T.O. 1T-38A-1

USAF SERIES

T-38A
AND
AT-38B

AIRCRAFT

FLIGHT MANUAL

AF33(600)38940 F41608-82-D-A097
F41608-87-D-A288
(AF59-1603 AND LATER AIRCRAFT)

THIS PUBLICATION INCORPORATES SAFETY SUPPLEMENTS T.O. 1T-38A-1SS-150 AND OPERATIONAL SUPPLEMENTS T.O. 1T-38A-1S-149, 151 AND 152. SEE TECHNICAL ORDER INDEX T.O. 0-1-1-5 AND SUPPLEMENTS THERETO FOR CURRENT STATUS OF TRAINER AIRCRAFT FLIGHT MANUALS, SAFETY AND OPERATIONAL SUPPLEMENTS, AND FLIGHT CREW CHECKLIST.

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1 JULY 1987

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CURRENT FLIGHT CREW CHECKLIST

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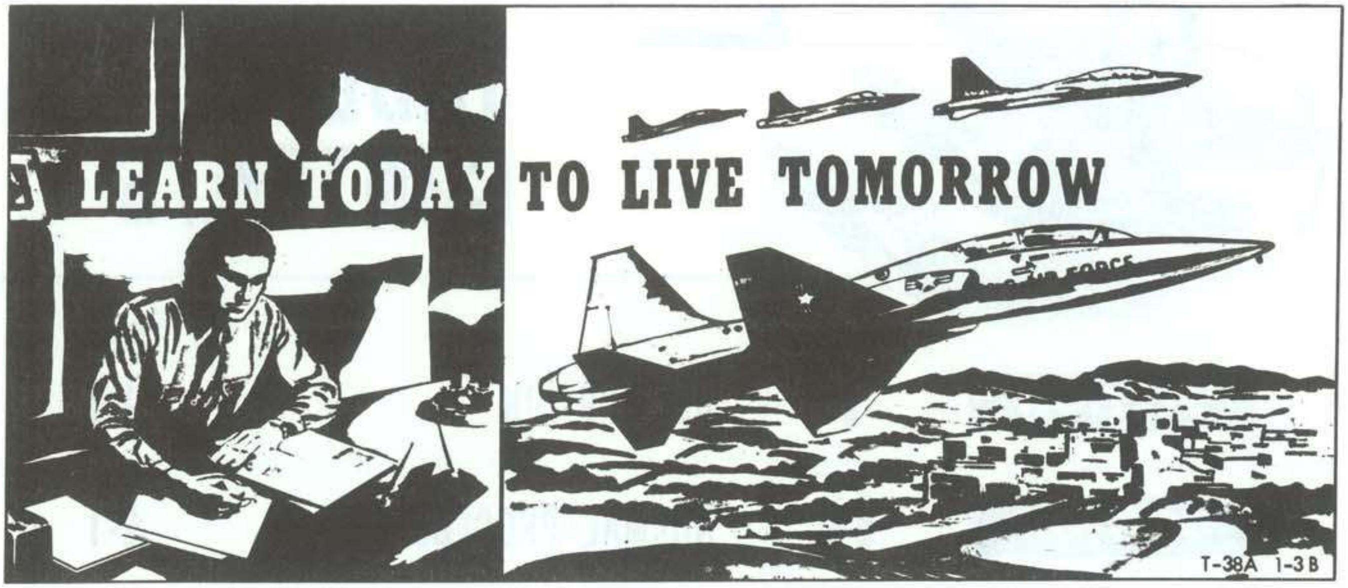


SCOPE. This manual contains all the information necessary for safe and efficient operation of the T-38A aircraft. These instructions do not teach basic flight principles, but are designed to provide you with a general knowledge of the aircraft, its flight characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and elementary instructions have been avoided.

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 as specified in this manual are prohibited unless specifically covered herein. Clearance must be obtained from San Antonio ALC/MMUA, Kelly AFB TX 78241-5000, through the respective major command before any questionable operation is attempted which is not specifically permitted in this manual.

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, the title block of each safety and operational supplement, and all status pages contained in the flight manual or attached to formal safety and operational supplements.

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 regardless of whether it is safety or operational. File supplements in reverse numerical order in the front of the Flight Manual.

CHECKLISTS. The flight manual contains itemized procedures with necessary amplifications. The checklist contains itemized procedures without the amplifications. Whenever a supplement affects the abbreviated checklist, write in the applicable change on the affected checklist page or if a checklist page is included, cut it out and insert it in your checklist.

HOW TO GET PERSONAL COPIES. Each flight crew member is entitled to personal copies of the flight manual, supplements, and checklist. Your publication distribution officer should be contacted to fill your technical order request. T.O. 00-5-1 and T.O. 00-5-2 give detailed information for ordering publications.

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, using AF Form 847 in accordance with T.O. 00-5-1, through your Command Headquarters, to: San Antonio ALC/MMUA, Kelly AFB, Texas 78241-5000.

CHANGE SYMBOLS. Changed text is indicated by a black vertical line in either margin of the page. The change symbol shows what part has been changed in the current change.

WARNINGS, CAUTIONS, AND NOTES. For your information, the following definitions apply to the "Warnings," "Cautions," and "Notes" found throughout the manual:

WARNING

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

CAUTION

Operating procedures, practices, etc, which if not strictly observed will result in damage to equipment.

NOTE

An operating procedure, condition, etc, which it is essential to emphasize.

GROUP CODING.

Aircraft having different or additional systems and equipment have been block coded to avoid listing aircraft serial numbers. The Air Force serial numbers of the aircraft included in each block are as follows:

Block	Air Force Serial Numbers
20	AF59-1603 thru AF59-1606
25	AF60-547 thru AF60-553
30	AF60-554 thru AF60-561
35	AF60-562 thru AF60-596
40	AF61-804 thru AF61-947
45	AF62-3609 thru AF62-3752
50	AF63-8111 thru AF63-8247

Block	Air Force Serial Number
55	AF64-13166 thru AF64-13305
60	AF65-10316 thru AF65-10475
65	AF66-4320 thru AF66-4389 and AF66-8349 thru AF66-8404
70	AF67-14825 thru AF67-14859 and AF67-14915 thru AF67-14958
75	AF68-8095 thru AF68-8217
80	AF69-7073 thru AF69-7088
85	AF70-1549 thru AF70-1591 and AF70-1949 thru AF70-1956

US NAVY AIRCRAFT.

The following aircraft operated by the US Navy are referred to in the manual by block numbers or by their Air Force serial numbers. These USAF serial numbers correspond to the following USN Bureau numbers:

USAF Serial Number	USN Bureau Number
65-0327	10327
68-8209	158198
68-8212	158199
68-8214	158200
68-8216	158201

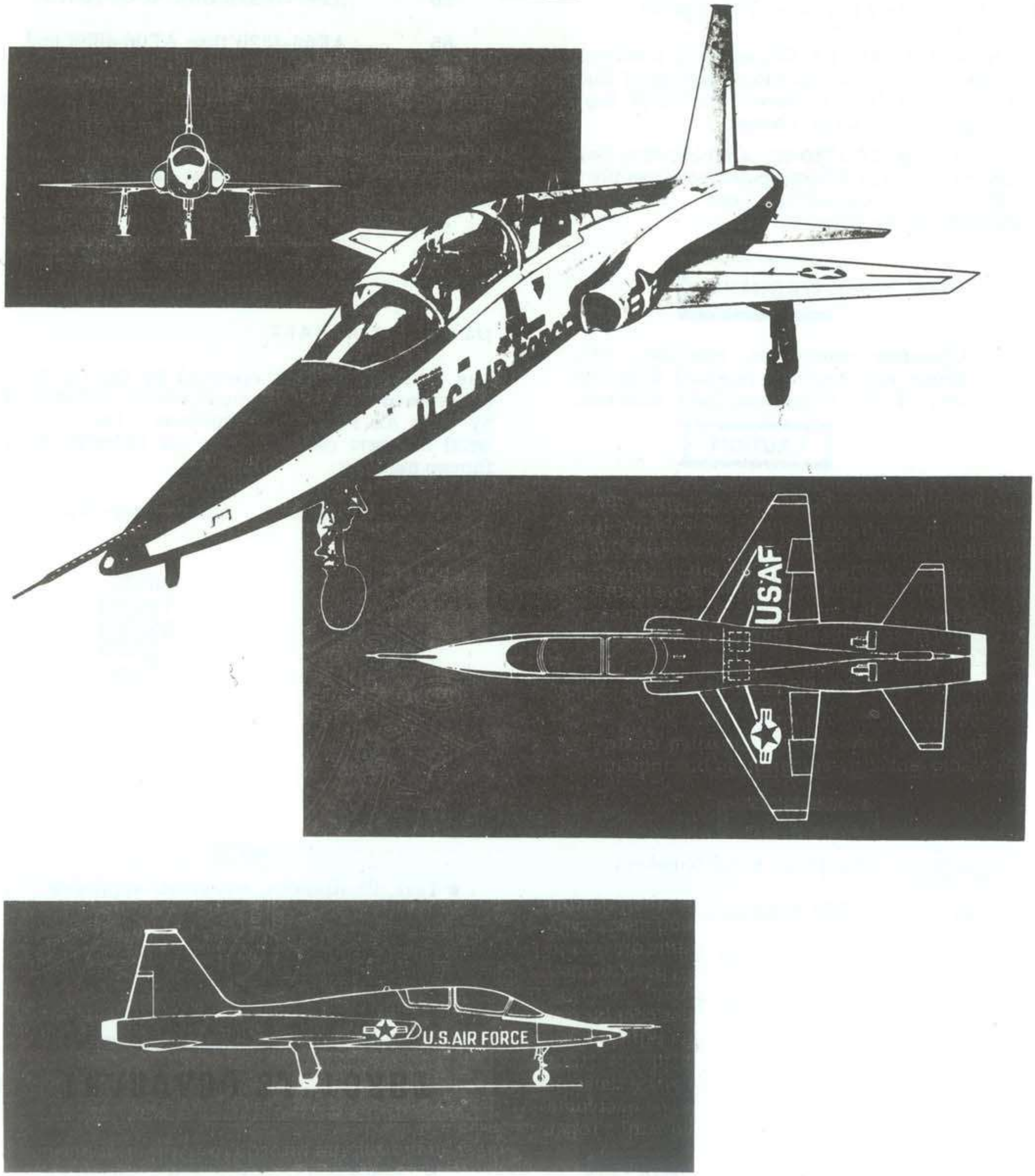
CODE SYSTEM

Ⓐ T-38A
Ⓑ AT-38B

NOTE

- Text, illustrations, and charts applicable to all aircraft are not coded.
- When complete paragraphs are affected, the appropriate code will appear opposite the heading.
- Notes, cautions, and warnings are treated as individual paragraphs with regard to coding.
- Steps of a procedure that have the code preceding the action item apply only to the individual model aircraft.

THE AIRCRAFT



DESCRIPTION

SECTION I

T-38A 1-100

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THE AIRCRAFT.

The T-38A aircraft, produced by Northrop Corporation, Aircraft Division, is a two-place, twin-turbojet supersonic trainer. Each cockpit contains an individual jettisonable canopy and ejection seat. A cabin air-conditioning and pressurization system conditions and pressurizes the air in both cockpits. The fuselage is an area-rule (coke bottle) shape, with moderately swept-back wings and empennage. The aircraft is equipped with an all-movable horizontal tail. A speed brake is located on the lower surface of the fuselage center section. The tricycle landing gear has a steerable nosewheel. All flight control surfaces are fully powered by two independent hydraulic systems.

The AT-38B is modified by the addition of a centerline pylon and a noncomputing gunsight. Some aircraft have the MXU-553 flight loads recorder installed. Cockpits contain additional controls for the armament system.

AIRCRAFT DIMENSIONS.

The overall dimensions of the aircraft with normal tire and strut inflation are:

Length	46 ft 4 in.
Wingspan	25 ft 3 in.
Height	12 ft 11 in.
Tread	10 ft 9 in.
Wheelbase	19 ft 5 in.

GENERAL ARRANGEMENT DIAGRAM
(TYPICAL)

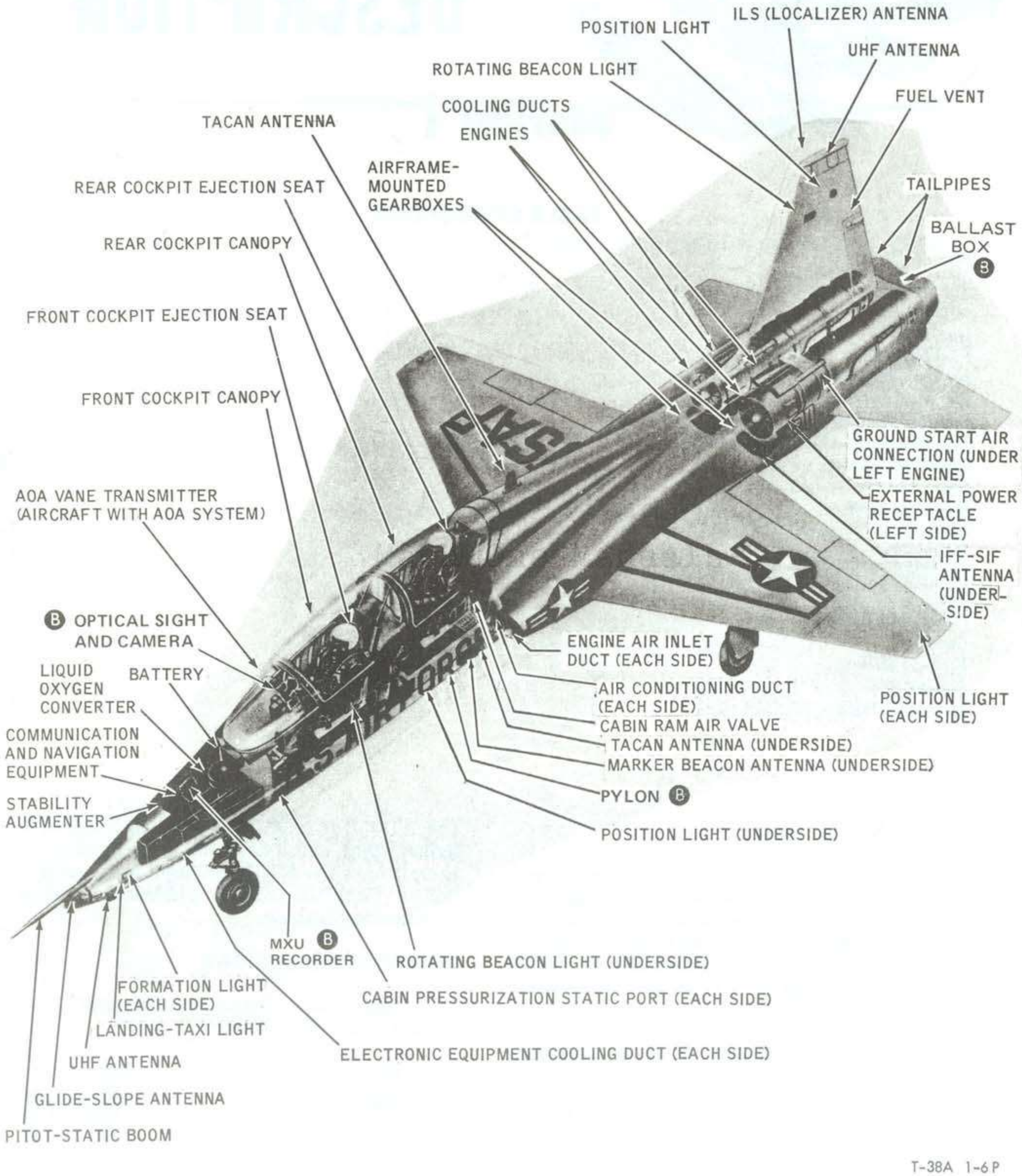


Figure 1-1.

SOLID BLACK PLATE NO. T-38A 1-6P

J85-GE-5 SERIES ENGINE

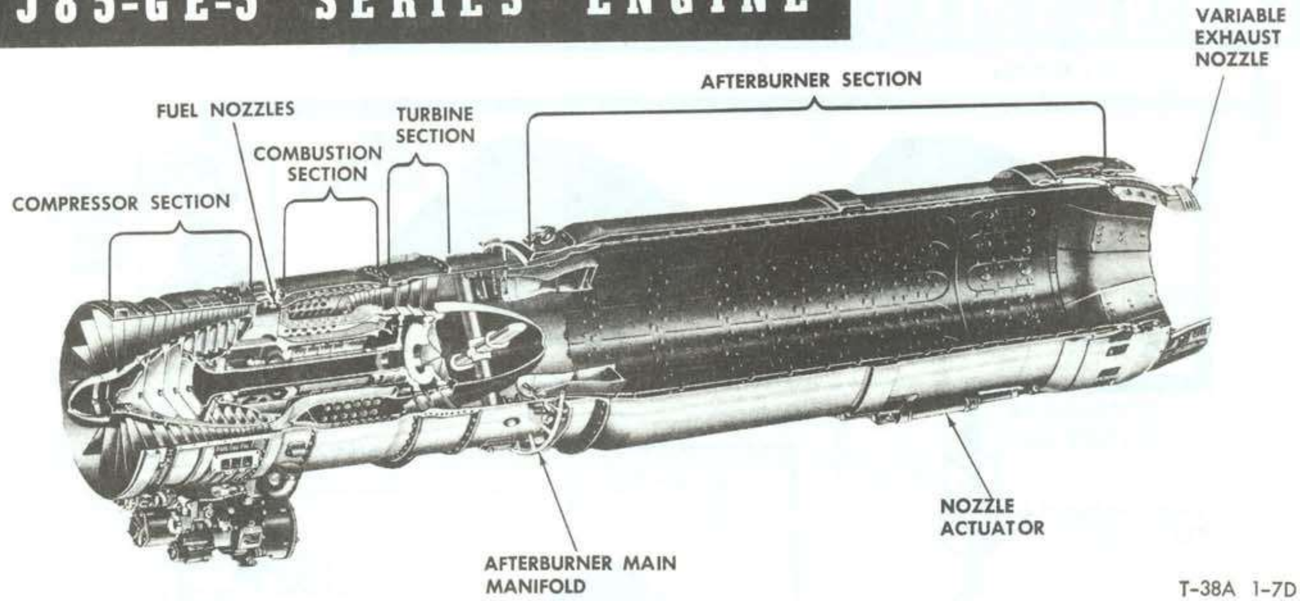


Figure 1-2.

AIRCRAFT GROSS WEIGHT.

The gross weight of the aircraft fully fueled and including two aircrew is approximately 12,500 pounds. The average gross weight of the B with the AF-B-37K-1 and four practice bombs is 12,700 pounds. The weight with the SUU-20 with six practice bombs and four 2.75 " rockets is 13,060 pounds. The weight with a fully loaded SUU-11 is 12,850 pounds. These weights shall not be used for computing aircraft performance or for any type operation.

ENGINES.

The aircraft is powered by two J85-GE-5 series, eight-stage, axial-flow, turbojet engines (figure 1-2). Sea level, standard day, static thrust for an installed engine is approximately 2050 pounds at MIL power and approximately 2900 pounds at full MAX power. Air enters thru the variable inlet guide vanes, which direct the flow of air into the compressor. The automatic positioning of the inlet guide vanes and air bleed valves assists in regulating compressor airflow to maintain compressor stall-free operation. Two turbine wheels and the compressor rotor stages are mounted on the same shaft. The exhaust gases are discharged thru a variable area exhaust nozzle. An exhaust gas temperature (T_5) sensing system varies the nozzle area to maintain exhaust gas temperature within limits at both MIL and MAX range throttle positions.

ENGINE FUEL CONTROL SYSTEM.

Each engine has a main fuel control system and an afterburner fuel control system (figure 1-3). The main fuel control system consists primarily of a two-stage engine-driven pump, a main fuel control, and an over-speed governor.

MAIN FUEL CONTROL.

The main fuel control selects engine power by metering fuel to the main engine combustor as a function of throttle position, engine inlet air temperature, compressor discharge pressure, and engine speed. The control performs the following functions automatically:

a. Regulates engine speed at the selected throttle position, limit engine minimum speed at IDLE and engine maximum speed at MIL and MAX range power.

b. Limits main engine fuel flow to safe levels during starts and during rapid throttle changes, providing protection from overtemperature, stalls, and flameouts.

c. Limits main engine fuel flow to a preset minimum by holding combustor fuel-air ratio at or above the proper level for low power settings and for engine restart during flight.

ENGINE FUEL CONTROL SYSTEM

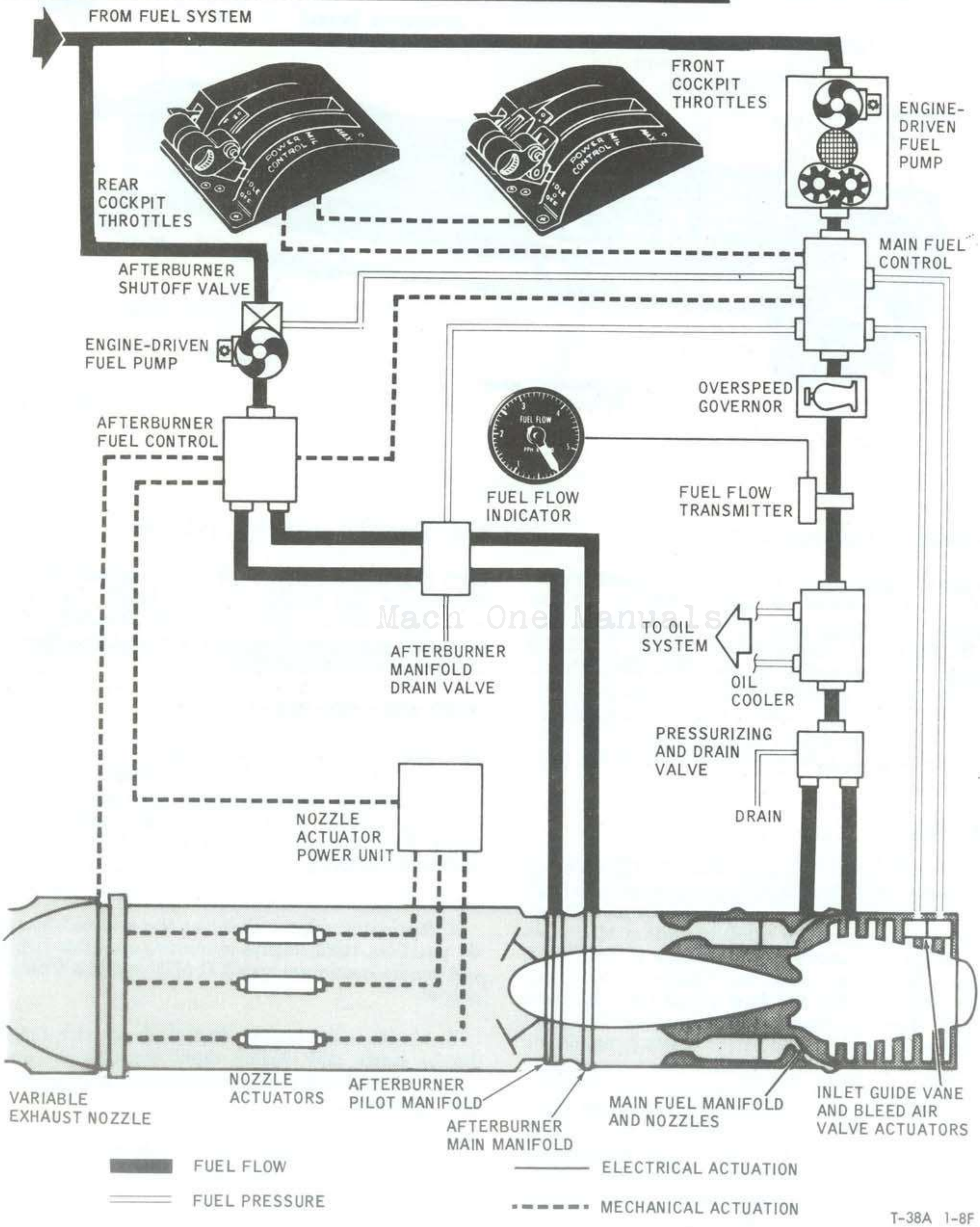


Figure 1-3.

d. Correctly positions the compressor inlet guide vanes and air bleed valves.

AFTERBURNER SYSTEM.

Each afterburner system contains an igniter plug, afterburner pilot manifold, afterburner main manifold, and afterburner fuel pump and control. Afterburner operation is initiated by advancing throttle from the MIL detent into the MAX range. Thrust is variable within MAX range. The total rate of fuel flow at full MAX position for each engine at sea level on a standard day is approximately 7300 pounds per hour with the aircraft at rest and 11,400 pounds per hour at mach 1.

AFTERBURNER FUEL CONTROL.

The primary function of the afterburner fuel control is to initiate and schedule fuel flow to the afterburner main and pilot spraybars. Fuel flow is metered as a function of throttle position and compressor discharge pressure. The control also senses and regulates variable area nozzle position and automatically limits fuel flow to prevent overtemperature in case of a nozzle actuating system malfunction or during rapid throttle advances into MAX range.

THROTTLES.

The throttles (figure 1-4) are provided with a roller ramp-type force gradient, which must be overcome to move the throttles from MIL into MAX range or from IDLE to OFF. The throttles in the front cockpit are equipped with fingerlifts which must be raised before the throttles in either cockpit can be retarded past the IDLE roller ramp to OFF. Friction is ground adjustable only. The throttles, when placed at OFF, mechanically shut off fuel to the engine at the main fuel control and electrically shut off fuel to the engine at the fuel shutoff valves.

WARNING

Avoid fingerlift actuation to preclude inadvertent engine shutdown when retarding throttle toward idle.

NOTE

Throttle movement should be conservative to help minimize blade failures. Abrupt or rapid throttle movements should be avoided. Throttle bursts (throttle movement in one second or less) from idle RPM to MIL should be avoided if possible. These procedures will allow the variable exhaust nozzle to keep pace and match the fuel flow and help to minimize the possibility of compressor blade failures.

PNEUMATIC SYSTEM.

Air taken from the eighth stage compressor is used for hydraulic reservoir and cabin pressurization, air conditioning systems, canopy defogging, engine anti-icing, canopy seal inflation, and for the anti-G system.

ENGINE START AND IGNITION SYSTEM.

Engine starts require compressor motoring (low pressure air supply), DC power to energize the ignition holding relay and AC power for ignitor firing. For ground starts, a manually operated diverter valve, mounted on the left engine, is externally positioned by the ground crew to direct the flow of air to the selected engine during the start cycle. Two engine start pushbuttons (figures 1-9, 1-10) are located in the left subpanel of each cockpit. Momentarily pushing the start button for the selected engine arms the ignition circuit (ignition timer and holding relay) for approximately 30 seconds. Moving the throttle to IDLE energizes the ignition exciter, firing main and afterburner igniters and starting fuel flow to the engine. Any delay in moving the throttle to IDLE after pushing

THROTTLE QUADRANT

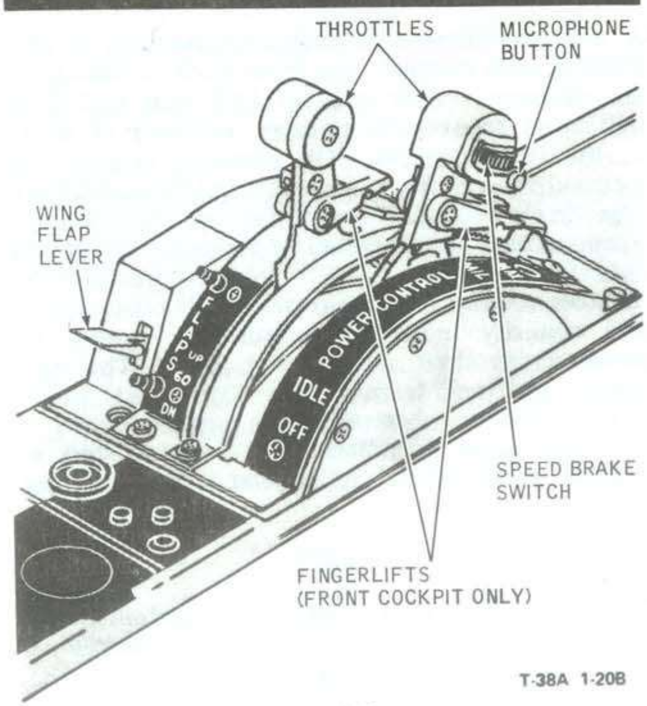


Figure 1-4.

the start button will decrease the available ignition time from the 30 second cycle by an equal amount. Momentarily pressing the start button again during a 30 second cycle will not reset the ignition timer and start another cycle since the first actuation locks-in the cycle (holding relay energized) until the timer expires. Without any start button ignition cycle operating, moving the throttle to the MAX range energizes the main and afterburner igniters for a 30 second cycle. Subsequently retarding the throttle out of MAX range at any time during the 30 second cycle will stop the igniters from firing, reset the timer (bypassing the ignition holding relay) and enable the ignition system for a new cycle. The throttle must be retarded from MAX to below MIL to reset the timer and returned to MAX to provide another 30 second cycle. However, pressing the start button within 30 seconds before or after selecting MAX will only provide ignition for the duration of the first 30 second ignition cycle selected and disables the MAX ignition reset feature until the first selected (start button or MAX) 30 second ignition cycle has expired. With the throttle at IDLE or above, the igniters may be energized at anytime for longer than 30 seconds by selecting and holding the appropriate start button. AC power from a battery-operated static inverter (figure 1-15) may be used for ground (one engine) or air starts (either engine). For battery start, the right engine should be started first, as the static inverter supplies ac power for the right engine instruments during the start cycle.

ENGINE INSTRUMENTS.

A full complement of engine instruments is provided in each cockpit. The front cockpit indicators are primary. Rear cockpit EGT and fuel flow indicators repeat the pointer positions of those in the front cockpit. Oil pressure, nozzle, and tachometer indicators represent independent readings from a single transmitter on each engine. Tachometers are powered independently of the aircraft electrical system. Nozzle position indicators require DC power only. All other engine and quantity indicating instruments require AC power from their respective busses. The right engine instruments may also receive AC power from a battery powered static inverter which is activated upon initiation of the engine start sequence when normal AC power is not available.

NOTE

Some front cockpit indicators contain an ON or OFF flag system which operates when AC power is applied.

OIL SYSTEM.

Each engine has an independent integral oil supply and lubrication system. The reservoir has a normal oil capacity of 4 quarts and an air expansion space of 1 quart. Heat from the engine oil is dissipated thru a fuel-oil cooler. Oil consumption thru engine operation and overboard venting caused by condensation and aerobatic flight should not exceed 1 pint per hour. See figure 1-26 for oil specification.

FUEL SYSTEM.

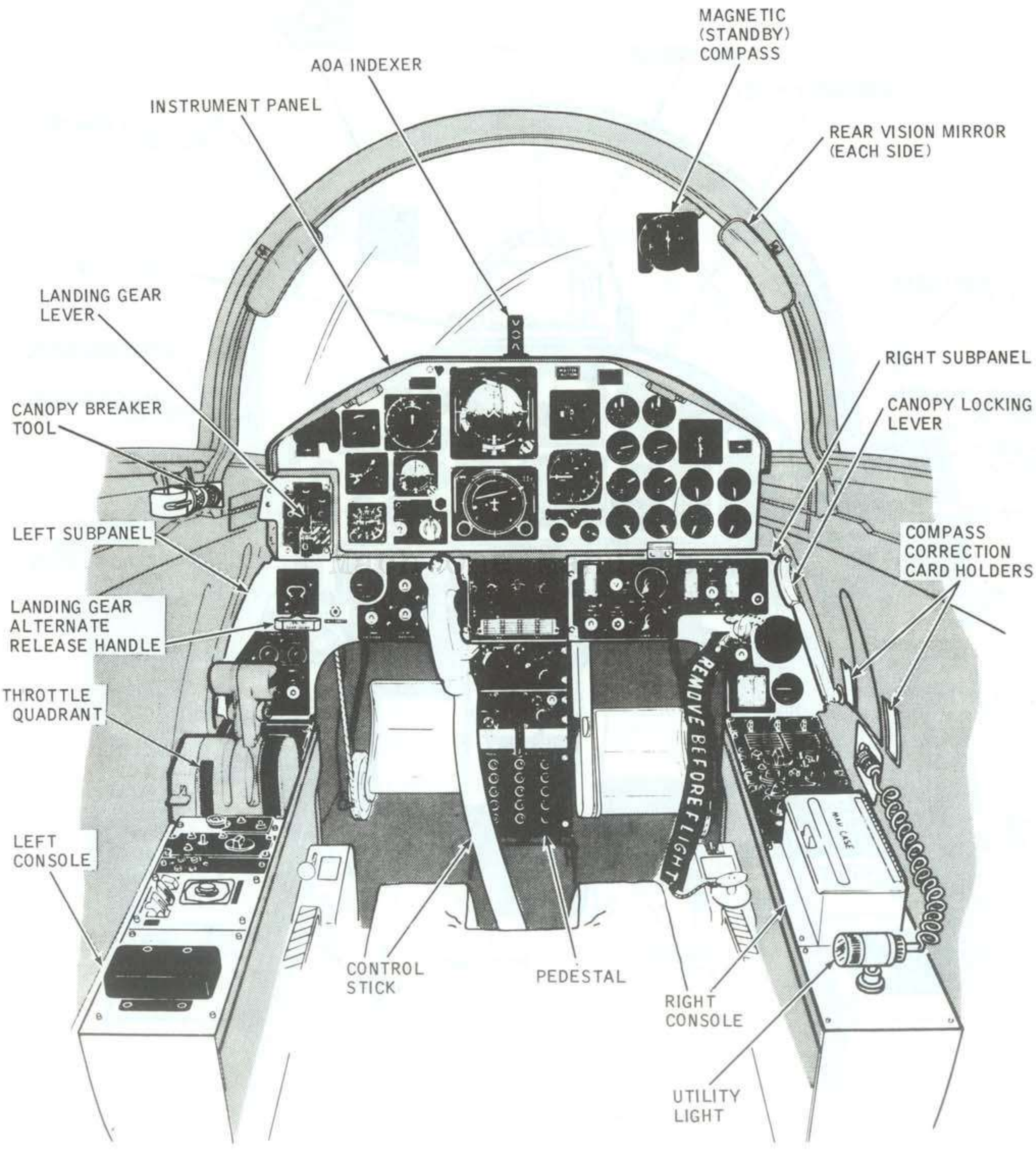
The aircraft has an independent fuel supply system for each engine (figure 1-13), interconnected by a dc electrically operated crossfeed valve. The left and right system fuel cells are in the fuselage. The left engine is supplied by the forward fuselage cell and the forward and aft dorsal cells; the right engine, by the center and aft fuselage cells. A single ac electrically driven fuel boost pump in each system supplies fuel under pressure to the engine-driven fuel pump during normal operation. The left system boost pump is in the inverted flight compartment of the forward fuselage cell, and the right system boost pump is in the inverted flight compartment of the aft fuselage cell. Without the aid of the boost pump, each engine can be supplied with fuel by gravity flow from its respective system. Normally, sufficient fuel will flow by gravity to maintain MAX power from sea level up to approximately 25,000 feet; however, by specifications, gravity flow is guaranteed only to 6,000 feet, and flameouts have occurred as low as 15,000 feet. Thru crossfeed operation, both systems may supply fuel to either engine with or without boost pump pressure (one engine off, crossfeed on, boost pumps functioning or failed). Also, one system under boost pump pressure will supply fuel to both engines. (Both engines operating, crossfeed on, one boost pump OFF.) Caution lights indicate fuel low level and low pressure conditions. See figure 1-26 for fuel specification and for fuel quantity data. Refer to fuel management, Section VII, for proper cross-feed operation.

BOOST PUMP SWITCHES.

Two guarded boost pump switches (figure 1-13), one for each fuel system, are located on the right subpanel of the front cockpit. All fuel pump circuit breakers (figure 1-16) should be closed before operating boost pumps.

COCKPIT ARRANGEMENT—FRONT (TYPICAL)

A

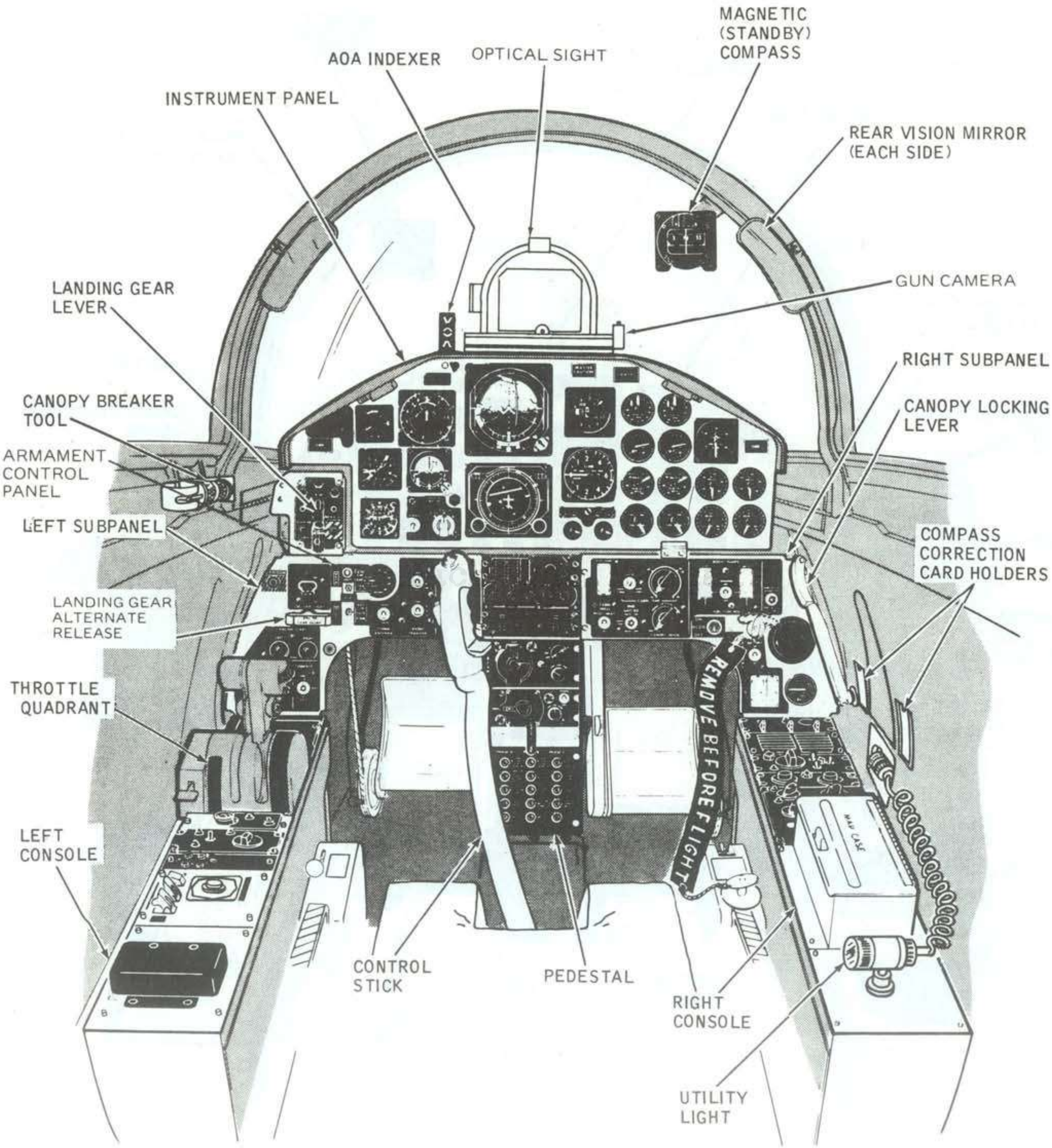


COCKPIT ARRANGEMENT – FRONT (TYPICAL)

Figure 1-5. (Sheet 1 of 2)

COCKPIT ARRANGEMENT — FRONT (TYPICAL)

B



COCKPIT ARRANGEMENT — FRONT (TYPICAL)

Figure 1-5. (Sheet 2 of 2)

COCKPIT ARRANGEMENT—REAR (TYPICAL)

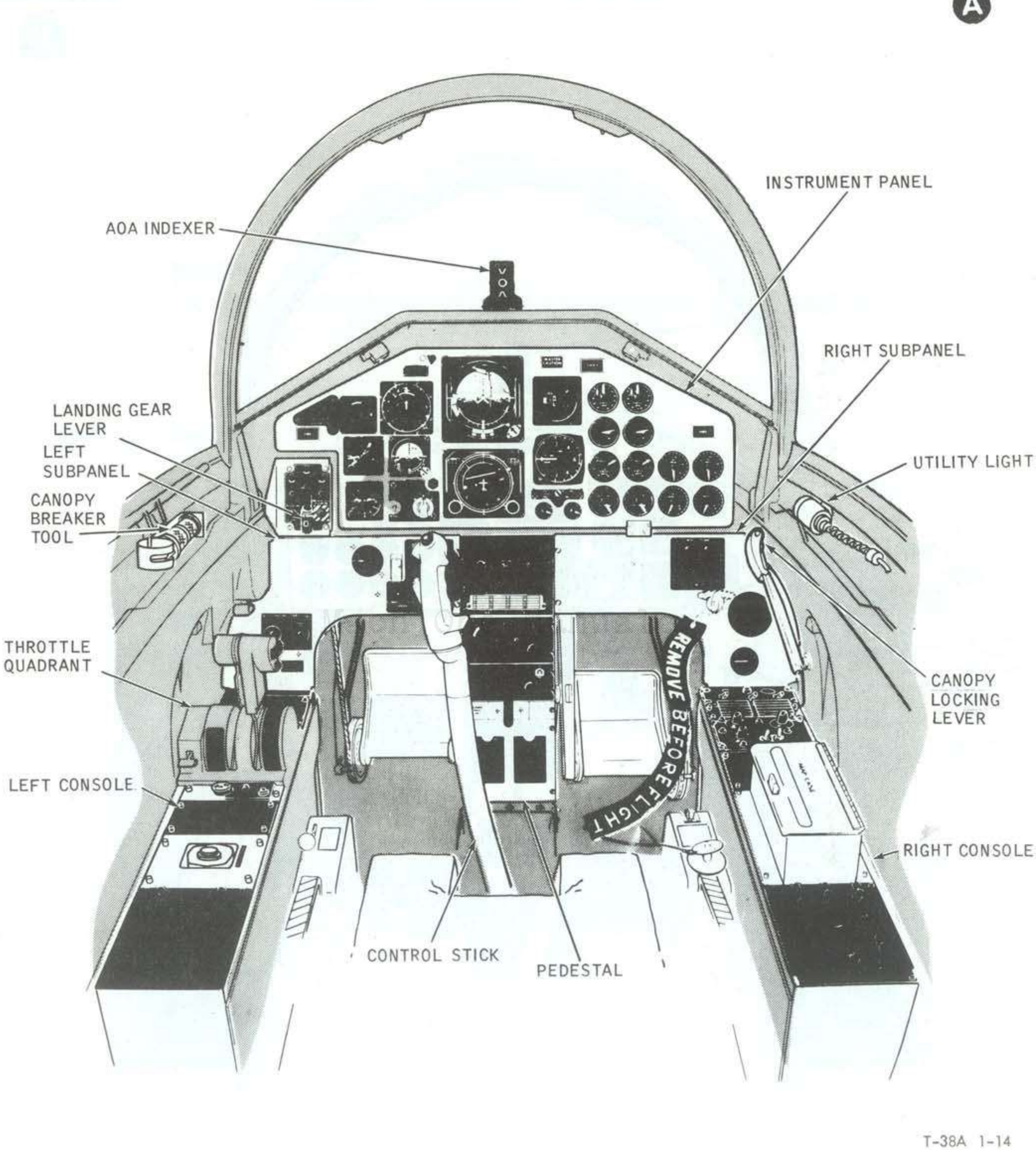


Figure 1-6. (Sheet 1 of 2)

COCKPIT ARRANGEMENT—REAR (TYPICAL)

B

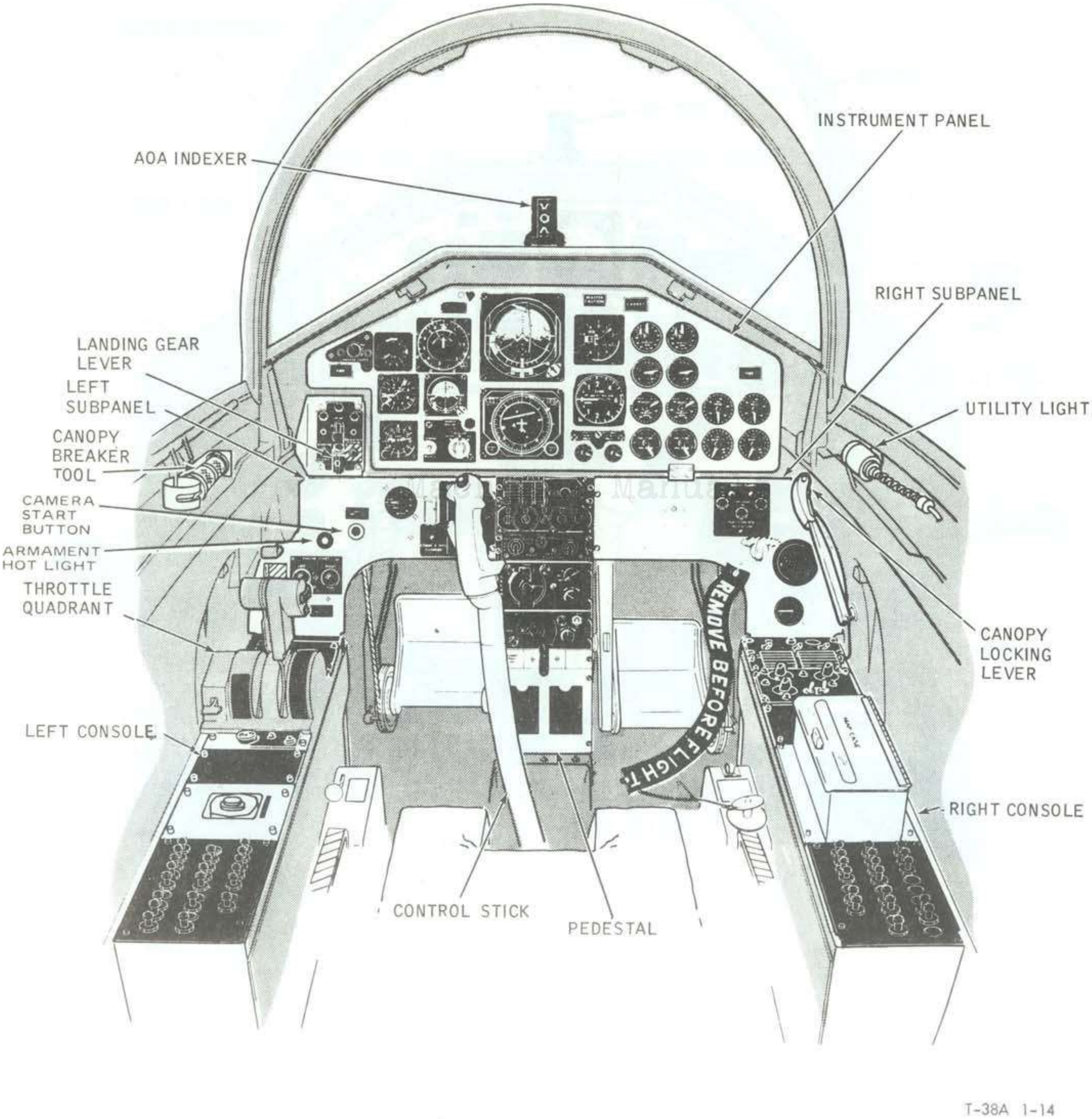
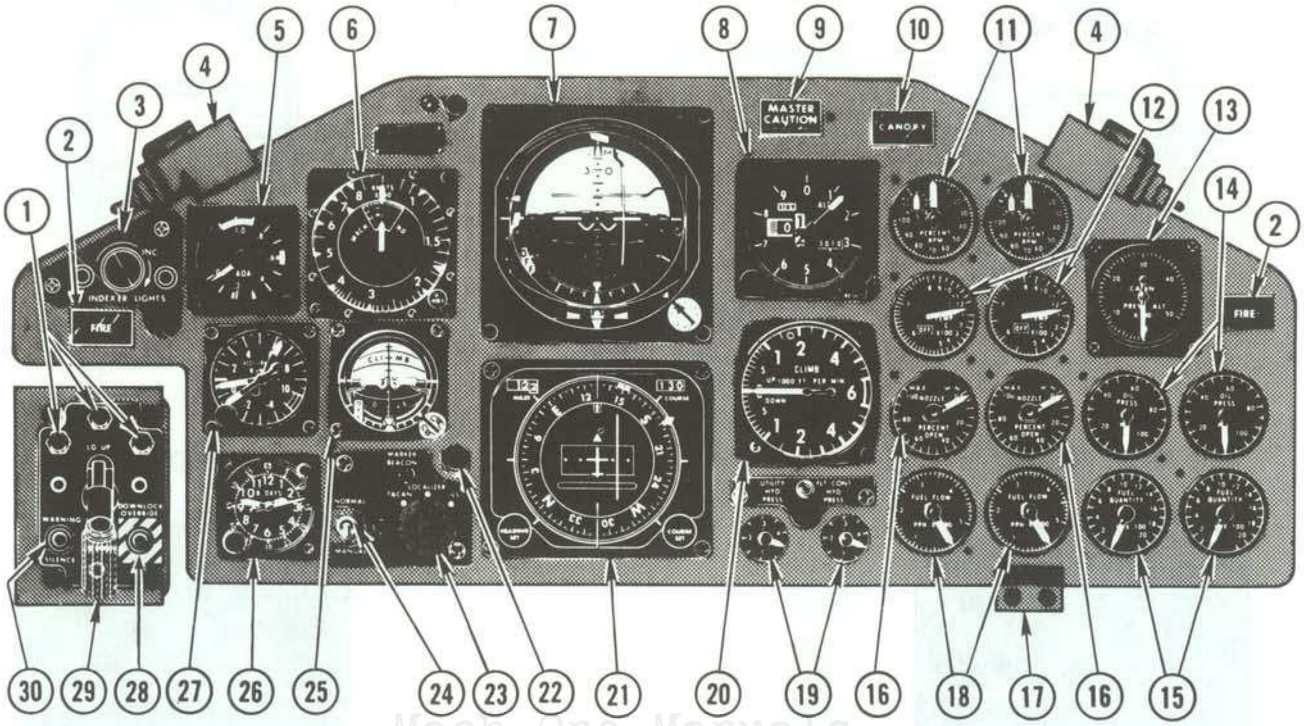
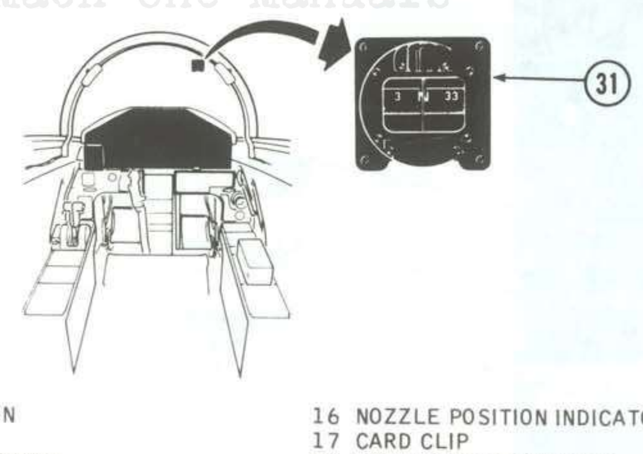


Figure 1-6. (Sheet 2 of 2)

INSTRUMENT PANEL—BOTH COCKPITS (TYPICAL)

AIRCRAFT WITH AOA SYSTEM





1 LANDING GEAR POSITION INDICATOR LIGHTS
2 ENGINE FIRE WARNING LIGHT
3 AOA INDEXER DIMMER
4 FLOODLIGHT
5 AOA INDICATOR
6 AIRSPEED/MACH INDICATOR
7 ATTITUDE DIRECTOR INDICATOR
8 ALTIMETER
9 MASTER CAUTION LIGHT
10 CANOPY WARNING LIGHT
11 ENGINE TACHOMETERS
12 EXHAUST GAS TEMPERATURE INDICATORS (Warning flags front cockpit only)
13 CABIN ALTIMETER (Front cockpit only)
14 OIL PRESSURE INDICATORS
15 FUEL QUANTITY INDICATORS
16 NOZZLE POSITION INDICATOR
17 CARD CLIP
18 FUEL FLOW INDICATORS
19 HYDRAULIC PRESSURE INDICATORS
20 VERTICAL VELOCITY INDICATOR
21 HORIZONTAL SITUATION INDICATOR
22 MARKER BEACON LIGHT
23 NAVIGATION MODE SWITCH
24 STEERING MODE SWITCH
25 STANDBY ATTITUDE INDICATOR
26 CLOCK
27 ACCELEROMETER
28 DOWNLOCK OVERRIDE BUTTON
29 LANDING GEAR LEVER
30 LANDING GEAR WARNING SILENCE BUTTON
31 MAGNETIC COMPASS (Front cockpit only)

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Figure 1-7.

PEDESTALS (TYPICAL)

A B

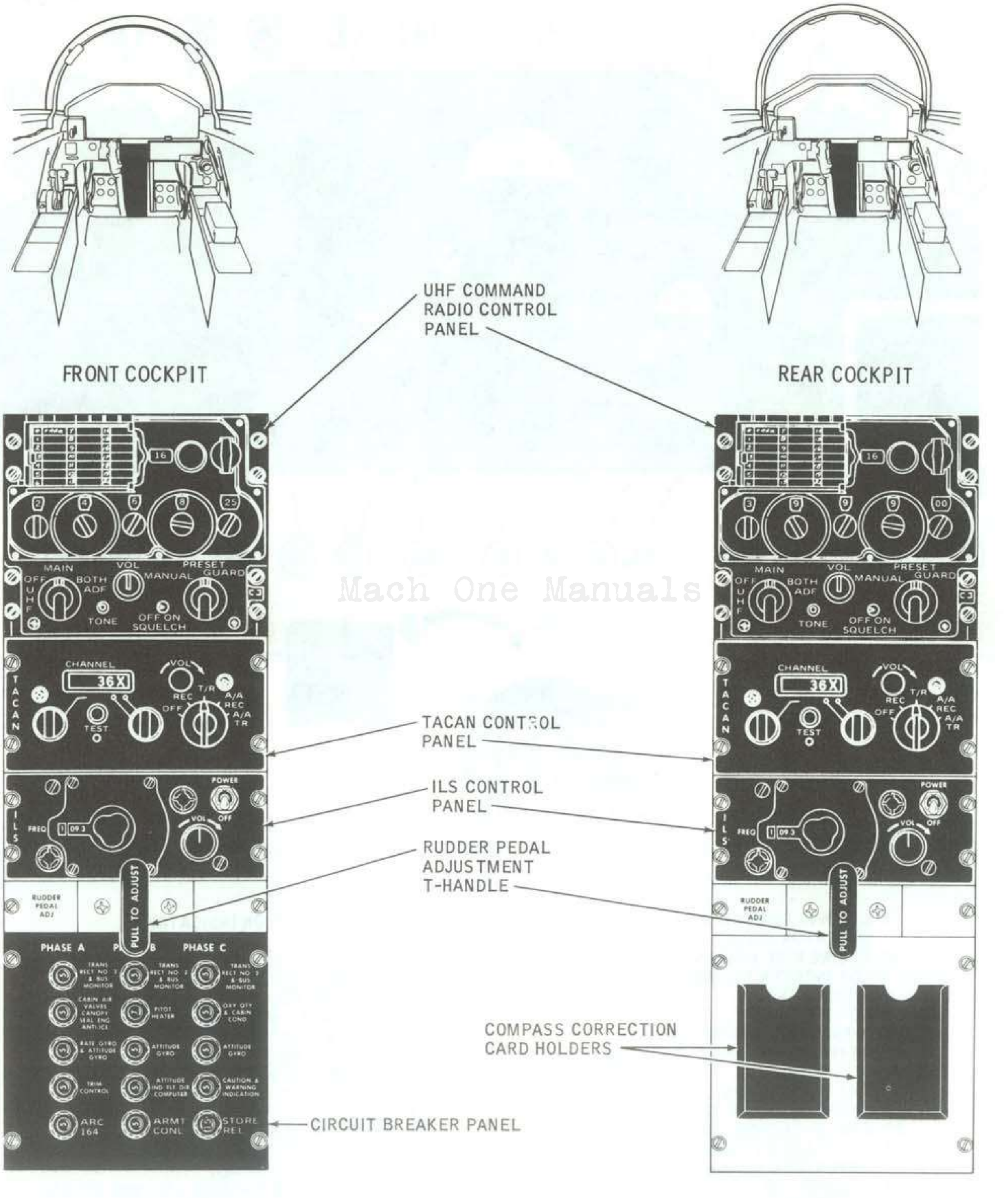


Figure 1-8.

SUBPANELS—FRONT COCKPIT (TYPICAL)

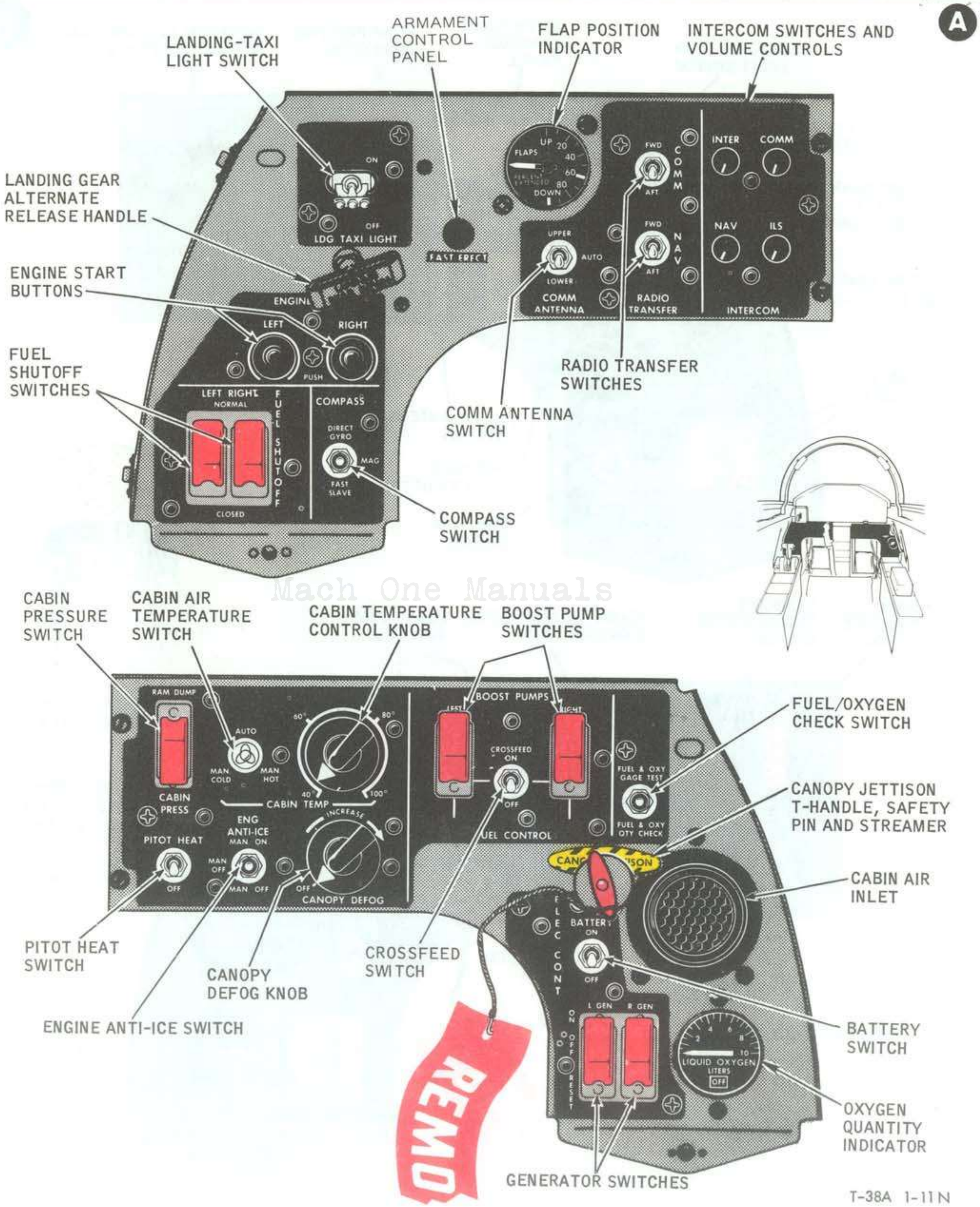


Figure 1-9. (Sheet 1 of 2)

SUBPANELS—FRONT COCKPIT (TYPICAL)

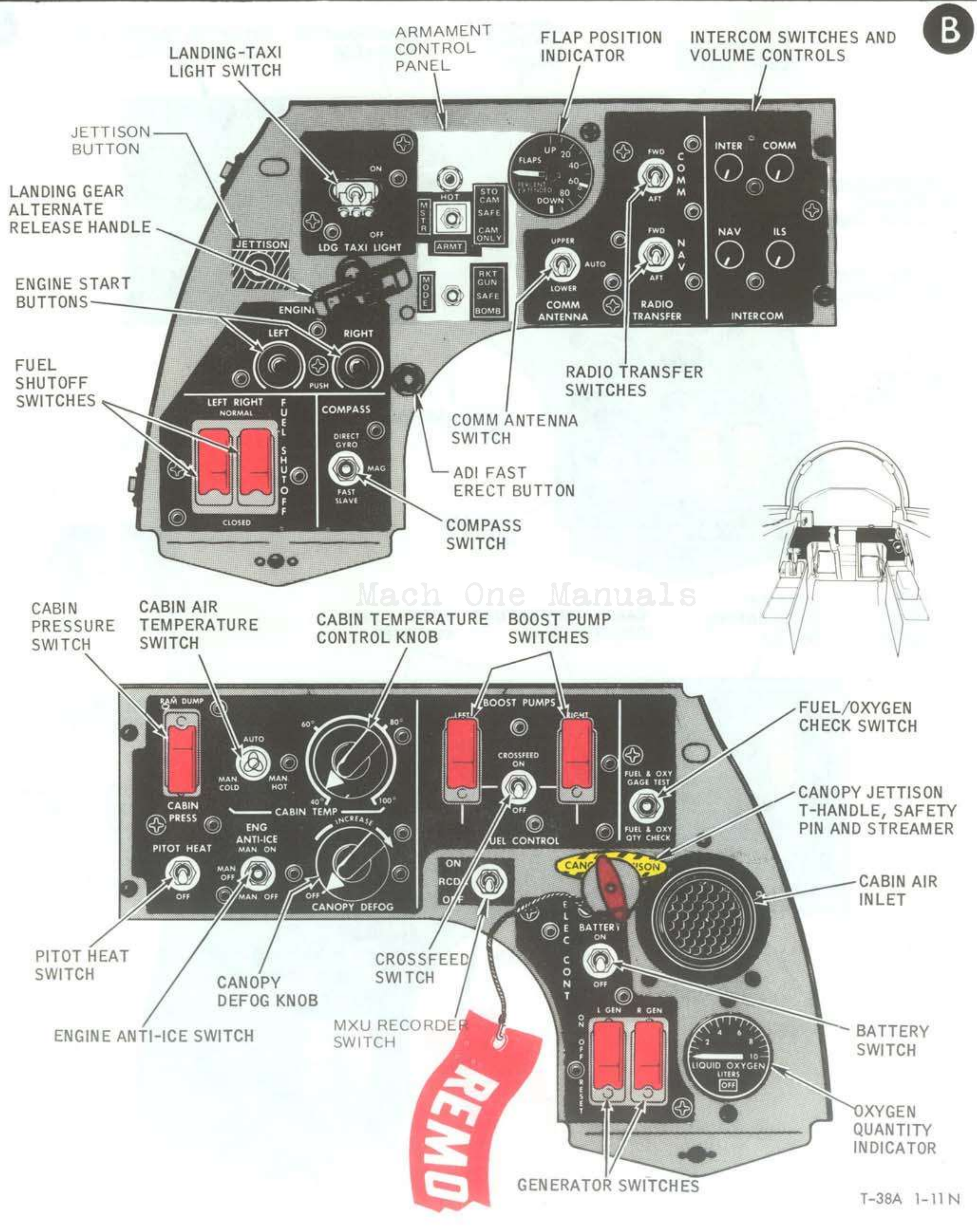
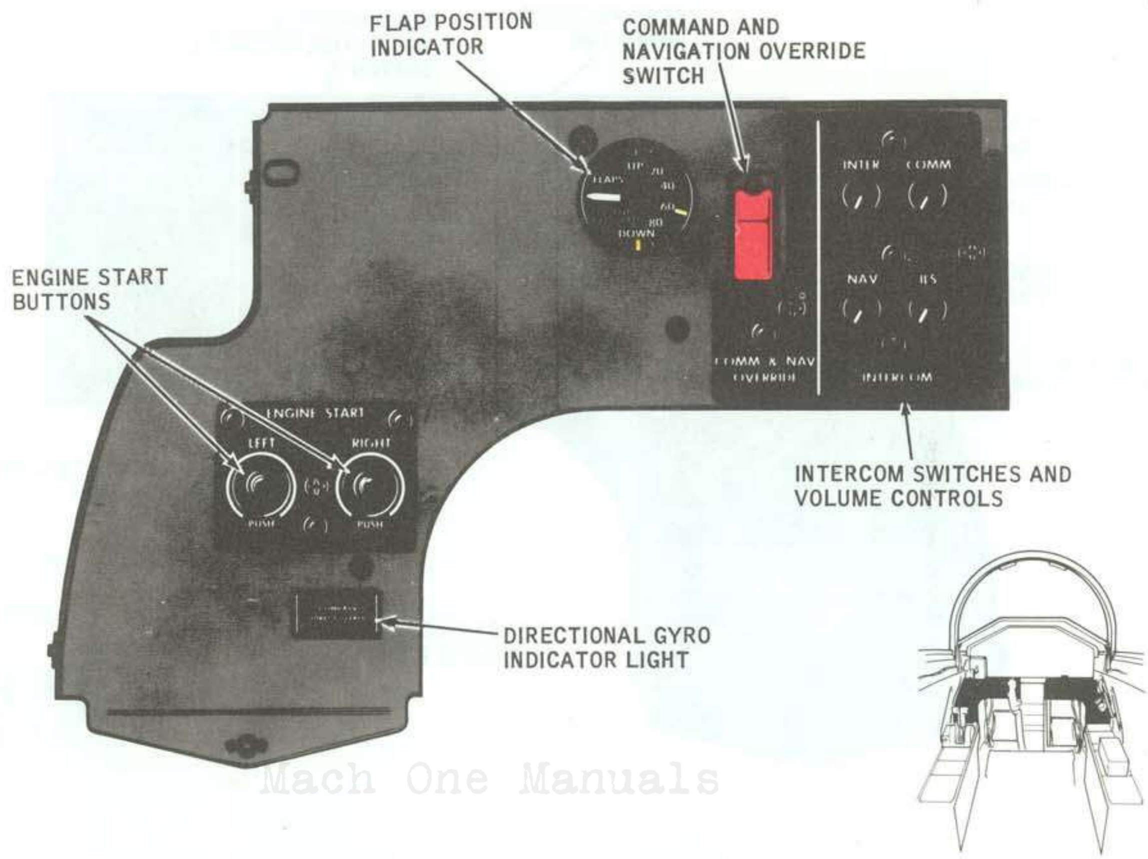


