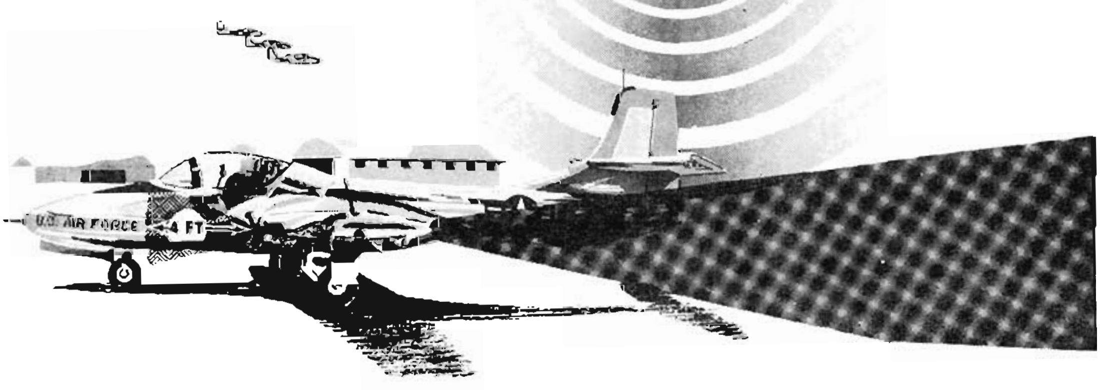


Figure 2-2

Note

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

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

CAUTION

If a battery start is attempted and normal starting RPM (8 - 12%) and fuel flow cannot be obtained; shutdown the engine and have the battery charged, obtain a spare battery or abort the aircraft. Do not use an APU to start the engine due to possibility of battery damage.

Note

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

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

CAUTION

- Because of possible RPM hang-up, a very high EGT peak may occur if the starter is released at 20-22% RPM. Holding the starter in the GND position until 25% RPM will help prevent RPM hang-up and result in a cooler more stabilized start.
- During the start, EGT peaks at approximately the same time idle RPM is attained. If RPM is slow to increase during start, a high EGT peak should be anticipated.
- If EGT rapidly approaches 780°C during start, shutdown engine, obtain APU and attempt second start. If EGT exceeds 780°C during any start, shut engine down immediately and abort the aircraft. Note in Form 781.

4. Left engine instruments - CHECK.
5. Hydraulic pressure - Check for 1250 to 1550 psi.
6. APU - DISCONNECT (if applicable).
7. Battery - ON (check for loadmeter jump indicating that battery is connected to the DC bus).

CAUTION

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

8. Loadmeter - CHECK.
9. RPM - ADVANCE to 60%.
10. Right engine start:
    a. Right starter - GND and hold.

Note

The left loadmeter will normally indicate a full scale deflection during the right engine start.

b. Right ignition - ON at 5% RPM and hold.
c. Right throttle - IDLE at 8% RPM.
d. Right ignition - RELEASE at rapid EGT rise.
e. Right starter - RELEASE at 25% RPM.

11. Right engine instruments - CHECK.
12. Right loadmeter - CHECK.
13. J-2 Compass Circuit Breaker - IN. Aircraft not modified with 500 VA inverters (T.O. 1T-37B-559) must wait 3 minutes after J-2 circuit breaker has been pushed in before taxiing.

BEFORE TAXIING

WARNING

Carbon monoxide contamination is possible during ground operations. This contamination may be caused by your own or other aircraft engine exhaust.

1. Fuel system - NORMAL.
2. IFF - STANDBY.
3. UHF - ON.
4. VOR/ILS - ON.

Note

- If the RMI needle(s) start to spin rapidly, turn off the VOR until the spinning stops, then return to ON. Repeat if necessary.
- The AN/ARN-127 VOR/ILS Receiver is solid state and requires no warm-up time.

5. DME - STANDBY.

Note

The DME should remain in STBY for one minute prior to operating or performing checks.

Minimum Turning Radius and Ground Clearance

MINIMUM GROUND CLEARANCE	
PITOT TUBE	2 FT. 10 IN.
WING TIP	3FT 4 IN.
MAIN GEAR INBOARD DOORS	6 IN.
MAIN GEAR OUTBOARD DOORS	10 IN.
VENTRAL FIN	2 FT. 10 IN.

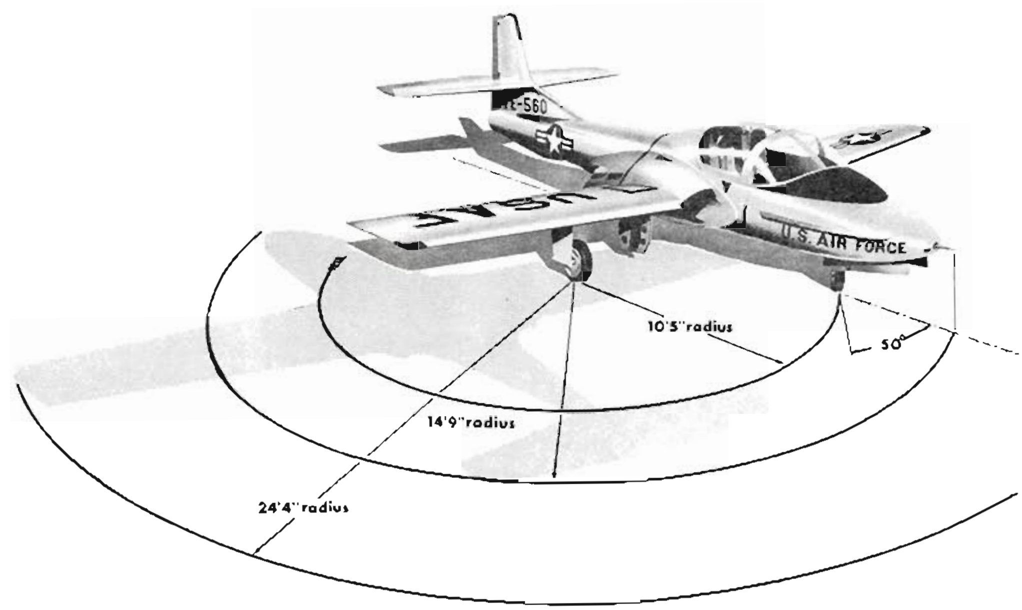


Figure 2-3

6. Cockpit air - AIR CONDITION.
7. Speed brake - CHECK OPERATION.
8. Flaps - 50%.

Note

Verify operation of spoilers, flaps, speed brake and thrust attenuators with the ground crew.

9. UHF radio - CHECK OPERATION.
10. VOR/ILS - CHECK (optional).

Note

- RPM may have to be increased above idle to insure a positive loadmeter indication for operation of the VOR/ILS and DME systems.
- Checks of flight and navigation instruments should be performed in accordance with procedures described in AFM 51-37. Aircrews may use the VOR/ILS and DME self-test features outlined in Section I, but not as substitues for AFM 51-37 checks.

11. DME - DME.
12. Flight instruments - CHECK.
   a. Altimeter - CHECK and SET.

WARNING

When setting the barometric scale, assure that the 10,000 foot pointer is reading correctly. The low symbol should be visible below 10,000 feet.

   b. Airspeed indicator - CHECK.
   c. Heading indicators - CHECK.
   d. Magnetic compass - CHECK. Determine that bowl is full of fluid.
   e. Attitude indicators - CHECK.

*13. Ejection seat and canopy jettison T-handle safety pins - REMOVE, DISPLAY and STOW.

WARNING

When removing the seat safety pin, use left hand to guard the handgrips until the streamer has cleared the seat.

WARNING

- During ground operation, if seat adjustments become necessary, install the seat safety pin before moving the seat adjustment lever.
- If seat adjustment is necessary in flight, check that no obstruction is below either handgrip to insure the handgrips will not move as the seat is lowered. Make no attempt to hold down the handgrips while adjusting the seat.

*14. Brakes - CHECK pedal pressure.
15. Chocks - REMOVED.
16. Taxi light - AS REQUIRED.
17. Anti-collision beacons - AS REQUIRED.

TAXIING

Observe the following precautions for taxiing.

CAUTION

- Nosewheel steering should be used with care to prevent overcontrolling while taxiing. Attempts to use a combination of nosewheel steering and brakes to maintain direction may result in overcontrolling and damage to the nose gear assembly. Release nosewheel steering if braking during a turn is required. Avoid taxiing over foreign objects, holes and ruts.
- To prevent inadvertent jettisoning or damage to the canopy, do not unlock or open canopy above 40 KIAS.

1. Turn and slip indicator - CHECK.
   During turns, check that turn needle indicates the proper direction and ball is free in the glass tube.
2. Heading indicators - CORRECT MOVEMENT AND HEADING.

BEFORE TAKEOFF

1. Flight controls - CHECK.

Note

Disengage nosewheel steering prior to checking the rudder.

*2. Zero delay and parachute arming lanyards - CONNECTED.
*3. Helmet visors - AS REQUIRED.
4. Takeoff data - REVIEW.
5. Anti-collision beacons - ON.
6. Position lights - STROBE & POS LT.
7. Pitot heat, defroster and cockpit temperature - AS REQUIRED.
   The pitot heat should be on when flying into areas of visible moisture.
8. VOR/ILS and DME - CHECKED.

Note

Insure all applicable checks of flight and navigation instruments have been completed. Refer to AFM 51-37 for instrument cockpit check procedures and parameters.

9. 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 it is clear.

Note

Unless canopy is locked after closing, it will automatically return to the full open position.

WARNING

Wing tank fuel quantity should be checked for a decrease as soon as practical to determine if both tanks are feeding. For this reason, a fuel balance check should be made between 1600-1700 pounds of fuel regardless of whether the aircraft is on the ground or is airborne. Thereafter, the fuel balance and fuselage tank quantity should be checked at approximately 15-minute intervals.

LINEUP

1. IFF - AS REQUIRED.
2. Attitude Indicators - CHECK.
3. Throttles - MILITARY.
4. Engine instruments - CHECK.
5. Heading indicators - CHECK within 5° of runway heading.
6. Loadmeters - CHECK.

Note

Nickel cadmium batteries may be charged at a much greater rate without damage than can the conventional lead-acid batteries. Engine start 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.

Note

Momentarily switching the higher generator OFF then ON may equalize the system.

7. Warning lights - CHECK OFF.

TAKEOFF

WARNING

Avoid wake turbulence. Refer to WAKE TURBULENCE, page 2-13.

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 Lineup check, release brakes and establish a straight takeoff roll.

Directional control should be maintained by use of nosewheel steering until rudder becomes effective at approximately 65 KIAS. Do not overcontrol when using nosewheel steering. As the elevators become effective (at approximately 65 KIAS), raise the nose smoothly to takeoff attitude and allow the aircraft to fly off the ground.

CROSSWIND TAKEOFF

WARNING

The maximum allowable crosswind component during takeoff and landing from an icy runway is 10 knots.

Release brakes and maintain directional control by the use of nosewheel steering, ailerons and rudder. Release nosewheel steering at the computed minimum nosewheel lift-off speed (refer to crosswind chart in Appendix I) 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 nosewheel lift-off speed will insure sufficient rudder control to maintain runway heading prior to becoming airborne.

AFTER TAKEOFF

When safely airborne, proceed as follows:

1. Gear - UP at 100 KIAS (minimum).
2. Landing lights - OFF/TAXI.
3. Flaps - UP at 110 KIAS (minimum).
4. Engine instruments - CHECK.

CLIMB (PASSING 10,000 FT MSL)

*1. Zero delay lanyard - Disconnect and stow 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.

CAUTION

When checking the oxygen system from the left seat, be careful not to inadvertently actuate the canopy jettison T-handle.

Note

When checking the oxygen system inflight, check the supply lever -ON, diluter lever - NORMAL OXYGEN, pressure gauge - QUANTITY, flow indicator - BLINKING, and oxygen mask - PRESSURE CHECK. The pressure check should be performed similar to the PRICE check under R -Regulator. The only difference is that the airborne pressure check is accomplished with the diluter lever in NORMAL.

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

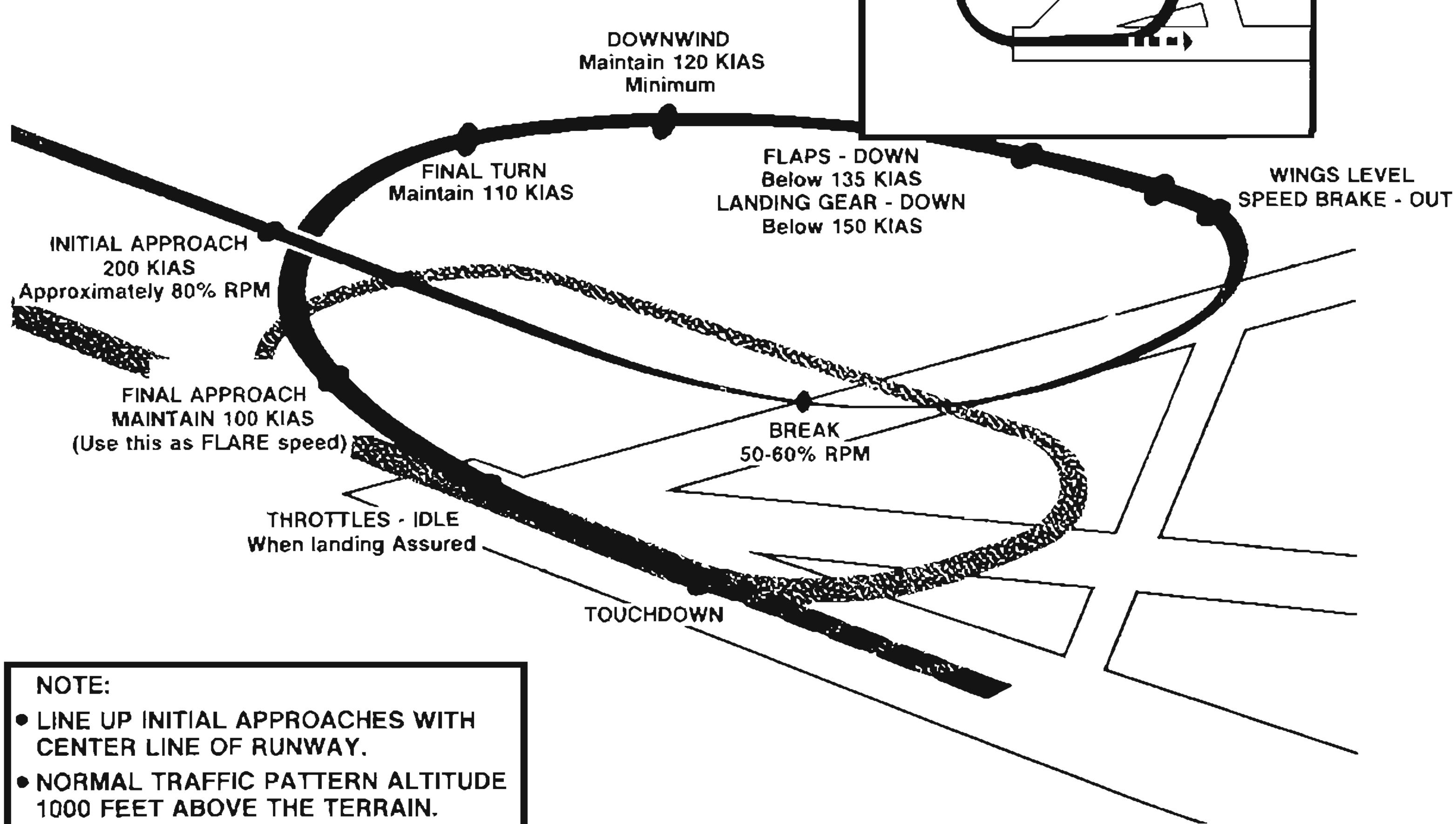
LEVEL OFF

*1. Oxygen system - CHECK.

Note

When checking the oxygen system inflight, check the supply lever - ON, diluter lever - NORMAL OXYGEN, pressure gauge - QUANTITY, flow indicator - BLINKING, and oxygen mask - PRESSURE CHECK. The pressure check should be performed similar to the PRICE check under R - Regulator. The only difference is that the airborne pressure check is accomplished with the diluter lever in NORMAL.

Typical Overhead Landing Pattern



NOTE:

- LINE UP INITIAL APPROACHES WITH CENTER LINE OF RUNWAY.
- NORMAL TRAFFIC PATTERN ALTITUDE 1000 FEET ABOVE THE TERRAIN.
- PATTERN REQUIRES APPROXIMATELY 50 POUNDS OF FUEL.

Figure 2-4

2. Loadmeters - CHECK.
3. Fuel quantity - CHECK
   When checking the fuel quantity, check the total fuel, wing tank balance and fuselage tank quantity.

WARNING

Wing tank fuel quantity should be checked for a decrease as soon as practicable to determine if both tanks are feeding. For this reason a fuel balance check should be made between 1600-1700 pounds of fuel regardless of whether the aircraft is on the ground or is airborne. If airborne, check fuel level only when aircraft is in coordinated flight. Both engines may flameout due to fuel starvation if the fuel transfer system has malfunctioned.

CRUISE

Refer to Section I 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. This will preheat the windshield and canopy to preclude the formation of frost or fog during descent.

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.

1. Heading and attitude systems - CHECK.
2. Pitot heat, defroster and cockpit temperature - AS REQUIRED.
   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.
3. Fuel quantity - CHECK.
   When checking the fuel quantity, check the total fuel, wing tank balance and fuselage tank quantity.

*4. Zero delay lanyard - CONNECT prior to initial approach fix for penetration descent or prior to 10,000 feet pressure altitude during enroute descent.

Note

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

*5. Altimeter - RESET AS REQUIRED.
*6. Helmet visors - AS REQUIRED.

APPROACH TO FIELD

During the approach or before entering the traffic pattern (and if practical, prior to each touch-and-go landing) complete the following:

*1. Zero delay lanyard - CONNECTED.
2. Hydraulic pressure - CHECK.
3. Fuel quantity - CHECK.
   When checking the fuel quantity, check the total fuel, wing tank balance and fuselage tank quantity.

BEFORE 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. The 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.

1. Speed brake - AS REQUIRED.
2. Gear - DOWN below 150 KIAS.
   Check landing gear position indications (indicator lights, warning light, and audible signal).
3. Flaps - AS REQUIRED below 135 KIAS.
4. Landing lights - AS REQUIRED below 135 KIAS.

WARNING

Avoid wake turbulence. Refer to WAKE TURBULENCE, page 2-13.

LANDING

CAUTION

If nosewheel shimmy is encountered during the landing roll, continue to apply forward stick pressure to place more weight on the nose gear.

NORMAL LANDING

The typical overhead landing pattern is depicted in figure 2-4. If crosswinds are not significant, maintain the landing attitude after touchdown. 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 nosewheel to the runway prior to minimum nosewheel touchdown speed and retract the speed brake if not needed to help stop the aircraft on the remaining length of runway.

If gusty wind conditions are encountered, use half flaps in the pattern and increase final approach airspeed to 110 KIAS. The speed brake should be used to improve airspeed and glide path control and should be extended in the same sequence as for a normal overhead pattern.

NO FLAP LANDING

The procedures for landing with no flaps are similar to those for landing with 100% flaps, except that a longer final approach (3/4 to 1 mile) should be planned. Maintain 110 KIAS in the final turn and on final. If gusty wind conditions are encountered, maintain 120 KIAS in the final turn and on final. Expect an extended flare and longer landing roll.

CROSSWIND LANDING

Note

Refer to Appendix page A2-4 for the maximum allowable crosswind component during takeoff and landing.

If crosswinds require the use of 50% flaps, extend the speed brake in the normal sequence and maintain 110 KIAS in the final turn and on final. If no flaps are required, extend the speed brake and maintain 120 KIAS in the final turn and on final. Prior to touchdown, establish a wing low attitude and apply appropriate rudder to maintain runway alignment. Start the roundout by smoothly establishing the landing attitude. Maintain the wing-low attitude and rudder application throughout the roundout.

Plan to touch down in a nose high attitude above the recommended nose gear touch down speed. (Refer to Appendix I) Smoothly lower the nose gear to the runway prior to minimum nosewheel touch down speed. Avoid lowering the nosewheel abruptly. Use rudder, brakes and nosewheel steering, if necessary, to maintain directional control. Continue to maintain ailerons deflected into the wind during the landing roll and retract the speed brake. 105 KIAS is recommended for main gear touchdown with zero flaps.

CAUTION

Damage to the nose gear assembly may occur if the strut is side loaded when fully extended. Avoid engaging the nosewheel steering until sufficient weight is placed on the nose gear. Also, avoid abrupt use of nosewheel steering during the high speed portion of the landing roll.

Note

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

BRAKING PROCEDURE

Wheel brake effectiveness increases as forward speed decreases. Use wheel brakes only as required to decelerate the aircraft to normal taxi speed on the remaining runway. If maximum braking is required, lower the nosewheel to the runway, check 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. 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 nosewheel.

WARNING

If maximum braking is used, the aircraft should not be taxied into a congested area. Peak temperatures occur in the wheel and brake assembly five to fifteen minutes after maximum braking. This could result in brake failure, explosion, or fire. Insure that 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, plan to arrive at a point and altitude on extended runway centerline (normally 3-5 miles) from which a transition to full flap, half flap, or no flap approach can be made using the final approach airspeeds listed above. Continue the approach planning to use a minimum of 50% RPM until landing is assured.

Note

Airspeeds and configurations for landing in gusty wind conditions or with a crosswind are identical to those for overhead patterns.

LANDING ON SLIPPERY RUNWAYS

Use recommended pattern and touchdown speeds since excessive landing speeds will result in a longer stopping distance. Touchdowns should be planned close to the approach end of the runway. Maintain the landing attitude as much as practical and leave the speed brake extended. After lowering nose to the runway, use brakes lightly, applying pedal pressure evenly and slowly. If brakes are applied hard and suddenly, a skid will result. Maintain directional control primarily with nosewheel steering. 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 nosewheel steering for directional control. Landing roll distances will be considerably increased.

WAKE TURBULENCE

Avoid wake turbulence. The T-37 is particularly susceptible to wake turbulence. The vortex-produced rolling moment can exceed the aileron authority of the aircraft. Allow a minimum of two minutes before takeoff or landing behind a heavier aircraft or helicopter, (i.e., any aircraft of heavier gross weight). The time should be extended to a minimum of four minutes behind extremely heavy aircraft, i.e., C-5A or 747. This will allow lateral displacement or dissipation of the vortices to a point where sufficient aileron control exists to counter the roll induced by the vortex.

Wake turbulence will be most pronounced during conditions of calm or near calm surface winds. Crosswinds below 5 knots tend to hold the vortices in the vicinity of the runway. Crosswinds above 5 knots cause the vortices to move away from the runway and break up rapidly. An aircraft penetrating the center of a vortex core would be subjected to a vertical airflow having a downward direction on one wing and an upward direction on the other. The aircraft will roll very rapidly, exceeding the amount of control available to counteract the rolling action.

PORPOISING

CAUTION

Avoid landing on the nosewheel first as porpoising and subsequent structural damage to the landing gear and airframe may occur.

Porpoising is a condition encountered during landing, wherein the aircraft bounces back and forth between the nosewheel and the main gear. This condition is caused by a landing attitude at touchdown which brings the nosewheel in contact with the runway before the main gear touchdown. It 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 pitch oscillation. The 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 a porpoise.

If you begin to porpoise, immediately position the controls to establish a nose high attitude sufficient to prevent the nose wheel from contacting the runway. Maintain this attitude and simultaneously advance throttles to MILITARY. Do not attempt to counteract each bounce with opposite stick movement; the combined reaction time of pilot and aircraft is such that this 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.

WARNING

If a go-around is initiated after porpoising, do not raise the landing gear. Structural damage can occur during porpoising and may prevent the landing gear from being lowered on the following landing attempt.

Note

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

GO AROUND/MISSED APPROACH

Make the decision to go-around or execute a missed approach in a timely manner. If touchdown is unavoidable, do not try to hold the aircraft off the runway; continue to fly the aircraft to touchdown. If a touchdown is made, lower the nose slightly and accelerate to takeoff airspeed, then establish takeoff attitude and allow the aircraft to fly off the runway.

1. Throttles - MILITARY.
2. Speed brake - IN.
3. Gear - UP at 100 KIAS (minimum) when definitely airborne.
4. Landing lights - OFF/TAXI.
5. Flaps - UP at 110 KIAS (minimum).
6. Engine instruments - CHECK.

TOUCH AND GO LANDINGS

To make a touch-and-go landing, perform the desired approach and landing, then perform normal go-around procedures.

WARNING

Touch-and-go landings encompass all aspects of the landing and takeoff procedures in a relative short time span. Be constantly alert for possible aircraft malfunctions during these two critical phases of flight.

Note

Directional control will be more difficult if uneven engine acceleration occurs when the throttles are advanced or when a crosswind exists.

AFTER LANDING

*1. Cockpit loose items - CHECK SECURED (before opening canopy).
*2. Seat and canopy jettison T-handle safety pins - INSTALL (optional).
3. Speed brake - CHECK IN.
4. IFF, VOR/ILS and DME - OFF.
5. Pitot heat - OFF.
6. Landing lights - AS REQUIRED.
7. Anti-collision beacons - AS REQUIRED.
8. Position lights - POS LT ONLY.
9. Flaps - UP.

WARNING

Do not move the canopy jettison T-handle or the seat handgrips in an effort to insert the pins.

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. Be sure chocks are in place before releasing brakes.

1. Fuel system - EMERGENCY.
2. Throttles - CUT-OFF.
3. Engine ice warning light - CHECK ON.

Note

The engine ice warning light should illuminate after placing the left throttle to CUT-OFF and before the left RPM reaches zero. Should the light fail to illuminate, note this on the AFTO Form 781.

*4. Seat and canopy jettison T-handle safety pins - CHECK INSTALLED.
5. Canopy downlock handle - FORWARD (locked).
6. UHF radio - OFF.
7. Interior and exterior lights - OFF.
8. ARU 44A and ARU 42A (if installed) - CAGE AND LOCK.
9. Trim - NEUTRAL.
10. Fuel boost pump - OFF.
11. Inverter - OFF.
12. Battery - OFF.
*13. Oxygen diluter - 100%.
14. Flight controls - LOCK.
15. Wheels - CHOCKED.
16. J-2 compass circuit breaker (if aircraft not modified with 500 VA inverters) - OUT.

BEFORE LEAVING AIRCRAFT

CAUTION

Before exiting the aircraft, ensure the parachute gold key is secured to the parachute clip.

1. Gear safety pins, grounding wire and pitot head cover - CHECK INSTALLED.

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.

CAUTION

- At some installations, it may be necessary for the aircrew to connect grounding wires. To prevent a dangerous shock, connect the grounding wire to the ground rod before making the connection to the aircraft. Reverse the order when removing grounding wire.

- Make appropriate entries in 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.

STRANGE FIELD PROCEDURES

The following checklist provides guidance for operation at fields that do not normally support the aircraft.

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

AFTER ENGINE SHUT DOWN (BEFORE LEAVING AIRCRAFT)

1. Install DME dust plug.
2. Canopy.
   a. Insure transient alert/maintenance personnel are familiar with canopy operation.
3. Oil requirements.
   a. Check oil immediately after engine shutdown. If oil level is at or below the 3/4 full mark on dipstick (eighth ring below filler neck), oil should be added as required to fill up to full mark on dipstick (first ring below filler neck). Do not overfill.

Note

- One quart of oil can be added when the oil level is down to the 3/4 mark on dipstick (eighth ring below filler neck).
- If engine has been shutdown more than ten minutes, run engine at 70% RPM for no less than five minutes to obtain true oil level reading; then shut down engine and recheck oil level.

   b. Type:
      MIL-L-7808 or NATO O-148.
4. Fuel requirements.
   a. Primary:
      JP-4 (MIL-T-5624 or NATO F-40).
   b. Alternate:
      JP-8 (MIL-T-83133 or NATO F-34).
      JP-5 (MIL-T-5624 or NATO F-44).
      JET A.
      JET A-1 (NATO F-35).
      JET B.
   c. Emergency:
      Aviation gasoline (NATO F-22)
5. Hydraulic fluid requirements:
   a. Type:
      MIL-H-5606 or NATO H-515.
      MIL-H-83282 or NATO H-537.
   b. Accumulator pressure:
      600 ±25 psi.
6. Oxygen requirements.
   a. Low Pressure system: 425 ±25 PSI.
   b. Type: MIL-O-27210.

BEFORE STARTING ENGINES

1. Auxiliary power unit (APU) requirements.
   a. Power output: 28.5 ±0.5 volts DC. 300 amps (minimum).
   b. APU types authorized: check IFR Supplement for APU types meeting the above requirements.

MINOR MAINTENANCE REQUIREMENTS

1. Landing gear.
   a. Emergency gear air bottle: service with nitrogen (N_2) or air. Pressure: 2000 ±250 PSI.
2. Tires.
   a. Main tire pressure: 110 +5 PSI.
   b. Nose tire pressure: 50 ±5 PSI.

CHECKLIST

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

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 takeoff and landing data card, is shown at the end of Appendix I, Part VIII, Planning the Mission.

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 aircraft 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 judgement. Procedures appearing in **BOLDFACE** 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, 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.

1. MAINTAIN AIRCRAFT CONTROL.
2. Analyze the situation and take proper action.
3. Land as soon as conditions permit.

GROUND OPERATION EMERGENCIES

ENGINE FIRE OR OVERHEAT DURING GROUND OPERATIONS (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/APU - OFF.

EMERGENCY GROUND EGRESS

Cut-off the throttles and pull off the fuel shutoff T-handles. Turn the battery switch OFF and insert ejection seat safety pin before evacuating the aircraft. Normal electrical canopy opening should be attempted prior to using declutch, or jettisoning the canopy. Varying circumstances will dictate how much of the above action can be accomplished.

Follow an orderly sequence. To clear the ejection seat: open the safety belt, clear the shoulder straps from the parachute harness, and disconnect the oxygen hose and radio cord. During ground egress when using the survival kit, the fastest egress is accomplished with the parachute and survival kit on.

DEPARTING A PREPARED SURFACE

Any time the aircraft departs a prepared surface, immediate engine shutdown is advisable. The possibility of engine foreign object damage is greater than the possibility of gear collapse.

Refer to EMERGENCY GROUND EGRESS to abandon the aircraft.

USE OF CANOPY BREAKER TOOL

To break the canopy, grasp the canopy breaker tool with both hands and with an arm-swinging thrust using full body force, strike the canopy perpendicular to the surface. The blade alignment will determine the direction of the cracks. No set pattern of blows is necessary; normally, three or four blows will open an adequate escape hole.

WARNING

The canopy breaker knife can cause injury if the curved edge of the blade faces forward resulting in a glancing rearward blow.

TAKEOFF EMERGENCIES

ABORT

If an abort is necessary for any reason, accomplish the following:

1. THROTTLES - IDLE/CUT OFF.

WARNING

In case of fire or overheat indications, the malfunctioning engine should be shut down by cutting off the throttle and pulling off the fuel shutoff T-handle.

Note

Cut off both engines if stopping distance is marginal.

2. WHEEL BRAKES - AS REQUIRED

WARNING

- Avoid contacting raised barriers. The barrier webbing can entangle the canopy, possibly causing pilot injury if the canopy is open, or jamming the canopy if it is closed.
- To afford protection against explosion, heat or fire, the canopy should be retained. The pilot may clear the aircraft by use of electrical canopy opening, canopy declutch, canopy breaker tool, or canopy jettison T-handle. Canopy declutch or breaker tool should be used if strong fuel fumes are present.

Note

In the event of imminent contact with an obstruction or raised barrier during landing or takeoff roll or other ground operations, the aircraft is capable of extremely short radius turns even at fairly high speeds with nosewheel steering and differential braking. However, nosewheel 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, depress and hold the override switch, then raise the gear handle (figure 3-1).

CAUTION

Do not use the override switch to retract fully extended gear in flight.

Note

The landing gear will retract only if hydraulic pressure and electrical power are available.

If the nose gear torque link is broken, the gear handle will not raise normally. Subsequent use of the override switch to effect retraction may cause the nosewheel to bind in the wheel well if the nosewheel is cocked. The pilot should attempt to determine the condition of the nosewheel prior to landing.

TWO ENGINE FAILURE (LOW ALTITUDE)

If both engines fail at low altitude or immediately after becoming airborne and altitude precludes aborting, air starting, or ejecting, land straight ahead, turning only as necessary to avoid obstructions.

1. GLIDE - 100 KIAS MINIMUM.
2. GEAR - DOWN.
3. THROTTLES - CUT OFF.

WARNING

To afford protection against explosion, heat or fire, the canopy should be retained.

LANDING GEAR EMERGENCY OVERRIDE SWITCH

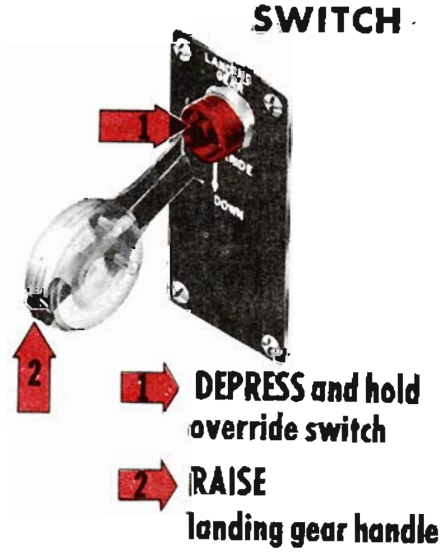


Figure 3-1

FLIGHT CHARACTERISTICS UNDER PARTIAL POWER CONDITIONS

Single engine operation in this aircraft introduces yaw and out-of-trim effect, however 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.

WARNING

- 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.
- Flaps should not be lowered to 50% once flying airspeed has been attained. Lowering 50% flaps decreases stall speed, but a significant increase in thrust is required.
- It is possible for the thrust attenuators to fail in the extended position whether or not hydraulic and/or electrical power is available. Initially, this malfunction may be difficult to detect. However, you will notice a significant lack of aircraft acceleration as power is applied, especially during traffic pattern operations. You can expect to lose approximately 39 to 44% thrust under standard day conditions. This loss is less severe than that experienced during single engine failure, and is well within the safe flight capability of the aircraft. If you suspect thrust attenuator failure and it is too late to abort, ensure the throttles are at military, the speed brake is IN and continue to take off using the procedures for ONE ENGINE FAILURE, FIRE OR OVERHEAT DURING TAKEOFF (AFTER AIRBORNE).

Note

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

Aircraft will neither climb nor accelerate with wing flaps full down

Figure 3-2

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.

Adequate performance and controllability exist to accelerate during single-engine operation between 90 and 100 KIAS. If the decision is made to continue, raise the gear and flaps as soon as possible after reaching a safe altitude and airspeed. Rate-of-climb with one engine inoperative will be slower, depending on such conditions as air density, gross weight, and configuration.

WARNING

When operating at high gross weights, and/or high density altitudes, (6000 feet), continued takeoff on one engine may be impossible.

If conditions permit a continued takeoff, proceed as follows:

1. **FLAPS - 50%.**
2. **GEAR - UP.**
3. **FLAPS UP - (100 KIAS MINIMUM).**

   Maintain a climb and accelerate to 125 KIAS. If an engine fire or overheat exists, proceed with Fire or Overheat Procedures.

4. Attempt airstart at safe altitude if warranted.

If an airstart attempt is unwarranted:

Throttle (Dead Engine) - CUT-OFF.

INFLIGHT EMERGENCIES

ENGINE FAILURE

Engine failure can be detected by a sudden decrease in engine exhaust gas temperature accompanied by a loss of thrust. Fluctuating RPM, fuel flow and exhaust gas temperature indicate erratic fuel flow to the engine which often precedes engine failure. 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.

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, gear and flaps - UP.
3. Airstart - ATTEMPT (if warranted).

If airstart attempt is unsuccessful or inadvisable, refer to Appendix I for single engine performance data.

TWO ENGINE FAILURE DURING FLIGHT

WARNING

If double engine failure is experienced at or below 2000 feet AGL, immediate ejection is advisable.

Note

If double engine failure occurs at low altitude, the aircraft should be zoomed (if airspeed permits) to better position the aircraft for ejection.

1. Glide - 125 KIAS.
2. Throttles - CUT-OFF.
3. Speed brake, gear and flaps - UP.
4. Airstart - ATTEMPT (if warranted).

If an airstart is unwarranted, refer to the Ejection or Forced Landing procedures.

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 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 corresponding engine.

WARNING

Should an overheat light accompanied by smoke in the cockpit occur in flight, immediate engine shutdown within the constraints of safe single engine flight is recommended.

Note

- Fire or overheat is usually accompanied by one or more of the following indications: Fluctuating fuel flow, excessive exhaust gas temperature, visual indications such as smoke in the cockpit or smoke trailing behind the aircraft, erratic engine operation, or roughness. 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.
- Internal structural failure of the engine may produce noise and heavy vibrations in addition to fire and overheat indications.

ENGINE FIRE DURING FLIGHT (AFFECTED ENGINE)

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

1. FUEL SHUTOFF T-HANDLE - PULL-OFF.

WARNING

After the fuel shutoff T-handle is pulled, an <u>immediate</u> drop in fuel flow to 100 PPH (minimum reading) is an indication the fuel shutoff valve has operated. Failure to get indications that the fuel shutoff valve has closed could indicate a continuing source of fuel to feed a fire even after the engine is shut down with the throttle.

2. THROTTLE - 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 a 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 to another aircraft. If corrective action has not extinguished the fire, EJECT.

WARNING

If the fuel shutoff valve has remained open, check the fuel shutoff circuit breaker in and reset if necessary.

3. Fire circuit - TEST.

Note

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

4. Cockpit air lever - AS REQUIRED.

OVERHEAT WARNING DURING FLIGHT (AFFECTED ENGINE)

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

1. THROTTLE - RETARD.

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

2. FUEL SHUTOFF T-HANDLE - PULL-OFF.
3. THROTTLE - 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.

4. Overheat circuit - TEST.

Note

If the overheat warning light goes out after remedial action, actuate the test circuit to determine if the circuit is still functional. If the circuit fails to illuminate the light, continue to investigate for actual fire.

5. Cockpit air lever - AS REQUIRED.

FUSELAGE, WING, OR ELECTRICAL FIRE

If fuselage, wing or electrical fire occurs, turn off the battery and generators. If fire continues out of control, eject if conditions permit. If ejection is impossible, land as soon as conditions permit.

SMOKE AND FUME ELIMINATION

WARNING

All odors not identifiable by flight crew shall be considered toxic. Immediately initiate SMOKE AND FUME ELIMINATION procedures and land as soon as conditions permit. Do not takeoff when unidentified odors are detected.

In the event smoke or fumes enter the cockpit during flight, proceed as follows:

1. OXYGEN - 100%.

2. Cockpit air - VENT.
3. Check for fire.
4. Battery and generators - OFF.

Note

- Turn both the battery and generator switches OFF until it is determined that 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.

5. Canopy jettison T-handle - PULL (if necessary).

It may be necessary to jettison the canopy if the smoke and fumes are severe and extended flight is required.

CAUTION

Smoke may be encountered in the cockpit after negative "G" flights due to oil loss 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.