Figure 1-9. (Sheet 2 of 2)

SUBPANELS—REAR COCKPIT (TYPICAL)

A



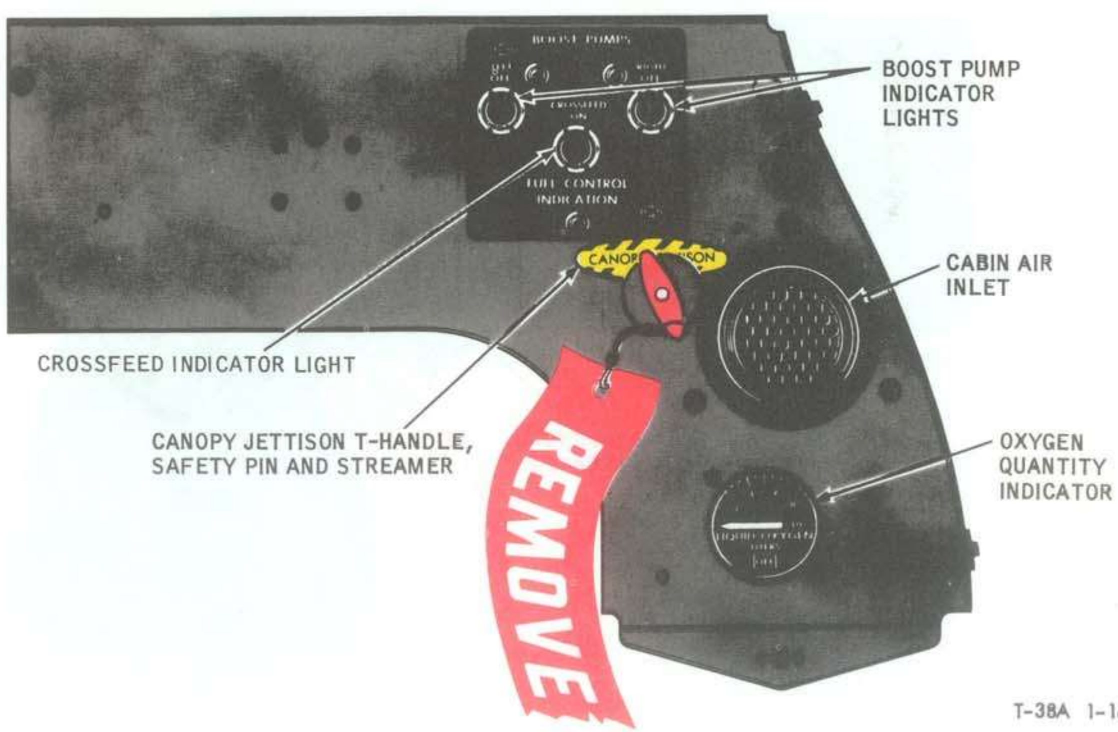


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Figure 1-10. (Sheet 1 of 2)

SUBPANELS—REAR COCKPIT (TYPICAL)

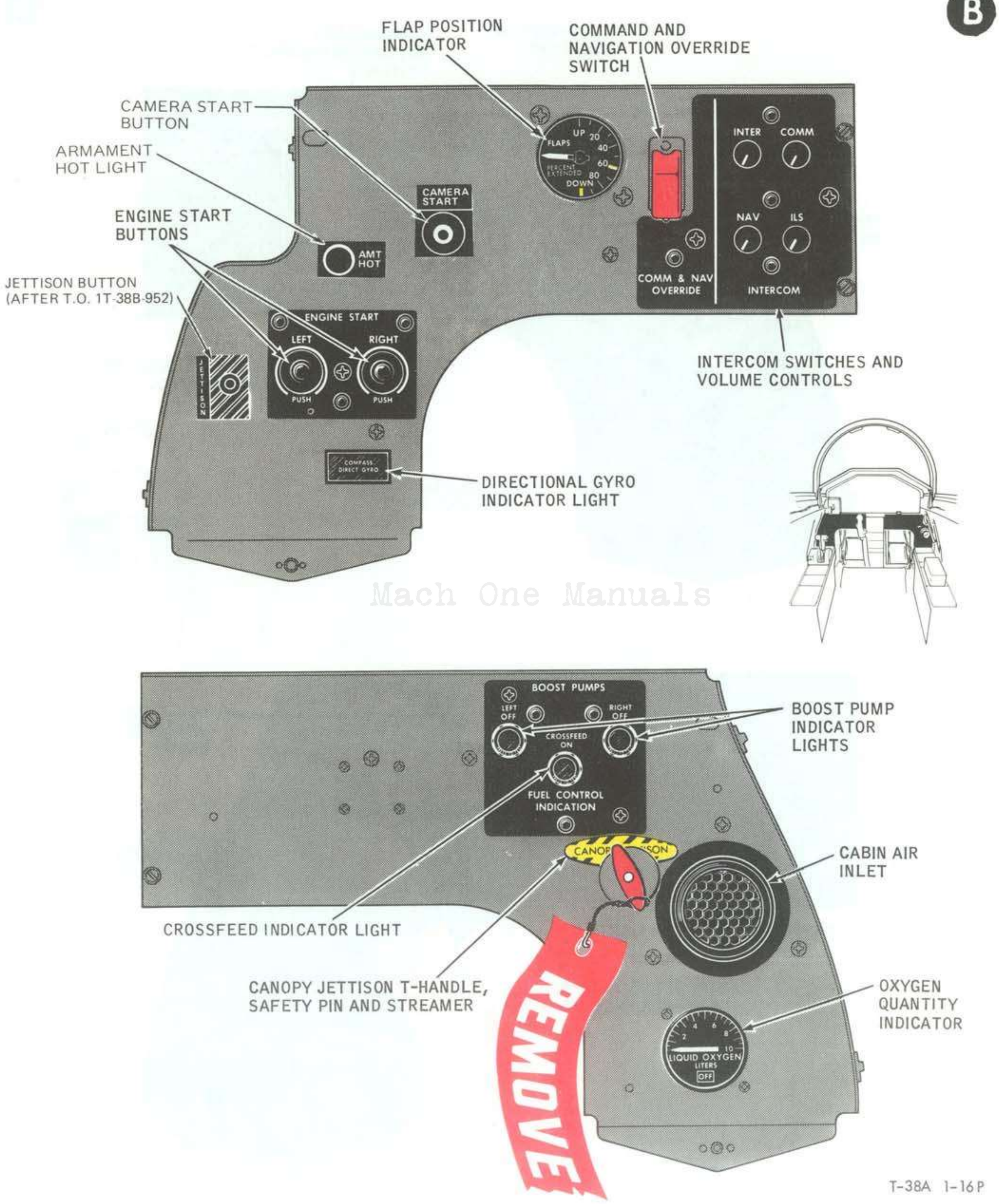


Figure 1-10. (Sheet 2 of 2)

CONSOLE PANELS—FRONT COCKPIT (TYPICAL)

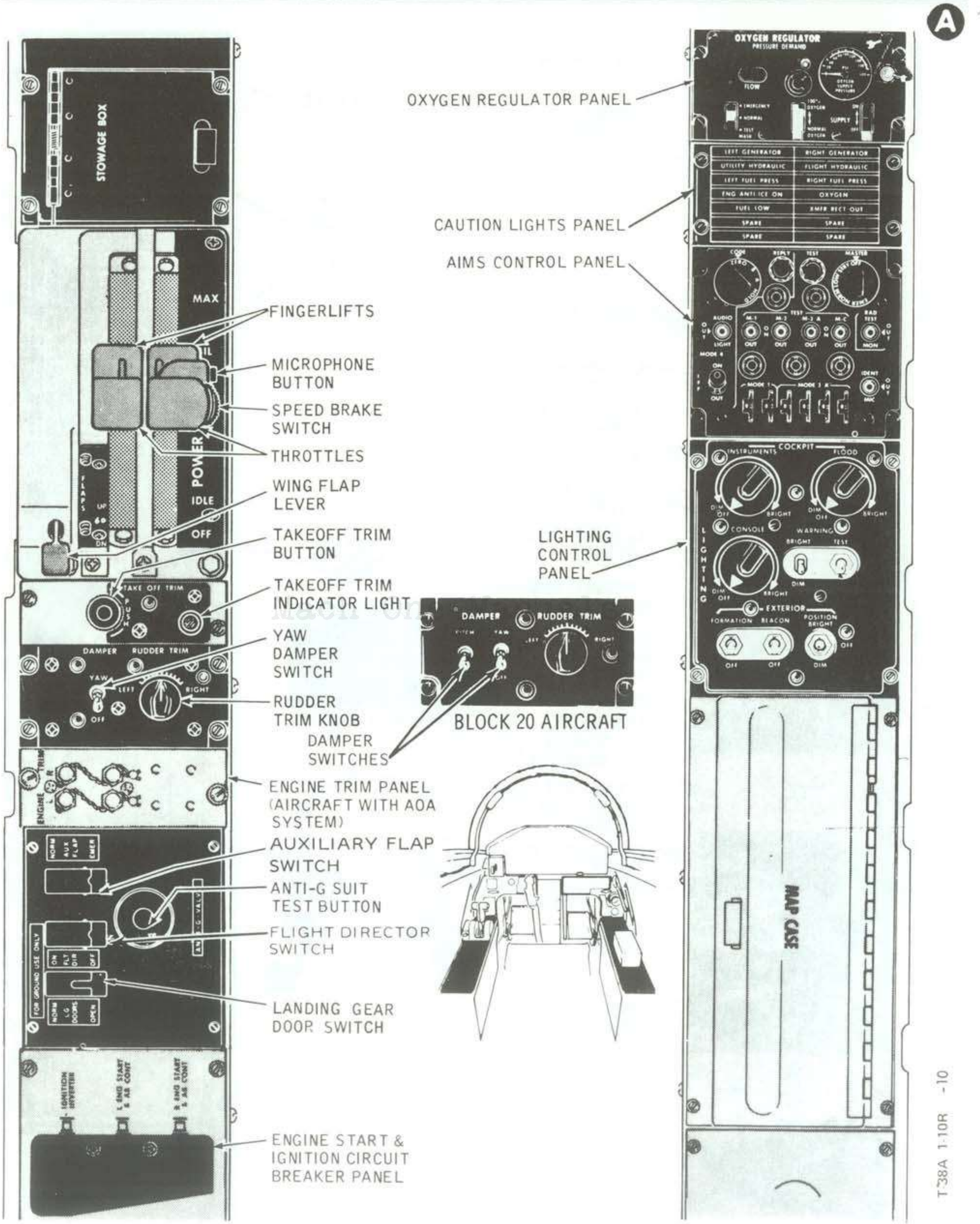


Figure 1-11. (Sheet 1 of 2)

CONSOLE PANELS—FRONT COCKPIT (TYPICAL)

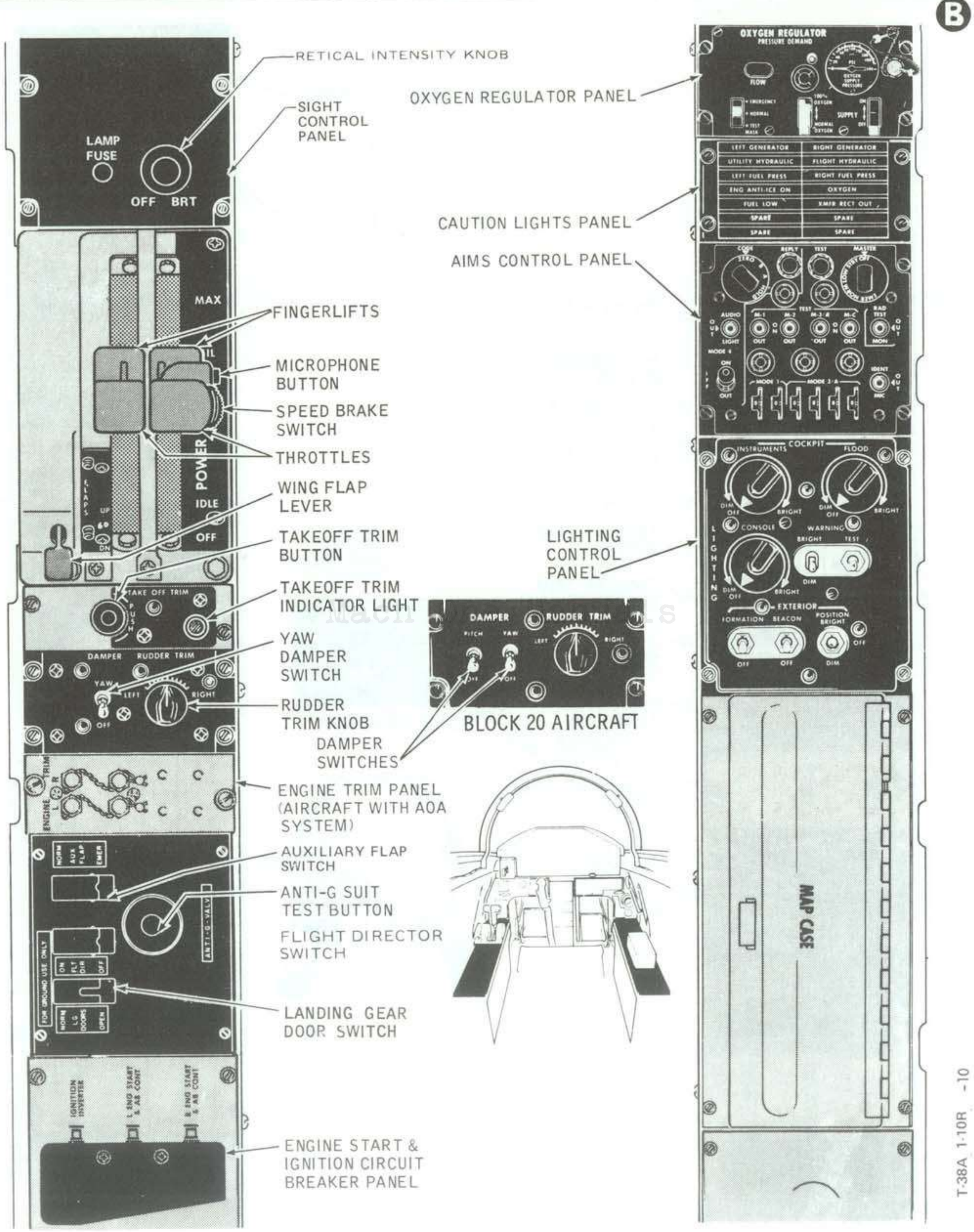


Figure 1-11. (Sheet 2 of 2)

CONSOLE PANELS – REAR COCKPIT (TYPICAL)

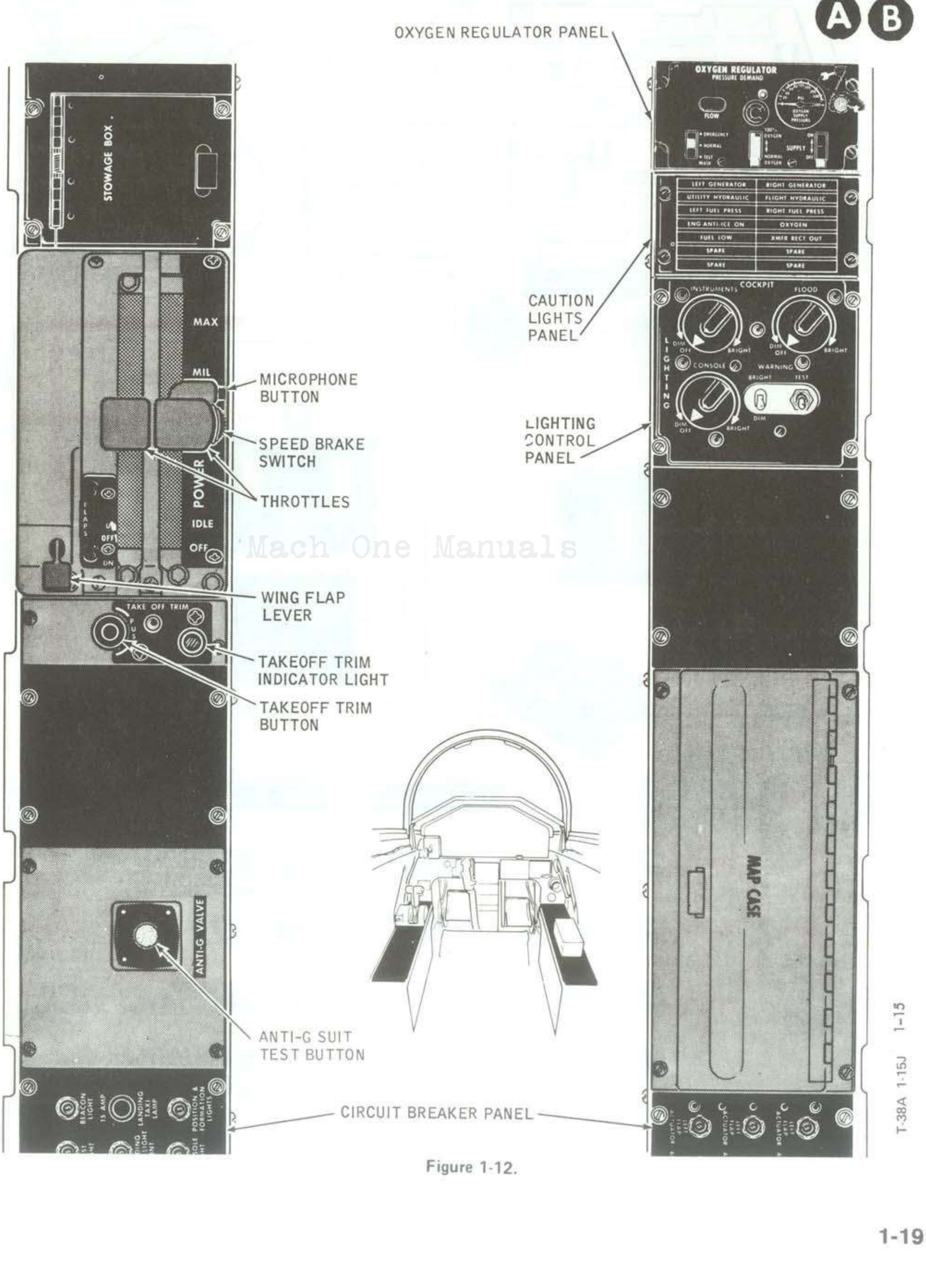


Figure 1-12.

FUEL SYSTEM

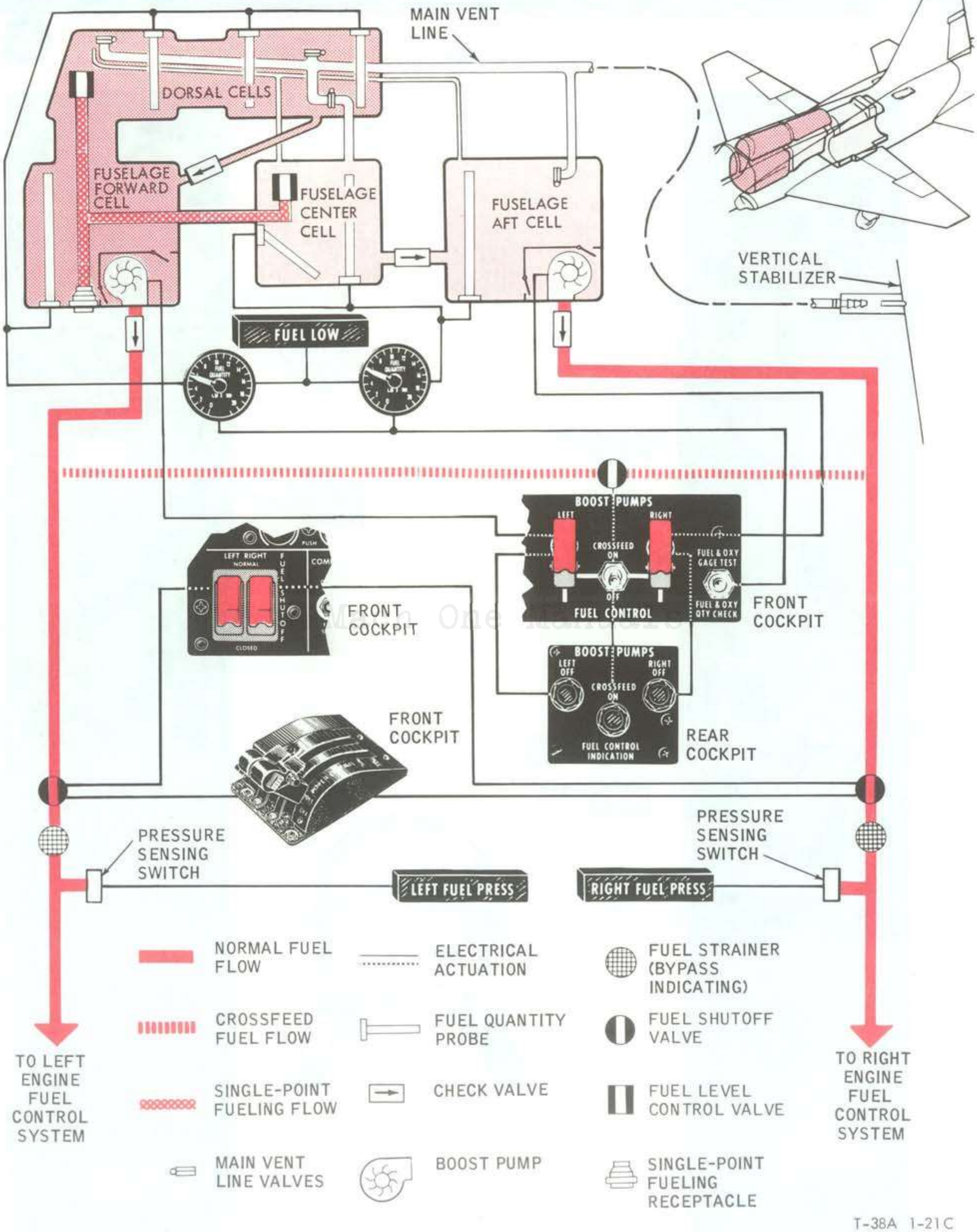


Figure 1-13.

BOOST PUMP INDICATOR LIGHTS.

Two boost pump indicator lights (figure 1-13), one for each boost pump, are located on the right subpanel of the rear cockpit. An indicator light illuminates when the corresponding boost pump switch is placed at OFF.

FUEL PRESSURE CAUTION LIGHTS.

Two fuel low pressure caution lights, placarded LEFT FUEL PRESS, RIGHT FUEL PRESS (figure 1-14), are located on the right console of each cockpit. The caution light will illuminate when the warning system detects a low-pressure condition and will remain illuminated as long as the low-pressure condition exists. Fuel low pressure caution lights may be used to determine if boost pumps are operating. Low pressure lights are only valid indications of boost pump output with crossfeed OFF, the corresponding fuel shutoff switch NORMAL and throttle out of OFF. The caution lights may blink when afterburner power is selected. Various other conditions may cause the lights to blink; this blink is not an indication of boost pump failure.

CROSSFEED SWITCH.

A crossfeed switch (figure 1-13), operating on dc, is located on the right subpanel of the front cockpit. The switch is used to electrically open and close the crossfeed valve in the crossfeed fuel manifold that connects the two fuel systems. The switch is placed at ON to use the fuel from both systems to supply one engine or to operate both engines on fuel from one system under boost pump pressure.

WARNING

With the crossfeed switch ON and either both boost pumps ON - or both boost pumps OFF - a rapid fuel imbalance can occur.

CROSSFEED INDICATOR LIGHT.

An amber crossfeed indicator light (figure 1-13) is located on the right subpanel of the rear cockpit. When the crossfeed switch in the front cockpit is placed at ON, the crossfeed indicator light illuminates.

FUEL SHUTOFF SWITCHES.

Two guarded fuel shutoff switches (figure 1-13), one for each engine, are located on the left subpanel of the front cockpit. The fuel shutoff valves (dc operated) are normally controlled by the throttles, with the fuel shutoff switches in the NORMAL position. Placing either or both of these switches at the CLOSED position shuts off fuel flow to either or both engines in approximately 1 second without using the throttles.

CAUTION

The switches should be used only in an emergency, as damage to the engine-driven fuel pumps and main fuel control may occur.

FUEL QUANTITY INDICATORS.

Two fuel quantity indicators (figure 1-13), one for each fuel system, are located on each instrument panel. The indicators operate on ac and indicate in pounds the total usable fuel quantity in each fuel supply system. Rear cockpit indicators repeat fuel quantity readings from the front indicators.

FUEL QUANTITY CAUTION LIGHT.

A fuel quantity low-level caution light, placarded FUEL LOW, is located on the right console of each cockpit (figure 1-13). The caution light will illuminate after a 7.5-second delay when a fuel quantity indicator reads below 275 to 225 pounds. The left and right system fuel quantity indicators must be checked to determine which system is low.

FUEL/OXYGEN CHECK SWITCH.

Fuel and oxygen quantities and indicator operation can be checked by a switch on the right subpanel of the front cockpit (figure 1-9). The three-position switch is spring-loaded to the unmarked OFF position. With external or generator ac power, fuel and oxygen quantities are indicated when switch is at the OFF position. To check operation of fuel and oxygen quantity indicators, the switch is held at the FUEL & OXY GAGE TEST position. Indicator pointers should move counterclockwise. When the switch is released, each indicator pointer will return to indicate the fuel and oxygen quantities. With battery power only, the switch is held at the FUEL & OXY QTY CHECK position to read the fuel and oxygen quantities on board the aircraft. (The static inverter supplies ac power to the indicating circuits when the switch is actuated.)

AIRFRAME-MOUNTED GEARBOX.

An airframe-mounted gearbox (figure 1-1) for each engine operates a hydraulic pump and an ac generator. A shift mechanism keeps ac generator output between 320 and 480 cycles per second. Gearbox shift occurs in the 65% to 70% RPM range.

ELECTRICAL SYSTEMS.

Two alternating current systems and one direct current system (figure 1-15) supply electrical power to the aircraft. The 115/200-volt ac power supply systems consist of two identical engine-driven ac generating systems and an external power receptacle. The dc power supply system consists of a dc bus powered either by a 24-volt, 5-ampere-hour battery or two 28-volt dc transformer-rectifiers.

AC POWER SYSTEM.

AC power is normally obtained from two engine-driven ac generators. The power distribution is divided into a right system and a left system. The generators are cut in individually when engine speed accelerates to approximately 43% to 48% RPM. If one generator should fail or is turned off, the functioning generator will automatically supply electrical power to both systems through the bus contactor relay.

Generator Switches and Caution Lights.

Two guarded generator switches (figure 1-9), one for the left and one for the right generator, are located on the right subpanel of the front cockpit. Generator caution lights, placarded LEFT GENERATOR and RIGHT GENERATOR (figure 1-14), are located on the right console of each cockpit. A caution light will illuminate when its generator switch is placed at OFF or when a generator malfunction occurs. A switch RESET position permits resetting the generators.

DC POWER SYSTEM.

DC power is normally obtained thru two transformer-rectifiers which convert ac to dc power. If one transformer-rectifier fails, the other automatically supplies all dc requirements. If both transformer-rectifiers fail, the master caution light on the instrument panel and the XFMR RECT OUT (XMFR RECT OUT on 14-module panel) light on the right console will illuminate. Under this condition, the dc bus will revert to battery power.

NOTE

The XFMR RECT OUT and master caution light may blink due to surge current developed by a high battery voltage overriding the dc bus voltage. This is a normal condition and does not indicate a failure.

Battery Switch.

A battery switch (figure 1-9) is located on the right subpanel of the front cockpit. Placing the switch at ON connects the battery to the dc bus. Under normal flight conditions, the battery switch should remain in the ON position to permit the battery to charge. A minimum battery voltage of 18 volts is required to close the battery relay.

STATIC INVERTER.

A static inverter, powered by the dc bus, converts the dc bus voltage to 115 VAC. The inverter, when activated, provides an alternate source of ac power for the following:

a. Starting first engine on the ground or during flight.

b. Operation of right engine autosyn instruments during start of right engine.

c. Fuel and oxygen quantity indicators.

On the ground, with dc power only, the inverter is activated when either engine start button is pushed for engine start, or when the fuel/oxygen check switch is held at FUEL & OXY GAGE TEST or FUEL & OXY QTY CHECK position. During flight, with dc power only, the inverter is activated when either engine start button is pressed or either throttle is moved into MAX range for engine restarts, or when the fuel/oxygen check switch is held at FUEL & OXY GAGE TEST or FUEL & OXY QTY CHECK position. With normal ac/dc power or dc power only, an operational check of the static inverter can be accomplished by positioning the fuel/oxygen check switch to FUEL & OXY GAGE TEST and observing counterclockwise movement of fuel and oxygen quantity indicator pointers.

CAUTION, WARNING, AND INDICATOR LIGHT SYSTEM.

CAUTION LIGHT PANEL.

A 14- or 10-capsule word caution light panel (figure 1-14) on the right console of each cockpit is provided to alert the crewmember of individual system malfunction or status change. The 14-capsule panel has 4 spare capsules. All capsule caution lights are yellow. Each caution light except the ENG ANTI-ICE ON light will remain illuminated as long as the malfunction exists or system status is unchanged. The caution lights will not go out if the master caution light is rearmed. The ENG ANTI-ICE ON light will illuminate when the engine anti-ice switch is turned on. Refer to the description of aircraft systems for operation of the applicable caution lights.

CAUTION LIGHT PANEL

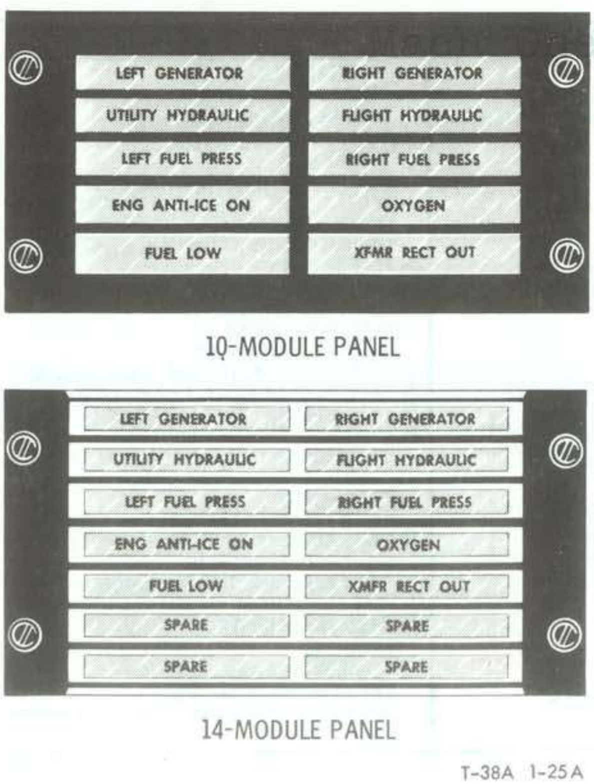


Figure 1-14.

MASTER CAUTION LIGHT.

A master caution light (figure 1-7), placarded MASTER CAUTION, is located on each instrument panel. When a light illuminates on the caution light panel, the master caution light will also illuminate. When the condition is corrected, the master caution light will automatically go out, but if the condition cannot be corrected, the master caution light may be pressed, causing it to go out and rearming it to provide warning of subsequent malfunctions.

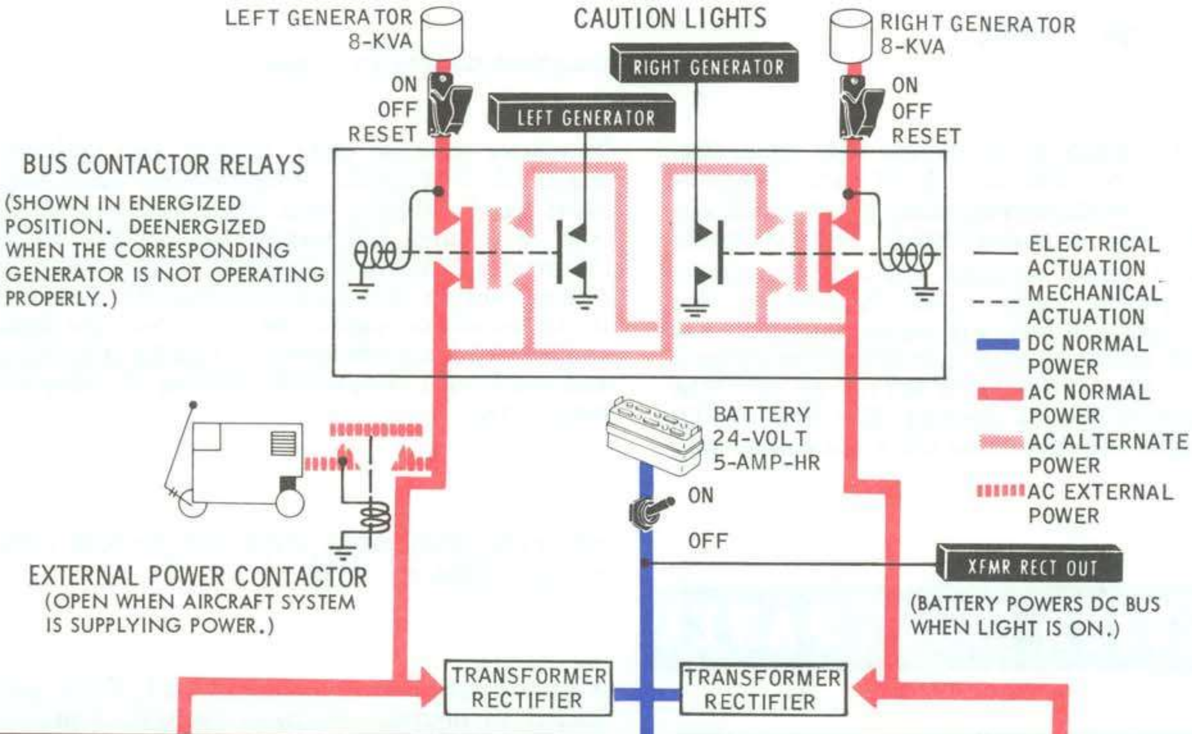
CAUTION, WARNING, AND INDICATOR LIGHT BRIGHT/DIM SWITCH.

A three-position switch (figures 1-11, 1-12) spring-loaded to neutral unmarked position is provided on the right console of each cockpit to dim all caution, warning, and indicator lights except the marker beacon, fire warning, takeoff trim indicator, and Ⓑ armament hot lights. With the instrument light control out of the OFF (detent) position, momentarily placing the switch in the DIM position will switch the power source from dc to ac, thus providing the DIM setting in that cockpit. Placing the switch momentarily to BRIGHT or placing the instrument light control to OFF will return the lights to bright.

CAUTION, WARNING, AND INDICATOR LIGHT TEST SWITCH.

The landing gear audible warning signal, the fire detection system, the AOA indexer lights (aircraft with AOA system), and all caution, warning, and indicator lights except the takeoff trim indicator light, Ⓑ armament hot light, and marker beacon light may be tested by placing the spring-loaded switch on the right console lighting control panel in each cockpit (figures 1-11, 1-12) at the TEST position.

ELECTRICAL SYSTEM



LEFT 115/200-VOLT AC BUS	28-VOLT DC BUS	RIGHT 115/200-VOLT AC BUS
△6 AIMS (3)	AIR DIVERTER VALVE	ADI STEERING BARS ⬢
△7 AOA COMPUTER	△7 AOA INDEXER LIGHTS	ATTITUDE SPHERE
△7 AOA VANE HEATER	CAUTION, WARNING, AND INDICATOR LIGHTS–BRIGHT (DIM LIGHT IS AC)	BEARING POINTER ⬢
CONSOLE LIGHTS	CROSSFEED VALVE	CABIN AIR-CONDITIONING
FUEL LOW WARNING	ENGINE START AND IGNITION CONTROL	CANOPY SEAL
△5 IFF-SIF	FIRE DETECTORS	CAUTION, WARNING, AND INDICATOR LIGHTS–DIM
INSTRUMENT LIGHTS	△4 FLAP CONTROL ⬢	COMPASS CARD (SLAVING REQUIRES DC)
LANDING-TAXI LIGHT △3 (REQUIRES DC FOR EXTENSION)	FLAP POSITION INDICATOR	ENGINE ANTI-ICE
(1) LEFT AUTOSYN INDICATORS	FLIGHT DIRECTOR MODE SELECTOR	EQUIPMENT COMPARTMENT COOLING
LEFT FUEL BOOST PUMP	(B) FLIGHT LOADS DATA RECORDER (MXU)	△2 FLAP CONTROL
(B) MXU	FLOODLIGHTS (EMERGENCY)	FLAP MOTORS
LEFT FUEL QUANTITY INDICATOR	FORMATION LIGHTS	FLOODLIGHTS (NORMAL)
POSITION LIGHTS (6-VOLT AC)	FUEL/OXYGEN CHECK SWITCH	FUEL LOW WARNING
ROTATING BEACONS	FUEL SHUTOFF VALVES	IGNITION EXCITERS ⬢
RUDDER TRIM CONTROL	ILS RECEIVER, INDICATORS, AND FLAGS ⬢	ILS RECEIVER, INDICATORS, AND FLAGS (3)
(B) SIGHT	INTERPHONE	△1 LANDING GEAR AUDIBLE WARNING SIGNAL
STABILITY AUGMENTER	△3 LANDING GEAR AUDIBLE WARNING SIGNAL	△1 LANDING GEAR CONTROL AND SAFETY CIRCUITS
STANDBY ATTITUDE INDICATOR	△3 LANDING GEAR CONTROL AND SAFETY CIRCUITS	△1 NOSEWHEEL STEERING CONTROL
	LANDING GEAR DOOR SWITCH	OXYGEN QUANTITY AND LOW-LEVEL WARNING CIRCUIT
	MARKER BEACON LIGHT	PITOT HEATER
	MASTER CAUTION LIGHT CONTROL	RADIO TRANSFER CONTROL
	△3 NOSEWHEEL STEERING CONTROL	(1) RIGHT AUTOSYN INDICATORS
	NOZZLE POSITION INDICATORS	RIGHT FUEL BOOST PUMP
	△3 SPEED BRAKE CONTROL	RIGHT FUEL QUANTITY INDICATOR
	STATIC INVERTER	SEAT ADJUSTMENT
	TACAN ⬢	△1 SPEED BRAKE CONTROL
	TACAN ANTENNA SELECTOR	TACAN (3)
	UHF RADIO, ARC-164 ⬢ (REAR COCKPIT)	TRIM CONTROL AND LIGHT
	TURN NEEDLE	UHF ANTENNA SELECTION
	△6 VIBRATOR, AAU–19/A ALTIMETER	UHF RADIO, ARC-34 (3) (REAR COCKPIT)
	(B) JETTISON SYSTEM	UTILITY LIGHTS

△1 BLOCKS 20 THRU 30 AIRCRAFT
△2 BLOCKS 20 THRU 35 AIRCRAFT
△3 BLOCK 35 AND LATER AIRCRAFT
△4 BLOCK 40 AND LATER AIRCRAFT
△5 BLOCKS 20 THRU 70 AIRCRAFT
△6 BLOCK 75 AND LATER AIRCRAFT
△7 AIRCRAFT WITH AOA SYSTEM

(1) AUTOSYN INDICATORS:
- EXHAUST GAS TEMPERATURE INDICATORS
- FUEL FLOW INDICATORS
- HYDRAULIC PRESSURE INDICATORS
- OIL PRESSURE INDICATORS

⬢ (ALSO REQUIRES AC)

(3) (ALSO REQUIRES DC)

T-38A 1-23 X

Figure 1-15.

CIRCUIT BREAKER PANELS (TYPICAL)

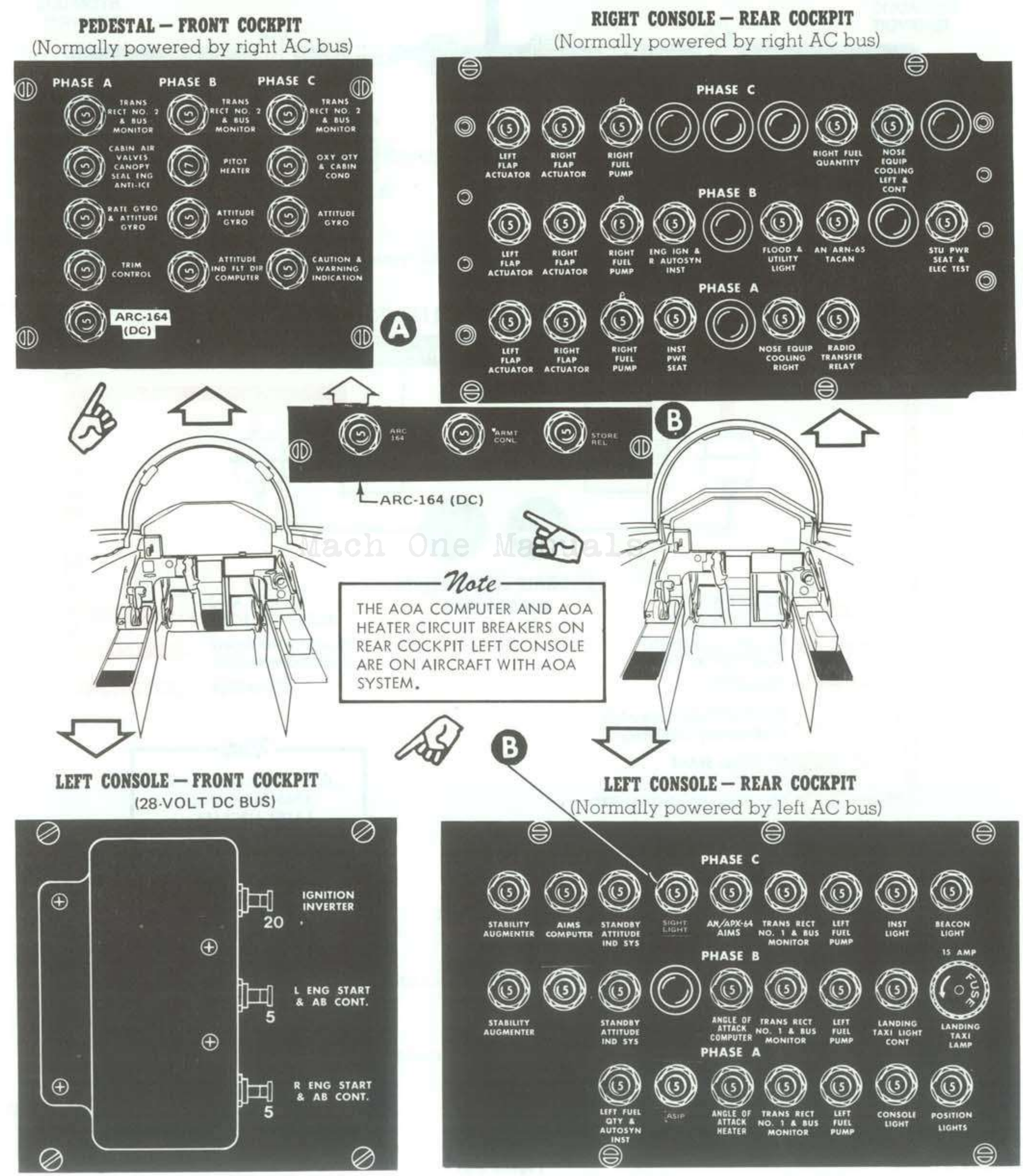


Figure 1-16.

HYDRAULIC SYSTEMS

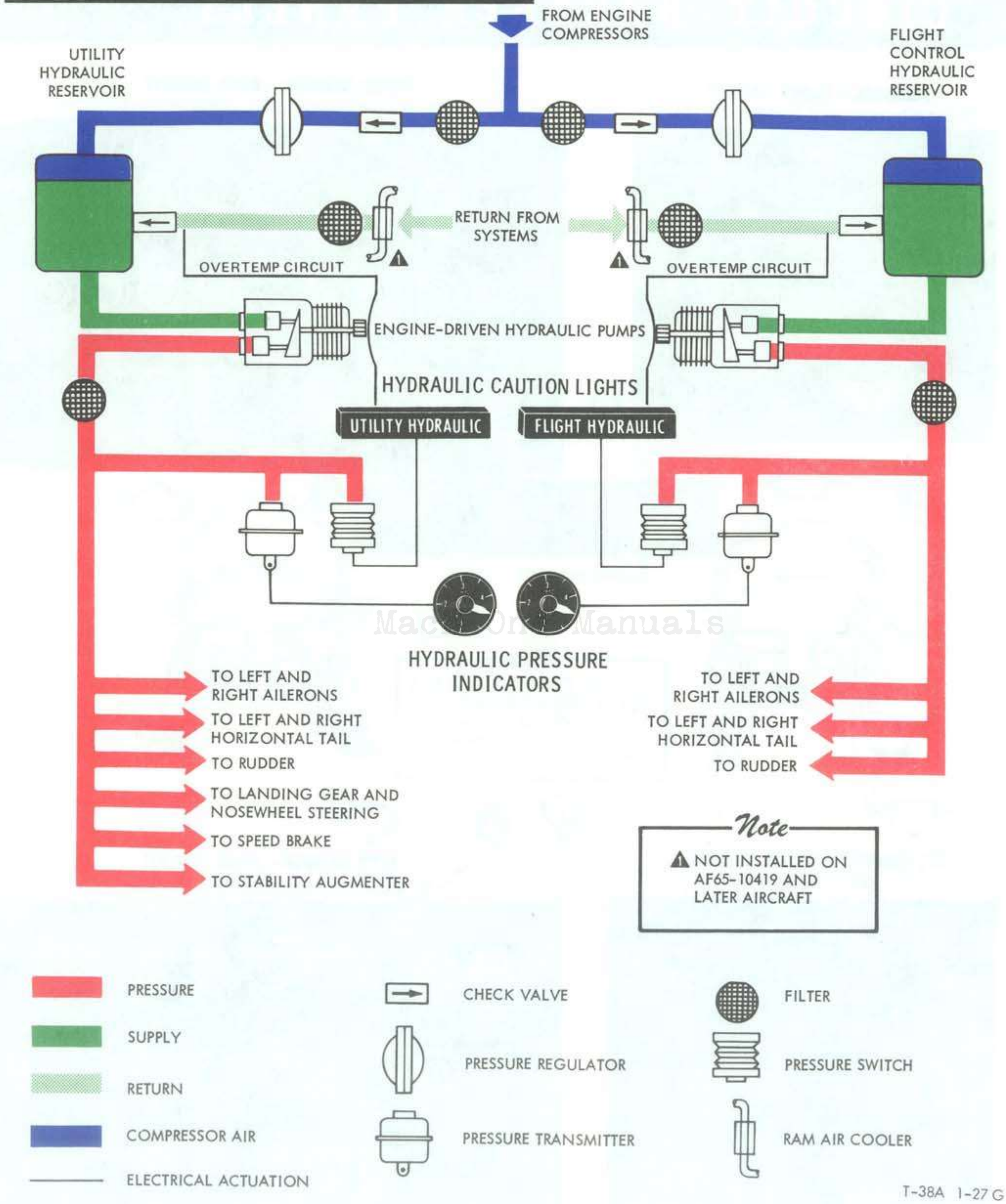


Figure 1-17.

NOTE

If the warning test switches in both cockpits are actuated simultaneously, all fire warning lights will illuminate. The landing gear audible warning signal will not come on in either cockpit.

FIRE WARNING AND DETECTION SYSTEM.

NOTE

An illuminated fire warning light may be a valid fire indication even though the test circuit may be inoperative.

The fire warning and detection system is provided to give a warning of a fire or overheat condition in either engine bay. Heat detectors are located in the forward engine bay and boattail area for each engine. The system responds to an overall average temperature or to highly localized temperatures caused by impinging flame or hot gas. Operation of the system in each engine compartment is independent of the other except when testing the system using the caution, warning, and indicator test switch. Placing either cockpit test switch at TEST checks all system detectors and fire warning light bulbs (4) in each cockpit. For test purposes only, each bulb is connected to a detector. However, any fire or overheat condition in either engine compartment will illuminate both bulbs of the respective fire warning lights in both cockpits.

ENGINE FIRE WARNING LIGHTS.

Two red fire warning lights (figure 1-7), placarded FIRE, one for each engine, on the instrument panel in each cockpit, are provided to warn of an overheat or fire condition in either engine compartment. When the fire detection system senses an overheat condition or fire, the warning light for the respective engine will come on. This light will remain on until the condition is corrected and then will go out. Should the overheat condition or fire recur, the light will again come on. Each fire warning light contains two bulbs.

HYDRAULIC SYSTEMS.

The aircraft hydraulic power supply systems (figure 1-17) include the 3000-psi utility system powered by the left engine and the 3000-psi flight control system powered by the right engine. No interflow can occur between the utility and flight control hydraulic systems. Separate pressure indicators and caution lights are provided for each system. On AF65-10419 and later aircraft, the ram air cooler has been deleted from the system. Refer to figure 1-26 for hydraulic fluid specification.

HYDRAULIC PRESSURE INDICATORS.

Two ac powered hydraulic pressure indicators (figure 1-17), one for each hydraulic system, are located on the instrument panel in each cockpit.

HYDRAULIC CAUTION LIGHTS.

A caution light for each hydraulic system placarded UTILITY HYDRAULIC and FLIGHT HYDRAULIC, is located on the right console of each cockpit (figure 1-17). The lights illuminate at approximately 1500 psi to indicate a low-pressure condition. The lights go out when a pressure of approximately 1800 psi is restored. The lights will also illuminate when the hydraulic fluid has excessively high temperatures. To determine which condition has caused the lights to illuminate, the hydraulic pressure indicators must be observed.

FLIGHT CONTROL SYSTEM.

A hydraulically powered, irreversible flight control system is provided (airloads on the control surfaces can not cause control stick or surface movement). Conventional aerodynamic "feel" in the control stick is provided artificially by springs and bob

CONTROL STICK (TYPICAL)

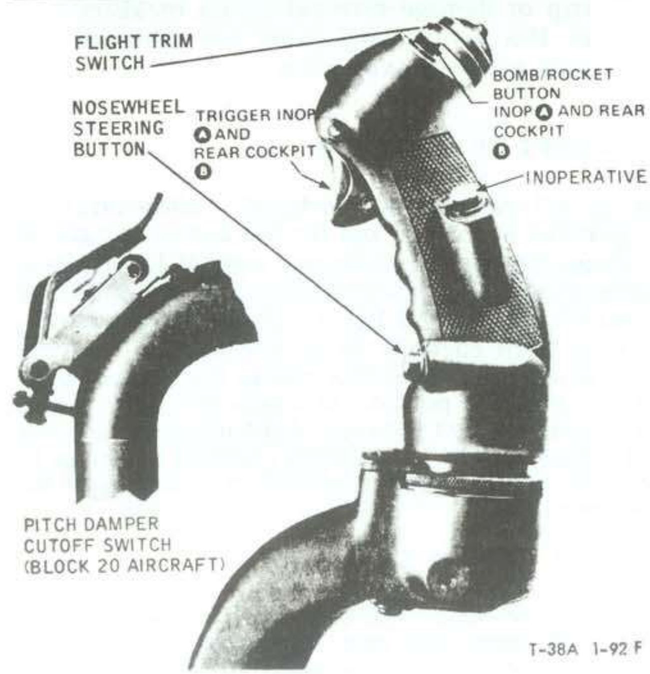


Figure 1-18.

weights. The springs progressively resist control stick displacement and the bob weight mechanism further resists aft stick travel during maneuvering flight. Lateral and longitudinal trim is provided by electric motors which change the neutral reference point of the feel springs and control stick position. Each control surface is moved by two hydraulic cylinders; one is powered by the UTILITY system, the other by the FLIGHT HYDRAULIC system.

CONTROL STICK.

Each cockpit has a control stick with a standard stick grip (figure 1-18), which contains a flight trim switch and a nosewheel steering button. On Block 20 aircraft, a stability augmenter pitch damper cut-off switch is located below the stick grip.

RUDDER PEDAL ADJUSTMENT T-HANDLE.

A mechanical rudder pedal adjustment T-handle (figure 1-8) is located on the pedestal of each cockpit. To adjust rudder pedals, pull T-handle out and hold until pedals are repositioned. Return the T-handle to the stowed position manually to lock the pedals in place.

CAUTION

Allowing the handle to snap back may trip or damage pedestal circuit breakers or ILS control and cause the cable to kink and wear excessively.

TAKEOFF TRIM SYSTEM.

A takeoff trim system is installed to allow positioning of the horizontal tail for the optimum takeoff setting. The system uses the normal longitudinal trim system along with a push button and indicator light (figure 1-11, 1-12) installed on the left console in both cockpits. When the button is pushed and held, the trim motor moves the control stick to the required position at which point the motor stops and a green indicator light illuminates in the left console. The aircraft has external markings to visually confirm proper takeoff trim horizontal tail position.

FLIGHT TRIM SYSTEM.

A conventional aileron/elevator trim switch is located on each stick grip. Operation of the switch (figure 1-18) causes operation of an AC motor, causing appropriate movement of the control stick. Limit and cutout switches are installed in the system which limit the range of stick travel obtainable through use of the trim system. Also, horizontal tail trim is interrupted when stick force is exerted against the direction of trim. These two cutout systems limit the effects of "runaway trim," since the aircraft can be flown with the control stick at either of the trim limit cutout positions; however, very heavy stick forces may be encountered.

RUDDER TRIM KNOB.

An ac electrical rudder trim knob (figure 1-11) on the left console of the front cockpit provides the means of trimming the rudder. The yaw damper switch must be turned on before the rudder will assume the selected trim position.

RUDDER LIMITER SYSTEM.

Deflection of the rudder is limited by a mechanical linkage between the rudder control system and the nose gear trunnion. When the nose gear is extended 3/4 or less, rudder deflection is limited to 6 degrees from neutral in either direction. When the nose gear is more than 3/4 extended, full rudder deflection of 30 degrees from neutral in either direction is available. The rudder limiter cannot be overcome by either crewmember.

STABILITY AUGMENTER SYSTEM.

The stability augmenter system uses utility hydraulic pressure to position the rudder to reduce yaw oscillations. Manual rudder trim is accomplished thru the yaw damper. A yaw damper switch is located on the left console of the front cockpit (figure 1-11). The switch is spring-loaded to OFF position and is held in the YAW position by ac power. The yaw damper is disengaged by returning the switch to OFF. The augmenter will disengage automatically in the event of ac power failure or certain system malfunctions. On Block 20 aircraft, the stability augmenter system also positions the horizontal tail to reduce pitch oscillations when the pitch damper switch next to the yaw damper switch is positioned to the PITCH position. The switch is held in the PITCH position by ac power. The pitch damper is disengage either by returning the switch to OFF or by actuating the pitch damper cutoff switch on the control stick (figure 1-18), and will disengage automatically in the event of ac power failure or certain system malfunctions.

WING FLAP SYSTEM.

The primary purpose of the flaps is to provide increased lift for takeoff and landing. The flaps should not be used in high AOA or aerobatic maneuvering. The flaps are electrically (DC) controlled by the flap lever switch in the front cockpit. The flaps are operated by two AC electric motors and are interconnected by a rotary flexible shaft. If one flap motor fails, both flaps are actuated through the rotary shaft. Flap extension time will be much longer than normal with one motor failed.

WING FLAP-HORIZONTAL TAIL (FLAP-SLAB) INTERCONNECT SYSTEM.

Flap operation changes the aerodynamic properties of the aircraft. The flap-slab interconnect system compensates for these aerodynamic changes and maintains essentially the same aircraft handling qualities, regardless of flap position.

To provide the required compensation, the flap position is mechanically transmitted to the horizontal tail operating mechanism through an interconnect cable. As the flaps are moved, the interconnect system provides the following:

a. The horizontal tail is automatically repositioned to essentially eliminate the pitch changes caused by flap movement.

b. As the flaps are extended, the interconnect system increases the amount of horizontal tail travel available in the nose down direction.

c. The interconnect system changes the pitch authority of the control stick by increasing the amount of horizontal tail deflection per inch of stick travel.

The majority of the compensation occurs in the first 35 percent of flap deflection.

AIRCRAFT WITH LOCKING DEVICE.

On some aircraft, the flap-slab interconnect system incorporates a locking device which operates only if the flaps are deflected and the interconnect cable breaks. The locking device will maintain the flight control compensation that existed at the moment of failure and will not change if flap position is subsequently altered.

If the interconnect system fails, the aircraft may exhibit the following characteristics:

a. A smooth but definite pitching motion as flaps are actuated. The direction of the pitch motion will be opposite the direction of the flap movement.

b. An unusual stick position to maintain level flight and the pilots inability to trim out stick forces.

c. The locking device will maintain the flight control compensation that existed at the moment of failure.

d. Normal aircraft handling qualities will be obtained only after the flaps are repositioned to the flap setting existing at the moment of interconnect system failure.

e. If the interconnect system fails with flaps 60% or more, and the flaps are subsequently retracted, the nose of the aircraft will pitch down, back stick force will be required to maintain level flight. Extreme pitch sensitivity will exist at speeds above 300 KIAS (or 0.9 IMN).

AIRCRAFT WITHOUT LOCKING DEVICE.

On other aircraft, the locking device is not installed. If the interconnect system fails with flaps extended, expect the following:

a. A spring mechanism will rapidly remove all flight control compensation and reposition the horizontal tail to the zero percent flap position.

b. The aircraft will always pitch up, and moderate to heavy forward stick forces (probably beyond the forward trim limit) will be required to maintain controlled flight. Greater than normal control stick movements will be required to affect pitch response.

c. When flaps are retracted following an uncommanded pitch up, the aircraft will have a pronounced tendency to settle and a large aft stick movement will be required to maintain level flight.

d. Normal handling qualities will be obtained only when the flaps are retracted to the up position.

WING FLAP LEVER AND POSITION INDICATOR.

A wing flap lever (figure 1-4) is located on the throttle quadrant of each cockpit. The two levers are mechanically interconnected by cables; however, the lever in the front cockpit actuates the electrical switch that operates the two flap motors. Sensing switches stop the flaps at 60% when the flap lever is placed in the 60% detent. When operating in the emergency mode, the flaps can be stopped at any position by placing the flap lever in the 60% detent. When UP or DOWN is selected, flap movement is stopped by limit switches at the fully retracted or extended position. The flap position indicator, which operates on dc, is located on the left subpanel of each cockpit (figures 1-9, 1-10). Flap extension is indicated as a percentage of full flap travel.

NOTE

> If the wing flap lever is between the 0 - 60% position or the 60 - 100% position the flaps will not extend or retract.

AUXILIARY FLAP CONTROL SWITCH.

The auxiliary flap control switch is located in the front cockpit (figure 1-11) on the left console. It is a two position switch. In the normal position, flap positions of full up, 60% down, and full down can be selected. In the emergency position, flaps can be set at any selection from full up to full down. In this mode of operation, flap extension or retraction is stopped by moving the lever to the 60% detent, which then functions as an OFF position when flaps have reached the desired position, or by limit switches when the flaps have fully extended or retracted.

SPEED BRAKE SYSTEM.

A DC electrically controlled, hydraulically activated dual surface speed brake is located on the lower surface of the fuselage center section. Design of the activation system permits selection of intermediate speed brake positions other than fully extended.

SPEED BRAKE SWITCH (figure 1-4).

A conventional, three position (UP-OFF-DOWN) speed brake switch (DC) is installed on the right throttle in each cockpit. The switch in the front cockpit has positive detents in each position. The switch in the rear cockpit has capability to override the position selected in the front cockpit and is spring-loaded to the center OFF position. Intermediate speed brake positions can be obtained by positioning the switch to the desired direction of movement and then returning to the OFF position. Speed brake creep will occur with the switch in the OFF position. Following override, control of the speed brake system is regained in the front cockpit by moving the switch to OFF. To prevent creep following actuation from the rear cockpit, the front cockpit switch should be placed in the position selected by the rear cockpit.

LANDING GEAR SYSTEM.

Extension and retraction of the landing gear and gear doors are powered by the utility hydraulic system and electrically controlled by the landing gear levers. Landing gear extension or retraction normally takes approximately 6 seconds. The normal landing gear cycle may be reversed at any time. The normal extension sequence is doors open, gear extends, doors close. The retraction sequence is doors open, gear retracts, doors close.

LANDING GEAR LEVER, WARNING SYSTEM, AND SYSTEM SILENCE BUTTON.

A landing gear lever (figure 1-7) is located on the instrument panel of each cockpit. The two levers are mechanically interconnected. A warning system consisting of an intermittent tone (beeper), audible thru the headset of each crewmember, and a red light within the wheel-shaped end of each landing gear lever will be activated if the landing gear is not down and locked and the following conditions exist:

a. The airspeed is 210 KIAS or less.

b. The altitude is 10,000 ± 750 feet or below.

c. Both throttles are below 96% RPM.

NOTE

> Power required under single engine conditions may be in excess of that required to activate the landing gear warning system.

When airspeed is decreasing, the system is activated in the range of 210 to 180 KIAS. With the system activated and the aircraft accelerating, the light and tone may not go out until speed reaches approximately 240 KIAS. With the gear handle in the UP position, and the system not activated a red light in the landing gear lever indicates that the landing gear doors are not up and locked. The audible warning signal is not activated by an unlocked gear door condition. A landing gear warning silence button (figure 1-7) is located on the instrument panel of each cockpit. Pressing either button silences the audible warning signal.

CAUTION

> Front cockpit pilot should not place the left foot outboard of the rudder pedal due to the possibility of striking the landing gear handle interconnect linkage causing uncommanded landing gear retraction.

Landing Gear Lever Downlock Override Button.

A landing gear lever downlock override button (figure 1-7) on the instrument panel of each cockpit enables either crewmember to raise the landing gear lever to the LG UP position if the locking solenoid fails to release the landing gear lever from the LG DOWN position. With button pressed the landing gear lever can be raised to the LG UP position during flight or on the ground. The rear cockpit downlock override button operates electrically; the front cockpit downlock override button operates mechanically.

LANDING GEAR POSITION INDICATOR LIGHTS.

Three landing gear position indicator green lights (figures 1-7) on each instrument panel illuminate when the gear is down and locked.

NOTE

- There are separate contacts on the landing gear down lock switches for each cockpit green light indicator. A good light in either cockpit assures that gear is safe.
- With DC failure, the rear cockpit nose gear light will not illuminate due to gear relay wiring.

LANDING GEAR ALTERNATE RELEASE HANDLE.

A landing gear alternate release handle (figure 1-9) on the left subpanel of the front cockpit permits gear extension without hydraulic pressure or electrical power. When the handle is pulled, the normal landing gear hydraulic and electrical systems are deenergized, and the gear uplocks and gear door locks are mechanically released, permitting the gear to extend by its own weight. No portion of the landing gear structure is under hydraulic pressure after extension by the alternate system. The handle must be held in the fully extended position (approximately 10 inches) until all three gears are unlocked. Extension of the main and nose landing gear will require approximately 15 seconds, but may take up to 35 seconds. If gear alternate extension was accomplished with the gear lever at LG UP, the lever must be placed at LG DOWN and then returned to LG UP to reactivate the normal system. After an alternate extension, the main gear doors will remain open and nosewheel steering will not be available until the system is reactivated. The nosewheel door assumes a spring-loaded closed position after alternate extension. A landing gear reset lever, located outboard of the left rudder pedal in the front cockpit, may be used to reset the landing gear switches.

NOTE

- During preflight, if the striker plate in the nose gear well is found in the extended position, check the reset lever in the reset (UP) position. This resets all gear switches, but will not raise the striker plate. The striker plate will remain extended until the nose gear retracts after takeoff.
- If the gear is lowered by the alternate release handle with the landing gear in the LG UP position, the red light in the landing gear lever will remain illuminated. In this situation, the illuminated red light indicates the gear door open condition normally associated with the gear retraction cycle. The landing gear green indicator lights will be illuminated and the warning signal silent, indicating a positive gear down and locked condition.

LANDING GEAR DOOR SWITCH.

A guarded landing gear door switch is provided on the left console of the front cockpit (figure 1-11). With electrical and hydraulic power available, this switch permits opening and closing the landing gear doors when the landing gear lever is at LG DOWN. If the gear is extended in flight with the gear door switch at OPEN, the gear doors will remain open until the gear is retracted or the gear door switch is placed at NORMAL.

NOSEWHEEL STEERING SYSTEM.

The nosewheel steering system provides directional control and shimmy damping. Hydraulic pressure for the system is supplied by the utility hydraulic system. Nosewheel steering is controlled by rudder pedal action and may be activated only when the weight of the aircraft is on the nosewheel. If the nosewheel position does not correspond to the position of the rudder pedals when steering is activated, the nosewheel will turn to correspond to the rudder pedal position.

NOSEWHEEL STEERING BUTTON.

Nosewheel steering is electrically controlled by the nosewheel steering button on the control stick (figure 1-18) in either cockpit. Steering is available only when the button is held in the pressed position. With button pressed, nosewheel steering is deactivated when one or both throttles are advanced to MAX range and restored when both throttles are retarded below MAX range. Whenever the weight of the aircraft is not on the nose gear, the system automatically deactivates.

NOSEWHEEL CENTERING MECHANISM.

A nosewheel centering cam mechanically streamlines the nosewheel whenever the nose gear strut is fully extended. Air pressure in the strut mechanism ensures that the nose gear strut remains fully extended during gear retraction.

WHEEL BRAKE SYSTEM.

The main gear wheel brakes are the segmented rotor type and are powered by a separate, completely self-contained hydraulic system. The brake pedals are the conventional toe-operated type. Each brake pedal controls a hydraulic master cylinder. Control of the brakes transfers to the crewmember applying the greater pedal force.

PITOT-STATIC SYSTEM.

The pitot-static system supplies both impact and static air pressure to the airspeed-mach indicator, the airspeed compensator of the stability augmenter system, and the airspeed and altitude pressure switch assembly that connects into the landing gear warning circuits. The altimeter and vertical velocity indicator receive only static pressure from the system.

CANOPY.

Each cockpit contains a manually operated clamshell type canopy. The canopy is locked closed or unlocked by an individual locking lever in each cockpit, or by individual locking handles outside the left side of the front cockpit (figure 1-19). Each canopy is counter-balanced throughout its travel limits. The canopy opening mechanism is protected against excessive loads by a hydraulic canopy damper, which also restricts canopy opening and closing speeds. An inflatable pressurization seal installed on each canopy is inflated when both canopies are locked, the cockpit pressure switch is in the CABIN PRESS position, and an engine is operating.