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. Fuel boost pump - ON.
5. Inverter - MAIN or SPARE.
6. Battery - ON.
7. Circuit breakers - CHECK IN.
8. Cockpit air - VENT.

9. Throttle - IDLE.

Note

- If flame out resulted from throttle linkage slip, it may be necessary to advance the throttle beyond idle to effect a restart.
- A start may not occur immediately. RPM may drop as low as 12% before signs of a start are observed.

10. Starter and ignition - GND - ON and hold simultaneously. If RPM is above 30%, allow the engine to windmill below 30% before attempting restart.
11. Exhaust gas temperature - MONITOR. The first indication of a start is a rise in the exhaust gas temperature.
12. Starter and ignition - Release at 30% RPM.
13. Engine instruments - CHECK.

CAUTION

If an engine has flamed out when the throttle was reduced to IDLE, or if you suspect a throttle linkage problem, avoid retarding the throttle to IDLE during subsequent power adjustments of the affected engine.

If starting attempt was unsuccessful:

14. Electrical load - REDUCE.
15. Attempt another start if warranted.

EMERGENCY AIRSTART

If time and/or conditions do not permit the use of procedures described in ENGINE RESTART DURING FLIGHT, proceed as follows:

1. STARTER - AIR.

2. FUEL SYSTEM - EMERGENCY.

Leave fuel system in emergency for remainder of flight.

If RPM drops below 16%.

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

WARNING

Throttle(s) must be out of cutoff to accomplish an airstart.

EJECTION VS FORCED LANDING

Normally, ejection is the best course of action if 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 predetermined 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 of 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, 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.

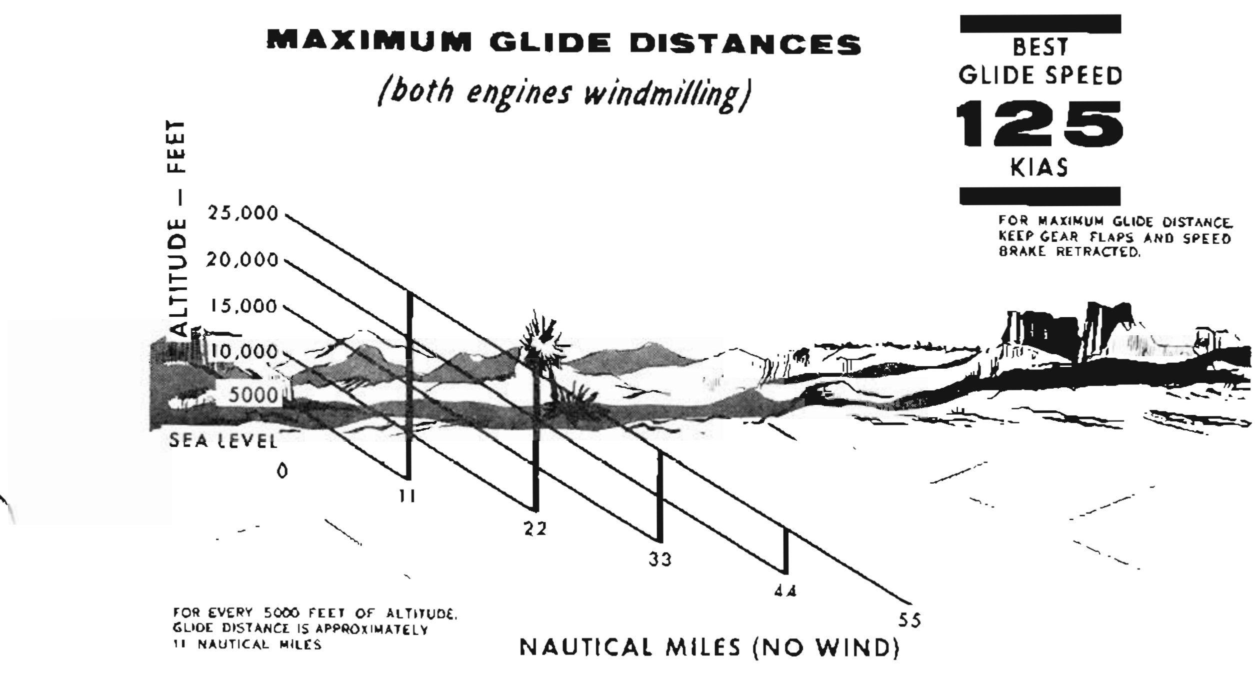


Figure 3-3

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.

Note

No attempt should be made to land a flamed out aircraft at any field where approaches are over heavily populated areas.

d. Weather and terrain conditions must be favorable. Cloud cover, visibility, turbulence, surface winds, etc., must not impede a proper flameout landing pattern.

Note

Do not attempt night flameout landings or flameout landings under poor lighting conditions, such as at dusk or dawn.

e. Flameout landings should only be attempted when either a satisfactory "High Key" or "Low Key" position can be achieved.
f. If at any time during the flamout approach conditions do not appear ideal for successful completion of the landing, eject. EJECT no lower than 2000 feet above the terrain.

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 circumstances preclude 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)

If both engines flameout during flight and airstarts are unsuccessful or inadvisable 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 KIAS.
   The landing gear, wing flaps and speed brake may be raised, if necessary, to increase maximum glide distance.
2. Gear - DOWN.
   The landing gear should be lowered over the field or at high key. Airspeed 120 KIAS 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.
- 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 - CONNECTED.
6. Helmet visor(s) - DOWN.
7. Shoulder harness - LOCK.
8. Battery and generators - OFF.

WARNING

To afford protection against explosion, heat, or fire, the canopy should be retained.

Note

- Directional control must be maintained by use of wheel brakes, as nosewheel steering will not be available with both engines inoperative.
- 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 KIAS during the forced landing pattern provides the optimum maneuvering glide speed for that configuration.
- 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.

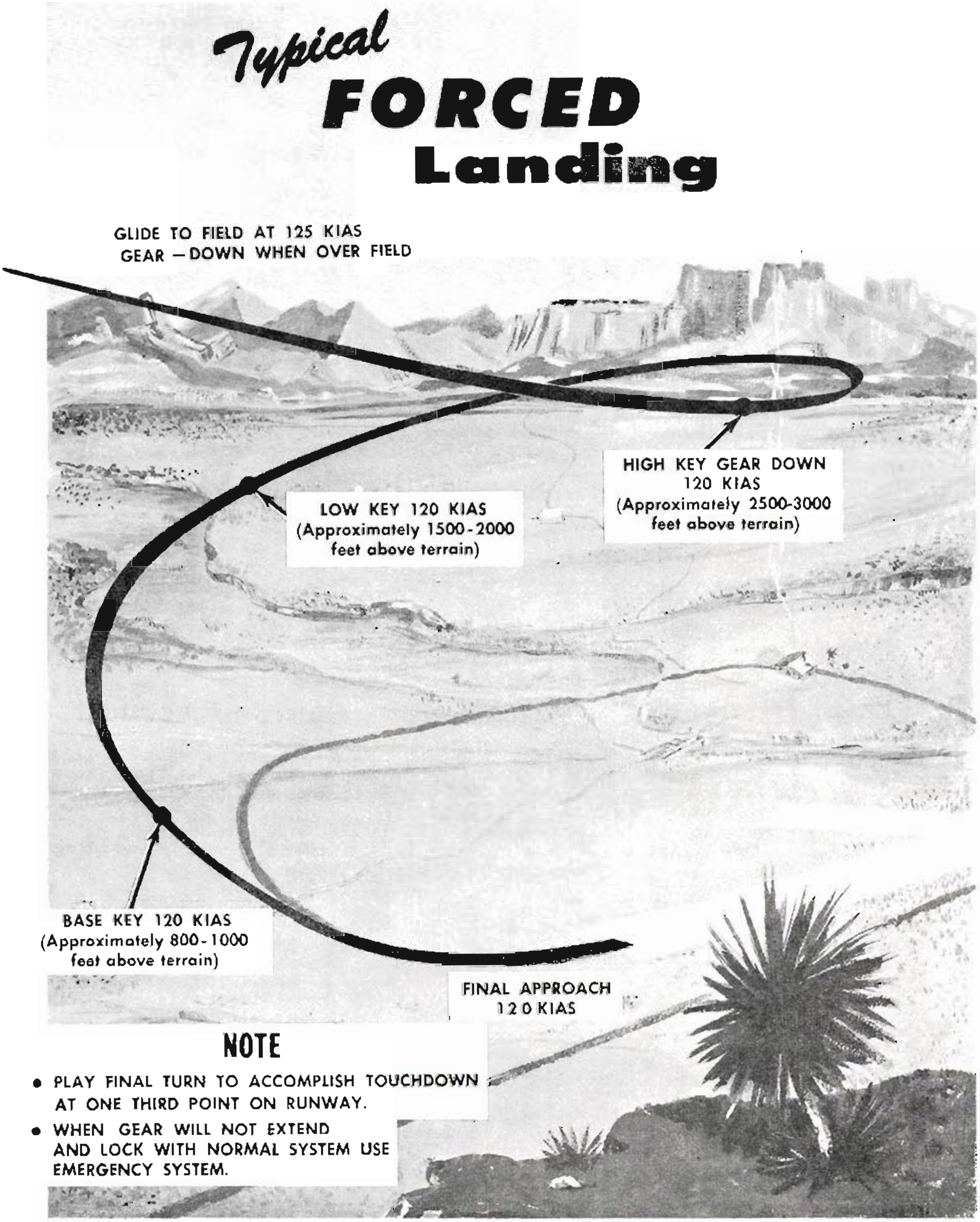

Typical
FORCED
Landing
GLIDE TO FIELD AT 125 KIAS
GEAR — DOWN WHEN OVER FIELD
HIGH KEY GEAR DOWN
120 KIAS
(Approximately 2500-3000 feet above terrain)
LOW KEY 120 KIAS
(Approximately 1500-2000 feet above terrain)
BASE KEY 120 KIAS
(Approximately 800-1000 feet above terrain)
FINAL APPROACH
120 KIAS
NOTE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

Figure 3-4

STRUCTURAL DAMAGE

[illegible] damage occurs in flight, the [illegible] whether to leave the air- [illegible] a landing. If aircraft is [illegible] proceed as follows:

WARNING

- [illegible] case allow airspeed to de- [illegible] below 90 KIAS.
- [illegible] reset wing flaps if signi- [illegible] structural damage is located [illegible].

[illegible] appropriate ground agency of in- [illegible].

[illegible] 10,000 feet above terrain (if [illegible] at a controllable airspeed. [illegible] landing approach and deter- [illegible] airspeed at which aircraft becomes difficult to control (minimum controllable airspeed).

Note

[illegible] aircraft becomes difficult to [illegible] approaches a stall, lower [illegible] and increase power for [illegible].

[illegible] aircraft becomes difficult to control [illegible] 105 KIAS (full flap), fly a no [illegible] landing approach. Abandon the air- [illegible] if it becomes difficult to control [illegible] 110 KIAS (no flaps).

[illegible] 20 KIAS above minimum control- [illegible] airspeed or 110 KIAS, whichever is [illegible] during descent and landing ap- [illegible].

[illegible] flat power-on, straight-in ap- [illegible] requiring minimum flare and plan [illegible] at no less than minimum [illegible] airspeed. Do not begin to [illegible] final approach speed until the [illegible] has crossed the runway thres- [illegible] is very close to the runway. [illegible] recommended airspeed for touch- [illegible] is 105 KIAS (full flaps), 130 KIAS [illegible] flaps).

NOSE COMPARTMENT DOOR OPENING IN FLIGHT (HIGH AIRSPEED)

[illegible] of an unlatched or improperly [illegible] compartment door is related to [illegible] attack of the aircraft. Nose [illegible] door openings have occurred at [illegible] of attack with both low and high [illegible]. Openings have also occurred dur- [illegible], approaches and landings. If a [illegible] compartment door comes open at high air-

1. Immediately slow to and maintain an air- speed at which the door will remain closed.

CAUTION

If nose compartment 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.

2. Avoid any abrupt change in pitch atti- tude.
3. Fly a straight-in, full flap approach maintaining 20-30 KIAS above normal final approach speed.

Experience indicates that the door will prob- ably begin to open at 120 to 130 KIAS as airspeed is decreased and will be fully open at 90 KIAS.

Fly the aircraft down very close to the run- way. Do not attempt to spike the aircraft on the runway and do not allow the aircraft to balloon. Plan to touchdown at no more than 105 KIAS.

NOSE COMPARTMENT DOOR OPENING ON TAKEOFF

If the nose compartment door opens on take- off, abort 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-not-locked warning light illu- minates, or it is obvious the canopy is not properly locked during flight, proceed as follows:

1. Slow to 100 KIAS while avoiding abrupt pitch changes.

CAUTION

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

2. External canopy circuit switch - EXTERNAL. Access to this switch in flight is through the zippered opening for the canopy declutch T-handle.

3. Make a straight-in approach (maintain 100 KIAS) using shallow turns. 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 external canopy circuit switch must be positioned to INTERNAL to open the canopy.

LOSS OF CANOPY IN FLIGHT

Make a straight-in approach maintaining a minimum of 110 KIAS on final approach.

RUNAWAY TRIM

The design of the aircraft is such that nose down stick forces may increase as airspeed increases at nose down trim settings. These nose down forces may become extreme at high airspeeds and the only way to bring these forces under control is by reducing airspeed or retrimming. Runaway trim can be the result of a malfunction or inadvertent application by a crew member. When experiencing any abnormal control stick forces, assume runaway trim and proceed as follows:

1. Airspeed - 110 to 150 KIAS.
2. With the aircraft under control, attempt to trim the aircraft by using both trim buttons in turn.

WARNING

At speeds above 275 KIAS full nose down trim results in extremely heavy stick forces. Immediate reduction of airspeed is required to assure aircraft control.

Note

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

3. If trim continues to runaway after retrimming, pull both trim circuit breakers when near neutral.
4. Land as soon as conditions permit using a straight-in approach.

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 breakers and turn battery and generator switches back on. Land as soon as conditions permit using a straight-in approach.

EJECTION

EJECTION

The ejection seat escape system is designed to provide escape during level flight from 100 feet to maximum flight altitude and from 120 KIAS to 425 KIAS. However, many variables can reduce your chances for survival and most are cumulative. They include altitude, airspeed, pitch and dive angles, sink rate, "g" loads, human reaction times, etc.

In most situations, ejection at higher altitudes (approximately 10,000 feet AGL) at reduced airspeeds compensates for these variables and allows more time for ejection difficulties.

Your chances for survival are better if you eject above 2000 feet AGL while flying straight and level at a low airspeed. When the aircraft is controllable at higher altitudes, trade excess airspeed and excess altitude for time to accomplish before ejection procedures.

Under level flight conditions, eject at least 2000 feet AGL whenever possible.

If you anticipate ejection at more than 2000 feet AGL in a controlled condition, disconnect the zero-delay lanyard to reduce chances of seat-chute-man involvement. Once the decision is made to eject, do not attempt to connect the zero-delay lanyard. The time lost in connecting is greater than any advantages which may be gained.

Under uncontrollable conditions, eject at least 10,000 feet AGL whenever possible. If the aircraft becomes uncontrollable below 10,000 feet AGL, eject immediately, since any delay reduces your chances for successful ejection.

At high altitudes, set up a speed and configuration to obtain maximum glide distance.

WARNING

- Minimum ejection altitudes are dependent upon dive angle, airspeed, and bank angle. Recommended minimums are 10,000 feet AGL if out of control and 2000 feet AGL in straight and level controlled flight.
- Attempt to slow the aircraft as much as practical prior to ejecting by trading airspeed for altitude. If the aircraft is not controllable, ejection must be accomplished at whatever airspeed exists.

WARNING

- Do not delay ejection below 2000 feet above the terrain in futile attempts to start the engines or for other reasons that may commit you to an unsafe ejection. Accident statistics clearly show a progressive decrease in successful ejections as altitude decreases below 2000 feet above the terrain.
- The automatic safety belt must not be opened manually before ejection, regardless of altitude. If the safety belt is opened manually, the automatic opening feature of the parachute is eliminated and seat separation may be too rapid at high speeds.

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 establish a positive ejection vector. Eject while the aircraft is in a wings level climb. 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

The following is based on straight and level flight at 120 KIAS or above.

WARNING

A minimum airspeed of 120 KIAS is extremely critical, during emergency low altitude ejections, to ensure rapid parachute opening.

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

The emergency minimum ejection altitudes are given only to show that low altitude ejection can be accomplished in case of an emergency which would require immediate ejection. It must not be used as a basis for delaying ejection when above 2000 feet.

BAILOUT IF SEAT FAILS TO EJECT

If seat fails to eject when the triggers are squeezed, a manual bailout will be required. Proceed as follows:

1. Reduce airspeed as much as practical.
2. Release safety belt, shoulder harness, radio and oxygen connections.
3. Jettison canopy.
4. If aircraft is controllable, trim full nose down and apply back pressure to attain a nose-high attitude.
5. Abruptly release stick and push free.
6. If aircraft is not controllable, bailout 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 rip cord.

EJECTION PROCEDURE

BEFORE EJECTION IF TIME AND CONDITIONS PERMIT

1. Turn IFF to EMERGENCY.
2. Notify appropriate ground agency of ejection (include type of aircraft, number of occupants, location and altitude).
3. Stow all loose equipment.
4. Disconnect zero-delay lanyard, lower helmet visor(s) and tighten oxygen mask and chin strap securely.
5. Turn aircraft toward uninhabited area.
6. Actuate emergency oxygen cylinder (high altitude if installed .
7. Attain proper airspeed, altitude and attitude.

Note

If zooming the aircraft, apply trim to prevent pitch down when the control stick is released for ejection.

8. Disconnect oxygen hose and radio cord.

EJECTION

1. HANDGRIPS - RAISE

WARNING

Sit erect, head firmly against headrest, feet back.

2. TRIGGERS - SQUEEZE.

WARNING

Both triggers should be squeezed simultaneously when possible. If only one trigger is squeezed, the fingers of the opposite hand must not be between the handgrip and the trigger as the seat may not fire.

AFTER EJECTION

1. Safety belt - Attempt to open manually.
2. Separate from seat.
   A determined effort must be made to separate from seat to obtain full parachute deployment at maximum terrain clearance. This is extremely important for low altitude ejections.
3. If safety belt is opened manually - (Immediately pull parachute arming lanyard (arming ball) if above 14,000 feet or the ripcord handle if below 14,000 feet.

Figure 3-5 (Sheet 1 of 2)

EJECTION CAPABILITIES

WARNING

- THE MINIMUM EJECTION ALTITUDES DEPICTED ARE COMPUTED EJECTION ALTITUDES WHICH SHOULD GIVE A FULL CHUTE 50 FEET ABOVE THE GROUND. THE FIGURES REFLECT THE MINIMUM AIRCRAFT ALTITUDE REQUIRED TO COMPLETE THE EJECTION SEQUENCE, AND INCLUDE THE FOLLOWING FACTORS: (1) 4 SECONDS TO MAKE THE DECISION TO EJECT; (2) 3 SECOND REACTION TIME TO RAISE HANDGRIPS (FIRST CREWMEMBER): (3) 1 SECOND DELAY TO PERMIT DEPARTURE OF FIRST SEAT AND REACTION TIME TO SQUEEZE TRIGGERS (SECOND CREWMEMBER) AND; (4) 1000 FEET ALTIMETER LAG FOR SPIN AND DIVE CONDITIONS.
- OTHER HUMAN DELAYS, ALTIMETER LAGS OR SYSTEM MALFUNCTIONS ARE NOT CONSIDERED. ADDITIONAL DELAYS WILL TAKE SEVERAL CRITICAL SECONDS AND WILL SIGNIFICANTLY RAISE THE MINIMUM ALTITUDE REQUIRED FOR SAFE EJECTION.
- DO NOT DELAY EJECTION TO MEET THESE CAPABILITIES AS EVERYTHING MUST FUNCTION PERFECTLY TO MEET THESE FIGURES.
- RECOMMENDED MINIMUM EJECTION ALTITUDES ARE 10,000 FEET AGL IF UNCONTROLLED AND 2000 FEET AGL IN STRAIGHT AND LEVEL CONTROLLED FLIGHT.

FLIGHT CONDITION	PITCH	BANK ANGLE	AIRSPEED (KIAS)	SINK RATE (FPM)	MINIMUM EJECTION ALTITUDE (FEET)
INVERTED ACCELERATED SPIN	-70 °	0 °	100	15,585	4200
NORMAL ERECT SPIN	-45 °	0 °	30	10,417	3400
DIVE	-60 °	0 °	350	30,500	6800
DIVE	-30 °	0 °	350	17,730	4400
*FLAMEOUT GLIDE	-4 °	0 °	125	885	300
*FINAL TURN	-8 °	35 °	110	1560	500
*FINAL	-5 °	0 °	100	885	300

*ZERO DELAY LANYARD CONNECTED

Figure 3-5 (Sheet 2 of 2)

LANDING EMERGENCIES

LANDING WITH ONE ENGINE INOPERATIVE

Single engine landings can be made using procedures similar to those used for two engine operation. Try 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. Fly the normal overhead pattern but use 50% flaps. The speed brake should not be used until on final approach and landing is assured. Fly the final approach at 110 KIAS. Full flaps may be used once landing is assured to prevent landing long.

If gusty wind conditions are encountered, follow normal single engine procedures, except, maintain 120 KIAS in the final turn and on final. If crosswinds require using no flaps, maintain 120 KIAS in the final turn and on final. Refer to Section II for crosswind landing touchdown procedures.

WARNING

When landing with one engine inoperative, the time for actuating of hydraulic components will be noticeably longer.

CAUTION

If porpoising occurs upon touchdown, do not increase power on good engine; 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.

SINGLE ENGINE GO-AROUND

WARNING

- The chances for a successful single engine go-around are greatly increased if an early decision is made to go-around.
- High gross weight coupled with high density altitude may make a single engine go-around impossible.

1. THROTTLE - MILITARY.
2. SPEED BRAKE - IN.

WARNING

The speed brake must be retracted.

3. FLAPS - 50%.

WARNING

Go-around with full flaps is not possible.

4. GEAR - UP.

Raise the landing gear only after you ascertain that touchdown will not occur.

5. FLAPS - UP (100 KIAS MINIMUM).

HYDRAULIC SUPPLY SYSTEM FAILURE

Hydraulic system failure will be indicated by a loss of pressure on the hydraulic pressure indicator. If you detect hydraulic system failure during flight, land as soon as conditions permit.

With complete hydraulic failure, the flaps, speed brake, spoilers, thrust attenuators and nosewheel steering will be inoperative. You will have to use the landing gear emergency extension system to lower the landing gear.

FAILURE OF GEAR TO EXTEND

Note

- An unsafe gear indication may be an actual gear malfunction or a system indicating problem. If you notice an unsafe condition and time and conditions permit, check hydraulic pressure and test the appropriate gear position indicator light to aid in determining the extent of the problem. Also consider having anotner aircraft or tower/runway supervisory unit visually check external gear condition.
- 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.

A malfunction of one of the main gear door sequencing switches can cause the main gear door to remain open and the landing gear to remain retracted. The affected landing gear may be extended by pulling the gear retract circuit breaker. Check the gear position indicators for a down and locked indication.

Normal Hydraulic Pressure Available

If any gear fails to extend or if you observe an unsafe indication when landing gear handle is placed DOWN, attempt to recycle the landing gear.

Note

- You may recycle the gear as many times as necessary. Your decision to either continue or abandon recycling will be based on fuel remaining, weather conditions, etc.
- If the landing gear handle will not raise when you attempt to recycle the gear, you may need to use the landing gear emergency override switch.

If you do not have safe gear indications after recycling, raise all gear and plan to land gear up in the center of the runway. Refer to procedures for LANDING WITH A GEAR MALFUNCTION.

No Hydraulic Pressure Available

If you determine that an unsafe gear indication is the result of the loss of hydraulic pressure, do not recycle the landing gear. Refer to procedures for LANDING GEAR EMERGENCY EXTENSION and, if necessary, LANDING WITH A GEAR MALFUNCTION. Plan on landing with whatever gear can be extended or partially extended.

LANDING GEAR EMERGENCY EXTENSION

The landing gear can be lowered with the emergency system as follows:

1. Airspeed - 150 KIAS or below.
2. Landing gear handle - DOWN.

Note

If the landing gear handle will not lower, attain sufficient altitude and lower both handles 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 the emergency landing gear T-handle unless the landing gear handle is down as damage to the aircraft may result.
- The T-handle must be turned clockwise 90° and pulled straight out. Side force on the handle may jam the mechanism and render the system inoperable.
- Do not attempt to return the T-handle to the "in" position after actuating the emergency system. This will cause the air pressure to bleed off from the down side of the gear.
- Do not recycle the landing gear after actuating the emergency system since rupture of the hydraulic reservoir and in-flight fire could result.

LANDING WITH A GEAR MALFUNCTION

If one or more landing gear remains up or unlocked, if the nosehweel torque link fails, or if all three gears are retracted, plan on making a straight-in approach and proceed as follows:

1. Reduce fuel load.
2. Seat handgrips safety pins - INSTALLED.
3. Shoulder harness - LOCK.
4. Helmet visor(s) - DOWN.
5. Flaps - DOWN.
6. Speed brake - OUT.
7. If all three gear are retracted, cutoff the throttles and pull the fuel shutoff T-handles just prior to contacting the runway.

After contact with the ground:

8. Throttles - CUT-OFF.
9. Fuel shutoff T-handles - PULL OFF.
10. Battery - OFF (AFTER AIRCRAFT STOPS).

WARNING

To afford protection against explosion, heat, or fire, the canopy should be retained.

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 nosewheel is on the runway and then only as necessary to maintain directional control.
- If nose gear torque link failure occurs, severe nosewheel shimmy is possible. Hold the nosewheel off the runway as long as practical. When the nose gear is lowered onto the runway, nose gear damage will be minimized by applying forward stick pressure to place more weight on the nose gear.
- 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 the brake on the lowered gear to maintain directional control.
- When landing with any gear malfunction, anticipate the possibility of departing the runway.

LANDING GEAR EMERGENCY T-HANDLE

Figure 3-6

UNSYMMETRICAL FLAP CONDITION

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

WARNING

Large fuel imbalances (greater than 160 lbs) may aggravate an unsymmetrical flap condition to the point where aileron control becomes marginal at final approach airspeeds. When landing with a fuel imbalance greater than 160 lbs., fly a straight in approach, lowering flaps in increments (20% to 30%). This will reduce the effects of an unsymmetric flap condition, should it occur.

LANDING WITH A FLAT TIRE

If a flat tire or tread separation occurs on takeoff with insufficient runway to abort, continue the takeoff, leave landing gear extended, and land. If the nose tire is flat, hold it off the runway until just prior to losing elevator control. After touchdown, trim full nose down to assist holding nose tire off runway. Use nosewheel 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 nosewheel steering for directional control.

If main tire tread separation occurs, the brake line may be damaged. Land in the center of the runway because of the possibility of tire and/or brake failure after touchdown. Consider reducing your fuel load before attempting to land.

WHEEL BRAKE FAILURE

When making a landing with a wheel brake inoperative, land on the side of the runway corresponding to the inoperative brake. Consider reducing your fuel load before attempting to land.

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 nosewheel steering and the good brake to maintain directional control and stop the aircraft. If both wheel brakes fail, use maximum aerodynamic braking Nosewheel steering may be used for short radius turns into taxi-ways or other suitable areas if runway is too short. As a last resort, in the event of imminent contact with obstructions, use the Emergency Gear Retraction procedure.

WARNING

Avoid contacting raised barriers.

MISCELLANEOUS EMERGENCIES

FLOAT SWITCH MALFUNCTION OR FUEL BOOST PUMP WARNING DURING FLIGHT

If the float switch assembly has malfunctioned, the first indication of impending double-engine flameout due to fuel starvation will be a slow increase of indicated fuel on the fuel quantity indicator. The amount of increase will vary with the distribution of fuel on board and the aircraft attitude. This will be followed by illumination of the fuel boost pump warning light and subsequent fuel flow fluctuations. Double-engine flameout will occur within a few seconds of boost pump light illumination.

WARNING

> If the fuel boost pump light has illuminated due to a fuel starvation in the fuselage tank, continued engine operation is questionable regardless of how rapidly corrective action is taken. Depending on altitude, consideration should be given to immediate initiation of EMERGENCY AIRSTART procedure.

If the fuel boost pump warning light illuminates during normal flight or fuselage tank fuel depletion is suspected, accomplish the following:

1. Fuel system - EMERGENCY.
2. Thrust - REDUCE TO MINIMUM PRACTICAL.
3. Fuselage tank - CHECK QUANTITY.
4. Do not perform inverted flight or negative "G's."

Note

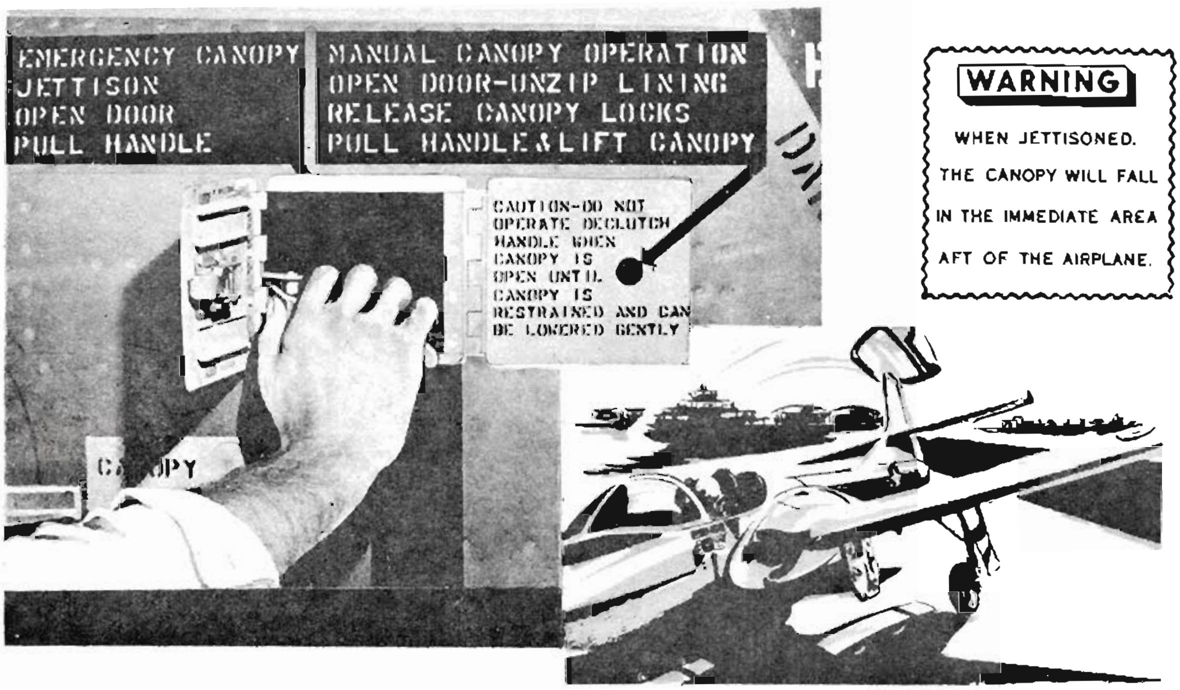
> The fuel boost pump warning light may flicker momentarily near zero "G" conditions due to a momentary lack of fuel at the pressure switch located in the fuel line.

HIGH FUEL FLOW

A significant fuel leak between the fuel flow transmitter and engine driven fuel pumps may be observed by indications on the fuel flow indicators. If an abnormally high flow rate (200 pounds difference between gages and/or above the normally expected flow for pressure altitude and power setting) is observed on one of the fuel flow indicators, accomplish the following:

1. Fuel boost pump switch - OFF. If no drop or only a slight drop in fuel flow occurs, suspect a fuel flow indicator malfunction and turn on the boost pump switch.

EMERGENCY ENTRANCE



WARNING

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

Figure 3-7

CAUTION

Fuel leaks could occur elsewhere in the system with less than 200 pph fuel flow differential and which would not be detectable by turning off the boost pump. If a fuel flow difference is observed and is accompanied by fuel fumes, fuel flow fluctuations, engines surges or other abnormal indications, it may be indicative of a fuel leak. In this instance the High Fuel Flow procedure should be applied.

If a significant drop occurs (fuel flow reading on high engine becomes approximately equal to the opposite engine):

2. Fuel shutoff T-handle (affected engine) - PULL OFF.
3. Throttle (affected engine) - CUT OFF after engine RPM begins to decrease.
4. Fuel boost pump switch - ON.

CAUTION

A significant drop indicates a leak in the fuel supply line between the fuel flow transmitter and engine driven fuel pumps.

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 recommended.

If complete electrical failure occurs:

- All electrical indicators and warning systems will be inoperative.
- Neither the lights nor any of the radios will operate.
- Speed brake, spoilers, thrust attenuators and nosewheel steering cannot be operated.
- Normal gear sequencing will not be available. Placing the gear handle down will extend the gear and gear doors simultaneously.

CAUTION

Should you experience complete electrical failure, use the landing gear emergency extension system to ensure the gear is down.

- Fuel system will automatically be on emergency gravity feed system and the fuel boost pump will be inoperative.
- Trim tabs will remain as set prior to electrical failure. Land as soon as conditions permit.

WARNING

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

GENERATOR FAILURE

If both generators fail and battery power is still available, turn off all nonessential 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 1-12). If the attitude indicator, heading indicator, fuel quantity gage or fuel flowmeters cease to function, place the inverter switch to SPARE.

WARNING

On aircraft equipped with the MXU-553 Flight History Recorder System, the load must be reduced prior to switching to SPARE inverter. This can be accomplished by pulling the Utility Lights circuit breaker which will deactivate both the utility lights and the recorder. The circuit breaker is located on the right instrument circuit breaker panel (figure 1-11).

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:

CAUTION

Any electrical accessory malfunction indicates a need to check the loadmeters. Abnormal readings are usually caused by a faulty voltage regulator or a faulty battery. Continued operation with a high loadmeter may result in battery failure, burning or explosion and extensive damage to other electrical components. Immediate checklist compliance may prevent further damage which could result in complete electrical failure/electrical fire.

If only one loadmeter is high:

1. Generator (high loadmeter) - OFF.
2. Opposite loadmeter - CHECK.
   If loadmeter is below 0.8, land as soon as conditions permit. If loadmeter reads 0.8 or above, turn both generators on and continue with procedures for two high loadmeters.

If both loadmeters are high:

1. Battery - OFF.
2. Loadmeters - CHECK.
   If loadmeters return to normal, battery is faulty. Leave battery switch OFF and land as soon as conditions permit.

If loadmeters remain high:

3. Inverter - SPARE.
4. Loadmeters - CHECK.
   If loadmeters remain high, proceed with step 5. If loadmeters return to normal, the main inverter is faulty. Turn the battery on and land as soon as conditions permit.
5. Generators - OFF.

Note

The interruption and reapplication of DC power will start the J-2 heading system fast slave cycle. Use caution when applying this procedure, particularly in actual weather conditions.

6. All DC accessories - OFF.
7. Monitor loadmeters while turning battery and generators ON. Turn only essential DC electrical accessories ON, one at a time. If the faulty system is located during this process, turn defective unit OFF unless it is critical for flight. Land as soon as conditions permit.

ZERO/NEGATIVE 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.

Note

The interruption and reapplication of DC power will start the J-2 heading system fast slave cycle. Use caution when applying this procedure, particularly in actual weather conditions.

5. Battery and opposite generator - ON.
6. Inoperative generator - OFF.

OIL SYSTEM MALFUNCTION

If an oil system malfunction (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 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 the 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 seizure as long as possible. At the first sustained indication of oil system malfunction:

1. Throttle (affected engine) - RETARD to maintain oil pressure within 3-65 PSI.
2. Throttle (affected engine) - CUT-OFF if oil pressure cannot be maintained within 3-65 PSI.
3. "G" forces - MINIMIZE. Avoid all abrupt maneuvers causing high "G" forces.

Note

Engine oil pressure above 45 PSI will result in oil loss through the rear bearing seal and smoke may be evident in the exhaust. At pressures above 65 PSI, oil loss becomes excessive and depletion may shortly result.

OXYGEN SYSTEM EMERGENCY OPERATION

In the event either pilot detects the symptoms of hypoxia or hyperventilation, proceed as follows:

1. Supply lever - ON.
2. Diluter lever - 100% OXYGEN.
3. Emergency lever - EMERGENCY.
4. Connections - Check security.

WARNING

If you do not feel positive pressure or if you suspect oxygen system contamination, consider using the emergency oxygen cylinder. If you do suspect oxygen system contamination, you should disconnect the aircraft oxygen hose after activating the emergency oxygen cylinder.

5. Breathe at a rate and depth slightly less than normal until symptoms disappear.
6. Descend below 10,000 feet and land as soon as conditions permit.

Note

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.

SECTION IV

CREW DUTIES

Crew duties are not applicable in this aircraft.

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 limitations 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.

ENGINE LIMITATIONS

Engine limitations are shown in figure 5-1 and are based on Standard Day sea level conditions.

ENGINE RPM LIMITATIONS

98.5% RPM to 100.5% RPM - limits for full throttle operation. If RPM during the lineup check is above 100.5% RPM, or below 98.5% RPM, abort and make an entry in Form 781.
103% RPM - overspeed limit.

Flight conditions during climbs and dives may result in temporary RPM increases, (as high as 103% RPM), which are characteristic of the engine fuel control and are permissible. When these conditions occur, however, adjust throttles to maintain engine speeds at or below 100.5% RPM.

If RPM reaches between 100.5% and 103% during a stable flight condition (constant altitude and airspeed), enter this in Form 781 at the completion of the mission.

RPM in excess of 103% constitutes an engine overspeed. When this condition occurs, adjust throttles to 100.5% RPM or below and abort. Make an appropriate entry in Form 781, indicating highest RPM, exhaust gas temperature and duration (in seconds) of overspeed above 103% RPM.

Note

A three percent decrease in maximum obtainable engine RPM is acceptable above 20,000 feet.

EXCESSIVE ENGINE EXHAUST GAS TEMPERATURE

If temperature limits are exceeded, adjust the throttles immediately to maintain the limits and make an entry in Form 781, indicating the highest RPM, exhaust gas temperature, and duration (in seconds) of the overtemperature. If 780° is exceeded, the mission should be aborted.

Note

If the EGT indicates less than 600°C (with throttles at military) during the lineup check, the engine requires minor adjustment and an appropriate entry should be made in Form 781 upon completion of the flight.

LOADMETER LIMITATIONS

- The loadmeters should be checked immediately after takeoff and every 15 minutes thereafter. After 10 minutes of flight, loadmeter reading should be 0.5 or below. Maximum loadmeter for takeoff is 0.8.
- The difference in loadmeter readings should not exceed .2. If the difference exceeds .2, an appropriate entry shall be made in Form 781 upon completion of the mission indicating loadmeter readings and duration of flight when the unequal reading was noted.

FUEL FLOW FLUCTUATION LIMITATIONS

Fuel flow fluctuations not accompanied by EGT, RPM fluctuations or actual engine surges are acceptable. Suspect a faulty gaging system and monitor the engine instruments for any other abnormal indications.

Fuel flow fluctuations accompanied by EGT or RPM fluctuations or actual engine surges are not acceptable. Reduce engine RPM to idle, and abort.

INSTRUMENT

The limiting structural airspeed pointer will move to indicate 382 KIAS or airspeed representing limiting Mach number of .70 indicated, whichever occurs first.

A maximum allowable airspeed of 275 KIAS shall be observed. The aircraft will not be flown above this airspeed due to longitudinal instability and/or rudder flutter.

AIRSPEED

135 KIAS flap-down limit airspeed

135 KIAS landing lights-down limit

150 KIAS gear-down limit airspeed

40 KIAS canopy open limit

LOADMETER

.8 maximum for takeoff

.5 maximum after 10 minutes of flight

.2 difference

TACHOMETER

38-95% rpm continuous operation

100.5% rpm

Note

Above 95% RPM up to 100.5% RPM - 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
- 280°C to 650°C continuous operation
- 680°C maximum for flight for 30 minutes at MILITARY
- 780°C instantaneous limit for starting and acceleration

OIL PRESSURE

- 3 PSI minimum idle
- 10-45 PSI continuous operation
- 65 PSI maximum

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

ACCELEROMETER

- 6.67 G maximum at design gross weight
- -2.67 G maximum at design gross weight

4.80 G maximum unsymmetric flight

Note

The instrument markings shown in this figure represent limitations that are not necessarily repeated elsewhere in the text.

Figure 5-1 (Sheet 2 of 2)

WEIGHT . . . 7200 lbs.

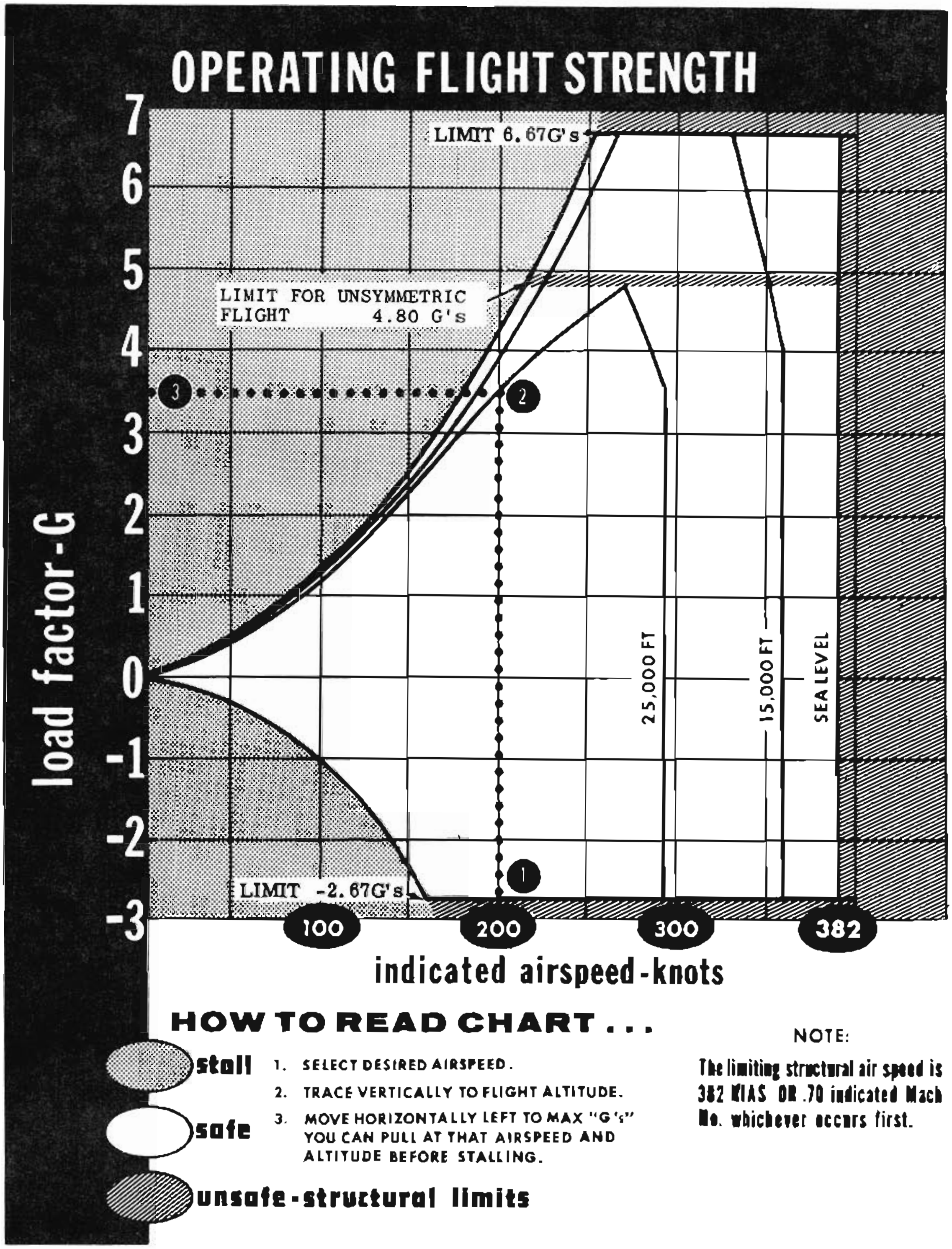

Figure 5-2

PROHIBITED MANEUVERS

The following maneuvers are prohibited:

1. Vertical (whip) stalls.
2. Snap rolls.
3. Spins, with fuel imbalance in excess of 70 pounds indicated.
4. Intentional fishtail-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, unless essential to relieve excessive stick forces.
7. Practice maneuvers with one engine inoperative.
8. Negative G 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 within satisfactory limits.

WEIGHT LIMITATIONS

The maximum gross weight should not exceed 7200 pounds. Above this weight, structural failure may result if a load factor in excess of 6.67 G's is obtained.

Hard landings at high gross weights may result in structural damage. If you experience a hard landing record it in Form 781. Include the accelerometer indication in the entry.

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

Ensure that the fuel boost pump is operating before doing any inverted flying or other maneuvers resulting in prolonged negative "G" force (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 flame out 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.

Note

The right seat occupant should use caution when gripping the throttles during negative G maneuvers as it is possible to inadvertently lift the throttles over the idle detent.

STALLS

Clean configuration stalls will be preceded by heavy buffeting approximately four knots above the stalling speed. During 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 the spoilers are extended, aircraft buffet will be felt between four and ten knots above stall speed.

Note

Above approximately 90 KIAS, the spoilers will be inoperative during configured stalls.

When the spoilers are inoperative, there is no stall warning when 25 percent or more flaps are down. When the speed brake is used with flaps, there is an increase in airframe buffet as the angle of attack is increased. Buffet intensity is light to moderate, and is easily identifiable. Further increase in angle of attack will cause the aircraft to abruptly stall. Aircraft response to the stall is best characterized by an abrupt roll to a large bank angle. If the aircraft is turning at the time of the stall, this roll will normally be in the direction of the turn. With the speed brake up and flaps extended to 50 to 100 percent, there is no approach to stall warning. However, the stall is gentle, with a light, easy to control rolling tendency. This stall is characterized by a rapid onset of airframe buffet which occurs simultaneously with a stagnation of aircraft nose movement. Lateral control throughout the stalls is good and no uncontrollable rolling tendencies occur; however, holding the control stick full back will cause pitch oscillations. Elevator control is very good throughout the stall. A rapid forward movement on the control stick will cause the aircraft to pitch sharply, resulting in immediate stall recovery. As the stall progresses, control effectiveness is lost in the following order: aileron, elevator and rudder. During stall recovery, control effectiveness is regained in the reverse order: rudder, elevator and aileron. 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 and yaw to the left or right. This roll and yaw is easily controlled by application of proper aileron and rudder except under severe stall conditions.

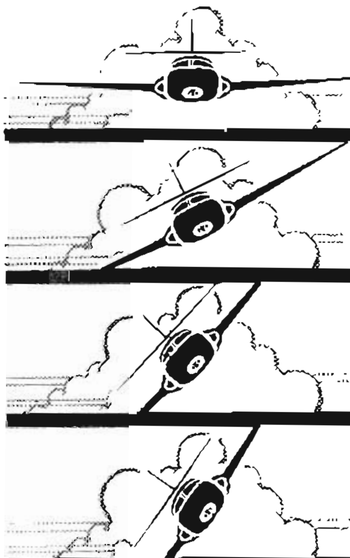
Note

- When the stall is allowed to progress too far (severe stall), the ailerons will lose their effectiveness; however, rapid or large aileron inputs will aggravate the stall, which could lead to an inadvertent landing configuration spin.
- Lowering 50% flaps while decreasing stall speed, will significantly increase thrust required.

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

STALL SPEED CHART

*POWER OFF ••• KIAS



GROSS WEIGHT	4400 LBS			5400 LBS			6400 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

SPINS

SPIN CHARACTERISTICS

The T-37 has four spin modes: erect normal (decelerated), erect accelerated, inverted decelerated, and inverted accelerated.

ERECT NORMAL SPINS

The T-37 will spin in either direction from a 1G stall or accelerated entry by applying full back stick and full rudder in the direction of the desired spin.

Note

- The T-37 will spin with neutral rudder if held for a prolonged time in a full aft stick stall. The stall preceding the spin will be characterized by heavy buffet.
- Spin development is slower from an accelerated stall, and the buffet preceding the spin will be more intense. Application of spin prevention procedures prior to spin development (in the incipient phase) will normally recover the aircraft immediately.

Spin entry is not violent, but will vary depending on gross weight and type of entry. Low gross weight, low pitch attitude, left spins, and accelerated entries will make entries faster and more oscillatory. The more oscillatory entries take longer to develop and stabilize.

If the stick is held full aft and the rudder is held at full deflection, the first turn of the spin is more like a roll with the nose dropping below the horizon in the first half and rising above the horizon in the last half. Succeeding turns will cause the oscillations to progressively damp out and the nose will tend to remain below the horizon. At very low fuel remaining, the spin tends to be initially flat and the nose may remain above the horizon for as many as three turns.

When all oscillations are damped, the nose will stabilize at -40° to -45° pitch attitude. The altitude loss is approximately 550 feet per turn, completing a turn in about three seconds. The aircraft will spin at different rates depending on the amount of fuel on board. The heavier the aircraft, the slower the spin rate and vice versa.

ERECT ACCELERATED SPINS

The accelerated spin is caused by spinning with the elevator control in some position other then full back stick. The highest stabilized rotation rate occurs with the stick full forward and with full rudder opposite to the direction of rotation. When starting from an erect normal spin, this condition is difficult to attain, as the controls must be moved abnormally slowly, requiring a minimum of four seconds to move the controls from stop to stop. If controls are moved too rapidly, 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 DECELERATED SPINS

The inverted spin can be entered only from a negative G stall. One way this can occur is by transitioning from an erect spin due to improper recovery technique. A light fuel weight (below 1000 pounds remaining) tends to make the negative G stall entry difficult to attain, although entries from an erect spin are not noticeably affected.

INVERTED ACCELERATED SPINS

The inverted spin can be accelerated by allowing the controls to free float or by placing the elevator in some position other then full forward stick. As with the erect accelerated spin, the nose drops and rotation rate increases until a new stabilized rate is reached.

LANDING CONFIGURATION SPINS

Landing configuration spins are normally characterized by a near "snap" into the first turn of the spin. The pitch attitude in a stabilized landing configuration spin is approximately 20 degrees lower than the normal erect spin.

SPIN PREVENTION

When an inadvertent spin is suspected, initiate the spin prevention. Simultaneously use stick forces as necessary to break the stall, apply rudder as necessary to eliminate the yaw, and check the throttles in idle. Use ailerons to stop the roll only after the stall is broken, and then return the aircraft to level flight. If full prevention controls (rudder and elevator) have been applied, and if the nose remains below the horizon and the rotation stabilizes at an increased rate, the spin has accelerated too much for spin prevention procedures to be effective. Consequently, a spin recovery will be necessary.

The degree of control deflection necessary to prevent the spin depends on how far the spin has developed and how much it has accelerated. In some cases, full control deflection may be required. Do not use abrupt control movements, but do use the controls positively. As the controls are applied, the rate of rotation may increase until the controls become effective. Applying stick forces as necessary to eliminate all stall indications is imperative since any degree of stall will reduce the possibility of a successful spin prevention.

WARNING

Control pressures necessary to prevent an inadvertent spin may differ from those normally experienced during practice spin preventions due to increased acceleration, the position of aircraft trim, or aircraft configuration.

Spin prevention procedures are most effective when employed at the early stages of spin development. Stall and yaw conditions can be easily controlled, rotation will slow, and the recovery is almost instantaneous. Aircraft response to spin prevention control inputs becomes slower as the spin nears full development. Increased time will be necessary for the controls to become effective, the rotation rate will be more pronounced, and the nose may lower to the vertical attitude. At this point, a successful recovery is usually imminent.

SPIN RECOVERIES

Spin Recovery

The following is a single procedure which will recover the aircraft from any spin:

1. THROTTLES - IDLE.

2. RUDDER AND AILERONS - NEUTRAL.

3. STICK - ABRUPTLY FULL AFT AND HOLD.

a. If spin is inverted, a rapid and positive recovery will normally occur within one turn.

WARNING

If the spin is inverted and has accelerated excessively or if the stick is moved fully aft slowly instead of abruptly, the aircraft may continue to spin inverted. In either case the missed attempt is due to acceleration of the spin. If this occurs, full forward stick should be abruptly applied and held as long as necessary to decelerate the spin followed by abruptly moving the stick full aft. For all recovery attempts, ensure that you comply with the first three steps of the spin recovery procedure.

b. If the spinning stops, neutralize controls and recover from the ensuing dive.

c. If spinning continues, use the turn needle and outside references to determine the direction of rotation and proceed with the following steps.

4. RUDDER - ABRUPTLY APPLY FULL RUDDER OPPOSITE SPIN DIRECTION (OPPOSITE TURN NEEDLE) AND HOLD.

WARNING

- Both intentional and inadvertent spins can be disorienting. Therefore, it is imperative that you determine the correct direction of rotation before continuing the recovery procedure.

- If rudder in the direction of rotation is used during an attemped recovery, the nose will pitch down when the stick is moved forward, the rotation rate will increase; more than normal stick forces may be required to move and hold the stick forward. Under most conditions, recovery will not occur if these control positions are held.

Note

At lower gross weights, opposite rudder may stop the spin prior to one turn. If this occurs, recover from the erect stall by easing the stick forward and neutralize the rudder, then recover from the ensuing dive.

5. STICK - ABRUPTLY FULL FORWARD ONE TURN AFTER APPLYING RUDDER.

a. As the nose pitches down near the vertical, neutralize the elevator while continuing to hold rudder until rotation has stopped. Do not allow the stick to move aft of neutral until recovery is affected.
b. If the stick is held forward after the nose pitches down near the vertical, the aircraft attitude can be past the vertical upon recovery. In this position, the aircraft will transition into an inverted spin unless controls are neutralized immediately.
c. Recovery should occur within one and three-fourths turns from the point at which recovery rudder was applied.
d. If forward stick is applied before rudder effectiveness is obtained, the spin will momentarily speed up and recovery may take slightly longer.

WARNING

- Use extreme caution when performing maneuvers with two hands on the stick to preclude inadvertent trim actuation.

- If controls are properly applied and held, the aircraft will always recover using the Spin Recovery procedure. Recovery attempts usually fail because of misapplication of controls. If recovery controls are not held long enough, a recovery may not be effected. If a second attempt is necessary, make it deliberate and ensure that full rudder (verify opposite to turn needle) is held until the spinning has stopped and that full forward stick is maintained until the nose pitches down near the vertical. Multiple attempts should be avoided since altitude loss will be excessive and unnecessary acceleration may result.

Note

The right seat occupant should use caution when gripping the throttles during negative G maneuvers as it is possible to inadvertently lift the throttles over the idle detent.

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

SPIN RECOVERY CHARACTERISTICS

Recovery characteristics using the Spin Recovery are as follows:

Erect 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. 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 under all conditions will be developed by one turn. As forward stick is applied, the nose drops sharply and rotation will stop within one-fourth to three-fourths of a turn.

Erect Accelerated Spins

From any control position, neutralize the rudder and abruptly 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, but 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.

Inverted Decelerated Spins

With the aircraft spinning inverted, neutralize rudder and abruptly move the stick full aft. A rapid and positive recovery will occur within one turn. The aircraft rolls rapidly into an erect stall condition and rotation stops within one 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 will eventually progress 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.

Inverted Accelerated Spins

With the aircraft spinning inverted, neutralize rudder and abruptly move the stick full aft. Recovery will be similar to the inverted decelerated spin, although response to control inputs will be more sluggish.

WARNING

If the spin is inverted and has accelerated excessively or if the stick is moved fully aft slowly instead of abruptly, the aircraft may continue to spin inverted. In either case the missed attempt is due to acceleration of the spin. If this occurs, full forward stick should be abruptly applied and held as long as necessary to decelerate the spin followed by abruptly moving the stick full aft. For all recovery attempts, ensure that you comply with the first three steps of the spin recovery procedure.

Landing Configuration Spins

If a landing configuration spin is entered, immediately apply spin prevention procedures. If spin prevention is unsuccessful, execute the Spin Recovery. The aircraft may not appear to react initially to control inputs. However, if the Spin Recovery procedures are used, the number of turns to recover should be identical to the clean configuration. Gear and flaps should be retracted as soon as possible after rotation stops 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 overcontrol during maneuvers because of sensitivity 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. (Refer to 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.

WARNING

To preclude inadvertent trim actuation, aircrews should use extreme caution when performing maneuvers with two hands on the stick.

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. For a detailed breakdown on the effect of normal acceleration on limiting Mach number, see Figure 5-2.

Note

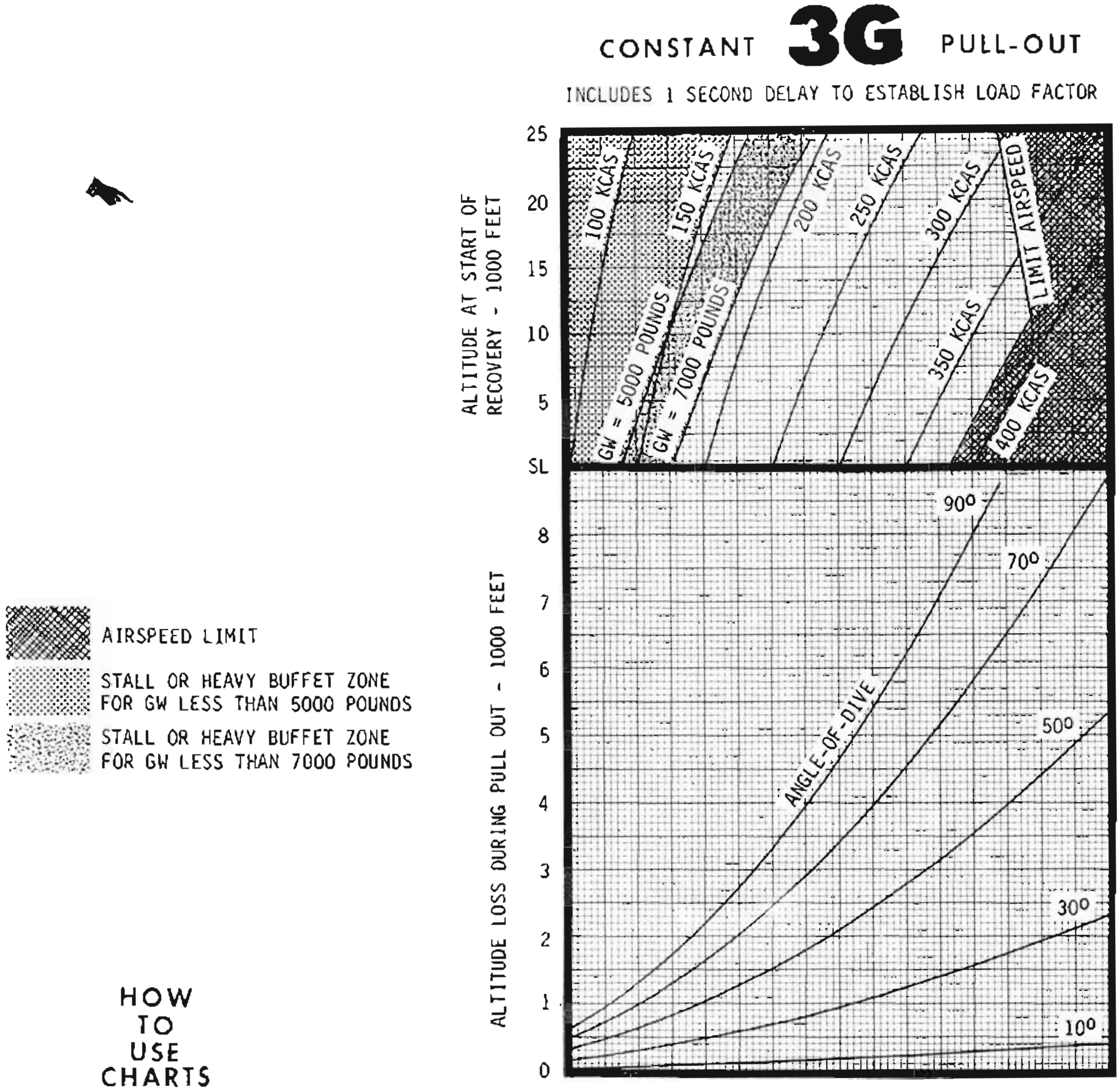
A maximum allowable airspeed of 275 KIAS shall be observed. The aircraft will not be flown above this airspeed due to longitudinal instability and/or rudder flutter.

LONGITUDINAL STABILITY

Some aircraft exhibit longitudinal instability at speeds above 250 KIAS. Positive longitudinal stability is defined as the tendency for the aircraft to return to its trimmed condition when maneuvered to other than trimmed condition. For example:

Positive stability is exhibited when nose-up stick forces tend to increase as airspeed increases. The instability exhibited by some T-37s causes nose-down stick forces to increase as airspeed is increased for some trim

ALTITUDE LOSS IN DIVE



HOW TO USE CHARTS

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 RECOVERY - EXAMPLE 20,000 FEET.
2. ON SCALE ALONG ALTITUDE LINE, SELECT POINT NEAREST THE KCAS AT WHICH RECOVERY IS STARTED (200 KNOTS KCAS).
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 1 of 2)

RECOVERY

CONSTANT 5G PULL-OUT

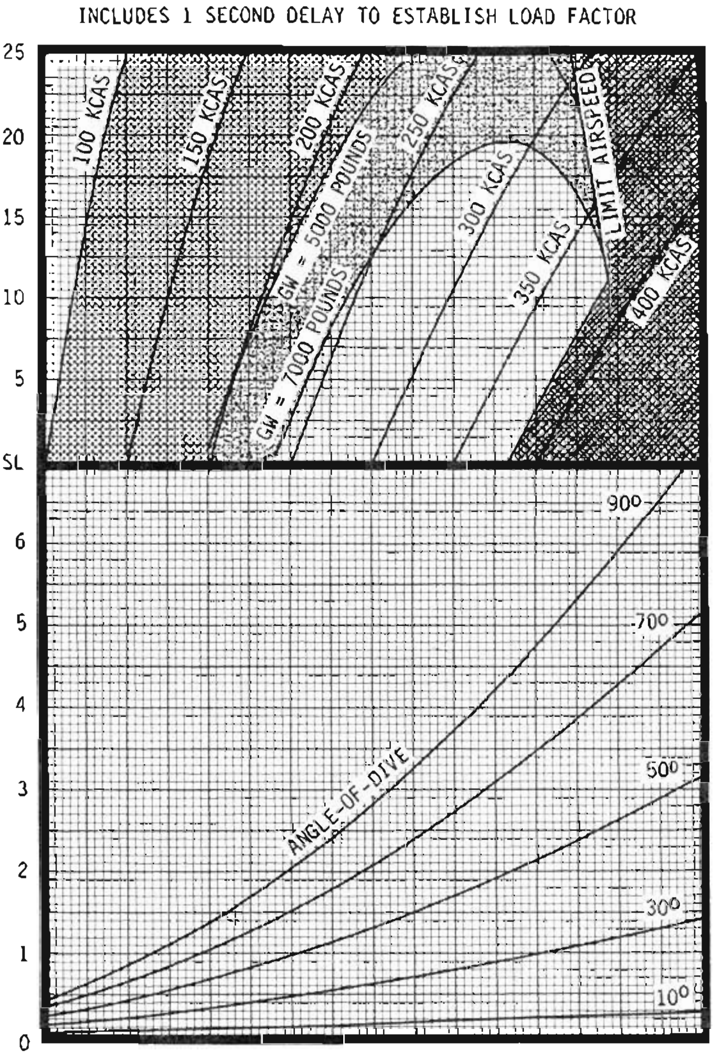


Figure 6-2 (Sheet 2 of 2)

settings. Introduction of excessive elevator trim either inadvertently or due to system malfunction during maneuvers can result in extreme stick forces during recovery. Recovery from maneuvers/conditions where extremely high stick forces are encountered may be facilitated by using elevator trim. Continuous application of trim should not be used as an overstress condition could occur. Short intermittent use of trim is the recommended technique of changing trim.

WARNING

At speeds above 275 KIAS full nose down trim results in extremely heavy stick forces. Immediate reduction of airspeed is required to assure aircraft control.

CAUTION

The maximum allowable airspeed can be exceeded when the aircraft is deliberately dived at very steep angles. Never allow the aircraft to exceed the maximum allowable airspeed.

If limiting structural 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.

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 maximum allowable, 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.

Use care not to dive at steep angles for prolonged periods without monitoring airspeed. Execut pull-out if maximum allowable airspeed is approached.

ABRUPT CONTROL STICK MOVEMENTS (ELEVATOR)

Abrupt control stick movements (stop to stop in less than 0.5 seconds) during unsymmetric maneuvers can cause failure of the horizontal stabilizer when flying above 210 KIAS. There may be no indication of excessive G's on the cockpit accelerometer. As airspeed increases above 210 KIAS, the rate of control stick movement required to structurally damage the horizontal stabilizer becomes proportionally less.

The limits depicted in the Operating Flight Strength Chart (Figure 5-2), which are applicable to nonabrupt control stick movements, remain valid.

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 speed 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 so 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.

SECTION VII

ALL-WEATHER OPERATION

TABLE OF CONTENTS

Note

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

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. Depending on radio and navigation equipment installed in the aircraft - the pilot may make the following types of approaches: VOR, VORTAC, VOR/DME, radar and ILS. If the aircraft is not equipped with IFF, or if the IFF is inoperative, consider performing a non-radar instrument approach (VOR, LOC, ILS), due to the poor radar return when IFF capability is lost. Pay special attention 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. Consult Appendix I for flight planning information and use particular care in planning an alternate destination. The following techniques are recommended 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. Adjust attitude indicator to superimpose the miniature aircraft and the horizon bar. Use nosewheel steering for directional control until nose wheel lift off (approximately 65 KIAS), increase pitch attitude by two bar widths on the J-8 attitude indicator or 5° on the MM-3/ARU-44A/ARU-42A. By maintaining this attitude, the aircraft will normally become airborne at approximately 90 KIAS.

When the altimeter and vertical velocity indicator indicate a positive climb, retract the landing gear at a minimum of 100 KIAS. Retract the flaps at a minimum of 110 KIAS and maintain a positive rate-of-climb until tech order climb speed has been attained.

INSTRUMENT CLIMB

Refer to Appendix I for the best climb data. Turns after takeoff should be made at a safe altitude and limited to 30° of bank.

INSTRUMENT CRUISING FLIGHT

Instrument cruise procedures do not differ from normal flight procedures. For ease and precision of flight, the angle of bank should be limited to 30° during all turns.

HOLDING

Recommended holding pattern airspeed is 160 KIAS. To descend when holding reduce power and maintain holding pattern airspeed, using speed brake as desired.

RADIO AND NAVIGATION EQUIPMENT

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

INSTRUMENT APPROACHES

WARNING

With aircraft equipped with the AN/ARN-127 Navigation Receiver, when a usable signal is lost, do not confuse the bearing pointer parking at the 4 o'clock position for station passage on a VOR or VOR/DME approach, where the FAF or IAF is located at the VOR station. When a usable signal is not present, the CDI OFF flag will be in view.

Note

- The aircraft is Category B for instrument approach purposes.
- Various conditions associated with some instrument approaches such as steep descent gradients, high pressure altitudes, etc., may necessitate the need for changes in configuration and/or airspeed from those normally recommended in this section.

Note

- Rapid descents can result in the windscreen fogging; therefore, preheat the canopy and wind screen for approximately 10 minutes before a descent is made.
- Aerobatics may induce gross precession errors in the heading and attitude systems.

PENETRATION AND ENROUTE/RADAR DESCENTS

Enroute descents (including radar letdowns) to initial penetration altitude (figure 7-1) or to the final approach segment of a radar approach (figure 7-2) may be made at the airspeeds and power settings listed in Part 6 of the Appendix. By proper control techniques for the letdown and turn onto final, maximum economy of fuel and time can be realized. If the aircraft is not equipped with an operating IFF, attempt a radar-controlled letdown only if a VOR penetration is not available.

For a normal jet penetration (figure 7-1), from initial penetration altitude reduce power to 65% and lower the pitch attitude approximately 10°. Once the airspeed reaches 200 KIAS, extend the speed brake (if desired). At approximately 1000 feet above level off altitude, raise the speed brake (if used) and decrease the pitch attitude by one-half. When reaching the normal lead point (approximately 10% of the vertical velocity), slowly raise the nose of the aircraft to level off at the desired altitude. Adjust power as necessary to maintain desired airspeed, (120 KIAS minimum) until configuring for the approach. Before reaching the final approach fix (FAF), establish the final approach configuration and airspeed.

An alternate method of flying a penetration from the initial penetrating altitude is to reduce power to idle and lower the pitch attitude to maintain 200-250 KIAS. The remainder of the penetration will be flown as stated above.

If a single engine penetration is flown, use 75% power when initiating the penetration. Use of the speed brake is optional. At approximately 1000 feet above the level off altitude, retract the speed brake (if used) and slow to desired airspeed, (120 KIAS minimum). Establish the final approach configuration at the FAF.

NON-PRECISION FINAL APPROACH (VOR/DME/VORTAC, LOCALIZER, ASR)

Several non-precision instrument approach options are available using course guidance from VOR, localizer, and ground radar. Maneuvering prior to the actual approach will normally be at 160 KIAS. However, other airspeeds may be used if necessary for traffic sequencing or expediency. For the approach, maintain a minimum of 120 KIAS until establishing the final approach configuration.

Prior to the FAF/descent point lower the landing gear, landing lights, 50% flaps, and speed brake (as desired). Maintain 110 KIAS on final.

Note

- Airspeeds and flap settings when landing in gusty winds or with a crosswind are specified Section II.
- Major commands may authorize alternate airspeeds and configurations.

When flying a single-engine non-precision approach, maintain a minimum of 120 KIAS prior to configuring. Approaching the FAF/descent point, extend the landing lights. Passing the FAF/descent point, lower the landing gear and maintain 110 KIAS. Lower flaps to 50% when field is in sight. Speed brake may be extended and flaps may be lowered to 100% when landing is assured, to prevent landing long.

Note

Airspeeds and flap settings when landing in gusty winds or with a crosswind are specified in Section III.

PRECISION FINAL APPROACH (ILS, PAR)

An ILS or PAR approach may be flown as depicted in Figure 7-4. Maneuvering prior to the actual approach will normally be at 160 KIAS. However, other airspeeds may be used if necessary for traffic sequencing or expediency. For the approach maintain a minimum of 120 KIAS until establishing the final approach configuration (approximately 7-8 miles from touchdown). Prior to glide path interception, lower the landing gear, landing lights, and 50% flaps. Maintain 110 KIAS on final. Speed brake may be used on the glide path if desired.

Note

- Airspeeds and flap settings when landing in gusty winds or with a crosswind are specified in Section II.
- Major commands may authorize alternate airspeeds and configurations.

When flying a single-engine precision approach, maintain a minimum of 120 KIAS prior to configuring. Approaching the glide path, extend the landing lights and lower the flaps to 50%. Upon intercepting the glide path, lower the landing gear and maintain 110 KIAS. Speed brake may be extended and flaps may be lowered to 100% when landing is assured to prevent landing long.

NOTE

THE PROCEDURES IN RED ARE RECOMMENDED SINGLE-ENGINE VOR PENETRATION PROCEDURES

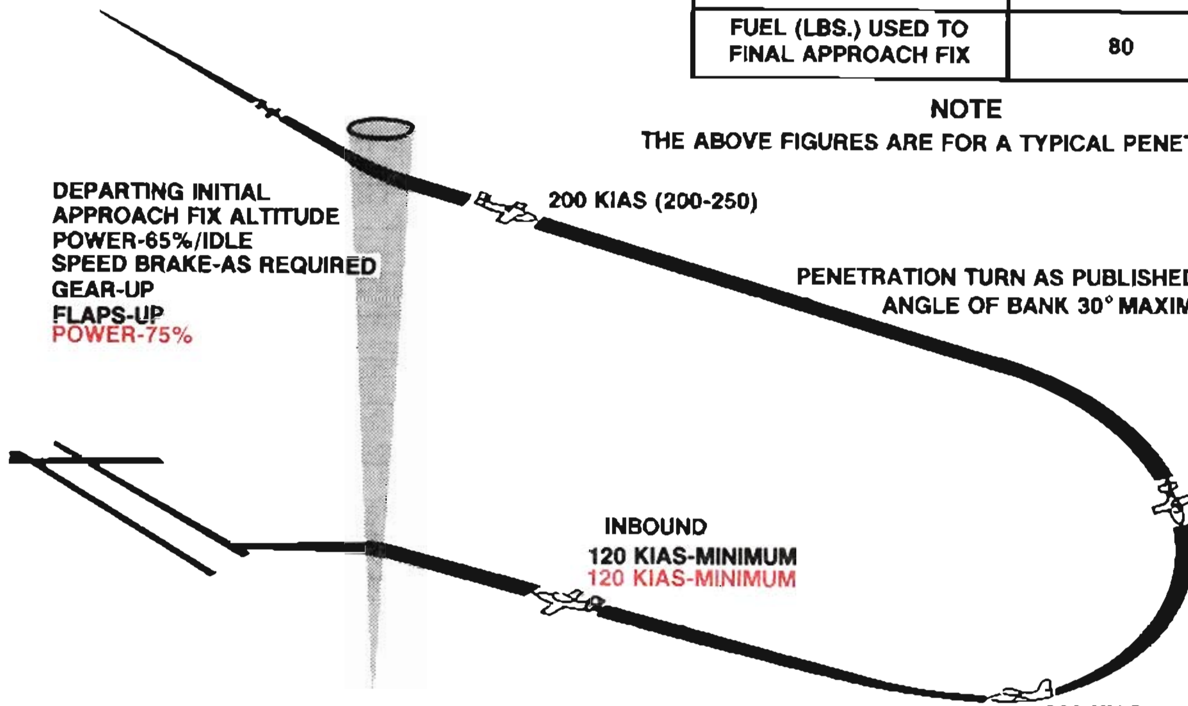
TYPICAL VOR/DME/VORTAC

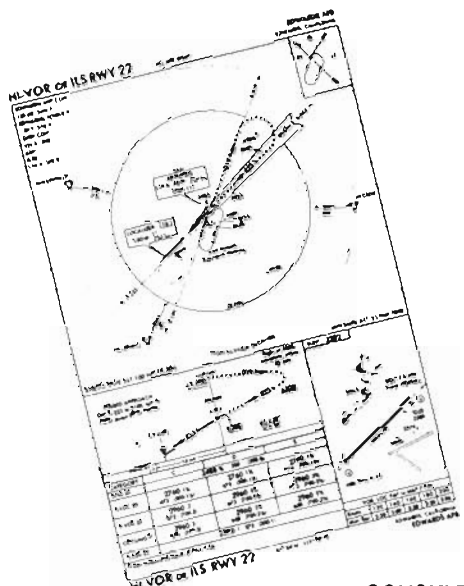
JET PENETRATION TO PRECISION OR NON-PRECISION FINAL

INITIAL ALTITUDE	20,000 FT.
TIME (MIN.) TO LOW STATION	6
FUEL (LBS.) USED TO FINAL APPROACH FIX	80

NOTE

THE ABOVE FIGURES ARE FOR A TYPICAL PENETRATION.





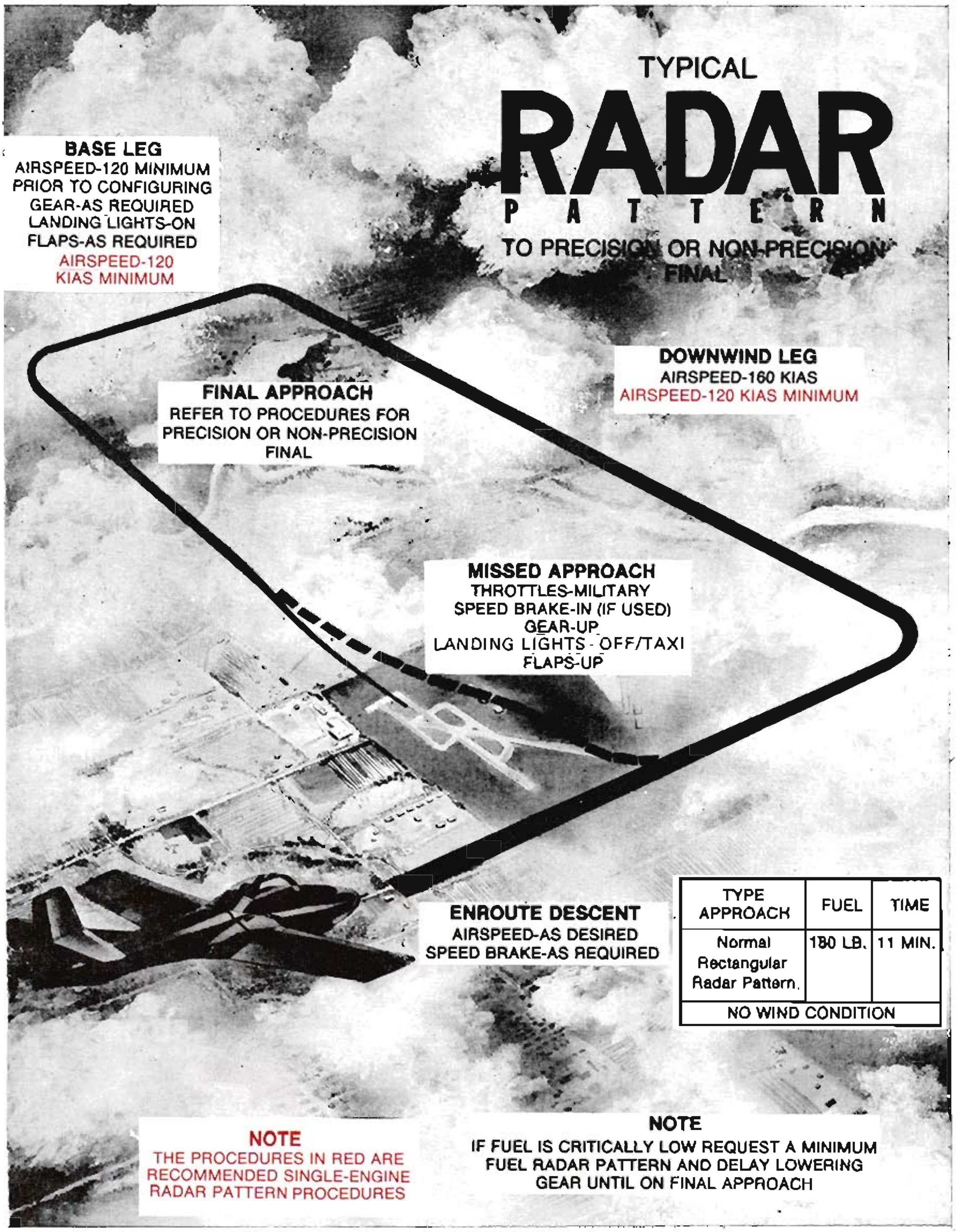
NOTE

BEGIN LEVEL OFF 1000 FEET ABOVE DESIRED ALTITUDE BY DECREASING PITCH ATTITUDE BY ONE-HALF.
THE SPEED BRAKE IS NORMALLY RETRACTED (IF USED) WHEN INITIATING THE LEVEL OFF, HOWEVER, IT MAY BE DELAYED UNTIL APPROACHING 120 KIAS AFTER LEVEL OFF DEPENDING ON TYPE APPROACH TO BE MADE.
RETRACT SPEED BRAKE (IF USED) 1000 FEET ABOVE DESIRED ALTITUDE OR AS REQUIRED.