CAUTION

- Canopy movement from the full open or closed and locked position must be initiated by the external or internal locking handle. Actual raising or lowering of the canopy must be done by hand pressure on the canopy frame. Do not apply pressure on the locking handle to raise or lower the canopy as damage to the mechanism may result.
- Use caution when opening the canopy under high or gusty wind conditions to avoid rapid canopy fly up.
- If an open canopy has been exposed to high winds or jet blast, it should be checked for normal operation, i.e., fully closed before taxi. If the canopy will not close, the aircraft should not be taxied or towed until cleared by qualified maintenance personnel. Aircraft movement may result in canopy separation.
- Damage and possible loss of canopy may occur if the hood is bunched between the drogue chute housing and canopy, and the seat is raised to the near full up position.

- If the canopy is closed with the shoulder harness on the drogue chute housing damage to the seat or canopy may occur.

CANOPY WARNING LIGHT.

A canopy warning light, placarded CANOPY (figure 1-19), operating on dc (bright) or ac (dim), is located on the instrument panel of each cockpit. When either canopy is unlocked, both canopy warning lights illuminate.

CANOPY JETTISON SYSTEM.

The canopy jettison system permits jettisoning each canopy individually from inside the cockpit or both canopies from outside the cockpit. From inside the cockpit, the canopy of the respective cockpit may be jettisoned independent of seat ejection by pulling the T-handle (figure 1-19) on the right subpanel of each cockpit. A safety pin is provided for each canopy jettison T-handle to prevent inadvertent jettison of the canopy. A spring clip on the bottom of the T-handle must be overcome to pull the T-handle out. To jettison the canopies from outside the cockpit, a canopy jettison D-handle (figure 1-19) is located externally on each side of the front cockpit, pointed out by the RESCUE decal. Opening either access door and pulling the D-handle jettisons both canopies. The front canopy jettisons first when the D-handle is pulled, followed 1 second later by jettison of the rear canopy. The canopy jettison system will function properly only with the canopy closed and locked. However, with the aircraft at rest, the canopy may not separate from the hinges if the canopy is in the fully open position. If the jettison system is activated with the canopy in a position other than fully open, the canopy will move to the full open position and probably separate from the aircraft.

WARNING

If the canopy jettison is activated with the canopy in other than the closed and locked position, the canopy could fall off its hinges and into the cockpit area.

CANOPY BREAKER TOOL.

A canopy breaker tool (figures 1-5, 1-6) is stowed on the left canopy frame in each cockpit. The tool is used to break the canopy glass if other methods of opening the canopy fail.

EJECTION SYSTEM.

The ejection system consists of an ejection seat with drogue chute and man-seat separator (figure 1-20), an automatic opening safety belt with 0.65 second delay initiator (figure 1-21 or 1-22), and an automatic opening parachute with 0.25 second delay initaitor or zero delay lanyard parachute with a one second delay initiator.

After ejection from the aircraft, the drogue chute deploys to stabilize the seat, the safety belt opens and actuates the man-seat separator forcing the crewmember from the seat. An aneroid delays parachute opening until between 15,000 and 11,500 feet pressure altitude when free falling. At or below this block altitude, parachute opening is initiated at 0.25 second (or one second) after seat separation. Low altitude capability (below 2000 feet AGL) is provided by the 0.25 second delay initiator or the zero delay lanyard connection. With the zero delay lanyard hooked to the parachute ripcord handle, the ripcord is pulled upon man-seat separation providing immediate parachute deployment. A stowage ring is provided on the parachute harness for the zero delay lanyard when not in use.

Refer to section II for proper connection of the zero delay lanyard and to section III for proper use of ejection equipment.

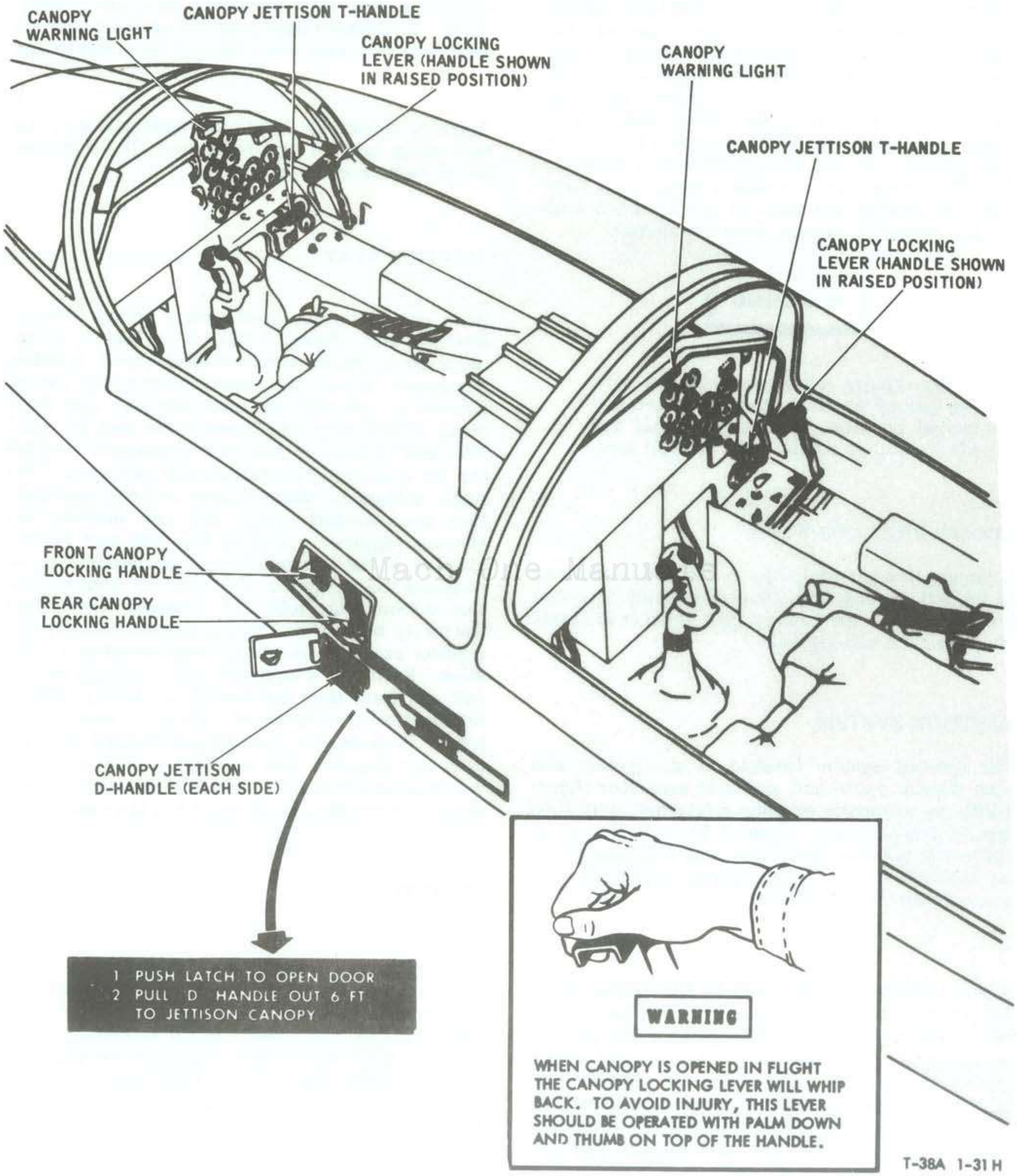
EJECTION SEAT.

Each cockpit is equipped with a rocket catapult ejection seat (figure 1-20). A calfguard, hinge-mounted to the forward end of each seat, is pulled downward behind the crewmember's legs during ejection to prevent the crewmember's legs from being thrust backward beneath the seat by wind blast and to assist in man-seat separation. Controls for the ejection sequence are the handgrips. The single motion of raising either or both handgrips fires the powered inertia reel and initiates the ejection sequence. During the first part of seat ejection, initial seat movement simultaneously disconnects the oxygen, anti-G suit, and communication disconnects, pulls the calfguard down, fires the safety belt delay initiator, disconnects the seat adjuster power cable and initiates drogue gun operation. Each seat is equipped with a canopy piercer and will eject thru the canopy if canopy jettison malfunction is experienced. The front seat canopy piercer is attached to the seat and is raised and lowered with the seat. The rear seat canopy piercer is not attached to the seat and will remain in a fixed position when the seat is raised and lowered.

Legbraces.

Two legbraces (figure 1-20), terminating in handgrips, are attached to the ejection seat (one on each side) and are linked together mechanically so that they rise simultaneously. Initial movement of either handgrip releases the downlock on both legbraces. When actuated, the legbraces are held in the raised position by an uplock and cannot be returned to the down stowed position by the crewmember.

CANOPY CONTROLS



T-38A 1-31 H

Figure 1-19.

SOLID BLACK PLATE
20% TONE PLATE NO. T-38A 1-31 H

EJECTION SEAT

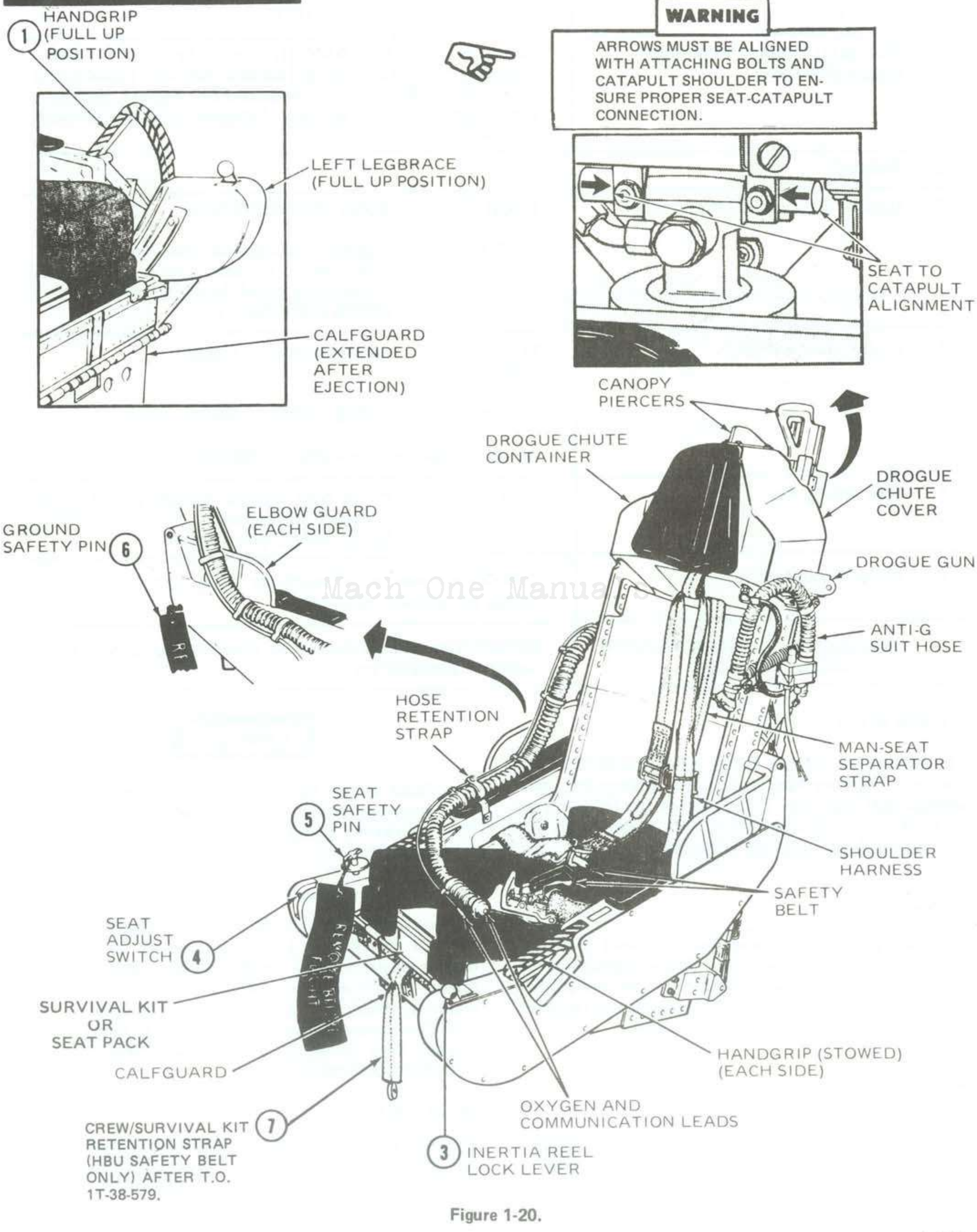


Figure 1-20.

EJECTION SEAT CONTROLS (Figure 1-20)

CONTROLS		FUNCTION	
1	Handgrips (Yellow with black diagonal stripes)	Pulling either or both handgrips up to travel limits raises legbraces to the fully up and locked position, retracts and locks the shoulder harness, jettisons the canopy, and initiates seat ejection. The first 12 degrees of travel unlocks both legbraces.	
2	Deleted		
3	Inertial Reel Lock Lever	LOCK	—Locks shoulder harness.
		AUTO	—Unlocks shoulder harness, freeing it to reel in and out. Harness will automatically lock during rapid 3-g acceleration and/or during seat ejection.
4	Seat Adjust Switch	Forward and Hold	—Lowers seat electrically.
		Center	—Spring-loaded neutral position.
		Aft and Hold	—Raises seat electrically.
5	Seat Safety Pin	Inserted	—Holds right legbrace handgrip down. The streamer is attached to the canopy jettison handle safety pin streamer.
6	Ground Safety Pin	Provides mechanical safing of the safety belt initiator during ground maintenance.	
7	Crew/Survival Kit Retention Strap (HBU Safety Belt only)	Retains crew and survival kit in position during zero and negative G maneuvers.	

Ejection Seat Safety Pin.

The safety pin (figure 1-20), when inserted, holds the right legbrace handgrip down, preventing inadvertent seat ejection. The streamer for the ejection seat safety pin is attached to the streamer for the canopy jettison T-handle safety pin.

Handgrips.

The handgrips are stowed in the down position when the legbraces are down. When the handgrips are raised fully up and locked, the powered inertia reel retracts and locks and the canopy is jettisoned followed in 0.3 second by seat ejection.

Seat Adjustment Switch.

A seat adjustment switch (figure 1-20) on the right legbrace provides control of seat adjustment thru a vertical range of 5 inches. The adjustment switches operate on ac.

CAUTION

Hard items stored under the seat may puncture the cockpit floor when the seat is lowered resulting in loss of cabin pressurization.

Oxygen/Communication Block.

The oxygen/communication block (figure 1-20) is secured to the seat to prevent injury to the pilot during ejection. The oxygen hose retention strap (figure 1-20) effects positive hose disconnection after man-seat separation. A snap fastener on the retention strap allows individual adjustment of the oxygen hose to obtain freedom of movement without disconnecting the hose.

Anti-G Suit Hose.

The anti-G suit hose (figure 1-20) is located on the left side of the ejection seat next to the headrest. The hose is held in the stowed position by a flexible spring.

Inertia Reel Lock.

An inertia reel lock consisting of a powered reel and cable attachment provides mechanical locking and unlocking of the shoulder harness controlled by an inertia reel lock lever located on the left legbrace (figure 1-20). When the handgrips are raised, the power-reel is actuated causing the shoulder harness to be forcibly retracted and restrained regardless of the inertia reel lock lever position.

Automatic-Opening Safety Belt.

The HBU-12 safety belt is equipped with a 0.65 second delay which provides automatic belt opening during ejection thereby reducing seat separation and parachute deployment time. This reduces the altitude required for safe ejection. The manual release/latch assembly on the left half of the belt is a black and silver lever that must be slightly raised to insert the belt link and pressed down to lock. The automatic parachute arming lanyard (Gold Key) is to be installed on the right side belt link and pressed into the base of the latch assembly in order to lock the belt. Positive locking shall be checked by exerting an upward pull from under the silver latch handle without depressing the black portion of the release/latch assembly. The lever must be squeezed and raised to manually release the belt. Refer to figure 1-22 for proper connection and operation of the belt.

Man-Seat Separation System.

A man-seat separation system forcibly separates the crewmember from the ejection seat when the safety belt initiator fires after ejection. On ejection, man-seat separation is aided by full deployment of the drogue chute.

PERSONNEL LOCATOR BEACON.

A personnel locator beacon installed in the parachute harness is used in locating crewmembers who have ejected. The beacon transmits a signal on 243.0 megahertz. The beacon will operate automatically upon parachute deployment when the actuator tab is snapped to the stud tab below the canopy release on the right-hand main lift web (figure 1-23). With the actuator tab unsnapped, the beacon will not operate automatically.

CHU-5A SEAT PACK.

The CHU-5A seat pack may be used as a seat bucket spacer when a survival kit is not required for mission accomplishment. In order to maintain proper ejection seat center-of-gravity, at least 10 pounds of ballast or equivalent weight shall be carried in the pack during flight.

SURVIVAL KIT.

The CNU-68/P or CNU-68A/P survival kit (figure 1-24) is designed to fit in the ejection seat and be used as a seat cushion with a back type parachute. The kit is divided into two sections, an aft section and a forward section. The aft section serves as a support for the back type parachute. The forward section contains a life raft attached to a 20-foot lanyard and a CO_2 bottle to inflate the life raft. The survival kit is attached to the crewmember's parachute harness by attaching straps on each side of the survival kit. An emergency release handle is located on the right side of the survival kit forward section. Pulling the emergency release handle during descent after ejection releases and inflates the life raft. Pulling the emergency release handle while seated in the aircraft releases both attaching straps from the survival kit, and the crewmember will be free of the unopened survival kit.

WARNING

Seats containing a survival kit or a seat pack with a 4-inch thick cushion shall contain a cutout to prevent interference with control stick full aft movement.

IMPROVED SURVIVAL KIT (AFTER T.O. 1T-38A-940)

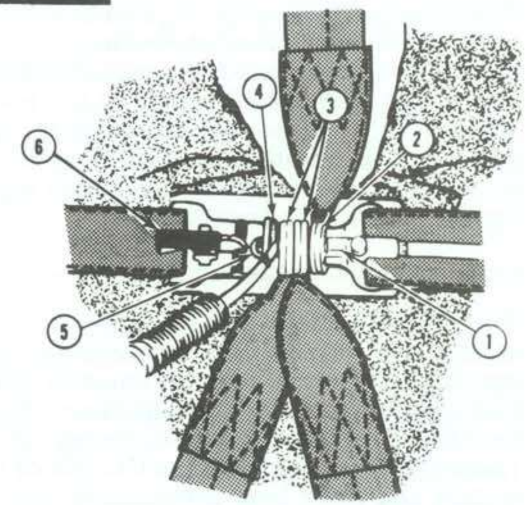
The improved survival kit (figure 1-25) fits in the ejection seat and is attached to the parachute harness by two quick-disconnect buckly/web strap assemblies. The forward section of the kit top is equipped with a seat cushion. The rear section of the kit top provides support for a back type parachute. Depending upon local command desires, kit contents will vary and may include a life raft.

AUTOMATIC/MANUAL DEPLOYMENT

The kit will be automatically released during the ejection sequence or retained for normal release, depending upon the selected position of the survival kit AUTO/MANUAL selector before ejection. During parachute deployment, the parachute

AUTOMATIC OPENING SAFETY BELT, HBU-12

LOCKED



(1) AUTOMATIC DISCONNECT LINK AND BELT LINK.

(2) CREW/KIT RETENTION STRAP LOOP OVER BELT LINK BEFORE SHOULDER HARNESS LOOPS.

WARNING

FAILURE TO INSTALL CREW/KIT RETENTION STRAP LOOP ON BELT LINK FIRST MAY DELAY OR NEGATE MAN/SEAT SEPARATION DURING EJECTION.

(3) RIGHT AND LEFT SHOULDER HARNESS LOOPS OVER BELT LINK.

(4) ANCHOR (GOLD KEY FROM AUTOMATIC PARACHUTE ARMING LANYARD) OVER BELT LINK.

WARNING

LANYARD MUST BE OUTSIDE PARACHUTE HARNESS AND NOT FOULED ON ANY EQUIPMENT, TO PERMIT CLEAN SEPARATION FROM SEAT.

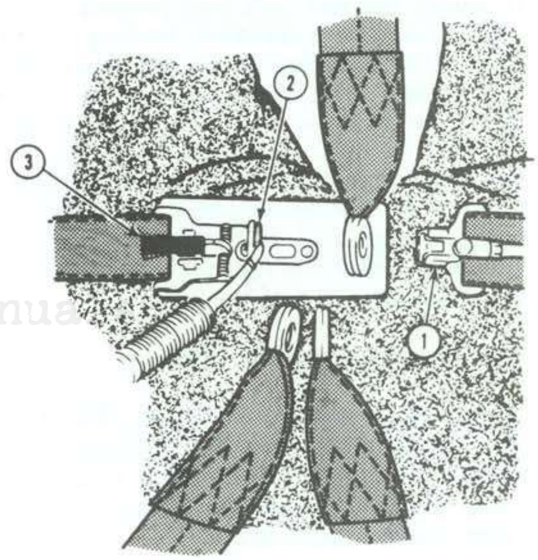
Note

ANCHOR MUST BE OVER BELT LINK LAST AND PRESSED INTO THE LATCH BASE IN ORDER TO LOCK THE LATCH.

(5) BELT LINK INSERTED IN MANUAL LATCH.

(6) MANUAL RELEASE LEVER LOCKED AND CHECKED.

AUTOMATICALLY OPENED

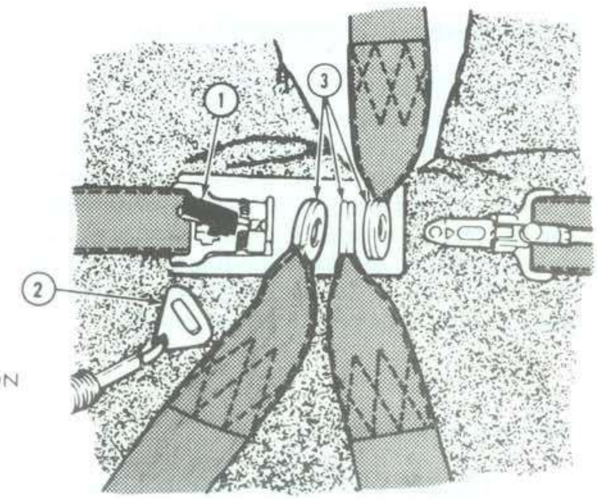


(1) AUTOMATIC DISCONNECT LINK RELEASED BY GAS PRESSURE FROM INITIATOR.

(2) ANCHOR RETAINED IN LATCH ON LEFT BELT AS SEAT FALLS AWAY.

(3) MANUAL RELEASE LEVER DOES NOT OPEN.

MANUALLY OPENED



F-5 1-41(6)A

(1) SQUEEZE AND RAISE MANUAL RELEASE LEVER.

WARNING

IF THE BELT IS MANUALLY OPENED DURING EJECTION, THE PARACHUTE WILL NOT OPEN AUTOMATICALLY UPON SEPARATION FROM THE SEAT.

(2) ANCHOR RELEASED FROM BELT LINK.

(3) SHOULDER HARNESS AND CREW/KIT RETENTION STRAP LOOPS RELEASED FROM BELT LINK.

Figure 1-21.

STRAP-IN CONNECTIONS

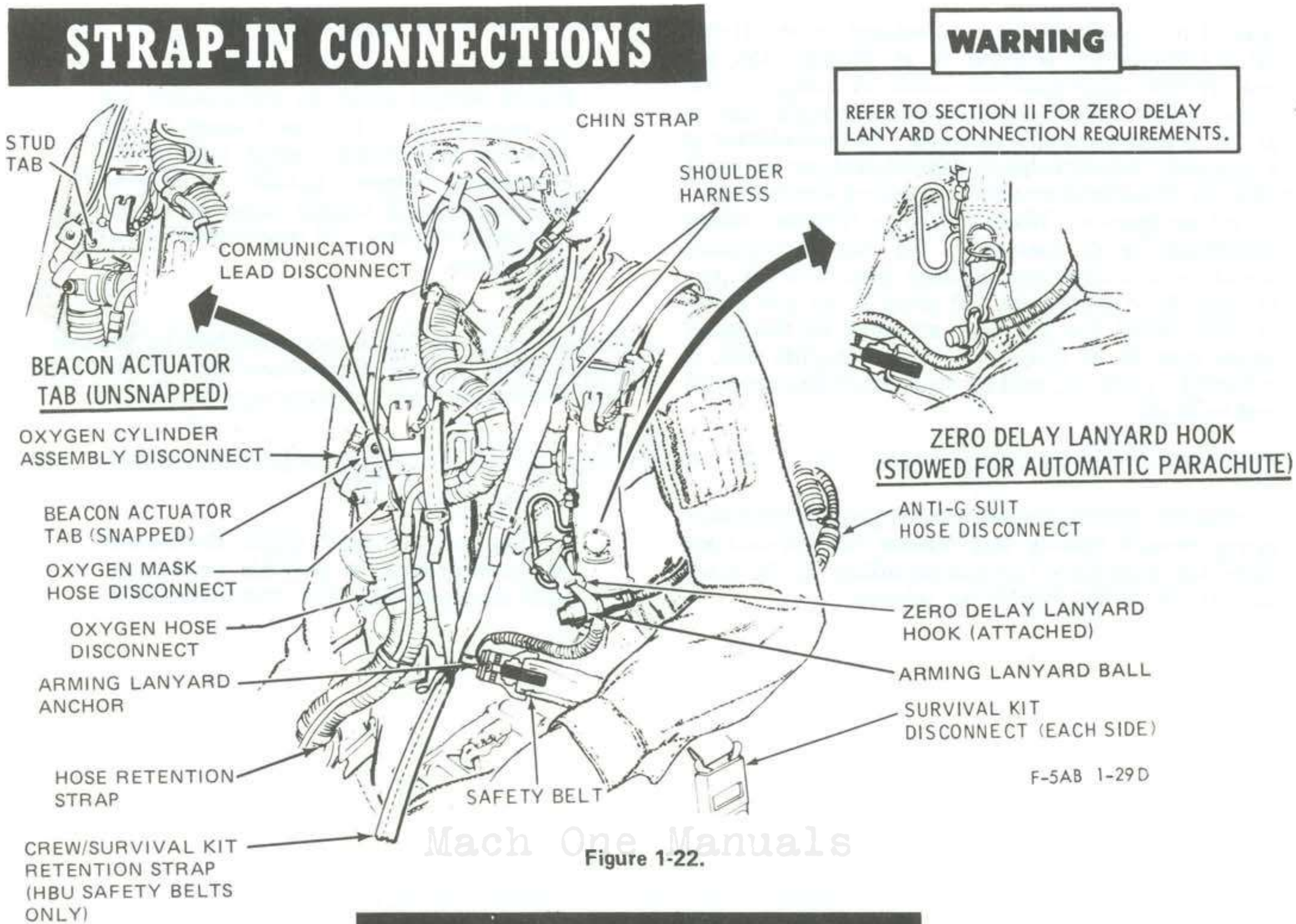


Figure 1-22.

SURVIVAL KIT

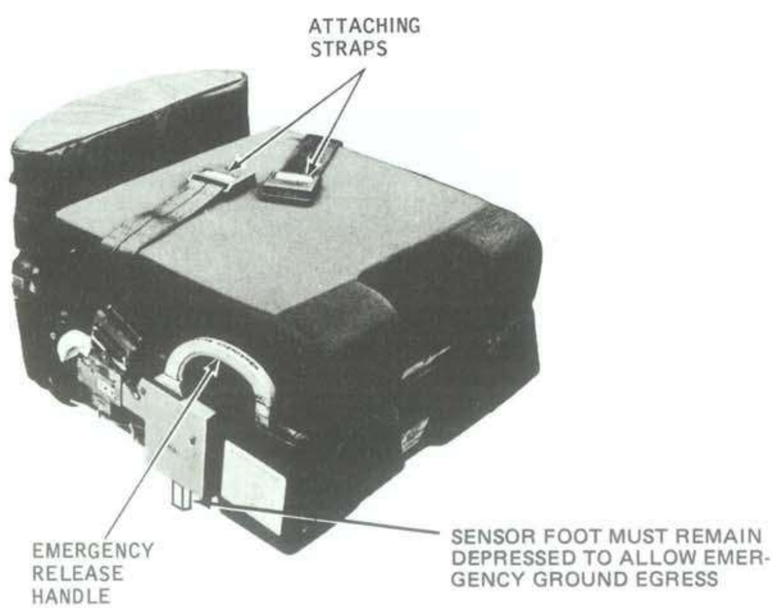


Figure 1-23.

shroud lines pull the kit auto-release cable. If the AUTO/MANUAL selector is at AUTO, the kit auto-release cable pull will cause an initiator cartridge to fire, and after a 4-second delay, the survival kit is automatically released. If the selector is at manual, the cartridge is safetied and the kit must then be released manually by pulling the emergency release handle. When the kit is released, either automatically or manually, the quick-disconnect buckle/web assemblies separate from the kit permitting it to open and fall away from the crewmember until the lanyard, attached to the parachute harness, is fully extended. The life raft, if included in the kit, will be automatically deployed and inflated.

EMERGENCY AND NORMAL EGRESS

During emergency ground egress, pulling the emergency release handle will release the survival kit from the parachute harness regardless of the position of the AUTO/MANUAL selector.

NOTE

Pilot's weight must be on survival kit to ensure the kit is bottomed in the ejection seat bucket while pulling the emergency release handle. Otherwise the lanyard will remain attached to the parachute harness and could cause egress difficulties.

Normal egress should be accomplished by manually disconnecting both quick-disconnect buckle/web strap assemblies from the parachute harness.

NOTE

Binding of the right quick disconnect buckle/web strap is possible while manually disconnecting from the survival kit.

SURVIVAL KIT

IMPROVED

AFTER T.O. 1T-38A-940

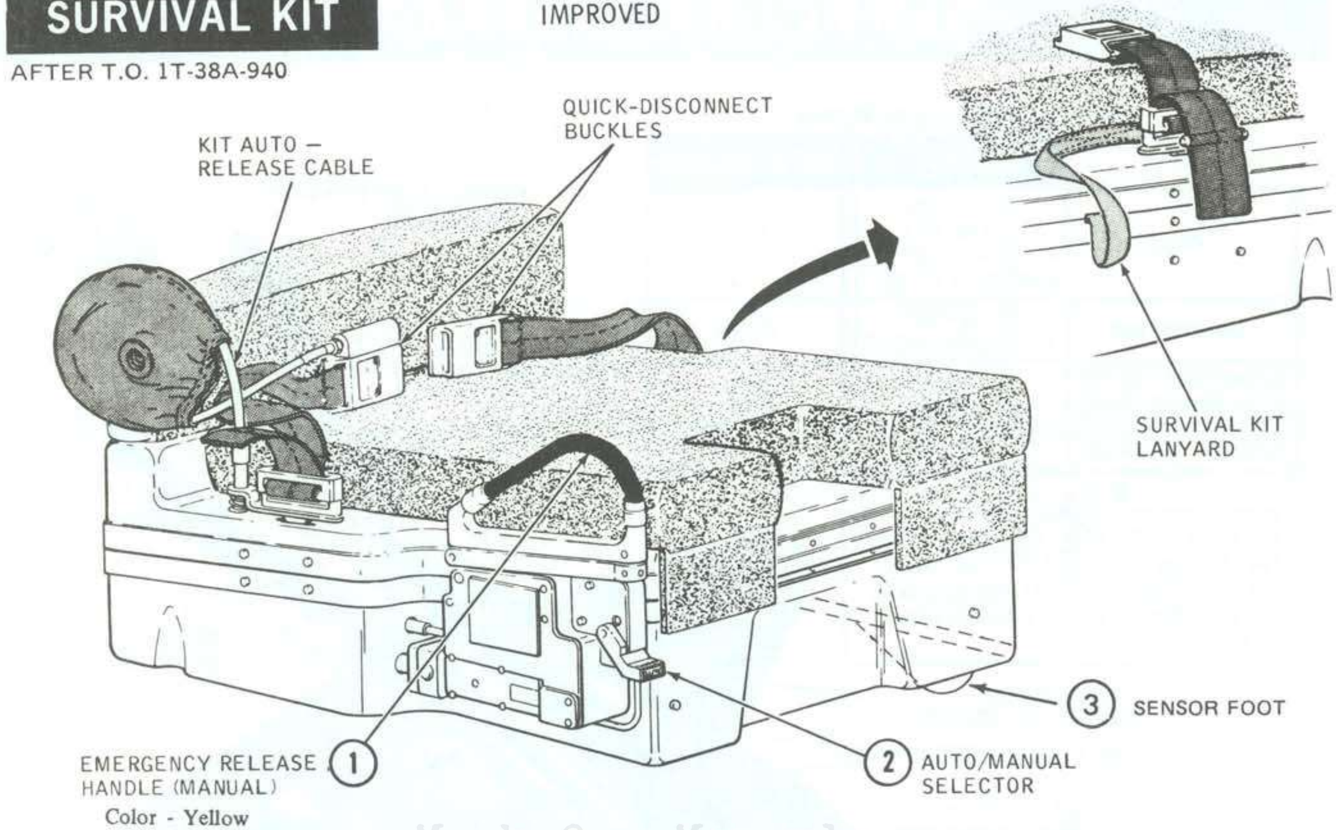


Figure 1-25.

SURVIVAL KIT **IMPROVED**

CONTROLS	FUNCTION
1 Emergency Release Handle	Pull —a. After ejection, with AUTO/MANUAL selector at MANUAL; releases kit. b. While seated on survival kit, regardless of the position of the AUTO/MANUAL selector; releases both quick-disconnects from kit.
2 AUTO/MANUAL Selector	AUTO (Up) — Permits automatic deployment of survival kit 4 seconds after parachute shroud lines are fully stretched. MANUAL— (Down) Permits manual deployment of survival kit when emergency release handle is pulled.
3 SENSOR FOOT	For emergency ground egress, the kit has to be bottomed in the seat bucket, depressing the sensor foot in order for the lanyard to release.

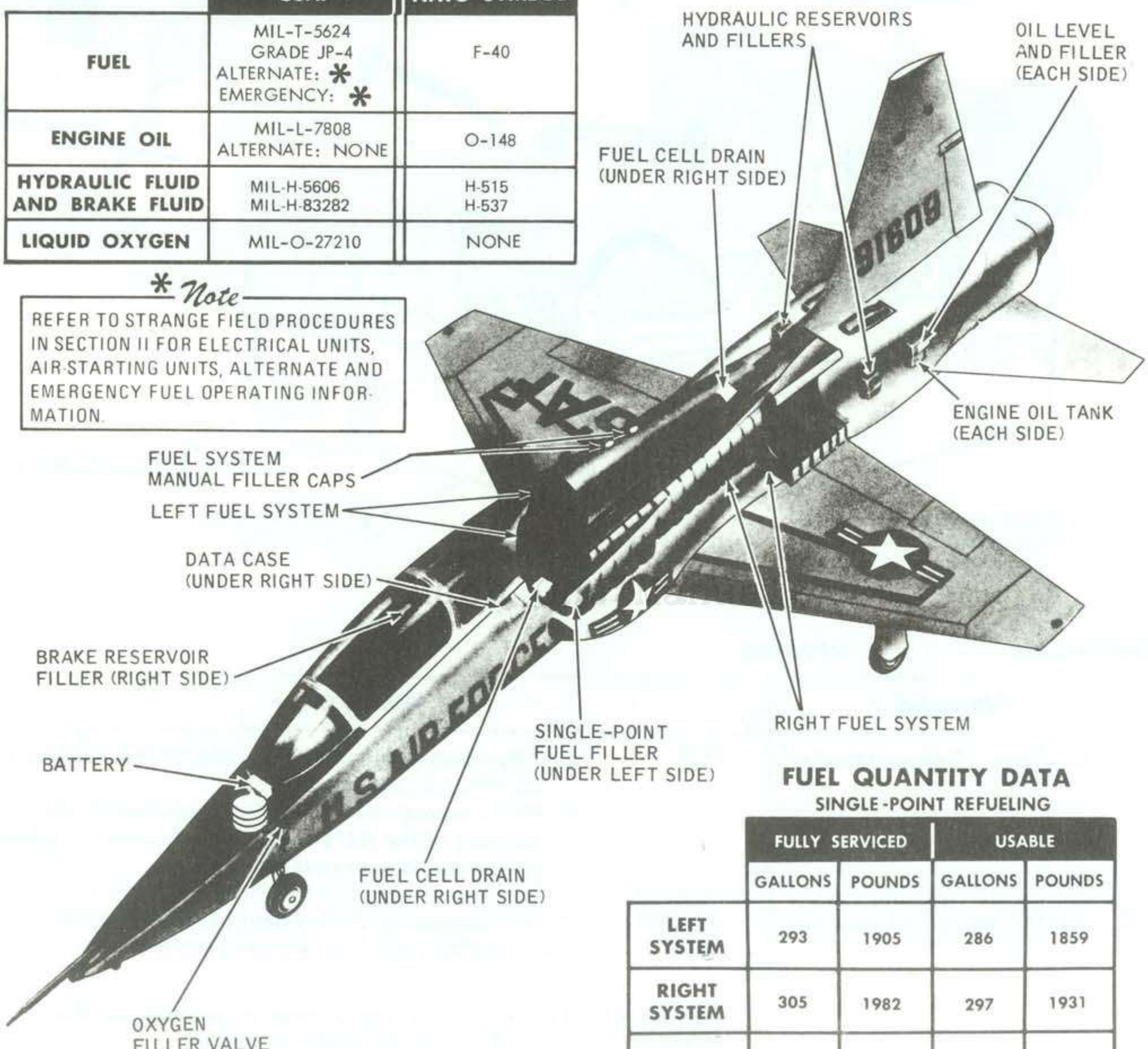
SERVICING DIAGRAM

FLUID SPECIFICATIONS

	USAF	NATO SYMBOL
FUEL	MIL-T-5624 GRADE JP-4 ALTERNATE: * EMERGENCY: *	F-40
ENGINE OIL	MIL-L-7808 ALTERNATE: NONE	O-148
HYDRAULIC FLUID AND BRAKE FLUID	MIL-H-5606 MIL-H-83282	H-515 H-537
LIQUID OXYGEN	MIL-O-27210	NONE

** Note*

REFER TO STRANGE FIELD PROCEDURES IN SECTION II FOR ELECTRICAL UNITS, AIR-STARTING UNITS, ALTERNATE AND EMERGENCY FUEL OPERATING INFORMATION.



FUEL QUANTITY DATA

SINGLE-POINT REFUELING

	FULLY SERVICED		USABLE	
	GALLONS	POUNDS	GALLONS	POUNDS
LEFT SYSTEM	293	1905	286	1859
RIGHT SYSTEM	305	1982	297	1931
TOTAL	598	3887	583	3790

Note

- FUEL — JP-4 6.5 LB PER GALLON
- SUBTRACT 6 GALLONS (39 POUNDS) FROM TOTALS IF MANUALLY REFUELED.

DATA BASIS: **ACTUAL**
DATE: 1 JULY 1978

T-38A 1-35R

Figure 1-25.

NORMAL PROCEDURES

SECTION II

T-38A 1-101

TABLE OF CONTENTS

PREFLIGHT CHECK.

BEFORE EXTERIOR INSPECTION.

(B) 1. Pylon Safety Pin — Install (if applicable) and Loose (if tight, pylon has released).

2. Form 781 — Check for aircraft status, proper servicing and (B) load configuration.

3. Seat and Canopy Safety Pins — Installed. If safety pins other than seat and canopy pins are installed, do not remove until the status of the ejection system has been checked with maintenance personnel.

4. (DUAL) Rear Seat Pack/Survival Kit Elastic Tiedown Cords — Removed and Stored as Required.

5. Seat Pack Tiedown Straps — Security and Condition (if applicable).

6. Oxygen Hose Retention Strap — Check Security and Adjust.

7. Seat Attach Bolts — Check.

WARNING

The two attach bolts must be aligned with the arrows and reference line (or shoulder) of catapult head. (See EJECTION SEAT illustration, Sec. I.)

8. Drogue Chute Cover - Check.

   Check that left cover fits closely and conforms to the contour of the drogue chute container. The forward edge of the cover should fit inside or below edge of container. The right cover is fixed in place.

WARNING

If the drogue chute cover is forced above the edges of the container, the chute is improperly installed and shall be replaced. If the left drogue chute cover is not flush with the drogue chute container, and if the canopy is lost or jettisoned in flight, wind blast effect could separate the drogue chute cover from the container and cause inadvertent drogue chute deployment. Chute deployment could cause an immediate out-of-control condition.

9. Publications — Check to ensure that all required navigational publications are on board.

(B) 10. Jettison Button — Not Depressed.

11. Fuel and Oxygen Quantity — Check.

12. Wing Flap Lever — UP.

NOTE

If the flaps are other than full up the flap switch must be set to correspond with the actual flap position. Otherwise, inadvertent flap extension/retraction will occur when AC power is applied.

13. Landing Gear Lever — LG DOWN. Physically check full down.

(B) 14. Armament Switches — Safe.

(B) 15. Reticle Intensity Knob — OFF.

(B) 16. Armament/Jettison Circuit Breakers — Check.

17. Radio Transfer Switch — FWD.

Rear Cockpit (Solo Flights).

1. Seat and Canopy Safety Pins — Check Installed, Streamers Fastened Together.
2. Seat Attach Bolts — Check.
3. Survival Kit/Seat Pack — Remove, or Secure with Elastic Tiedown Cords.

WARNING

Seat safety belt and shoulder harness do not provide adequate restraint for survival kit/seat pack during zero or negative-G maneuvers.

NOTE

The survival kit/seat pack shall be removed for solo flights unless required for pilot/passenger pickup missions.

4. Safety Belt, Shoulder Harness, Crew/Kit Retention Strap, Oxygen Hose and Man-Seat Separator Straps — Secure and Lock.

WARNING

If these items are not secured, they may become entangled with the control stick. In securing the man-seat separator straps, do not twist the upper portion which is reeled into the back of the ejection seat.

5. Drogue Chute Cover — Check.

   Check left cover fits closely and conforms to the contour of the drogue chute container. The forward edge of the cover should fit inside or below edge of container. The right cover is fixed in place.

6. Stowage Box Cover — Closed and Secured.

(B) 7. Jettison Button — Not Depressed.

8. Communication and Navigation Equipment — Check.

   a. Command radio: Function Switch — BOTH; Manual/Preset/Guard Switch — GUARD.

   b. TACAN: Function Switch — T/R; Channel Selector Knobs — Desired Channel.

   c. ILS: Steering Mode Switch — NORMAL; Navigation Mode Switch — LOCALIZER; Power Switch — POWER; Channel Selector — Desired Channel.

9. Command and Navigation Override Switch — OFF.

10. Loose Equipment — Check Securely Stowed.

11. Circuit Breakers — Check.

12. Lights — OFF.

13. Oxygen — NORMAL — 100% — ON.

14. Map Case — Removal all unnecessary mission items, Check Closed and Secured.

15. Instrument Hood — Remove or Secure. Check all bungee cords connected.

16. Canopy — Closed and Locked.

CAUTION

- The pilot will personally insure the rear canopy is closed and locked. To check for a locked condition, the pilot will push up on the canopy.
- While stowing the outside handle, do not apply clockwise pressure after the canopy is locked.

EXTERIOR INSPECTION.

Conduct the exterior inspection as shown in figure 2-1.

INTERIOR INSPECTION.

Cockpit (All Flights).

On dual flights, all items marked with an asterisk should also be checked in the rear cockpit.

1. Battery/External Electrical Power — As Required.

CAUTION

If external power is connected the battery should be turned off to prevent battery damage.

NOTE

If the aircraft will not accept external AC power and the APU checks good, cycling the battery switch ON then OFF may actuate necessary relays to allow the aircraft to accept external AC power.

*2. Intercomm Switches - As Required.

3. Crew Retractable Steps — Assure Stowed (If Required).

If steps are used, the pilot will assure that they are stowed to prevent flight with the steps extended.

*4. Survival Kit (if applicable) — Attached and adjusted.

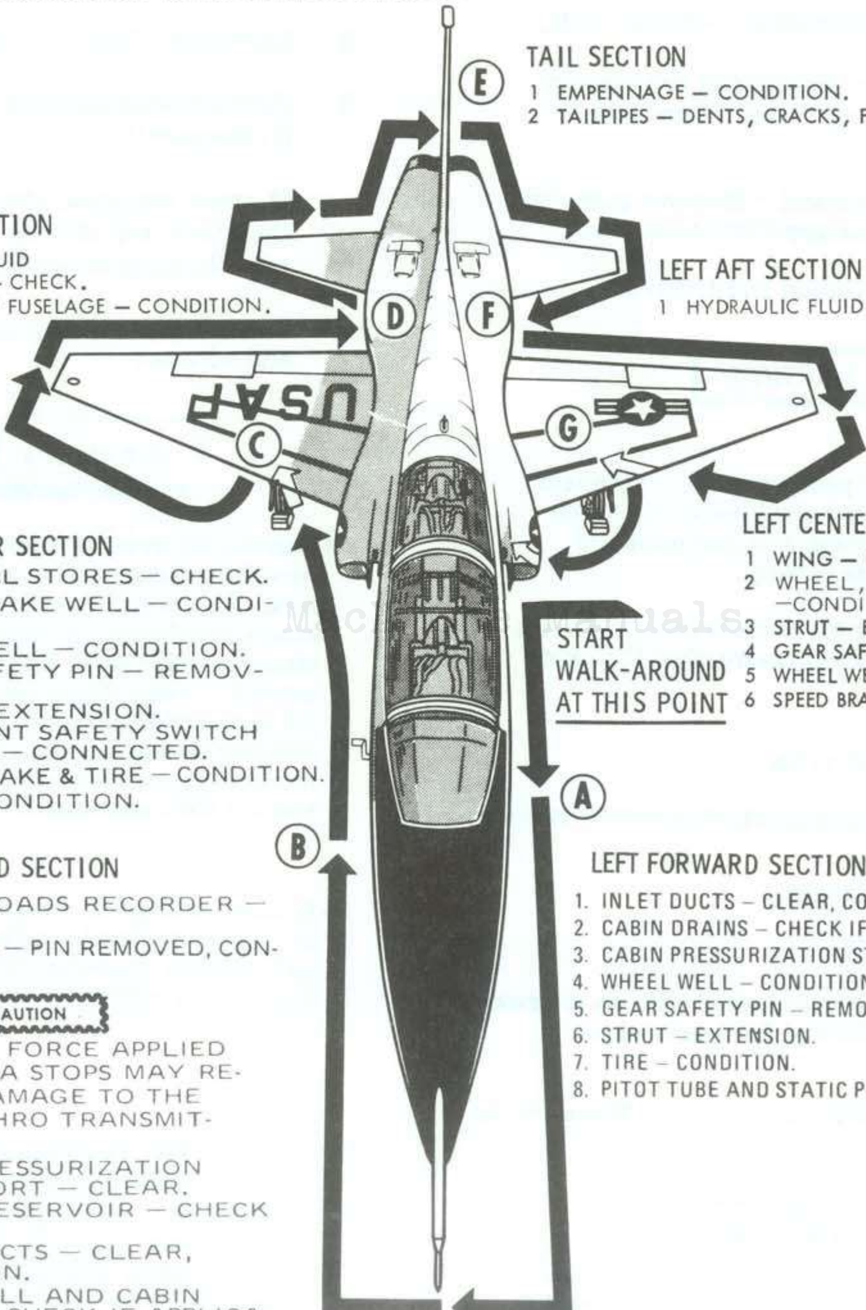
WARNING

- Survival kit must be connected to the parachute harness prior to fastening lap belt. Failure to properly tighten these straps could result in injury or seat-man-chute entanglement during ejection sequence. Loose straps can result in the kit moving forward and up out of the seat bucket during zero or negative -G maneuvers and restrict or prohibit aft control stick movement in both cockpits.
- Ensure survival kit straps are routed under the safety belt to prevent interference and possible man-seat entanglement during ejection sequence.

*5. Safety Belt, Shoulder Harness, Crew/Survival Kit Retention Strap (if applicable), Parachute Arming Lanyard Anchor, Zero-Delay Lanyard Hook (if applicable), Beacon Actuator Tab, Oxygen Connectors, Hose Retention Strap, Anti-G Suit Hose, and Helmet Chin Strap — Fasten and Adjust.

EXTERIOR INSPECTION

DURING THE EXTERIOR INSPECTION, THE AIRCRAFT SHOULD BE CHECKED FOR GENERAL CONDITION, WHEELS CHOCKED, ACCESS DOORS, PANELS, AND FILLER CAPS SECURED, GROUND WIRES REMOVED, FOR HYDRAULIC, OIL, AND FUEL LEAKS. CHECK ALL SCREWS/ FASTENERS FORWARD OF THE ENGINE INTAKES ARE PROPERLY INSTALLED OR THOSE MISSING ARE APPROPRIATELY ANNOTATED IN THE AFTO 781. ADDITIONALLY, THE FOLLOWING SPECIFIC ITEMS WILL BE CHECKED:



TAIL SECTION

1. EMPENNAGE — CONDITION.
2. TAILPIPES — DENTS, CRACKS, FUEL.

RIGHT AFT SECTION

1. HYDRAULIC FLUID INDICATORS — CHECK.
2. UNDERSIDE OF FUSELAGE — CONDITION.

LEFT AFT SECTION

1. HYDRAULIC FLUID INDICATORS — CHECK.

RIGHT CENTER SECTION

1. (B) EXTERNAL STORES — CHECK.
2. SPEED BRAKE WELL — CONDITION.
3. WHEEL WELL — CONDITION.
4. GEAR SAFETY PIN — REMOVED.
5. STRUT — EXTENSION.
6. (B) ARMAMENT SAFETY SWITCH LINKAGE — CONNECTED.
7. WHEEL, BRAKE & TIRE — CONDITION.
8. WING — CONDITION.

LEFT CENTER SECTION

1. WING — CONDITION.
2. WHEEL, BRAKE & TIRE —CONDITION
3. STRUT — EXTENSION.
4. GEAR SAFETY PIN — REMOVED.
5. WHEEL WELL — CONDITION.
6. SPEED BRAKE WELL — CONDITION.

RIGHT FORWARD SECTION

1. (B) FLIGHT LOADS RECORDER — SET.
2. AOA VANE — PIN REMOVED, CONDITION.

CAUTION

EXCESSIVE FORCE APPLIED TO THE AOA STOPS MAY RESULT IN DAMAGE TO THE AOA SYNCHRO TRANSMITTER.

3. CABIN PRESSURIZATION STATIC PORT — CLEAR.
4. BRAKE RESERVOIR — CHECK LEVEL.
5. INLET DUCTS — CLEAR, CONDITION.
6. STICK WELL AND CABIN DRAINS —CHECK IF APPLICABLE.
7. WSSP (IF INSTALLED) - SECURE CHECK PYLON TO AIRCRAFT ATTACH BOLTS AND POD NOSE SECTION FOR SECURITY.

LEFT FORWARD SECTION

1. INLET DUCTS – CLEAR, CONDITION.
2. CABIN DRAINS – CHECK IF APPLICABLE.
3. CABIN PRESSURIZATION STATIC PORT – CLEAR.
4. WHEEL WELL – CONDITION.
5. GEAR SAFETY PIN – REMOVED.
6. STRUT – EXTENSION.
7. TIRE – CONDITION.
8. PITOT TUBE AND STATIC PORTS – CLEAR.

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Figure 2-1.

WARNING

- Failure to attach personal equipment correctly may prevent separation from seat after ejection. Refer to figures 1-21 or 1-22 and 1-23.
- Assure that hose retention strap is adjusted to preclude hose separation from oxygen-disconnect on parachute harness.
- Do not route the anti-G suit hose under the safety belt or in any manner which would interfere with disconnecting the hose if required.
- The oxygen hose from the mask to the disconnect should be routed under the right shoulder harness strap before connecting to the disconnect. This helps 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.
- Before T.O. 1T-38-579 the survival kit can rise up and move forward during zero or negative-G maneuvers even though the seat safety belt and shoulder harness are tightly adjusted.
- The seat pack can rise up and move forward during zero or negative-G maneuvers even though the seat safety belt and shoulder harness are tightly adjusted.

*6. Ejection Seat Handgrips — Push (to ensure fully down).

*7. Oxygen System — Check (PRICE).

*8. Circuit Breakers — Check.

9. Gear Door Switch — NORMAL.

10. Flight Director Switch — ON.

11. Aux Flap Switch — NORMAL.

12. Rudder Trim Knob — CENTERED.

*13. Throttles — OFF.

14. Speed Brake Switch — OPEN.

15. Compass Switch — MAG.

16. Fuel Shutoff Switches — NORMAL (guarded position).

17. Landing Gear Alternate Release Handle — IN.

18. Landing-Taxi Light Switch — OFF.

*19. Landing Gear Lever — LG DOWN.

*20. Airspeed-Mach Indicator — Check.

*21. Standy Attitude Indicator — Uncage and Adjust.

*22. Accelerometer — Check.

*23. Clock — Set.

*24. Steering Mode Switch — As Required.

*25. Navigation Mode Switch — As Required.

*26. Marker Beacon Light — Test.

*27. Radio Transfer Switches — As Required.

28. Comm Antenna Switch — AUTO.

*29. UHF, TACAN, ILS — ON.

30. Magnetic Compass — Check.

*31. Altimeter — Set.

*32. Vertical Velocity Indicator — Check.

33. Cabin Altimeter — Check.

34. Cabin Pressure Switch — CABIN PRESS.

35. Cabin Air Temperature Switch — AUTO.

36. Pitot Heat Switch — OFF.

37. Engine Anti-Ice Switch — As Required.

38. Fuel Boost Pump Switches — ON.

39. Crossfeed Switch — OFF.

40. Generator Switches — ON.

41. IFF/SIF — STBY.

(B) 42. MXU — ON.

*43. Warning Test Switch — TEST.

(Without ac power on Block 30 and earlier aircraft, no landing gear audible warning signal.)

NOTE

- When the test switches in both cockpits are actuated simultaneously, all fire warning lights will illuminate. The landing gear audible warning signal will not come on in either cockpit.
- All four fire warning light bulbs in both cockpits must illuminate during TEST. Failure of any bulb to illuminate may indicate an inoperative fire detector.

*44. Interior and Position Lights — As Required.

45. Rotating Beacon — ON.

*46. Forms/Publications/Loose Items — Stowed.

(B) 47. Sight Dust Cover — Stowed.

(B) 48. Gun Camera Film Pack — Secure.

STARTING ENGINES.

RIGHT ENGINE.

Start the right engine first, using the following procedure:

1. Danger Areas — Clear, Fore, aft and under the aircraft.
2. External Air — Apply.
3. Engine Start Button — Depress at approximately 14% RPM.

   Minimum required is 12% RPM.
4. Throttle — Advance to IDLE.

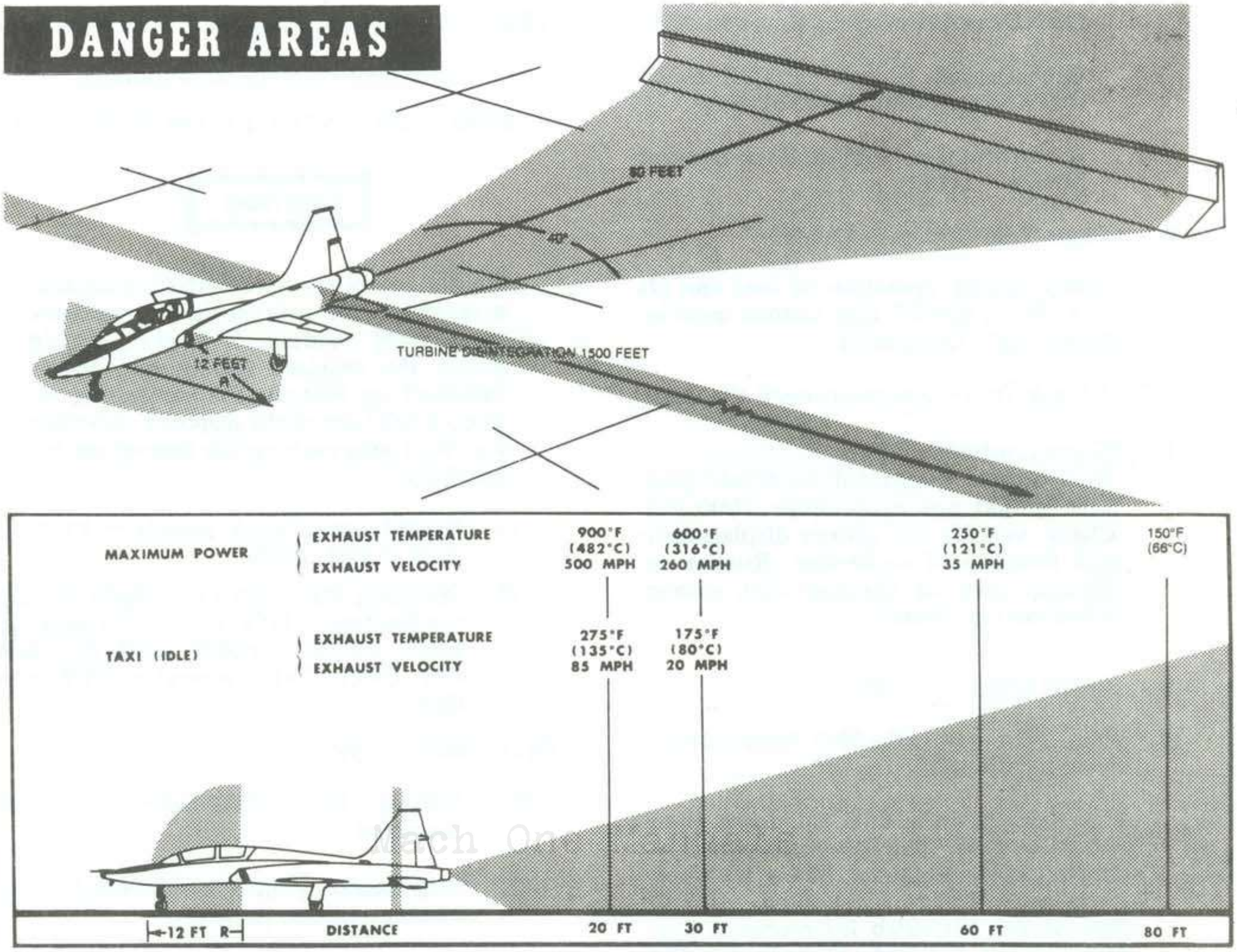
CAUTION

- Prior to moving either throttle to IDLE, assure that the respective OFF flag is out of view or the ON flag is in view as applicable (front cockpit only) otherwise an engine start cannot be properly monitored.
- If ignition does not occur before fuel flow reaches 360 LB/HR, retard throttle to OFF. Maintain airflow to permit fuel and vapors to be purged from engine. Wait at least 2 minutes to permit fuel to drain before attempting another start.
- If EGT does not begin to rise within 12 seconds after the first indication of fuel flow, abort the start. If engine light is normal but RPM do not reach generator cut-in speed before termination of the start cycle, push the engine start button to assure aircraft electrical power is available to monitor the start.

5. Engine Instruments — Check.
6. Hydraulic Pressure — Check.
7. Caution Light Panel — Check.

LEFT ENGINE

1. Left Engine — Start Same As Right Engine.
2. Signal ground crew to disconnect external power and/or air supply.
3. Battery Switch — Check ON.



T-38A T-38D

Figure 2-2.

BEFORE TAXIING

CAUTION

Allow 3 1/2 minutes to elapse after power has been applied to the attitude gyro control assembly before taxiing.

1. Canopy Defog, Cabin Temp and Pitot Heat — Check (check pitot heat if required).

WARNING

For night or anticipated weather operation with conditions of high humidity and narrow temperature-dewpoint spread, the canopies should be closed and the cabin temperature increased to the 100° AUTO position to preheat all flight instruments and canopy surfaces. Return temperature control to a comfortable inflight setting after completion of the line-up check.

*2. Circuit Breakers — Check.

3. Anti-G Suit Test Button — Press-to-test.

4. Yaw Damper Switch — YAW.

5. (Block 20 aircraft) Pitch Cutoff Switch — Check.

   a. Pitch Damper Switch — PITCH.

   b. Pitch Cutoff Switch — Actuate.

c. Pitch Damper Switch — Moves to OFF.

d. Pitch Damper Switch — PITCH; check that horizontal tail does not move.

e. If horizontal tail moved, Pitch Damper Switch — OFF.

6. Flight Trim System — Check.

Verify proper operation of fore and aft trim. Press takeoff trim button until indicator light illuminates.

7. Aileron Trim — Neutral (Check Visually).

8. Flight Controls — Check.
With normal movement, hydraulic pressure should not drop below 1500 PSI. Check visually for proper displacement and freedom of movement. Rudder deflection may be checked with mirrors when canopy is open.

9. Speed Brake — Closed.

10. Wing Flap and Flap-Slab Interconnect System — Check.

Wing flaps down to 60%, full down, then retract to 60%. The flap position indicator should be checked at 60% ± 5% when flaps are lowered or retracted. Operation of the Flap-Slab Interconnect System must be checked. Visually note the trailing edge of the slab moves down continuously as the flaps are lowered. Also note the trailing edge of the slab moves up as the flaps are raised.

WARNING

Do not attempt flight if proper operation of the Flap-Slab Interconnect System has not been verified. The leading edge of the horizontal tail must be aligned with the upper index mark on the fuselage at the 60% flap setting. The visual alignment portion of the interconnect system check must be performed by ground personnel.

*11. Communication and Navigation Equipment — Check.

Refer to Section IV for description of proper system operation.

(B) 12. Optical Sight/Camera — Check/Set.

*13. Altimeter — Check (as required).

Refer to Section IV for altimeter operation

CAUTION

Do not rotate the barometric set knob at a rapid rate or exert force to overcome momentary binding. If binding should occur, the required setting may be established by rotating the barometric set knob a full turn in the opposite direction and then approaching the desired setting carefully.

14. Fuel/Oxygen Check Switch — FUEL & OXY GAGE TEST.

15. Crossover Relay Check — Right Generator Switch — OFF then ON (when external electrical power used for start, also check Left Generator OFF then ON).

(B) 16. MXU — OFF.

*17. Survival Kit (AUTO/MANUAL) — As Required.

*18. Seat Height - Adjust to insure ability to assume ejection position.

WARNING

Ensure all equipment is stowed and clear of the handgrips to prevent inadvertent handgrip movement during seat adjustment. Whenever practical during ground operations, adjust the seat with the seat safety pin installed.

*19. Seat and Canopy Safety Pins — Remove, display to ground crew, and stow.

CAUTION

Care should be taken to prevent inadvertent pulling of the canopy Jettison T-handle when removing the safety pin.

*20. Brakes — Check Pedal Pressure.

21. Chocks — Removed.

TAXIING.

WARNING

If carbon monoxide contamination is suspected during ground operation, use 100% oxygen.

CAUTION

- If brake drag is encountered or suspected, the aircraft should be aborted.
- Simultaneous use of wheel brakes and nose wheel steering to effect turns results in excessive nosewheel tire wear. Nosewheel tires are severely damaged when maximum deflection turns are attempted at speeds in excess of 10 knots.
- A low nose gear strut indicates insufficient strut pressure and may result in a cocked nosewheel and/or damage to the nosewheel well during retraction. Do not fly the aircraft if the nose gear strut is deflated or if the strut "bottoms" during taxiing.

NOTE

To prevent possible damage to the canopy downlock mechanism, taxi with either both canopies open or both closed and pressurized whenever practical.

*1. Flight Instruments — Check (as required).

BEFORE TAKEOFF.

*1. Takeoff Data — Review.

2. Battery Switch — Check ON.

3. Canopy Defog, Cabin Temp — As Required.

4. Engine anti-Ice — As Required.

*5. Parachute Arming Lanyard, Zero-Delay Lanyard (if applicable) and survival kit (if applicable) — Check.

*6. Cockpit Loose Items — Check Secured.

*7. Helmet Visors — As Required.

*8. Flight Controls — Check for free and proper movement.

9. Takeoff Trim Button — Press. Check that indicator light illuminates.

*10. Canopy — Closed, Locked; Warning light — Out.

CAUTION

- Before lowering the canopy, ensure the hood is not bunched between the ejection seat drogue chute housing and the canopy or damage may occur to the seat or canopy.
- Should the canopy be difficult to close and lock or if binding is encountered in transit, have the system checked by qualified maintenance personnel before flight.
- Should the canopy jam in the fully open position, the aircraft should not be taxied or towed until cleared by qualified maintenance personnel. Efforts to close the canopy or vibrations set up by aircraft movement could result in canopy separation.

LINEUP CHECK.

1. Pitot Heat — As Required.

2. IFF/SIF — As Required.

3. Nosewheel Steering — Check Disengaged.

4. Throttles — MIL.

5. Master Caution Light — Out.

6. Engine Instruments — Check.

7. Hydraulic Pressure — Check.

NORMAL TAKEOFF (TYPICAL)

BASED ON GROSS WEIGHT OF 12,500 LBS

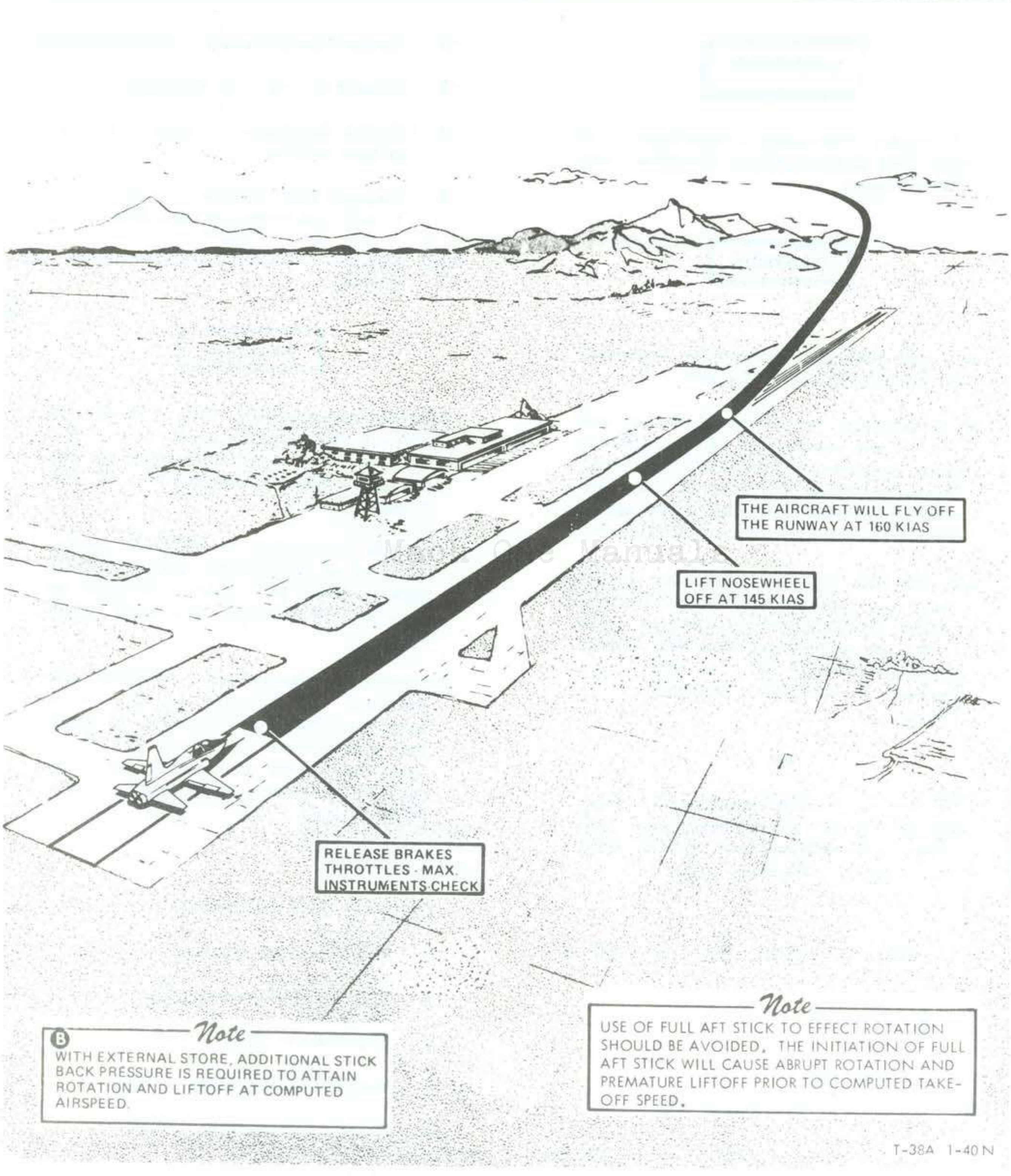


Figure 2-3.