WARNING

CONSULT THE PILOT'S FLIGHT INFORMATION PUBLICATION (TERMINAL) FOR THE CURRENT APPROACH TO YOUR DESTINATION.

Figure 7-1



TYPE APPROACH	FUEL	TIME
Normal Rectangular Radar Pattern.	180 LB.	11 MIN.
NO WIND CONDITION		

Figure 7-2

TYPICAL NON-PRECISION FINAL APPROACH

(VOR/DME/VORTAC, LOCALIZER, ASR)

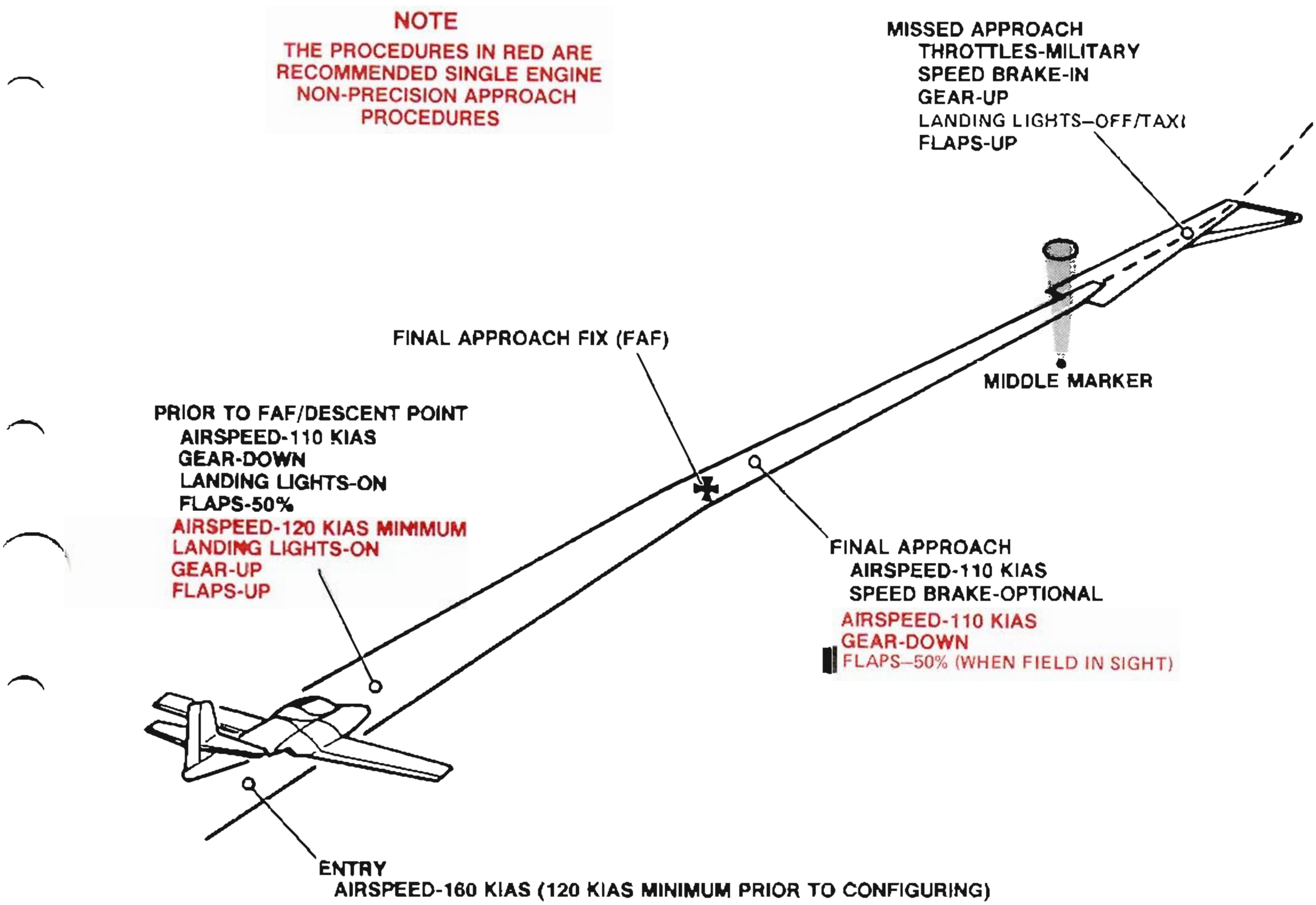


Figure 7-3

TYPICAL PRECISION FINAL APPROACH (PAR, ILS)

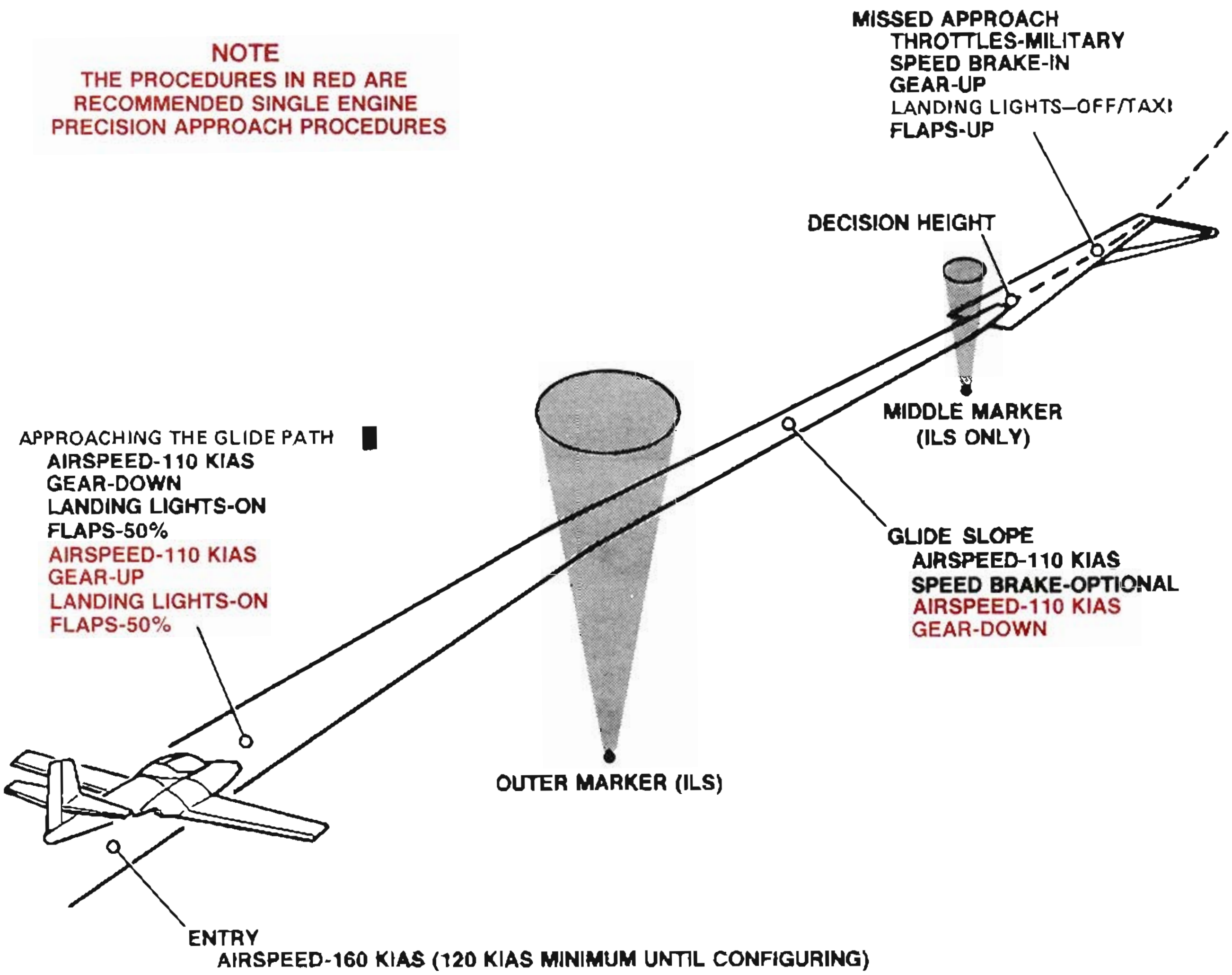


Figure 7-4

Note

Airspeeds and flap settings when landing in gusty winds or with a crosswind are specified in Section III.

CIRCLING APPROACH

When flying a circling approach, maintain a minimum of 120 KIAS prior to configuring. Prior to the FAF/descent point, extend landing lights, lower landing gear and flaps to 50%. Maintain 110 KIAS. Extend the speed brake on base or final.

Note

- Airspeeds and flaps settings when landing in gusty winds or with a crosswind are specified in Section II.
- Major Commands may authorize the use of alternate final approach configurations and airspeeds.

When flying a single-engine circling approach, maintain a minimum of 120 KIAS until configuring with gear and flaps. Prior to the FAF/descent point, extend the landing lights. On base or final, lower the landing gear and flaps to 50% and maintain 110 KIAS. Speed brake may be extended and flaps lowered to 100% when landing is assured to prevent landing long.

Note

Airspeeds and flap settings when landing in gusty winds or with a crosswind are specified in Section III.

ICE AND RAIN

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 will be avoided. If engine flameout occurs due to ice ingestion, immediate restart is possible without engine damage.
- Ice on or in the air intake may restrict required airflow to the engine. For this reason, avoid rapid throttle movement when operating in areas of known or suspected icing conditions.

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, change altitude as soon as possible 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

WARNING

Flights through thunderstorms or other areas of extreme turbulence should be avoided due to possibility of engine flameout, structural failure, or damage due to hail, lightning, and violent up/down drafts. Maximum use of weather forecast facilities and ground radar to avoid thunderstorms or other areas of extreme turbulence is essential. Avoid flying in instrument meteorological conditions in areas where thunderstorms are known to be present.

Should flight through an area of thunderstorm activity become necessary, the following recommended procedures should be followed:

1. Preparation - Turn on pitot heat, tighten seat belt, lock shoulder harness and stow loose items. At night, use white lighting to minimize blinding effect of lightning.

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 seat.

2. Airspeed - A penetration airspeed of **180 KIAS** should be established. Trim the aircraft for level flight at this speed. Severe turbulence may cause large and rapid variations in indicated airspeed. **Do not chase the airspeed.**
3. Attitude - The key to proper flight technique through turbulence is attitude. Both pitch and bank should be controlled by reference to the attitude indicator. **Do not change trim** after the proper attitude has been established. Extreme gusts will cause large attitude changes. Use smooth and moderate aileron and elevator control inputs to reestablish the desired attitude. To avoid overstressing the aircraft, **do not make large or abrupt attitude changes.**
4. Thrust - Establish and maintain the thrust setting consistent with the desired penetration airspeed and altitude.
5. Altitude - Severe vertical gusts may cause appreciable altitude deviations. Allow altitude to vary. Sacrifice altitude to maintain desired attitude. **Do not chase the altimeter.**

NIGHT FLYING

During normal VFR flight, unfiltered lights should be used sparingly. Reflections in the canopy may be reduced by lowering the intensity of all cockpit lights.

Note

- During night/intermittent IMC, reflections from the anti-collision lights or strobe lights on clouds or precipitation may create a distraction to the pilot and induce spatial disorientation. If so, the anti-collision lights or strobe lights should be turned off until clear of the area of reduced visibility.
- When making VFR takeoffs in areas of limited horizon references, referral to the flight instruments is recommended to avoid flying back into 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 THE AIRCRAFT

Remove all protective covers and dust plugs and check that the entire aircraft is free from frost, snow and ice. Depending upon the weight of snow and ice accumulated, takeoff distances and climb out performance can be seriously affected. The roughness and distribution of the ice and snow could vary stall speeds and characteristics to an extremely dangerous degree. In view of the unpredictable and unsafe effects of such a practice, the ice and snow must be removed before flight is attempted. Brush off all light snow and frost. Remove ice by a direct flow of air from a portable ground heater.

WARNING

- Ensure water from melted ice is sponged so it will not drain to some critical area and refreeze.
- Ensure 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. Using an APU for start will prevent a large battery discharge. Oil pressure may be high after starting cold engines. This is not dangerous unless the pressure remains high. Do not takeoff with oil pressure above 45 PSI.

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 of 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

Nosewheel steering is essential for takeoff from an 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 preheating 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.

TAXING 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 overheating.

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. 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

TABLE OF CONTENTS

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 nonstandard 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 + ΔV_i.
ΔV_c	Airspeed compressibility correction.
EAS	Equivalent airspeed, calibrated airspeed corrected for compressibility: EAS = CAS - ΔV_c.
TAS	True airspeed, equivalent airspeed corrected for atmosphere density: TAS = EAS x $\frac{1}{\sqrt{\sigma}}$
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 (-), tailwinds 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

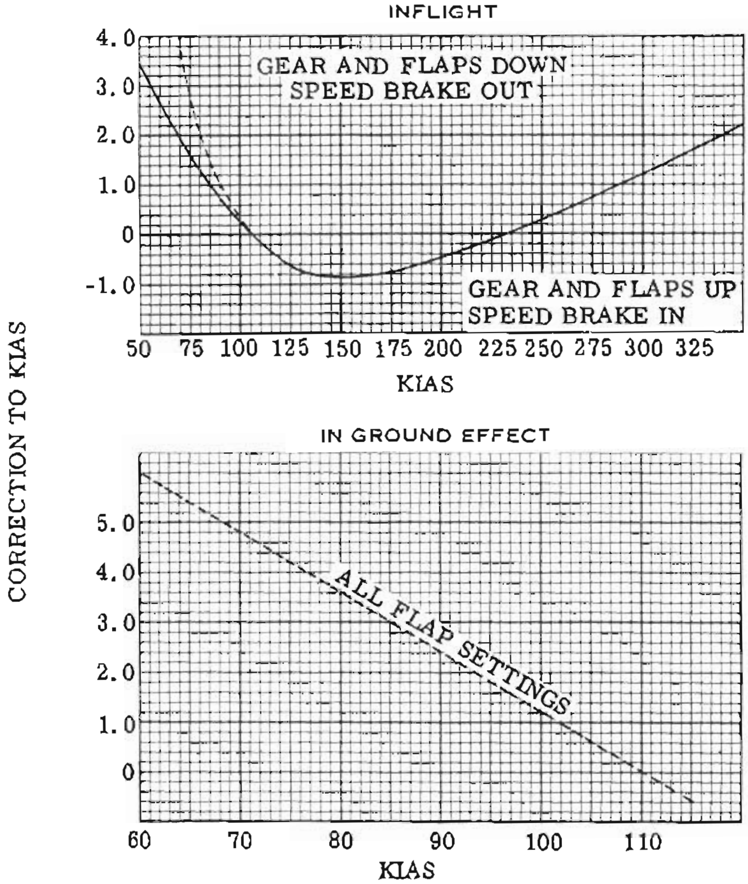


Figure A1-1

COMPRESSIBILITY CORRECTION CHART

SUBTRACT COMPRESSIBILITY CORRECTION FROM KCAS TO OBTAIN KEAS

EXAMPLE: During flight at 20,000 feet and 200 KCAS, compressibility correction is 3 knots. Subtract 3 from 200 to obtain 197 KEAS

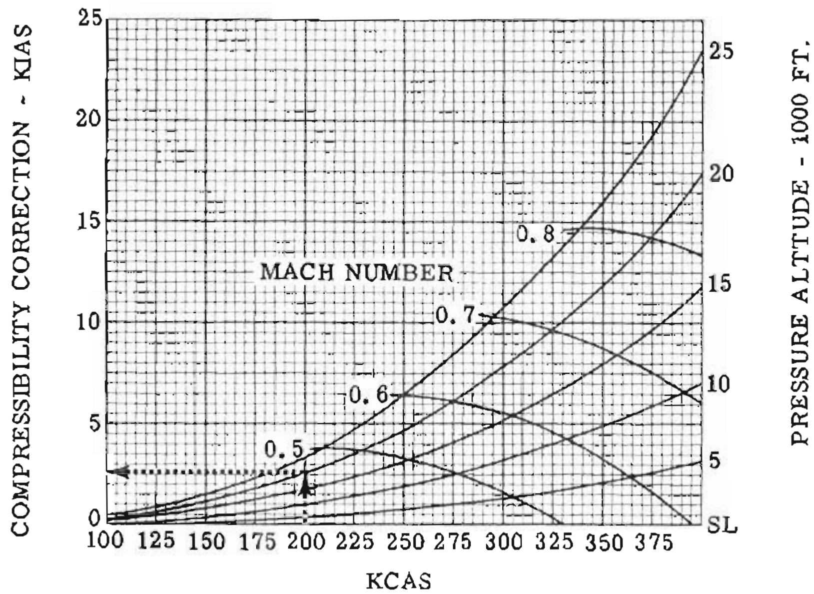
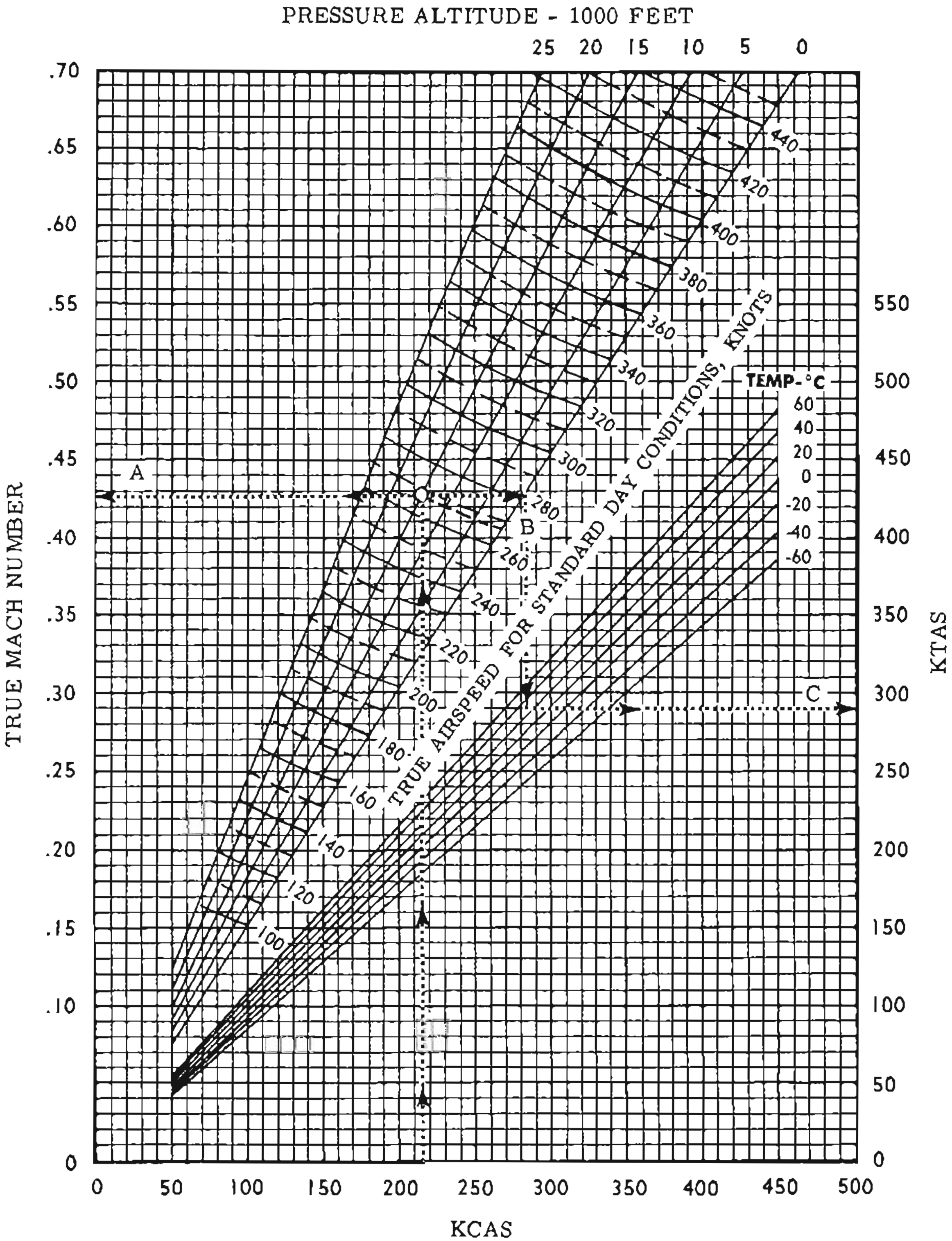


Figure A1-2

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

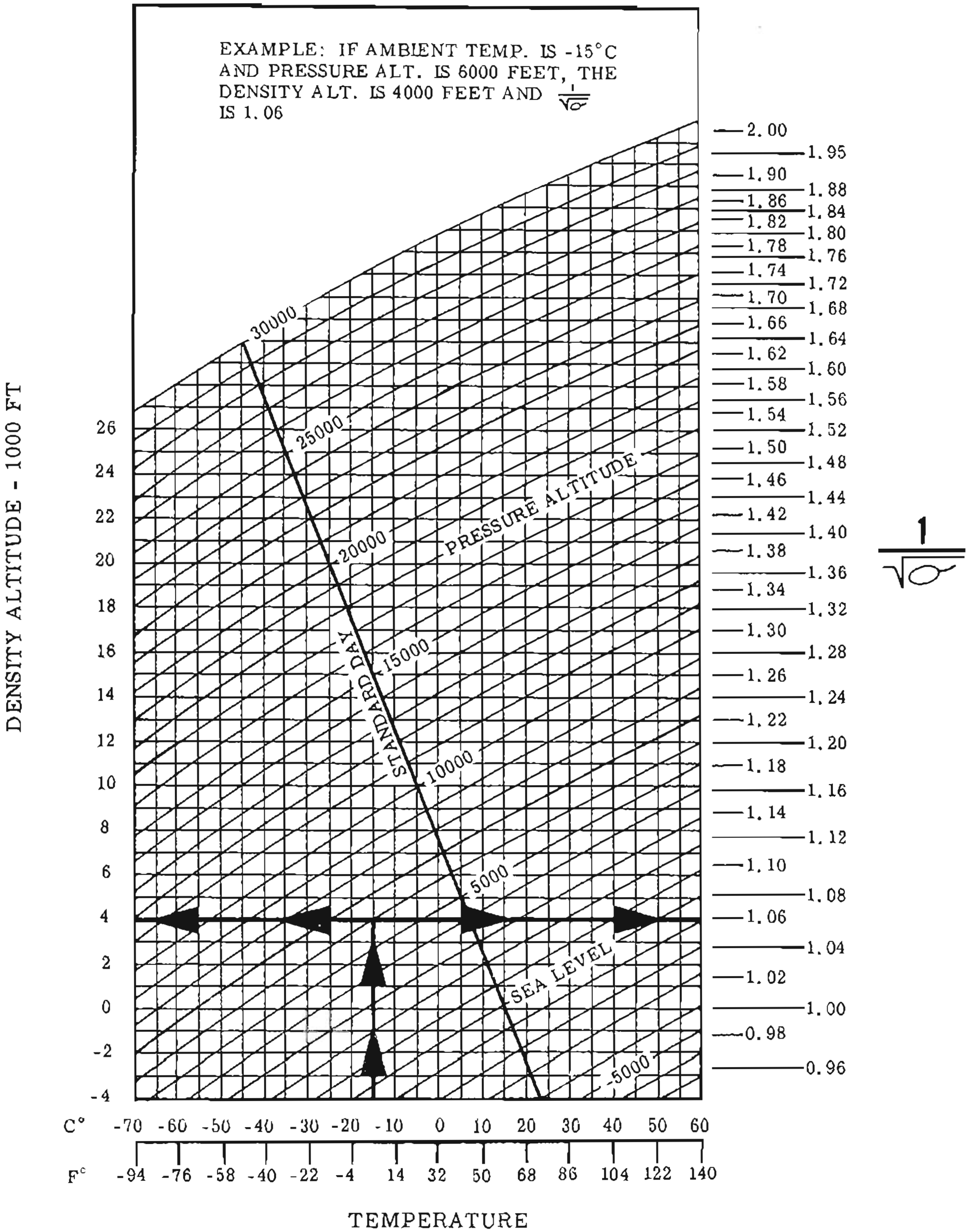


Figure A1-4

STANDARD ATMOSPHERIC TABLE

Standard Sea Level Air:

T = 15°C. W = .07651 lb/cu. ft. P_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 table is based on ICAO Technical Report No. 3182 a_o = 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/P_o
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 nosewheel lift-off and nosewheel touchdown speed and flap setting 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 nosewheel is off the runway. A maximum speed of 100 KIAS is recommended for nosewheel lift-off or nosewheel touchdown. 105 KIAS is recommended for main gear touchdown with zero flaps.

At any time the crosswind component exceeds 13 knots, the intersection of the guide line and the crosswind component must be used to determine recommended airspeed for takeoff and airspeed and configuration for touchdown. Maximum recommended 90 degree crosswind components for dry, wet and icy runways and those containing standing water (SW) of 17.5, 13 and 10 knots respectively are depicted.

EXAMPLE:

Conditions:

Wind Direction	40°
Steady Wind Velocity	20 knots
Maximum Gust Velocity	32 knots
Active Runway	Runway 01

Find: Headwind component, crosswind component, minimum nose wheel lift-off and nosewheel touchdown speed, recommended flap setting.

SOLUTION: (See figure A2-1)

1. Compute wind direction from the runway: 40° -10° = 30°
2. Enter chart at 30° angle between wind and runway (A) and follow the 30° radial line to maximum gust velocity = 32 knots (B).

Note

Use maximum reported gust velocity for determining tail wind component, crosswind component, and minimum nosewheel lift-off and nosewheel touchdown speed, and recommended landing flap setting. Use reported steady wind velocity for determining headwind component.

3. Proceed downward and read crosswind component = 16 knots (C).
4. Proceed upward along crosswind component line to intersect guide line (D).
5. Proceed right and read minimum nosewheel lift-off and nosewheel touchdown speed = 90 KIAS (E), and recommended flap setting = 50%.

Note

Since the minimum nosewheel touchdown speed with 100% flaps is 85 KIAS or less, landing must be made with no more than 50% flaps.

6. Re-enter chart at wind angle = 30° and reported steady wind velocity = 20 knots (F).
7. Proceed left and read headwind component = 17 knots (G).

Note

If crosswind component falls to the left of the guide line use 65 KIAS for minimum nosewheel 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 below 6700 pounds is 90 KIAS unless crosswind conditions require a higher speed. Single engine recommended takeoff speed is 100 KIAS. The chart also includes takeoff and climb speeds for minimum distance to clear an obstacle.

EXAMPLE:

Conditions:

Gross Weight 6300 lbs.

Find: Stall speed, initial stall warning speed.

SOLUTION: (Figure A2-2)

1. Enter the chart at gross weight = 6300 lbs. (A).
2. Proceed upward to intersect the stall guide line, then left to read stall speed = 73 KIAS (B).
3. Return to gross weight = 6300 lbs. and continue upward to the initial stall warning guide line, then left to read initial stall warning speed = 79 KIAS (C).

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 take-off run to the point where the obstacle height is reached.

Distance may be determined for various conditions of atmosphere, gross weight, wind, runway slope and obstacle height. The distances are based on 50% flaps, military power, the takeoff speed shown in figure A2-2, and 105 KIAS over the obstacle with gear up and 50% flaps. The distance required when using 98% RPM may be found by adding 15% to the distance obtained from the chart.

If crosswind conditions require a higher takeoff speed, instructions for computing takeoff distance are covered under Velocity During Takeoff Ground Run, figure A2-7.

EXAMPLE:

It is desired to lead a formation takeoff with the following conditions:

Power Setting	98% RPM
Temperature	27°C
Pressure Altitude	2000 ft.
Gross Weight	6500 lbs.
Headwind Component	15 knots
Active runway:	
Slope	1% uphill
Length	5000 ft.
Surface condition	Dry

Find: Takeoff ground run distance and total distance to clear a 50 foot obstacle.

SOLUTION: (Figure A2-3)

1. Enter chart at temperature = 27°C (A) and proceed right to intersect the temperature conversion guide line (B).
2. Proceed upward and read temperature = 81°F (C).
3. Continue upward to pressure altitude = 2000 ft. (D), then right to gross weight = 6500 lbs. (E).
4. Drop down to wind base line (F), then parallel to headwind guide lines to wind = 15 knots (G).
5. Drop down to slope base line (H), then parallel to uphill guide lines to slope = 1% grade (I), then drop down to read ground run = 1760 feet (J).
6. Compute ground run with 98% RPM:
   1760 feet x 1.15 = 2024 feet.
7. From point J drop down to obstacle height = 50 feet (K), then proceed left to read total distance over obstacle = 2700 feet (L).
8. Compute total distance over obstacle with 98% RPM:
   2700 feet x 1.15 = 3105 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 military power 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%.

EXAMPLE:

Conditions: Same as NORMAL TAKEOFF DISTANCE example.

Find: Critical Field Length.

SOLUTION: (Figure A2-4)

1. Enter chart at temperature = 27°C (A) and proceed upward to pressure altitude = 2000 feet (B), then right to gross weight - 6500 lbs. (C).
2. Drop vertically to dry runway guide line (D).
3. Proceed to the right to wind base line (E), then parallel to headwind guide lines to wind = 15 knots (F), and then continue right to read critical field length = 3400 feet (G).
4. Compute critical field length with 98% RPM:
   3400 feet x 1.10 = 3740 feet.

REFUSAL SPEEDS

The highest indicated airspeed to which an aircraft can accelerate and then be stopped in the available runway remaining is called the refusal speed. This speed is determined from the Refusal Speed Chart (figure A2-5) for existing takeoff conditions and runway length. The chart is based on a military power acceleration to the refusal speed, and then normal braking at idle RPM to a 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. For wet or icy conditions, the stopping distance increases and the corrected refusal speed is obtained from figure A2-6. If 98% RPM is used for takeoff, reduce the effective runway length by 10%.

EXAMPLE I:

Conditions: Same as NORMAL TAKEOFF DISTANCE example.

Find: Refusal speed.

SOLUTION: (Figure A2-5)

1. Enter the chart in the upper right hand corner at actual runway length = 5000 feet (A).
2. Proceed right to headwind = 15 knots (B) and drop down to read effective runway length = 7000 feet (C).
3. Compute effective runway length with 98% RPM.
   7000 feet x .90 = 6300 feet.
4. Enter the main chart at gross weight = 6500 lbs. (D) and proceed right to pressure altitude = 2000 feet (E).
5. Proceed downward to temperature = 27°C (F).
6. Proceed right to effective runway length = 6300 feet (G), then down to read refusal speed = 85 KIAS (H).

EXAMPLE II:

Condtions: Same as NORMAL TAKEOFF DISTANCE example, except runway condition is wet (RCR 12).

Find: Corrected Refusal Speed.

SOLUTION: (Figure A2-6)

1. Dry runway refusal speed = 85 KIAS was obtained from Example I.
2. Enter chart at dry runway (RCR 23) refusal Speed = 85 KIAS (A) and proceed upward to wet runway condition line (B).
3. Proceed left to read corrected refusal speed = 65 KIAS (C).

The critical engine failure speed may also be determined from the 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 actual 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 (figure A2-2) for the prevailing conditions and following the guide lines to the fixed point distance.

EXAMPLE I:

The normal takeoff ground run has been determined from figure A2-3 to be 1600 feet, and the takeoff speed to be 90 KIAS from figure A2-2.

Find: Speed after 1000 feet of ground run.

SOLUTION: (Figure A2-7)

1. Enter the chart at normal takeoff ground run distance = 1600 feet (A) and proceed right to takeoff speed = 90 KIAS (B).
2. Construct BC parallel to the guide lines.
3. Re-enter chart at distance = 1000 feet (D) and proceed right to intersect BC.
4. At intersection (E) drop down to read speed = 67 KIAS (F).

If crosswind conditions require an increase in takeoff speed, compute the takeoff distance using the Velocity During Takeoff Ground Run Chart (figure A2-7). Enter the chart with the normal takeoff distance. Proceed horizontally to intersect the normal takeoff speed. Proceed along the guidelines to the required takeoff speed, then horizontally left to read the takeoff distance.

EXAMPLE II:

From example I normal takeoff distance is 1600 feet at a normal takeoff speed of 90 KIAS. Assume that the required takeoff speed is 100 KIAS.

Find: Takeoff ground run distance.

SOLUTION: (Figure A2-7).

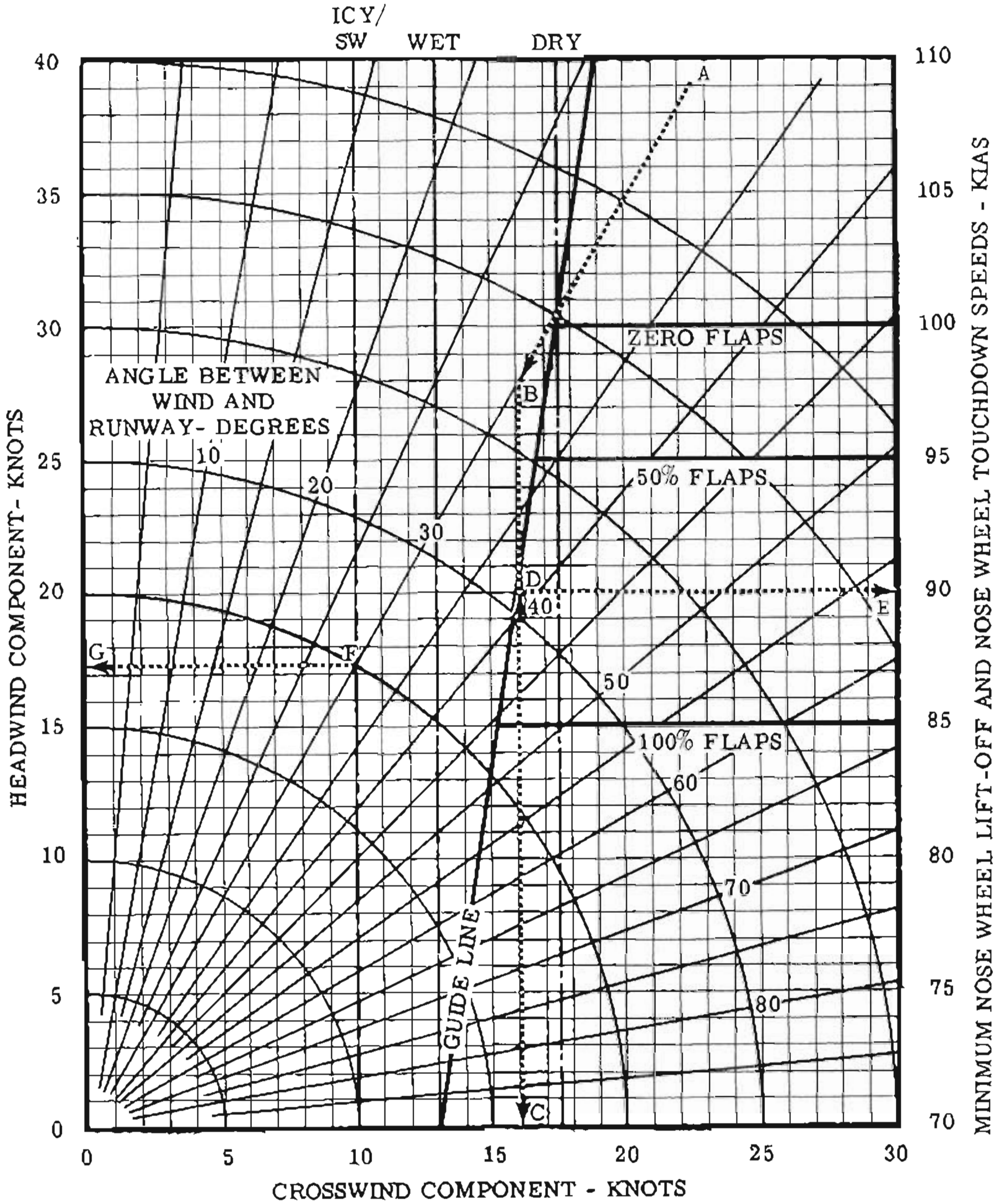
1. Enter the chart at normal takeoff ground run distance = 1600 feet (A) and proceed right to normal takeoff speed = 90 KIAS (B).
2. Construct BG parallel to the guide lines.
3. Re-enter the chart at speed = 100 KIAS (H) and proceed upward to intersect BG.
4. At intersection (I) proceed left to read distance = 1950 feet (J).

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



- - — MAXIMUM RECOMMENDED CROSSWIND COMPONENT

SW- STANDING WATER

NOTE

- ENTER CHART WITH STEADY WIND TO DETERMINE HEADWIND COMPONENT AND WITH MAXIMUM GUST VELOCITY TO DETERMINE TAILWIND/CROSSWIND COMPONENT.
- ALL INITIAL TAKEOFFS ARE MADE WITH 50% FLAPS.

Figure A2-1

Model. T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test

TAKEOFF SPEED

HALF (50%) FLAP — MILITARY POWER
LANDING GEAR DOWN

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

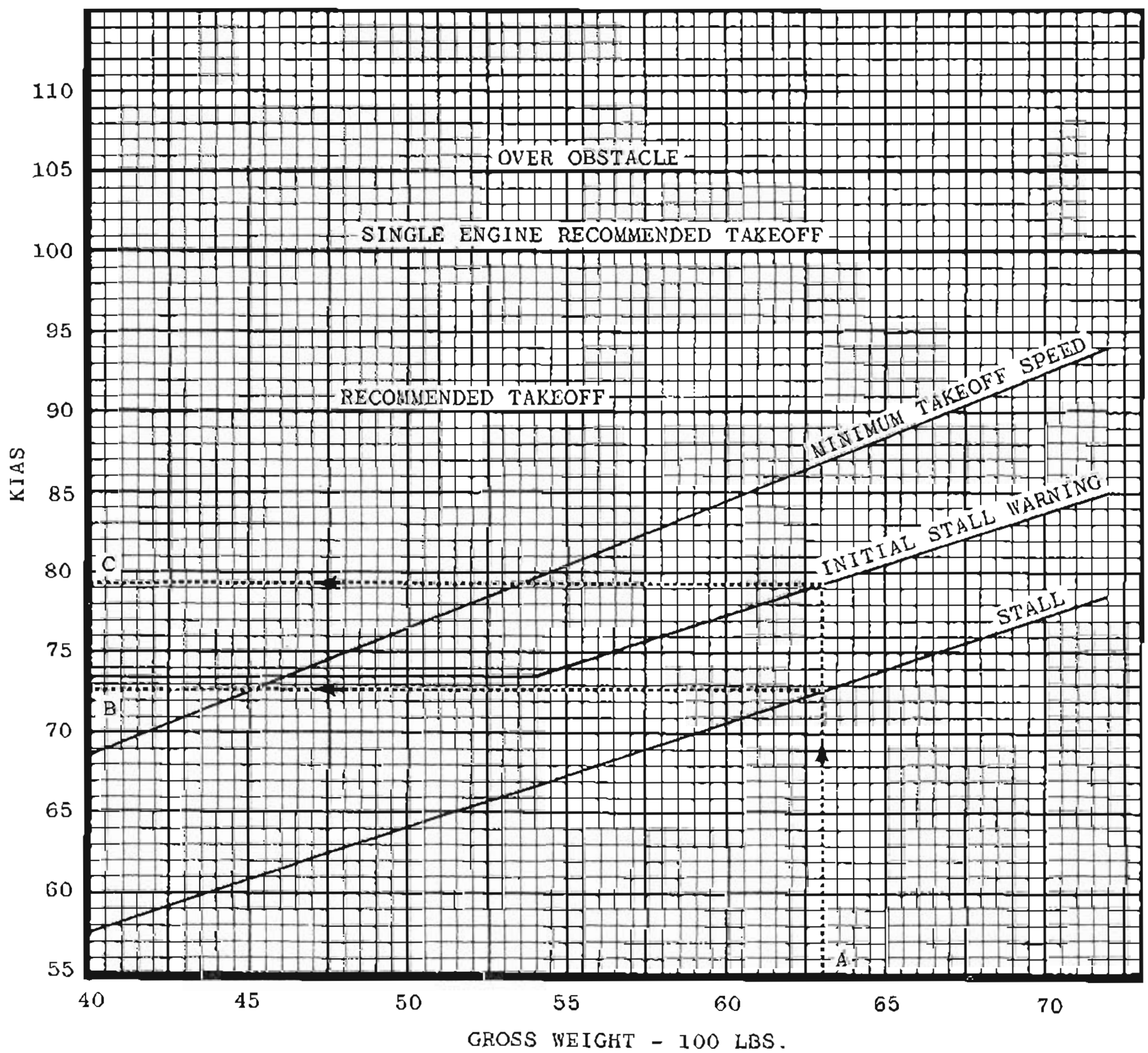
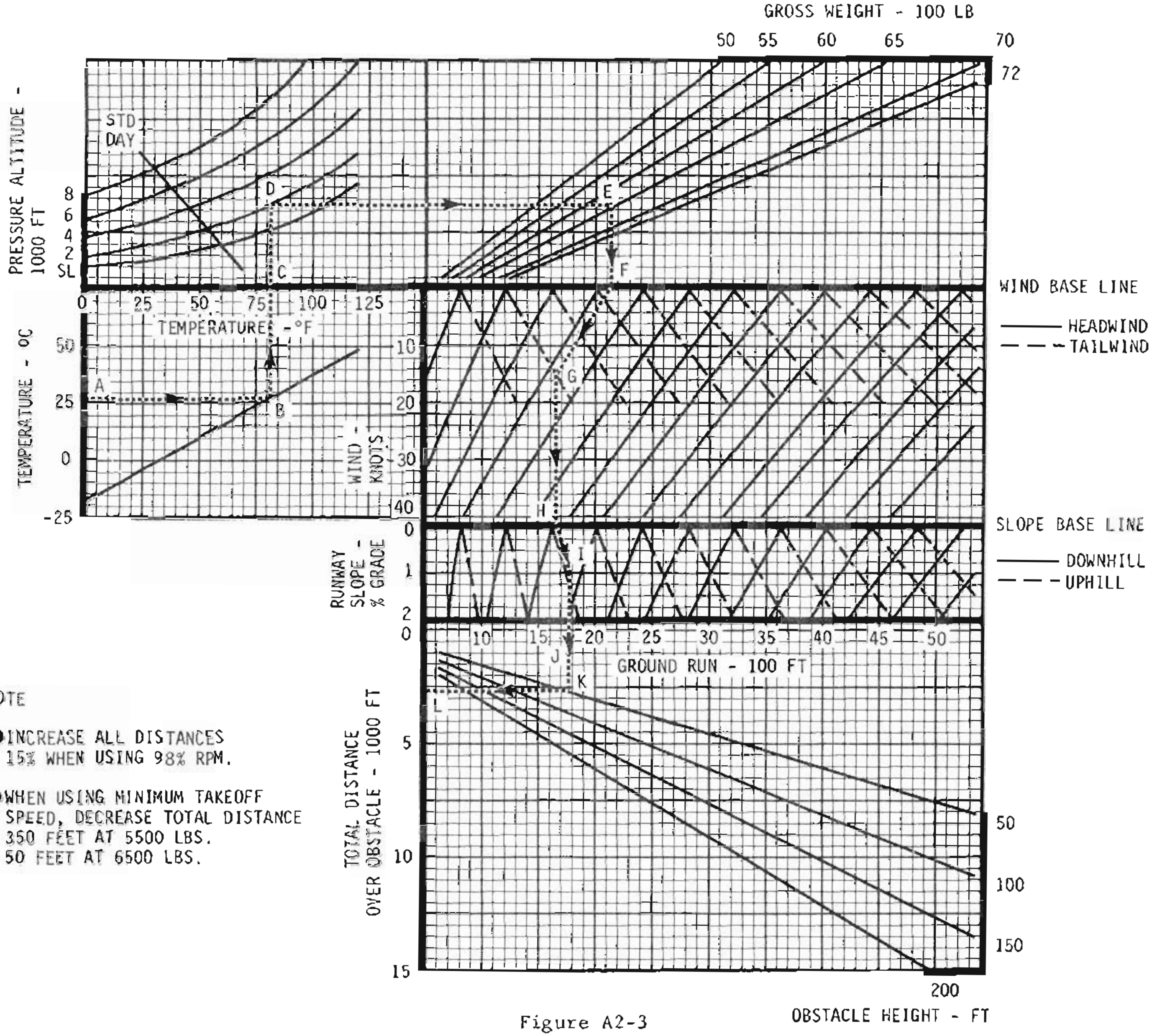


Figure A2-2

Model T-37B
Date 1 Apr. 1975
Data Basis: Flight Test.

NORMAL TAKEOFF DISTANCE
MILITARY POWER
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.

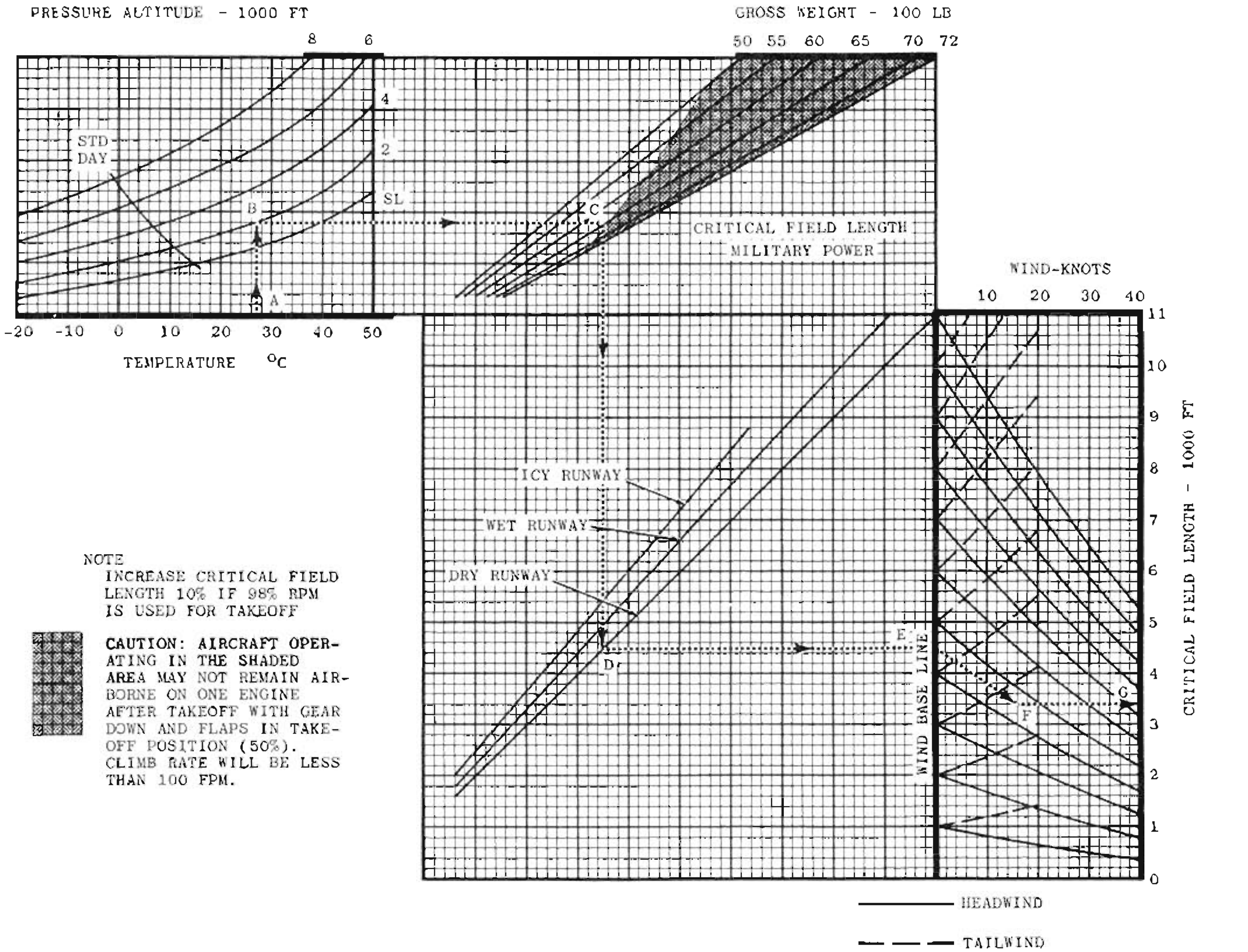
Figure A2-3

Model: T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test.

CRITICAL FIELD LENGTH

MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



NOTE
INCREASE CRITICAL FIELD LENGTH 10% IF 98% RPM IS USED FOR TAKEOFF

CAUTION: AIRCRAFT OPERATING IN THE SHADED AREA MAY NOT REMAIN AIRBORNE ON ONE ENGINE AFTER TAKEOFF WITH GEAR DOWN AND FLAPS IN TAKEOFF POSITION (50%). CLIMB RATE WILL BE LESS THAN 100 FPM.

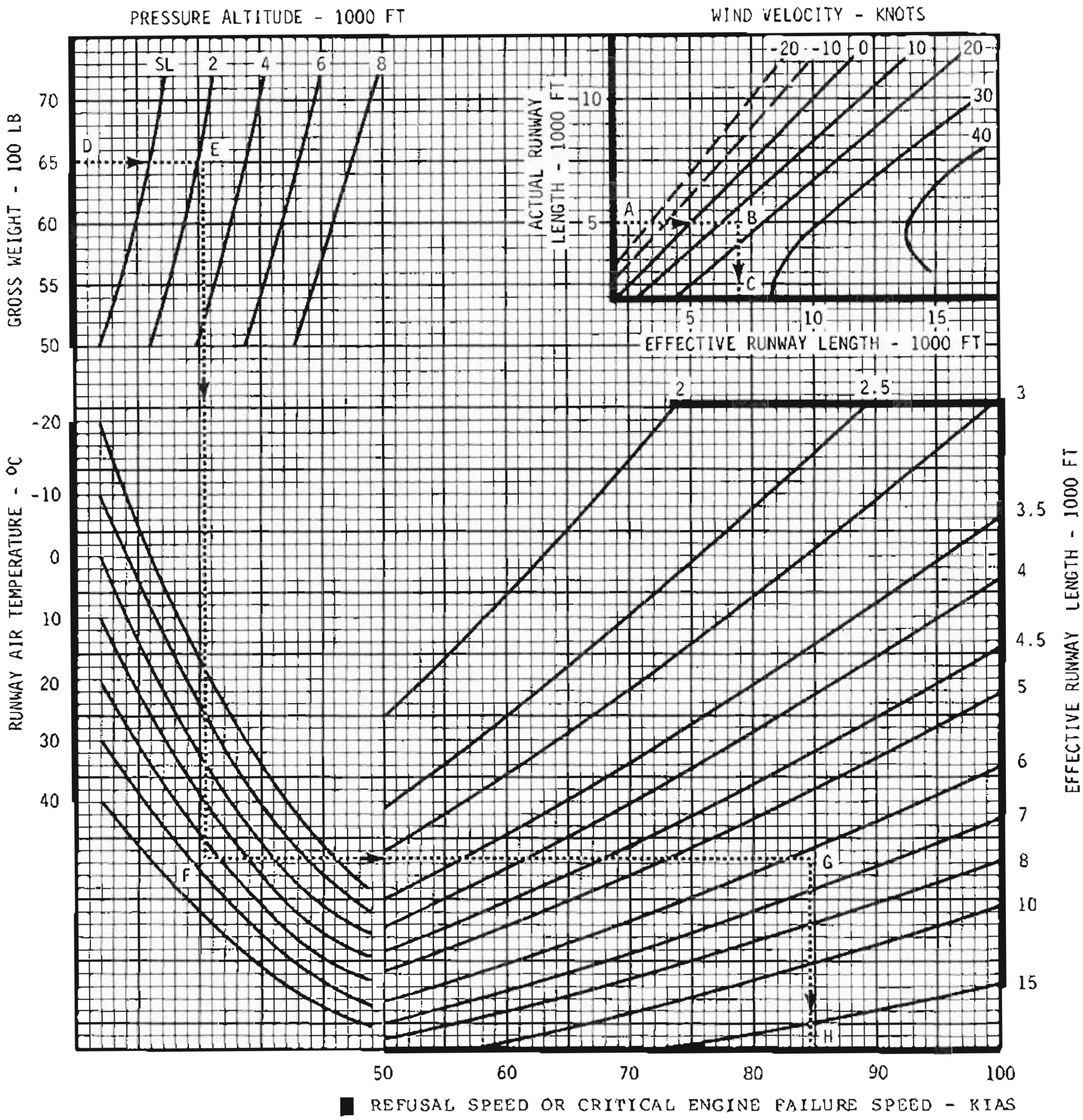
Figure A2-4

Model: T-37B
Date: 1 Apr 1975
Data Basis: Flight Test.

REFUSAL SPEEDS OR CRITICAL ENGINE FAILURE SPEED

MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



NOTE:
DECREASE EFFECTIVE RUNWAY LENGTH 10% IF 98% RPM IS USED FOR TAKEOFF.

HEADWIND

TAILWIND

Figure A2-5

Model: T-37B
Date: 1 Mar. 1981
Data Basis: Flight Test.

CORRECTION TO REFUSAL SPEED OR CRITICAL ENGINE FAILURE SPEED FOR RUNWAY CONDITION

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

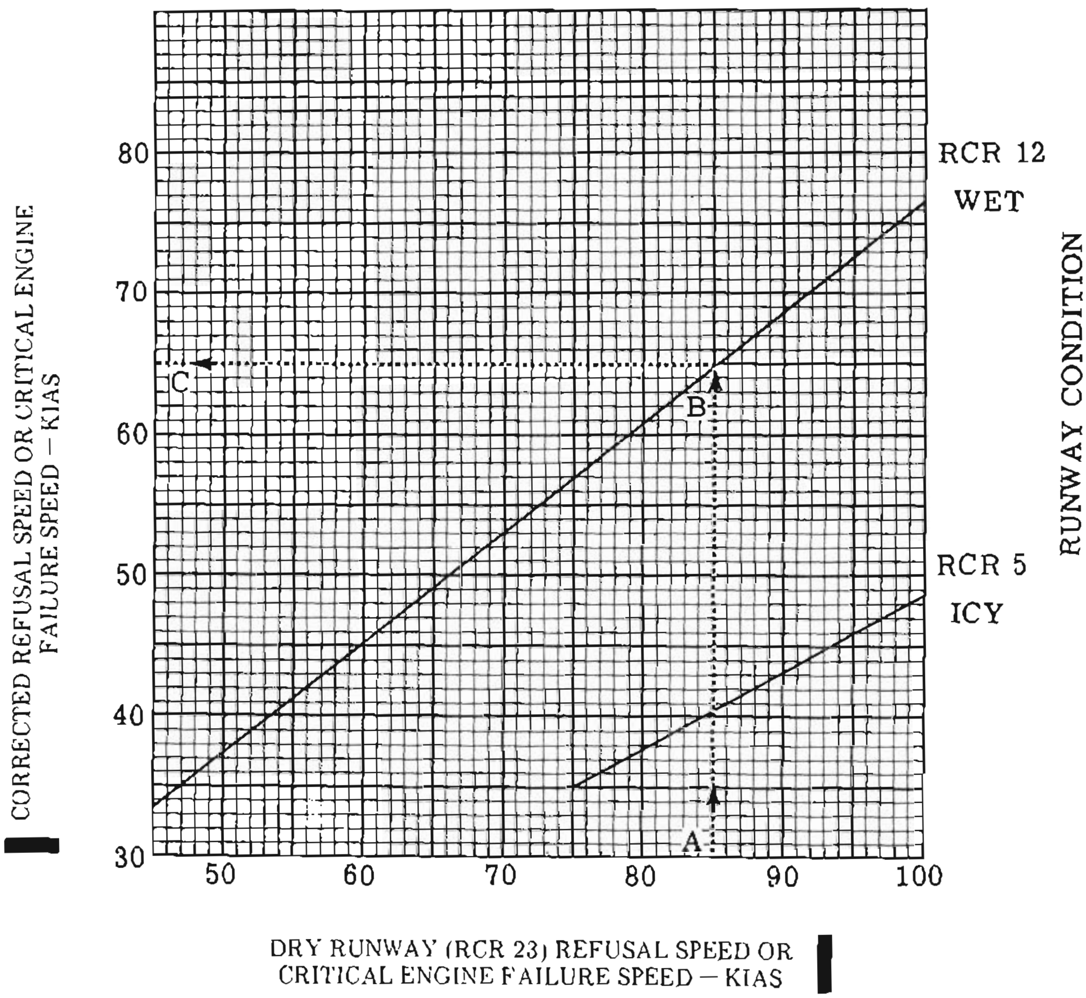


Figure A2-6

Model: 1 378
Date: 1 Apr. 1975
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

VELOCITY DURING TAKEOFF
GROUND RUN

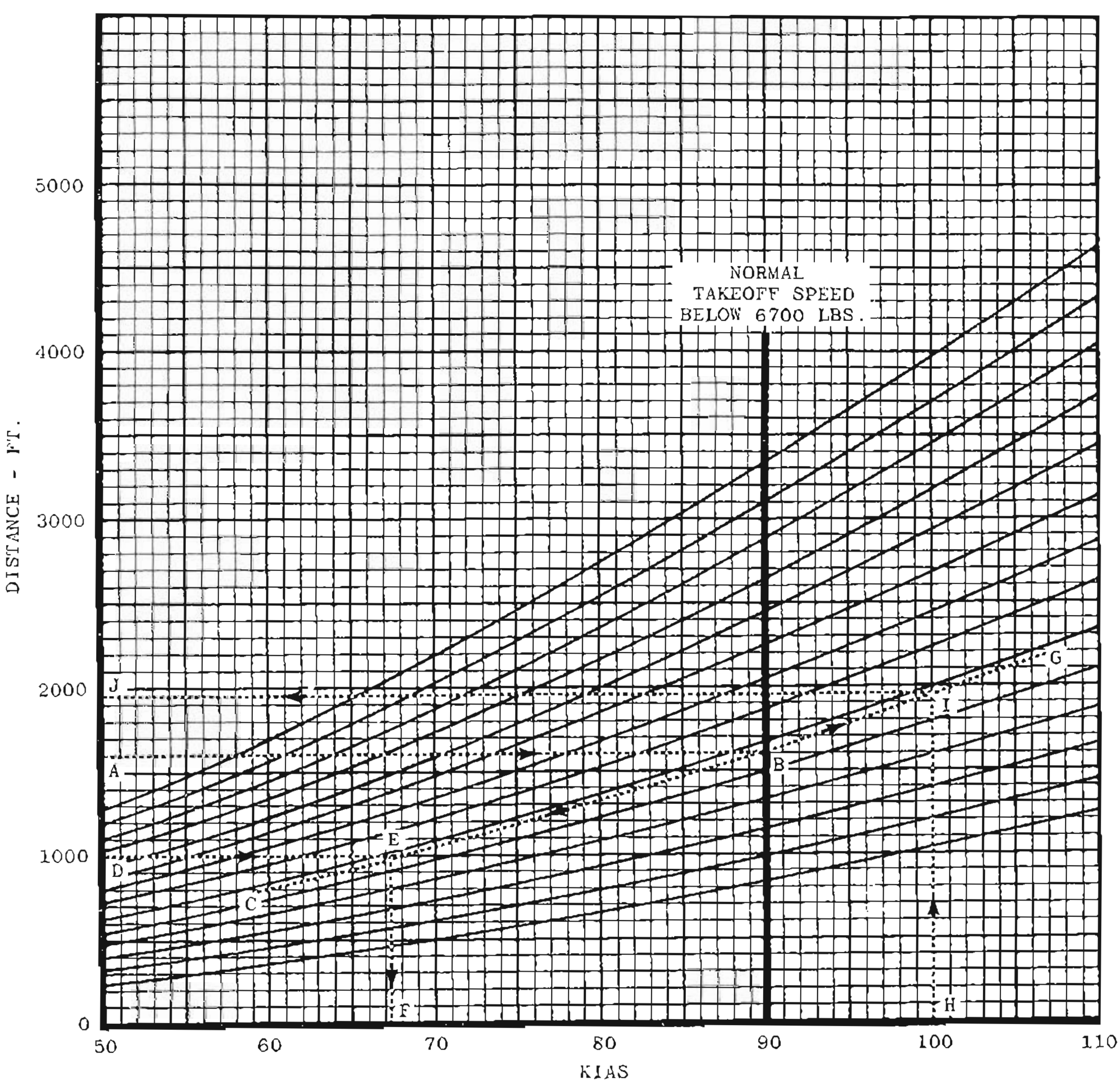


Figure A2-7

PART III CLIMB

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CLIMB PERFORMANCE

The Climb Performance Charts (figures A3-1 through A3-3) two engine and (figures A3-4 through 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.

The Charts are used for computing climb performance after the technical order climb airspeed has been attained. This will be approximately 500 feet above the terrain and two minutes after brake release. Fuel for start, taxi, takeoff and acceleration to technical order climb airspeed is approximately 145 pounds.

EXAMPLE:

Conditions:

Initial altitude	2500 ft
Initial gross weight	6400 lb
Final altitude	25,000 ft
Temperature Deviation	+10°C

Find: Fuel used, time to climb, horizontal distance traveled.

SOLUTION: (See figures A3-2 and A3-3)

1. Enter figure A3-2:
   At initial gross weight = 6400 lb (A)
   Move horizontally to altitude = 25,000 ft (B)
   Drop vertically to guide line (C)
   Move horizontally to base line (D)
   Move parallel to "Hotter" guide lines to △ Temp = +10°C (E)
   Move horizontally to the fuel used scale and read fuel used = 370 lb (F)

2. Enter figure A3-3:
   At initial gross weight = 6400 lb (G)
   Move horizontally to altitude = 25,000 ft (H)
   Drop vertically to time guide line (I)
   Move horizontally to base line (J)
   Move parallel to "Hotter" guide lines to △ Temp = +10°C (K)
   Move horizontally to the time scale and read time = 14.8 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 = +10°C (O)
   Move horizontally to the distance scale and read distance = 51.0 Naut mi (P)

3. Re-enter figures A3-2 and A3-3 and repeat steps (A) through (P) using:
   Altitude = 2500 ft and △ Temp = 10°C hotter. Read:
   Fuel used = 30 lb
   Time = 1 minute
   Distance = 3 miles

4. Determine fuel used from 2500 ft to 25,000 ft:
   Fuel used from seal level to 25,000 ft: 370 lb
   Fuel used from sea level to 2500 ft: 30 lb
   Fuel used: 370 - 30 = 340 lb

5. Determine time to climb from 2500 ft to 25,000 ft:
   Time from sea level to 25,000 ft: 14.8 minutes
   Time from sea level to 2500 ft: 1 minute
   Time to climb: 14.8-1 - 13.8 minutes

6. Determine horizontal distance traveled in climb from 2500 ft to 25,000 ft:
   Distance to climb from sea level to 25,000 ft: 51.0 Naut miles
   Distance to climb from sea level to 2500 ft: 3 Naut miles
   Horizontal distance traveled in climb: 51.0 - 3 = 48.0 Naut miles

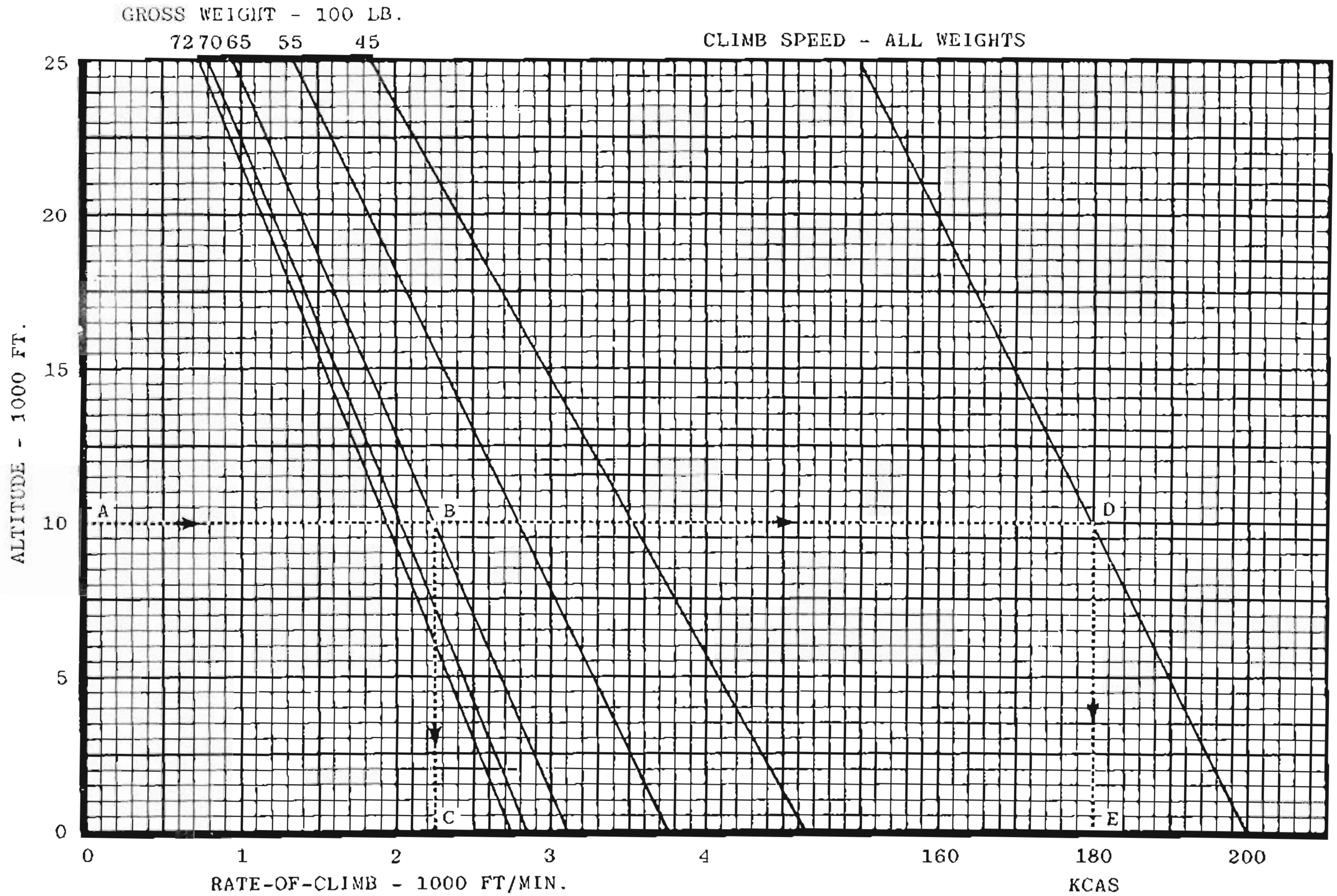
The climb speed schedule to be followed is taken from figure A3-1.

Model T 37B
Date. 1 Apr. 1975
Data Basis: Flight Test.

BEST CLIMB SPEED AND RATE-OF-CLIMB

TWO ENGINES MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



EXAMPLE

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 KCAS)

NOTE

This chart reflects best rate-of-climb and best climb speed. A close approximation may be obtained by climbing at 180 KIAS from sea level to 10,000 feet and at 160 KIAS from 10,000 feet to 25,000 feet.

Figure A3-1

Model: T-37B
Date: 1 Apr 1975
Data Basis: Flight Test.

FUEL USED TO CLIMB

TWO ENGINES
MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

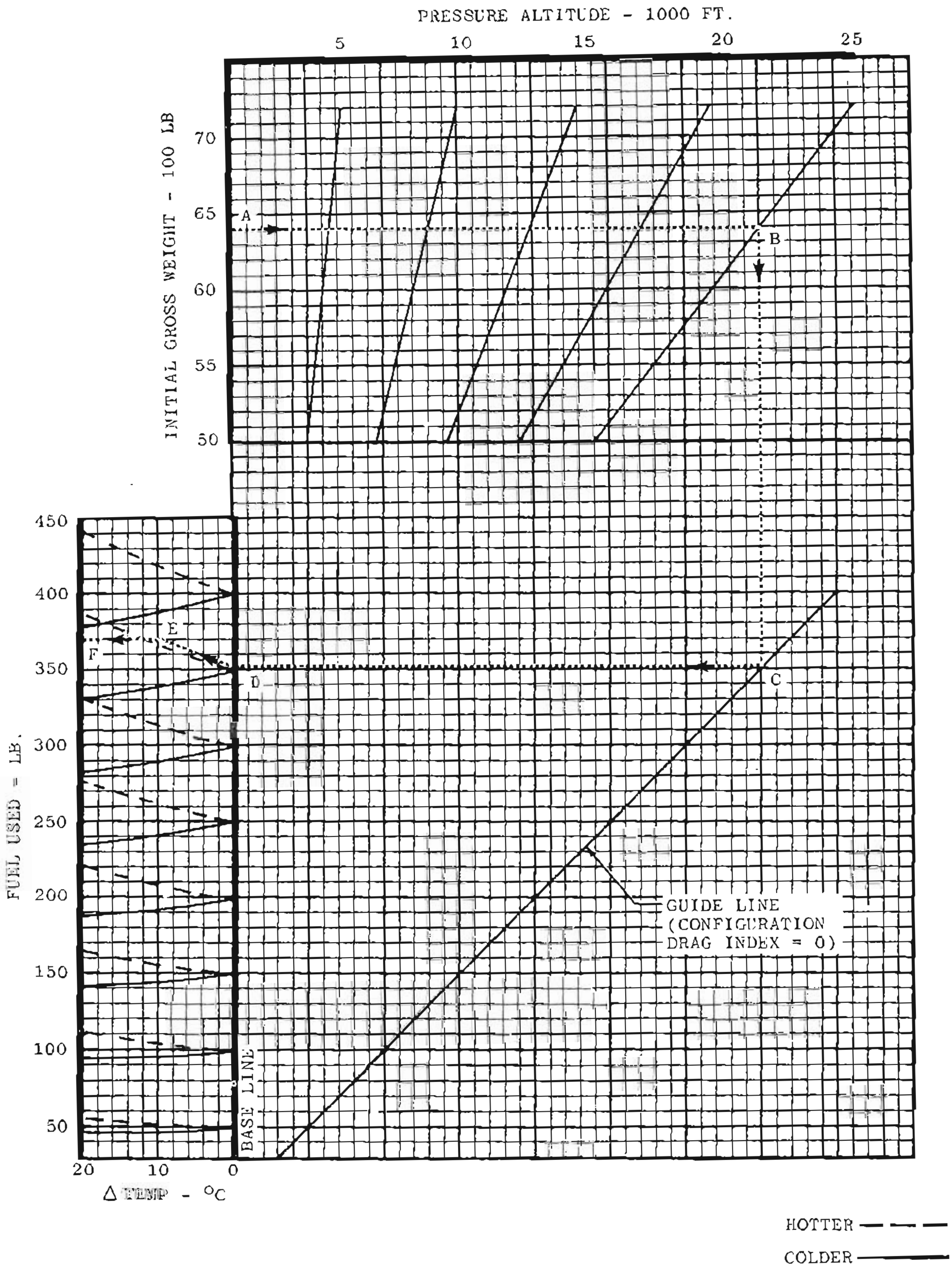


Figure A3-2

Model: T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test.

TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB

TWO ENGINES

MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

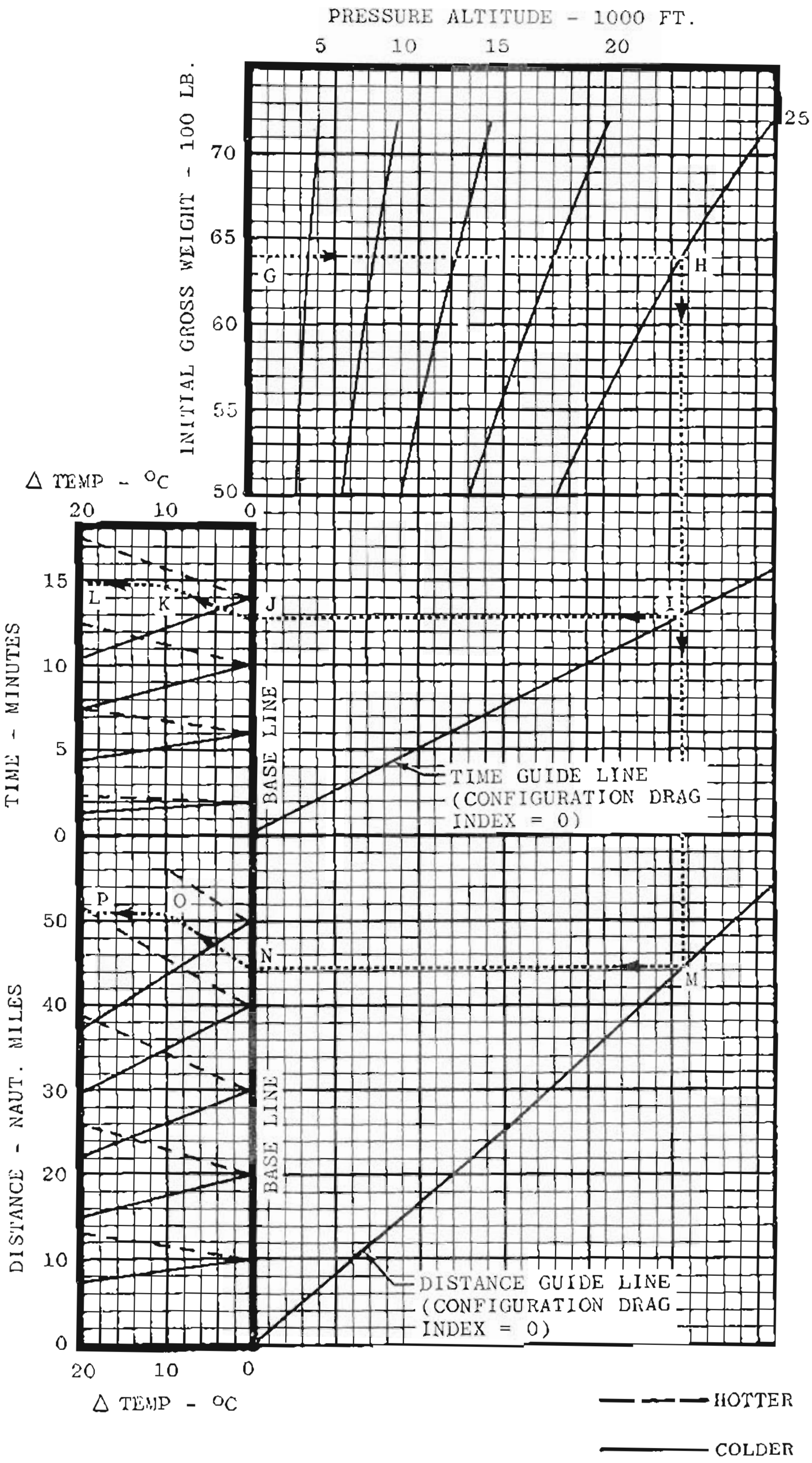


Figure A3-3

Model. T-37B
Date. 1 Apr. 1975
Data Basis: Flight Test.