TAKEOFF.

The following takeoff procedure, and that given in figure 2-3 forms the basis of the performance predictions in Appendix I. Conditions such as weight, wind, single engine performance considerations, etc., may make it prudent to delay rotation and lift-off above the speeds shown in the figure. However, tire limit speeds should be observed.

WARNING

Avoid wake turbulence. Allow a minimum of two minutes before takeoff behind any heavier type aircraft or helicopter and a minimum of four minutes behind jumbo jet aircraft. With effective crosswind of over 5 knots, the interval may be reduced. Attempt to remain above and upwind of the preceding aircraft's flight path. See Section VI.

1. Brakes — Release.
2. Throttles — MAX.
3. Instruments — Check.

CAUTION

The takeoff should be aborted if either afterburner fails to light within 5 seconds or if the light off is abnormal.

NOTE

The acceleration check speed is the only means by which actual aircraft (engine) performance can be referenced to the computed values. Less than predicted acceleration will invalidate all computed speeds and associated distances.

CROSSWIND TAKEOFF

Aileron into the wind will aid in directional control and help in preventing compression of the downwind strut. The aircraft should be allowed to crab into the wind as rotation occurs.

AFTER TAKEOFF.

1. Landing Gear Lever — LG UP, when definitely airborne.

CAUTION

Check the red light in the gear handle out prior to 240 KIAS.

2. Wing Flap Lever — UP.

CLIMB.

*1. Zero-Delay Lanyard (if applicable) — Disconnect above 2,000 feet AGL.

*2. Oxygen System — Check.

3. Cabin Pressure — Check.

4. Canopy Defog and Cabin Temp — As Required.

5. Fuel Quantity — Check.

LEVEL-OFF AND CRUISE.

*1. Oxygen System — Check.

2. Cabin Pressure — Check.

3. Fuel Quantity — Check.

*4. Altimeter — Reset as required, check STBY and return to RESET.

CAUTION

The altimeter may malfunction without reverting to standby mode. If any altimeter malfunction is suspected, check STBY position and return to RESET. If during any check the difference between primary and standby mode exceeds 150 feet below 10,000 feet or 250 feet above 10,000 feet, continue the mission in standby mode.

LANDING AND GO-AROUND PATTERN
(TYPICAL)

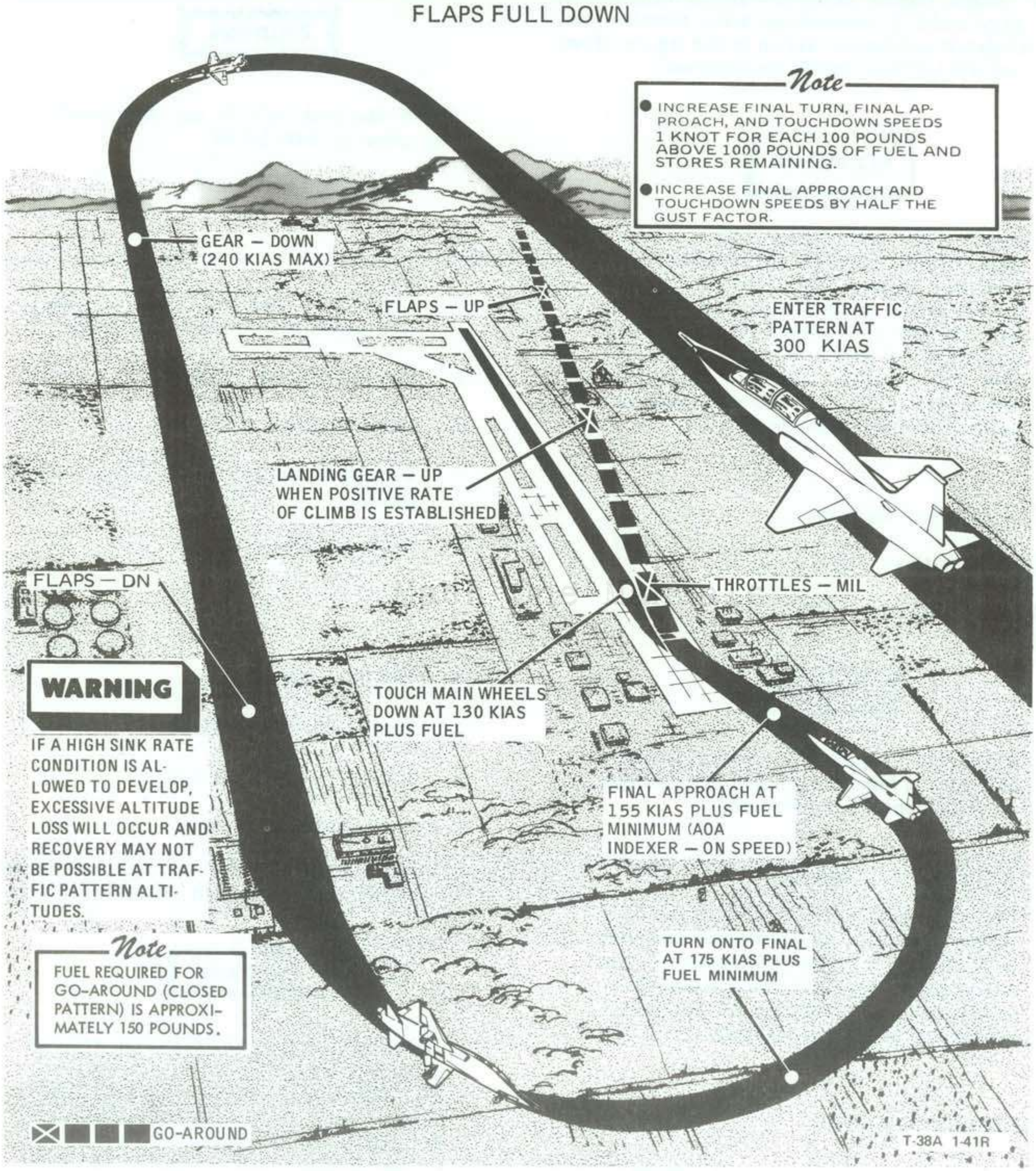


Figure 2-4.

NOTE

If the AAU-19/A altimeter reverts to standby operation at any time during flight, attempt to return to the servoed mode of operation by placing the altimeter function switch momentarily to the RESET position. If the altimeter will not reset or reverts to standby after a few seconds, continue mission in the standby mode.

DESCENT.

(B) *1. Armament Safety Check — Completed.

(B) 2. Reticle Intensity Knob — OFF.

*3. Helmet Visors — As Required.

4. Canopy Defog, Cabin Temp – As Required.

5. Pitot Heat, Engine Anti-Ice — As Required.

*6. Altimeter — Reset as required, check STBY and return to RESET.

*7. Fuel Balance — Check.

8. Crossfeed — OFF.

9. Landing and Position Lights — As Required.

*10. Zero-Delay Lanyard (if applicable) — Attach above 2,000 feet AGL.

BEFORE LANDING.

See figure 2-4 for pattern speeds:

*1. Pattern Airspeeds — Compute.

*2. Gear — Down & Check Down. (Physically press the front cockpit lever full down.)

CAUTION

Failure of the landing gear lever interconnect cable while the landing gear is being lowered from the rear cockpit may result in normal gear extension without full down travel of the front landing gear lever, leading to possible uncommanded gear retraction on landing. To preclude this, the front landing gear lever shall be physically checked full down anytime the gear is lowered from the rear cockpit.

*3 Hydraulic Pressures — Check.

*4. Flaps — As Required.

LANDING.

WARNING

Avoid wake turbulence. Allow a minimum of two minutes before landing behind any heavier type aircraft or helicopter and a minimum of four minutes behind jumbo jet aircraft. With effective crosswinds of over 5 knots, the interval may be reduced. Attempt to remain above and upwind of the preceding aircraft's flight path. See Section VI.

NORMAL LANDING.

Normal landings are performed using flaps full down. Refer to figure 2-4 for recommended landing and go-around pattern. After touchdown, continue to increase back-pressure on the stick to obtain the highest possible nose-high attitude without flying the aircraft off the runway. Just prior to loss of elevator authority, lower the nosewheel to the runway. After the nosewheel is lowered to the runway, a single, smooth brake application should be used to stop. This technique could increase landing distance as much as 50 percent from that computed from the landing distance chart in Part 7 of Appendix.

CAUTION

- Extreme CAUTION must be exercised when applying wheel brakes above 120 KIAS as locked wheels or tire skids are difficult to recognize. If tire skids are detected, immediately release both brakes and cautiously reapply.
- (B) Attempting to aerobrake using full back stick until the nose can no longer be held up will produce a hard nosewheel impact at approximately 100 KIAS.
- Extreme nose high aerobraking when crossing raised arresting cables may result in damage to the afterburner ejectors.

MINIMUM ROLL LANDING.

Decrease airspeed 10 knots below normal landing final approach airspeed to assure touchdowns at speeds noted in the landing distance chart in Part 7 Appendix. The landing distance chart shows data for landing at computed touchdown speed at approximately 12 degrees nose high attitude. Just prior to loss of elevator authority, lower the nosewheel to the runway and apply optimum wheel braking. For wet runways, a firm touchdown will tend to reduce the effects of hydroplaning.

CROSSWIND LANDING.

Approach and Touchdown.

On final approach, counteract drift by crabbing into the wind, maintaining flight path alignment with the runway. The crab should be held thru touchdown. When the crosswind component exceeds 15 knots, touchdown should be planned for the center of the upwind side of the runway. Maintain precise airspeed control throughout the final approach; in gusty conditions, increase the indicated airspeed by one-half of the gust increment above the wind velocity. Refer to Section V for landing rate of descent.

After Touchdown.

The landing attitude should be maintained by continuing to increase back pressure on the stick. Aileron into the wind will aid in directional control, will help in preventing compression of the downwind strut, and will prevent the upwind wing from becoming airborne. Maintain directional control of the aircraft with the rudder. A too rapid increase in the back stick pressure may cause the aircraft to become airborne and drift across the runway. Drift will create a high probability of tire damage. Just prior to loss of elevator authority, lower the nosewheel to the runway.

CAUTION

B Attempting to aerobrake using full back stick until the nose can no longer be held up will produce a hard nosewheel impact at approximately 100 KIAS.

Lowering the nose prematurely in a crosswind will produce a compression of the downwind strut. This hampers directional control and may be minimized by use of aileron. Early downwind strut compression combined with weathervaning usually results in damage to the downwind tire.

USE OF WHEEL BRAKES.

Wheel Brake Operation.

To minimize brake wear, the brakes should be used as little and as lightly as possible. If the first application of brakes does not provide adequate pressure or if the brakes feel spongy, normal pressure might be regained by pumping the brake pedals. The pedals should be allowed to return to the full up position between strokes. Failure of certain brake components within a cockpit may result in complete failure of one or both brakes. Should this occur, braking might be gained by operating the brakes in the other cockpit. Full advantage of the length of runway should be taken during landing or aborted takeoff. Minimize use of brakes during turns and avoid dragging the brakes during taxiing. When there is considerable lift on the wings, such as immediately after touchdown, heavy brake pressure will lock the wheel more easily than when the same pressure is applied after the full weight of the aircraft is on the tires. Once a wheel is locked, it may be necessary to completely release brake pressure to allow wheel rotation.

Optimum Braking Action.

The physical limitations of the tire and brake system make it extremely difficult to consistently achieve optimum braking action, particularly at high speeds (above 120 KIAS), where the weight component is reduced due to lift. A single, smooth application, increasing as airspeed decreases, offers the best braking opportunity. Great caution should be used when braking at speeds above 100 KIAS. Locked brakes are difficult to diagnose until well after the fact. Braking should be discontinued at the first indication of directional problems and then cautiously reapplied. At speeds below 100 KIAS, the chances of approaching optimum braking action are greatly increased.

WARNING

- Braking required for high speed, heavy gross weight abort may result in extremely hot brakes or brake failure and the possibility of tire fire should be anticipated.
- If hot brakes are suspected, the aircraft should not be taxied into a congested area. Ensure all personnel remain clear of the main wheels until they have cooled.

NOTE

All stopping distances computed from the appendix are based on optimum braking. Optimum braking is difficult to achieve. Variables such as brake and tire condition, pilot technique, etc. may increase computed distances.

GO-AROUND

Make the decision to go-around as early as possible. Military power is normally sufficient for go-around, but do not hesitate to use maximum power if necessary.

WARNING

If conditions do not permit an aerial go-around, do not try to hold the aircraft off the runway; continue to fly the aircraft to touchdown and follow the go-around procedure.

1. Throttles — MIL (MAX if necessary).
2. Landing Gear Lever — LG UP, when definitely airborne.
3. Wing Flap Lever — UP.

NOTE

If touchdown is made, lower the nose slightly to accelerate. Establish takeoff attitude to allow the aircraft to fly off the runway at takeoff speed.

TOUCH-AND-GO LANDINGS.

To make a touch-and-go landing, perform the desired approach and landing. After touchdown, follow the normal go-around procedure.

WARNING

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

AFTER LANDING.

*1. Seat and Canopy Safety Pins — Install.

2. Pitot Heat — OFF.

*3. Loose Items — Check Secured (before opening canopy).

4. Cabin Altimeter — Check.
   If reading is below field elevation write up the failure in the AF Form 781.

5. Cabin Pressure Switch — RAM DUMP.

CAUTION

After placing the cabin pressure switch at RAM DUMP, insure the cabin altimeter displays field elevation before opening the canopy. Pressure equalization may take several seconds.

6. Gear Door Switch — OPEN.

7. Takeoff Trim Button — Press.

*8. Wing Flaps — Up.

9. Speed Brake — Open.

10. Landing-Taxi Light — As Required.

*11. TACAN, ILS, IFF/SIF — OFF.

*12. Canopy — Unlocked.

ENGINE SHUTDOWN.

1. Operate engines at 70% RPM or below for a minimum of 1 minute.

*2. Seat — Full Up.

3. Cabin Pressure Switch — CABIN PRESS

4. Position Lights — OFF.

NOTE

Allow 10 seconds for landing-taxi light retraction and/or closure of ram dump door prior to engine shutdown.

5. Rotating Beacon — OFF.

*6. Oxygen — 100%.

7. Throttles — OFF.

*8. Standby Attitude Indicator — Cage and Lock.

*8. All Unguarded Switches — OFF.

9. Wheels — Chocked.

*11. Gold Key — Secured.

12. Battery — OFF.

13. Flight Director Switch - Off.

(B) 14. Sight Dust Cover - Replace.

WARNING

Ensure the seat safety pin is installed and all equipment is properly secured to prevent entanglement with the ejection seat handgrips and possible handgrip movement during egress.

STRANGE FIELD PROCEDURES.

The following information provides guidance for operation at fields that do not normally support the aircraft:

1. Oil: Use MIL-L-7808 (NATO 0-148). Alternate: None.

   Check oil level immediately after flight.

2. Fueling: Use MIL-T-5624, Grade JP-4 (NATO F-40).

Alternate Fuels.

Alternate fuels can be used continuously with a possible loss of efficiency. The use of these fuels might result in increased maintenance. The use of JP-5, JP-8 and Jet A-1 with FSII is limited to three (3) consecutive flights after which fuel density adjustments must be accomplished for continued use. Any fuel used as an alternate fuel must contain an anticing inhibitor. If it does not, it must be downgraded to emergency status.

Emergency Fuels.

Emergency fuels may cause significant damage to the engine or other systems. Examples of conditions that might warrant use of emergency fuels are an accomplishment of an important mission and emergency evacuation flights.

a. Use of emergency fuels is restricted to a one time subsonic flight with minimum maneuvers and power changes. Engine RPM and EGT must be closely monitored to prevent exceeding operating limits during throttle movement. Rapid throttle movements and afterburner lights in flight are allowed only under emergency conditions.

b. Idle speed (minimum thrust) may be increased, acceleration may be faster causing the engine to stall, max RPM and EGT may be exceeded, and finally afterburner fuel flow may be high and cause the engine to stall.

c. When using fuel without an anti-icing inhibitor, flight is restricted to altitudes where temperature below the freezing point of water will not be encountered.

Single-Point - Use a 45 - 55 PSI system no flow pressure. After fuel flow starts, expect a drop in pressure. Do not increase fuel flow pressure during refueling. Start fuel flowing and then move the precheck valve handle, located adjacent to the single-point fueling adapter, to the PRIM (primary) position. Fuel flow should stop within 10 seconds. Stoppage is indicated by fuel flow not greater than 10 gallons per minute at fuel truck meter. Return precheck valve handle to OFF. Allow fuel flow to continue for a short duration and then place precheck vlave handle in the SEC (secondary) position. Fuel flow should stop within 10 seconds. Return precheck valve handle to OFF position and continue refueling. If fuel flow fails to stop in both check positions, do not use single-point refueling.

Manual — Service left system first or aircraft may settle on tail.

3. Oxygen: Use MIL-O-27210.

4. Hydraulic Fluid and Brake Fluid: Use MIL-H-5606 (NATO H-515) or MIL-H-83282 (NATO H-537).

5. Tire Pressure:

   Main — 250 PSI. Nose — 75 PSI.

6. Loose Fasteners: Use Torq-Set bit.

7. Air Starting Units:

   Air Force — MA-1, MA-1A, MA-1MP, MA-2, MA-2MP, M32A-60, MA-3MP, and 502-70.

   Navy — GTC-85, MA-1E, WELLS AIR START SYSTEM, and RCPP/RCPT/NCPP-105.

8. Electrical Units: (115 200 volts, 3-phase, 400-cycle required).

FUEL SPECIFICATIONS		
GRADE DESIGNATION	FREEZE POINT °C	NATO SYMBOL
PRIMARY FUEL		
JP-4	-60	F40
ALTERNATE FUEL		
JET B	-50	NONE
EMERGENCY FUELS		
* JP-5	-50	F44
* JP-8	-50	F34
* JET A-1 with FSII	-50	F34
AVGAS		

NOTE

- When aviation gasoline is used a 3 percent lubricating oil, specification MIL-L-22851, type II, must be added to improve its lubricity characteristics.
- When an alternate or emergency fuel is used enter the fact in the aircraft AFTO Form 781.

* To continue use of these fuels beyond three flights, fuel control adjustments are required.

EMERGENCY PROCEDURES

SECTION III

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TABLE OF CONTENTS

GROUND-OPERATION EMERGENCIES

TAKEOFF EMERGENCIES

IN-FLIGHT EMERGENCIES

IN-FLIGHT EMERGENCIES

LANDING EMERGENCIES

NOTE

- A Critical Procedure is an emergency procedure that must be performed immediately without reference to printed checklist and that must be committed to memory. These critical procedures appear in **BOLDFACE** capital letters. Non-critical Procedures are all other steps wherein there is time available to consult the checklist.

- In the event of multiple emergencies, the pilot is required to exercise sound judgment as to the appropriate action. A thorough knowledge of the correct procedures and aircraft systems is essential to analyze the situation correctly and determine the best course of action.

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

1. Maintain Aircraft Control.
2. Analyze the Situation and Take Proper Action.
3. Land as soon as conditions permit.

GROUND-OPERATION EMERGENCIES

ENGINE FIRE DURING START.

If a fire warning light illuminates, or if there is other indication of a fire, proceed as follows:

1. Throttles — OFF.
2. Battery/APU—OFF.

EXCESSIVE HYDRAULIC PRESSURE (CAUTION LIGHT NOT ILLUMINATED) ON GROUND.

1. Shut down the affected engine.

DEPARTING PREPARED SURFACE.

Any time the aircraft departs a hard surface (taxiway or runway), immediately shut down both engines. REFER TO EMERGENCY EXIT ON THE GROUND TO ABANDON THE AIRCRAFT.

EMERGENCY EXIT ON THE GROUND.

When a situation develops which requires a crewmember to abandon the aircraft, place the throttles at OFF, battery switch at OFF, insert the ejection seat safety pin, release the survival kit, if one is carried, by pulling the survival kit emergency release handle (figure 1-24), disconnect personal leads and release safety belt. Crewmembers should consider removing the parachute when disconnecting equipment to facilitate exit from cockpit. Open the canopy. If either canopy cannot be opened by the normal procedure, pull the canopy jettison T-handle. If either canopy fails to open or jettison, break thru the canopy, using the canopy breaker tool (figure 3-1).

WARNING

- Inadvertently raising the ejection seat handgrip rather than the survival kit emergency release handle will cause ejection.
- To avoid kit deployment and possible pilot-survival kit entanglement during emergency exit, the survival kit must be seated firmly in position before the survival kit emergency release handle is pulled.
- Ensure the seat safety pin is installed and all equipment is properly secured to prevent entanglement with the ejection seat handgrips and possible handgrip movement during egress.

CAUTION

The canopy seals will remain inflated if engines are shut down with both canopies locked making the canopies more difficult to open.

USE OF CANOPY BREAKER TOOL.

To break the canopy, grasp the canopy breaker tool with both hands and use your body weight behind an arm swinging thrust. Aim the point of the tool to strike perpendicular to the canopy surface. The blade alignment will determine the direction of the cracks. No set pattern of blows is necessary on the front canopy. Several minutes of chopping may be required to open an adequate hole in the rear canopy.

CANOPY BREAKER TOOL

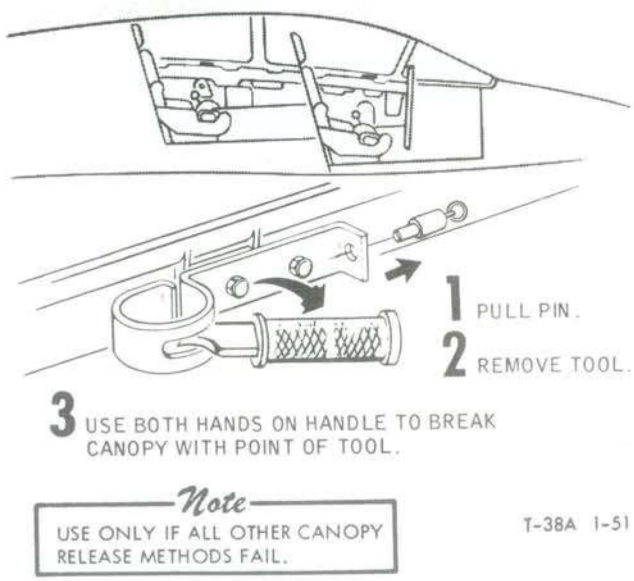

Figure 3-1.

WARNING

To preclude personal injury, the curved edge of the blade must be towards you. This will allow glancing blows against the canopy to deflect away from you.

SMOKE, FUMES, OR ODORS IN COCKPIT.

Do not take off if smoke, fumes, or unidentified odors are detected. Refer to Smoke, Fumes, or Odors in Cockpit procedure under Inflight Emergencies, this section.

TAKEOFF EMERGENCIES

ABORT/BARRIER ENGAGEMENT.

If the decision is made to abort during a takeoff or touch-and-go-landing, such variables as gross weight, pressure altitude, runway condition (i.e., dry, wet, icy) and runway length must be evaluated. The braking energy required during a high speed, heavy gross weight abort may result in brake failure, a significant decrease in braking effectiveness, hot brakes or tire failure/fire. Below 130 KIAS maximum deceleration can be obtained by optimum braking in a three point attitude, but tests have demonstrated that optimum braking is difficult to achieve and should not be attempted at airspeeds above 100 KIAS. Aerodynamic braking is more effective than cautious wheel braking above 100 KIAS, and it avoids the potential for skidding, blown tires, brake failure, etc. Therefore, use aerodynamic braking to the maximum extent possible during any abort above 100 KIAS. Once the nosewheel returns to the runway, initiate a smooth brake application with the stick full aft, increasing brake pressure as the airspeed decreases. Unless brake failure occurs, avoid pumping the brakes. During heavy gross weight aborts, the nose will lower at approximately 120 KIAS. When the nose wheel is lowered to the runway, immediately commence moderate braking while maintaining full aft stick. Optimum braking should not be attempted in excess of 100 KIAS. Aerodynamic braking performed with less than full flaps or a 12 degree pitch attitude becomes progressively less effective. Aerobraking is recommended even if it is not possible to obtain this optimum configuration and pitch attitude. If runway length is insufficient to completely stop the aircraft, decelerate as much as possible and prepare to engage the barrier or depart the hard surface. Approach the barrier perpendicularly, in a three point attitude, and if possible, in the center. After barrier engagement, actuation of the controls or changing aircraft configuration may cause damage to the aircraft.

1. THROTTLES—IDLE.
2. WHEEL BRAKES—AS REQUIRED.

WARNING

- Braking required for high speed, heavy gross weight abort may result in extremely hot brakes or brake failure and the possibility of tire fire should be anticipated.
- If hot brakes are suspected, the aircraft should not be taxied into a congested area. Ensure all personnel remain clear of the main wheels until they have cooled.

CAUTION

- During high speed abort situations, it is essential maximum aerodynamic braking be attained. Once established in an aerobrake, lowering flaps will further reduce the stopping distance. Flaps should not be repositioned until the full aft stick pitch attitude is attained. The aircraft may become airborne if flaps are lowered above the computed full flap touchdown speed.
- Steer so as to engage perpendicular to barrier and discontinue braking before engagement.
- Heavy braking above 100 KIAS may cause skidding, tire failure, and loss of directional control.
- Extreme caution must be exercised when applying wheel brakes above 120 KIAS as locked wheels or tire skids are difficult to recognize. If tire skid is detected, immediately release both brakes and cautiously reapply.
- MA1A barrier engagement is unlikely with the WSSP/External Stores installed or speed brake open.

Refer to Takeoff/Abort charts in Part 2 of Appendix.

ENGINE FAILURE/FIRE WARNING DURING TAKEOFF.

If an engine fails on takeoff prior to reaching decision speed, use the procedure in this section titled ABORT/BARRIER ENGAGEMENT. If an engine fails on takeoff above the computed decision speed, it is possible to continue the takeoff. Limited excess thrust is available for takeoff, acceleration, and climb-out when operating on a single engine. The available runway should be used to accelerate the aircraft above single-engine takeoff speed (SETOS). The computed single-engine takeoff speed is the minimum speed at which the aircraft will takeoff and be able to fly out of ground effect. Thrust predictions of the takeoff factor can be verified only by an accurate acceleration speed check. A significant relationship exists between airspeed and initial climb performance: between SETOS and SETOS + 20 KIAS, single-engine climb performance increases at the rate of 100 feet per minute for each knot of airspeed above SETOS. Best acceleration occurs with the aircraft in a three point attitude, with the stick at, or slightly aft of, the takeoff trim setting. The nosewheel should not be allowed to "dig-in", nor should it be permitted to lift off. This attitude must be maintained until the airspeed reaches a minimum of SETOS; however, SETOS + 10 KIAS is the optimum rotation speed. Initial pitch attitude is shallower than normal. Climb should be restricted to only that required to avoid obstacles until the airspeed reaches 190 KIAS and flaps are retracted. The gear should be retracted as soon as the aircraft is airborne above SETOS + 10 KIAS. Gear door drag is not a factor during retraction above SETOS + 10 KIAS. The flaps should be raised after gear retraction and above 190 KIAS.

Due to the critical nature of airspeed and altitude and the ejection envelope, the decision made by the pilot may vary.

If Decision Is Made To Stop:

1. ABORT.

NOTE

If the Abort was made as a result of an engine fire, place the throttle of the affected engine to OFF once the aircraft is under control. If the fire is confirmed, accomplish the Emergency Exit On The Ground procedures once the aircraft is stopped.

If Takeoff Is Continued:

1. THROTTLES–MAX.

NOTE

Depending on airspeed and altitude, it may be necessary for the pilot to leave the throttle of the affected engine at a high power setting until reaching a safe airspeed and/or altitude for ejection.

2. FLAPS–60%.

B 3. STORE – JETTISON (If necessary).

WARNING

B Jettisoning the external store on the runway may endanger the aircraft and personnel due to possible impact detonation, fire and collision with the aircraft.

4. **ATTAIN AIRSPEED ABOVE SETOS, 10 KNOTS DESIRED.**
5. Gear – UP (when airborne above SETOS + 10 KIAS).
6. Flaps – UP (as required above 190 KIAS).

WARNING

- Continuing a takeoff on a single engine should be attempted only at maximum thrust.
- With TOF above 4.5 (gross weight 11,800 lbs) or above 4.2 (gross weight 12,500 lbs) single-engine takeoff is not considered possible.
- With other than 60% flaps, single-engine capability is impaired to such an extent that high takeoff factors coupled with heavy gross weights may make takeoff impossible.
- If engine failure occurs after rotation, it will probably be necessary to lower the nose to attain speed above SETOS. If engine failure occurs after takeoff, it may be necessary to allow the aircraft to settle back to the runway.

NOTE

- If the left engine is inoperative but windmilling, generally gear retraction may be accomplished but will require an extended time period; however, gear doors may not completely close. Gear retraction, when initiated between SETOS plus 10 knots and 190 KIAS, may require up to one minute.

- If unable to retract the landing gear, best level flight/climb capability is obtained at 190 KIAS with 60 percent flaps or at 220 KIAS with the flaps up. At high gross weight, with the landing gear extended, flap retraction should not be initiated prior to 220 KIAS.

- After flaps are set at 60% the flap indicator should be checked to insure flaps are within 60% range.

TIRE FAILURE DURING TAKEOFF.

A takeoff abort with tire failure will present a greater problem than landing with a failed tire. The effects of a tire failure are most pronounced at heavy gross weights and speeds below 100 KIAS. Directional control is more difficult, and braking effectiveness is greatly reduced at higher gross weights.

If Decision Is Made To Stop:

1. ABORT.

If Takeoff Is Continued:

1. GEAR – DO NOT RETRACT.

LANDING GEAR RETRACTION FAILURE.

If the warning light in the landing gear lever remains illuminated after the lever has been moved to the LG UP position, proceed as follows:

1. Airspeed — Maintain below 240 KIAS.
2. Landing Gear Lever — LG DOWN.

NOTE

After placing the landing gear lever down and a safe gear down indication is obtained, do not retract or recycle the gear unless a greater emergency exists.

INFLIGHT EMERGENCIES

SINGLE-ENGINE FLIGHT CHARACTERISTICS.

Single-engine directional control can normally be maintained at all speeds above the stall. Very little rudder is required because of the close proximity of the thrust lines to the centerline of the aircraft. In high-drag, high-thrust, low-airspeed conditions, rudder must be used to coordinate flight to obtain optimum aircraft performance. There are conditions under which the aircraft will not maintain altitude in takeoff configuration or landing configuration with one engine operating at either MIL or MAX thrust. For fully fueled takeoffs, single engine takeoff speed should be attained to insure excess thrust is available. At other fuel weights, final approach speed will insure excess thrust is available for go-around. Single-engine performance in a landing configuration with 60% flaps is shown in the Thrust Required and Available chart and the Effect of Bank Angle on Vertical Velocity charts in Part 7 of the appendix. Minimum single-engine flying speed for any condition occurs where the thrust available and thrust required lines cross. If the airspeed is less than the minimum speed, altitude must be sacrificed to attain this minimum and/or the configuration must be changed to reduce the drag. Every effort should be made to immediately attain a speed that will give excess thrust. It is imperative that the speed brake be closed during all single-engine flight to obtain the performance stated in the single-engine charts. The single-engine service ceiling can be attained by following the climb schedule shown in the Single-Engine Service Ceiling chart in Part 3 of Appendix. (B) In some single-engine flight conditions consideration should be given to the jettison of the external store. However, external store/airplane separation tests have not been conducted.

ENGINE FAILURE/SHUTDOWN DURING FLIGHT.

If an engine operates abnormally or fails during flight, reduce drag to a minimum and maintain airspeed and directional control while investigating to determine the cause. Failure of the left engine may deactivate speed brake, normal landing gear extension and retraction, nosewheel steering, and the stability augmenter system. However, left engine windmilling rpm under this condition may supply sufficient hydraulic pressure to operate these systems. Use the following procedure for shutting down an engine in flight:

1. Safe single-engine airspeed — Maintain.
2. (B) Store — Jettison if necessary.
3. Throttle (inoperative engine) — OFF for 10 seconds before attempting a start if conditions permit.
4. Crossfeed — As Necessary.

WARNING

With the crossfeed ON and either both boost pumps ON — or both boost pumps OFF — a rapid fuel imbalance can occur.

With fuel less than 250 pounds in either system:

5. Fuel Boost Pump Switches — LEFT and RIGHT ON.
6. Crossfeed Switch — ON.

NOTE

Under single engine low fuel conditions with two operating boost pumps, placing the crossfeed ON and both boost pumps ON will provide the maximum usable fuel.

Refer to Single-Engine Diversion Range Summary Table in Part 4 of Appendix.

(B) JETTISON – EXTERNAL STORE.

The external store may be released as follows:

1. Jettison Button — PUSH.

DUAL ENGINE FAILURE AT LOW ALTITUDE.

If both engines fail during flight at low altitude and with sufficient airspeed, the aircraft should be zoomed (approximately 20 degrees nose up attitude) to exchange airspeed for altitude and to allow additional time to accomplish subsequent emergency procedures. ALTERNATE AIRSTART should be attempted immediately upon detection of dual engine flameout. If the decision is made to eject, ejection should be accomplished during the zoom while the aircraft is in a nose high positive rate of climb. It is imperative that the ejection sequence be initiated prior to reaching a stall or rate of sink.

WARNING

Do not delay ejection by attempting airstarts at low altitude if below the optimum airstart airspeed and below 2,000 feet AGL.

RESTART DURING FLIGHT.

Airstarts can be expected at or below 26,000 feet between 250 KIAS and 310 KIAS. Optimum restart capability at higher altitudes occurs at 270 KIAS. At lower altitudes, an engine RPM of 16% or greater affords sufficient airflow for restart. If engine flameout is experienced, use the following procedure:

1. Throttle (inoperative engine) — Check OFF for 10 seconds before attempting a start if conditions permit.
2. Altitude — 26,000 feet or below.
3. Airspeed — 250 KIAS to 310 KIAS.
4. Battery Switch — Check ON.
5. Boost Pump Switches — Check ON. (Circuit Breakers — IN, if applicable)

NOTE

When the rear cockpit is occupied, the fuel pump circuit breakers should be checked in.

6. Engine Start Button — Push Momentarily.
7. Throttle (windmilling engine) — Advance to slightly above IDLE, then retard to IDLE.

NOTE

- Leave throttle at IDLE for 30 seconds before aborting a start.
- If dual engine flameout occurs, right engine should be attempted first as right engine instruments will operate normally as soon as engine start button is pushed.

If restart attempt fails.

8. Throttle — OFF for approximately 10 seconds.
9. Crossfeed Switch — ON.
10. Engine Start and Ignition Circuit Breaker—In.
11. Attempt another start.

NOTE

- The RPM may hang up during restart after combustion occurs at low airspeeds. RPM hangup during an airstart may be eliminated by increasing airspeed.
- If it appears that a boost pump has failed, remain below 25,000 feet. Turn crossfeed OFF to avoid having to use an abnormal fuel balancing procedure.
- If it appears that a boost pump has failed and flight below 25,000 feet is impractical, engine operation above 25,000 feet with gravity fuel flow is possible at reduced power settings. If a reduced power setting is also impractical, use crossfeed operation to insure boost pump pressure and minimize the possibility of fuel flow interruption. Monitor the fuel balance and descend as soon as practical. Flight at lowest practical altitude and reduced power setting will minimize probability of fuel flow interruption.

ALTERNATE AIRSTART.

The alternate airstart is primarily designed for use at low altitude when thrust requirements are critical. An airstart may be accomplished by advancing the throttle to MAX range. This energizes normal and afterburner ignition for approximately 30 seconds (if throttle remains in MAX range). If the engine does not start after 30 seconds, additional starts may be attempted by retarding the throttle out of MAX range to reset the circuit and again advancing the throttle into MAX range to reactivate the ignition cycle. After engine start, the throttle may be left in MAX range if afterburner operation is desired.

If alternate airstart is required, proceed as follows:

1. THROTTLE(S) – MAX.

WARNING

- If throttle is already in MAX, recycle throttle MIL to MAX.
- With dual engine failure, battery switch must be at ON to provide ignition.

NOTE

If the throttle is in the MAX range, pushing the start button will also provide ignition; however, only for that period of time which the button is held.

COMPRESSOR STALL.

If an engine compressor stalls, proceed as follows:

1. Throttle – IDLE.
2. Increase airspeed and advance throttle slowly.

NOTE

If engine damage is suspected, advance throttle above idle only if required.

If engine will not recover:

3. Throttle – OFF.

NOTE

- After experiencing a compressor stall, the engine may not recover to the full range of operation. If normal instrument indications can be achieved for a given power setting, the engine should not be shutdown unless other circumstances dictate.
- If the engine is shut down, an airstart may be attempted as applicable.
- Rapidly retarding the throttle to IDLE and immediately pushing the engine start button may permit the engine to recover and prevent complete flameout.

FIRE WARNING DURING FLIGHT. (Affected Engine).

If a fire warning light illuminates, use the following procedure:

1. THROTTLE – IDLE.

When a fire warning light is preceded or accompanied by a pop, bang or thump it usually indicates a serious engine malfunction and/or fire. Consideration should be given to shutting down the engine.

CAUTION

If the fire warning light goes out, check the light by positioning the warning test switch to TEST. If one or both bulbs of the affected fire warning light does not illuminate, it indicates a possible burn-through of one or both fire sensors. In this case, shut the engine down.

2. THROTTLE – OFF, IF FIRE WARNING LIGHT REMAINS ON.

WARNING

- Do not delay placing the throttle to OFF due to possible rapid loss of flight control system from fire damage.
- If engine cannot be shut down with the throttle, the fuel shutoff switch (affected engine) should be closed.

CAUTION

Do not attempt to restart the affected engine if the fire is extinguished. Make a single-engine landing.

3. IF FIRE IS CONFIRMED – EJECT.

Any time the fire warning lights illuminate, verify the condition by other indications before abandoning the aircraft. It is possible that the warning system may have malfunctioned and given an erroneous indication. Fire is usually accompanied by one or more of the following indications: excessive EGT, erratic or vibrating engine operation, fluctuating fuel flow, smoke trailing the aircraft, and/or smoke in the cockpit.

ELECTRICAL FIRE.

If an electrical fire occurs, proceed as follows:

1. Battery and Generator Switches — OFF.

NOTE

With boost pumps inoperative, engine flameout may occur if above 25,000 feet.

2. All Electrical Equipment — OFF.
3. Battery, Generator(s), electrical equipment — ON, as necessary for flight and landing.

SMOKE, FUMES, OR ODORS IN COCKPIT.

All odors not identifiable shall be considered toxic. If smoke, fumes, or odors are encountered in the cockpit, proceed as follows:

1. Oxygen — 100%.

NOTE

If odors persist, use of emergency oxygen bottle should be considered.

2. Check for Fire.
3. Cabin Pressure Switch — RAM DUMP, Below 25,000 Feet, if possible.
4. If Smoke Becomes Severe — Jettison Canopy, Below 300 KIAS, if possible.

LOSS OF CANOPY.

If either or both canopies are lost, immediately slow the aircraft to 300 KIAS or less to minimize turbulence and noise. Minimum drag occurs at approximately 225 KIAS. Reestablish intercockpit communications. Land as soon as conditions permit.

NOTE

After the canopy is lost or jettisoned, inadvertent drogue chute deployment is possible. Chute deployment could cause an immediate out-of-control condition.

Figure 3-2.

CABIN PRESSURE LOSS.

1. Descend immediately — Maintain aircraft at or below 25,000 feet.
2. Oxygen system — 100% and Emergency. Below 25,000 feet oxygen system operation may be returned to normal.
3. Land as soon as conditions permit.

OXYGEN SYSTEM EMERGENCY OPERATION.

Should either pilot detect symptoms of hypoxia or hyperventilation, proceed as follows:

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

WARNING

If positive pressure is not felt after completing Step 4 or oxygen system contamination is suspected, use of the emergency oxygen cylinder should be considered. If oxygen system contamination is suspected, further consideration should be given to disconnecting 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 MSL (cabin pressure) and land as soon as conditions permit.

OIL SYSTEM MALFUNCTION.

Abnormal engine oil pressure indications frequently are an early indication of some engine trouble. The engine oil pressure indicators are marked for normal operating conditions on the ground or in the air. If engine oil pressure is not within the operating limits, or a sudden change in pressure of 10 psi or more occurs at any stabilized rpm, proceed as follows:

1. Throttle—Adjust (to maintain pressure within limits).

2. Throttle—OFF (if 5 to 55 psi pressure cannot be maintained or if engine seizure appears imminent).

NOTE

- Simultaneous failure of the engine RPM and oil pump (oil pressure indicates zero) may be an indication of a sheared oil pump shaft.
- If the operating engine requires shutdown, the engine previously shutdown for oil system malfunction may be restarted.

ENGINE OVERTEMPERATURE.

If excessive exhaust gas temperature occurs, immediately retard throttle to the setting at which the exhaust gas temperature of the affected engine decreases and remains within limits.

NOZZLE FAILURE.

If nozzle failure occurs in closed range, excessive EGT is possible. If this condition occurs, follow the engine overtemperature procedure. If a nozzle fails in the open position, low EGT will result. The affected engine will operate from idle to mil, but with a much lower thrust output. Afterburner may not be available. Depending on the severity of either condition, consideration should be given to recovering the aircraft in accordance with single engine landing procedures. If the nozzle is closed, EGT may increase above acceptable limits during landing rollout or taxi. If this occurs, the engine should be shut down.

EJECTION VS FORCED LANDING.

Ejection is preferable to landing on an unprepared surface. Do not land the aircraft with both engines flamed out.

DITCHING.

Ejection is to be accomplished in preference to ditching the aircraft.

EJECTION PROCEDURE.

Escape from the aircraft should be made with the ejection seat, using the sequence shown in figure 3-3. After ejection, the safety belt automatically opens and a man-seat separation system forcibly separates the crewmember from the ejection seat (figure 3-6). A rapid deployment escape system is provided to improve low-altitude escape capability. The zero-delay lanyard if present on the parachute may be disconnected for completely controlled ejections if time and altitude permit. If the zero-delay lanyard is present it should be connected in accordance with present directives. However, if the crewmember knows he is going to eject at more than 2000 feet AGL (Above Ground Level) in a controlled condition, he should disconnect the zero-delay lanyard to reduce chances of seat-chute-man involvement. There is no evidence to indicate that one should attempt to connect the zero-delay lanyard after deciding to eject. The time lost in connection is greater than any advantages which may be gained.

WARNING

- Do not delay ejection below 2000 feet in futile attempts to start the engines, or for other reasons that may commit you to an unsafe ejection or a dangerous flame-out landing. Accident statistics emphatically show a progressive decrease in successful ejections as altitude decreases below 2000 feet above the terrain.
- Under uncontrollable conditions, eject at least 15,000 feet above the terrain whenever possible.

EJECTION

WARNING

ASSUME PROPER POSITION

- SIT ERECT, HEAD FIRMLY AGAINST HEADREST, FEET HELD BACK AGAINST SEAT.
- POSITION ELBOWS CLOSE TO BODY WITHIN ELBOW GUARDS, TO PROTECT ELBOWS WHEN LEGBRACES ARE RAISED, AND DURING EJECTION.
- THE CREWMEMBER IN REAR COCKPIT SHOULD EJECT FIRST IF ALTITUDE PERMITS. THIS WILL PREVENT POSSIBLE INJURY FROM FRONT SEAT ROCKET BLAST.
- MAINTAINING AIRCRAFT CONTROL MAY REQUIRE USE OF ONE HAND TO INITIATE THE EJECTION SEQUENCE.

1 HANDGRIPS — RAISE

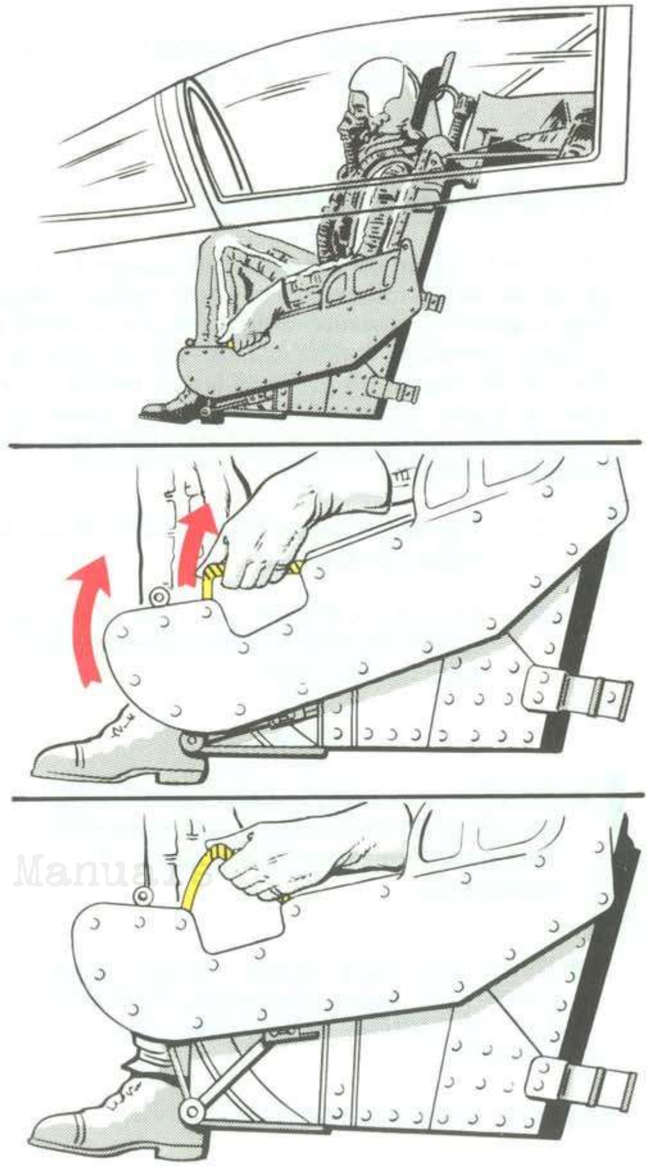

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Figure 3-3.

During any low-altitude ejection, the chances for successful ejection can be greatly increased by pulling up to exchange airspeed for altitude if airspeed permits. Ejection should be accomplished while in a positive rate of climb with the aircraft approximately 20 degrees nose-up, and before the start of any sink rate. Ejection while the nose of the aircraft is above the horizon and in a positive rate of climb will result in a more nearly vertical trajectory for the seat, thus providing more altitude and time for seat separation and parachute deployment. See figure 3-4 for safe minimum ejection altitude versus sink rate and figure 3-5 for ejection altitude versus bank/dive angle. If rate of climb cannot be accomplished, level flight ejection should be accomplished immediately to avoid ejection with a sink rate. The automatic safety belt must not be opened before ejection, regardless of altitude. If the safety belt is opened manually, the automatic feature of the parachute is eliminated.

WARNING

If the aircraft is not controllable, ejection must be accomplished at whatever speed exists, as this offers the only opportunity for survival. At sea level, wind blasts and deceleration will exert medium forces on the body up to approximately 450 KIAS (0.7 mach), severe forces causing flailing and skin injuries between 450 (0.7 mach) and 600 KIAS (0.9 mach), and excessive forces above 600 KIAS (0.9 mach). As altitude increases, the speed ranges of the injury-producing forces will be a function of the mach number.

The emergency MINIMUM ejection conditions, based on a level attitude, with no sink rate are as follows:

BA-22 or BA-25 parachutes with 0.25 sec. delay opening or BA-22 parachute with zero delay lanyard ATTACHED	Ground Level at 50 KIAS
BA-22 parachute with zero delay lanyard NOT ATTACHED (1 second delay opening)	100 feet AGL

WARNING

The foregoing information is based on numerous rocket-sled tests using the ballistic rocket ejection catapult. No safety factor is provided for equipment malfunction. Since survival from an extremely low altitude ejection depends primarily on the aircraft attitude and altitude, the decision to eject must be left to the discretion of the pilot. Factors such as G-loads, high sink rates, and aircraft attitudes other than level or slightly nose high will decrease chances for survival. The emergency minimum ejection conditions (ground level and 50 KIAS) are provided only to show that zero 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.

The emergency MAXIMUM ejection airspeeds from sea level through 14000 feet are as follows:

BA-22 or BA-25 parachutes with 0.25 sec. delay opening	500 KIAS
BA-22 parachute - zero delay lanyard ATTACHED	400 KIAS
BA-22 parachute - zero-delay lanyard NOT ATTACHED (1-second delay opening)	550 KIAS

BEFORE EJECTION.

If time and conditions permit . . .

1. Notify crewmember of decision to eject.
2. Turn IFF to EMERGENCY, and if not in radio contact with appropriate agencies, turn radio to GUARD and transmit MAYDAY.
3. Turn aircraft toward uninhabited area.
4. Stow all loose equipment.
5. Survival Kit (AUTO/MANUAL)—As Required.
6. (High Altitude) Actuate emergency oxygen cylinder.
7. Disconnect oxygen hose and G-suit, tighten oxygen mask and chin strap securely (well beyond comfortable range), and lower and lock visor(s). Under controlled conditions above 2000 feet AGL, disconnect and stow zero-delay lanyard (if applicable).
8. Attain proper airspeed, altitude, and attitude.
9. Assume proper position.

Refer to WARNINGS in figure 3-3.

EJECTION ALTITUDE VS SINK RATE

0.25 SECOND DELAY OPENING PARACHUTE OR ZERO DELAY LANYARD ATTACHED

Note

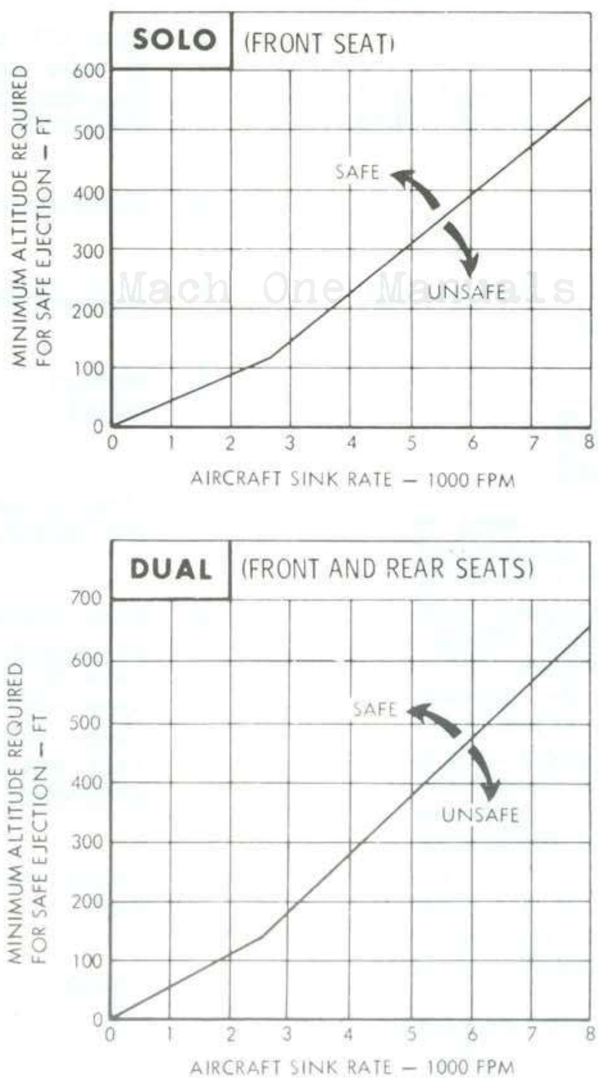
- ASSUMED REAR SEAT EJECTS FIRST, FOLLOWED IN 0.75 SECOND BY FRONT SEAT.
- IF THE WINGS ARE NOT LEVEL, BANK ANGLE EFFECTS (FIGURE 3-5) MUST BE ADDED.
- BOTH EJECTION SEATS HAVE THE SAME EJECTION CAPABILITY.

WARNING

- THE MINIMUM EJECTION ALTITUDES SHOW SEAT CAPABILITY (WITH 2-SECOND REACTION TIME) AS AFFECTED BY AIRCRAFT SINK RATE. THE MINIMUM ALTITUDES DO NOT PROVIDE ANY SAFETY FACTOR FOR EQUIPMENT MALFUNCTION, DELAY IN SEPARATING FROM THE SEAT, AND AIRCRAFT DIVE AND BANK ANGLES ABOVE 2000 FEET TERRAIN CLEARANCE.
- THE MINIMUM EJECTION ALTITUDES SHALL NOT BE USED AS THE BASIS FOR DELAYING EJECTION WHEN ABOVE 2000 FEET TERRAIN CLEARANCE.

CONDITIONS

AIRSPEED AT EJECTION — 150 KIAS
WINGS LEVEL — SLIGHT NOSE-UP ATTITUDE
2-SECOND REACTION TIME



SINK RATE

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Figure 3-4.

EJECTION ALTITUDE VS BANK/DIVE ANGLE

0.25 SECOND DELAY OPENING PARACHUTE OR WITH ZERO DELAY LANYARD ATTACHED.

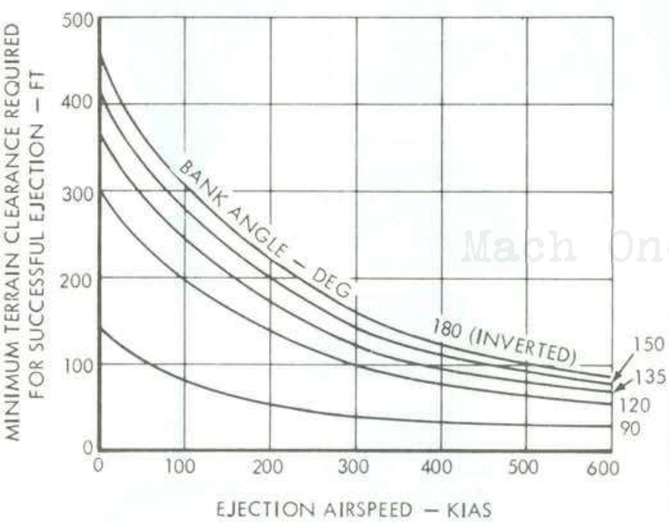
WARNING

- EJECTIONS ABOVE EACH TIME REACTION, DIVE ANGLE, OR BANK ANGLE LINE ARE SAFE FOR GIVEN CONDITIONS.
- EJECTIONS BELOW EACH LINE ARE UNSAFE.

BANK ANGLE

CONDITION

CONSTANT ALTITUDE



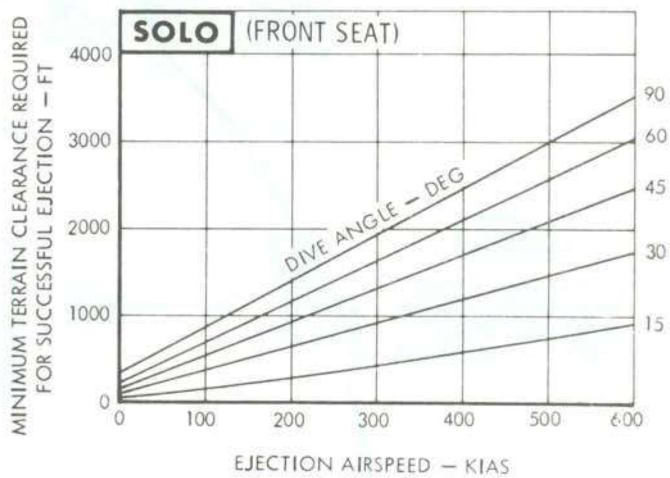
Note

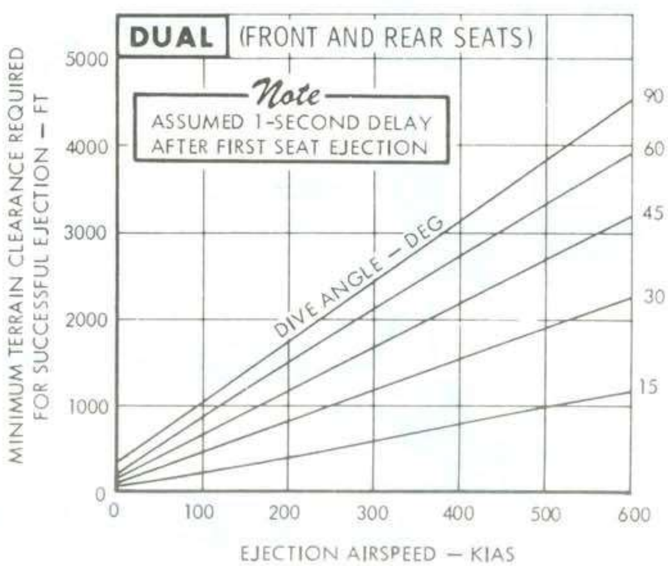
BANK ANGLES UP TO 60°ARE SAFE FOR LEVEL FLIGHT AT ALL AIRSPEEDS UP TO 500 KIAS WITH 0.25 SECOND DELAY OPENING PARACHUTE OR 400 KIAS WITH ZERO DELAY LANYARD ATTACHED.

DIVE ANGLE

CONDITIONS

WINGS LEVEL
2-SECOND REACTION TIME





Note

IF THE WINGS ARE NOT LEVEL, BANK ANGLE EFFECTS MUST BE ADDED.

Figure 3-5.

EJECTION SEQUENCE

Note

- TIME FROM RAISING HANDGRIP(S) TO FULL 0.25 SECOND DELAY PARACHUTE DEPLOYMENT IS 3.42 SECONDS (APPROX) AT AN EJECTION AIRSPEED OF 150 KNOTS. VARIABLES SUCH AS LOWER AIRSPEEDS AND THE ATTITUDE OF THE PILOT AT TIME OF PACK OPENING CAN INCREASE PARACHUTE DEPLOYMENT TIME.
- TIME TO FULL PARACHUTE DEPLOYMENT IS THE SAME FOR BOTH SEATS.

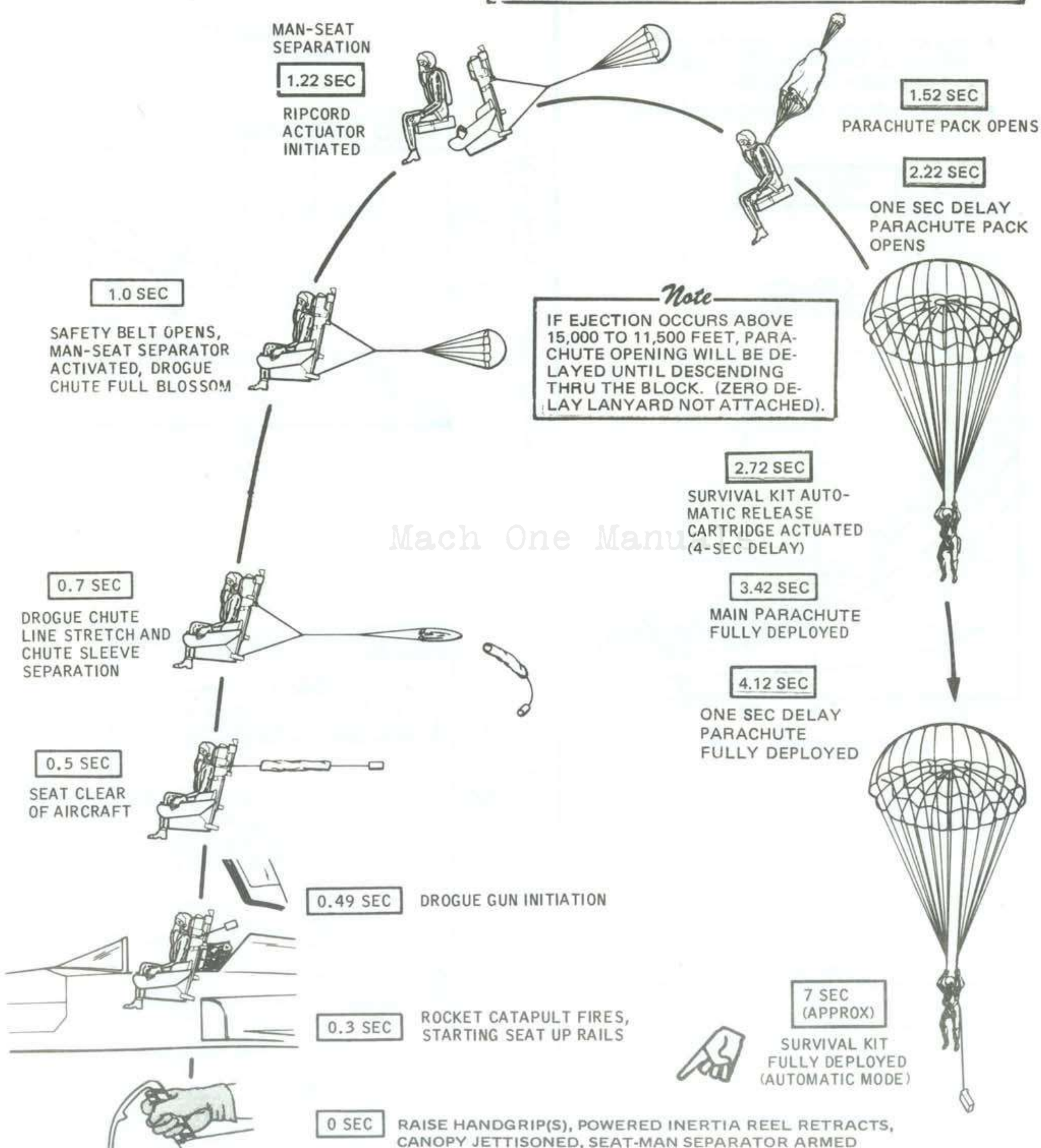


Figure 3-6.

EJECTION.

1. HANDGRIPS – RAISE.

AFTER EJECTION.

Immediately after ejection the following procedures apply:

1. Safety Belt – Attempt To Open Manually.
   Attempt to manually open the safety belt as a precaution against the belt failing to open automatically.

2. Safety Belt Released – Attempt To Separate from Seat.

   A determined effort must be made to separate from the seat to obtain full parachute deployment at maximum terrain clearance. This is extremely important for low altitude ejections.

3. If Safety Belt Opened Manually – Immediately Pull Parachute Arming Lanyard (Arming Ball). If flying over high terrain, consideration should be given to pulling the ripcord handle even if above automatic parachute opening altitude.

4. Survival Kit – Deploy after Parachute Opening.

WARNING

Refer to T.O. 14D1-2-1, Section III for various landing situations (i.e.: water, tree, power line, etc).

TRIM MALFUNCTION

If an aircraft trim malfunction results in either full nose up or full nose down trim, stick force needed to position the horizontal stabilizer may be several times greater than expected. Runaway trim effects may be minimized by immediately attempting to trim opposite the undesired stick forces in order to stop or reverse the horizontal tail trim movement. If the trim malfunction results in excessive nose down trim loads, increasing airspeed may reduce required stick forces to maintain level flight. If the trim malfunction results in excessive nose up trim loads, decreasing airspeed may reduce required stick forces to maintain level flight.

STABILITY AUGMENTER MALFUNCTION.

A stability augmenter yaw system failure at high airspeeds may cause an abrupt yaw followed by a moderate rudder roll. If the yaw damper switch (pitch or yaw switch on Block 20 aircraft) is found in the OFF position during flight, the mission may be continued. Do not reengage the damper switch. Note the discrepancy on Form 781 after termination of the flight. If yaw or pitch oscillations are induced by the stability augmenter, the affected damper switch should be turned OFF.

1. Yaw Damper Switch – OFF.

2. Stability Augmenter Circuit Breakers— Pull (if applicable).

NOTE

If malfunction continues, reduce airspeed to minimize yaw and land as soon as conditions permit.

RUDDER SYSTEM FAILURE.

If rudder system failure is experienced, the failure mode may be a full 30 degrees left hardover rudder. The pilot's only indications of this type failure will be uncontrolled yaw and roll movements. At airspeeds above 300 KIAS, aircraft control is probably impossible to retain. If uncontrollable conditions persist, eject at least 15,000 feet AGL whenever possible. At airspeeds below 300 KIAS, the aircraft will initially roll slightly to the right followed by a rapid roll to the left. If no pilot corrective action is taken within two seconds, the aircraft will stall. Aircraft control can be regained by the use of appropriate ailerons and stabilator if the pilot reacts within two seconds. Once under control, the aircraft cannot be landed safely due to high sideslip angles and lack of directional control on the ground. The aircraft should be flown to a safe bail-out altitude and area where a controlled ejection can be performed.

FUEL QUANTITY INDICATOR AND LOW LEVEL CAUTION LIGHT SYSTEM MALFUNCTION.

When fuel quantity indicator failure is experienced, the fuel low-level caution light is unreliable. Failure of the fuel low-level caution system is indicated when either fuel quantity indicator reads less than 250 ± 25 pounds and the low-level light does not illuminate. With fuel quantity indicator failure or low-level caution system failure, closely monitor the fuel quantity and land as soon as conditions permit.

WARNING

Do not attempt crossfeed operation with a fuel quantity indicator inoperative as it will be impossible to monitor the fuel balance.

LOW FUEL PRESSURE.

If a fuel pressure caution light comes on, proceed as follows:

1. Boost Pump Circuit Breakers — Check.

NOTE

If circuit breakers are found popped, turn off appropriate boost pump before resetting circuit breakers.

2. Power — Reduce.
3. Descend — 25,000 feet or below.

NOTE

If a reduced power setting at high altitude is impractical, turn the crossfeed switch on to minimize the possibility of fuel flow interruption. Monitor the fuel balance and descend as soon as practical.

4. Land as soon as conditions permit.

TRANSFORMER-RECTIFIER FAILURE.

When the XFMR RECT OUT caution light illuminates, it indicates a possible failure of both transformer-rectifiers. If both transformer-rectifiers have failed, the systems requiring dc power will be supplied by the battery for approximately 17 minutes. Land as soon as conditions permit.