BEST CLIMB SPEED AND RATE-OF-CLIMB

SINGLE ENGINE
MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

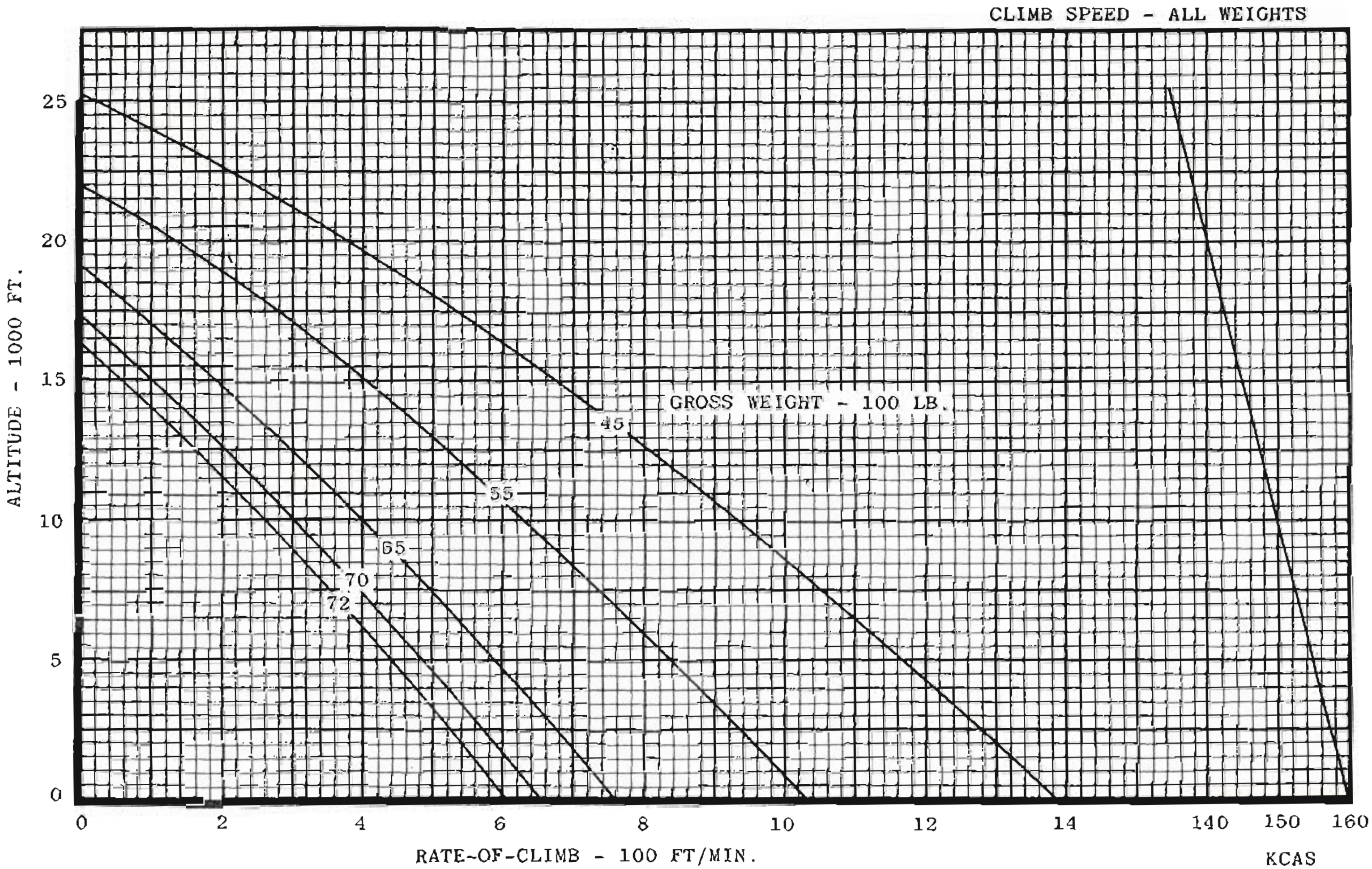


Figure A3-4

Model. T 37B
Date: 1 Apr 1975
Data Basis: Flight Test.

FUEL USED TO CLIMB

SINGLE ENGINE
MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

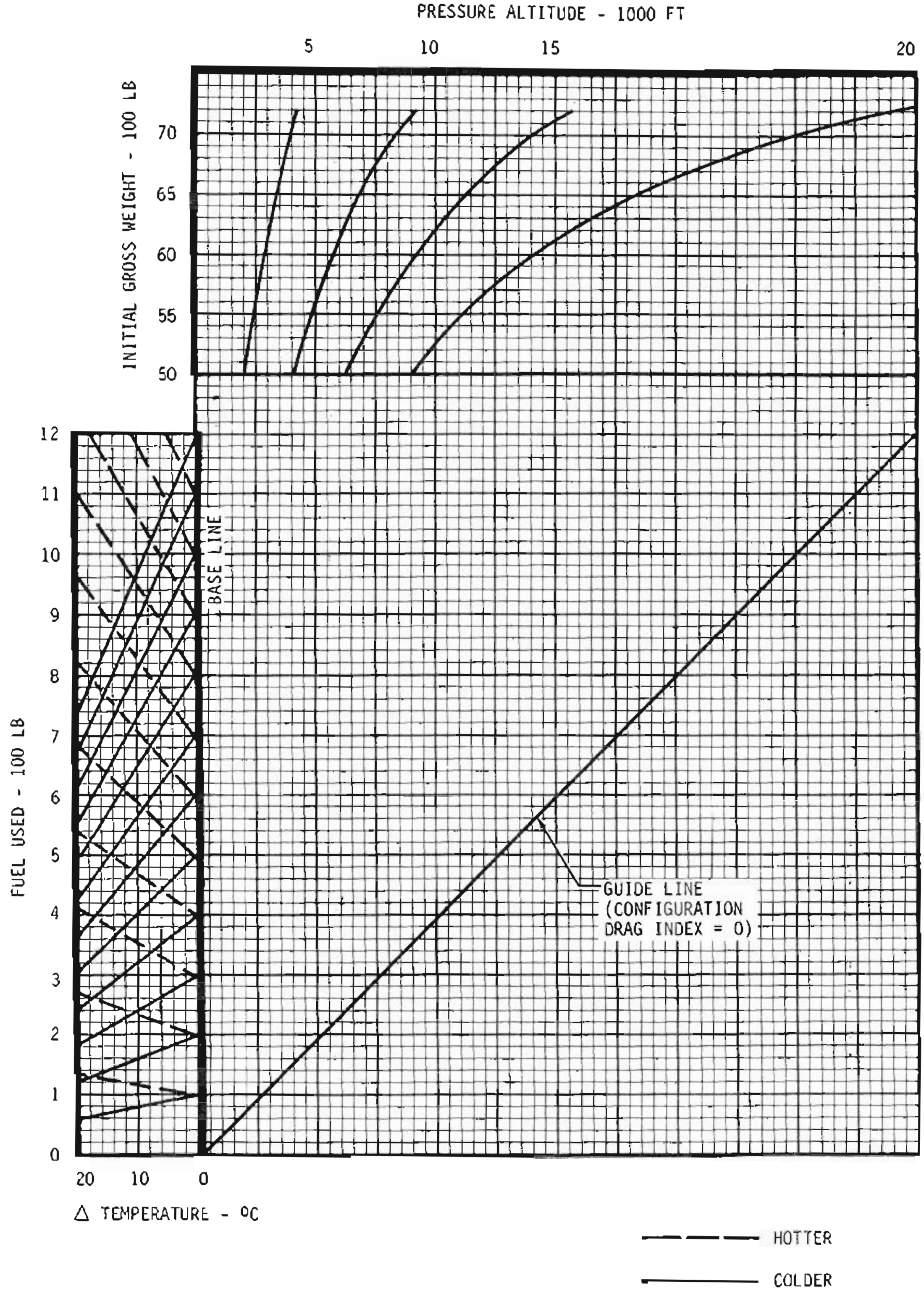


Figure A3-5

Model: T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test

TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED

SINGLE ENGINE
MILITARY POWER

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

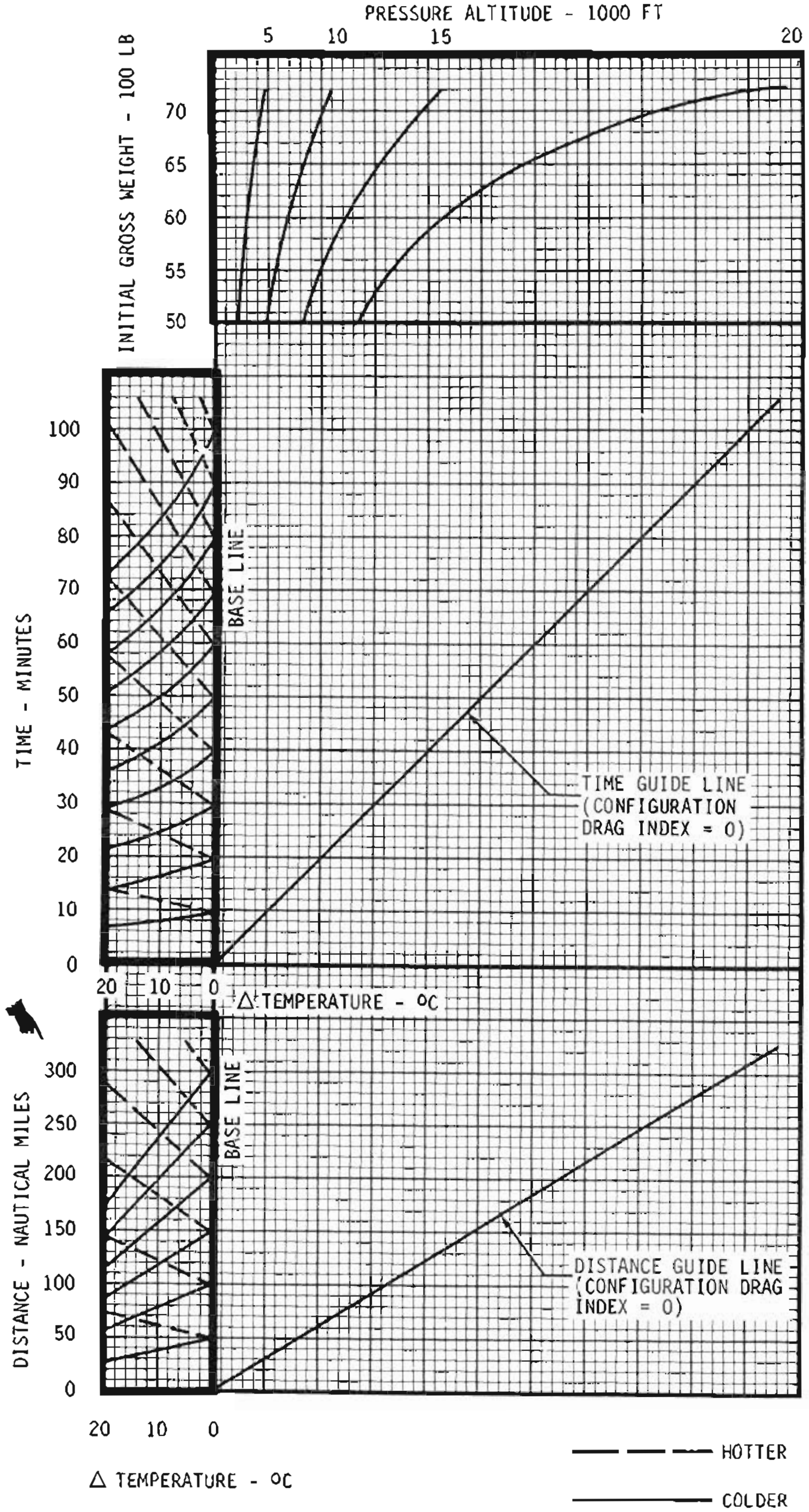


Figure A3-6

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 cruise performance at a particular pressure altitude, temperature, wind velocity, and average gross weight. The charts provide data for air and ground speeds, time, nautical miles per pound of fuel, fuel flow, and fuel required.

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 Temperature:	-20°C
Cruise Fuel:	600 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: 600 lb
   Final Gross Weight: 5800-600 = 5200 lb
   Average Gross Weight: $\frac{5800+5200}{2}$ = 5500 lb

2. Enter Sample Chart for Time and Airspeed
   At Average Gross Weight - 5500 lb (A)
   Move horizontally to Altitude = 20,000 ft (BB)
   Drop vertically to guide line (CC), then move to the left to Mach number = .434 (DD) (Read cruise speed = 197 KCAS from figure A4-1)
   Move to the right from (CC) to base line (EE)
   Follow guide lines to temperature = -20°C (FF)
   Move horizontally to the 20 knot tailwind guide line (GG)
   Drop vertically to ground speed = 289 knots (HH)
   $TAS = GS - V_W = 289 - 20 = 269$ knots
   Construct vertical line (GGHH)

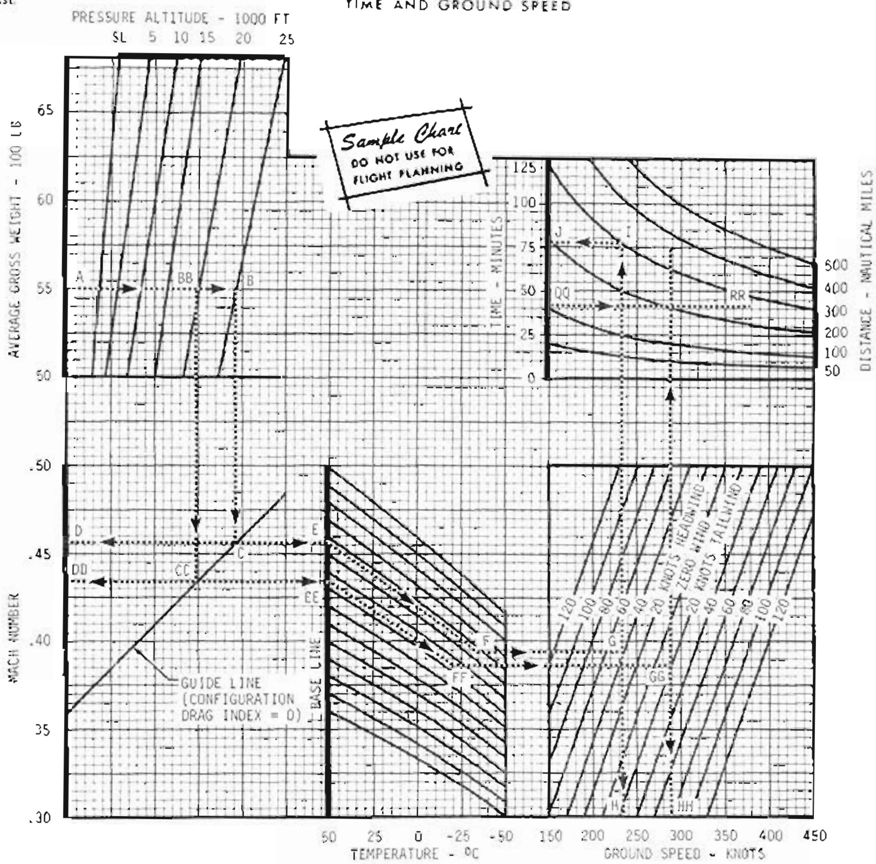
3. Enter sample chart for fuel flow and fuel required:
   At average gross weight = 5500 lb (K)
   Move horizontally to altitude = 20,000 ft (LL)
   Drop vertically to guide line (MM), then move to the right to Nautical Air Miles per Pound = .314 NMI/lb (NN)
   Move horizontally to true airspeed = 269 knots (OO)
   Construct vertical line (OOPP)
   Enter fuel required scale at 600 lb (QQ)
   Construct horizontal line (QQRR)
   Read at intersection of constructed lines (OOPP) and (QQRR)
   Time = 42 minutes (SS) and fuel flow = 856 lb/hr (TT).

4. Re-enter sample chart for time and airspeed:
   At time = 42 minutes (QQ)
   Construct horizontal line (QQRR)
   Read at intersection of constructed lines (GGHH) and (QQRR)
   Distance = 200 Naut Miles

Model T-37B
Date 1 Apr 1975
Data Basis: Flight Test

CONSTANT ALTITUDE CRUISE
(99% MAXIMUM RANGE)
TIME AND GROUND SPEED

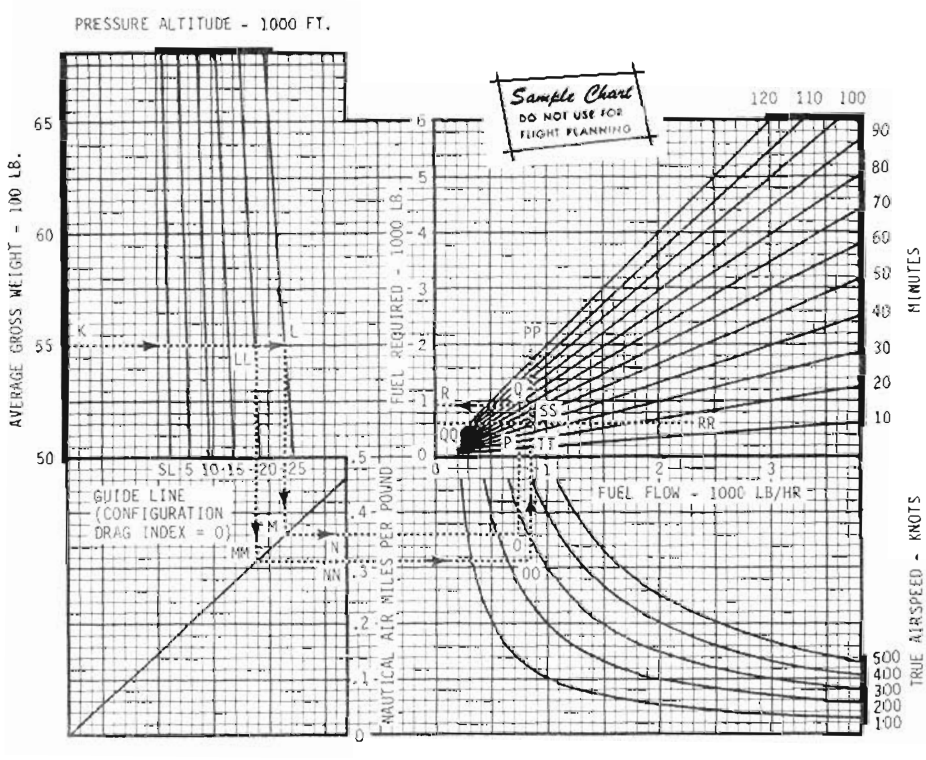
STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



Model T-37B
Date 1 Apr 1975
Data Basis Flight Test.

CONSTANT ALTITUDE CRUISE
(99% MAXIMUM RANGE)
FUEL FLOW AND FUEL REQUIRED

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



EXAMPLE II:

Conditions:
- Initial Gross Weight: 5950 lb
- Cruise Altitude: 25,000 ft
- Cruise Temperature: -35°C
- Cruise Distance: 300 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: 5950 lb
   Estimated Fuel Used: 900 lb
   Estimated Final Weight: 5950-900=5050 lb
   Estimated Average Gross Weight: $\frac{5950+5050}{2}$=5500 lb

3. Enter sample chart for time and groundspeed:
   At average gross weight = 5500 lb (A)
   Move horizontally to altitude = 25,000 ft (B)
   Drop vertically to guide line (C), then move to the left to Mach number scale and read Mach number = .456 (D)
   (Read cruise speed = 185 KCAS from figure A4-1)
   Move to the right to temperature base line (E)
   Follow the guide lines to temperature = -35°C (F)
   Move horizontally to wind velocity = 40 knot headwind (G)
   Drop vertically to ground speed = 233 knots (H)
   True airspeed = GS - V_w = 233 - (-40) = 273 knots
   Move up to distance = 300 Naut miles (I)
   Move to the left to time = 77 minutes (J)

4. Enter sample chart for fuel flow and fuel required:
   At average gross weight = 5500 lb (K)
   Move horizontally to altitude = 25,000 ft (L)
   Drop vertically to guide line (M), then move horizontally to Nautical air miles per pound = .362 NMI/lb (N)
   Continue to move right to true airspeed = 273 knots (O)
   Move vertically to fuel flow scale, read fuel flow = 754 lb/hr (P)
   Continue up to time = 77 minutes (Q)
   Move to the left to fuel required scale and read fuel required = 968 lb (R)

5. The estimated and computed fuel quantities closely approximate each other; therefore, 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 cruise performance at a particular pressure altitude, temperature, wind velocity, and average gross weight. The charts provide data for air and ground speeds, time, nautical miles per pound of fuel, fuel flow, and fuel required.

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 it is desired to cruise at speeds other than those given in the Constant Altitude Cruise charts.

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 average gross weight, cruise altitude, the desired type of cruise control 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:

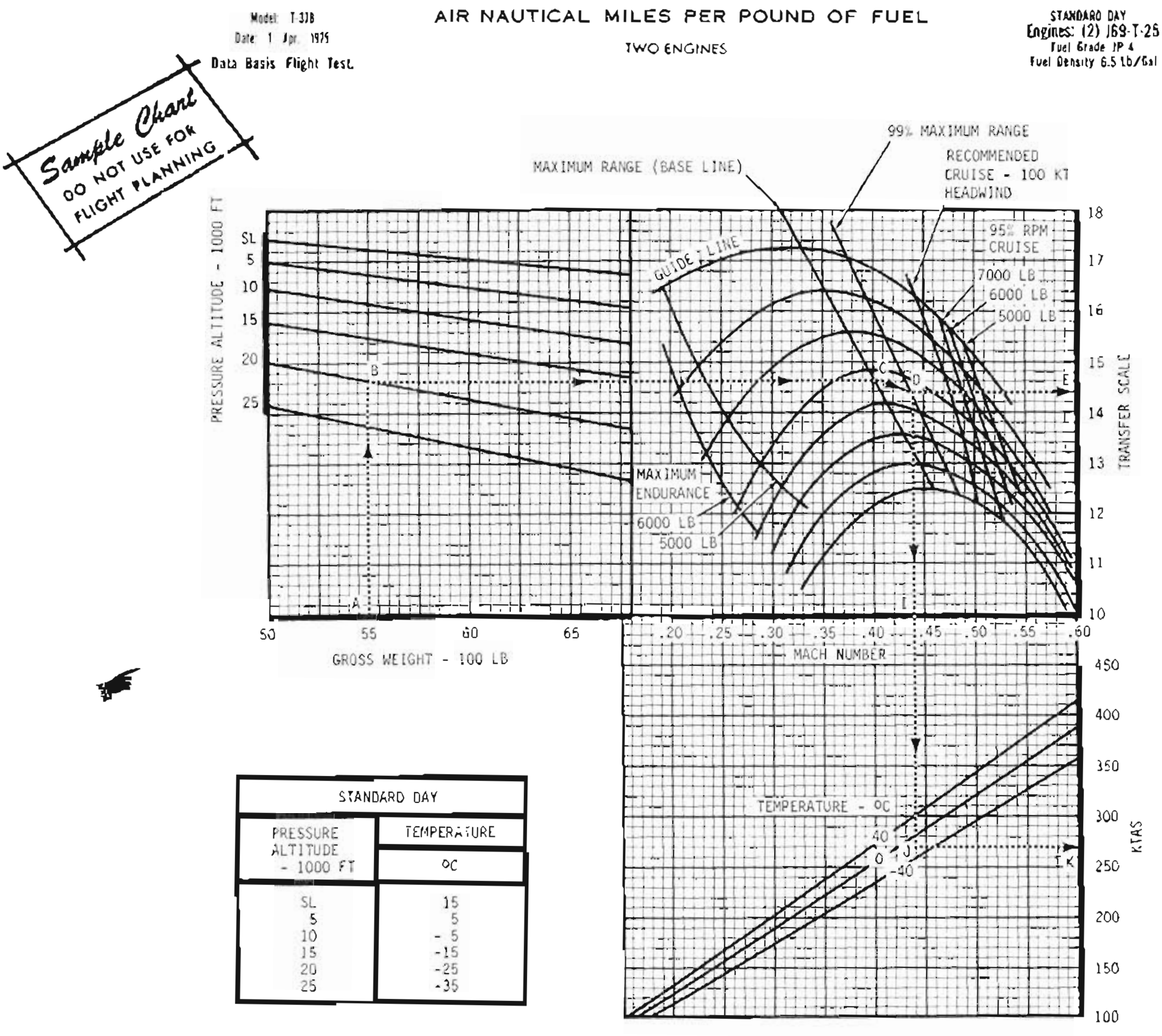
Conditions:

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: 1200 lb
2. Determine Estimated Average Gross Weight:
   Initial Gross Weight: 6100 lb
   Estimated Fuel Used: 1200 lb
   Estimated Final Weight: 6100-1200=4900 lb
   Estimated Average Gross Weight: $\frac{6100+4900}{2}$=5500 lb
3. Enter Sample Chart:
   At Gross Weight = 5500 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 = 15.10 (E)
   Enter Sample Chart:
   At Transfer scale = 15.10 (E)



STANDARD DAY	
PRESSURE ALTITUDE - 1000 FT	TEMPERATURE °C
SL	15
5	5
10	- 5
15	-15
20	-25
25	-35

Move to Altitude = 15,000 ft (F)
Drop vertically to NMI/lb scale and read NMI/lb = .265 (G)
Construct vertical line (GH)
Return to Sample Chart
Drop vertically from (D) to Mach number scale and read Mach number -.435 (I)
(Read Cruise Speed = 218 KCAS from figure A4-1)
Continue down to Temperature = -20°C (J)
Move horizontally to True Airspeed scale and read True Airspeed = 270 knots (K)

Enter Sample Chart:
At True Airspeed = 270 knots (K)
Construct horizontal line (KL)
At the intersection of constructed lines (GH) and (KL) read Fuel Flow 1015 lb/hr (M)

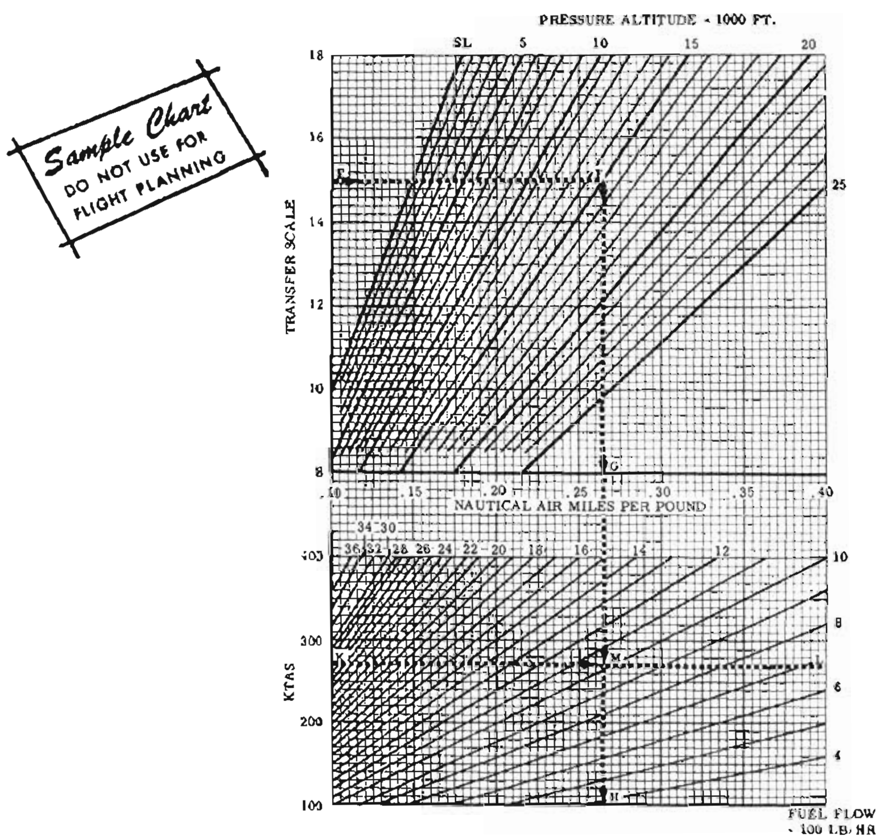
4. Compute Ground Speed:
Ground Speed = TAS - Headwind = 270 - 60 = 210 knots
Compute Time to fly 200 Naut. Mi.
Time = Distance - Ground Speed = 0.952
Compute Fuel Used in cruise:
Fuel Used = Fuel Flow x Time = 1015 lb/hr x 0.952 hr = 967 lb

Model T-37B
Date 1 Apr 1975
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



5. Revise Estimated Average Gross Weight:
   Initial Gross Weight: 6100 lb
   Computed Fuel Used: 967 lb
   Final Gross Weight: 6100-967=5133 lb
   Average Gross Weight: $\frac{6100+5133}{2}$=5616 lb

6. Entering the chart at 5616 lb Gross Weight it is evident that this would result in essentially the same solutions as above, therefore, the problem is not reworked.

DIVERSION RANGE SUMMARY TABLES

The two-engine and single-engine diversion range summary tables, figures A4-8 show in quick reference form the range available and time required for a return to base or diversion to an alternate with a given quantity of fuel remaining.

Two return profiles are presented: (1) continue cruise at the initial altitude until over the destination field with penetration descent to sea level, or (2) climb to the optimum altitude and cruise until over the field, with a penetration descent to sea level. The optimum altitude is the cruise altitude which gives the best range for the profile selected. Range performance for 500, 750 and 1000 pounds remaining fuel are presented. These fuel quantities include a 250 pound allowance at sea level for approach and landing at the destination, but no other reserves or allowances. The tables also include recommended cruise speed and fuel flow, and fuel, time and distance for an on-course maximum range descent from cruise altitude.

EXAMPLE:

Conditions:

Two engines	
Initial altitude	15,000 feet
Fuel remaining	750 pounds

Find: optimum cruise altitude, range available, time required, speed, fuel flow.

SOLUTION: (Figure A4-8)

1. Enter the table at 750 pounds fuel.
2. Select column for 15,000 feet initial altitude.
3. Read optimum altitude = 25,000 feet.
4. On line for optimum altitude cruise profile read nautical miles = 139 and minutes = 38.6.
5. In cruise section of table for the optimum altitude of 25,000 feet read KCAS = 185, KTAS = 273 and fuel flow = 750 pounds per hour.

Model: T-37B
Date 1 Mar. 1961
Data Basis: Flight Test.

MACH NUMBER - CALIBRATED AIRSPEED CHART

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

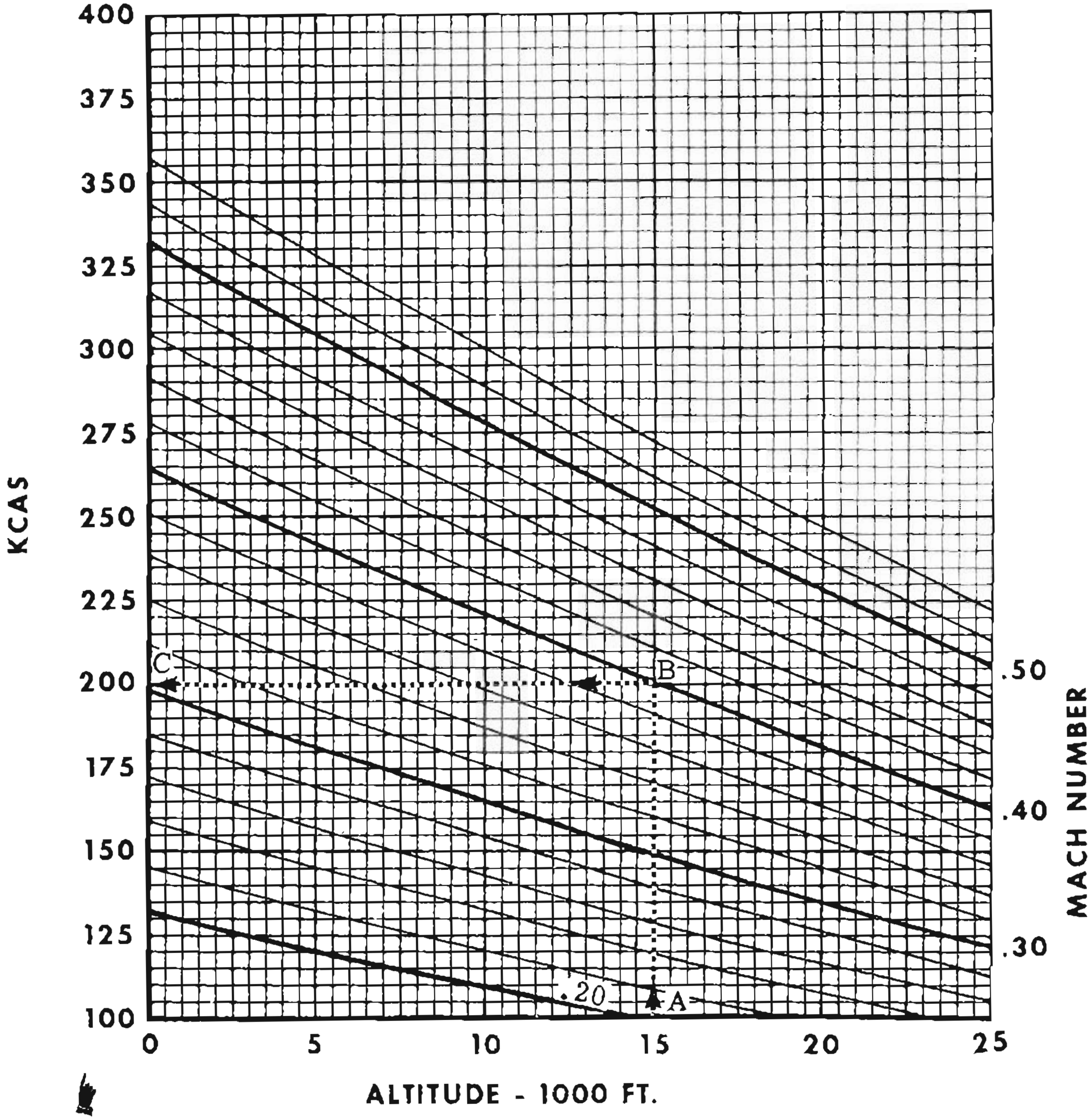


Figure A4-1

CONSTANT ALTITUDE CRUISE

(99% MAXIMUM RANGE)
TIME AND GROUNDSPEED

Model: T-37B
Date: 1 Apr 1975
Data Basis: Flight Test.

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

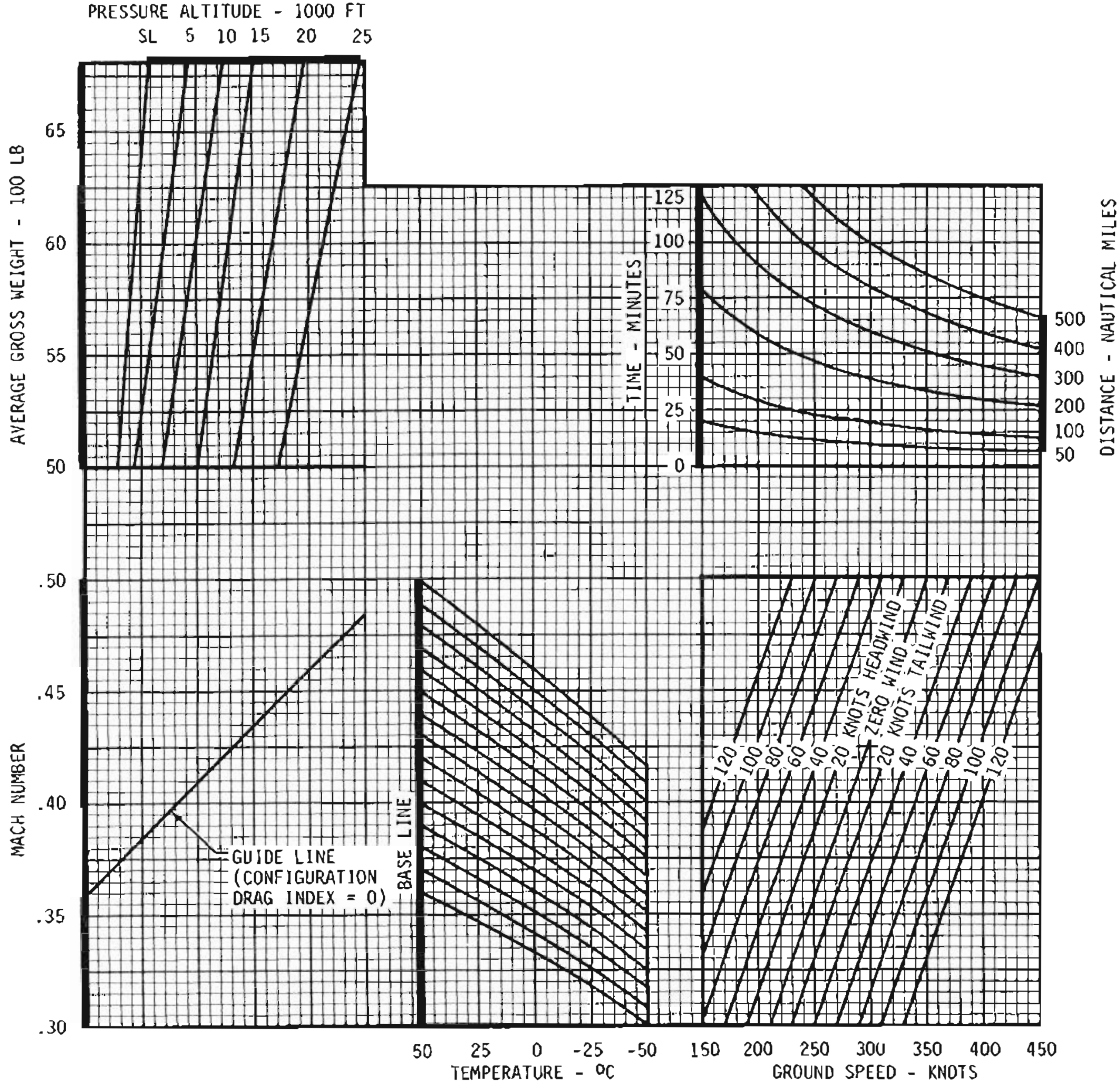


Figure A4-2

Model: T-37B
Date: 1 Apr 1975
Data Basis: Flight Test.

CONSTANT ALTITUDE CRUISE

(99% MAXIMUM RANGE)

FUEL FLOW AND FUEL REQUIRED

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

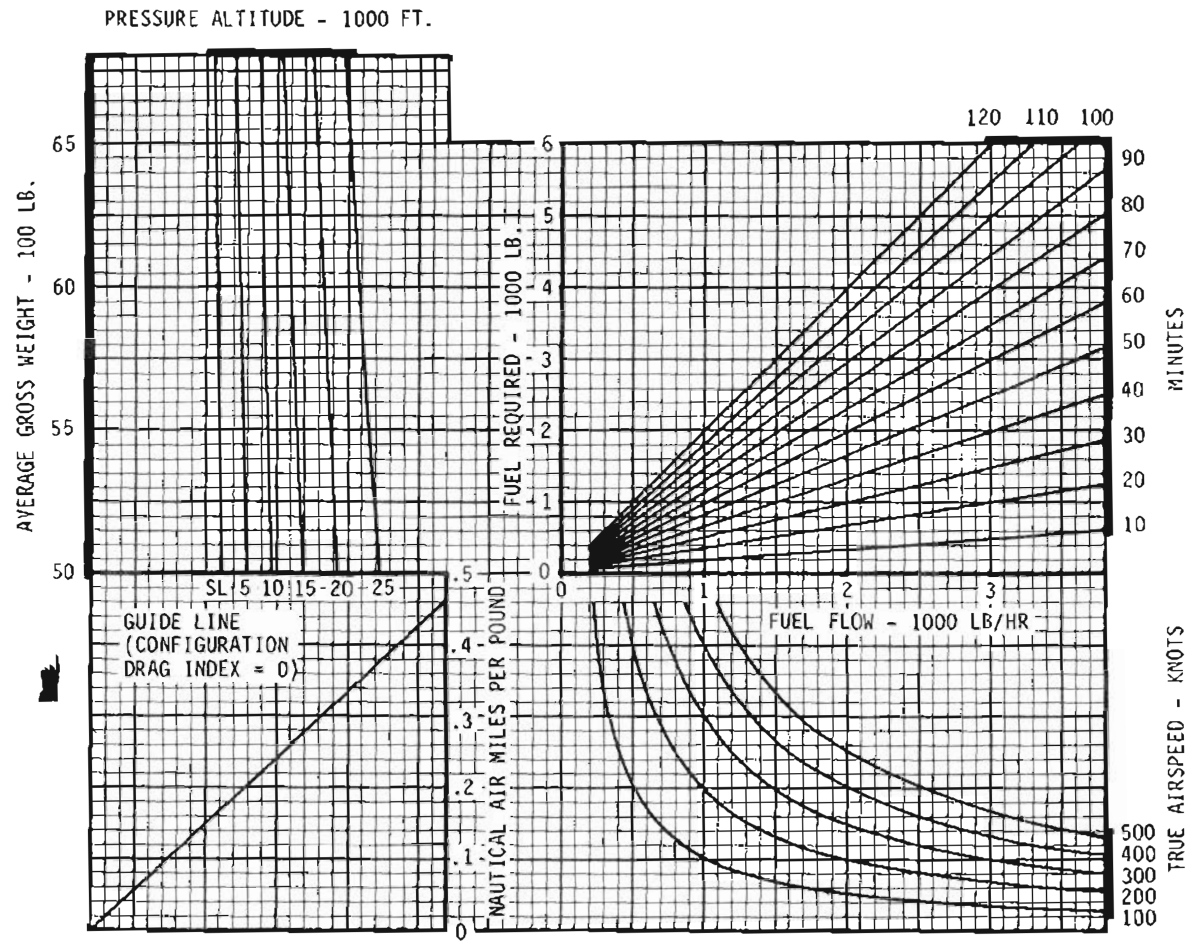


Figure A4-3

Model: T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test.

CONSTANT ALTITUDE CRUISE
(95% RPM)
TIME AND GROUND SPEED

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

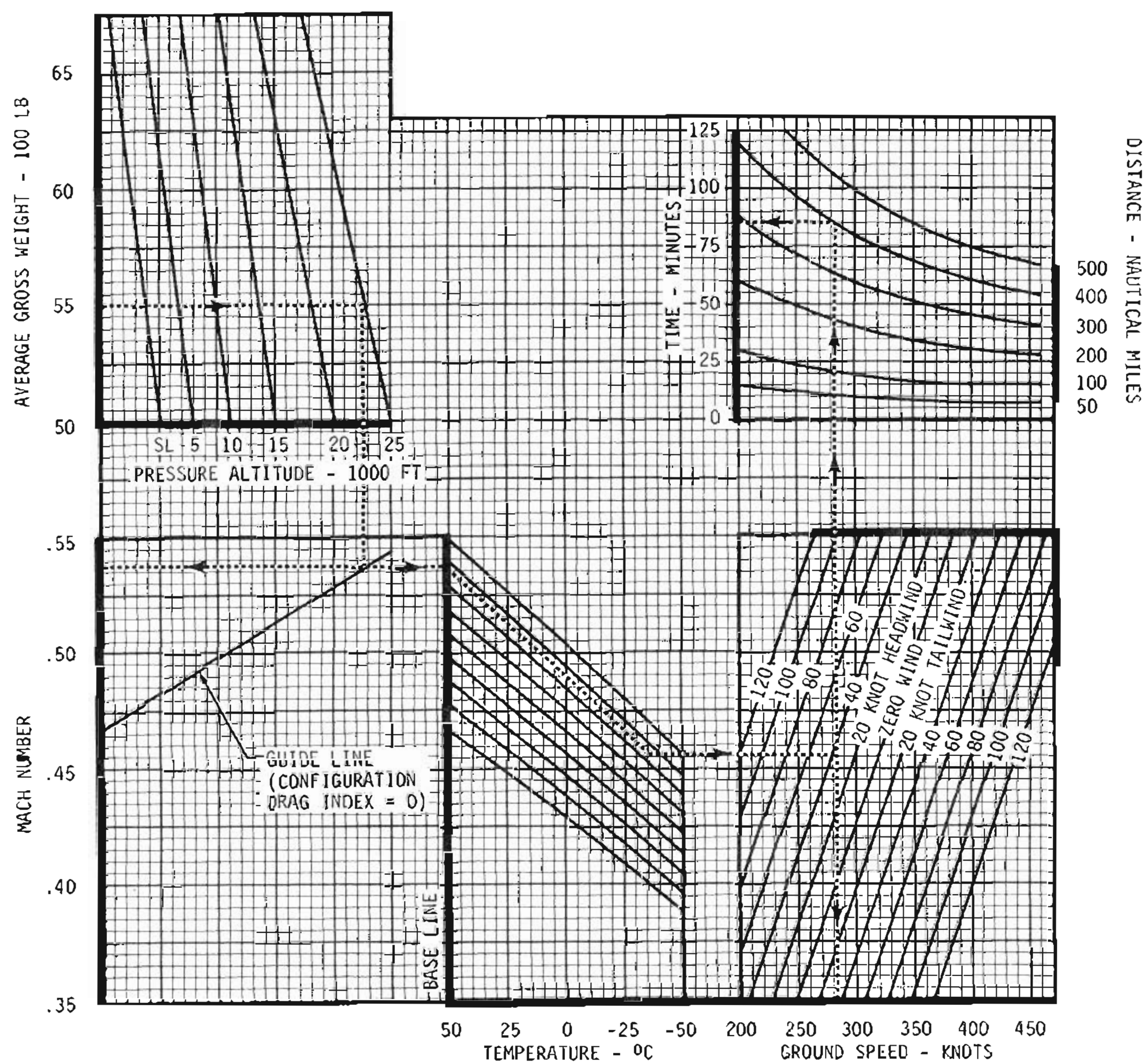


Figure A4-4

Model: T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test

CONSTANT ALTITUDE CRUISE

(95% RPM)
FUEL FLOW AND FUEL REQUIRED

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

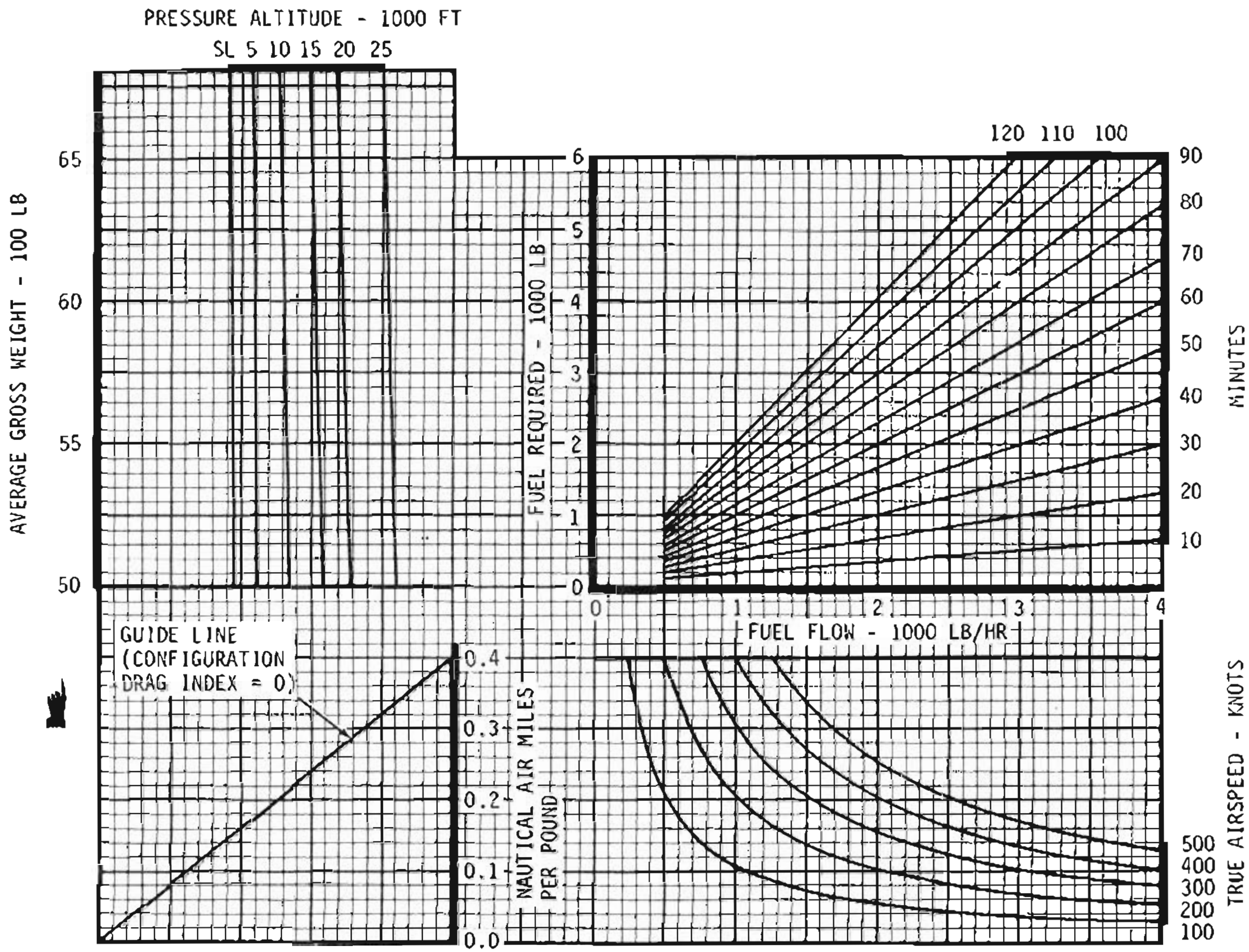


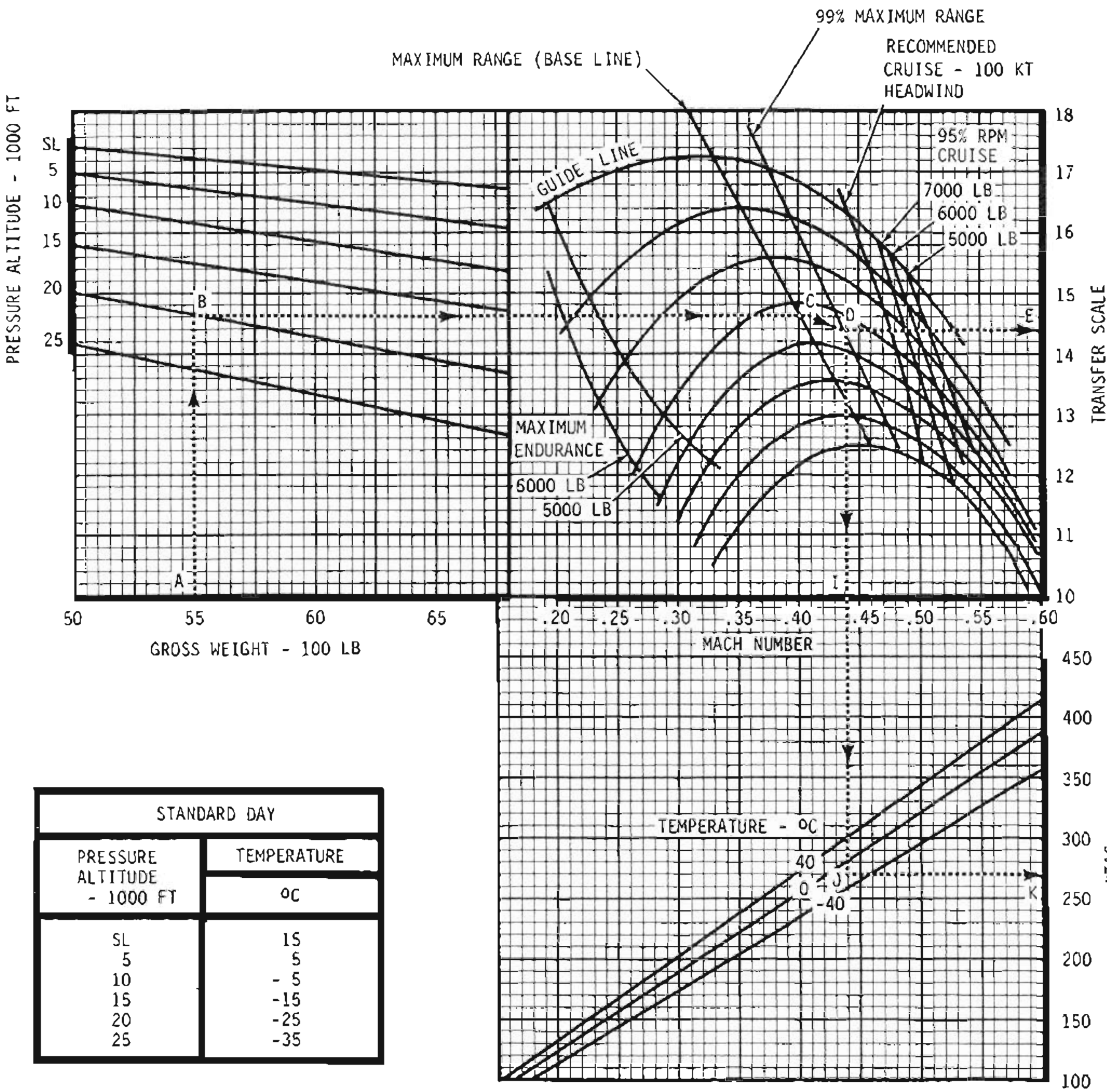
Figure A4-5

Model: T-37B
Date: 1 Apr 1975
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)

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

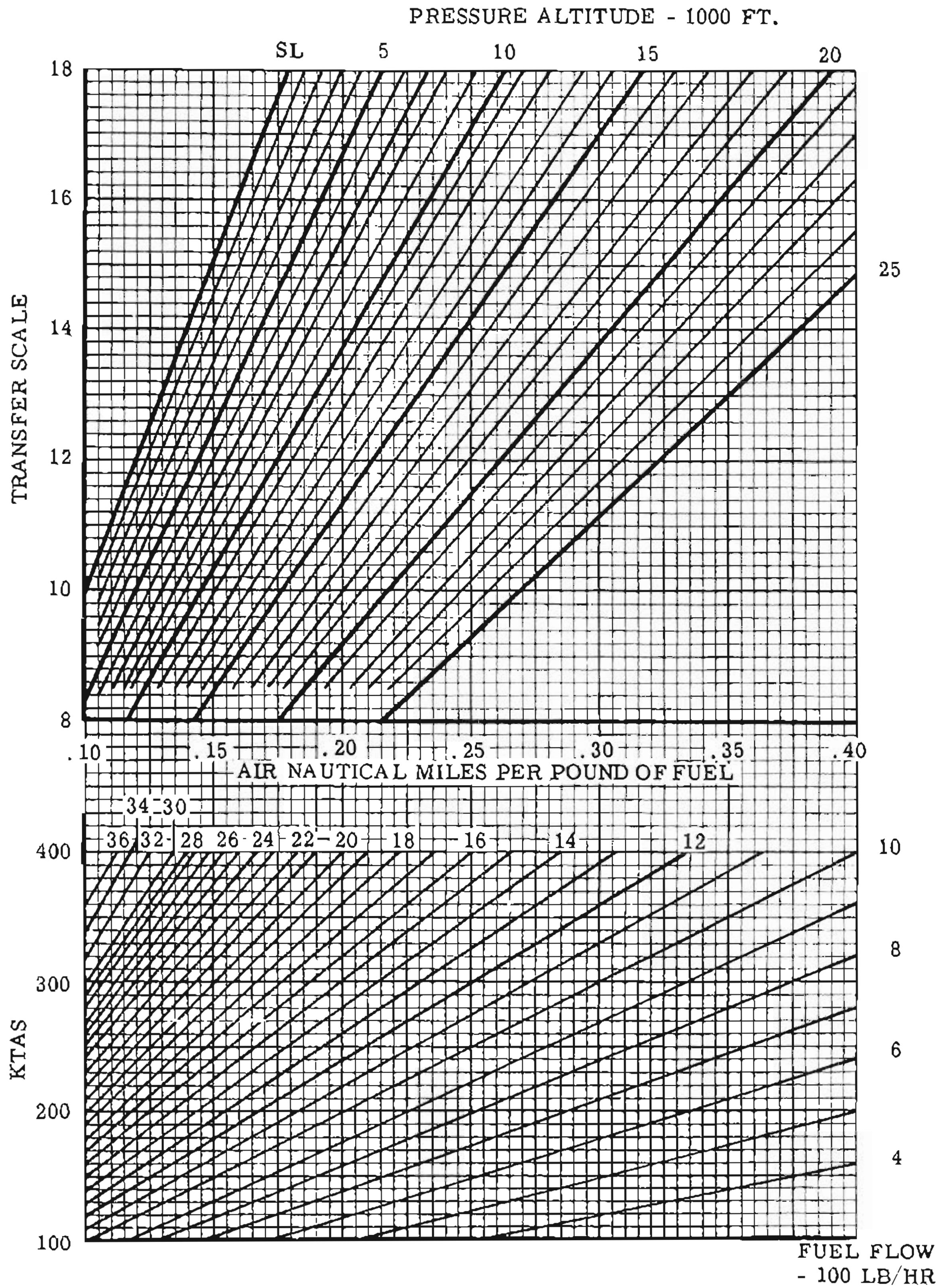


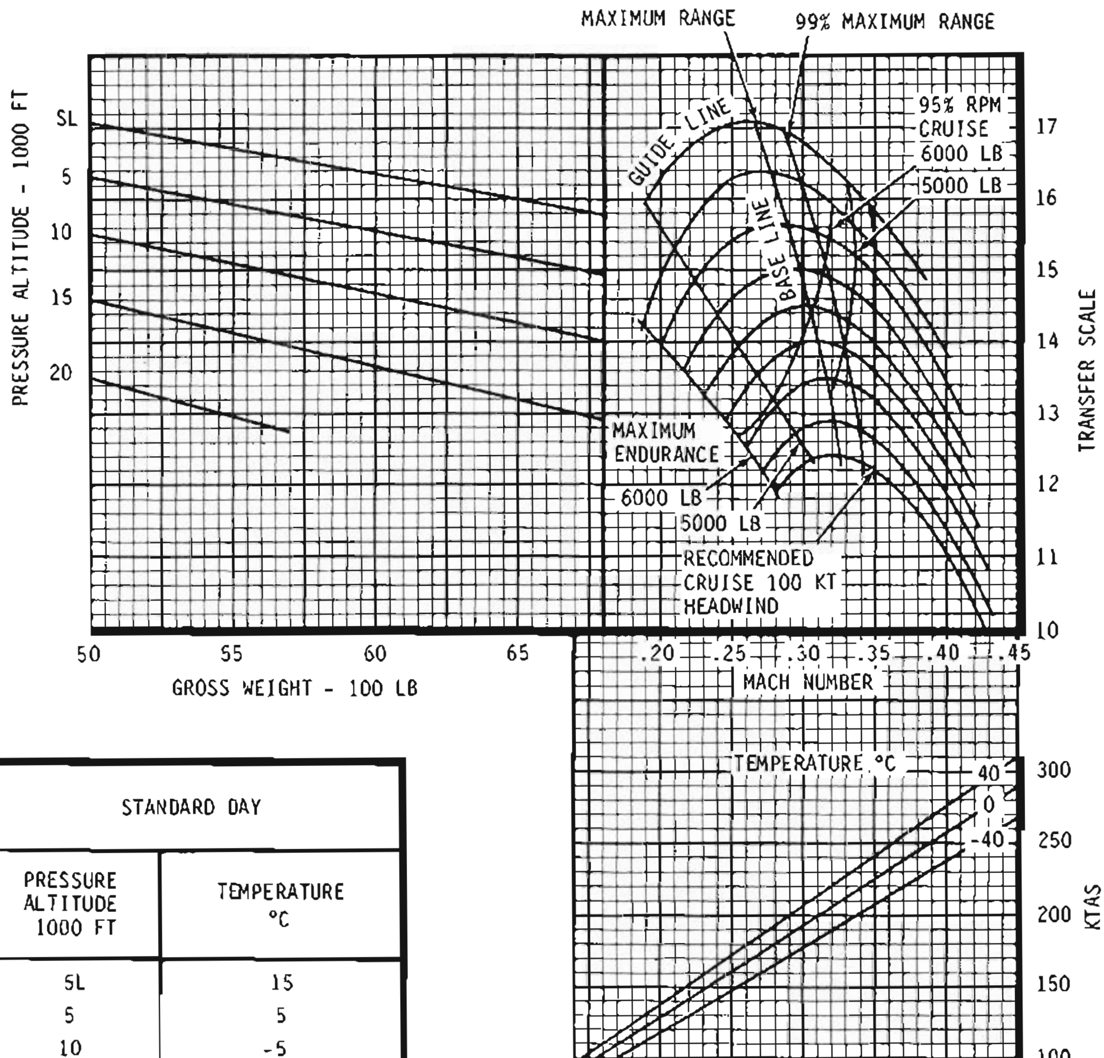
Figure A4-6 (Sheet 2 of 2)

Model: T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

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

Figure A4-7 (Sheet 1 of 2)

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

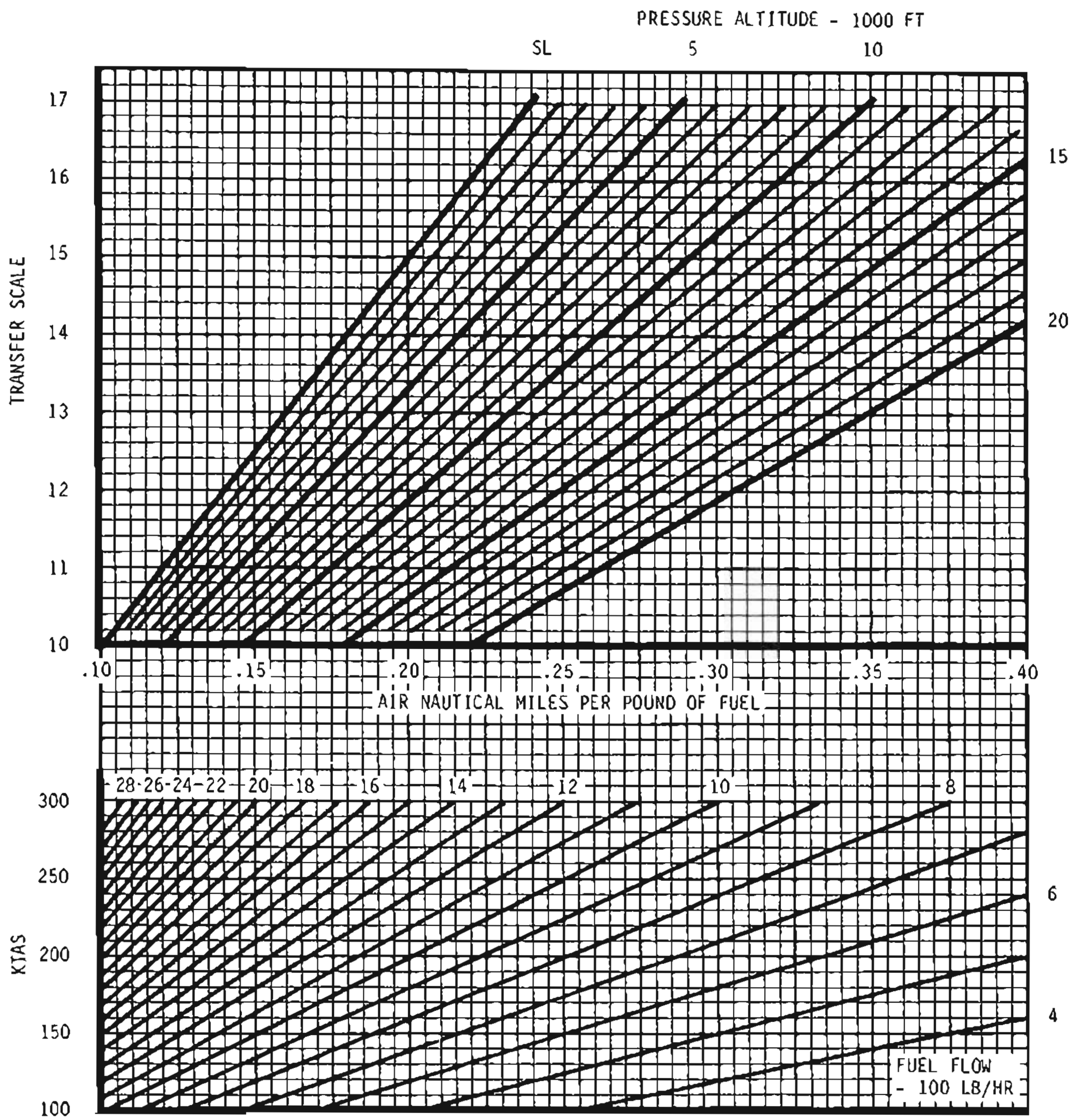


Figure A4-7 (Sheet 2 of 2)

DIVERSION RANGE SUMMARY TABLE

STANDARD DAY **TWO ENGINES** **ZERO WIND**

FUEL, RANGE AND TIME REMAINING WITH 250 LBS. FUEL AT SL								PROCEDURE
FUEL	1000 FT	SL	5	10	15	20	25	INITIAL ALTITUDE
500 LB	NMI MIN	42 10.4	46 13.0	50 15.8	54 17.7	59 19.7	67 21.7	CRUISE AT INITIAL ALT TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIGURATION
	1000 FT	SL	5	10	15	20	25	OPTIMUM ALTITUDE (REMAIN AT PRESENT ALT.)
	NMI MIN							CLIMB TO OPT ALT & CRUISE TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIG.
750 LB	NMI MIN	85 20.7	96 26.0	109 29.7	121 33.0	137 37.5	158 41.8	CRUISE AT INITIAL ALT TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIGURATION
	1000 FT	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	98 30.4	111 33.5	127 36.2	139 38.6	150 40.4	158 41.8	CLIMB TO OPT ALT & CRUISE TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIG.
1000 LB	NMI MIN	122 29.5	146 37.0	168 43.4	188 48.8	216 55.2	248 61.5	CRUISE AT INITIAL ALT TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIGURATION
	1000 FT	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	186 52.0	200 52.4	215 55.2	228 53.1	239 60.0	248 61.5	CLIMB TO OPT ALT & CRUISE TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIG.

CRUISE	KCAS KTAS F/F (lb/hr)	247 247 1460	231 250 1300	218 253 1100	206 258 960	195 264 840	185 273 750
ON COURSE DESCENT	NMI		7	14	22	29	37
	TIME		2.0	4.0	6.0	7.8	9.5
	FUEL		19	34	48	58	68

NOTES

- Fuel and time included for climb at T.O. A/S to opt alt and penetration descent.
- On course descent - clean configuration, idle RPM, 200 KCAS; values given apply only for the descent.

Figure A4-8 (Sheet 1 of 2)

DIVERSION RANGE SUMMARY TABLE

STANDARD DAY **SINGLE ENGINE** **ZERO WIND**

FUEL, RANGE AND TIME REMAINING WITH 250 LBS. FUEL AT SL								PROCEDURE
FUEL	1000 FT	SL	5	10	15	20	25	INITIAL ALTITUDE
500 LB	NMI MIN	60 19	59 22	60 25	61 27	62 30		CRUISE AT INITIAL ALT TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIGURATION
	1000 FT	SL	5	10	15	20		OPTIMUM ALTITUDE (REMAIN AT PRESENT ALT.)
	NMI MIN							CLIMB TO OPT ALT & CRUISE TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIG.
750 LB	NMI MIN	118 37	125 42	134 47	144 52	150 55		CRUISE AT INITIAL ALT TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIGURATION
	1000 FT	SL	5	10	15	20		OPTIMUM ALTITUDE
	NMI MIN							CLIMB TO OPT ALT & CRUISE TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIG.
1000 LB	NMI MIN	176 55	190 61	208 69	223 75	236 80		CRUISE AT INITIAL ALT TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIGURATION
	1000 FT	10	10	15	15	20		OPTIMUM ALTITUDE
	NMI MIN	182 64	199 68	210 81	223 75	236 80		CLIMB TO OPT ALT & CRUISE TO BASE; DESCEND OVER BASE; NORMAL PENETRATION CONFIG.
CRUISE	KCAS KTAS F/F (lb/hr)	190 190 804	181 195 733	171 198 664	161 202 613	151 205 572		
ON COURSE DESCENT	NMI		7	14	21	28	36	
	TIME		1.9	3.8	5.6	7.3	8.9	
	FUEL		9	17	22	28	32	

NOTES

- Fuel and time included for climb at T.O. A/S to opt alt and penetration descent.
- On course descent - clean configuration, idle RPM, 200 KCAS; values given apply only for the descent.

Figure A4-8 (Sheet 2 of 2)

PART V ENDURANCE

TABLE OF CONTENTS

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 KCAS 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: 5600 lb
Loiter Altitude: 20,000 ft

Find: Loiter time available with 1200 lb fuel.

SOLUTION:

1. Determine Average Gross Weight:
   Initial Gross Weight: 5600 lb
   Loiter Fuel: 1200 lb
   Final Gross Weight: 5600-1200=4400 lb
   Average Gross Weight: $\frac{5600+4400}{2}$=5000 lb

2. Enter Sample Chart:
   At Average Gross Weight = 5000 lb (A)
   Move horizontally to Altitude = 20,000 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 (G)

EXAMPLE II:

Conditions:
Initial Gross Weight: 5450 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: 5450 lb
   Estimated Fuel Used: 900 lb
   Estimated Final Weight: 5450-900=4550 lb
   Estimated Average Gross Weight: $\frac{5450+4550}{2}$=5000 lb

3. Enter Sample Chart:
   At Average Gross Weight = 5000 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: 5450 lb
   Computed Fuel Used: 720 lb
   Final Gross Weight: 5450-720=4730 lb
   Average Gross Weight: $\frac{5450+4730}{2}$=5090 lb

5. Entering the chart at 5090 lb. Average Gross Weight it is evident the solution would be essentially the same as shown above, therefore, the problem is not reworked.

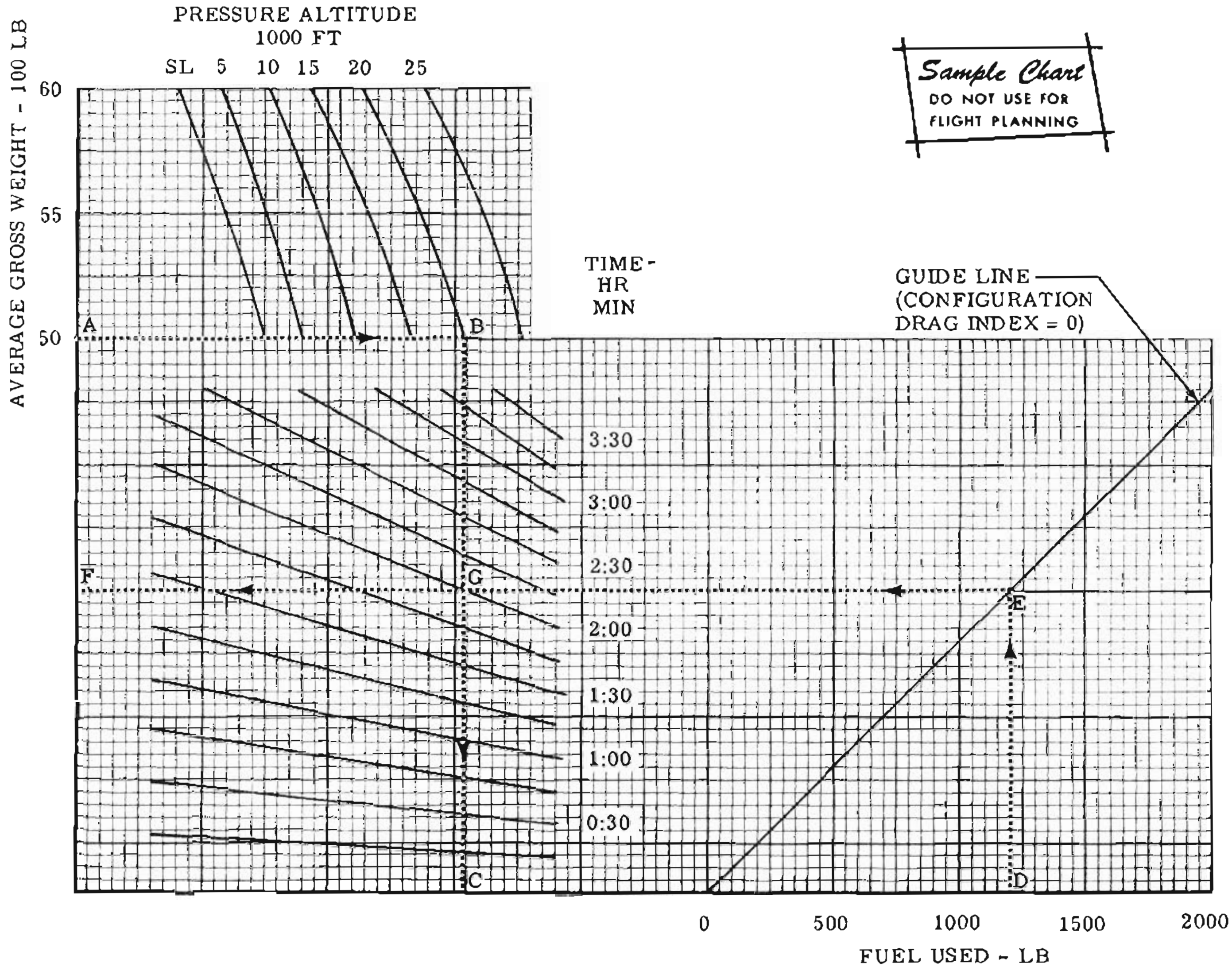
Model T-37B
Date. 1 Mar. 1961
Data Basis: Flight Test.

MAXIMUM ENDURANCE

TWO ENGINES

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

V = 125 KCAS



(Sheet 1 of 2)

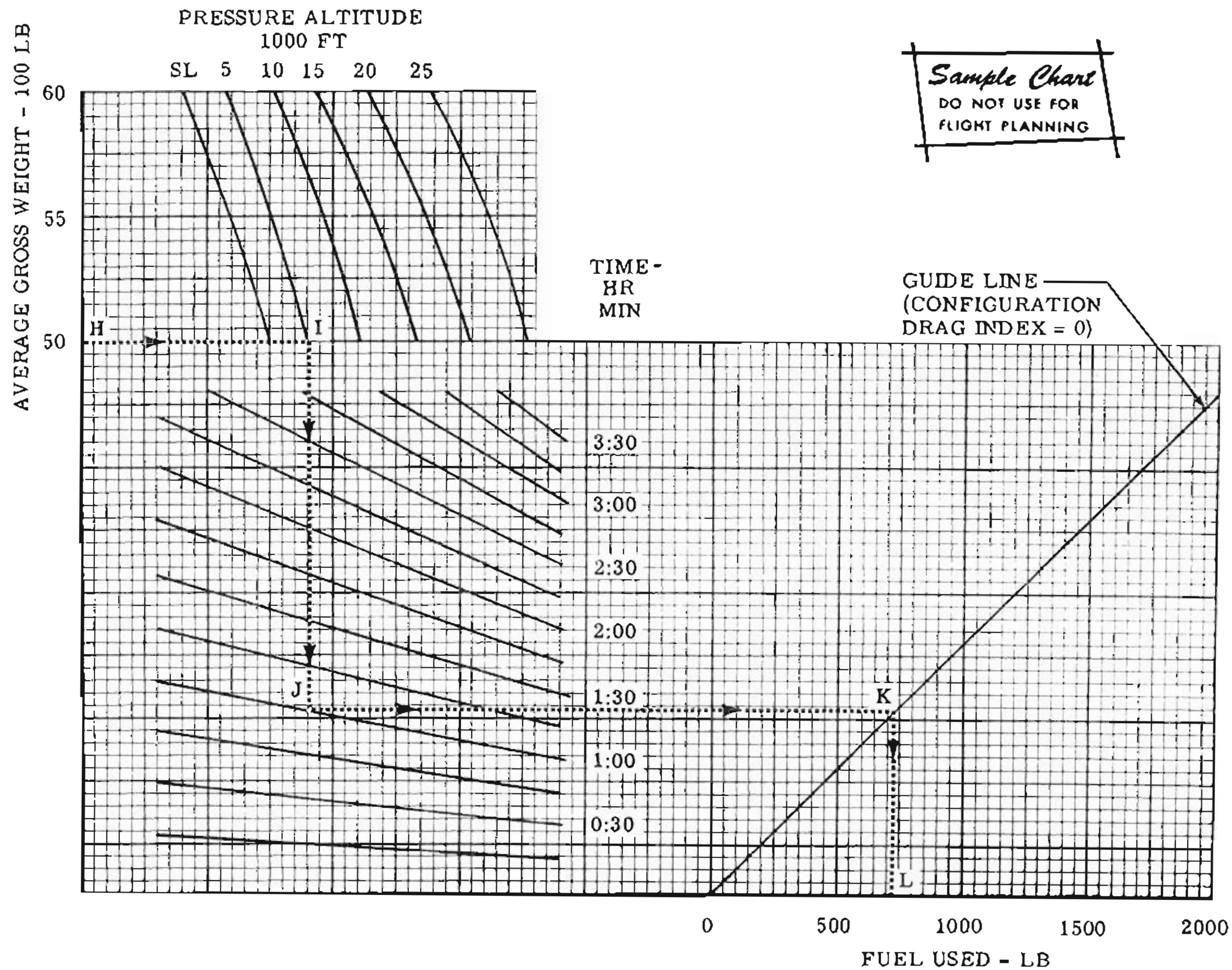
Model T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test.

MAXIMUM ENDURANCE

TWO ENGINES

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

V = 125 KCAS



(Sheet 2 of 2)

Model: T-37B
Date: 1 Apr 1975
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

V = 125 KCAS

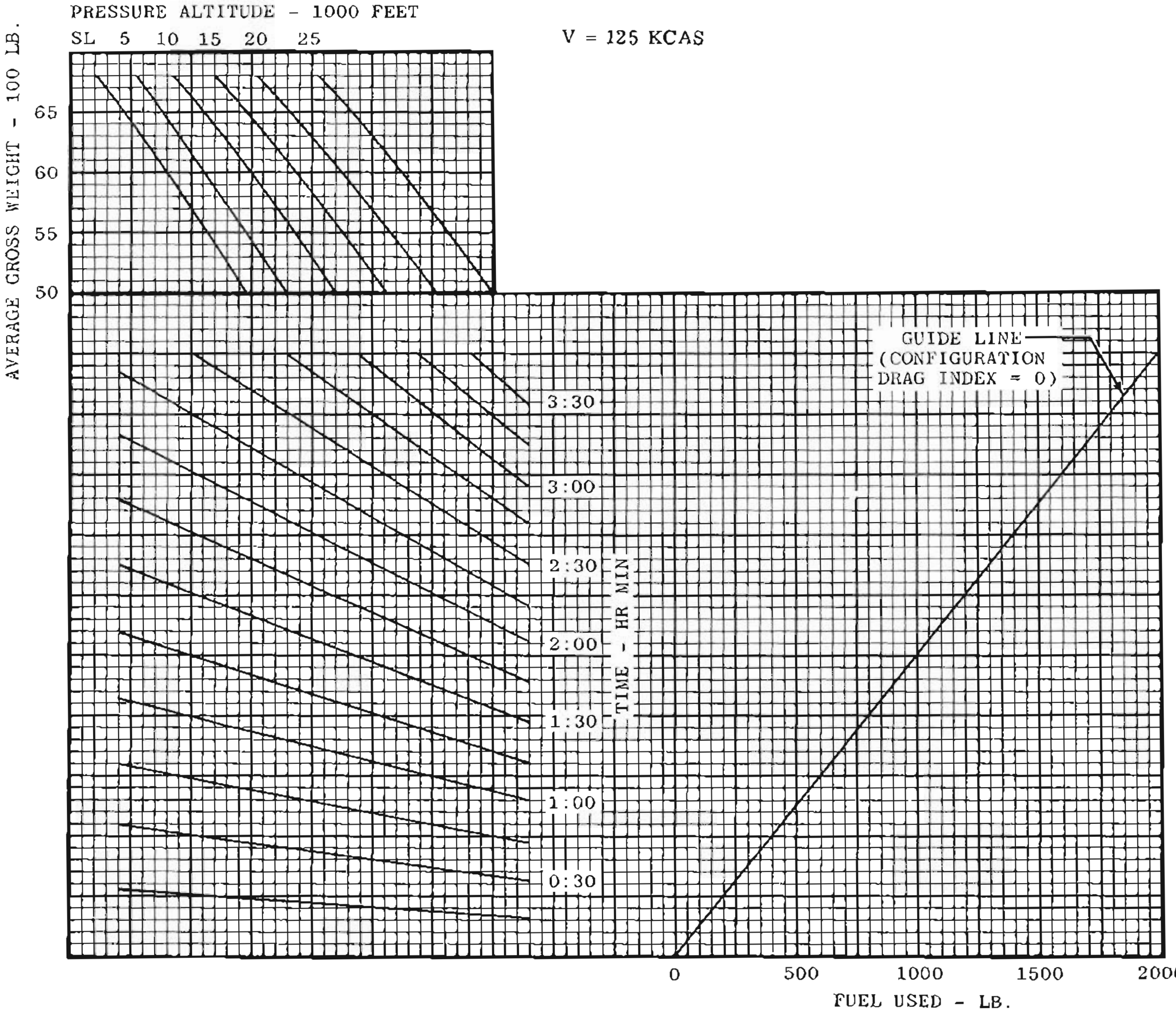


Figure A5-1

Model: T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test.