Proceed as follows:

1. Transformer-Rectifier Circuit Breakers — In.

If battery fails:

2. Cockpit Instruments Rheostat — Out of OFF position.
3. Caution, Warning, and Indicator Lights Bright/Dim Switch — DIM.

CAUTION

If complete DC failure occurs with the landing gear extended, downside hydraulic pressure will be lost. The gear should be pinned prior to taxiing clear of the runway.

ELECTRICAL FAILURE — COMPLETE.

With complete electrical failure, all warning systems, engine instruments (except engine tachometers), flight director, flight trim, communication and navigation systems, speed brake, flaps, landing gear normal extension, landing gear indicators, nosewheel steering, fuel boost pumps, and engine ignition system are inoperative; and each engine anti-ice valve opens. Use the following procedures:

1. Battery Switch — Check ON.
2. Generator Switches — RESET then ON. Hold generator switches at RESET momentarily, then return switches to ON in an attempt to regain electrical power.

If generators fail to reset, proceed as follows:

3. Generator Switches — OFF.
4. Descend — To lowest practical altitude below 25,000 feet.
5. Land as soon as conditions permit. A no-flap landing will be necessary and the landing gear must be extended using the alternate system (see LANDING GEAR ALTERNATE EXTENSION).

GENERATOR FAILURE.

If generator caution light illuminates, proceed as follows:

1. Adjust RPM of engine with failed generator to opposite side of shift range.
2. Generator Switch – RESET, then ON.

WARNING

The pilot should refrain from attempting to reset the generator more than once due to the danger of generator burning.

If generator caution light continues to illuminate, proceed as follows:

3. Generator Switch – OFF.
4. Land as soon as conditions permit.
5. After landing, engine with failed generator will be shut down after clearing runway.

GENERATOR FAILURE - PARTIAL.

The loss of certain electrical components without illumination of the generator caution light may indicate the loss of one or two phases of an AC generator. If conditions permit, use the following procedures:

1. Identify the affected generator by reference to the circuit breaker page of the checklist.
2. Affected Generator Switch – OFF.

If malfunction not corrected:

3. Affected Generator Switch – ON.
4. Land as soon as conditions permit.

GEARBOX FAILURE – AIRFRAME-MOUNTED.

A complete gearbox failure is indicated by simultaneous illumination of the generator and hydraulic caution lights for the same engine. Confirm complete gearbox failure by checking the appropriate hydraulic indicator.

If Gearbox Fails Completely and excessive vibration exists:

1. Throttle (affected engine) – OFF.

A gearbox failure to shift is indicated when the LEFT or RIGHT GENERATOR caution light illuminates when accelerating or decelerating thru the shift range.

If Gearbox Fails to Shift:

1. Engine RPM – Return to range where generator operation can be maintained.
2. Generator Switch – RESET then ON, if necessary.
3. Engine RPM – Leave in range of successful generator operation until on final approach; then use as necessary to complete landing.

HYDRAULIC SYSTEMS MALFUNCTIONS.

Three different types of hydraulic system malfunctions may be encountered: hydraulic fluid overtemperature, low pressure, and high pressure. The hydraulic caution light will illuminate for either a fluid overtemperature or a low pressure condition. To determine the cause of a hydraulic caution light, check the indicators. Readings below 1500 psi indicate a low pressure situation. Momentary drops in pressure sufficient to cause illumination of the hydraulic caution light may be an indication of an unpressurized system. Normal or excessive pressure readings indicate a fluid overtemperature condition. The hydraulic indicators provide the only warning of high hydraulic pressure: a situation that can cause a hydraulic overtemperature condition. Although fluid overtemperature and high pressure usually occur together, it is possible to have one without the other. The corresponding engine should be shut down immediately whenever an overtemperature condition exists. If the pressure is high, but not accompanied by light or sluggish controls, the aircraft should be landed as soon as possible; be alert for the indications of overtemperature.

WARNING

An ejection should be accomplished with dual hydraulic system failure since flight control is impossible.

WARNING

Hydraulic pressure provided solely by a windmilling engine is insufficient to control the aircraft for landing.

HYDRAULIC MALFUNCTIONS (CAUTION LIGHT ILLUMINATED).

With a utility hydraulic system failure, the speed brake, nosewheel steering, normal landing gear system, and stability augmenter will be inoperative. If the UTILITY or FLIGHT HYDRAULIC caution light illuminates, use the following procedure:

1. Hydraulic Pressure Indicators — Check.

If hydraulic pressure is low:

1. Monitor both systems and avoid zero and negative G flight.
2. Land as soon as conditions permit.

CAUTION

If utility hydraulic pressure is depleted, stop straight ahead and have gear pins installed prior to clearing runway.

If hydraulic pressure is normal or high (fluid overtemperature):

1. Shut down affected engine.

NOTE

If the Hydraulic Caution light goes out the engine may be restarted if necessary. However, the engine should be left shut down as long as possible to permit maximum cooling of hydraulic fluid.

2. Land as soon as conditions permit.

EXCESSIVE HYDRAULIC PRESSURE (CAUTION LIGHT NOT ILLUMINATED).

A steady-state hydraulic pressure higher than 3200 psi in either system must be considered a system malfunction; proceed as follows:

If on the ground:

1. Shut down the affected engine.

If airborne:

1. Land as soon as conditions permit.
2. If accompanied by sluggish flight controls, shut down the affected engine.
3. After landing and clear of runway, shut down the affected engine.

CONTROLLABILITY CHECK (STRUCTURAL DAMAGE)

If structural damage or a flight control malfunction occurs or is suspected in flight, a decision must be made whether to abandon the aircraft or attempt a landing. The purpose of this check is to determine if the aircraft is landable, and if so, to determine what configuration is best for landing. Normally, the aircraft would be configured with gear and full flaps, and slowed to a minimum controllable airspeed, or normal touchdown speed, whichever is higher. If unable to achieve a normal configuration and airspeed, then configuration and airspeed should be adjusted in order to accomplish a landing. Proceed as follows:

1. Notify appropriate ground agency of intentions.

2. Climb to at least 15,000 feet AGL (if practical) at a controlled airspeed.
3. Simulate a landing approach.

CAUTION

Consider using the auxiliary flap control switch to reposition the flaps. If damage to the flaps or flap actuating mechanism (other than flap-slab interconnect) is known or suspected, do not reposition flaps.

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

NOTE

In no case allow airspeed to decrease below touchdown speed.

5. Do not change aircraft configuration.
6. Maintain at least 20 KIAS above minimum controllable airspeed during descent and landing approach.

7. Fly a power-on straight-in approach requiring minimum flare. Plan to touchdown at 10 knots above either normal speed or minimum control speed whichever is higher.

WARNING

Touchdowns as high as 200 knots are possible. High speed touchdown initially limits the effectiveness of aerodynamic and/or wheel braking.

WING FLAP ASYMMETRY.

If lateral rolling and yawing is experienced during operation of the wing flaps or while the flaps are extended, an asymmetric wing flap condition probably exists. Asymmetry may occur from physical binding or only one flap tracking when the flaps are actuated resulting in a gradually increasing uncommanded roll and yaw as the flap extends or retracts. This is readily detected and can be corrected by reversing the direction of flap movement. A more serious control situation arises when the asymmetry occurs following an instantaneous failure within the flap system. The severity is dependent on airspeed and flap position (in transit or fully extended) at the moment of failure. The situation is characterized by an immediate uncommanded yaw and rapid roll. Sufficient control authority is available to counteract the yaw and roll at pattern airspeeds. If either condition occurs, use the following procedure:

1. Throttles — MAX.
2. Wing Flap lever — actuate to eliminate or minimize the wing flap asymmetric condition.
3. Attain airspeed above 180 KIAS.
4. Aux Flap Switch — Emergency.

NOTE

In the emergency position flap settings can be set to any intermediate position to eliminate the asymmetrical condition.

5. If asymmetry persists, land as soon as conditions permit, maintaining airspeeds 20 KIAS above the normal turn to final, final approach, and touchdown speeds. However, in no case touchdown below 160 KIAS.

NOTE

If the asymmetric condition cannot be corrected and conditions permit, land from a straight-in approach.

WING FLAP HORIZONTAL TAIL LINKAGE MALFUNCTION.

Aircraft response to flap-slab interconnect failure depends on whether the locking device is part of the system, as well as the position of the flaps at the time of failure. Refer to wing flap system description in Section I.

ALL AIRCRAFT.

If the interconnect system fails with the flaps retracted, all aircraft will have the same characteristics: As flaps are lowered, a smooth but definite pitch-up will occur. This pitch-up can be controlled. As flaps approach 60%, the control stick must be positioned very close to the forward stop to maintain controlled flight. Heavy forward stick forces will be required which cannot be completely trimmed out, as the stick will be forward of the trim cut out limit. Although the aircraft may be flown in level flight in this configuration, very little nose down control authority is available to maneuver the aircraft. If such a condition is encountered, retract the flaps and make a no-flap landing whenever possible. A no flap landing is preferred. However, if landing conditions require the use of some flap extension to reduce touchdown speed and improve aerodynamic braking, a flap setting of between 30 and 45% will provide limited but adequate nose down control authority and manageable forward stick forces. Fly a straight-in approach and be careful to avoid over-rotation as forward stick pressure is relaxed to initiate the landing flare. Final approach and touchdown airspeed will be between the normal and no-flap computed speeds; maintain an AOA on-speed indication on final approach.

NOTE

It is easy to confuse trim failure with flap-slab interconnect failure. Careful analysis of configuration and control movements at the time of occurrence are essential.

AIRCRAFT WITH LOCKING DEVICE.

With the locking device installed, failure of the interconnect system will be apparent only when the flaps are moved from the position existing at the moment of failure. If flaps are raised, a smooth but definite pitch-down will result requiring noticeable aft stick forces to maintain level flight. If flaps are extended, a smooth but definite pitch-up will result, requiring noticeable forward stick forces to maintain level flight. In each case, after the flaps are moved, the stick position required to maintain level flight will probably be beyond the pitch trim limit, resulting in an inability to trim out the stick forces until the flaps are repositioned to the setting at which the interconnect failed. This inability to trim out stick forces should not be confused with a pitch trim malfunction. An interconnect failure (with locking device) can be identified by the unusual stick position necessary to maintain level flight, as well as an increased pitch sensitivity from that of a normal aircraft.

If interconnect failure occurs at 60% flaps or more, and the flaps are subsequently retracted, the stick position required to maintain level flight will be aft of the trim limit. In this condition, a potentially catastrophic problem will be encountered because the aircraft pitch control will become progressively more sensitive as airspeed is increased. At any altitude, under these conditions, a pilot induced oscillation (PIO) is extremely likely above 300 KIAS (or 0.9 IMN) and is especially hazardous, since releasing the stick will produce an immediate negative "g" pitch-down which may exceed aircraft structural and pilot limits. If a PIO is encountered under this failure condition, maintain rigid back-stick force while decreasing airspeed to 300 KIAS or below. Do not release the stick while holding back stick force.

WARNING

If interconnect failure with locking device is suspected, and the flaps are subsequently retracted, flight above 300 KIAS (or 0.9 IMN) should be avoided due to increased stick sensitivity and the possibility of a pilot-induced oscillation (PIO).

NOTE

The use of speed brakes should be avoided, if possible, since they produce a pitching moment which may compound the PIO recovery problem.

UNUSUAL CONTROL STICK POSITION WITH INABILITY TO TRIM.

If it becomes necessary to position the stick to an unusual position to maintain level flight or if control forces cannot be completely trimmed out, flap-slab interconnect failure should be suspected. When controlled level flight and a safe altitude are obtained, proceed as follows:

1. Auxiliary Flap Control Switch — EMER.
2. If control stick is aft or pull forces are required — Lower flaps incrementally until normal control is restored. Observe flap limit speeds.
3. If control stick is forward or push forces are required — Raise flaps incrementally until normal control is restored. Do not exceed 300 KIAS.
4. Land with flap setting providing normal control.

AIRCRAFT WITHOUT LOCKING DEVICE.

On aircraft without the locking device, if the interconnect system fails with flaps lowered any amount, the horizontal tail will instantly reposition to the zero flap setting and all flight control compensation is removed. This will always result in an abrupt and uncommanded aircraft pitch-up. The severity of the pitch-up is directly dependent on the airspeed and flap setting at the moment of failure. The stick must be positioned forward (to within one inch of the forward stop) to obtain controlled level flight. Furthermore, the available nose down slab deflection is greatly reduced and the stick must be positioned full forward to arrest the initial pitch-up rate caused by the interconnect failure. These forward stick forces cannot be trimmed out. When a safe airspeed and altitude are obtained, positioning the flaps up will return flight control and handling characteristics to normal. Flight tests have verified that at speeds as low as touchdown airspeeds, this type of failure is recoverable and that a controlled go-around is possible. However, the recovery procedure requires immediate pilot response and must be precisely applied within three seconds to ensure recovery without a loss of altitude. Recovery from an interconnect failure during the final approach or touchdown phase requires the use of full afterburners and the immediate retraction of flaps to 60% to eliminate the excess drag caused by full flaps.

WARNING

If takeoff is made with interconnect system failure (non-locking), a lighter than normal stick force and reduced amount of stick travel will be required for rotation. Until the flaps are retracted, significant forward stick pressure will be required to keep the pitch attitude from increasing.

ABRUPT AND UNCOMMANDED AIRCRAFT PITCH-UP, WING FLAPS EXTENDED.

If an abrupt aircraft pitch-up occurs while the wing flaps are extended, flap-slab interconnect failure (without locking device) should be suspected. If the failure occurs at conventional traffic pattern airspeeds and configurations, the aircraft, in addition to pitching up, will exhibit heavy buffeting, wing-rock, and stall immediately. If this occurs in the traffic pattern, proceed as follows:

1. Control Stick — Full forward to arrest pitch rate.
2. Throttles — MAX.
3. Flaps — 60%.
4. Landing gear — LG UP when continued flight is assured.
5. Flaps — UP when the aircraft accelerates above no-flap flying airspeed. (Be prepared to relax forward stick force as flaps are retracted.)
6. Land with wing flaps retracted.

WARNING

- If interconnect cable failure occurs on an aircraft without the locking device after flaps are down 60% or more, a sudden pitch-up will occur and the aircraft will stall instantaneously. Full forward stick will be necessary to arrest the rate of pitch up and the pilot must take corrective action within three seconds to ensure recovery without a loss of altitude.
- If failure occurs while flying at final approach airspeed, initially repositioning the flaps to 60% will reduce stick forces and will provide the best chance of recovery. Do not retract the flaps to the no-flap position until the aircraft accelerates above no-flap flying airspeed.

NOTE

- Interconnect failure can occur even after flaps have stabilized in a given position.
- The amount of horizontal tail authority will be that available with zero flaps regardless of the actual flap setting.
- With the flaps set at 60 percent or more, the required stick position will be beyond the forward trim cutout limit.
- Moderate to heavy stick forces will be present until the flaps are retracted.

BRAKE SYSTEM MALFUNCTION (FLUID VENTING).

Failure of certain components of the wheel brake master cylinders on brake lines located within the pressurized area of the cockpit may cause brake fluid overboarding through the brake fluid reservoir. If allowed to continue all the brake fluid could be forced overboard. If brake fluid overboarding is suspected or detected, proceed as follows:

1. Descend — 25,000 feet or below, if practical.
2. Cabin Pressure Switch — RAM DUMP, below 25,000 feet.
3. Land at lowest practical gross weight.

WARNING

If brake failure is encountered on landing roll, braking action may be regained by repeatedly pumping the brakes. The pedals should be released to the full UP position between strokes.

CAUTION

Do not pump the brakes in flight as this action could introduce air into the brake system which could result in complete brake failure.

LANDING EMERGENCIES

SINGLE-ENGINE LANDING.

A straight-in approach should be flown. See figure 3-7 or Section IX for single-engine approaches. The following procedure should be accomplished before landing:

1. Gear — Down and Check Down.

NOTE

- Power required under single-engine conditions may be in excess of that required to activate the landing gear warning system.
- If left engine is inoperative, normal windmilling rpm will provide adequate utility hydraulic pressure for a landing gear normal extension in a slightly longer extension time. If utility hydraulic system pressure is depleted, use the landing gear alternate extension system to extend the gear, and allow additional time for gear extension.

2. Wing Flaps — 60% (Set on Final Prior to Descent).
3. Wing Flaps — DN when landing is assured (optional).

CAUTION

- At high density altitudes and/or high gross weights, limited excess thrust is available to offset full flap drag. If full flaps are selected in the flare, an immediate touchdown and premature landing may occur.
- Aerodynamic braking with less than 100% flaps is less effective and longer landing distances should be anticipated.

WARNING

Use maximum power, if necessary, to maintain landing pattern airspeeds. Refer to section VI and part 7 of the appendix for the effect of bank angle on vertical velocity.

SINGLE-ENGINE GO-AROUND.

The available altitude and/or runway should be used to accelerate. The aircraft should be rotated at single engine takeoff speed plus 10 knots or in time to become airborne prior to the end of the runway, whichever comes first. Allow the aircraft to accelerate straight ahead, climbing only as necessary, until reaching 190 KIAS.

If, during the go-around, a touchdown occurs and take-off appears questionable, an abort may be warranted.

If go-around is continued:

1. **THROTTLE(S) – MAX.**
2. **FLAPS – 60%.**
3. (B) **STORE – JETTISON (if necessary).**
4. **ATTAIN AIRSPEED ABOVE SETOS, 10 KNOTS DESIRED.**
5. Gear — UP (As required above SETOS plus 10 knots).
6. Flaps — UP (As required above 190 KIAS).

WARNING

- A single-engine go-around should be attempted only at maximum power.
- With TOF above 4.5 (gross weight 11,800 lbs) or above 4.2 (gross weight 12,500 lbs) single engine takeoff is not considered possible.
- With other than 60% flaps, single-engine capability is impaired to such an extent that high takeoff factors coupled with heavy gross weights may make go-around impossible.
- It may be necessary to lower the nose to sacrifice altitude and perhaps allow the aircraft to settle to the runway to attain single engine takeoff speed. If the aircraft settles to the runway, lower the nose to facilitate acceleration.

NOTE

- If the left engine is inoperative but windmilling, generally gear retraction may be accomplished, but will require an extended time period; however, gear doors may not completely close. Gear retraction, when initiated between final approach speed and 190 KIAS, may require up to one minute.
- If unable to retract the landing gear, best level flight/climb capability is obtained at 190 KIAS with 60 percent flaps or at 220 KIAS with the flaps up. At high gross weight, with the landing gear extended, flap retraction should not be initiated prior to 220 KIAS.
- After flaps are set at 60% the flap indicator should be checked to insure flaps are within 60% range.

NO FLAP LANDING.

If a landing is to be made with the wing flaps retracted, use the normal landing procedure modified as follows:

1. Downwind Leg — Extend.
2. Airspeed — Increase the final turn, final approach and touchdown airspeeds by 15 KIAS.

CAUTION

Extreme caution must be exercised when applying wheel brakes above 120 KIAS as locked wheels or tire skids are difficult to recognize. If a tire skid is detected, immediately release brakes and cautiously reapply.

NOTE

A no-flap full stop landing using aerobraking to just prior to loss of elevator authority and optimum braking thereafter may double the normal landing distance.

LANDING GEAR EXTENSION FAILURE.

Unsafe cockpit gear indications should not be the only factor in the determination of an unsafe gear condition. Gear position should be determined by chase aircraft, if available, or other visual means. In the absense of visual confirmation of gear position any gear that indicates down in one or both cockpits is down and locked based upon the independent warning systems for each cockpit green light indicator. If all gear are fully down (verified by chase or other visual means) but one or more are indicating unsafe, stop straight ahead on the runway and have the gear safety pins installed.

Before attempting a landing with gear up, carefully consider whether to attempt a landing or to eject. Use the following table as a guide in determining whether a landing is feasible. Disregard gear door position.

GEAR CONDITION *		RECOMMENDED ACTION
NOSE	MAIN	
UP	BOTH DOWN	LAND
UP	BOTH UP	LAND EXCEPT (B)
UP	ONE DOWN	EJECT
DOWN	BOTH UP	
DOWN	ONE DOWN	

*Actual landing gear position (not indication)

WARNING

- Landing in lieu of ejection for gear conditions recommending ejection is considered more hazardous.
- Recommendation to land presupposes that a favorable runway environment exists.
- (B) DO NOT ATTEMPT a landing with all gear up unless carrying an empty SUU-20 dispenser or an empty/soft or nonflammably loaded MXU-648. With other store configurations including pylon only, ejection is recommended.

NOTE

Landing with all gear up may be accomplished with an empty/soft or nonflammably loaded WSSP installed.

Landing should always be made on a hard-surfaced runway. If time and conditions permit, request runway be foamed and expend excess fuel to reduce gross weight, minimize fire hazard, and provide a better sliding surface.

Use normal approach speeds for all configurations. Use normal touchdown speeds for all configurations except when landing with all gear up. Minimize rate-of-sink at touchdown but maintain a normal landing attitude to avoid excessive "slam-down." The procedures to be used for landing with gear extension failure are contained in the following paragraphs.

LANDING GEAR ALTERNATE EXTENSION.

If the landing gear normal extension procedure fails to extend the gear to a down and locked position, leave the landing gear lever at LG DOWN and use the landing gear alternate extension system to extend the gear by using the following procedure:

1. Airspeed — 240 KIAS, or less.
2. Gear Door Switch — OPEN.
3. Landing Gear Lever — LG DOWN.
4. Landing Gear Alternate Release Handle — PULL approximately 10 inches and hold until gear unlocks; then stow handle.
5. Gear Position — Check.

CAUTION

Stop straight ahead on the runway, and have the landing gear safety pins installed prior to clearing runway.

NOTE

- Once the three landing gear position indicators indicate that all three gears are down and locked, do not further activate landing gear controls.
- After lowering the landing gear with the alternate release handle, do not attempt to reset the switches by cycling the landing gear lever. Cycling the landing gear lever may lead to further complications, particularly if the alternate release handle is not fully stowed.
- If the main gear fails to extend fully, yawing the aircraft and applying negative or positive G forces may aid in extension.
- If the landing gear has been extended by use of the landing gear alternate release handle, nosewheel steering will not be available for taxiing.

If the gear alternate extension system does not provide a safe gear indication and utility hydraulic pressure is available, use the following procedure to return utility hydraulic pressure to the landing gear system and possibly provide a safe gear indication.

6. Flaps — As Required.
7. Landing Gear Lever — LG UP(momentarily), LG DN.

If the landing gear cannot be lowered by the normal or alternate procedures, it may be due to failure of the landing gear door selector valve or an electrical malfunction disrupting normal gear sequencing. In this case, the landing gear may not lower due to pressure in the utility hydraulic system or failure of the gear sequence relay to be activated. Dissipating this hydraulic pressure or bypassing the electrical circuit will allow the gear uplocks to release and the gear to extend. If the gear uplocks do not release the gear and when all the gears are in the full up position proceed as follows:

1. Gear Door Switch — Check OPEN.
2. Throttle (left engine) — OFF.
3. Control Stick — Rapid lateral stick movements to deplete utility hydraulic pressure.
4. Landing Gear Lever — LG DOWN.

5. Landing Gear Alternate Release Handle — Pull approximately 10 inches, while pressure is depleted, and hold until gear unlocks; then stow handle.

6. Gear Position - Check; if indications are still unsafe, Landing Gear Lever LG UP, then LG DOWN.

7. Left Engine — Restart.

NOTE

With gear extended, limiting airspeed of 240 KIAS may not provide sufficient airspeed for engine restart.

LANDING WITH NOSE GEAR UP OR UNSAFE.

1. Cabin Pressure Switch — RAM DUMP.

2. Shoulder Harness — LOCK.

3. Wing Flaps — FULL DOWN.

4. Landing Pattern — Normal.

5. Throttles — IDLE at touchdown.

6. Nose — Gently lower to runway.

7. If nose gear is up, throttles — OFF, when nose touches runway.

8. Wheel Brakes — As Required.

NOTE

Do not use brakes if a safe stop can be made without them when the nose gear is down but indicating unsafe.

9. Battery Switch — OFF.

LANDING WITH ALL GEAR UP.

This procedure should be used only under favorable conditions of the runway environment:

1. Gear — UP.

2. Cabin Pressure Switch — RAM DUMP.

3. Shoulder Harness — LOCK.

4. Speed Brake — Open.

NOTE

After landing, the speed brake may grind down beyond the actuator attach point. When this occurs, expect the nose to drop suddenly accompanied by increased noise, vibration, and deceleration.

5. Wing Flaps — FULL DOWN. Fly a power on approach requiring minimum flare. Plan to touchdown at 10 knots above normal touchdown speed.

6. Landing Pattern - Normal.

7. Throttles — OFF at touchdown.

8 Battery Switch — OFF.

LANDING WITH BLOWN TIRE, LOCKED BRAKE, OR DIRECTIONAL CONTROL DIFFICULTY.

The aircraft may be safely landed with a blown tire, locked brake, or similar directional control difficulty. Plan to land at minimum gross weight unless landing sooner is necessitated. Go-around after touchdown on a blown tire or locked brake should be avoided as rubber or other debris may be ingested by the engines. When it has been determined that a main gear tire has blown or a brake is locked, land on the side of the runway away from the malfunction. Make maximum use of rudder and wheel braking to maintain directional control. Nosewheel steering should be engaged only as a final attempt to maintain or regain directional control.

WARNING

If one brake system fails or failure is suspected, with no other directional control problems such as a blown tire or locked brake, plan to land in the center of the runway. Stop the aircraft by using aerodynamic braking followed by a combination of wheel brake and nosewheel steering. Rudder pedals should be neutralized prior to engaging the nosewheel steering to prevent violent swerving and possible loss of directional control.

SINGLE-ENGINE LANDING PATTERN (TYPICAL)

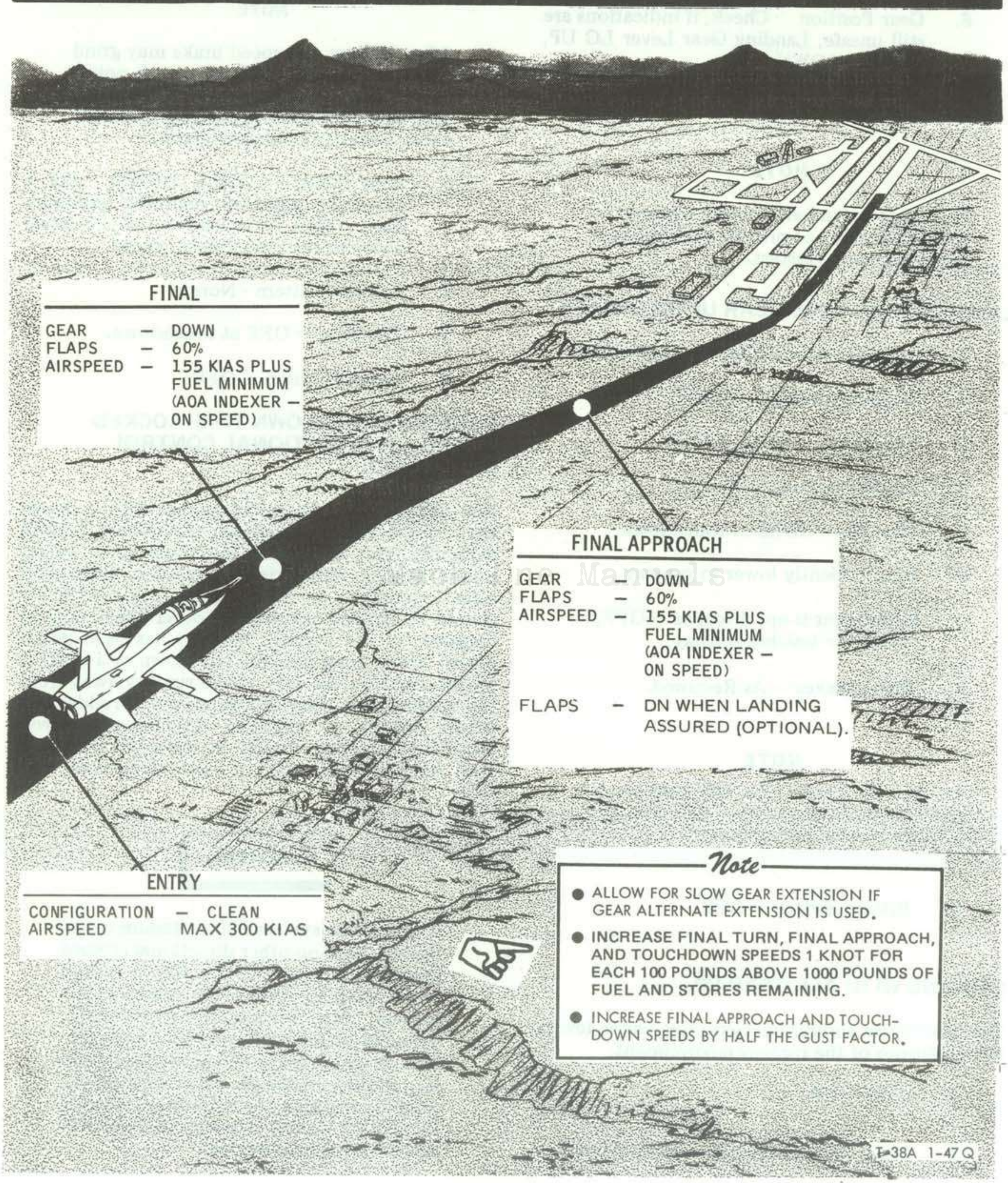


Figure 3-7.

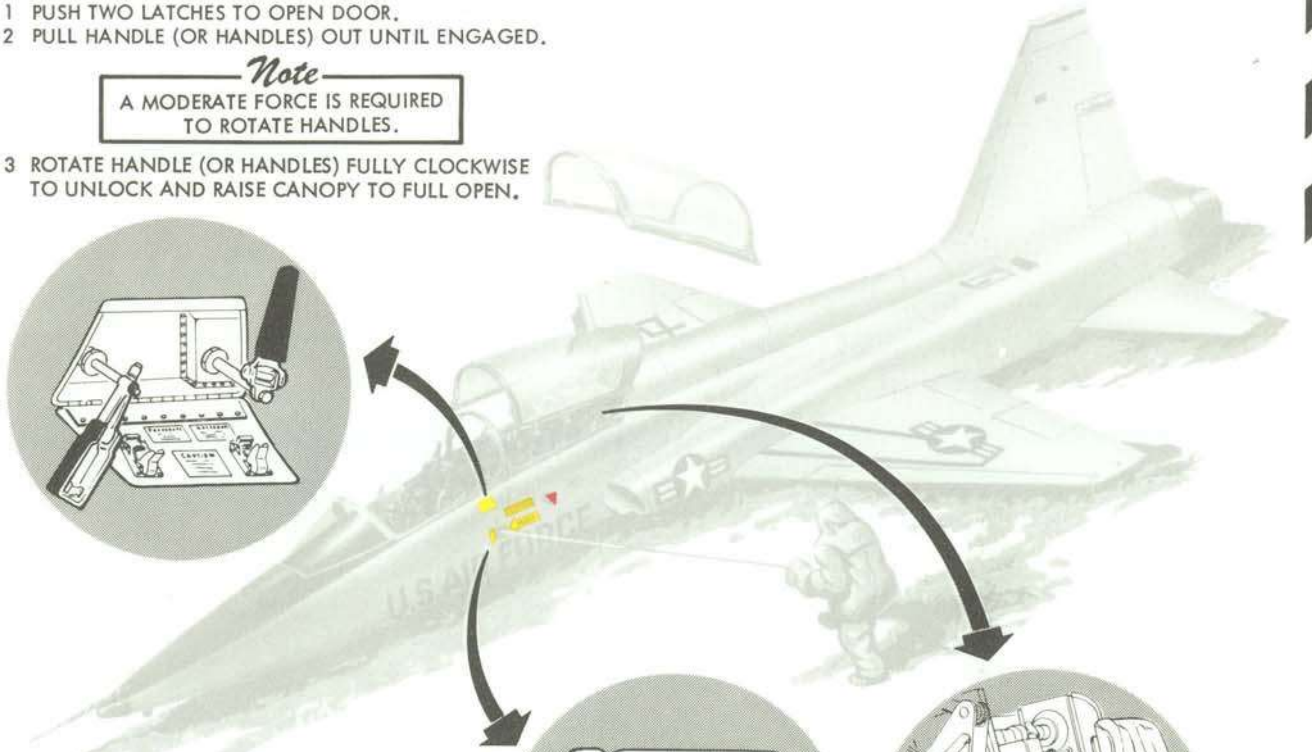
EMERGENCY ENTRANCE

NORMAL ENTRANCE (LEFT SIDE OF FUSELAGE)

1 PUSH TWO LATCHES TO OPEN DOOR.
2 PULL HANDLE (OR HANDLES) OUT UNTIL ENGAGED.

> *Note*
>
> A MODERATE FORCE IS REQUIRED TO ROTATE HANDLES.

3 ROTATE HANDLE (OR HANDLES) FULLY CLOCKWISE TO UNLOCK AND RAISE CANOPY TO FULL OPEN.



CANOPY JETTISON ENTRANCE
(EITHER SIDE OF FUSELAGE)

WARNING

Do not use this method when residual fuel is around cockpit area.

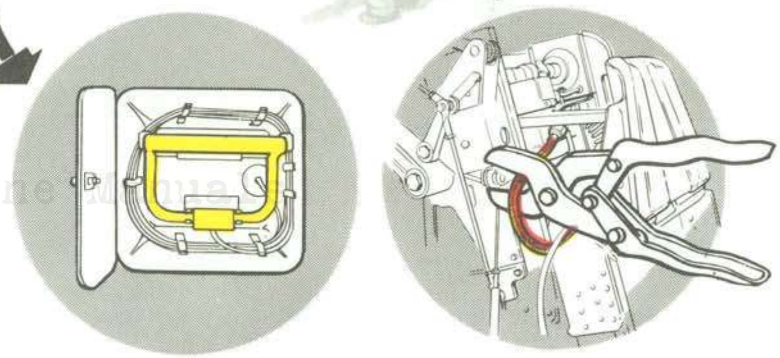
1 PUSH LATCH TO OPEN DOOR.
2 PULL D-HANDLE OUT TO FULL LENGTH (APPROXIMATELY 6 FEET).

> *Note*
>
> BOTH CANOPIES ARE JETTISONED WHEN EMERGENCY D-HANDLE IS PULLED.

IF UNABLE TO OPEN CANOPY

BREAK CANOPY BEHIND PILOT/AIRCREW WITH AX OR SIMILAR IMPLEMENT.

> *Note*
>
> SPRAYING CANOPY WITH CO_2 WILL CAUSE THE GLASS TO BECOME BRITTLE AND EASY TO BREAK.



AFTER ACCESS TO COCKPIT IS GAINED

WARNING

Inadvertent seat jettison is possible if handgrips are raised.

CUT CATAPULT HOSE AND DROGUE GUN INITIATOR HOSE, USING WISS BULLDOG SHEARS NO. 5 OR BOLT CUTTER.

> *Note*
>
> IF HANDGRIPS HAVE NOT BEEN RAISED, INSERT SAFETY PIN IN RIGHT EJECTION SEAT LEGBRACE TO PREVENT INADVERTENT EJECTION.

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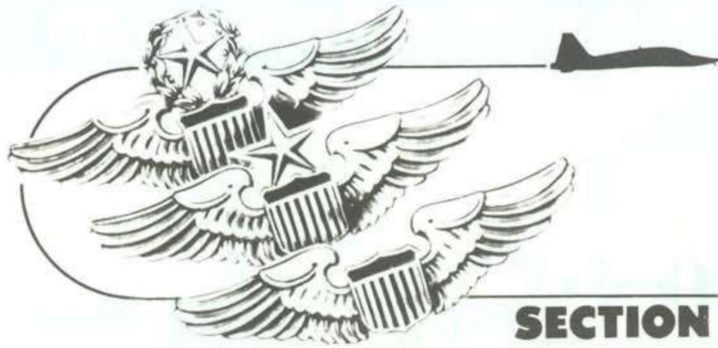
Figure 3-8.



AUXILIARY EQUIPMENT

SECTION IV

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CABIN AIR-CONDITIONING AND PRESSURIZATION SYSTEM.

CABIN PRESSURE REGULATOR.

A cabin altimeter on the instrument panel of the front cockpit (figure 1-7) indicates the pressure altitude within the cabin. All controls in the air-conditioning and pressurization system, except the canopy defog, are electrically (ac) controlled. The canopy defog is pneumatically controlled and does not require ac power. Refer to figure 4-2 for cabin pressurization schedule.

CABIN PRESSURE SWITCH AND CABIN TEMPERATURE CONTROL KNOB.

A guarded cabin pressure switch (figure 4-1) is located on the right subpanel of the front cockpit. The switch controls cabin air-conditioning and pressurization. When the switch is placed at CABIN PRESS, both the cabin air-conditioning and pressurization systems are activated; the cabin temperature desired is then selected by rotating the cabin temperature control knob to the desired temperature. This is the automatic mode of operation. When the cabin pressure switch is placed at RAM DUMP, the anti-G suit, canopy defog, cabin pressurization and air-conditioning systems, and canopy seal are deactivated, and ram air enters the cabin for ventilating purposes. Placing the cabin pressure switch in RAM DUMP position does not deflate the canopy seal, but prevents air flow into the seal. The seal will remain inflated for an undetermined amount of time. Normal seal deflation is provided by an AC switch activated by opening the canopy locking lever, provided AC power is available.

NOTE

To eliminate cabin conditioning duct "howl" with the rear cockpit cabin air inlet valve closed, adjust either the front cockpit cabin air inlet valve toward the closed position or adjust the rear cockpit cabin air inlet valve toward the open position.

CABIN AIR-CONDITIONING AND PRESSURIZATION SYSTEM

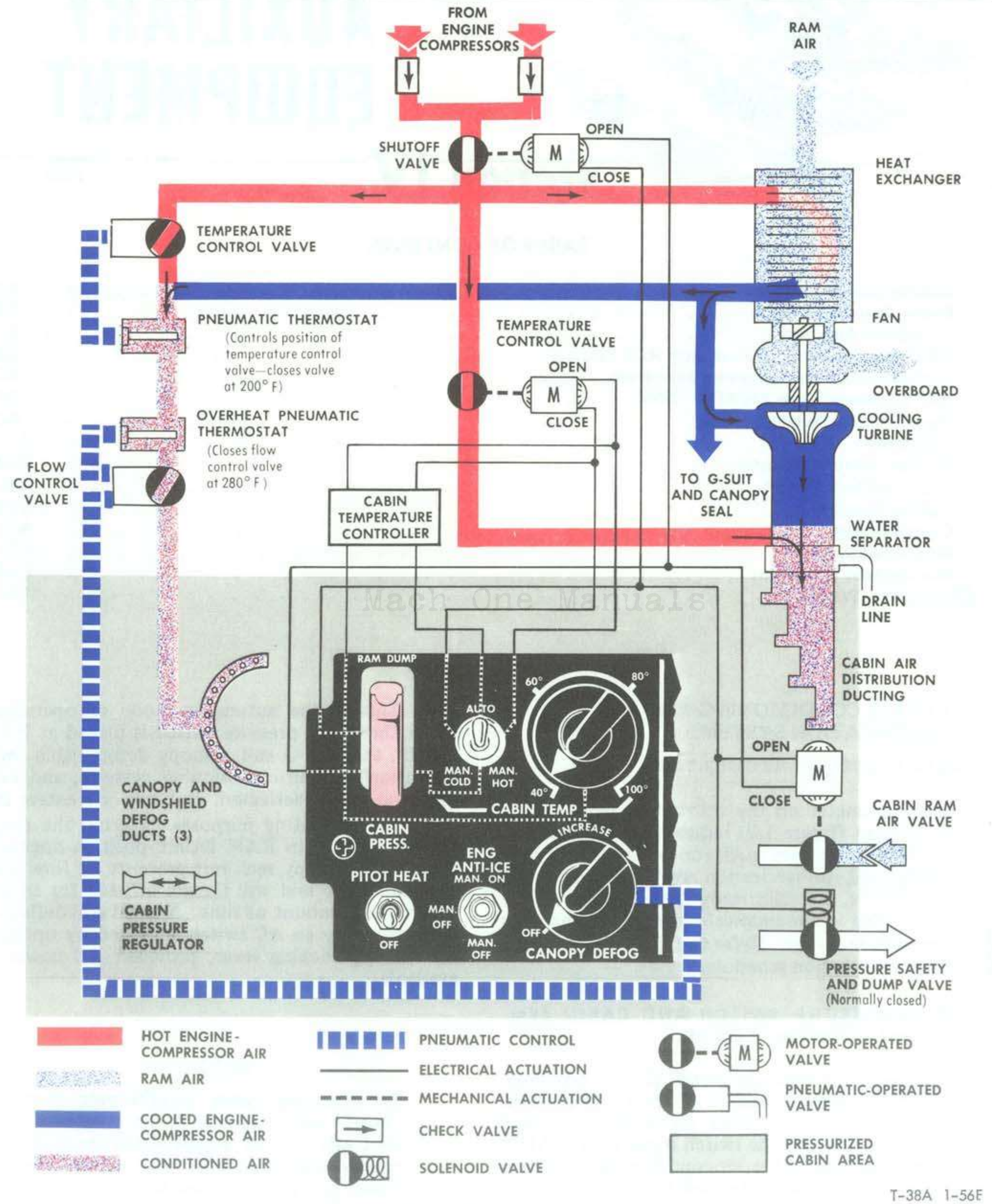

Figure 4-1.

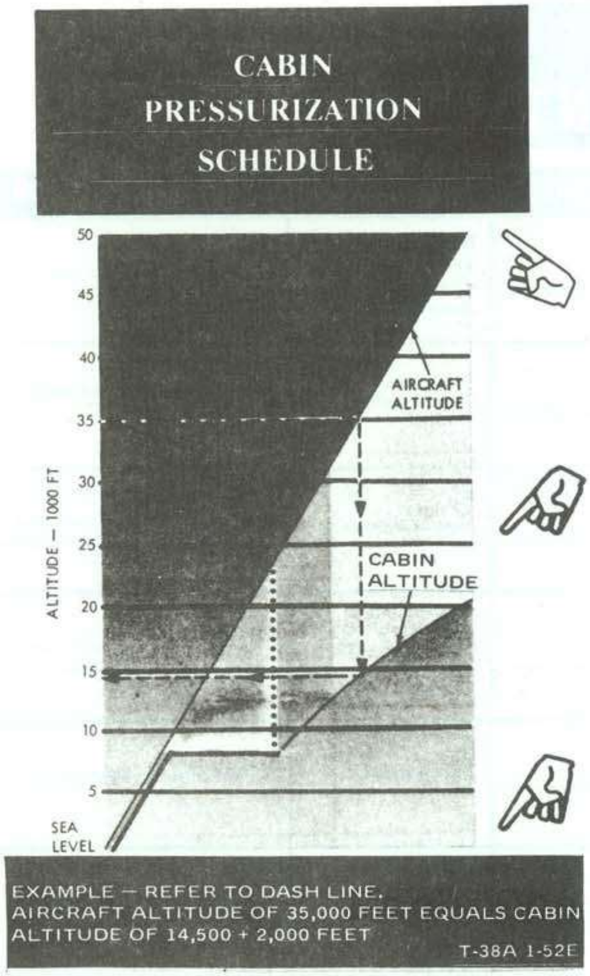

Figure 4-2.

CABIN AIR TEMPERATURE SWITCH.

A cabin air temperature switch (figure 4-1) is located on the right subpanel of the front cockpit. The MAN HOT and MAN COLD positions provide for manual temperature control when the automatemperature control system fails.

NOTE

When controlling temperature manually, momentarily stop switch at the center position before going to desired position.

CANOPY DEFOG KNOB.

The flow of defog air to the windshield and both canopies is controlled by the canopy defog knob in the front cockpit (figure 4-1).

ENGINE ANTI-ICE SYSTEM.

Engine anti-icing is accomplished by directing compressor eighth-stage air to the inlet guide vanes and bullet nose of the engine. A normally closed shutoff valve is controlled electrically by a three-position engine anti-ice switch (figure 4-1) on the right subpanel of the front cockpit. The switch positions are placarded MAN. ON in the up position and MAN. OFF in the center and down positions. Placing the switch at MAN. ON allows hot air to flow to the inlet guide vanes and bullet nose of the engine and causes the ENG ANTI-ICE ON light on the caution light panel and the MASTER CAUTION light in each cockpit to illuminate. The caution light alerts the crewmember that the switch is in the MAN. ON position but does not indicate that the system is operating. At engine speeds of 94% to 98% RPM, an increase in EGT of approximately 15°C is normal with the switch at MAN. ON. The engine anti-ice system fails to the on position with a complete loss of ac electrical power. Below 65% RPM, the anti-ice valve is always open, allowing hot air to flow to the inlet guide vanes and bullet nose of the engine, regardless of the position of the engine anti-ice switch. The switch should normally be at MAN. OFF. A 9% loss in MIL thrust and a 6.5% loss in MAX thrust can be expected with the engine anti-ice switch on.

PITOT BOOM ANTI-ICING.

The pitot boom is de-iced by an AC electrical heating system. The heater is controlled by a pitot heat switch (figure 4-1) on the right subpanel in the front cockpit. Placing the switch to the up position (placarded PITOT HEAT) turns the pitot boom heat on.

AOA VANE ANTI-ICING (AIRCRAFT WITH AOA SYSTEM).

The vane of the AOA transmitter is deiced by an electric heating element powered by the left ac bus and activated when the pitot heat switch is turned on.

COMMUNICATION AND NAVIGATION EQUIPMENT.

Communication and navigation equipment installed in the aircraft is listed in figure 4-3. Refer to figure 1-15 for electrical power requirements to operate the communication and navigation equipment and the associated controls.

COMMUNICATION AND NAVIGATION EQUIPMENT

TYPE	DESIGNATION	USE	OPERATOR	RANGE	CONTROL LOCATION
INTERPHONE	AN/AIC-18	Crew intercommunication; flight crew and ground personnel intercommunication when aircraft is parked.	Both crewmembers.	Either cockpit and exterior when ground receptacle is used.	Left subpanel—both cockpits.
UHF COMMAND RADIO	AN/ARC-164	Air-to-air and air-to-ground communication.	Both crewmembers.	Line of sight.	Pedestal and left subpanel—both cockpits.
TACAN	AN/ARN-118	Bearing and range information. Reception of coded identification signals.	Both crewmembers.	Line of sight.	Pedestal, left subpanel, and instrument panel—both cockpits.
ILS (LOCALIZER, GLIDE SLOPE, MARKER BEACON)	AN/ARN-58	Reception of marker beacon signals and vertical and horizontal guidance during approach.	Both crewmembers.	Localizer—85 miles. Glide slope—35 miles. Marker beacon—vertical.	Pedestal, left subpanel, and instrument panel—both cockpits.
IFF/SIF [1]	AN/APX-64	Automatic coded replies to ground interrogation for aircraft identification and air traffic control.	Front cockpit crewmember.	Line of sight.	Right console, front cockpit.
AIMS [2]	AN/APX-64	Automatic coded replies to ground interrogation for aircraft identification, altitude reporting, and air traffic control.	Front cockpit crewmember.	Line of sight.	Right console, front cockpit

[1] AF65-10364 THRU BLOCK 70 AIRCRAFT [2] BLOCK 75 AND LATER AND MODIFIED AIRCRAFT

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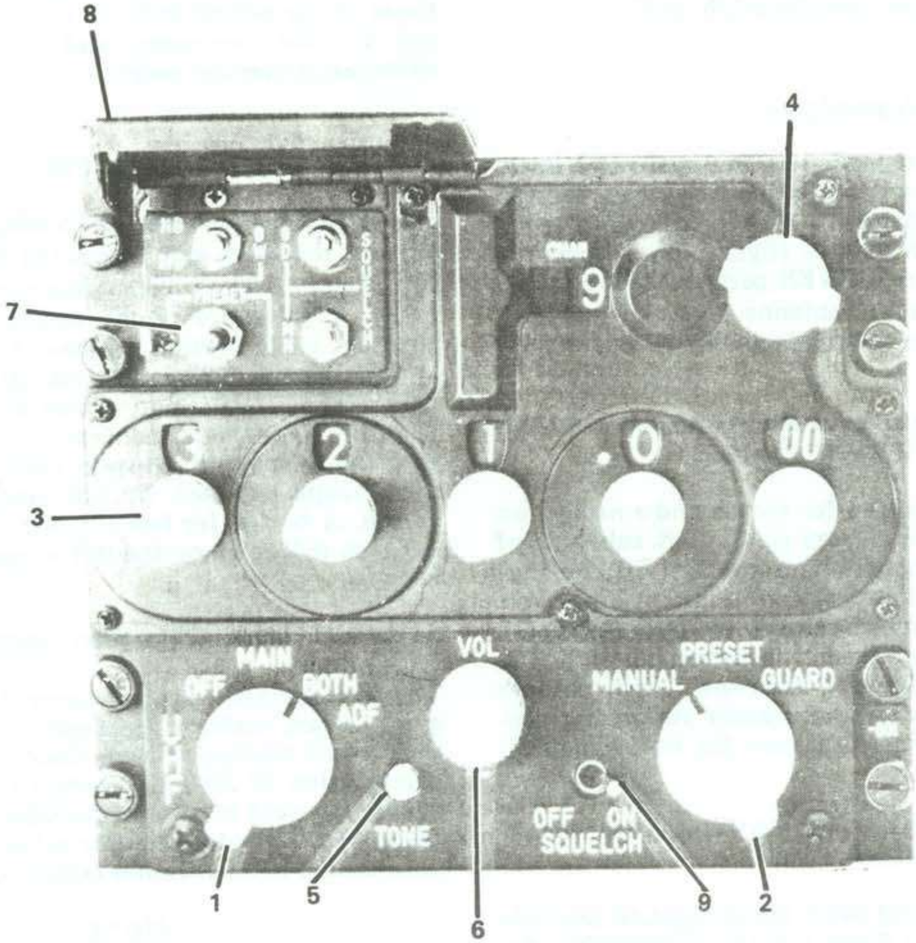
Figure 4-3.

UHF COMMAND RADIO, AN/ARC-164(V). (Figure 4-4.)

The AN/ARC-164(V) UHF Command Radio set provides line-of-sight voice and tone transmission and reception. The control panel is located on the pedestal in each cockpit. A four-position function control switch (1) selects OFF, MAIN, BOTH, and ADF (inactive). The MAIN position of the switch permits normal operation on the selected main frequency. The BOTH position permits normal operation on the selected main frequency and simultaneous reception on guard channel. The ADF position is inoperative. A three-position mode control switch (2) selects MANUAL PRESET, and GUARD. The MANUAL position of the switch permits selection of any desired frequency within the range of the set to be manually selected by the manual frequency selector knobs (3). PRESET position permits selection of any of the 20 preset frequencies by use of the channel selector knob (4). GUARD position selects the fixed guard frequency (243.0) for the main receiver and transmitter. A button marked TONE (5) is adjacent to the function control switch and is used to provide a continuous wave (CW) for homing operations. The volume control knob (6) is inoperative. A PRESET button (7) is located under the channel frequency card (8). New frequencies are preset by selecting PRESET on the mode control switch, placing the channel selector knob on the desired channel, setting the desired frequency with the manual frequency selector knobs and depressing the PRESET button under the channel frequency card. The 20 preset frequencies are normally standardized and set by communications personnel. The set is powered by the 28-volt DC bus. It can operate on as little as 18 volts and will operate on battery power in the

UHF COMMAND RADIO, AN/ARC-164(V)

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 4-4.

event of electrical failure. In the event of AC electrical failure, the front cockpit radio is in control. The rear cockpit occupant can transmit and receive only as determined by front cockpit control settings.

NOTE

Reception of weak signals may be aided by turning the squelch switch OFF.

COMM ANTENNA SWITCH.

The aircraft is equipped with an upper and a lower UHF antenna. An antenna selector switch is located on the left subpanel of the front cockpit, placarded COMM ANTENNA (figure 1-9). Placing the switch at UPPER or LOWER permits reception and transmission thru the antenna manually selected. The AUTO position now selects the lower antenna.

COMMAND RADIO AND NAVIGATION TRANSFER SWITCHES (FRONT COCKPIT).

A command radio transfer switch and a navigation transfer switch are located on the left subpanel of the front cockpit, placarded RADIO TRANSFER (figure 1-9). The switches enable the front cockpit crewmember to transfer control of command radio and navigation equipment to either cockpit. The cockpit selected by the command radio transfer switch and the navigation transfer switch has control of the respective systems for both cockpits.

COMMAND RADIO AND NAVIGATION OVERRIDE SWITCH (REAR COCKPIT).

A guarded command radio and navigation override switch, placarded COMM & NAV OVERRIDE (figure 1-10), on the left subpanel of the rear cockpit operates on ac. The switch enables the rear cockpit crewmember to take control of command radio and navigation equipment, regardless of the command radio and navigation transfer switch positions.

INTERCOM PANEL.

An intercom panel (figures 1-9, 1-10) on the left subpanel of each cockpit contains four volume control knobs, placarded INTER (interphone), COMM (command radio), ILS, and NAV (TACAN). With command radio, ILS, or TACAN equipment turned on, pulling out the corresponding control knob permits headset reception of signals of the applicable equipment in that cockpit. Pulling out either interphone knob actuates the interphone system, providing interphone communication between crewmembers without the use of microphone switches. Volume for each cockpit is controlled by pulling out and rotating the applicable knob; the volume control knobs on the ILS, command radio, and TACAN control panels are inoperative. The signals received in both cockpits are those of the station selected in the cockpit designated by the command and navigation transfer switches or override switch.

FLIGHT DIRECTOR SYSTEM.

The flight director system consists of an attitude director indicator and horizontal situation indicator (figure 4-5), a flight director switch (figure 1-11), a navigation mode switch (figure 1-7), a steering mode switch (figure 1-7), a compass switch (figure 1-9), a directional gyro indicator light (figure 1-10), and an attitude gyro control assembly. The instrument presentation is always identical in the two cockpits, with mode control in the cockpit selected by the navigation transfer switch. A button for fast erection of the ADI vertical gyro is located on the left subpanel in the front cockpit.

ATTITUDE GYRO CONTROL ASSEMBLY.

The attitude gyro control assembly contains two gyros, which perform functions for both the compass system and the attitude director indicator. The combination of attitude (vertical) and directional gyros, mounted in independent gimbals but jointly suspended, provides accurate attitude and heading information in all attitudes continuously.

NOTE

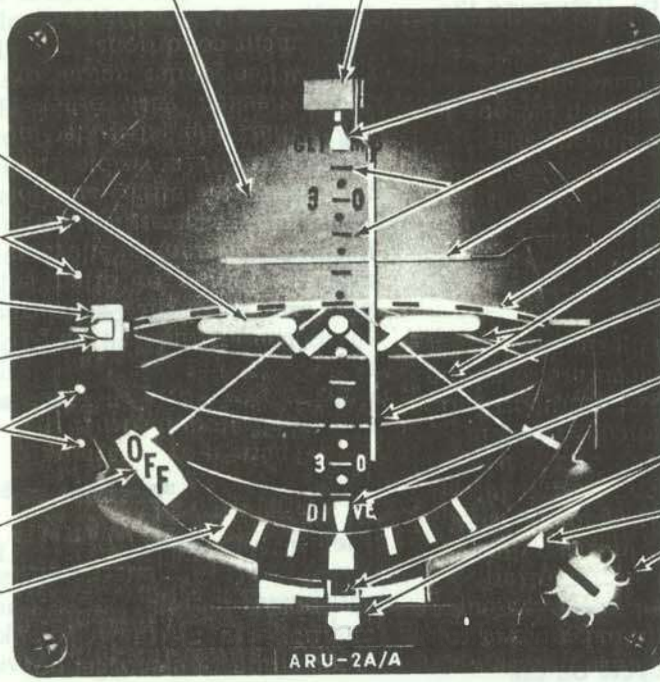
Gyro erection time for both ADI and HSI is approximately 3.5 minutes. Some precession can be expected during or following "over the top" aerobatic maneuvers. Normally, under these circumstances, precession will not exceed 4 degrees in pitch, bank, or heading.

FLIGHT DIRECTOR SWITCH.

A guarded flight director switch (figure 1-11) is located on the left console of the front cockpit. Placing the switch to the OFF position removes electrical power from the flight director system. The switch also controls power to the standby attitude indicator.

FLIGHT DIRECTOR SYSTEM DISPLAY

ATTITUDE DIRECTOR INDICATOR (ADI)



NOTE: POINTERS AND FLAGS SHOWN FOR RECOGNITION ONLY.

HORIZONTAL SITUATION INDICATOR (HSI)

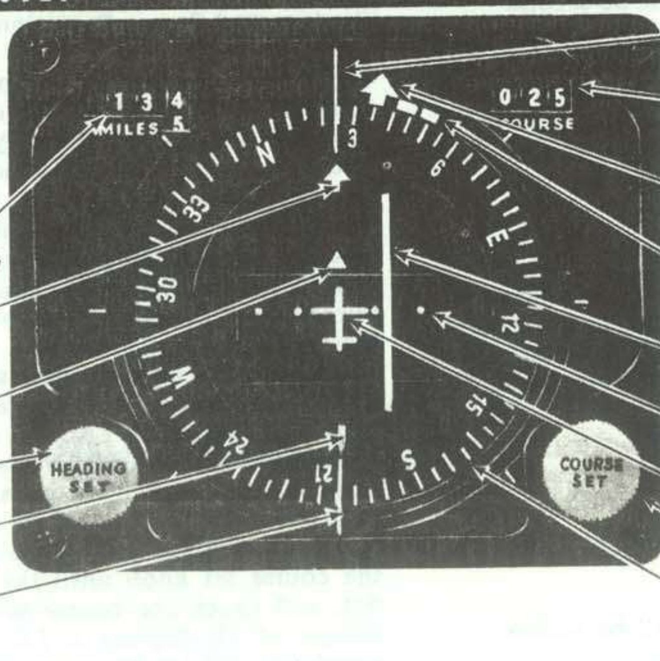


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Figure 4-5.

COMPASS SWITCH AND INDICATOR LIGHT.

A compass switch (figure 1-9) is located on the left subpanel of the front cockpit. When the switch is in the MAG position, the compass card will fast slave to indicate the correct magnetic heading and will remain slaved to magnetic north. In the DIRECT GYRO position, magnetic sensing is no longer available and the heading displayed is based solely on directional gyro stability. Returning the switch from DIRECT GYRO to MAG automatically fast slaves the system. Placing the switch momentarily at FAST SLAVE and returning it to MAG will also provide rapid correction of the system to magnetic north.

NOTE

A 2-minute period should be allowed between FAST SLAVE cycle attempts.

When using FAST SLAVE or returning the system to MAG from DIRECT GYRO or after ac power interruption, the aircraft should remain in level unaccelerated flight for the 30-second FAST SLAVE cycle.

NOTE

It is recommended that the aircraft be stationary when the compass system is put into the FAST SLAVE cycle on the ground and that the aircraft not be moved until completion of the 30-second FAST SLAVE cycle.

A directional gyro indicator light (figure 1-10) on the left subpanel of the rear cockpit illuminates when the compass switch is placed at DIRECT GYRO.

FAST ERECT BUTTON (ADI GYRO).

A button for rapidly erecting the vertical gyro (figure 1-9) is located on the left subpanel in the front cockpit. Pressing and holding the pushbutton erects the vertical gyro at a minimum rate of 15 degrees/minute.

NOTE

- Maintain level, unaccelerated flight while actuating the button.
- The attitude warning flag will be visible during actuation of the button.

HORIZONTAL SITUATION INDICATOR (HSI).

An HSI (figure 4-5) on each instrument panel provides the pilot with a view of the navigation situation as if he were above the aircraft looking down.

Heading Information.

When the compass switch is at MAG, the magnetic heading of the aircraft is displayed under the upper lubber line and the reciprocal heading is displayed under the lower lubber line. When the compass switch is in the DIRECT GYRO position, the heading displayed will be a random heading. If DIRECT GYRO is selected with the correct magnetic heading displayed at the time of selection, the heading will probably remain close to the correct magnetic heading, as the gyro has a very slow random drift rate. If DIRECT GYRO is selected when the compass card is not properly slaved to magnetic north, the compass card will be stabilized but will not indicate proper magnetic heading. In this case, the magnetic compass must be used for correct magnetic heading.

Heading Marker and Heading Set Knob.

The heading marker may be positioned about the compass card by use of the heading set knob. Once positioned, the marker remains fixed relative to the card. Use of the heading marker is discussed under steering mode switch and navigation mode switch.

Course Arrow, Course Set Knob, Course Selector Window, and Course Deviation Indicator.

The course arrow may be positioned about the compass card by use of the course set knob. The course set knob simultaneously positions the course arrow and course selector window so that they will always read the same course. Once positioned, the course arrow remains fixed relative to the compass card. When the course arrow is set, it will remain aligned (parallel) with the radial or localizer course selected, providing the compass card is slaved to magnetic north. The course deviation indicator, which consists of the center section of the course arrow, indicates lateral and angular displacement from the selected TACAN or localizer course. After tuning in a TACAN station and receiving a reliable signal, center the course deviation indicator (CDI) by rotating the course set knob, and check the reading of the course selector window. Rotate the course set knob until the CDI is at the outer dot, and check the course selector window for a change of 10 degrees ± 1.5. Radar, if available, should be used for any suspected HSI malfunction.

Bearing Pointer.

The bearing pointer indicates correct magnetic bearing to a selected TACAN station when the compass card is functioning in the MAG mode. If the compass card is not aligned with magnetic north, which is possible when in the DIRECT GYRO mode, the bearing pointer will still indicate magnetic bearing to a selected TACAN station. The bearing pointer will not indicate proper relative bearing if the compass card is not slaved to magnetic north. With bearing pointer or compass malfunctions, the CDI may be used to find magnetic headings to a TACAN station by centering the CDI with a "to" indication, and flying the course in the course set window, using the standby compass.

CAUTION

> With bearing pointer or compass malfunction, using the CDI to determine the magnetic course to a TACAN station should be attempted only as a last resort if unable to confirm position by radar.

To/From Indicator.

The to/from indicator functions only for TACAN. If the course deviation indicator is centered when the "to/from" reading is taken, it will immediately indicate whether the course selected, if intercepted and flown, will lead "to" or "from" the station. A "to" indication is presented when the "to/from" indicator appears on the same side of the instrument as the HEAD of the course arrow and conversely a "from" indication is presented when the indicator appears on the same side of the instrument as the TAIL of the course arrow.

Aircraft Symbol.

The aircraft symbol is presented at the center of the HSI and is fixed relative to the instrument. Comparison of the aircraft symbol with the compass card, course arrow, course deviation indicator, and heading marker will give a pictorial view of the angular relationship between the aircraft and the selected information.

Range Indicator.

The range indicator reads slant range in nautical miles to the selected TACAN station.

ATTITUDE DIRECTOR INDICATOR (ADI).

An ADI (figure 4-5) is located on each instrument panel. For modes of operation of the ADI, refer to the steering mode switch and navigation mode switch discussion in this section.

Attitude Sphere, Pitch Trim Knob, and Miniature Aircraft.

The attitude sphere upper half is painted gray and the lower half is black. The gray area represents the sky and the black area, with etched perspective lines, represents the ground. At the junction of the gray and black is the horizon bar. General pitch attitude near level flight may be obtained by referencing the miniature aircraft against the sphere color. Specific pitch attitude may be obtained by referencing the miniature aircraft against the attitude sphere pitch markings. There are dots each 5 degrees of pitch, lines each 10 degrees of pitch, and numbered lines each 30 degrees of pitch. The pitch trim knob allows the attitude sphere to be adjusted to provide the desired pitch presentation relative to the miniature aircraft.

Bank Pointers.

A bank pointer is provided at the top and bottom of the instrument. The top pointer is without scale, but the bottom pointer is provided with a bank scale which is graduated in 10-degree increments up to 30 degrees and in 30-degree increments up to 90 degrees of bank. General bank information may be obtained by noting the angle between the miniature aircraft and numbered pitch lines. When the aircraft is erect, the legends on the attitude sphere will appear right side up.

NOTE

> Since two bank pointers are provided, they cannot be used as a "sky pointer."

Attitude Warning Flag.

The attitude warning flag (OFF) will appear whenever electrical power to the system has failed or is interrupted. The flag will also appear during initial application of electrical power for approximately 1 minute. The instrument is unreliable until the flag disappears.

WARNING

- There is no warning of attitude sphere malfunctions other than power failure.
- The attitude warning flag will not appear with a slight electrical power reduction or failure of other components within the system. Failure of certain components can result in erroneous or complete loss of pitch and bank presentations without a visible flag. It is imperative that the attitude indicator be cross-checked with other flight instruments when under actual or simulated instrument conditions.

Turn and Slip Indicator.

One needle width deflection provides a 4-minute 360-degree turn.

Glide-Slope Indicator and Glide-Slope Warning Flag.

The glide-slope indicator indicates aircraft position relative to an ILS glide slope. The glide-slope warning flag retracts from view if the glide-slope signal strength is sufficient for satisfactory glide-slope information.

Course Warning Flag.

The course warning flag retracts from view if the localizer signal strength is sufficient for satisfactory localizer information. The course warning flag is at the top of the ADI, but serves as warning for localizer information displayed on the HSI course deviation indicator.

Bank Steering Bar.

The bank steering bar may be used in two ways: First, in the MANUAL mode, if the aircraft is flown in such a manner as to keep the bank steering bar centered, it will cause the aircraft to turn to a heading selected by the heading knob and displayed by the heading marker. Second, in the NORMAL mode, if the aircraft is flown in such a manner as to keep the bank steering bar centered, it will cause the aircraft to turn to and intercept a selected localizer beam in the direction of the approach course. In both of the above cases, the correct amount of bank is maintained during roll-in, turn, and roll-out by keeping the bank steering bar centered.

Pitch Steering Bar.

The pitch steering bar functions only to intercept and maintain a glide slope. If the aircraft is flown so as to keep the pitch steering bar centered, the aircraft will fly to and maintain a glide slope. The bar will center when (1) the pitch angle is correct to return to the glide slope, (2) the pitch angle is correct for leveling out on the glide slope, and (3) the pitch angle is correct for remaining on the glide slope.

NOTE

Although the course and glide-slope warning flags are positioned on the ADI near the pitch and bank steering bars, they do not warn of pitch and bank steering malfunctions. If the pitch and bank steering bars are being used for an ILS approach, the warning flags must be out of view. The steering bars may malfunction without warning, so the glide-slope indicator and the course deviation indicator must be monitored during an ILS approach to ensure that desired aircraft positioning is being obtained using the steering bars.

STEERING MODE SWITCH AND NAVIGATION MODE SWITCH.

A steering mode switch and a navigation mode switch (figure 1-7) are located on each instrument panel. The following discussion assumes that desired navigation facilities are tuned in.

Steering Mode Switch.

The steering mode switch has two positions, (1) MANUAL and (2) NORMAL. In the MANUAL position, the bank steering bar is displayed on the ADI. If the aircraft is flown in such a manner as to center the bank steering bar, the aircraft will roll in, turn to, roll out, and maintain the heading selected by the heading set knob and displayed by the heading marker. This is the sole function of the MANUAL position and it will operate in this manner regardless of the position of the navigation mode switch. Operation of the system with the switch in the NORMAL position will be discussed under Navigation Mode Switch.

Navigation Mode Switch.

The navigation mode switch has three positions: (1) TACAN, (2) LOCALIZER, and (3) INSTRUMENT LANDING SYSTEM (ILS). The following discussion of switch selections assumes that the steering mode switch is in the NORMAL position.

TACAN Selected. When TACAN is selected, the bearing pointer indicates magnetic bearing to the TACAN station. The course arrow and course window, which are set simultaneously with the course set knob, indicate the TACAN course selected. The course deviation indicator indicates the aircraft position relative to the selected TACAN course, and the range indicator indicates range to the TACAN station in nautical miles. The "to/from" indicator indicates whether the course selected, if intercepted and flown, will lead the aircraft "to" or "from" the station. No steering bars are in view.

LOCALIZER Selected. When LOCALIZER is selected, the course arrow and course window should be set with the published localizer front course. The course deviation indicator will then show aircraft position relative to the localizer course. If within the area of the glide-slope reception, the glide-slope indicator will provide indications of the aircraft position relative to the glide-slope. The bank steering bar will be in view.

ILS Selected. When ILS is selected, the operation is the same as in LOCALIZER, except that the bank required to center the bank steering bar is reduced from a maximum of 35 degrees to 15 degrees. The pitch steering bar is in view to provide pitch steering relative to the glide-slope. Crosswind correction is also provided in this mode.

FLIGHT DIRECTOR OPERATION.

Manual Heading Mode.

1. Navigation Mode Switch — TACAN.
2. Steering Mode Switch — MANUAL.
3. Heading Marker — Set to desired heading.
4. Bank Steering Bar — Centered.

NOTE

The maximum bank angle commanded by the bank steering bar in the manual mode is 35 degrees.

TACAN Course Interceptions.

Refer to AFM 51-37, INSTRUMENT FLYING, for course interceptions using the flight director system. Select TACAN on navigation mode switch when making TACAN course interceptions.

ILS Approach.

1. ILS Receiver — Tune, identify, and monitor.
2. Course Arrow and Course Window — Set localizer front course.
3. Navigation Mode Switch — LOCALIZER.

NOTE

With the localizer front course selected, the aircraft symbol is always directional in relation to the course deviation indicator (CDI).

4. Steering Mode Switch — NORMAL.
5. Bank Steering Bar — Centered.
   The bank steering bar may be used when the aircraft heading is within 90 degrees of the localizer front course. The flight director directs an intercept angle up to 45 degrees to the localizer. A maximum bank angle of 35 degrees is required to center the bank steering bar.

WARNING

- The bank steering bar may be used only for a front course approach.
- If the published front course has not been set in the course selector window, the bank steering bar will be unreliable.

6. Navigation Mode Switch — ILS when on the localizer.
   Keeping the bank steering bar centered will maintain the aircraft on or correct it

to the localizer course. Wind drift corrections are accomplished automatically.

NOTE

The bank steering bar will command excessive or erroneous steering indications if the aircraft is not on or near the localizer course when ILS is selected.

7. Pitch Steering Bar — Centered.
   As the glide-slope indicator (GSI) approaches midscale, adjust the pitch to center the pitch steering bar. Keeping the pitch steering bar centered will maintain the aircraft on or correct it to the glide slope.

8. CDI and GSI — Cross-check throughout the approach.
   The navigation mode switch must be at LOCALIZER or ILS to obtain localizer or glide-slope indications from the CDI and GSI. The course and glide-slope warning flags function only in LOCALIZER and ILS and are out of view in TACAN. TACAN bearing and range are available in the LOCALIZER or ILS positions.

TACAN.

AN/ARN-118(V) (FIGURE 4-6).

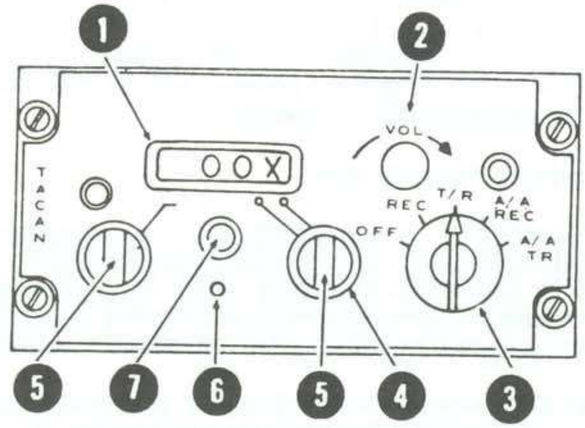
The AN/ARN-118(V) TACAN system provides range and bearing navigation information for air-to-air operation with a suitably equipped cooperating aircraft. A suitably equipped cooperating aircraft is defined as an aircraft equipped with TACAN bearing and/or distance transmitting equipment using prearranged 63-channel separation. The AN/ARN-118(V) will act as a distance transmitter but will not transmit bearing information. It eliminates 40-degree lock-on error and long search cycles. In case of co-channel interference in T/R mode, the interfering identifier is garbled. A warning flag appears when the desired station signal is invalid. When a temporary loss of signal occurs, memories keep range and bearing indications tracking for 15 seconds and 3 seconds respectively until the signal is regained. It automatically self tests after any temporary signal loss and displays its status on the control head. Operational range is up to 390 NM depending on aircraft altitude. The set requires ac and dc power.

AN/ARN-118(V) TACAN CONTROLS.

Function Selector Switch (3)

1. OFF — Turns TACAN equipment off.

AN/ARN - 118 (V) TACAN CONTROL HEAD



1. CHANNEL DIGITAL DISPLAY
2. VOLUME CONTROL KNOB
3. FUNCTION SELECTOR SWITCH
4. CHANNEL MODE SELECTOR SWITCH (X, Y)
5. CHANNEL SELECTOR SWITCHES
6. PRESS - TO - TEST BUTTON
7. TEST INDICATOR LIGHT

Figure 4-6.

2. REC — Receives only. Indicators display bearing to ground station; no distance is displayed.

3. T/R — Indicators display bearing and distance to ground station. This is the normal position.

4. A/A REC — Indicators display bearing to other suitably equipped aircraft. No distance is displayed.

5. A/A T/R — Indicators display bearing and distance to other cooperating suitably equipped aircraft.

6. Channel Selector Switches (5).

   The Channel selector switches select TACAN channels 1 through 126.

7. Channel Mode Selector Switch (4).

   The Channel Mode Selector Switch selects either X or Y modes making a total of 252 TACAN channels available.

8. Volume Control Knob (2).

   VOL — Not operational.

9. Press-to-Test Button/Test Indicator Light (6 and 7).

TEST — Self-test is initiated by pressing the button. The test indicator light will flash to confirm lamp operation. If the test indicator light illuminates at a subsequent time, a receiver-transmitter fault has been detected. For maximum test capability, allow 2 minutes of operation before initiation. The function selector switch should be set to T/R or A/A T/R for self-test. A test cycle may be terminated at any time by rotating either a channel or mode selector switch. Only receiver-transmitter faults are displayed by the test indicator light.

AN/ARN-118(V) TACAN OPERATION.

Preflight Check.

1. Function Selector Switch — T/R.
2. HSI Course — Set to 180 degrees.

NOTE

Allow 90-second warm-up.

3. Press-to-Test Button — Depress and release. Observe HSI and test indicator light:
   a. Test indicator light flashes momentarily.
   b. DME warning flag comes into view.
   c. Bearing pointer may slew to 270 degrees for approximately 7 seconds.

NOTE

The following indications last approximately 15 seconds.

   d. DME warning flag goes out of view.
   e. Range Indication — 000.0 ± 0.5 NM.
   f. Bearing Indication — 180 ± 3 degrees.
   g. CDI — Centered ± 1/2 dot.
   h. To-From arrow — To.
   i. DME warning flag comes into view until a usable signal is received.

Normal Operation for Air to Ground Navigation.

NOTE

Allow 90-second warm-up.

1. Function Selector Switch — T/R.
2. Channel Mode and Selector Switches — Set frequency, adjust volume, and identify station.
3. HSI — Check (DME, CDI, To-From arrow and bearing pointer information displayed).
4. HSI Course Set — Adjust to proper course. Fly normal intercept procedures.

Normal Operation for Air to Air Navigation.

NOTE

- For A/A operation, use preassigned channels or contact a cooperating aircraft. The channel of the receiving aircraft must be either 63 channels above or below the cooperating aircraft and within the 1 through 126 channel X or Y range. Y mode is preferred to preclude interference since few Y mode ground stations are presently operating. Interference shows mainly as reduced bearing and distance lock-on range. To avoid interference, do not use a Y mode ground station channel within 200 NM of the ground station.
- To prevent IFF/TACAN interference, avoid channels 1 through 11, 58 through 74, and 121 through 126.
- As many as five aircraft can lock-on to a "parent" aircraft in A/A T/R mode. The radius of operation for all aircraft involved will be limited to a distance equal to four times the distance between the "parent" aircraft and the nearest other aircraft unless the system is otherwise set by ground maintenance personnel. If system is otherwise set, bearing information received from a "parent" aircraft may be erratic due to resultant noise pickup when an automatic gain control is disabled.

1. Function Selector Switch — A/A T/R.

2. Channel Mode and Selector Switches — Set to desired frequency. If the cooperating aircraft is equipped to transmit bearing signals, CDI, distance, to-from, and bearing information will be displayed. If not, DME only will be displayed.

NOTE

- Automatic Self-Test. If the TACAN signal is lost, an automatic self-test is initiated. This is indicated by the bearing pointer slewing to 270 degrees for about 7 seconds. If the test indicator light illuminates, a system malfunction has occurred, and a press-to-test should be accomplished. Changing channel or mode will not initiate a self-test.

- Press-to-Test. If the test indicator light illuminates during flight, perform a preflight test. If the light remains on, repeat the test in REC or A/A REC function. If the light goes out, the malfunction is probably in the transmitter and bearing information is valid. If the light is illuminated in both T/R and REC functions, all information in considered invalid.

AIM SYSTEM.

The AIM system provides for identification (IFF/SIF), altitude reporting, and a corrected display of the aircraft altitude on an AAU-19/A counter-drum-pointer altimeter. The IFF/SIF function and altitude reporting are accomplished thru the receiver-transmitter (AN/APX-64), which enables the aircraft to identify itself automatically and report the aircraft altitude when challenged by surface or airborne radar equipment capable of interrogation. The set can also identify the aircraft in which it is installed as a friendly aircraft within a group of specific friendly aircraft. The modes of operation have the following significance: Mode 1 — Friend Identity, Mode 2 — Personal Identity, Mode 3/A — Air Traffic Control, Mode 4 — Not Used, and Mode C — Altitude Reporting. The receiver is sensitive to all interrogation signals within operating frequency; however, only those signals meeting the complete predetermined requirements of the mode being used will be recognized and answered. Mode 2 code settings are set into the receiver-transmitter on the ground and thus are fixed for any one flight. Mode 1 and 3/A codes are set up at the control panel and all modes can be turned on or off. The corrected altitude function is accomplished by an altitude computer and the counter-drum-pointer altimeters. The altitude computer (CPU-46/A) provides digital altitude information, corrected for static pressure effect, to the receiver-transmitter, and as an electrical input to the counter-drum-pointer altimeters (AAU-19/A). An airborne test set is a component of the system to self-interrogate or monitor the replies to external interrogation. When the test set is not installed, all self-interrogation and external checks are inoperative. The system is powered by the left ac bus except for the test set and AAU-19/A altimeter vibrator, which are powered by the 28-volt dc bus.

AIM SYSTEM CONTROL PANEL.

The AIM system control panel (figure 4-7) is located on the right console of the front cockpit.

Master Control Knob.

The master control knob has five positions, placarded OFF, STBY, LOW, NORM, and EMER. When the master control knob is positioned to STBY (standby), the system is inoperative but ready for use after the initial 3-minute warmup period. In the LOW position, the system operates at reduced sensitivity and replies only in the area of strong interrogations. In the NORM (normal) position, the system operates at full sensitivity, which provides maximum performance. To select the EMER (emergency) position, the master control knob must be pulled out and rotated. When the knob is positioned at EMER, modes 1, 2, and 3A are automatically enabled regardless of the position of the mode select switch or code selector wheel. Mode 3 code 7700 is transmitted each time the set is interrogated by ground radar. On some control units, the STBY position has a detent stop; when returning from any selected position to OFF, the master control knob must be pulled out and rotated to return to the OFF position.

Radiation Test/Monitor Switch.

The radiation test/monitor switch has three positions, placarded RAD TEST, OUT, and MON. The switch is spring-loaded for momentary contact in the RAD TEST (radiation test) position and will return to the OUT position when released. The RAD TEST position is used by the ground crew to preflight the system. With the switch at the MON (monitor) position, illumination of the TEST light indicates a normal operating condition for the signal response to external interrogations for the mode switches that are ON. With the radiation test/monitor switch in the OUT position, the TEST light will not illuminate in response to external interrogations. The MON position is inoperative when the airborne test set is not installed.

Mode Select/Test Switch.

Four mode select/test switches are placarded TEST, ON, and OUT. The switches grouped under the TEST heading are labeled M-1, M-2, M-3/A, and M-C. The OUT position for each switch deactivates the mode selected. If more than one switch is placed at ON, the receiver-transmitter will reply to interrogations for all modes selected. With the M-C mode switch at ON, the aircraft altitude is reported in increments of 100 feet referenced to a barometric pressure of 29.92 inches of Hg to an altitude of 80,000 feet when interrogated. The switches are spring-loaded to the ON position from the TEST position. With the radiation test/monitor switch at the OUT position and a mode select switch held in the TEST position, the selected mode can be self-interrogated; illumination of the TEST light indicates a normal operating condition. The TEST function is inoperative when the airborne test set is not installed.

Code Selector Wheels.

Two sets of code selector wheels are provided to set Mode 1 and Mode 3/A. A set of two wheels placarded Mode 1 will select 32 different codes. A set of four wheels placarded Mode 3/A will select 4096 codes. Each wheel is placarded with digits 0 thru 7, which can be seen thru the recessed windows on the face of the control panel.

Identification of Position (I/P) Switch.

The identification of position (I/P) switch has three positions, placarded IDENT, OUT, and MIC. When the switch is momentarily held in the spring-loaded IDENT (identification) position, the I/P timer is energized for approximately 15 to 30 seconds. The receiver-transmitter will transmit an identification-of-position pulse group during the period if a Mode 1, 2, or 3/A interrogation is recognized. When the switch is placed in the MIC (microphone) position, the system will function in an identical manner as it did in the IDENT position except the system will not be activated until the microphone button on the right throttle in either cockpit is pressed. Placing the switch to the OUT position prevents transmission of identification-of-position pulse groups.

Mode 4.

Mode 4 is not used and all controls and lights are inoperative.

COUNTER-DRUM-POINTER ALTIMETER.

A servo/pneumatic counter-drum-pointer altimeter (AAU-19/A) on the instrument panel in each cockpit (figure 4-8) consists of a precision pressure altimeter combined with a servomechanism. The altimeter has two modes of operation; primary (servoed) mode and standby (pneumatic) mode. In the primary mode of operation, the altimeter is controlled by signal inputs from the altitude computer. Direct readout of the altitude is accomplished by the numbers on the 10,000-foot counter, 1000-foot counter, and the 100-foot drum on the face of the instrument. A single pointer indicates hundreds of feet around the fixed circular scale. The 100-foot pointer serves as a precise readout of values less than 100 feet. Below an altitude of 10,000 feet, a diagonal warning symbol will appear on the 10,000-foot counter. A barometric pressure set knob is provided to insert the desired altimeter setting in inches of Hg. Rapid rotation of the barometric pressure set knob or use of abnormal force to overcome binding of the knob may cause internal gear disengagement or gear failure, resulting in excessive altitude indication errors in both the primary and standby modes. In case of an electrical power interruption longer than 3 seconds or a system failure in the altimeter or altitude computer, a warning flag placarded STBY (standby) will appear in the upper left portion of the instrument face, indicating that the altimeter has automatically reverted to standby mode of operation (pressure altimeter) and uncorrected altitude is displayed. Simultaneously, a dc operated vibrator is activated in the altimeter. A function switch, placarded STBY (standby) and RESET, is a spring-loaded self-centering switch used to select the primary or standby mode of operation. To select the primary mode of operation, momentarily place the function switch to RESET after ac electrical power is available. The standby mode of operation may be selected while the altimeter is in the primary mode of operation by momentarily placing the function switch to STBY. Each altimeter can be operated independent of the other in the primary mode or in the standby mode.

Primary (Servoed) Mode of Operation.

In the primary mode of operation, corrected pressure altitude (installation error correction) synchro signals are sent from the altitude computer to the receiver-transmitter and to a servomechanism in the altimeter. These signals are computed only for a barometric pressure of 29.92 inches of Hg. To correct the altimeter indicated altitude for other than 29.92 inches of Hg, set the current altimeter

AIM SYSTEM CONTROL PANEL

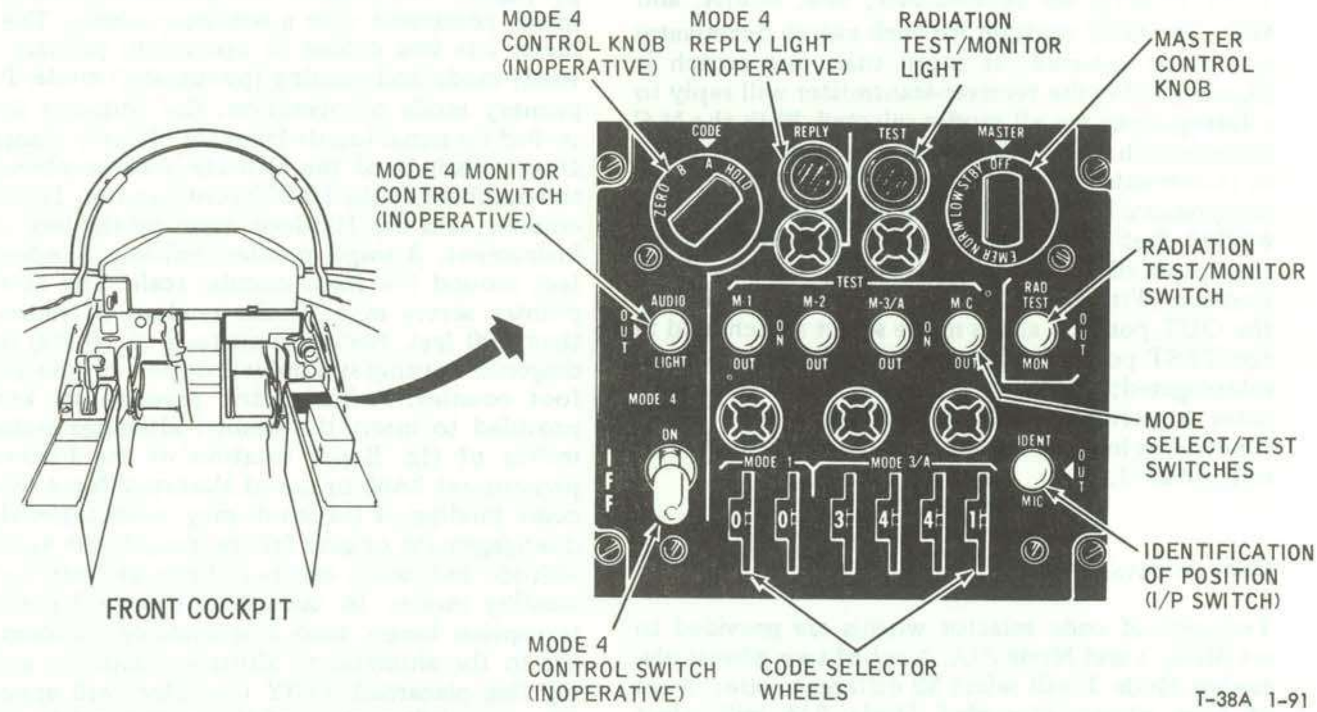


Figure 4-7.

COUNTER-DRUM-POINTER ALTIMETER (AAU-19/A)

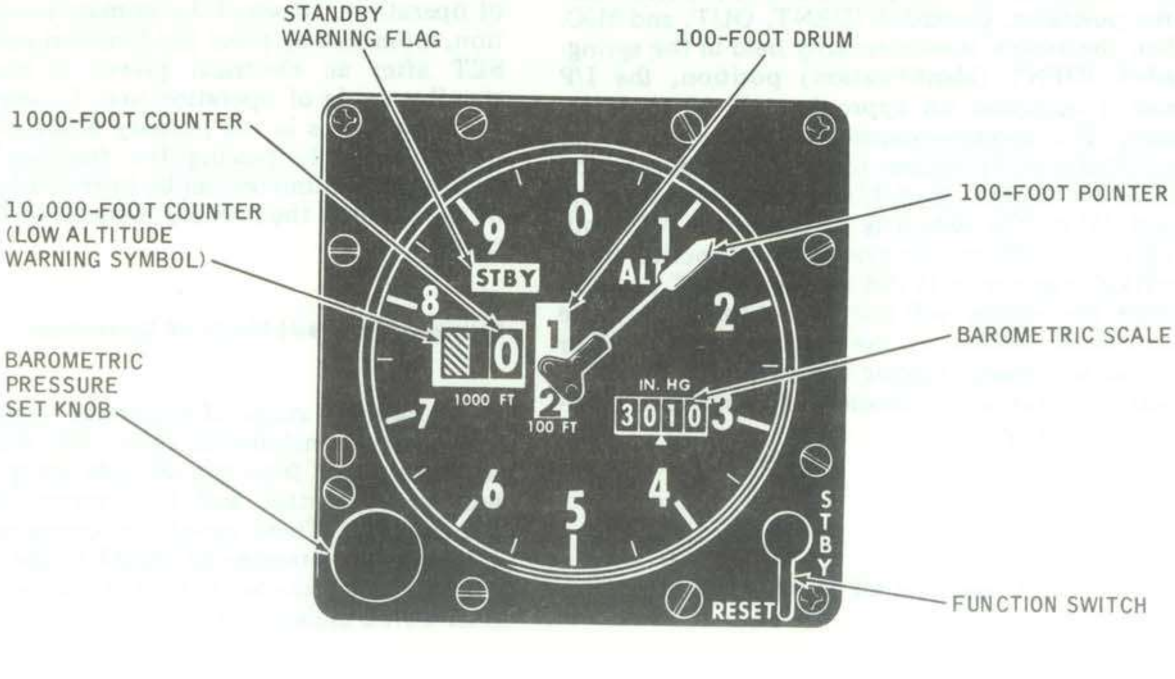


Figure 4-8.

setting in the altimeter barometric scale. When the system is interrogated for altitude reporting (mode C), the receiver-transmitter will automatically report the aircraft altitude to the nearest 100 feet for a barometric pressure of 29.92 inches of Hg, regardless of the setting in the altimeter barometric scale.

Standby (Pneumatic) Mode of Operation.

In the standby mode of operation, the altimeter receives static air pressure directly from the pitot-static system and operates in exactly the same manner as the standard pressure altimeter (AAU-7). Altimeter installation error corrections from the appendix must be used to correct the aircraft altitude. Mode C altitude reporting is available if the standby mode of operation has been selected by the crewmember and is not the result of the system automatically reverting to standby operation due to an altitude computer failure. In the standby mode of operation, the vibrator is automatically energized to remove the friction from the counter-drum-pointer mechanism, decreasing the lag in the altimeter indications.

WARNING

If the AAU-19/A altimeter internal vibrator is inoperative, due either to internal failure or dc power failure, the 100-foot pointer may momentarily hang up when passing thru 0 (12-o'clock position). If the vibrator has failed, the 100-foot pointer "hangup" can be minimized by tapping the case of the altimeter.

ALTIMETER ERROR CROSS-CHECK.

Operational checks of the altimeter should be performed routinely as prescribed in Section II and anytime a malfunction is suspected. When changing from RESET to STBY to RESET positions, a change in readings will be observed due to the difference between corrected altitude (RESET position) and uncorrected altitude (STBY position). At sea level static conditions, the change may be up to 75 feet. At airspeeds up to 0.9 mach, below 10,000 feet, the indicated change may be as much as 150 feet and above 10,000 feet as great as 250 feet. This difference may be observed between the modes of one altimeter or the modes of both front and rear altimeters (front in RESET, rear in STBY, etc). The allowable difference between the primary mode (RESET) readings of both altimeters is 75 feet during preflight and at all altitudes and airspeeds throughout the operating range.

NOTE

If the difference in indicated altitude between RESET and STBY modes of one altimeter or between altimeters exceeds allowable limits, continue the mission in the STBY mode(s).

STANDBY ATTITUDE INDICATOR.

A standby attitude indicator (figure 1-7) is located on the instrument panel to provide an attitude indicating system if the flight director system malfunctions. The indicator is remotely operated by signals from an MD-1 vertical gyro, which is separate from the flight director system and located in the dorsal section of the fuselage. Complete erection requires 5 minutes after ac power is applied. The MD-1 gyro senses pitch-and-bank angles and incorporates a pitch-and-bank erection system. The aircraft attitude is shown accurately thru 360 degrees of roll and plus or minus 82 degrees of pitch. The pitch-and-bank erection system reduces turning errors to a minimum. Acceleration and deceleration cause slight errors in pitch indications, which are most noticeable on takeoff. Pitch and roll attitudes are shown by the circular motion of a universally mounted sphere displayed as the background for a miniature reference aircraft. The miniature reference aircraft is always in proper physical relationship to the simulated earth, horizon, and sky areas of the background sphere. On the sphere, the horizon is represented by a solid fluorescent line, the sky by a light gray area, and the earth by a dull black area. Horizontal markings on the face of the sphere show accurate aircraft attitudes up to 82 degrees of climb or dive. The pitch trim knob on the lower right side of the instrument electrically rotates the sphere to the proper position in relation to the fixed miniature reference aircraft to correct for pitch attitude changes. This adjustment is necessary, since the level-flight attitude of the aircraft varies with weight and speed.

STANDBY ATTITUDE INDICATOR (After incorporation of T.O. 1T-38-648).

The ARU-42/A2 attitude indicator (figures 1-7 and 4-9) is self-contained and provides a visual indication of the bank and pitch of the aircraft. The instrument limits are: 92 degrees climb, 78 degrees dive with full 360 degrees roll capability. The pitch trim knob is used to adjust the miniature aircraft and to cage the indicator. Rotating the knob while in adjusts the miniature aircraft. Pulling the knob out to the fully extended position cages (erects) the indicator. With the knob fully extended, rotating the knob fully clockwise locks the indicator in the cage position until 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 during flight. It should be caged prior to removing electrical power after the flight. When power is interrupted or the indicator is caged, the OFF warning flag appears on the face of the indicator. It will provide a minimum of 9 minutes of useful attitude information after power failure (accurate to within ± 6 degrees). 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 prior to applying power to and prior to removing power from the instrument. Avoid snap-releasing the pitch trim knob after uncaging to prevent damage to the indicator.

ARU-42/A2

STANDBY ATTITUDE INDICATOR

1. PULL TO CAGE/PITCH TRIM KNOB
2. OFF FLAG

Figure 4-9.

ATTITUDE WARNING FLAG.

The attitude warning flag (OFF) will appear whenever electrical power to the system has failed or is interrupted. The flag will also appear during initial application of electrical power for approximately 1 minute. The instrument is unreliable until the flag disappears.

WARNING

- There is no warning of attitude sphere malfunctions other than power failure.
- The attitude warning flag will not appear with a slight electrical power reduction or failure of other components within the system. Failure of certain components can result in erroneous or complete loss of pitch and bank presentations without a visible flag. It is imperative that the attitude indicator be cross-checked with other flight instruments when under actual or simulated instrument conditions.

NOTE

During high G maneuvering the warning flag may appear without system malfunction.

ANGLE-OF-ATTACK SYSTEM.

The angle-of-attack (AOA) system (figure 4-9) senses aircraft angle of attack and displays this information to both crewmembers. The AOA system consists of an AOA vane transmitter, AOA CPU-115/A computer, and in each cockpit, an AOA indicator, AOA indexer, and indexer lights dimmer control. The system provides compensation for various wing flap and landing gear configurations. The AOA system presents the following displays in each cockpit:

a. Optimum AOA for final approach.

b. AOA when buffet and stall will occur.

c. Approximate AOA for maximum range and maximum endurance.

The vane of the AOA transmitter is located on the forward right side of the fuselage. The vane is electrically heated for anti-ice and is activated when the pitot heat switch is turned on. The AOA computer, which is powered by the left ac bus, receives signals from the AOA vane transmitter, wing flap position synchro-transmitter, and nose gear downlock indicating system. The computer automatically computes and sends the appropriate signals to the AOA indicator and AOA indexer in each cockpit.

AOA INDICATOR.

The ARU-26/A AOA dial indicator on the instrument panel operates during all phases of flight and indicates AOA information. The indicator presents AOA as a percentage of maximum lift AOA. The dial is calibrated in units of .1 counterclockwise from 0 to 1.1. Each unit represents approximately 10% of aircraft lift, from 0% at 0 indication to 100% at 1.0 indication. Three preset fixed indices and two colored arcs on the dial indicate the following:

.18 White Index — Maximum Range (1-G flight)

.3 White Index — Maximum Endurance (1-G flight)

.6 White Index — Optimum Final Approach at 3-o'clock Position (1-G flight)

.9 to 1.0 Yellow Arc — Buffet Warning

1.0 to 1.1 Red Arc — Stall Warning

The red OFF flag will appear on the face of the dial when electrical power is removed from the AOA system or when the system has failed. The AOA indicator is powered by the left ac bus.

WARNING

The airspeed indicator should be cross-checked frequently when using AOA information; some system malfunctions may not necessarily trigger the OFF flag or be repeated in the other cockpit.

AOA INDEXER.

The ARU-27/A AOA indexer above the instrument panel is controlled by the AOA computer and provides an illuminated heads-up display of the AOA information in the form of low-speed, on-speed, and high-speed indexer lights. (See figure 4-9). The three indexer lights are powered by the dc bus. The lights are operative in the landing configuration with the wing flaps up or down, or when the landing gear is up and the wing flaps are extended 5 percent or more. With the landing gear and wing flaps up, the high-speed indexer light is inoperative to eliminate continuous illumination during cruise flight conditions. See figure 4-10 for allowable On-Speed Band for AOA indexer. AOA system failure is indicated when all three symbols of the indexer are illuminated. The three indexer lights can be tested by placing the warning test switch on the right console at TEST.

AOA INDEXER LIGHTS DIMMER.

The AOA indexer lights dimmer to the left of the AOA indicator controls the light intensity of the three indexer lights from dim to bright.

LIGHTING EQUIPMENT.

EXTERIOR LIGHTING.

Rotating Beacon Lights and Switch.

One rotating beacon light is located near the top of the vertical stabilizer and one on the lower fuselage. The lights operate on ac and are controlled by the beacon light switch (figure 1-11) on the right console of the front cockpit.

Position Lights and Switch.

The position lights, which operate on 6-volt ac from a transformer off the left ac bus, are individually located in each wingtip, in the vertical stabilizer, and in the lower fuselage. The position lights are controlled by a bright/dim switch (figure 1-11) on the right console of the front cockpit.

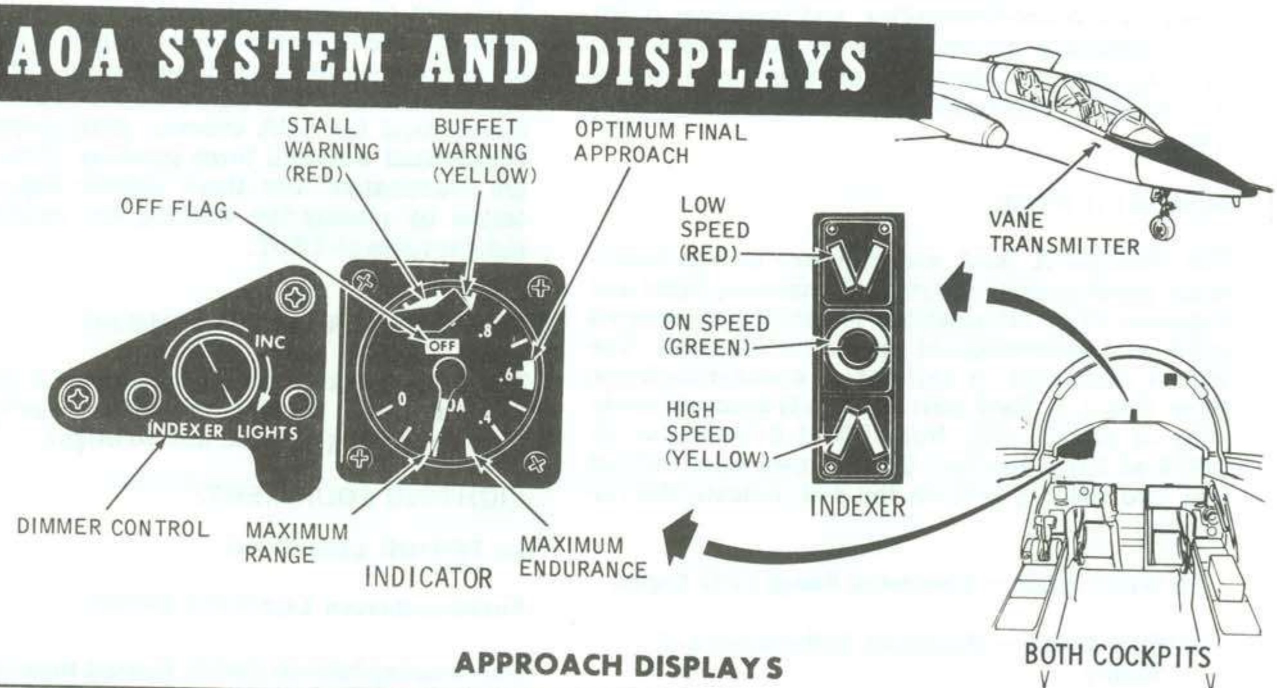
Formation Lights and Switch.

Formation lights, operating on dc bus power, are individually located on each side of the forward nose section. Formation lights are controlled by a switch (figure 1-11) on the right console of the front cockpit.

Landing-Taxi Light.

A single retractable landing-taxi light with dual filaments is installed. When the position lights are turned on, and the gear is extended, the light also extends. The landing-taxi light switch (figure 1-9) on the left subpanel of the front cockpit controls only the filament power. When the weight of the aircraft is off the main gear and the landing-taxi light switch is at ON, both filaments are burning. When the weight of the aircraft is on the main gear,

AOA SYSTEM AND DISPLAYS



APPROACH DISPLAYS

INDICATOR	INDEXER	AIRSPEED	ATTITUDE
		SLOW	VERY HIGH AOA 
		SLIGHTLY SLOW	HIGH AOA 
		ON SPEED	OPTIMUM AOA 
		SLIGHTLY FAST	LOW AOA 
		FAST	VERY LOW AOA 

T-38A 1-98A

Figure 4-10.

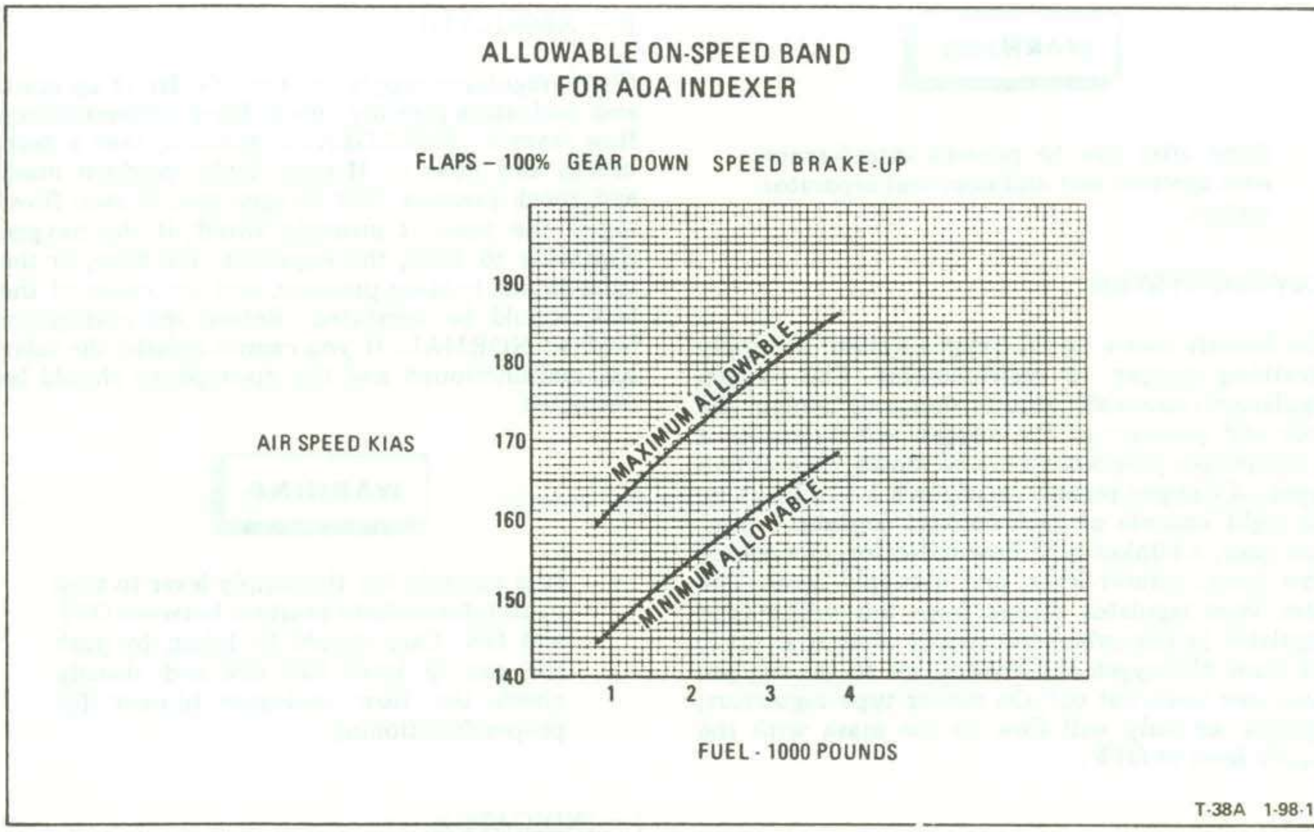


Figure 4-11.

the light moves to the taxi position and one filament is extinguished. Turning off the position lights retracts the landing light in about 10 seconds.

INTERIOR LIGHTING.

The instrument lights operate on ac power. A knob (figures 1-11, 1-12) on the right console of each cockpit controls operation and intensity of the instrument lights. White floodlights, operating on ac, aid in illuminating the instrument panel, console panels, and the cockpit area. The floodlights are controlled by a knob (figures 1-11, 1-12) on the right console of each cockpit. The two floodlights over each cockpit instrument panel (figure 1-7) automatically switch from ac to dc if the ac power supply fails, provided the floodlight control knob is not at the OFF position. These floodlights serve as an alternate lighting source under this condition and cannot be dimmed when operating on dc power. The integral console, subpanel, and pedestal lights operate on ac. Operation and intensity of these lights are controlled by rotating the console lights knob (figures 1-11, 1-12) on each right console.

NOTE

If the left generator and bus transfer relay fail instrument and console lights will not be operational. Floodlights which are powered by the right AC bus will not be automatically available, and the floodlight rheostat must be adjusted to obtain cockpit lighting.

UTILITY LIGHTS.

Two removable utility lights, one in each cockpit, are normally mounted on the right console aft of the map case (figure 1-5) in the front cockpit and on the right canopy frame (figure 1-6) in the rear cockpit. Each light is controlled by a rheostat, which is an integral part of the light. Each light can be removed from the mounting bracket and is equipped with a spring extension cord, enabling use anywhere in the cockpit, or it can be placed in various other mounting brackets in the cockpit. The lights operate on DC power.

WARNING

Stow after use to prevent interference with ejection seat and man-seat separator system.

OXYGEN SYSTEM.

The aircraft uses a liquid oxygen system to supply breathing oxygen to crewmembers. The oxygen regulators (automatic diluter demand) control the flow and pressure of the oxygen and distribute it in the proper proportions to the masks. One of two types of oxygen regulators (figures 1-11, 1-12) on the right console of each cockpit contains a pressure gage, a blinker type flow indicator, emergency flow lever, diluter lever, and a supply lever. The later type regulator differs from the earlier type regulator in that when the supply lever is at OFF, the flow of oxygen and cockpit air to the oxygen mask are both cut off. On earlier type regulators, cockpit air only will flow to the mask with the supply lever at OFF.

OXYGEN QUANTITY INDICATOR.

An oxygen quantity indicator, operating on ac and located on the right subpanel of each cockpit (figures 1-9, 1-10), indicates converter liquid oxygen quantity in liters. The indicator is provided with an OFF flag, which will appear in case of electrical power failure.

OXYGEN LOW-LEVEL CAUTION LIGHT.

An oxygen low-level caution light (figures 1-11, 1-12) on the right console of each cockpit illuminates when the oxygen indicator reads 1 liter or less of liquid oxygen. The light may blink, due to oxygen sloshing, if the system contains less than 3 liters.

OXYGEN SYSTEM PREFLIGHT CHECK (PRICE).

P — PRESSURE.

The pressure gage should read 50 to 120 psi (figure 5-1) and should agree with the pressure gage in the other cockpit.

R — REGULATOR.

Check regulator supply lever at ON. Hook up mask and perform a pressure check. Place the emergency flow lever at EMERGENCY position, take a deep breath and hold it. If mask leaks, readjust mask and check pressure. The oxygen should stop flowing if the mask is properly fitted; if the oxygen continues to flow, the regulator, the hose, or the 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 has malfunctioned and the discrepancy should be corrected.

WARNING

It is possible for the supply lever to stop in an intermediate position between OFF and ON. Care should be taken to push the supply lever full ON and visually check the flow indicator blinker for proper functioning.

I — INDICATOR.

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

C — CONNECTIONS.

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

E — EMERGENCY.

Check emergency oxygen cylinder properly connected and a minimum pressure of 1800 psi. (Pressure gage must be checked during parachute preflight.)

ANTI-G SUIT SYSTEM.

Air pressure from the air-conditioning system is used to inflate the anti-G suit in each cockpit to offset the effects of high load factor.

OXYGEN DURATION HOURS TABLE

CREWMEMBER DURATION IN HOURS

Crewmembers	Cockpit Altitude Feet	Diluter Lever	10	9	8	7	6	5	4	3	2	1	Below 1
ONE CREWMEMBER	40,000 & ABOVE	Top (100% Oxygen)	56	50	45	39	33	28	22	16	11	5.6	EMERGENCY DESCEND TO ALTITUDE NOT REQUIRING OXYGEN.
		Bottom (Normal Oxygen)	56	50	45	39	33	28	22	16	11	5.6	
	35,000	Top (100% Oxygen)	56	50	45	39	33	28	22	16	11	5.6	
		Bottom (Normal Oxygen)	56	50	45	39	33	28	22	16	11	5.6	
	30,000	Top (100% Oxygen)	40	36	32	28	24	20	16	12	8.1	4.0	
		Bottom (Normal Oxygen)	41	37	32	29	25	20	16	12	8.3	4.1	
	25,000	Top (100% Oxygen)	31	28	25	21	18	15	12	9.4	6.2	3.1	
		Bottom (Normal Oxygen)	39	35	31	27	23	19	15	11	7.8	3.9	
	20,000	Top (100% Oxygen)	23	21	19	16	14	11	9.5	7.1	4.7	2.3	
		Bottom (Normal Oxygen)	44	40	35	31	26	22	17	13	8.9	4.4	
	15,000	Top (100% Oxygen)	19	17	15	13	11	9.5	7.6	5.7	3.8	1.9	
		Bottom (Normal Oxygen)	54	48	43	37	32	27	21	16	10	5.4	
	10,000	Top (100% Oxygen)	15	13	12	10	9.2	7.6	6.1	4.6	3.0	1.5	
		Bottom (Normal Oxygen)	54	48	43	37	32	27	21	16	10	5.4	
TWO CREWMEMBERS	40,000 & ABOVE	Top (100% Oxygen)	28	25	22	19	16	14	11	8.4	5.6	2.8	EMERGENCY DESCEND TO ALTITUDE NOT REQUIRING OXYGEN.
		Bottom (Normal Oxygen)	28	25	22	19	16	14	11	8.4	5.6	2.8	
	35,000	Top (100% Oxygen)	28	25	22	19	16	14	11	8.4	5.6	2.8	
		Bottom (Normal Oxygen)	28	25	22	19	16	14	11	8.4	5.6	2.8	
	30,000	Top (100% Oxygen)	20	18	16	14	12	10	8.1	6.1	4.0	2.0	
		Bottom (Normal Oxygen)	20	18	16	14	12	10	8.3	6.2	4.1	2.0	
	25,000	Top (100% Oxygen)	15	14	12	11	9.4	7.8	6.2	4.7	3.1	1.5	
		Bottom (Normal Oxygen)	19	17	15	13	11	9.8	7.8	5.9	3.9	1.9	
	20,000	Top (100% Oxygen)	11	10	9.5	8.3	7.1	5.9	4.7	3.5	2.3	1.1	
		Bottom (Normal Oxygen)	22	20	17	15	13	11	8.9	6.6	4.4	2.2	
	15,000	Top (100% Oxygen)	9.5	8.6	7.6	6.6	5.7	4.7	3.8	2.8	1.9	0.9	
		Bottom (Normal Oxygen)	27	24	21	18	16	13	10	8.1	5.4	2.7	
	10,000	Top (100% Oxygen)	7.6	6.9	6.1	5.3	4.6	3.8	3.0	2.3	1.5	0.7	
		Bottom (Normal Oxygen)	27	24	21	18	16	13	10	8.1	5.4	2.7	
LIQUID CONTENTS LITERS			10	9	8	7	6	5	4	3	2	1	BELOW 1

- TOP FIGURES INDICATE DILUTER LEVER "100% OXYGEN"
- BOTTOM FIGURES INDICATE DILUTER LEVER "NORMAL OXYGEN"

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Figure 4-12.

ANTI-G SUIT TEST BUTTON.

An anti-G suit press-to-test button in the top of each regulator (figures 1-11, 1-12) is located on the left console of each cockpit. The button is used to manually test operation of the anti-G suit valve; the further the button is pressed, the greater is the anti-G suit pressure available.

MISCELLANEOUS EQUIPMENT.

Additional items provided include:

a. Instrument hood.

b. Rearview mirrors.

c. Map data case.

d. Weapon System Support Pod (WSSP).

(1) Some aircraft are equipped to carry a WSSP which mounts under the center section of the fuselage. The nose section of the pod is attached to a tray which slides out for loading and, when stowed, is secured in place by a metal over-center latch type strap on each side. Each latch strap is covered by a stream-lined fairing which is secured by a wing nut dzus-type fastener. The pod is approximately 84 inches long, 24 inches wide, and 16 inches deep. The nose and tail sections are faired. Normal load capacity is approximately 140 pounds. Maximum loaded weight of the pod (with attached pylon) is 250 pounds. The assigned drag number is 25 (refer to Appendix 1, Part 1).

(B) e. MXU-648 Aircraft Baggage/Cargo Pod.

(1) The MXU-648 baggage/cargo pod is a modification of a fire bomb container. Each pod has a hinged access door on the left side. Some pods have a removable tail cone for loading a variety of cargo in size and length. The cargo compartment contains a metal floor and a cargo tie-down system which consists of straps and/or netting secured to permanent hooks installed in the floor. Refer to Section V for external stores limitation.

f. Elastic Tiedown Cords.

(1) The optional elastic tiedown cords are to secure the rear cockpit seat pack/survival kit in the seat bucket during solo flights for pilot/passenger pickup or delivery missions. They are to be attached in a criss-cross fashion by attaching the rear cord hooks to the safety belt attachment clevis pins near the back of the seat bucket on one side and the other hook attached under the opposite forward corner of the seat bucket.

(B) ARMAMENT SYSTEM.

Refer to T.O. 1T-38B-34-1-1.

OPERATING LIMITATIONS

SECTION V

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INTRODUCTION.

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

MINIMUM CREW REQUIREMENT.

The minimum crew requirement for this aircraft is one pilot. Solo flights must be made with the pilot flying the aircraft from the front cockpit.

THROTTLE SETTING THRUST DEFINITIONS.

NORMAL THRUST.

Normal (maximum continuous) thrust is the thrust obtained at 98.5% RPM or 630°C EGT, whichever occurs first.

MILITARY THRUST.

MIL (military) thrust is the thrust obtained at 100% RPM without afterburner operation.

MAXIMUM THRUST.

MAX (maximum) thrust is the thrust obtained at 100% RPM with the afterburner operating. Afterburner range extends from minimum afterburner of approximately 5 percent augmentation above MIL thrust to maximum afterburner, which is approximately 40 percent augmentation above MIL thrust.

AIRSPEED LIMITATIONS.

WING FLAPS.

Do not exceed the following airspeeds for the wing flap deflections:

1% to 45%	300 KIAS
46% to 60%	240 KIAS
Over 60%	220 KIAS

LANDING GEAR.

Do not exceed 240 KIAS with the landing gear extended and/or landing gear doors open.

CAUTION

Extension/retraction of landing gear at bank angles greater than 45 degrees or at load factors greater than 1.5 G's can result in overstress failure of the main landing gear sidebrace trunnion.

WEAPON SYSTEM SUPPORT POD (WSSP).

Do not exceed the following airspeed when the WSSP is installed:

350 KIAS in severe turbulence or with speed brake open.
400 KIAS under all other conditions.

CAUTION

Avoid abrupt control movements at airspeeds greater than 240 KIAS.

NOSEWHEEL STEERING.

Do not exceed 65 KIAS with nosewheel steering engaged.

CANOPY.

Do not exceed 50 KIAS while taxiing with a canopy open.

LOAD FACTOR LIMITATIONS.

Do not exceed the following (see figures 5-3, 5-4).

SYMMETRICAL FLIGHT.

Load Factor (G's)	Weight of Fuel Remaining (Pounds)
-2.5 to +6.0	3000
-2.7 to +6.6	2000
-2.9 to +7.2	1000

UNSYMMETRICAL FLIGHT

Load Factor (G's)	Weight of Fuel Remaining (Pounds)
0 to +4.3	3000
0 to +4.7	2000
0 to +5.1	1000

CAUTION

Do not exceed the following G limits when the Weapon System Support Pod is installed:

0 to +4.0G Symmetrical Flight
0 to +3.0G Unsymmetrical Flight

SPECIAL FLIGHT LIMITATIONS.

Functional check flights (FCF) and one-time ferry flight authorizations may require limitations or operation different from standard. Prior to flying an aircraft for these missions, a briefing should be received from appropriate maintenance (QC) and/or operations personnel. T.O. 1T-38A-3 contains requirements for one-time ferry flights and other special instructions. Certain conditions could exist which may allow continuous operation with restrictions. These conditions and restrictions will be noted and flight approval from the using command will be required. These aircraft will be identified by a placard on the cover of the AFTO 781 and cockpit placards.

PROHIBITED MANEUVERS.

VERTICAL STALLS.

Vertical stalls are prohibited.

SPINS.

Intentional spins are prohibited. Refer to section VI for spin recovery procedure in case an inadvertent spin is experienced.

ROLLS.

Do not enter continuous aileron rolls at any load factor other than 1.0 G. When continuous aileron rolls are accomplished, do not exceed three-quarters stick travel.

MISCELLANEOUS LIMITATIONS.

FUEL SYSTEM.

To prevent fuel starvation and subsequent engine flameout, do not exceed the following:

INSTRUMENT MARKINGS

BASED ON FUEL GRADE JP-4

EHU-31A/A

TEMPERATURE EXHAUST GAS

WARNING

WITH EHU-31A/A INDICATORS, IT IS POSSIBLE TO EXPERIENCE AN ENGINE START OR FLAMEOUT UNRECOGNIZED BY THE PILOT. OTHER ENGINE INSTRUMENTS MUST BE REFERENCED TO CONFIRM AN ENGINE START OR FLAMEOUT.

- (Red) 140°C — MINIMUM
- (Green) 140°C TO 630°C — CONTINUOUS OPERATION
- (Red) 645°C — MAXIMUM STEADY STATE
- (Red) 925°C — MAXIMUM DURING START OR ACCELERATION, MOMENTARY
- 630°C TO 645°C — MIL AND MAX THRUST RANGE

OIL PRESSURE

- (Red) 5 PSI MINIMUM (IDLE)
- (Green) 20 TO 55 PSI NORMAL OPERATING RANGE
- (Red) 55 PSI MAXIMUM

ENGINE TACHOMETER

- (Green) 83% TO 98.5% RPM CONTINUOUS
- (Red) 104% RPM MIL AND MAX THRUST

(99.0% TO 104% RPM– MIL AND MAX THRUST RANGE)

(EARLIER) (LATER)

OXYGEN PRESSURE

- (Green) 50 TO 120 PSI NORMAL RANGE

HYDRAULIC PRESSURE

- (Red) 1500 PSI MINIMUM
- (Green) 2850 TO 3200 PSI NORMAL RANGE
- (Red) 3200 PSI MAXIMUM

ACCELEROMETER

- (Red) −2.3 G'S FULLY FUELED
- (Red) +5.6 G'S FULLY FUELED
- (Red) +7.33 G'S WITH 900 POUNDS OR LESS OF FUEL REMAINING

AIRSPEED-MACH NO. INDICATOR

- (Yellow) 220 KNOTS IAS MAXIMUM ALLOWABLE AIRSPEED WITH FLAPS EXTENDED OVER 60%.

> *Note*
>
> A RED POINTER ON THE INSTRUMENT IS SET TO INDICATE A MAXIMUM ALLOWABLE AIRSPEED OF 710 KNOTS EAS.

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Figure 5-1.

ENGINE OPERATING LIMITATIONS

CONDITION	EGT °C	RPM %	NOZZLE POSITION %	FUEL FLOW LB/HR	OIL PRESSURE PSI	TIME DURATION (MINUTES)
GROUND STEADY STATE						
START	925 (MAX) ✱ 845	---	---	360 (MAX)	INDICATION	---
IDLE	---	46.5-49.5	77-92	400-600 (STD DAY)	5-20	---
MILITARY	630-645	99.0-100.5	0-20	2100-2500 (SEA LEVEL)	20-55	30
(MAX) AFTERBURNER	630-645	99.0-100.5	50-85	---	20-55	5
FLIGHT STEADY STATE						
START	925 (MAX) ✱ 845	---	---	360 (MAX)	INDICATION	---
IDLE	140 (MIN)	---	---	200 (MIN) (STD DAY)	5 (MIN)	---
MILITARY	630-645	99.0-104	0-20	---	20-55	30
(MAX) AFTERBURNER	630-645	99.0-104	50-85	---	20-55	15
FLUCTUATION LIMITS WITHIN STEADY STATE LIMITS						
IDLE (GROUND)	---	46.5-49.5	NONE ALLOWED	± 25	± 2	---
MILITARY AND AB (GROUND)	✱✱	99.0-100.5	± 3	± 50	± 2	---
MILITARY AND AB (FLIGHT)	✱✱	± 1	± 3	± 50	± 2	---

OTHER LIMITATIONS

EGT:

✱ 1. ABORT START IF EGT REACHES 845°C TO PRECLUDE EXCEEDING TEMPERATURE LIMITS.

2. ABORT AIRCRAFT DURING GROUND START IF EGT EXCEEDS 925°C MOMENTARILY.

✱✱ 3. TOTAL FLUCTUATIONS IN EGT OF 15°C (±7.5°C) ARE ACCEPTABLE IF THE AVERAGE EGT IS BETWEEN 630°C AND 645°C.

4. AT LOW COMPRESSOR INLET TEMPERATURES, MILITARY AND AFTERBURNER EGT AND RPM MAY BE BELOW NORMAL OPERATING LIMITS. (SEE SECTION VII.)

RPM:

1. MAXIMUM ALLOWABLE TRANSIENT RPM IS 107%.

NOZZLE POSITION:

1. FOLLOWING RAPID THROTTLE MOVEMENTS, NOZZLE POSITION SHOULD STABILIZE WITHIN PERMISSIBLE FLUCTUATION RANGE WITHIN 10 SECONDS.

2. NOZZLE POSITION MAY BE LESS THAN 50% WHEN OPERATING THE AFTERBURNER AT LESS THAN MAX AB.

OIL PRESSURE:

1. DURING COLD WEATHER STARTS, OIL PRESSURE USUALLY EXCEEDS 55 PSI. TO EXPEDITE OIL WARM-UP, ENGINE MAY BE OPERATED AT MILITARY POWER OR BELOW. IF OIL PRESSURE DOES NOT RETURN TO OPERATING LIMITS WITHIN 6 MINUTES AFTER ENGINE START, SHUT DOWN ENGINE.

2. IF A SUDDEN CHANGE OF 10 PSI OR GREATER IN OIL PRESSURE INDICATION OCCURS AT ANY STABILIZED RPM, FOLLOW ENGINE OIL SYSTEM MALFUNCTION PROCEDURES IN SECTION III.

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Figure 5-2.

OPERATING FLIGHT STRENGTH

SYMMETRICAL FLIGHT

DATE: 1 MARCH 1970
DATA BASIS: **FLIGHT TEST**

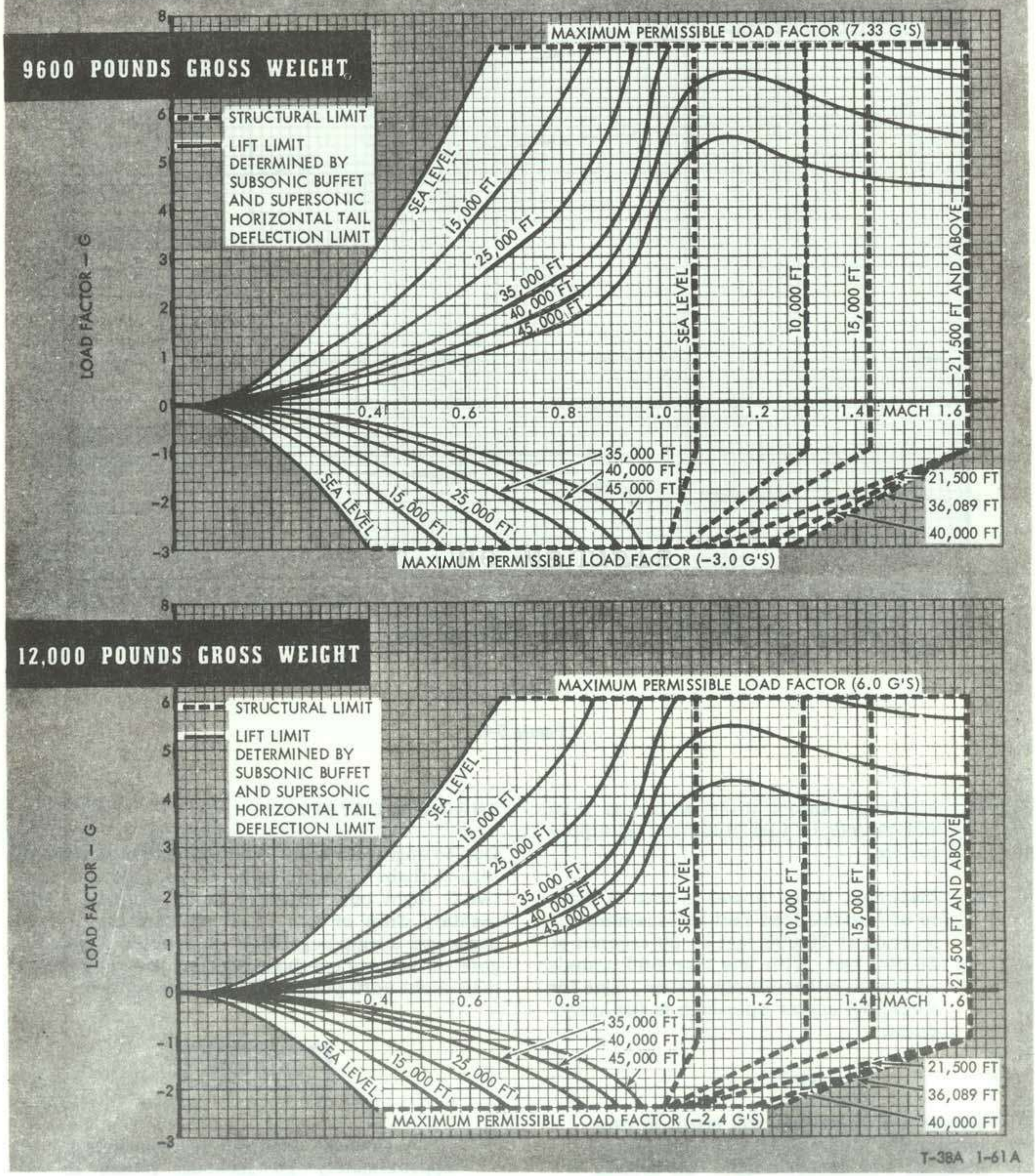

Figure 5-3.

MAXIMUM PERMISSIBLE LOAD FACTOR

Figure 5-4.

1. Maximum thrust dives with less than 650 pounds of fuel in either fuel supply system.

2. Maximum thrust power in zero G flight or at negative load factors exceeding 10 seconds at 10,000 feet or 30 seconds at 30,000 feet. With less than 650 pounds of fuel in either supply system, time for successful engine operation is further reduced.

NOTE

Lower power settings will result in proportionally longer operating times; however, do not exceed engine oil system supply limitations.

ENGINE OIL SYSTEM.

Due to engine oil supply and pressure requirements zero-G flight is restricted to 10 seconds and negative-G flight (any attitude) to 60 seconds. A momentary drop or loss of oil pressure may be experienced during negative-G or inverted flight. Engine oil venting overboard and/or low oil pressure may occur until positive-G loads are applied.

CAUTION

If oil pressure does not recover within approximately 10 seconds, return to normal flight conditions.

WHEEL BRAKES AND TIRES.

If the following minimum time intervals between full stop landings cannot be complied with, brakes, wheels, and tires should be allowed to cool with the aircraft parked in an uncongested area, and the condition reported in Form 781.

	Minimum Time Interval Between Full Stop Landings
Gear retracted in flight. . .	45 minutes
Gear extended in flight. . .	15 minutes

LANDING RATE OF DESCENT.

Landing should be made with as low a sink rate as practicable. Do not exceed the following sink rates at touchdown:

590 feet per minute normal landing, 395 feet per minute crab landing, with less than 1700 pounds of fuel.
340 feet per minute normal landing, 200 feet per minute crab landing, with full fuel.

WEIGHT AND CENTER OF GRAVITY LIMITATIONS.

The weight and balance limitations cannot be exceeded by normal operating or loading conditions; however it is possible to attain an aft center of gravity when the right fuel system contains more fuel than the left fuel system. To avoid exceeding the aft center of gravity limit during solo flight, do not allow the right (aft) fuel system quantity to equal more than twice the left (forward) fuel system quantity. If this should occur, longitudinal static stability is reduced and caution should be exercised to prevent overcontrolling during high speed subsonic flight or landings.

HYDRAULIC PRESSURE.

Hydraulic pressure readings outside the normal range with no demand on the respective system are indicative of a malfunction within the system. High pressures pose the greater danger because of possible fluid overtemperatures. However, operating hydraulically powered equipment (e.g., making rapid flight control movements) will cause pressure fluctuations well outside the static limit. These fluctuations are not considered a malfunction.

B AUTHORIZED STORES

STORE
SUU-11 A/A, B/A with the GAU-2B/A GUN
SUU-20/A(M), A/A, B/A with BDU-33(/) and 2.75 FFAR
MXU-648 Baggage/Cargo Pod

Figure 5-5.

B EXTERNAL STORES LIMITATIONS

STORE	AIRSPEED LIMITATIONS: CARRIAGE	AIRSPEED LIMITATIONS: EMPLOYMENT	AIRSPEED LIMITATIONS: JETTISON	ACCELERATION – G: CARRIAGE SYM	ACCELERATION – G: CARRIAGE UNSYM	ACCELERATION – G: EMPLOYMENT	ACCELERATION – G: JETTISON	MAX DIVE FOR DEL	STORES CONFIGURATION WEIGHT LBS.	TOTAL DRAG INDEX	REMARKS
PYLON	600 1.2	NA	NA	BAL	BAL	NA	NA	NA	29	5	
B-37K-1	500 1.0	300 to *500 or 0.9	300/ 0.7 *	+6.0 -1.0	+4.0 0.0	+4.0 +0.7	1.0 LEVEL FLT	45°	F186 E86	F 45 E 40 **	***
SUU-20(/) with BDU-33(/) 2.75 FFAR	500 1.0	BOMBS 300 to *500 or 0.9	300/ 0.7 *	+6.0 -1.0	+4.0 0.0	+4.0 +0.7	1.0 LEVEL FLT	45°	F485 E270	F 60 E 63 **	***
		RX 300 to *450 or 0.9				+4.0 +0.5		60°			
SUU-11(/)	500 1.0	200 to 450 0.9	300/ 0.7 *	+6.0 -1.0	+4.0 0.0	+5.0 +0.5	1.0 LEVEL FLT	30°	F325 E245 with 250 Rounds, 260 lbs.	34 **	***
MXU-648	500 1.0	NA	NA	+3.0 0.0	+2.4 +0.5	NA	NA	NA	Removable Tail E130 F430 Fixed Tail E98 F398	25 **	*** MAX CARGO LOAD - 300 LBS

NA - Not Applicable/Not Authorized
* Whichever is less
** Store drag includes pylon
*** If gross weight exceeds 11,700 lbs., refer to Figure 5-4

BAL — Basic Aircraft Limits

CAUTION

FFAR and the SUU-11 shall not be fired with the speed brake open.

Figure 5-6.

FLIGHT CHARACTERISTICS

SECTION VI

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Ⓑ CHARACTERISTICS

The addition of an external store shifts the center-of-gravity forward. This results in increased rotation and liftoff speeds, reduced trim authority, higher aft stick forces, increased deceleration during flare for landing and reduced aerobraking capability.

WAKE TURBULENCE

Avoid wake turbulence. The aircraft because of the short wingspan, is particularly susceptible to wake turbulence upset. The vortex-produced rolling moment can exceed aileron authority in the takeoff and/or landing configuration. The rapid changes in lift can result in a stall without sufficient altitude to recover.

STALLS.

The stall is characterized by airframe buffet and a high sink rate rather than by a clean nose-down pitch motion. As angle of attack is increased, there is a corresponding increase in buffet intensity. The buffet is most severe with flaps fully extended. The stall condition is immediately preceded by heavy low-speed buffet and moderate wing rock. The wing rock can be controlled with rudder. The actual stall is normally not accompanied by any abrupt aircraft motion, but is indicated only by the very high sink rate.

WARNING

If the stall condition is aggravated by abrupt control inputs, unusual aircraft attitudes may result.

STALL RECOVERIES.