MAXIMUM ENDURANCE

SINGLE ENGINE
V = 125 KCAS

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

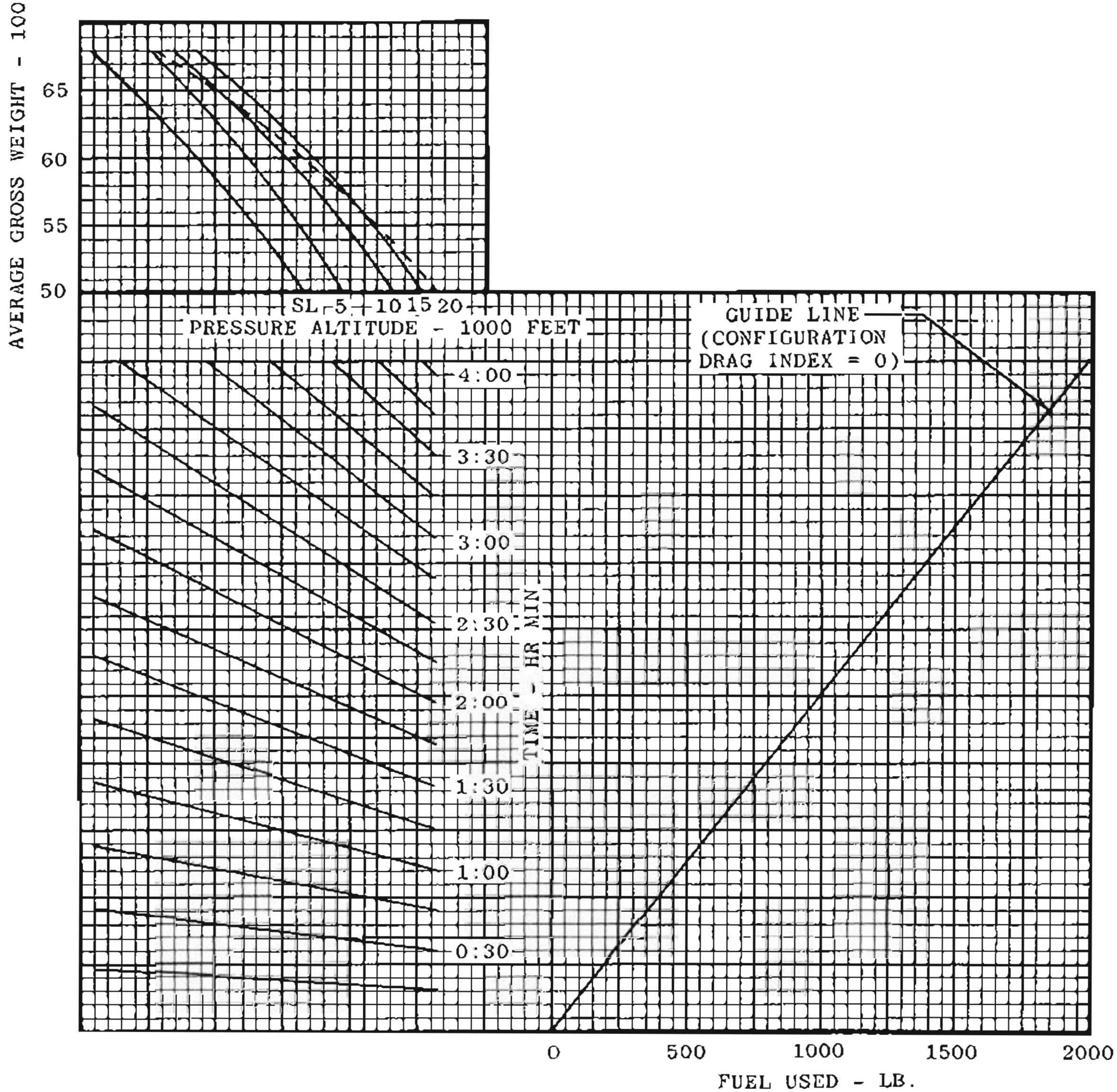


Figure A5-2

PART VI DESCENT

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DESCENT

Three types of descent are shown in the Descent Charts (figures A6-1 through A6-3).

1. The maximum range descent is made with idle RPM, speed brake retracted and 200 KCAS.
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.
3. The penetration descent is made with 65% RPM and 200 KCAS. The speed brake may be either extended or retracted.

EXAMPLE I:

A maximum range descent from 20,000 feet to sea level is planned.

Find: Rate of descent, time to descend, fuel used and horizontal distance traveled.

SOLUTION: (Figure A6-1)

1. Enter chart at 20,000 feet (A), proceed to the right to rate of descent guide line (B) and drop down to read rate of descent = 3000 feet per minute (C).
2. At the intersection of line AB and the configuration drag index guide line (D) drop down to the time to descend guide line (E) and proceed left to read time to descend = 7.8 minutes (F).
3. From E proceed right to the fuel used guide line (G) then drop down to read fuel used = 58 pounds (H).
4. Return to point E and drop down to read horizontal distance traveled = 29 nautical miles (I).

EXAMPLE II:

A rapid descent from 20,000 feet to sea level is to be made.

Find: Speed, rate of descent, time to descend, fuel used and horizontal distance traveled.

SOLUTION: (Figure A6-2)

1. Enter chart at 20,000 feet (A) and proceed right to read 293 KCAS (B). Continue right to rate of descent guide line (C) and drop down to read rate of descent = 22,000 feet per minute (D).
2. At the intersection of line AC and the configuration drag index guide line (E) drop down to time to descend guide line (F) and proceed left to read time to descend = 43 seconds (G).
3. From F proceed right to the fuel used guide line (H) and drop down to read fuel used = 5 pounds (I).
4. Return to point F and drop down to read horizontal distance traveled = 3.2 nautical miles (J).

EXAMPLE III:

A penetration descent with speed brake extended from 20,000 feet to sea level is planned.

Find: Time to descend, fuel used and horizontal distance traveled.

SOLUTION: (Figure A6-3)

1. Enter chart at 20,000 feet (A) and proceed right to drag index guide line for speed brake out (B).
2. Drop down to time to descend guide line for speed brake out (C) and proceed left to read time to descend = 6 minutes (D).
3. From C proceed right to fuel used guide line for speed brake out (E) and drop down to read fuel used = 64 pounds (F).
4. Return to point C and drop down to read horizontal distance traveled = 23 nautical miles (G).

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test

# MAXIMUM RANGE DESCENT
V=200 KCAS
CLEAN CONFIGURATION
IDLE RPM

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

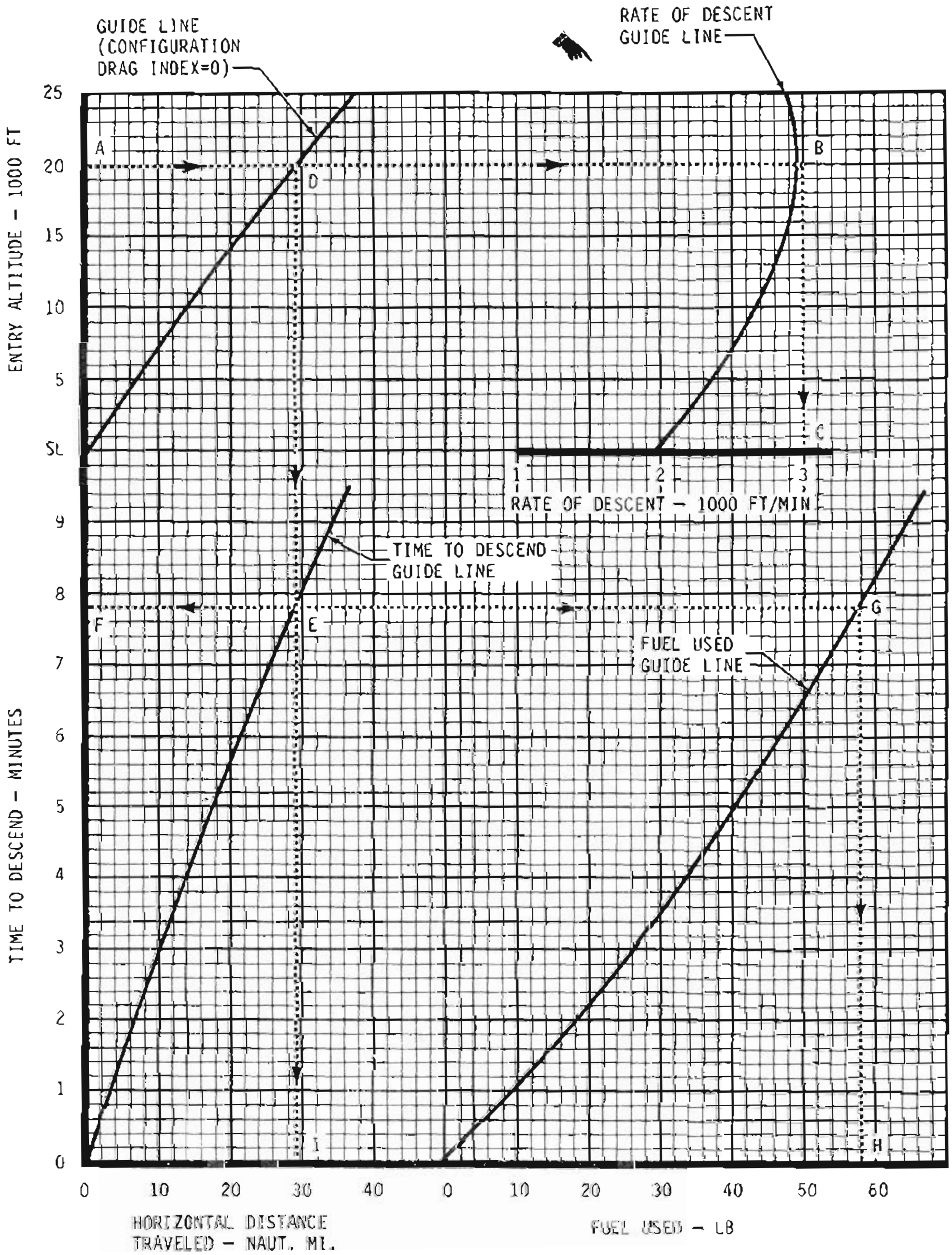

Figure A6-1

Model: T-37B
Date: 1 Mar. 1961
Data Basis: Flight Test

RAPID DESCENT
IDLE RPM
SPEED BRAKE OUT

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

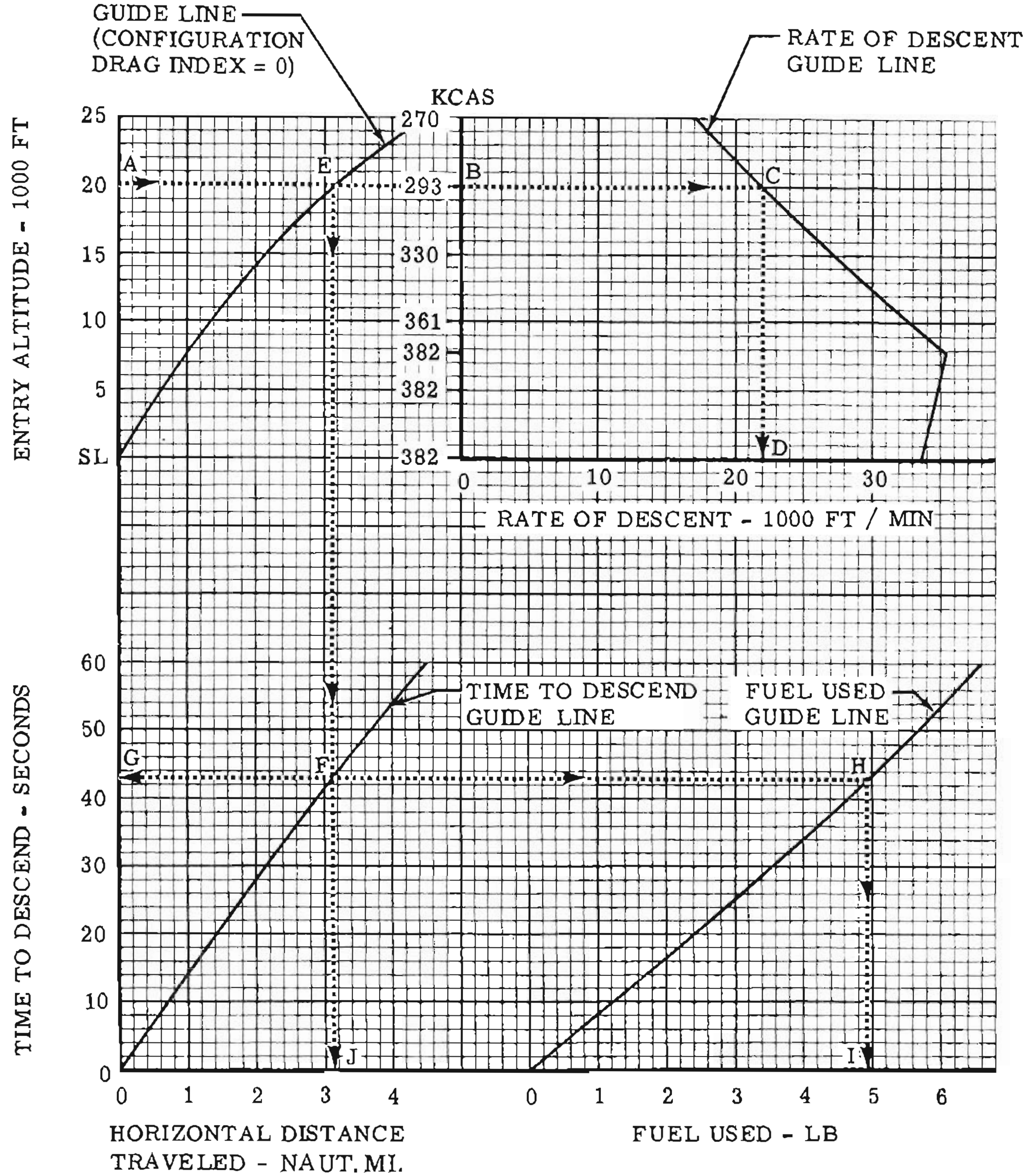

Figure A6-2

Model. T-37B
Date. 1 Mar. 1961
Data Basis: Flight Test.

PENETRATION DESCENT
65% RPM
V = 200 KCAS

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

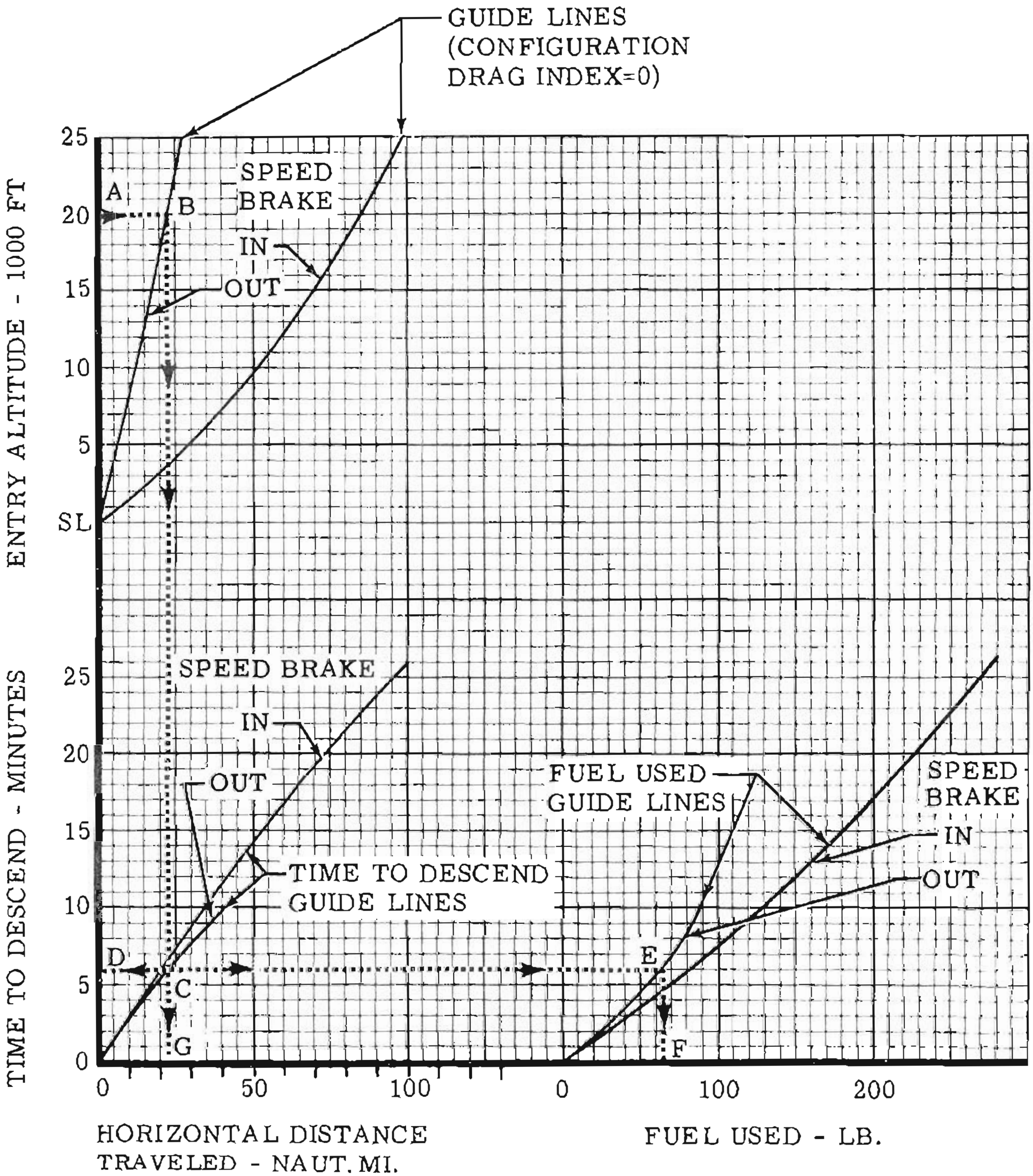

Figure A6-3

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 KIAS with 100% flaps and 110 KIAS 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 KIAS, 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 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 KIAS approach speed.

EXAMPLE:

Conditions:

Temperature	27°C
Pressure altitude	2000 feet
Gross weight	6000 pounds
Headwind component	10 knots
Runway condition	dry

Find: Landing ground roll distance and total distance to clear a 50 foot obstacle.

SOLUTION: (Figure A7-2)

1. Enter chart at temperature = 27°C (A) and proceed right to intercept the temperature conversion guide line (B).
2. Proceed upward and read temperature = 81°F (C).
3. Continue upward to pressure altitude = 2000 feet (D), then right to gross weight = 6000 pounds (E).
4. Drop down to wind base line (F), proceed parallel to headwind guide lines to wind = 10 knots (G), then drop down to read ground roll = 1800 feet (H).
5. Continue down to total distance guide line (I), then left to read total distance to clear 50 foot obstacle = 3150 feet (J).

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 a 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.

EXAMPLE:

From the previous example, the dry runway ground roll was 1800 feet and the total distance was 3150 feet.

Find: Ground roll and total distance if the latest reported RCR = 12.

SOLUTION: (Figure A7-3)

1. Enter chart at dry runway ground roll = 1800 feet (A).

2. Proceed upward to RCR = 12 (B), then left to read corrected ground roll = 3100 feet (C).
3. Compute air distance:
   3150 feet - 1800 feet = 1350 feet.
4. Compute corrected total distance:
   1350 feet + 3100 feet = 4450 feet.

Model. T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test

LANDING SPEEDS

FULL (100%) FLAP, GEAR DOWN, SPEED BRAKE OUT

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal

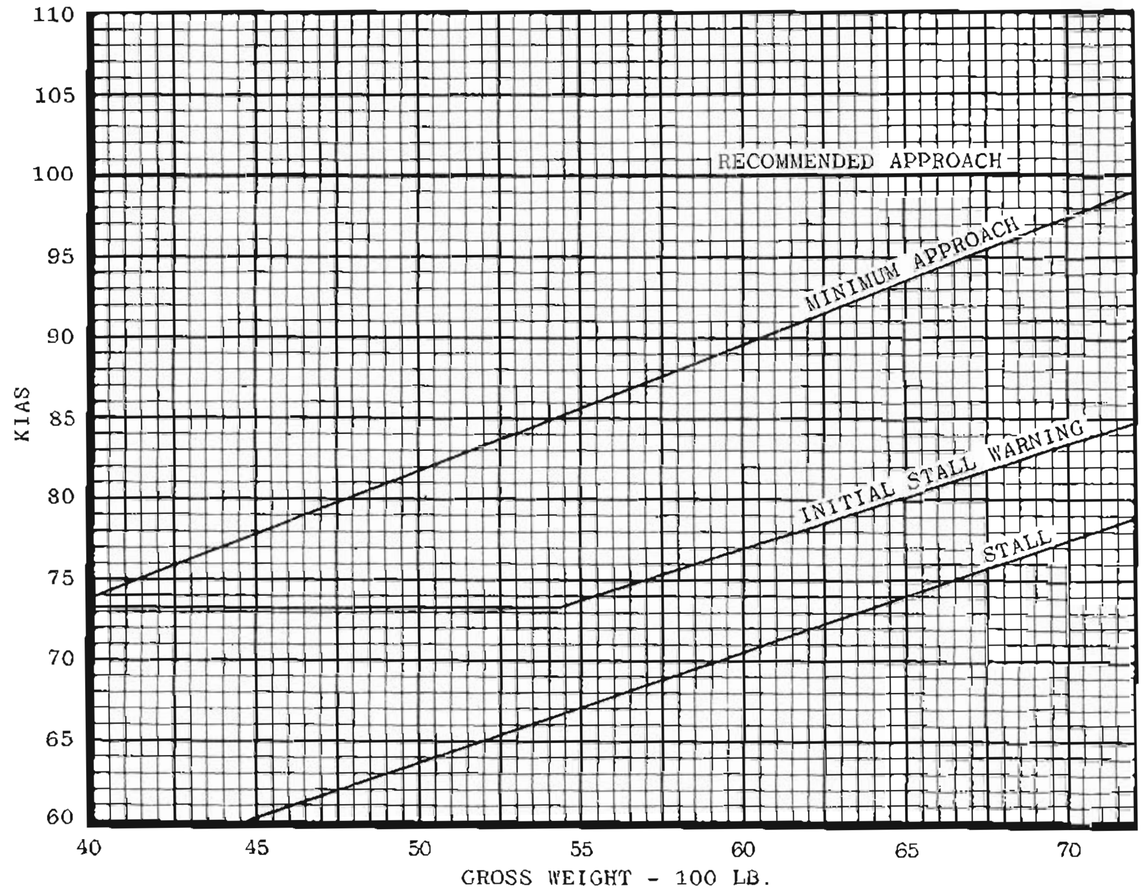


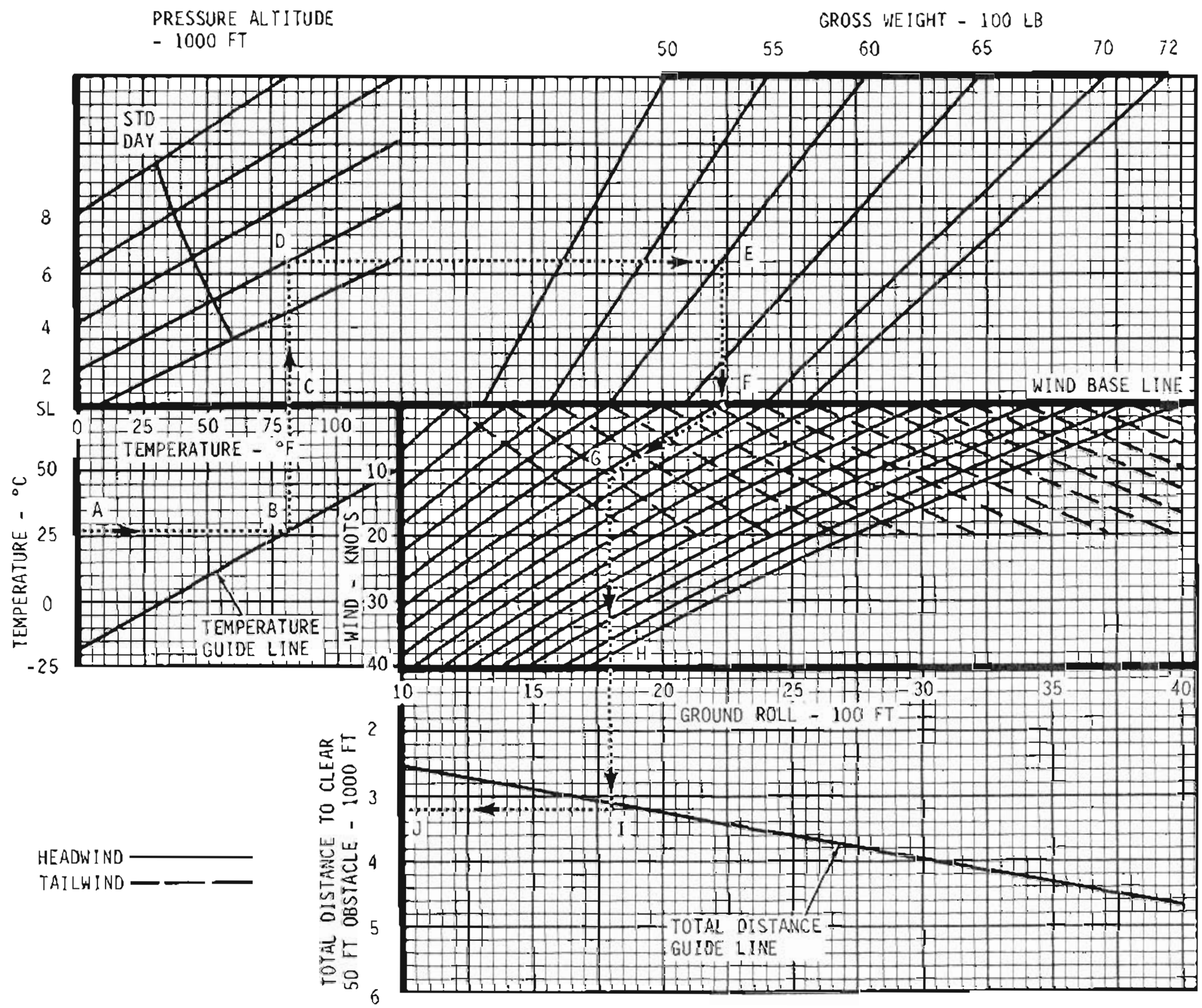
Figure A7-1

Model. T-37B
Date: 1 Apr. 1975
Data Basis: Flight Test.

NORMAL LANDING DISTANCES

100% FLAPS

STANDARD DAY
Engines: (2) J69-T-25
Fuel Grade JP-4
Fuel Density 6.5 Lb/Gal



NOTE

INCREASE ALL DISTANCES 20% FOR FLAPS UP LANDING.

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)

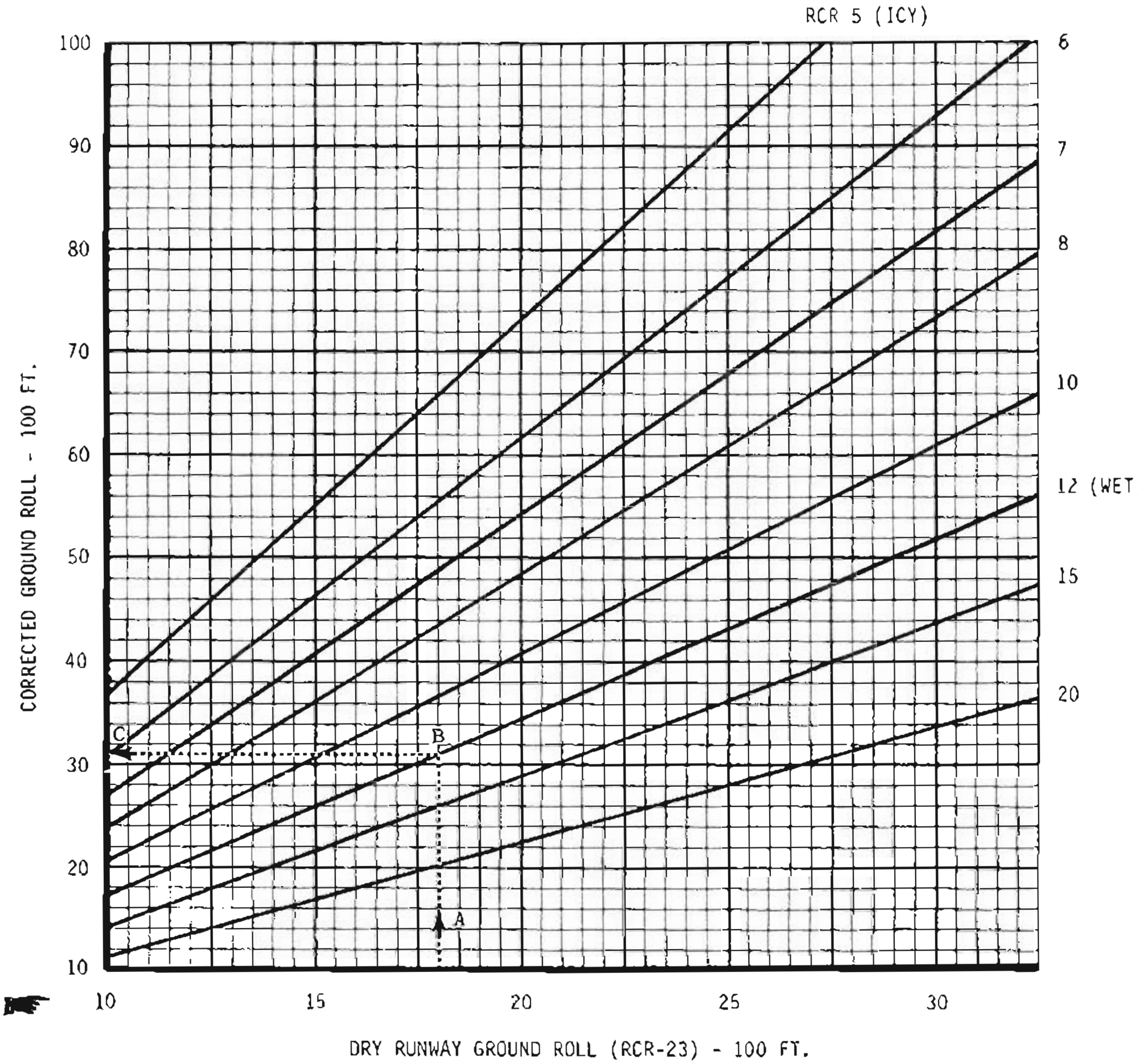


Figure A7-3

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 use of the charts and procedures to fill out the takeoff 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 KIAS.)

REFUSAL SPEED

The refusal speed (KIAS) 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 is 125 KIAS (clean).

LANDING DATA

GROSS WEIGHT

Gross weight of the aircraft at end of mission in pounds.

MINIMUM NOSEWHEEL TOUCHDOWN SPEED

The speed at which the nosewheel should be lowered to 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:

1. This mission is to be a navigational flight to a check point 200 nautical miles due west of the home field and then to destination located 175 nautical miles due north of the check point. Constant altitude cruise at 99% maximum range will be used to the check point and constant altitude cruise at 95% RPM will be used from the check point to destination. A maximum range descent will be planned to arrive over destination at 2000 feet. Cruise altitude will be 20,000 feet. The Air Nautical Miles Per Pound of Fuel Chart (figure A4-6) will be used; however, similar results can be attained using the Constant Altitude Cruise Charts (figures A4-2 through A4-5). For planning purposes, an average gross weight of 5500 pounds will be used. Normal deviations from this weight will result in insignificant changes in performance values.

2. The weather report over the intended route includes a wind of 25 knots from 360° and the temperature at 20,000 feet is -10°C. Temperature deviation during climb is 10°C hotter than standard. Winds for climb and descent are light and variable.

3. The home field conditions are: elevation 500 feet, pressure altitude 600 feet, runway air temperature 30°C, wind 265° magnetic at 22 knots, active runway 22 which is 4000 feet long, surface wet, and RCR = 12.

4. The destination field conditions are: elevation 1000 feet, pressure altitude 1200 feet, runway air temperature 25°C, wind 290° magnetic at 12 knots, active runway is 26 which is 5000 feet long, and RCR = 8.

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

1. Gross weight (Full fuel and crew of two) . 6575 lbs

2. Runway air temperature (Weather data) . . . . 30°C

3. Field pressure altitude . . . 600 ft

4. Effective wind
   Headwind component (from figure A2-1) . . . . 15 kts
   Crosswind component (from figure A2-1) . . . . 15 kts

5. Runway slope 0%

It must also be noted from figure A2-1 that the minimum nosewheel lift-off and touchdown speed is 86 KIAS.

6. Runway conditions reading (RCR) . 12

7. Runway length . . . . 4000 ft

TAKEOFF DATA

1. Critical field length (from figure A2-4) . . . . . . 3510 ft

2. Takeoff run (from figure A2-3) . . . . . . 1450 ft

3. Takeoff speed (from figure A2-2) . . . . . . 90 KIAS

4. Refusal speed (from figures A2-5 and A2-6) . 67 KIAS

5. One engine out, best rate-of-climb speed (from figure A3-4) . . 159 KCAS

6. One engine speed for best angle-of-climb (clean) . . . . . 125 KIAS

LANDING IMMEDIATELY AFTER TAKEOFF

1. Landing roll (from figures A7-2 & A7-3) . 2970 ft

LANDING DATA (DESTINATION)

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.

1. Gross weight . . . . 4990 lbs

2. Minimum Nosewheel Touchdown Speed (from figure A2-1) . . . 70 KIAS

3. Landing roll (from figures A7-2 & A7-3) . 2900 ft

The airborne portion of the mission is planned as follows:

WESTBOUND LEG

The westbound leg consists of a climb from 500 feet above field elevation to cruise altitude and then cruise at speeds for 99% maximum range to the turning point. Air nautical miles per pound of fuel chart will be used for cruise data.

1. Climb from 1000 to 20,000 feet.
   a. Gross weight at start of climb (allow 145 pounds for ground operation and takeoff)
      Engine start gross weight - ground allowance (6575-145) 6430 lb
   b. Fuel used (figure A3-2) (275-13) . . 262 lb
   c. Time required (figure A3-3)(10-1/2) . 9 1/2 min
   d. Horizontal distance covered (figure A3-3)(34-1) . . 36 naut mi

2. Cruise at 20,000 feet
   a. Average gross weight . . 5500 lb
   b. Distance (first leg-climb distance = 200-36) . . . . . . 164 naut mi
   c. Recommended Mach No/TAS (figure A4-6) . . . . .43/272 kts
   d. Calibrated Airspeed (figure A4-1) . . . . . 195 kts
   e. Fuel Flow (figure A4-6) . . . . 860 lb/hr
   f. ETE to turning point (Climb + Cruise = 9 1/2 + 36) . . . . 45 1/2 min
   g. Fuel required to turning point (STTO + climb + cruise = 145 + 262 + 530) . . . . 937 lb

RETURN LEG

The leg from turning point to destination consists of cruise at speeds for 95% RPM and then a maximum range descent to 2000 feet.

1. Cruise at 20,000 feet
   a. Average gross weight . . 5500 lbs
   b. Distance required to descend at end of cruise (figure A6-1) . . . 26.5 naut mi
   c. Cruise distance (To destination - descent distance = 175-26) . 149 naut mi
   d. Recommended Mach No/TAS (figure A4-6) . . . .53/335 kts
   e. Calibrated airspeed (figure A4-1) . . . . . 242 kts
   f. Fuel flow (figure A4-6) . . . . 1200 lb/hr
   g. Ground speed (335-25) . . 310 kts
   h. Time required - Turning point to descent . . . . 29 min
   i. Fuel required - Turning point to descent . . . . 580 lb
2. Descent
   a. Fuel used (figure A6-1) . . . . . . 53 lb
   b. Time required (figure A6-1) . . . . . 7 min

AT DESTINATION

1. ETE after turn point (Cruise + descent = 29 + 7) . . 36 min
2. Total mission time (0+46+0+36) . . . . 1 hr 21 1/2 min
3. Total fuel used (Ground allowance + climb + outbound cruise + return cruise + descent = 145+262+530+53) . . . . . 1570 lb
4. Fuel reserve (Initial fuel - total fuel used = 2000 - 1570) . . . . 430 lb
5. Landing gross weight (Engine start gross weight - total fuel used = 6575-1570) . 5005 lb

The landing data for 4990 lb gross weight may now be entered on the Takeoff and Landing Data Card.

T37B TAKEOFF AND LANDING DATA CARD

CONDITIONS

	Takeoff	Landing
Gross Weight	6575 lbs	5005 lbs
Runway Air Temperature	30°C	25°C
Field Pressure Altitude	600 ft	1200 ft
Wind (Dir & Vel)	265°/22 kn	290°/12 kn
Runway Condition Reading (RCR)	12	8
Runway Length	4000 ft	5000 ft

TAKEOFF

Takeoff Run	1450 ft
Takeoff Speed	90 kts
Minimum Nosewheel Lift-off Speed	83 kts
Refusal Speed	67 kts
Critical Field Length	3510 ft
One Engine Speed for Best Angle-of-Climb (clear)	125 KIAS

LANDING

	Immediately After Takeoff	Final Landing
Gross Weight	6430 lbs	5005 lbs
Minimum Nosewheel Touchdown Speed	83 kts	70 kts
Landing Roll	2970 ft	2900 ft

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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