Stalls can be terminated by relaxing back stick pressure, rolling wings level, and moving throttles to MAX simultaneously. If in the landing configuration, raise gear and speed brake, allowing flaps to remain extended until stall recovery has been accomplished. While it is normally not necessary to allow the nose to pitch down, relaxation of back pressure is critical in breaking the stall and allowing the aircraft to accelerate, reducing the buffet, eliminating wing rock, and maintaining adequate aileron control. Reducing the bank angle will lower the stall speed and decrease the sink rate (see figures 6-1, 6-2, and the Effect of Bank Angle on Vertical Velocity charts in Part 7 of appendix). Since timely identification of an actual stall is difficult, stall recovery should be initiated at the first indication of increasing buffet or rate of sink. Recovery from a stalled condition can be accomplished with a minimum loss of altitude using the above stall recovery technique.

STALL SPEED CHART

POWER—OFF (IDLE THRUST)

LANDING GEAR UP OR DOWN — SEA LEVEL TO 5,000 FT

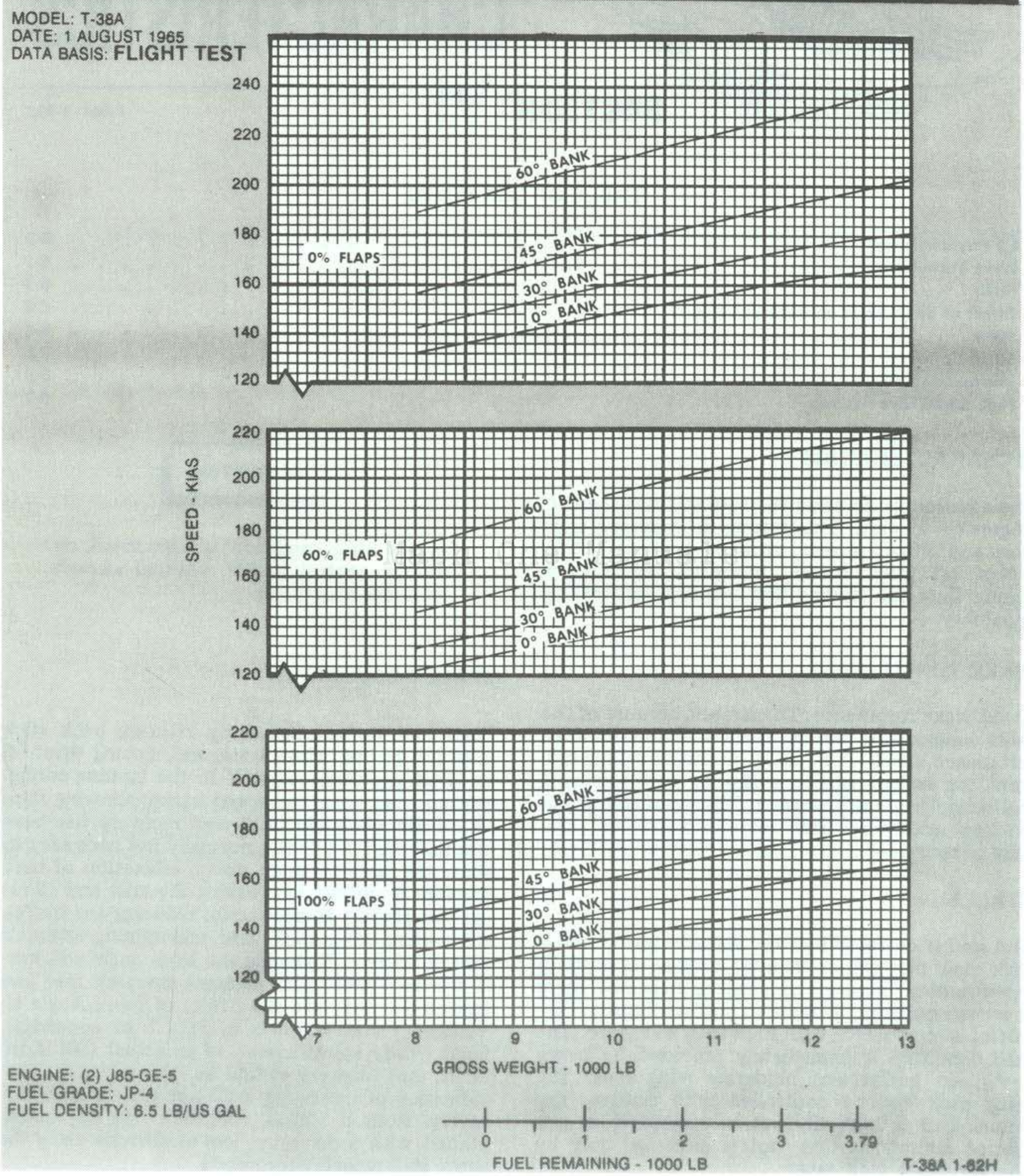

Figure 6-1.

EFFECT OF BANK ANGLE ON VERTICAL VELOCITY

SEA LEVEL STANDARD DAY

60% FLAPS AND GEAR DOWN

DATE: 1 APRIL 1969
DATA BASIS: **FLIGHT TEST**

Note

CHART VALID ONLY FOR RECOMMENDED APPROACH TURN SPEED.

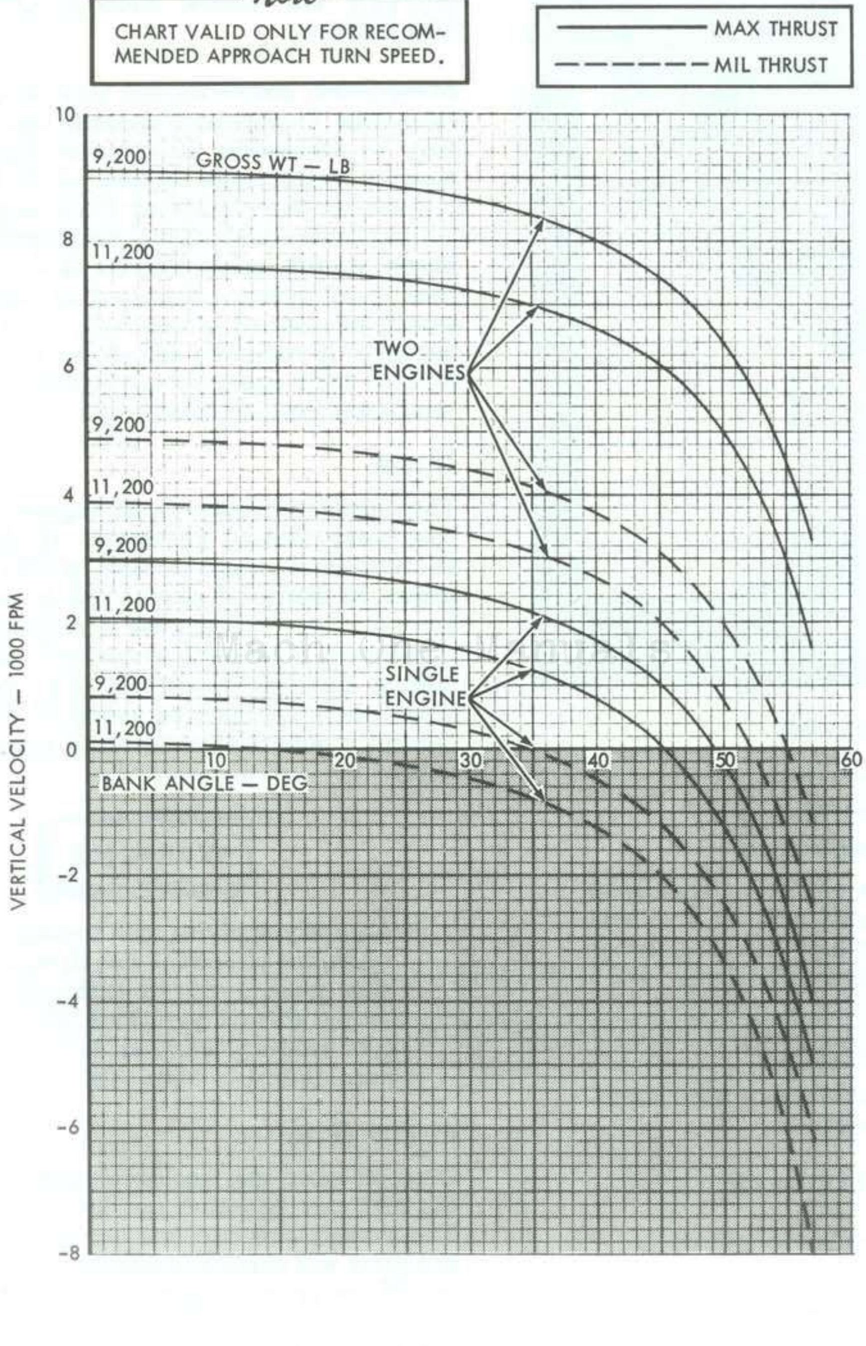

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Figure 6-2.

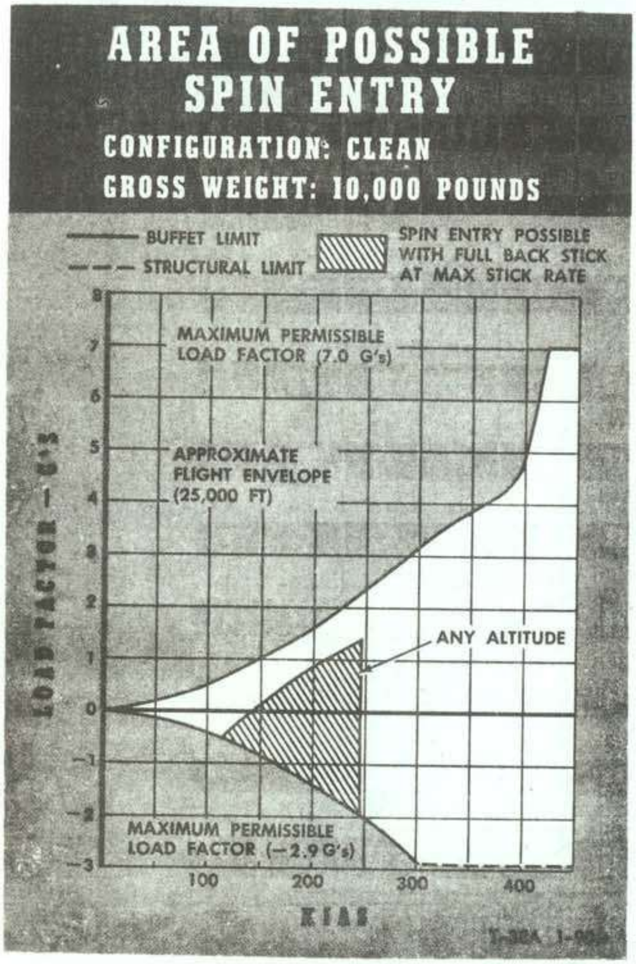


Figure 6-3.

WARNING

If a high sink rate condition is allowed to develop, excessive altitude loss will occur and recovery may not be possible at traffic pattern altitudes.

NOTE

See section VII for engine operating instructions during stall.

SUBSONIC ACCELERATED STALLS.

Accelerated stalls are similar to 1-G stalls.

POST STALL GYRATIONS.

Gyrations can be experienced during 1-G stalls, inverted stalls (negative G, negative angle of attack and stick held forward), accelerated stalls and cross control stalls. These gyrations will not result in a spin (abrupt full aft stick movement at near maximum rate is required for spin entry). The corrective procedure for all unrecognizable gyrations is to smoothly neutralize controls until the aircraft settles into a recognizable maneuver or recovers. Expect a short period of erratic motion and/or negative load factors after controls are neutralized.

EFFECT OF BANK ANGLE ON VERTICAL VELOCITY.

Steep bank angles during turn to final approach can cause a very rapid descent rate from which it may be impossible to recover. This is especially true for single-engine approaches to landing. Figure 6-2 shows the effects of bank angle on velocity for sea level standard day conditions for light and heavy aircraft gross weights at the recommended final turn speed. Single-engine landing patterns should be planned so that steep bank angles are not required. A complete set of charts showing the effects of bank angle on vertical velocity for various conditions can be found in part 7 of the Appendix.

SPINS.

The aircraft exhibits a high degree of resistance to spin entry; abrupt application of aft stick at close to maximum possible rates within the envelope shown in figure 6-3 is required to enter a spin. Entry will occur without use of rudder. Normal flight maneuvers, if properly flown, will not cause a spin. During unusual maneuvers (e.g., collision avoidance), the pilot must be aware of his airspeed and control inputs relative to those required for a spin entry.

WARNING

Abruptly applying spin recovery controls when the aircraft is not in an actual spin may cause a spin or extremely disorientating aircraft gyrations. Do not apply spin recovery controls unless a spin has been definitely diagnosed.

ERECT SPIN.

Once an erect spin has developed, the spin will be flat and may be either oscillatory or very smooth. The aircraft may oscillate about all three axes, and the pilot will experience transverse G-loads. Flameout of one or both engines can be expected.

Erect Spin Recovery.

The primary antispin control is the aileron, and it is imperative that full aileron deflection be held during recovery.

WARNING

If full aileron deflection in the direction of the spin is not maintained throughout the recovery, spin recovery may be prolonged or prevented.

Immediately upon recognition of the direction of rotation, use the following procedure.

1. Control stick — Full aileron in the direction of the spin (use both hands) and as much aft stick as possible without sacrificing aileron.
2. Rudder — Full opposite.
3. Do not change gear, flaps and speed brake positions during recovery.
4. Neutralize controls after recovery.

NOTE

Recovery from the spin is normally abrupt and may be followed by some spiraling during the resultant dive.

INVERTED SPIN.

An inverted spin is very oscillatory about all axes and is easily recoverable.

Inverted Spin Recovery.

Immediately upon experiencing an inverted spin, use the following procedure:

1. All flight controls — Neutralize.

WARNING

- Maintain controls in neutral position throughout the spin recovery. Any aileron or rudder deflection can induce a transition to an erect spin.
- Ejection from either an erect or inverted spin is to be accomplished if a spin recovery is not completed by 15000 feet above the terrain, or if transverse G-loads preclude maintaining antispin controls, whichever occurs first.

FLIGHT CONTROLS.

STABILITY AUGMENTATION.

The stability augmenter system positions the rudder control surfaces to automatically damp out yaw short period oscillations. On Block 20 aircraft, the stability augmenter system additionally damps out pitch oscillations. The aircraft may be flown safely throughout the flight envelope without the stability augmenter system engaged.

G-OVERSHOOT.

The horizontal tail control system incorporates a bob-weight to increase stick forces under G-loads. Since the pilot does not feel the effect of the bob-weight until the aircraft responds to the stick movement, G-overshoots may occur if the stick is deflected too abruptly.

CAUTION

Abrupt forward or aft deflection or "pulsing" of the stick in the mach range from 0.80 to 0.95 may result in overshoot of the limit load factor.

LATERAL CONTROL.

Aileron deflection does not increase proportionally with stick travel. The first 4-1/2 inches of stick travel provide one-half aileron deflection, while the remaining 1-1/2 inches of stick travel provide full aileron deflection.

MANEUVERING FLIGHT.

NOTE

Maneuvering and handling qualities are degraded at lower airspeeds; therefore, a minimum of 300 KIAS should be maintained except for instrument approaches, maximum range descents, landings, and tactical maneuvering. The objective for establishing a minimum airspeed is to maintain a satisfactory energy state (i.e. "G" available that will provide desired recovery response if an undesirable flight parameter is encountered below 15,000 feet AGL).

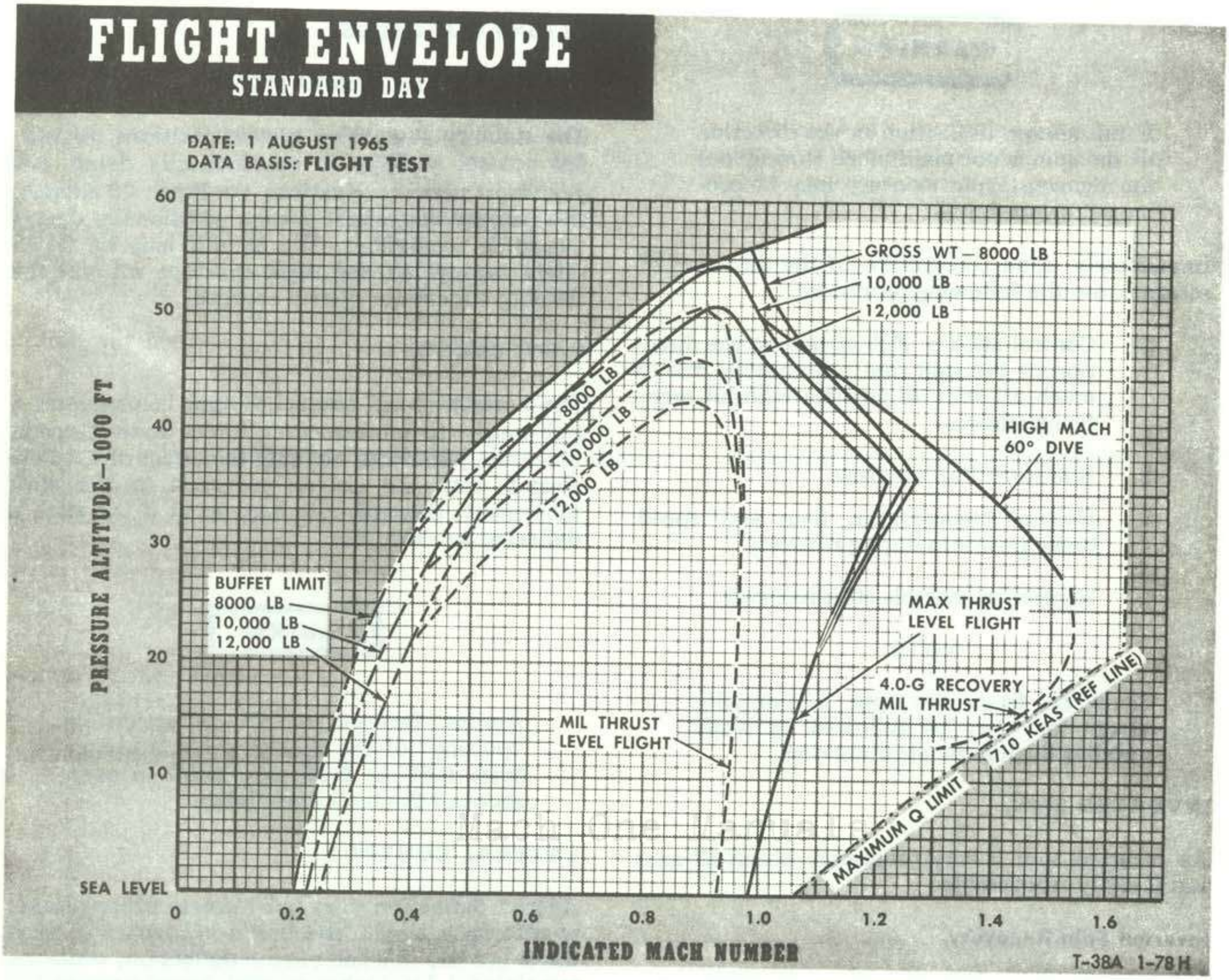


Figure 6-4.

STICK FORCES.

Minimum stick forces per G occur at approximately mach 0.9. Be careful not to overcontrol when maneuvering near this airspeed so that the allowable load factor is not exceeded.

PILOT INDUCED OSCILLATIONS.

The relationship between pilot response and aircraft pitch response in high subsonic-low altitude flight is such that overcontrolling may lead to severe pilot induced oscillations. This oscillation is characterized by a sudden and violent divergence in pitch attitude resulting in very large positive and negative load factors, which are actually made larger by the pilot attempting to control the oscillation. Because the basic aircraft is stable, the pilot should immediately release the stick so that the aircraft can damp itself or if at very low altitude or close to another aircraft, the pilot should attempt to apply and rigidly hold back-pressure on the stick. In addition to the above, a reduction in airspeed will aid in recovery. It should be noted that if the pilot is not securely strapped into his seat, the above recovery procedures may be difficult to accomplish.

ROLLS.

Roll rates obtainable in this aircraft with full aileron deflection are extremely high and could cause the pilot to become disoriented. Caution should be exercised when using rudder in conjunction with aileron application during rapid roll or turn entry. Rapid input of both rudder and half (or more) aileron, can cause large load factor excursions during the maneuver.

UNSYMMETRICAL-G.

Unsymmetrical-G forces occur anytime the aircraft has a roll rate. A phenomenon known as roll coupling can also super-impose an additional G increment during rolling maneuvers. In steady state banked coordinated flight (roll rate = 0), G forces are symmetrical. When evaluating G-limit overshoots as a result of a wingtip vortex or wake turbulence encounter, the unsymmetrical acceleration limit applies.

HIGH SPEED DIVE RECOVERY.

To recover from a high speed dive, simultaneously retard throttles to IDLE, open the speed brake, level the wings, and pull out with sufficient G-forces for a safe recovery.

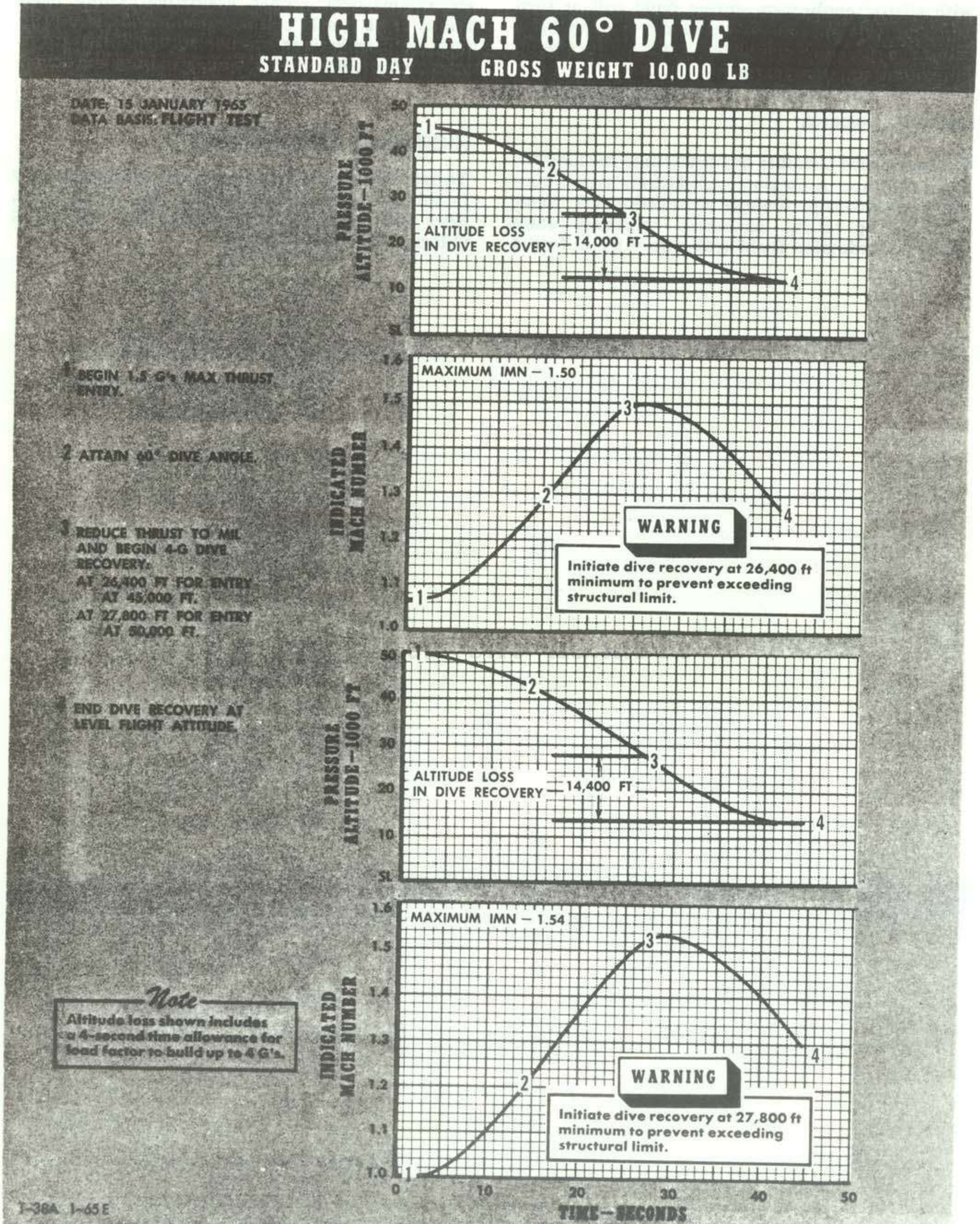
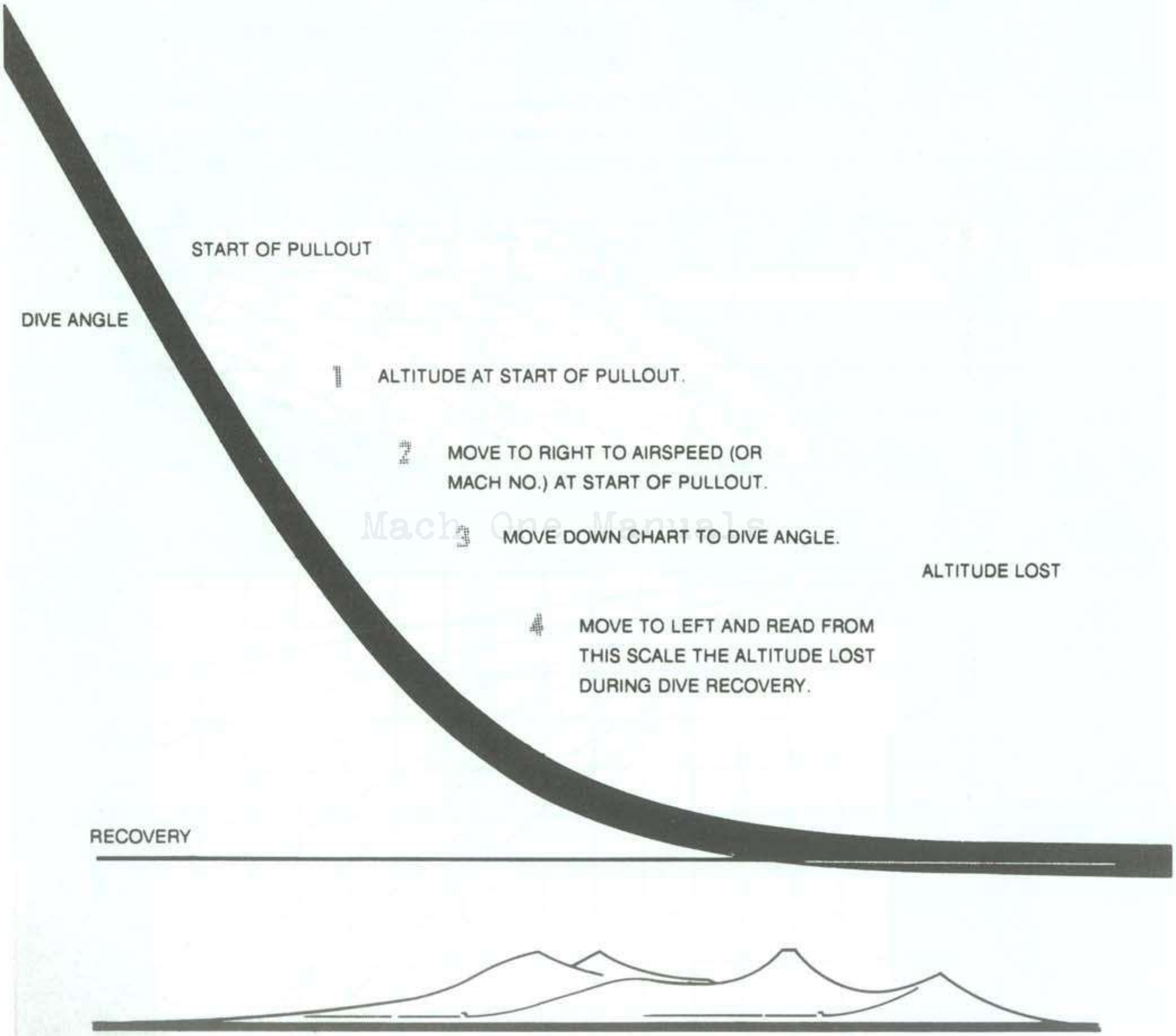

HIGH MACH 60° DIVE
STANDARD DAY
GROSS WEIGHT 10,000 LB
DATE: 15 JANUARY 1965
DATA BASIS: FLIGHT TEST
1 BEGIN 1.5 G's MAX THRUST ENTRY.
2 ATTAIN 60° DIVE ANGLE.
3 REDUCE THRUST TO MIL AND BEGIN 4-G DIVE RECOVERY:
AT 26,400 FT FOR ENTRY AT 45,000 FT.
AT 27,800 FT FOR ENTRY AT 50,000 FT.
4 END DIVE RECOVERY AT LEVEL FLIGHT ATTITUDE.
Note
Altitude loss shown includes a 4-second time allowance for load factor to build up to 4 G's.
PRESSURE ALTITUDE—1000 FT
ALTITUDE LOSS IN DIVE RECOVERY
14,000 FT
INDICATED MACH NUMBER
MAXIMUM IMN — 1.50
WARNING
Initiate dive recovery at 26,400 ft minimum to prevent exceeding structural limit.
ALTITUDE LOSS IN DIVE RECOVERY
14,400 FT
MAXIMUM IMN — 1.54
WARNING
Initiate dive recovery at 27,800 ft minimum to prevent exceeding structural limit.
TIME—SECONDS
T-38A 1-65 E

Figure 6-5.

HOW TO READ DIVE RECOVERY CHARTS . . . .



NOTE

IF AIRCRAFT CONFIGURATION OR POWER SETTINGS ARE SUCH AS TO CAUSE DECELERATION DURING DIVE RECOVERY, THE ALTITUDE LOST WILL BE LESS THAN THAT SHOWN ON THE CHARTS.

T38A-1-64(1)A

Figure 6-6. (Sheet 1 of 4)

ALTITUDE LOST DURING DIVE RECOVERY

CONSTANT 4.0 G ACCELERATION

DATE: 15 JANUARY 1965
DATA BASIS: **FLIGHT TEST**

- SUBSONIC LIFT LIMIT IS DETERMINED BY BUFFET.
- SUPERSONIC LIFT LIMIT IS DETERMINED BY HORIZONTAL TAIL DEFLECTION LIMIT.
- THE DASHED LIMITS (LIFT LIMITS) ON THE LEFT OF THE CHART SHOW THE AIRSPEED AT WHICH THE AIRCRAFT WILL ENTER AN ACCELERATED STALL AT THE G'S INDICATED.

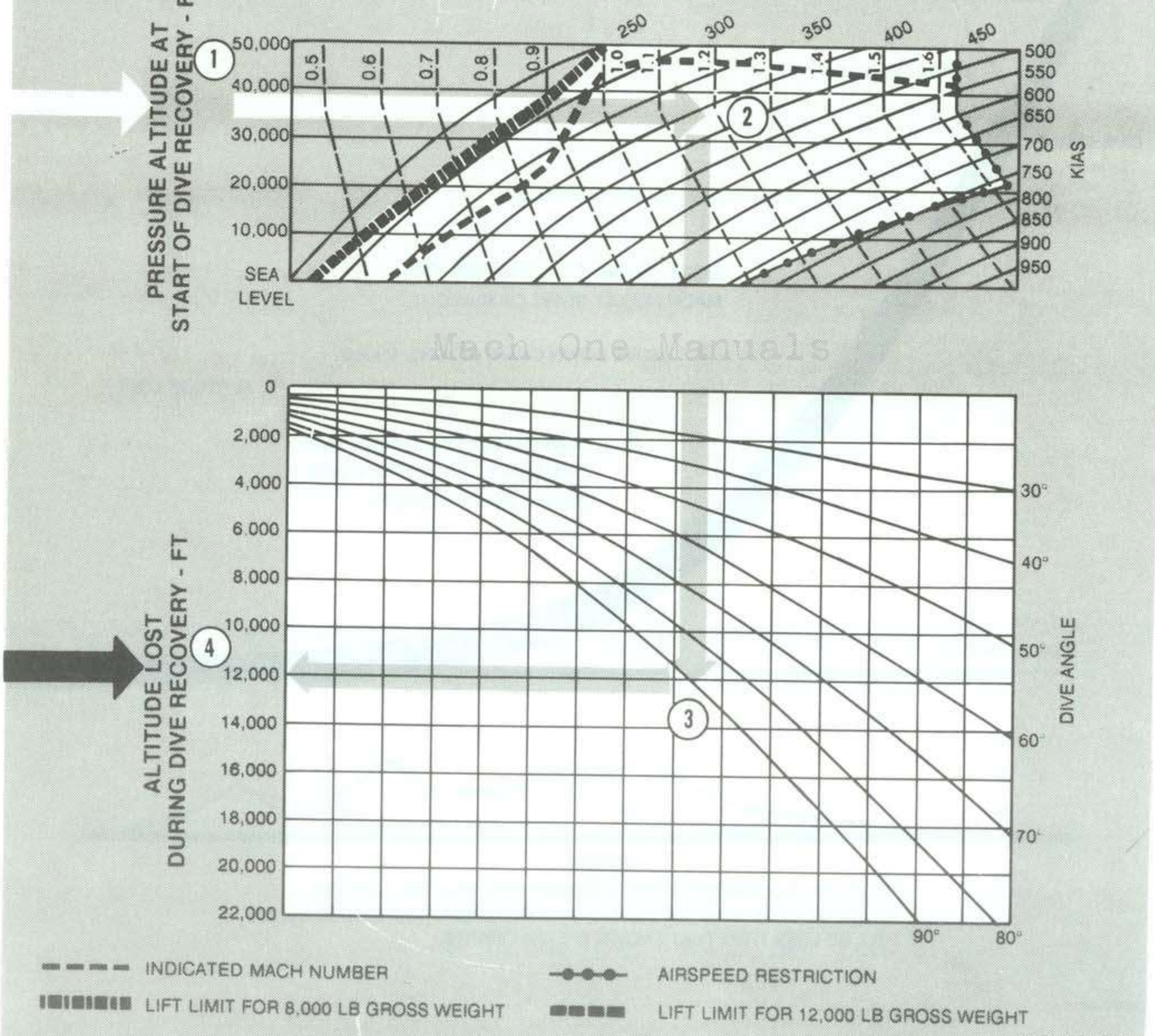


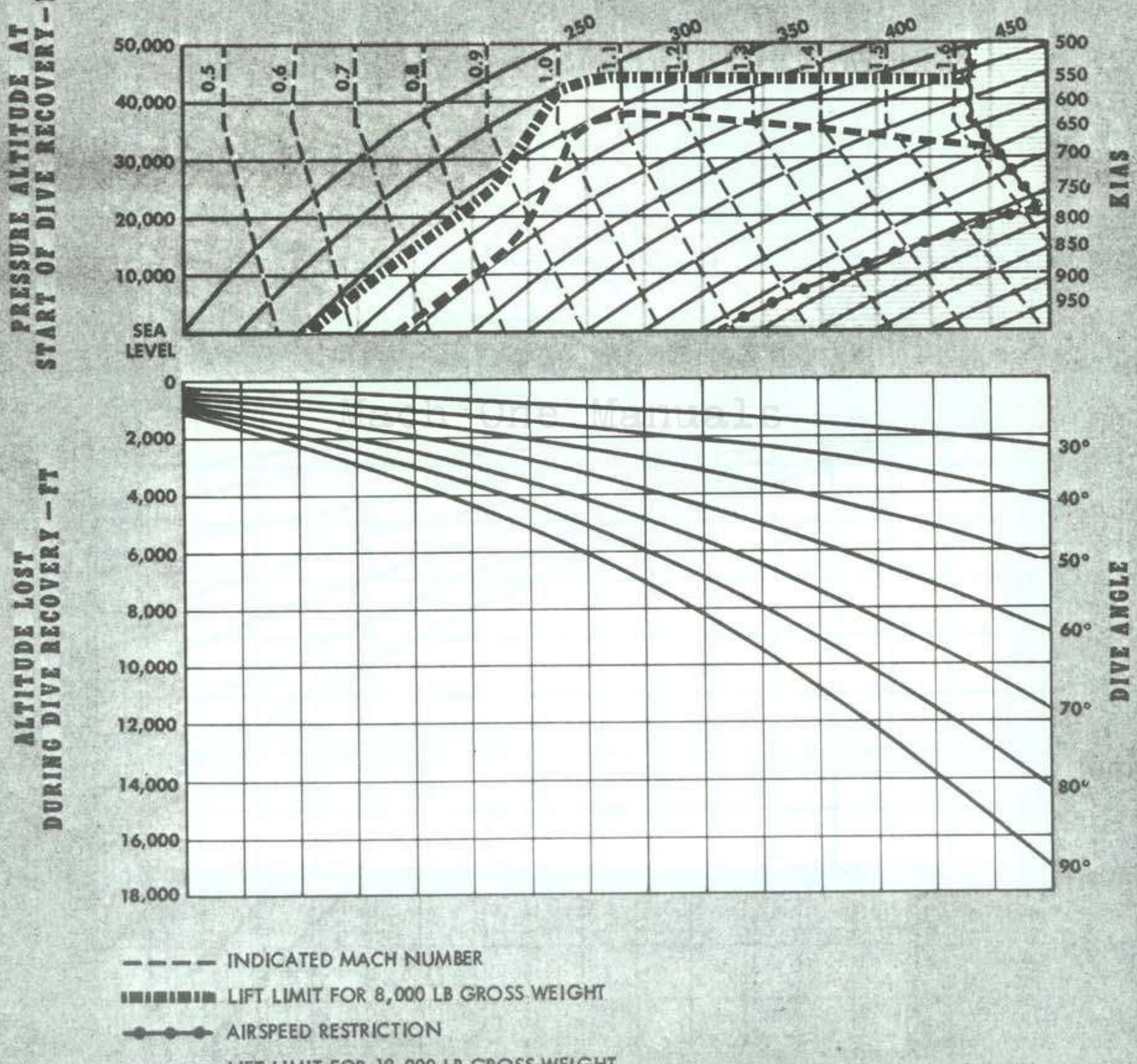
Figure 6-6. (Sheet 2 of 4)

ALTITUDE LOST DURING DIVE RECOVERY

CONSTANT 6.0 G ACCELERATION

DATE: 15 JANUARY 1965
DATA BASIS: **FLIGHT TEST**

- SUBSONIC LIFT LIMIT IS DETERMINED BY BUFFET.
- SUPERSONIC LIFT LIMIT IS DETERMINED BY HORIZONTAL TAIL DEFLECTION LIMIT.
- THE DASHED LINES (LIFT LIMITS) ON THE LEFT OF THE CHART SHOW THE AIRSPEED AT WHICH THE AIRCRAFT WILL ENTER AN ACCELERATED STALL AT THE G'S INDICATED.



T-38A 1-64(5)D

Figure 6-6. (Sheet 3 of 4)

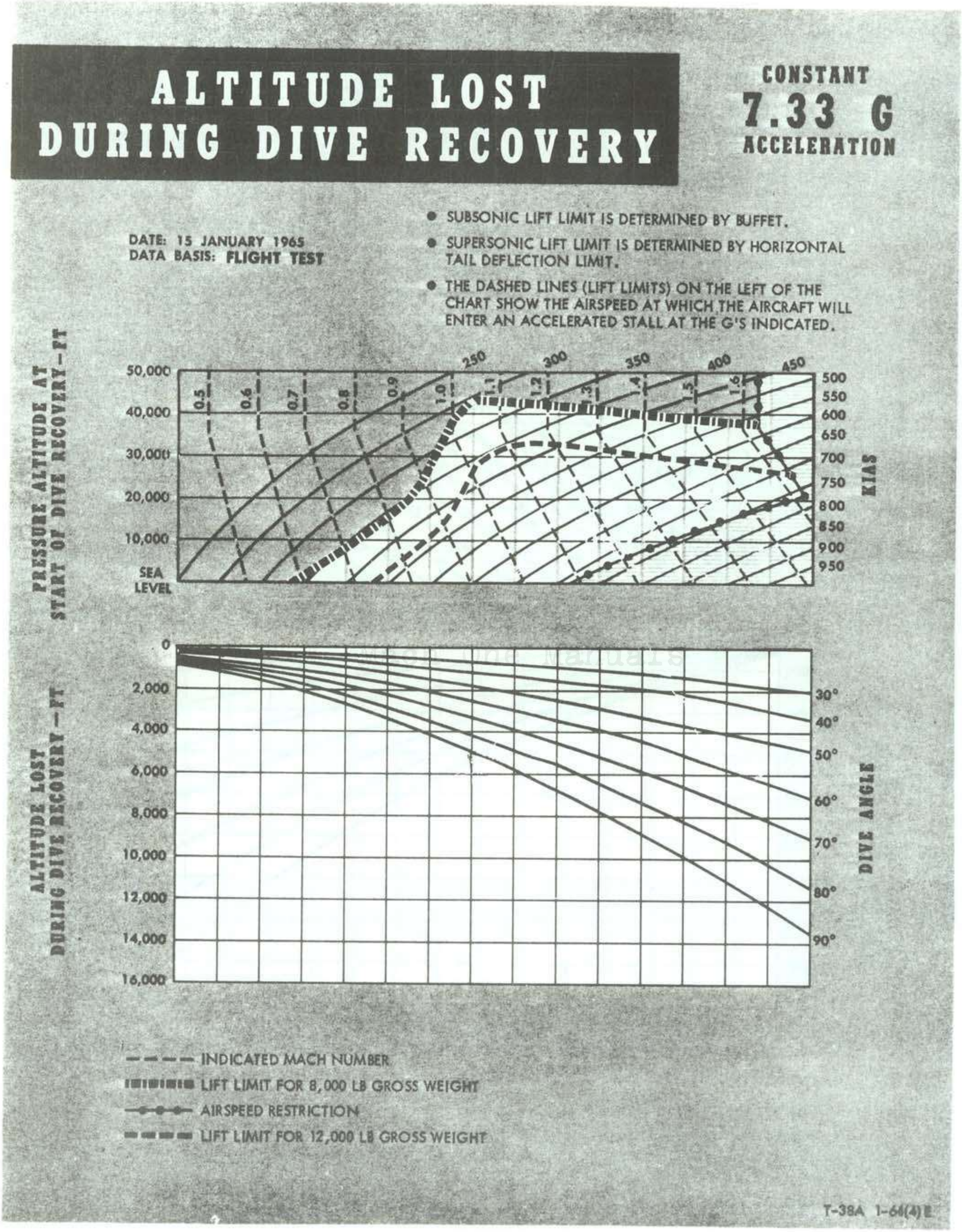


Figure 6-6. (Sheet 4 of 4)

SYSTEMS OPERATION

SECTION VII

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FUEL MANAGEMENT.

The fuel systems function automatically to supply fuel to the engines once the throttles have been moved from the OFF position and the fuel boost pumps turned on. The fuel quantity indicators should be monitored to maintain the two systems within 200 pounds of each other to ensure the aircraft center-of-gravity (CG) is maintained within limits. Maintaining the two systems within the 200 pound parameter is accomplished by using the fuel balancing (crossfeed) procedures in this section. Crossfeeding is not recommended during low fuel conditions or while at low altitudes, instead use differential power settings to obtain proper balance. With the fuel low caution light illuminated, a slightly nose up flight attitude should be maintained to assure maximum usable fuel from both systems. Maintaining this attitude is necessary to preclude uncovering the fuel boost pump inlets, allowing air to enter the fuel supply lines, causing engine flameout.

NOTE

During low fuel state descents do not maintain a nose down attitude for extended periods. Occasionally transit to a positive pitch attitude to refill the boost pump sump.

FUEL BALANCING (CROSSFEED).

Crossfeeding is recommended when fuel differences exceed 200 pounds. Attempt to enter traffic pattern in a fuel-balanced condition. Differential power settings should be used to balance fuel to avoid use of crossfeed operation during low fuel conditions.

1. Fuel Quantity Gage — TEST.

If a malfunctioning fuel gage is indicated, do not crossfeed.

2. Crossfeed Switch — ON.
3. Boost Pump Switch (on side of lower fuel quantity) — OFF.

WARNING

With the crossfeed switch ON and either both boost pumps ON — or both boost pumps OFF — a rapid fuel imbalance can occur.

WARNING

If crossfeed operation is continued until the active system runs dry, dual engine flameout will occur.

4. Boost Pump Switches — Both ON When Quantities Are Equal.
5. Crossfeed Switch — OFF.

LOW FUEL OPERATION.

If an internal system has less than 650 pounds of fuel, the surface of the fuel falls below the fuel boost pump upper-inlet and the boost pump output is reduced approximately 40%. During crossfeed operation, if the engines are operated at high power settings, the low pressure light may come on and engine RPM fluctuations may occur because of insufficient fuel pressure. With a low fuel state (approximately 250 pounds in either system) do not attempt to ensure fuel flow to both engines by selecting crossfeed operation with both fuel boost pumps operating. If the fuel supply in one system is depleted, or is pulled away from the boost pump by G-forces, and the boost pump in the other system fails, air may be supplied to the engines causing dual engine flameout. There is no cockpit indication of boost pump failure.

LOW FUEL OPERATION – SINGLE ENGINE.

When 250 pounds of fuel remains in either system, place both boost pumps ON and crossfeed switch ON to allow the engine to be fed from both systems simultaneously.

COMPRESSOR STALL.

A compressor stall is an aerodynamic interruption of airflow thru the compressor section. Factors that can increase the stall sensitivity and decrease the compressor stall margin are: Foreign object damage, high aircraft angles of attack at low airspeeds, low compressor inlet temperatures (CIT), maneuvering flights, unusual flight attitudes, atmospheric variations, jet wash, temperature and pressure distortion, ice formation on inlet ducts and engine inlet guide vanes or a combination of the above. Compressor stalls can be caused by various other factors such as: Engine component malfunction, incorrect engine rigging, incorrect RPM and fuel flow trim, throttle burst to military or maximum power at high altitude and low airspeed, and by hot gas ingestion. The various types of stalls that may occur are discussed below.

TAKEOFF OR LOW ALTITUDE AND HIGH AIR SPEED COMPRESSOR STALL.

Compressor stall may occur on takeoff with AB initiation or at low altitude and very high airspeed when in military or AB operation. The stall is recognized by a "pop" or "bang" followed by an audible "buzzing" sound and vibration, accompanied by a rapid RPM drop and high EGT. The stall should be cleared as soon as possible to prevent engine damage by overtemperature. This type of compressor stall can normally be recovered by rapidly retarding throttle to IDLE. Flameout usually does not occur.

HIGH ALT-LOW AIRSPEED COMPRESSOR STALL.

Compressor stall/flameout at high altitude, low airspeed and very low ambient temperatures can occur during a throttle advance to military or afterburner power. The stall is recognized by an audible "chug" or "pop" accompanied by rapid unwinding of RPM and decreasing EGT. The stall may be cleared by rapidly retarding the throttle to idle. Immediately pressing the start button will provide a restart capability if the stall has progressed to a flameout.

VARIABLE INLET GUIDE VANES.

Variable inlet guide vanes and air bleed valves have been incorporated in the J-85 engine to reduce the possibility of a compressor stall throughout the normal operating range of the engine. The vanes function automatically to direct the flow of air to the compressor blades at the proper angle. The bleed valves open and close automatically to provide proper control of compressor pressure. Prior to start, the bleed valves may be partly open or completely closed. This is due to residual servo hydro-pressure unbalance in the bleed valve actuator system and main fuel control after engine shutdown. The valves will open during normal engine start.

ENGINE COMPRESSOR STALL/FLAMEOUT SUSCEPTIBILITY AREA (FIGURE 7-1).

Figure 7-1 depicts the stall/flameout prone areas for the installed J85-5 engine. The chart is presented in terms of pressure altitude versus indicated mach number for standard day conditions with considerations for temperature deviation of ±10°C from standard. The chart illustrates the operating airspace at higher altitudes where colder temperatures and less dense air may cause the engine to stall or flameout. This operating restriction is further expanded as temperatures colder than standard are encountered. Conversely, the opposite is true as temperatures warmer than standard are encountered. These regions of flight require operator attention and have been portrayed on the chart as the black striped and shaded areas. Flight is not prohibited in these area but merely requires the operator to acknowledge the engine susceptibility as indicated on the chart.

THROTTLE MOVEMENT.

The engine stall margin and operating parameters decrease with increasing altitude where the air is less dense and colder. As a result, throttle movement must be more carefully controlled in the black striped and shaded areas shown in figure 7-1. Abrupt throttle movements, which are acceptable to the engine at low altitude, are not recommended in these areas and can result in a stall or flameout.

AFTERBURNER INITIATION (HIGH ALTITUDE).

Afterburner initiation attempts in the black striped area as indicated in figure 7-1 are not recommended. Afterburner light-off is not guaranteed and even if successful, may drive the engine RPM down (rollback) and possibly cause engine flameout.

NOTE

> To increase the probability of afterburner lightoff if required (in the black striped area), increase airspeed as much as practical before initiating afterburner.

MANEUVERING.

Maximum performance maneuvering involves high AOA, low airspeed, unusual attitudes, high yaw, roll and pitch rates, and throttle manipulation, which increase the engine susceptibility to compressor stall and flameout. Maneuvering above approximately 28,000 ft and below 0.6 IMN (figure 7-1, shaded area) has proven to increase susceptibility to stall/flameout due to reduced/distorted ram air flow to the engine, caused by lower air density coupled with reduced effective intake duct area. Throttle manipulation demanding more engine air increases the possibility of stall/flameout. The area below approximately 30,000 ft and above 0.6 IMN has not been a stall/flameout prone area because ram air in the higher speed range is sufficient to satisfy engine requirements. However, excessive heavy maneuvering and throttle movements broaden the susceptible area indicated on the chart.

HIGH MACH DIVE.

CAUTION

> Avoid afterburner operation as indicated in the solid black area of figure 7-1. Engine stall or damage to the variable exhaust nozzles may occur.

EFFECT OF COMPRESSOR INLET TEMPERATURE (T^2 CUTBACK.)

The T^2 sensor in the main fuel control automatically reduces the physical RPM and EGT (T^2 cutback) to prevent overpressurization and high corrected speed conditions of the compressor at low compressor inlet temperatures (CIT). At any normal operating condition, CIT is higher than the outside air temperature (OAT) and varies with airspeed for a given OAT. Increasing airspeed will increase CIT. At low indicated airspeeds and low OAT conditions, the engine RPM and EGT indications may be below the normal operating limits at MIL and MAX power. When the aircraft is flown in the striped black area of the engine envelope, figure 7-1, T^2 cutback may be observed. In maneuvering flight, the CIT of each engine will vary depending on flight attitude. As a result, the engine sensing the lower CIT will have a decreased stall margin and increased probability of compressor stall if a throttle transient is made. If T^2 cutback is observed, the airspeed should be increased by exchanging altitude for airspeed to increase CIT prior to making a throttle movement.

EGT DROOP AT HIGH-Q/MIL POWER.

At low altitude and high airspeed (500 KIAS), EGT droop may occur with engine at military power when accompanied by three percent or less nozzle indication.

EFFECT OF HIGH ALTITUDE AND LOW AIRSPEED ON ENGINE RPM.

During 1.0 G stalls at or above 20,000 feet, with throttles at IDLE detent and airspeed 200 KIAS or below, the in-flight idle RPM can decay to less than normal ground idle speed (46.5% to 49.5% RPM), and the generator caution lights will illuminate. Under these flight conditions, an engine on which RPM has dropped below normal idle speed will not accelerate when the throttle is advanced. To avoid this condition, maintain engine RPM at 80 percent or above when airspeeds of less than 200 KIAS above 20,000 feet are anticipated. Corrective action for idle unwind is to increase airspeed to above 200 KIAS by lowering the nose of the aircraft. As airspeed increases, throttle advances may be attempted; however, the throttle should be returned to IDLE detent if the engine does not accelerate.

ENGINE COMPRESSOR STALL/FLAMEOUT SUSCEPTIBILITY AREAS — 1G LEVEL FLIGHT

DATA BASIS: FLAMEOUT STATISTICS

Note

EXCESSIVE YAW AND ANGLE OF ATTACK EXPANDS THE AREAS OF SUSCEPTIBILITY.

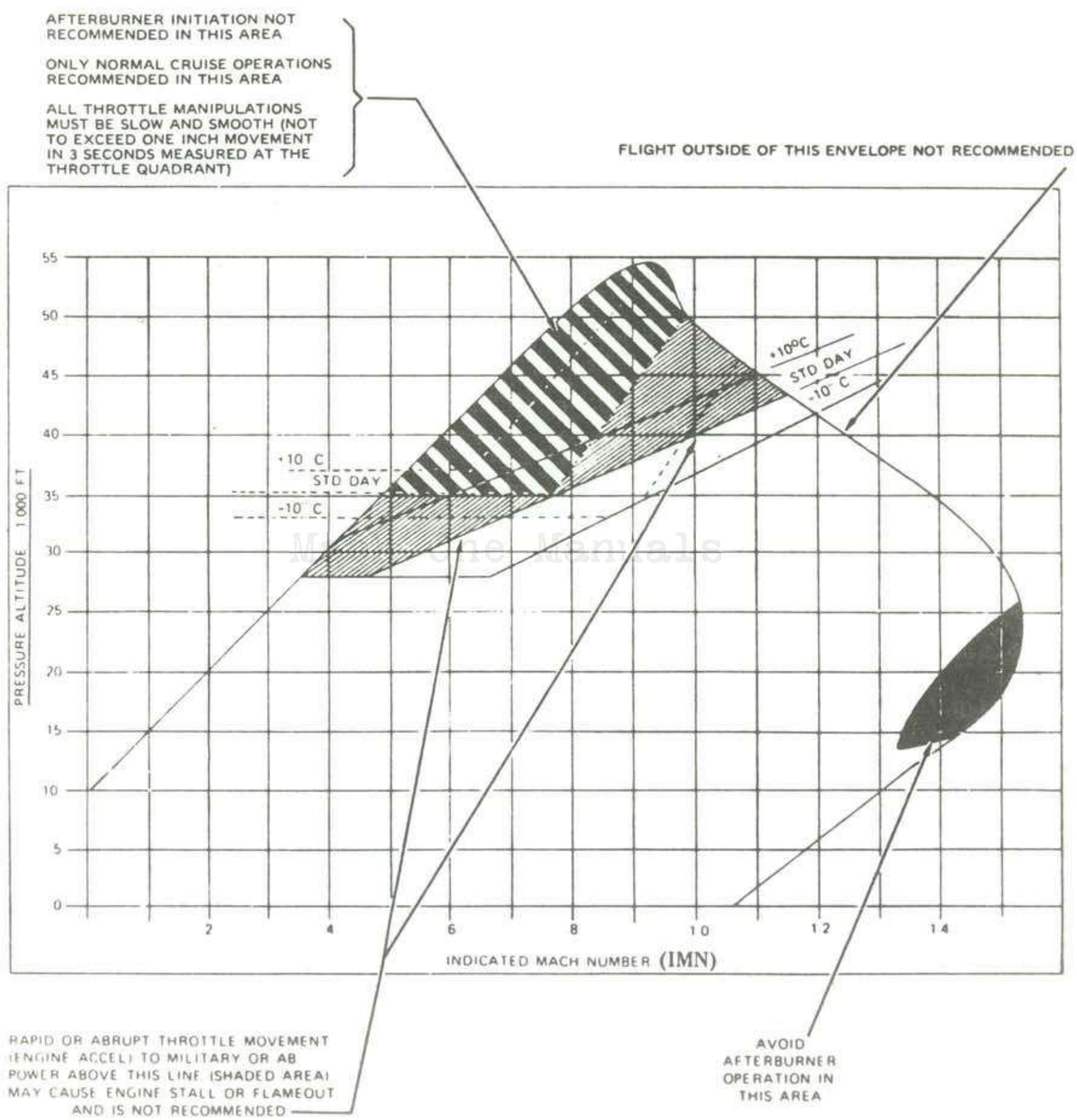

Figure 7-1.

SECTION VIII

CREW DUTIES

(Not Applicable)

ALL-WEATHER OPERATION

SECTION IX

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INSTRUMENT FLIGHT PROCEDURES

INSTRUMENT TAKEOFF.

For an instrument takeoff, perform all normal pretakeoff checks, and turn on pitot heat and engine anti-ice system, if necessary. Allow for increased takeoff roll if engine anti-ice is used. Check the horizontal situation indicator for proper heading, and align the index marker on the pitch trim knob with the reference index on the ADI case. On a level surface with proper strut inflation, this should give approximately a 3-degree nose low indication. This setting will give an approximate level flight indication for intermediate altitude level-offs during departures and at normal cruise conditions. Manual bank steering may be used to aid in maintaining directional control, but steering bar indications should be cross-checked with the compass card. Whenever visibility permits, runway features and lights should be used as an aid to maintain proper headings. Adjust back stick pressure to attain the takeoff attitude and allow the aircraft to fly off the runway. When vertical velocity indicator and altimeter indicate a definite climb, retract the landing gear. Raise the wing flaps immediately after the landing gear lever has been placed at LG UP.

INSTRUMENT CLIMB.

Approaching 300 KIAS in a 5-degree climb indication, retard throttles to MIL thrust. Maintain a 2 to 5-degree climb indication and at least a 1000-fpm climb until reaching recommended climb schedule. A slow airspeed and/or low rate of climb may be required to comply with departure procedures. For this type climb, reduce power below MIL as required. Power settings between 90% and 95% RPM will provide comfortable climb rates at 300 KIAS for intermediate altitude level-offs. MAX thrust instrument climbs require extremely high pitch angles and are not normally used for instrument departures. If conditions require a MAX thrust climb, maintain a 2- to 5-degree climb indication until approaching recommended climb mach, then rotate to approximately a 20- to 25-degree initial climb indication.

HOLDING PATTERNS.

Hold at 250 to 265 KIAS at all altitudes. To descend in holding patterns, reduce power and maintain holding airspeed in descent. The speed brake may be used for holding pattern descents, but higher descent rates must be anticipated.

PENETRATION DESCENTS.

Prior to penetration descent, the canopy defog system should be operated at the highest flow possible (consistent with crewmembers' comfort) during high altitude flight to prevent the formation of frost or fog during descent. To enter a penetration descent, reduce power and lower the nose approximately 10 degrees on the attitude sphere. Open speed brake (if required) at 300 KIAS and maintain by adjusting pitch as required. Initiate the level-off from a penetration descent 1000 feet or more above the desired altitude by decreasing the the pitch attitude by approximately one half. Use normal lead point for level-off at the desired altitude. The speed brake may be left open or closed as required to obtain the desired airspeed at the final approach fix.

NOTE

For engine anti-ice operation, 80% RPM or above is recommended.

INSTRUMENT APPROACHES.

Figure 9-1 shows a typical TACAN penetration and approach. Normally, a maximum of 300 KIAS will be maintained during approach maneuvering prior to extending the gear. Recommended final approach airspeed will depend upon the type of approach being made. AOA indexer will show a fast indication after final approach fix. For a straight-in approach, maintain 155 KIAS plus fuel minimum (AOA indexer on speed). Full flaps should be used for landing.

NOTE

Increase final approach and touchdown speeds by half the gust factor.

CIRCLING APPROACHES.

A circling approach is a visual maneuver flown at a lower altitude than a normal VFR overhead traffic pattern. The pilots shallower look angle to the runway causes a tendency to fly a downwind and/or a base leg that is too close to the runway, thus increasing the possibility of an overshoot or steeper than normal final approach. Ensure sufficient downwind and/or base leg displacement prior to initiating the turn to final approach. As the circling maneuver may initially be a level turn, aircraft configuration will require higher power settings than those used in an overhead traffic pattern. Bank angles in excess of 45° may make a level turn impossible under some conditions of heavy gross weights, high temperatures and pressure altitudes. Maintain 175 KIAS plus fuel minimum and 60% flaps until aligned with the landing runway. AOA indications will vary depending on airspeed, bank angle and back pressure applied during the circling maneuver. Refer to AFM 51-37 for illustrations of circling approach maneuvers.

INSTRUMENT LANDING SYSTEM (ILS).

Refer to figures 9-5 and 9-6 for aircraft configuration. Refer to section IV for flight director procedures.

MISSED APPROACH PROCEDURE.

To accomplish a missed approach, advance throttles to MIL, close speed brake (if open) as power is applied, and rotate the aircraft to normal instrument takeoff attitude. Retract landing gear and flaps as in an instrument takeoff and accelerate to 240-300 KIAS. Reduce power to 90% to 95% RPM, and climb at 240-300 KIAS to missed approach altitude.

SINGLE-ENGINE APPROACHES.

Refer to figures 9-2, 9-4, and 9-6 for recommended airspeed and configuration for single engine TACAN, radar, or ILS approach. Delay lowering landing gear until just prior to glide slope if heavy fuel loads, engine anti-ice operation, turbulence, or other conditions cause single-engine MIL thrust to be inadequate for gear down level flight at recommended airspeeds. MAX thrust should be used on single-engine approaches, if necessary.

Single-Engine Missed Approach.

Refer to figures 9-2, 9-4, and 9-6 for single-engine instrument approach power settings and configurations. If a single-engine missed approach is necessary, use the procedure for single-engine go-around.

TACAN HOLDING, PENETRATION, AND APPROACH (TYPICAL)

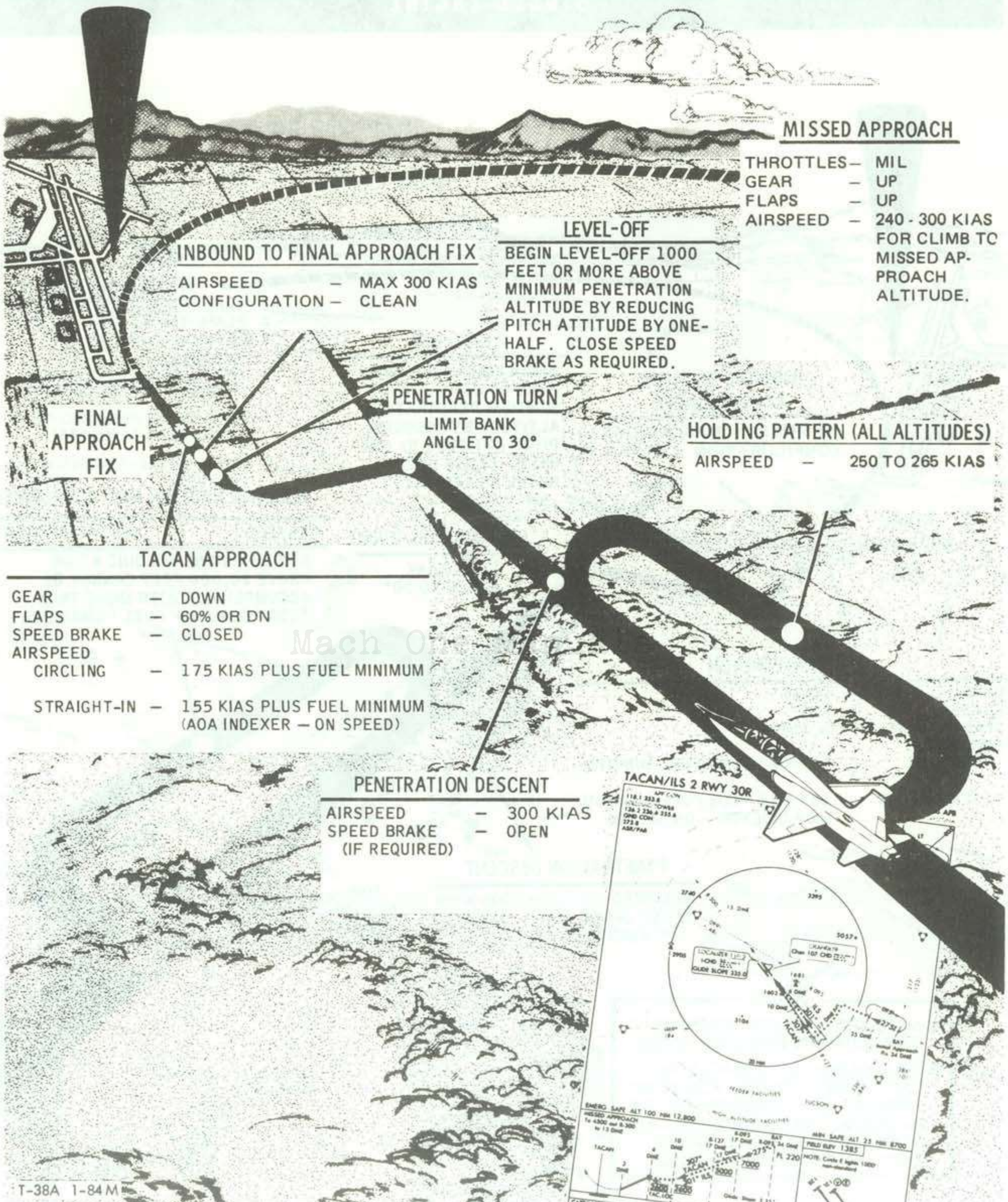

Figure 9-1.

TACAN HOLDING, PENETRATION, AND APPROACH (TYPICAL)

SINGLE-ENGINE

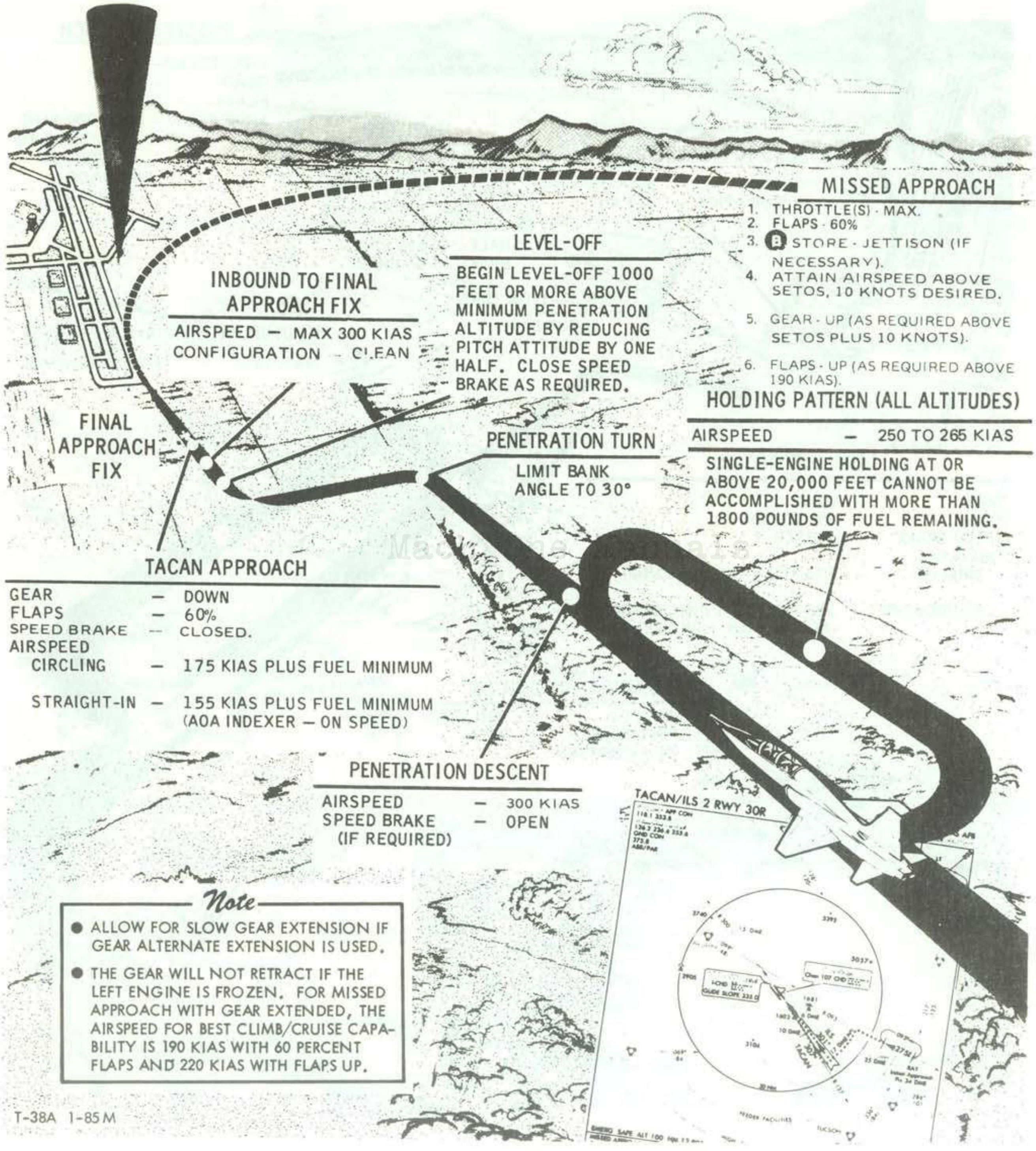

Figure 9-2.

RADAR APPROACH (TYPICAL)

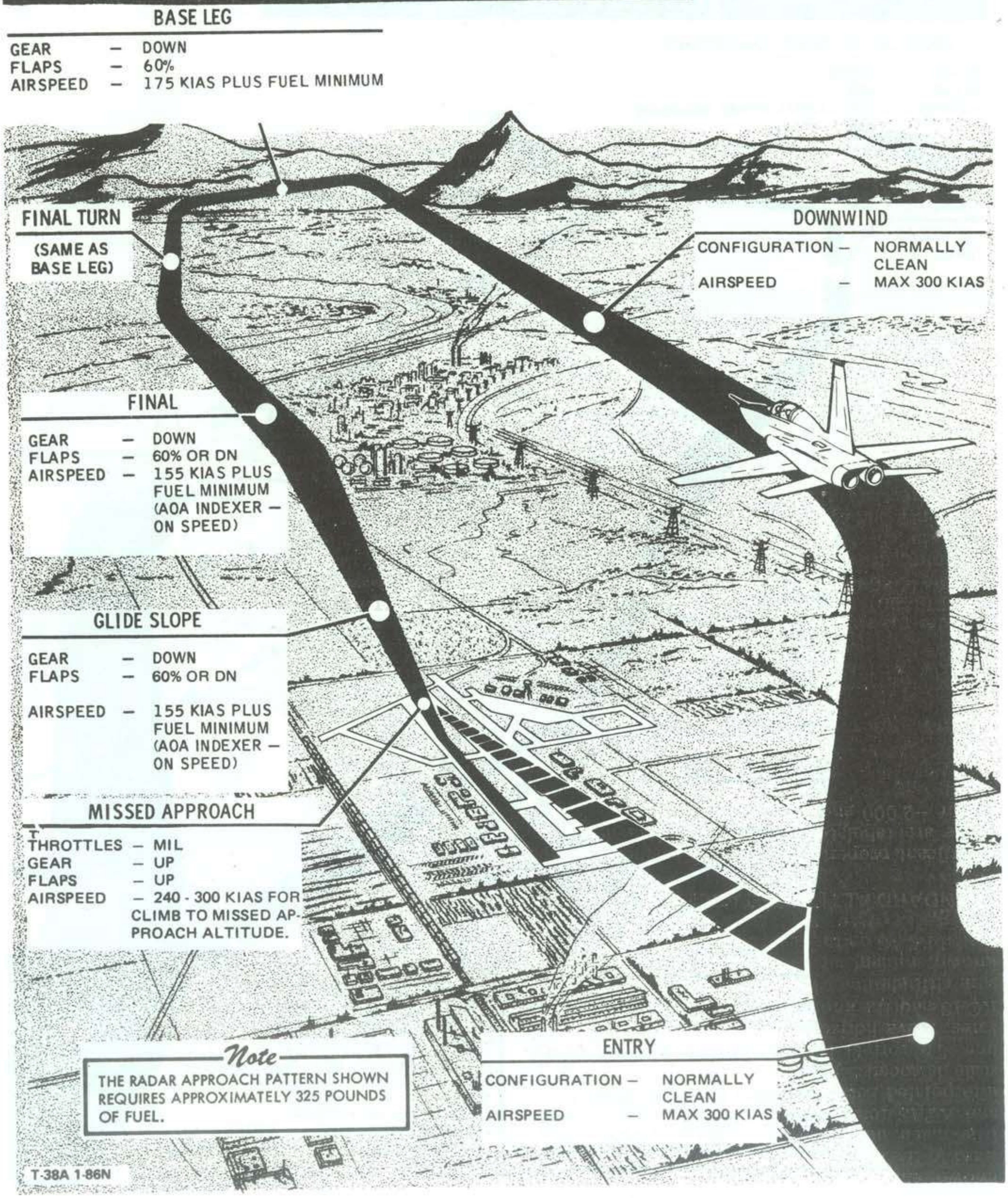

Figure 9-3.

RADAR APPROACH (TYPICAL)
SINGLE-ENGINE

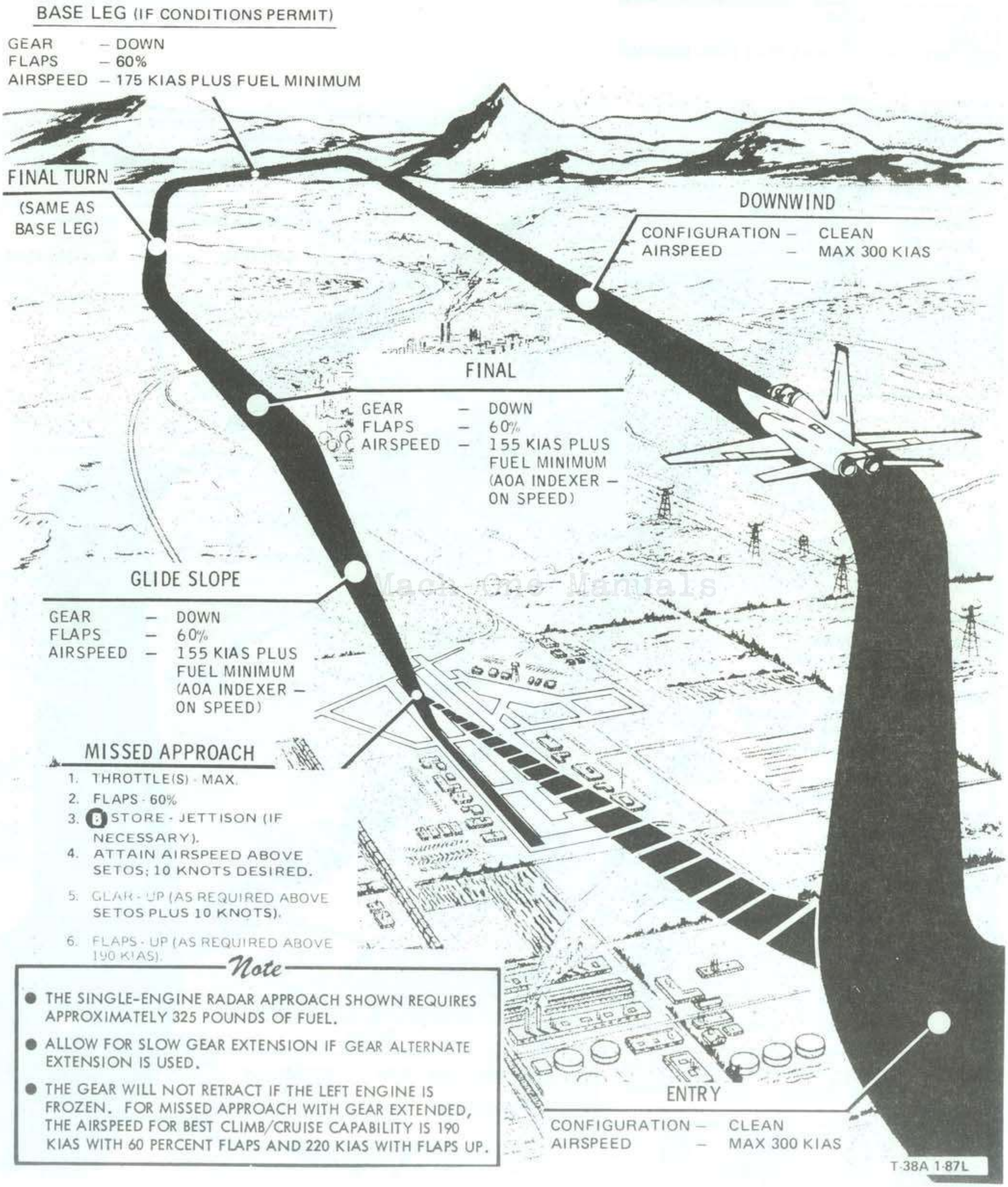

Figure 9-4.

ILS APPROACH (TYPICAL)

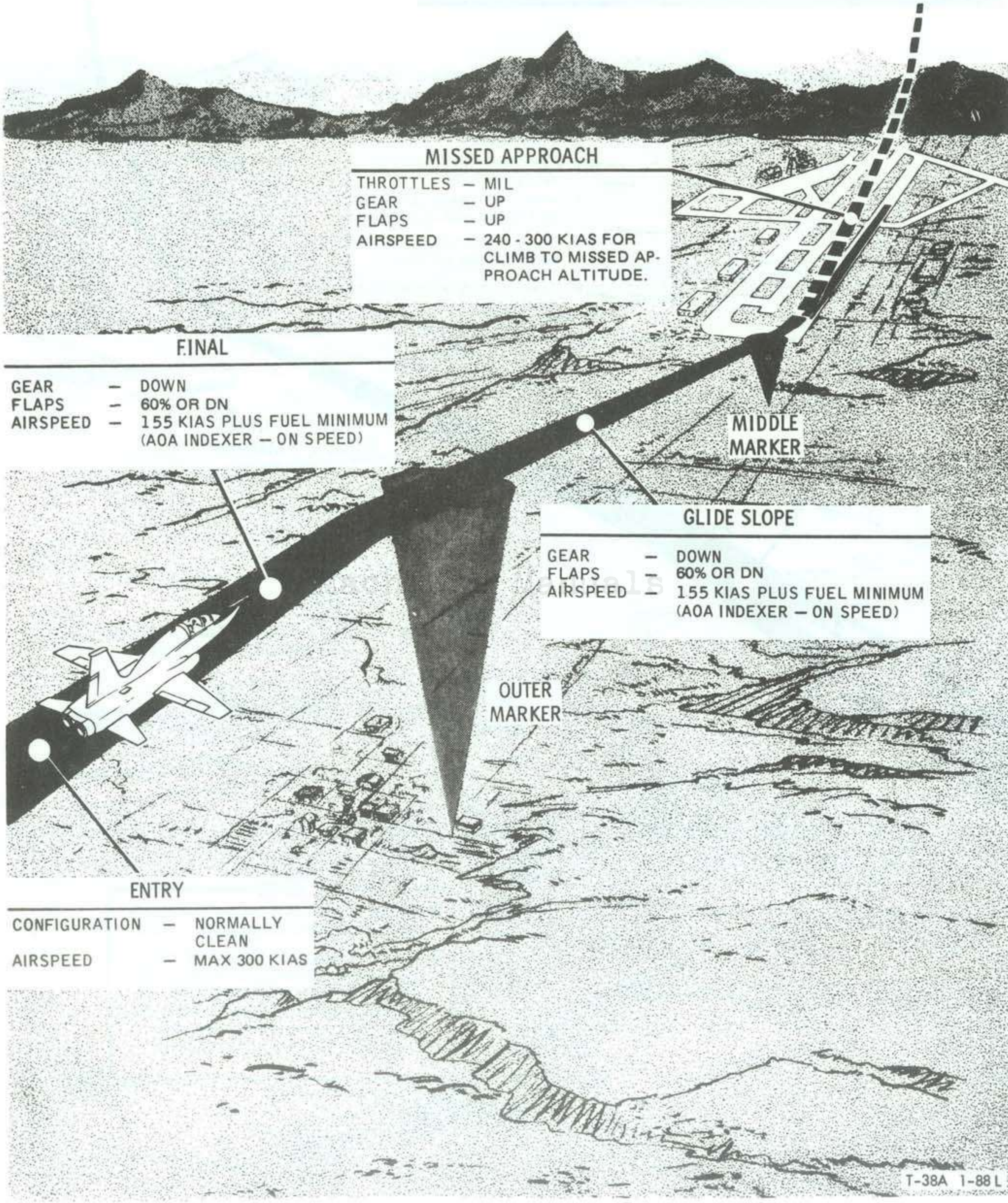

Figure 9-5.

ILS APPROACH (TYPICAL)
SINGLE-ENGINE

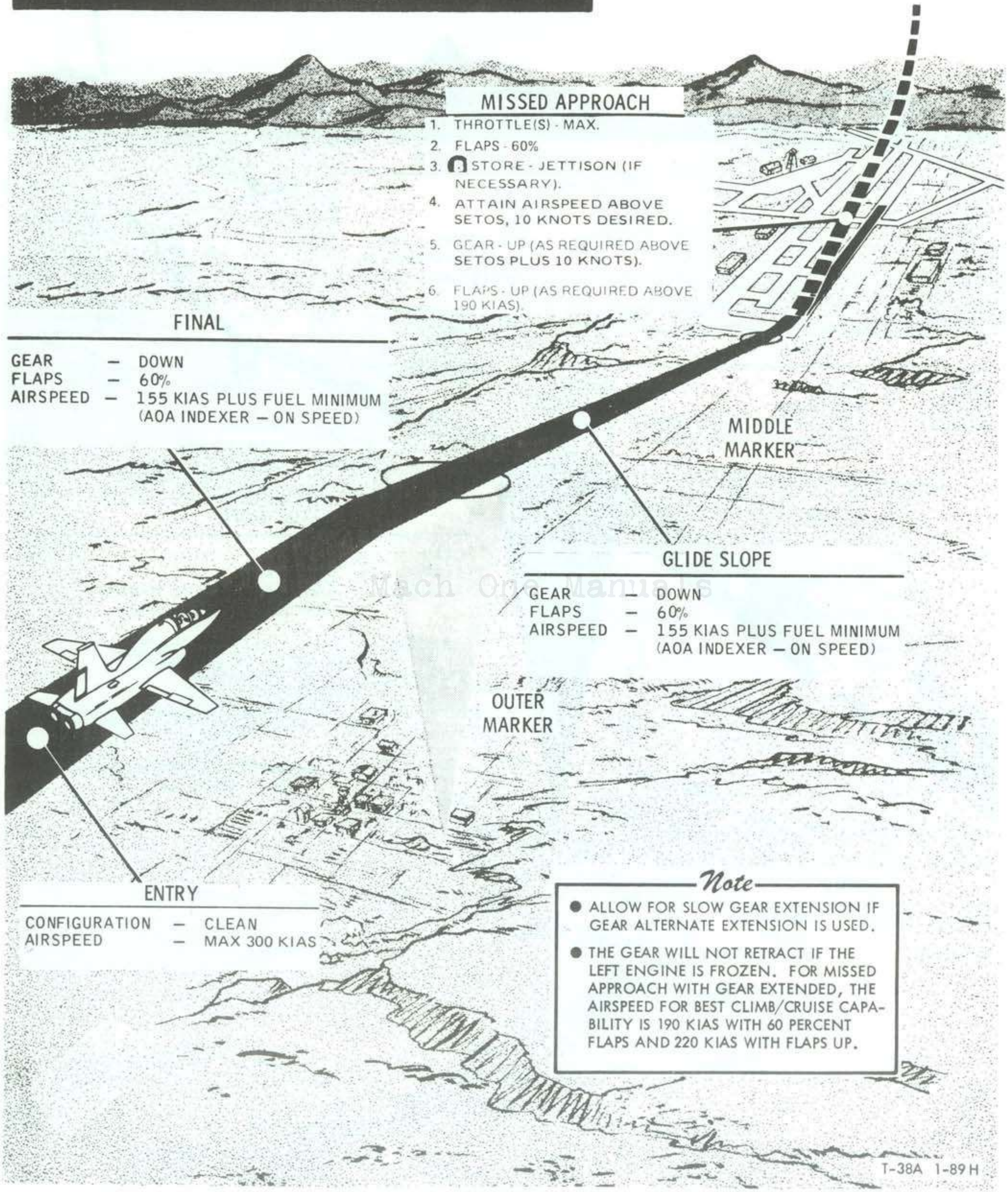

Figure 9-6.

ICE AND RAIN

TAKEOFF.

Monitor engine performance closely during takeoff on runways with large amounts of puddled water. Flameouts can be caused by water thrown up by the nosewheel.

ICING.

Anti-icing equipment for the wings, empennage, and inlet ducts is not provided. The aircraft is provided with engine anti-ice, pitot heat, and canopy defog heat, which also provides windshield heat for adverse weather operation. Icing conditions which may be encountered are trace, light, moderate, and severe. Moderate and severe icing, particularly, can cause rapid buildup of ice on the aircraft surfaces and greatly affect performance.

WARNING

The aircraft should not be flown in icing conditions. If icing is inadvertently encountered, leave the area of icing conditions as soon as possible.

When icing conditions are unavoidable, the pitot heat switch should be placed at PITOT HEAT and the canopy defog knob turned to full increase. The aircraft is not equipped with a windshield anti-icing or rain removal equipment. Instrument approaches in heavy rain are possible, but forward visibility thru the windshield may be marginal. Forward visibility in icing conditions is further reduced and may be completely obscured thru the windshield.

ICE INGESTION.

Engine damage may occur if as little as 1/4 inch of ice accumulates on engine inlet duct lips. Ingestion of accumulated ice into an engine may be evidenced by a jar or noise in the engine and may result in damage to inlet guide vanes and first-stage compressor blades. Engine instrument indications may remain normal, even though engine damage from ice ingestion has been experienced.

CAUTION

- After ice ingestion, the affected engine should be operated at the lowest possible RPM necessary to make a safe landing, avoiding abrupt or rapid throttle movements.
- If flight in icing conditions results in ice accumulations on the aircraft, enter this information in Form 781, as the engines must be inspected for ice ingestion damage when this occurs.

ENGINE ICING.

Engine inlet duct and/or guide vane icing may occur when the ambient temperature is at or slightly above freezing and either the humidity is high or when operating in visible moisture. Under these conditions, and when icing conditions are unavoidable, the engine anti-ice switch should immediately be placed at MAN ON, ensuring continuous anti-icing action.

NOTE

To ensure effective anti-icing, maintain a minimum of 80% RPM when the engine anti-icing system is turned ON.

RAIN.

CAUTION

Flight in moderate precipitation may damage the nose cone or vertical stabilizer. Nose cone damage may result in in-flight engine FOD. If flight in moderate precipitation is unavoidable, slow to the minimum practical airspeed to negate or lessen damage.

TURBULENCE AND THUNDERSTORMS

WARNING

Intentional flight in thunderstorms should be avoided.

The recommended best penetration airspeed if turbulence and thunderstorms are experienced is 280 KIAS.

NIGHT FLYING

When flying away from concentrations of ground lights, caution should be exercised to prevent spatial disorientation.

COLD WEATHER OPERATION

Most cold weather operating difficulties are encountered on the ground. The following instructions are to be used in conjunction with the normal procedures given in section II when cold weather aircraft operation is necessary.

BEFORE ENTERING AIRCRAFT.

Remove all protective covers and duct plugs; check to see that all surfaces, ducts, struts, drains, canopy rails, and vents are free of snow, ice, and frost. Brush off light snow and frost. Remove ice and encrusted snow either by a direct flow of air from a portable ground heater or by using de-icing fluid.

WARNING

- All ice, snow and frost must be removed from the aircraft before flight is attempted. Takeoff distance and climbout performance can be adversely affected by ice and snow accumulations. The roughness and distribution of these accumulations can vary stall speeds and alter flight characteristics to a degree extremely hazardous to safe flight.
- Ensure that water does not accumulate in control hinge areas or other critical areas where refreezing may cause damage or binding.

CAUTION

To avoid damage to aircraft surfaces, do not permit ice to be chipped or scraped away.

Check the fuel system vents on the vertical stabilizer for freedom from ice. Remove all dirt and ice from landing gear shock struts, actuating cylinder pistons, and limit switches. Wipe exposed parts of shock struts and pistons with a rag soaked in hydraulic fluid. Inspect aircraft carefully for fuel and hydraulic leaks caused by contraction of fittings or by shrinkage of packings. Inspect area behind aircraft to ensure that water or snow will not be blown onto personnel and equipment during engine start.

ON ENTERING AIRCRAFT.

Use external power for starting to conserve the battery. No preheat or special starting procedures are required; however, at temperatures below −30°F (−34°C), allow the engines to idle 2 minutes before accelerating. Turn on cockpit heat and canopy defog system, as required, immediately after engine start. Check flight controls, speed brake, and aileron trim for proper operation. Cycle flight controls four to six times. Check hydraulic pressure and control reaction, and operation of all instruments.

ENGINE OIL PRESSURE INDICATIONS.

Oil pressure indications above 55 psi will be observed after engine start. As the oil warms up, pressure should reduce to within operating limits. To reduce time for oil pressure to return to normal, the engine may be operated above idle up to military power until oil pressure is within limits. If oil pressure does not return to within operating limits, shut down engine and determine cause.

ENGINE IDLE RPM.

Low engine idle RPM can be expected after engine start when the engines are cold and the ground ambient temperature is below −16°F (−26°C). Monitor EGT and increase engine RPM as necessary to cut in the ac generators. If engine RPM will not increase when the throttle is advanced, shut down engine and determine cause. Engine idle RPM should be within operating limits after the engine has warmed up and the oil pressure has decreased to the normal operating range.

TAXIING.

Nosewheel steering effectiveness is reduced when taxiing on ice and hard packed snow. A combination of nosewheel steering and wheel braking should be used for directional control. The nosewheel will skid sideways easily, increasing the possibility of tire damage. Reduce taxi speeds and exercise caution at all times while operating on these surfaces. Increase the normal interval between aircraft both to ensure a safe stopping distance and to prevent icing of the aircraft from melted snow and ice caused by the jet blast of the preceding aircraft. Minimize taxi time to conserve fuel and reduce the amount of ice fog generated by the engines. If bare spots exist thru the snow, skidding onto them should be avoided. Check for sluggish instruments while taxiing.

TAKEOFF.

Do not advance throttles into MAX range until the aircraft is rolling straight down the runway.

WARNING

> Do not take off on slush covered runway; the nosewheel may sling slush into the inlet ducts, causing engine flameout and/or damage.

LANDING.

Use landing techniques given in section II. When landing on runways that have patches of dry surface, avoid locking the wheels. If the aircraft starts to skid, release brakes until recovery from skid is accomplished.

ENGINE SHUTDOWN.

Use normal engine shutdown procedure.

HOT WEATHER AND DESERT OPERATION

Operation of the aircraft in hot weather and in the desert requires that precautions be taken to protect the aircraft from damage caused by high temperatures, dust, and sand. Care must be taken to prevent the entrance of sand into aircraft parts and systems such as the engines, fuel system, pitot-static system, etc. All filters should be checked more frequently than under normal conditions. Plastic and rubber segments of the aircraft should be protected both from high temperatures and blowing sand. Canopy covers should be left off to prevent sand from accumulating between the cover and the canopy and acting as an abrasive on the plastic canopy. With a canopy closed, cockpit damage may result when ambient temperature is in excess of 110°F. Desert and hot weather operation require that in addition to normal procedures, the following precautions be observed.

TAKEOFF.

1. Monitor pitch attitude closely to ensure a positive rate of climb during gear and flap retraction and to prevent an excessive angle of attack.

2. Be alert for gusts and wind shifts near the ground.

APPROACH AND LANDING.

1. Monitor airspeed closely to ensure that recommended approach and touchdown airspeeds are maintained; high ambient temperatures cause speed relative to the ground to be higher than normal.

2. Anticipate a long landing roll due to higher ground speed at touchdown.

3. Utilize effective aerodynamic braking and all available runway for stopping the aircraft without overheating the wheel brakes.

PERFORMANCE DATA

APPENDIX I

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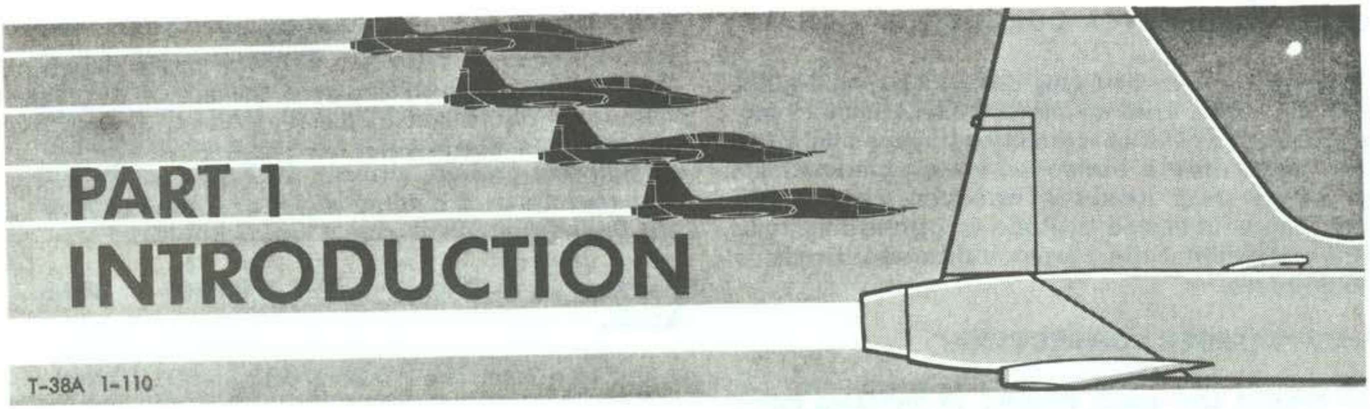
ABBREVIATIONS AND DEFINITIONS

KBAS	Basic airspeed (knots). Indicated airspeed corrected for instrument error.
KIAS	Indicated airspeed (knots). Airspeed indication uncorrected for instrument error.
KCAS	Calibrated airspeed (knots). Indicated airspeed corrected for instrument error and installation error (pitot-static system error and errors induced by aircraft attitude).
KEAS	Equivalent airspeed (knots). Calibrated airspeed corrected for compressibility.
KTAS	True airspeed (knots). Calibrated airspeed corrected for density and compressibility.
GS	Groundspeed (knots). Speed over the ground equal to true airspeed corrected for headwind (subtract) or tailwind (add).
Mach	A number expressing the ratio of the true airspeed of a moving body with the speed of sound in the air surrounding it.
IMN	Indicated mach number. Indicated mach reading uncorrected for instrument error.
TMN	True mach number. Indicated mach reading corrected for installation error.
ICAO	International Civil Aviation Organization.
IN. Hg	Inches of mercury.
H_i	Indicated pressure altitude. Altimeter indicated pressure altitude with respect to the reference level set on barometric scale of the instrument. Standard pressure altitude is read by setting barometric scale at 29.92 inches of mercury.
H_p	True pressure altitude. Altimeter reading corrected for installation error ($H_p = H_i - \Delta H_p$).
ΔH_p	Altimeter installation error correction.
ΔV_p	Airspeed installation error correction.
ΔV_c	Airspeed compressibility correction.
ΔV_M	Increase in takeoff speed above normal for military thrust.
ΔV_{SE}	Increase in takeoff speed above normal for single-engine maximum thrust.
% RPM	Engine speed expressed as a percentage of maximum engine speed (16,500 rpm = 100%).
Δ TEMP	Temperature correction.
a	Speed of sound at altitude.
a_0	Speed of sound at sea level.
P	Static pressure at altitude.
P_0	Static pressure at sea level.
δ	Pressure ratio, P/P_0
ρ	Ambient air density.
ρ_0	Air density at sea level.
σ	Relative air density, ρ/ρ_0.
MAC	Mean aerodynamic chord.
CG	Center-of-gravity.
KN	Knot.
FPM	Feet-per-minute.
NMI	Nautical miles.
NMI/LB	Nautical miles per pound.
LB/MIN	Pounds per minute.
LB/HR/ENG	Pounds per hour per engine.
RCR	Runway Condition Reading.
SL	Sea level.
ALT	Altitude.
AMB TEMP	Ambient air temperature.
TEMP	Temperature.
STD	Standard.
G	Load factor or G-loading.
Q	Dynamic pressure.
PRESS	Pressure.



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INTRODUCTION.

The flight performance charts provide the pilot with flight test data for basic flight planning purposes. All charts are based on standard day conditions except when necessary, as in the takeoff and landing charts, to include temperature corrections for nonstandard days. These corrections are based on maintaining the recommended indicated mach number or indicated airspeed. Instrument error is assumed to be zero in all performance charts of this appendix.

TAKEOFF FACTOR.

The takeoff factor is used to simplify the takeoff charts. The factor is based on atmospheric condition and the desired takeoff power setting. This factor reduces the time and effort required in takeoff planning.

DESCRIPTION OF DRAG INDEX SYSTEM.

The Drag Index System permits the presentation of performance for a number of external store loadings on one chart and greatly reduces the number of charts required in flight planning work. In the drag index system, each item of the external store configuration, such as a bomb or pylon, is assigned a drag number whose value depends on the size and shape of the item and its location on the aircraft. These numbers are not drag coefficients. The summation of the store drag numbers for a particular loading defines a drag index for that configuration. This drag index, when used in the performance charts, determines the aircraft performance for that external store configuration. The T-38A, with no external stores capability, has a drag index of zero. The Weapon System Support Pod is assigned a drag number of 25.

ALTIMETER AND AIRSPEED INSTALLATION ERROR CORRECTION.

Static pressure, which affects both airspeed and altimeter indications, is not always accurately measured because of the location of the static ports. This pressure error is a function of both airspeed and altitude. KCAS is obtained from KIAS by correcting for the installation error in static pressure (airspeed installation error). Knowing indicated airspeed and pressure altitude, both airspeed and altimeter installation corrections may be read from FA1-1.

USE OF ALTIMETER CORRECTION CHART.

Consider the aircraft flying at 280 KIAS at 40,000 feet (FL 400). Read up the 280 KIAS line to intersect the 40,000-foot correction curve, and from this point, draw a horizontal line to the left margin of the chart. Read the correction, which is +60 feet. Since indicated altitude is pressure altitude plus correction, the proper indicated altitude is 40,060 feet.

MACH NUMBER CORRECTION.

To convert true mach number to indicated mach number, use mach number correction chart FA1-2.

COMPRESSIBILITY CORRECTION TO CALIBRATED AIRSPEED.

The compressibility correction chart (FA1-3) provides the necessary airspeed correction to convert KCAS to KEAS (KEAS = KCAS — ΔV_c).

AIRSPEED CONVERSION.

The chart in FA1-4 is used to convert between KCAS, true mach number, and KTAS. If KCAS is known, enter the chart at that value and move upward to the known pressure altitude. At that point, true mach number is read on the left-hand scale and KTAS for standard atmosphere conditions is interpolated between the sloping speed lines whose scale is located at the sea level pressure altitude line. To correct KTAS for nonstandard temperatures, move horizontally from the intersection of KCAS and the known altitude to the sea level pressure altitude line, then vertically downward to the known ambient air temperature, and read the corrected KTAS on the scale at the right.

STANDARD ALTITUDE TABLE.

Significant properties of the ICAO standard atmosphere are tabulated at 1,000-foot increments between —2,000 and 65,000 feet altitude in FA1-5. Sea level values of the properties are listed in the top of the chart for use with the ratios shown in the table. As an example of the use of the table, find the equivalent airspeed in knots in standard atmosphere corresponding to 0.85 mach number at 30,000 feet pressure altitude. In FA1-5, at 30,000 feet read a/a_o = 0.8909, read $1/\sqrt{\sigma}$ = 1.6349, and at the top of the table read a_o = 661.7 knots.

Then: $a = a_o \times a/a_o$ = 661.7 X 0.8909 = 589.5 knots.

KTAS = Mach X a = 0.85 X 589.5 - 501.1 knots.

KEAS = KTAS $\div 1/\sqrt{\sigma}$ = 501.1 ÷ 1.6349 = 306.5 knots.

DENSITY ALTITUDE.

FA1-6 presents the variation of density altitude with ambient temperature for constant values of pressure altitude. Values of $1/\sqrt{\sigma}$ are tabulated at the right of the chart as a function of the density altitude scale on the left side. ICAO standard atmosphere conditions are defined by the line which slopes to the left and upward thru the chart. As an example of the use of the chart, find the value of $1/\sqrt{\sigma}$ at 8000 feet pressure altitude and 19° centigrade temperature. Move vertically upward to the 8000 feet pressure altitude line, then move horizontally right to the scale and read $1/\sqrt{\sigma}$ = 1.16. The equivalent density altitude, if required, is 10,000 feet. Note that these conditions do not correspond to those of the standard atmosphere, since the true temperature at 8000 feet pressure altitude in standard atmosphere is approximately 0° and $1/\sqrt{\sigma}$ = 1.12.

STANDARD CONVERSION TABLE.

Linear scales for converting units of temperature, distance, and speed from one measurement system to another are provided in FA1-7. Additional conversion factors for volume, pressure, and weight are listed at the bottom of the table.

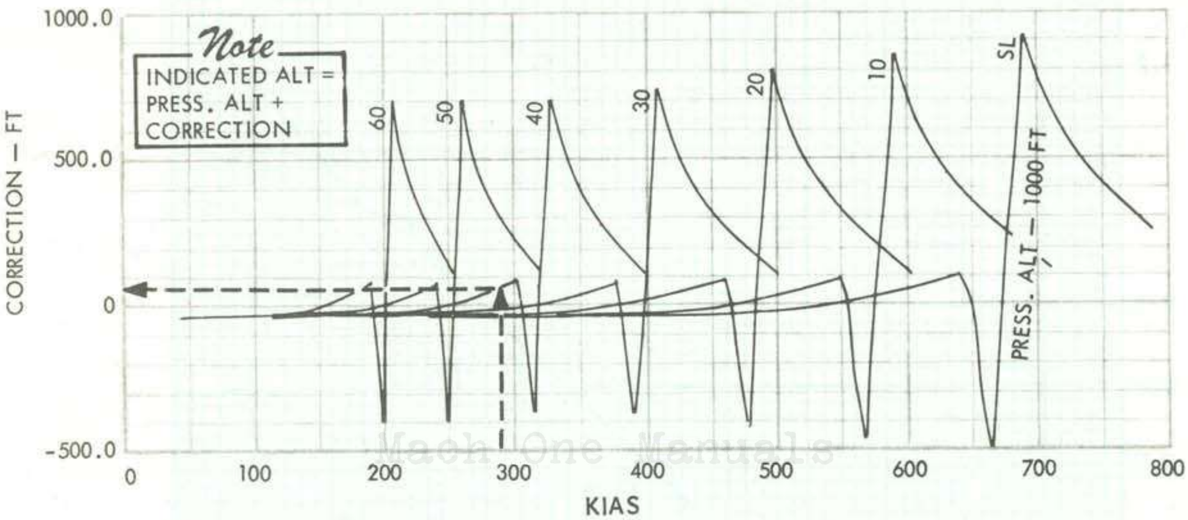
ALTIMETER AND AIRSPEED INSTALLATION ERROR CORRECTIONS

CLEAN CONFIGURATION

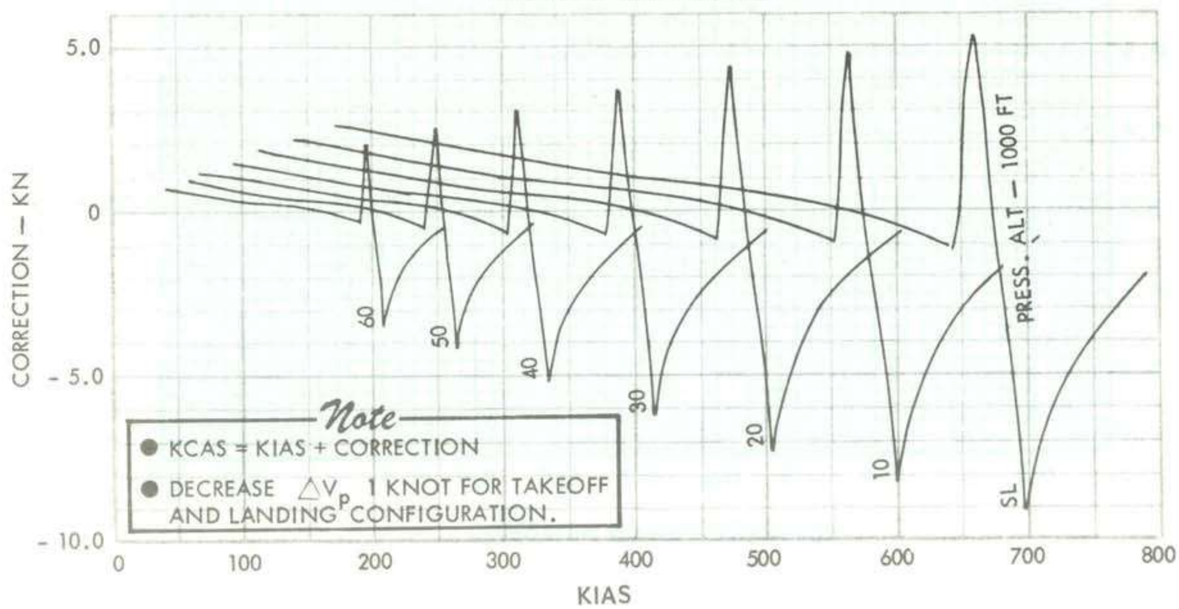
MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

ALTIMETER CORRECTION



AIRSPEED CORRECTION



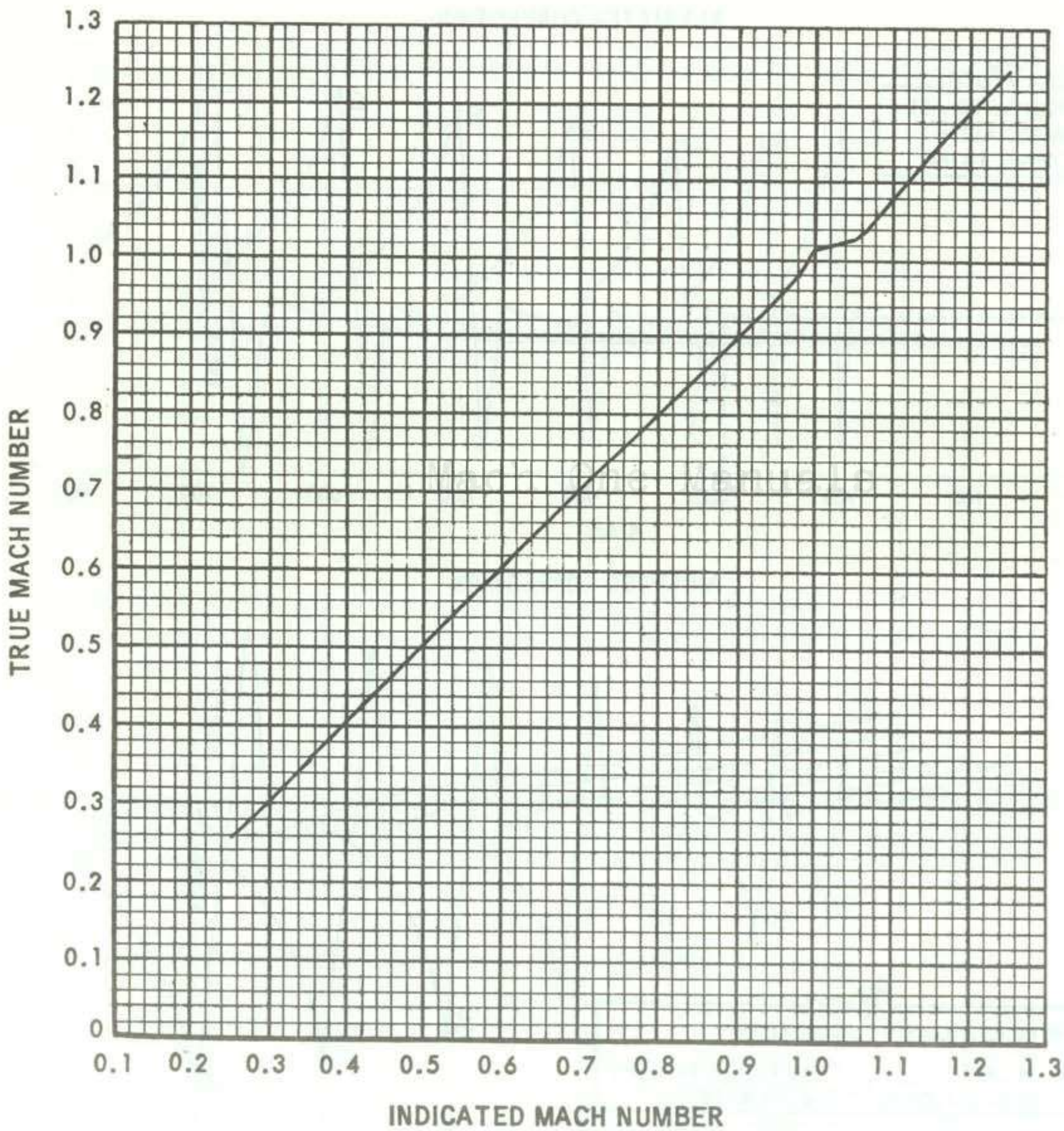
T-38A 1-300C

FA1-1

MACH NUMBER CORRECTION

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

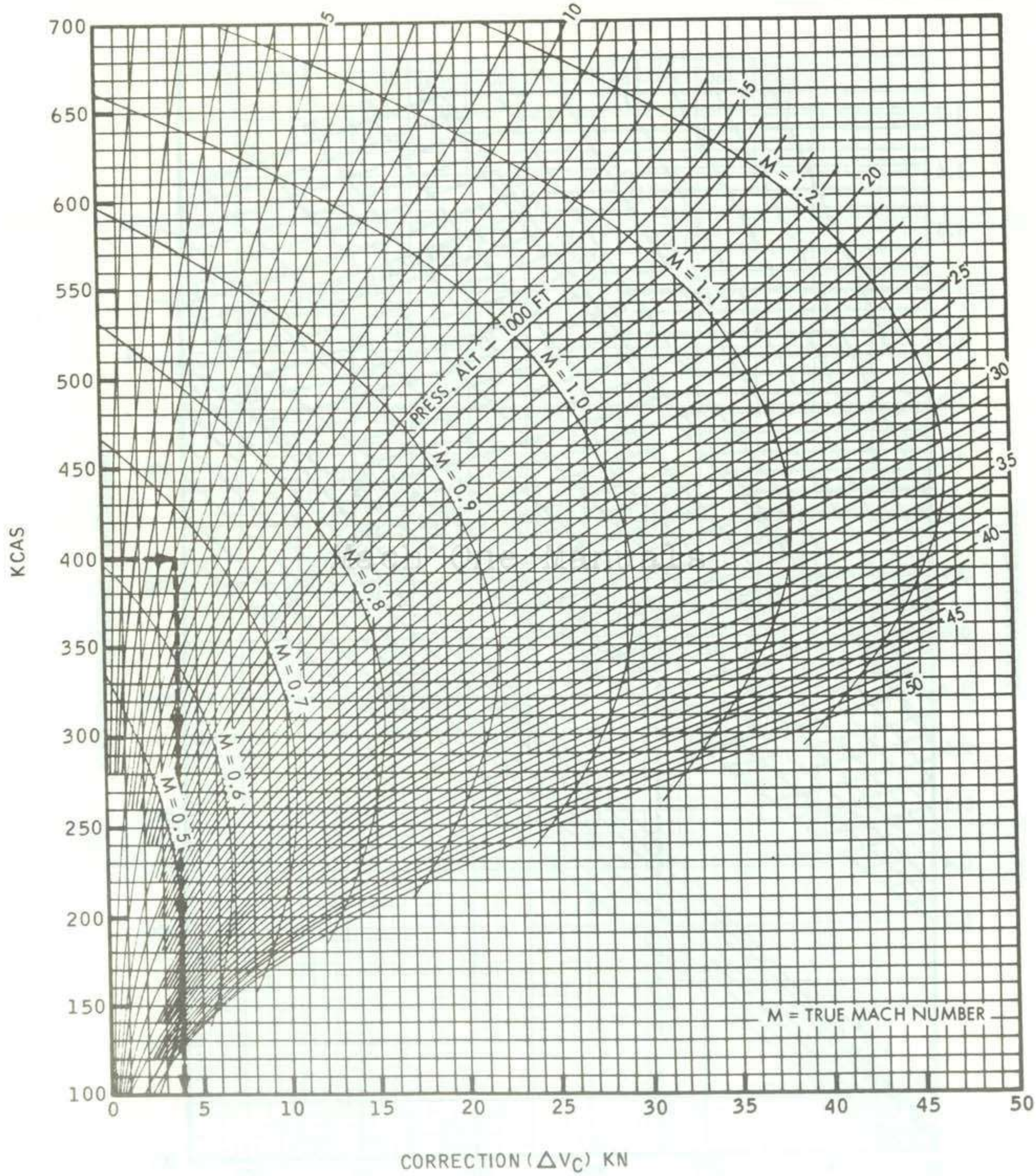
ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-301A

FA1-2

COMPRESSIBILITY CORRECTION
TO CALIBRATED AIRSPEED

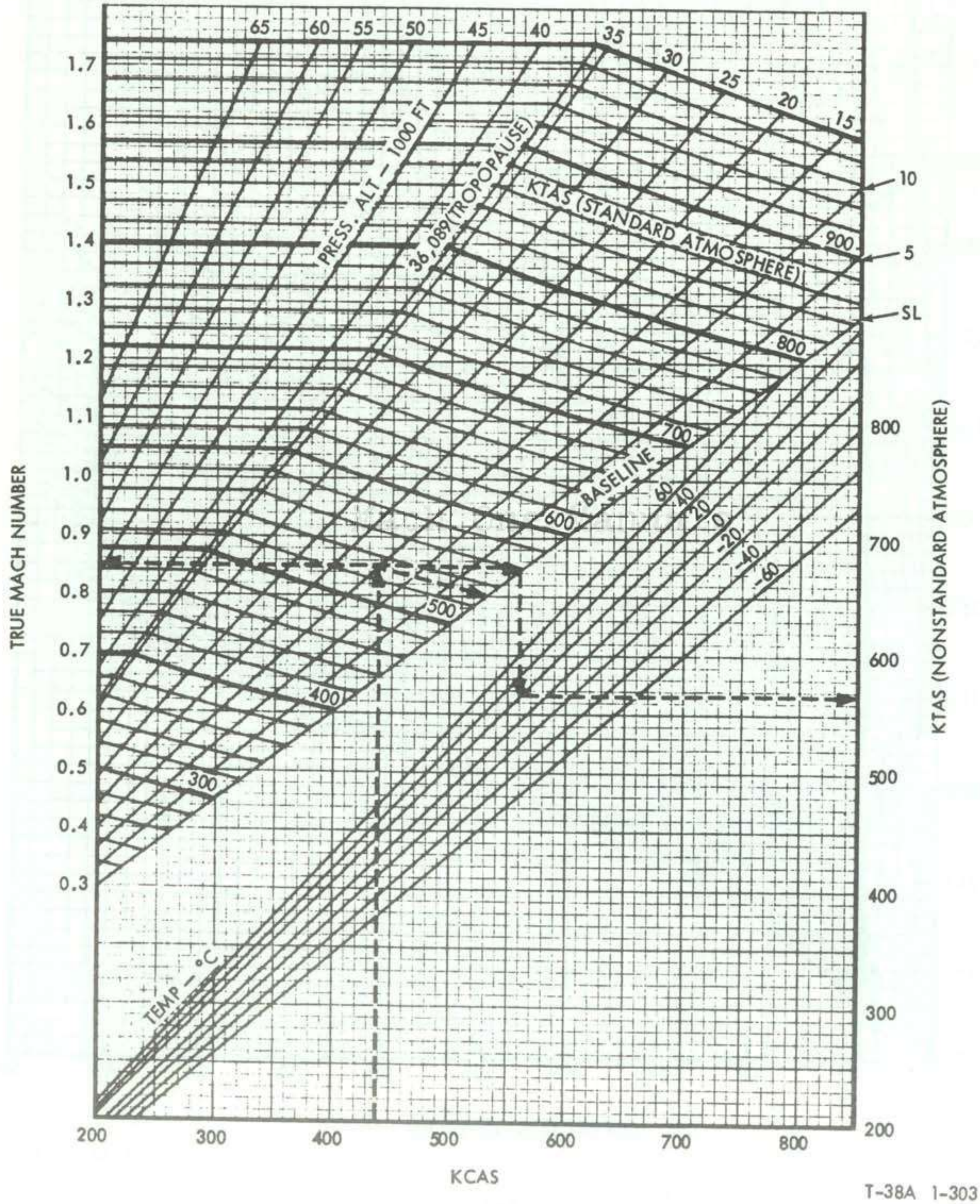


T-38A 1-302 D

FA1-3

EXAMPLE:
KCAS = 440
PRESS. ALT = 15,000 FT
TMN = 0.85
KTAS (STD DAY) = 530
KTAS (AT 20°C) = 565

AIRSPEED CONVERSION



FA1-4

STANDARD ALTITUDE TABLE

STANDARD SEA LEVEL AIR:
T = 59°F (15°C)
P = 29.921 IN. OF HG

W = 0.076475 LB/CU FT ρ_0 = 0.0023769 SLUGS/CU FT
1" OF HG = 70.732 LB/SQ FT = 0.4912 LB/SQ IN.
a_0 = 1116.89 FT/SEC = 661.7 KN

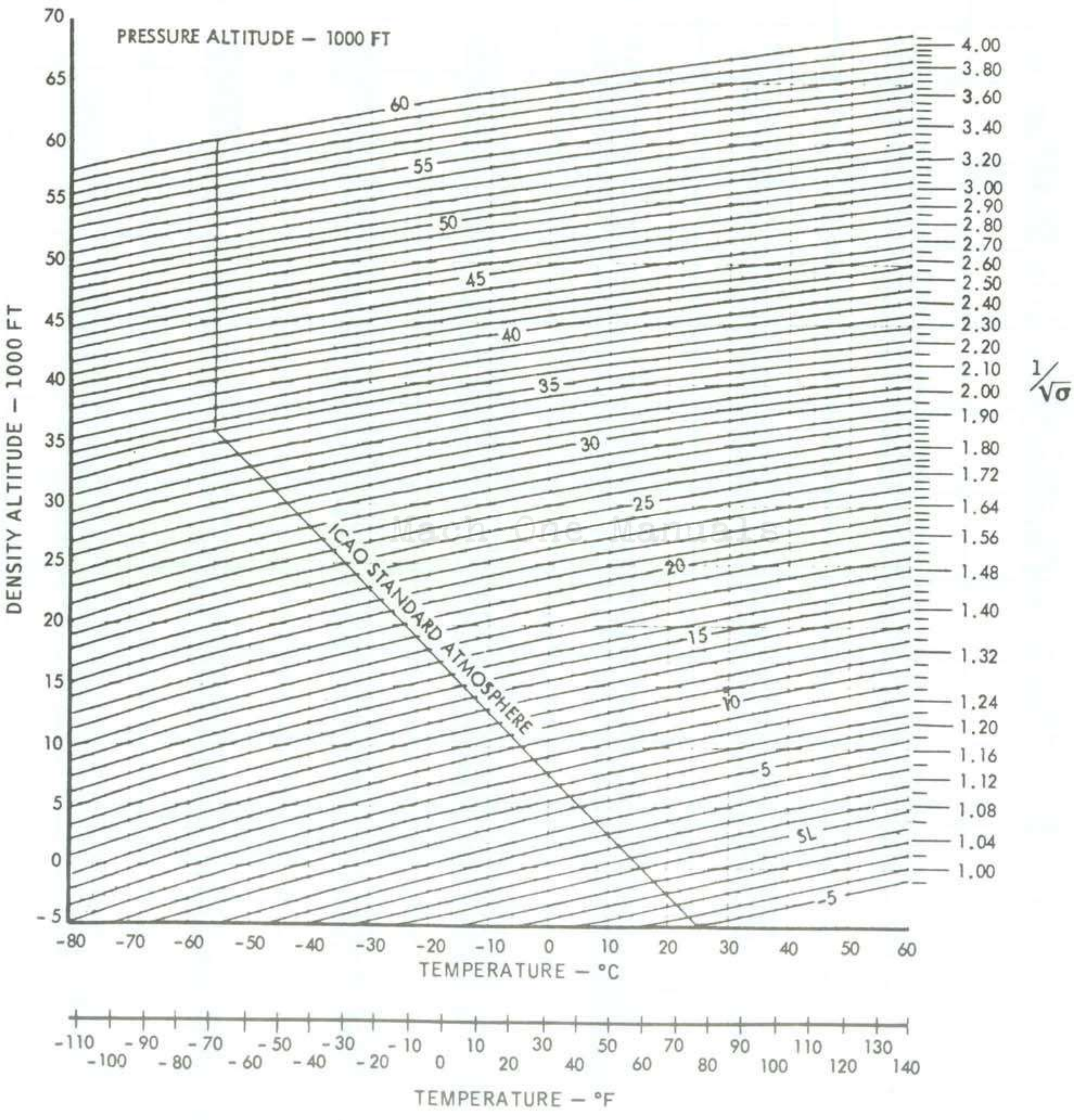
STANDARD ATMOSPHERE
(NACA TECHNICAL REPORT NO. 1235)

ALTITUDE FEET	DENSITY RATIO $\rho/\rho_0 = \sigma$	$1/\sqrt{\sigma}$	TEMPERATURE DEG. F	TEMPERATURE DEG. C	SPEED OF SOUND RATIO a/a_0	PRESSURE IN. OF HG	PRESSURE RATIO $P/P_0 = \delta$
−2,000	1.0598	0.9714	66.132	18.962	1.0064	32.15	1.0294
−1,000	1.0296	0.9855	62.566	16.981	1.0030	31.02	1.0147
0	1.0000	1.0000	59.000	15.000	1.0000	29.92	1.0000
1,000	0.9711	1.0148	55.434	13.019	0.9966	28.86	0.9644
2,000	0.9428	1.0299	51.868	11.038	0.9931	27.82	0.9298
3,000	0.9151	1.0454	48.302	9.057	0.9896	26.82	0.8962
4,000	0.8881	1.0611	44.735	7.075	0.9862	25.84	0.8637
5,000	0.8617	1.0773	41.169	5.094	0.9827	24.90	0.8320
6,000	0.8359	1.0938	37.603	3.113	0.9792	23.98	0.8014
7,000	0.8106	1.1107	34.037	1.132	0.9756	23.09	0.7716
8,000	0.7860	1.1279	30.471	− 0.849	0.9721	22.22	0.7428
9,000	0.7620	1.1456	26.905	− 2.831	0.9686	21.39	0.7148
10,000	0.7385	1.1637	23.338	− 4.812	0.9650	20.58	0.6877
11,000	0.7156	1.1822	19.772	− 6.793	0.9614	19.79	0.6614
12,000	0.6932	1.2011	16.206	− 8.774	0.9579	19.03	0.6360
13,000	0.6713	1.2205	12.640	−10.756	0.9543	18.29	0.6113
14,000	0.6500	1.2403	9.074	−12.737	0.9507	17.58	0.5875
15,000	0.6292	1.2606	5.508	−14.718	0.9470	16.89	0.5643
16,000	0.6090	1.2815	1.941	−16.699	0.9434	16.22	0.5420
17,000	0.5892	1.3028	− 1.625	−18.681	0.9397	15.57	0.5203
18,000	0.5699	1.3246	− 5.191	−20.662	0.9361	14.94	0.4994
19,000	0.5511	1.3470	− 8.757	−22.643	0.9324	14.34	0.4791
20,000	0.5328	1.3700	−12.323	−24.624	0.9287	13.75	0.4595
21,000	0.5150	1.3935	−15.889	−26.605	0.9250	13.18	0.4406
22,000	0.4976	1.4176	−19.456	−28.587	0.9213	12.64	0.4223
23,000	0.4807	1.4424	−23.022	−30.568	0.9175	12.11	0.4046
24,000	0.4642	1.4678	−26.588	−32.549	0.9138	11.60	0.3876
25,000	0.4481	1.4938	−30.154	−34.530	0.9100	11.10	0.3711
26,000	0.4325	1.5206	−33.720	−36.511	0.9062	10.63	0.3552
27,000	0.4173	1.5480	−37.286	−38.492	0.9024	10.17	0.3398
28,000	0.4025	1.5762	−40.852	−40.473	0.8986	9.725	0.3250
29,000	0.3881	1.6052	−44.419	−42.455	0.8948	9.297	0.3107
30,000	0.3741	1.6349	−47.985	−44.436	0.8909	8.885	0.2970
31,000	0.3605	1.6654	−51.551	−46.417	0.8871	8.488	0.2837
32,000	0.3473	1.6968	−55.117	−48.398	0.8832	8.106	0.2709
33,000	0.3345	1.7291	−58.683	−50.379	0.8793	7.737	0.2586
34,000	0.3220	1.7623	−62.249	−52.361	0.8754	7.382	0.2467
35,000	0.3099	1.7964	−65.816	−54.342	0.8714	7.041	0.2353
36,000	0.2981	1.8315	−69.382	−56.323	0.8675	6.712	0.2243
37,000	0.2844	1.8753	−69.700	−56.500	0.8671	6.397	0.2138
38,000	0.2710	1.9209	−69.700	−56.500	0.8671	6.097	0.2038
39,000	0.2583	1.9677	−69.700	−56.500	0.8671	5.811	0.1942
40,000	0.2462	2.0155	−69.700	−56.500	0.8671	5.538	0.1851
41,000	0.2346	2.0645	−69.700	−56.500	0.8671	5.278	0.1764
42,000	0.2236	2.1148	−69.700	−56.500	0.8671	5.030	0.1681
43,000	0.2131	2.1662	−69.700	−56.500	0.8671	4.794	0.1602
44,000	0.2031	2.2189	−69.700	−56.500	0.8671	4.569	0.1527
45,000	0.1936	2.2728	−69.700	−56.500	0.8671	4.355	0.1455
46,000	0.1845	2.3281	−69.700	−56.500	0.8671	4.151	0.1387
47,000	0.1758	2.3848	−69.700	−56.500	0.8671	3.956	0.1322
48,000	0.1676	2.4428	−69.700	−56.500	0.8671	3.770	0.1260
49,000	0.1597	2.5022	−69.700	−56.500	0.8671	3.593	0.1201
50,000	0.1522	2.5630	−69.700	−56.500	0.8671	3.425	0.1145
51,000	0.1451	2.6254	−69.700	−56.500	0.8671	3.264	0.1091
52,000	0.1383	2.6892	−69.700	−56.500	0.8671	3.111	0.1040
53,000	0.1318	2.7546	−69.700	−56.500	0.8671	2.965	0.09909
54,000	0.1256	2.8216	−69.700	−56.500	0.8671	2.826	0.09444
55,000	0.1197	2.8903	−69.700	−56.500	0.8671	2.693	0.09001
56,000	0.1141	2.9606	−69.700	−56.500	0.8671	2.567	0.08578
57,000	0.1087	3.0326	−69.700	−56.500	0.8671	2.446	0.08176
58,000	0.1036	3.1063	−69.700	−56.500	0.8671	2.331	0.07792
59,000	0.09877	3.1819	−69.700	−56.500	0.8671	2.222	0.07426
60,000	0.09414	3.2593	−69.700	−56.500	0.8671	2.118	0.07078
61,000	0.08972	3.3386	−69.700	−56.500	0.8671	2.018	0.06746
62,000	0.08551	3.4198	−69.700	−56.500	0.8671	1.924	0.06429
63,000	0.08150	3.5029	−69.700	−56.500	0.8671	1.833	0.06127
64,000	0.07767	3.5881	−69.700	−56.500	0.8671	1.747	0.05840
65,000	0.07403	3.6754	−69.700	−56.500	0.8671	1.665	0.05566

T-38A 1-304A

FA1-5

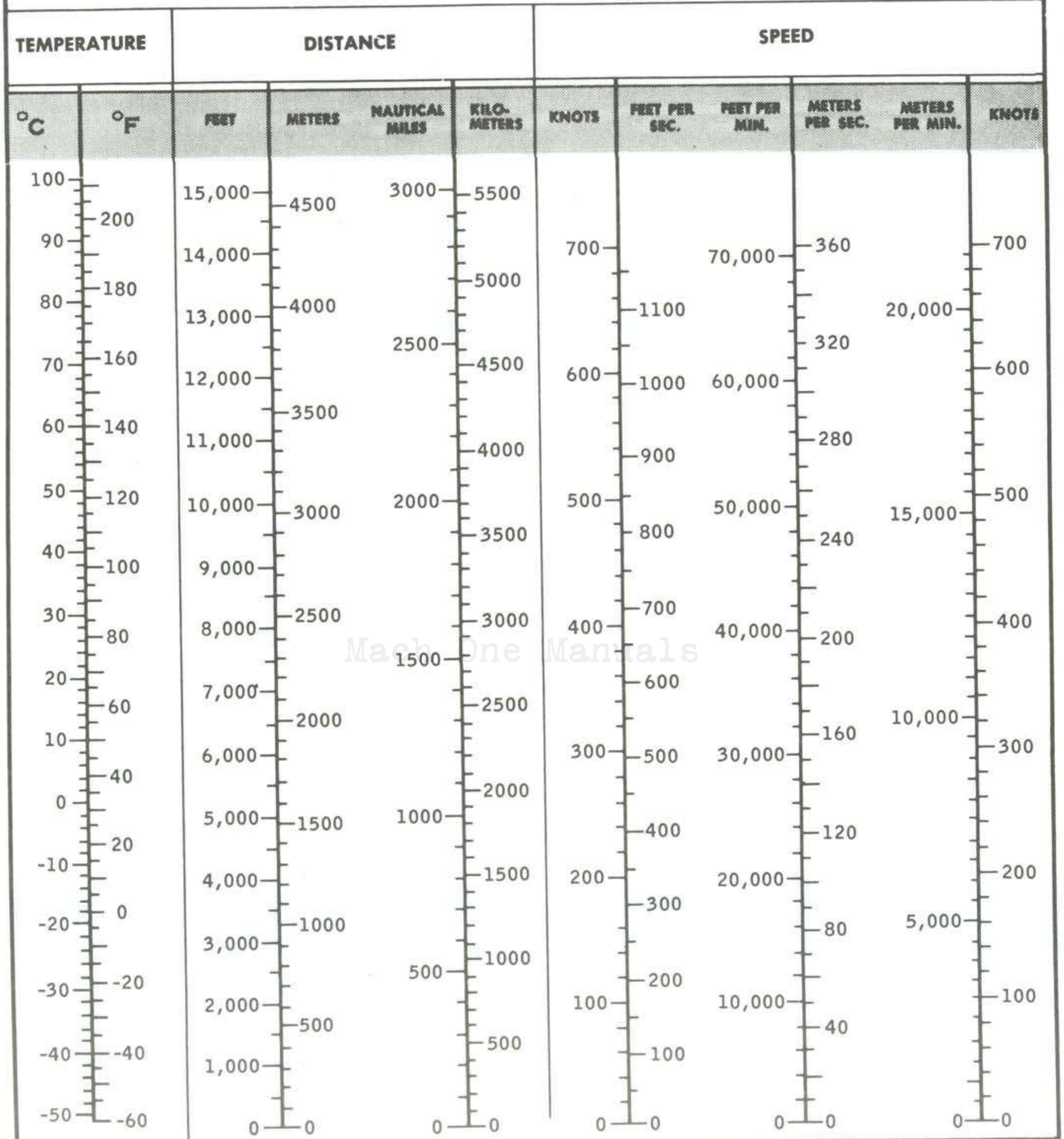
DENSITY ALTITUDE



T-38A 1-305A

FA1-6

STANDARD CONVERSION TABLE



Note

- TO OBTAIN US GALLONS MULTIPLY LITERS BY 0.264
- TO OBTAIN IMPERIAL GALLONS MULTIPLY LITERS BY 0.220
- TO OBTAIN INCHES OF MERCURY MULTIPLY MILLIBARS BY 0.0295
- TO OBTAIN POUNDS MULTIPLY KILOGRAMS BY 2.20

FA1-7

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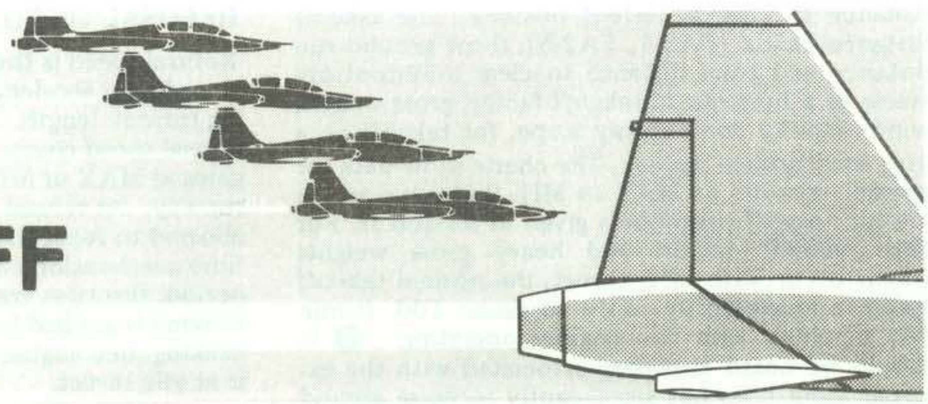

PART 2 TAKE OFF

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WIND COMPONENTS.

A takeoff and landing wind components chart (FA2-1) is provided to enable the pilot to convert surface winds to headwind and crosswind components. The headwind component is used to compute takeoff and landing data. The crosswind component is used to determine the feasibility of operations. Maximum recommended 90 degree crosswind components for dry runways is 30 knots, for wet runways 20 knots, and for icy runways and those containing standing water (SW) 10 knots. These limits are depicted on the wind components chart (FA2-1).

USE OF WIND COMPONENTS CHART.

The chase-thru lines (FA2-1) show a 35-degree right crosswind of 42 knots. The headwind component is 34 knots, and the crosswind component is 24 knots.

TAKEOFF FACTOR.

The takeoff factor is a number which is common to all takeoff charts for a given thrust rating and atmospheric condition. The takeoff factor chart (FA2-2) shows the takeoff factor as a function of pressure altitude, runway air temperature, and thrust rating, including the effect of the anti-ice system operation.

USE OF TAKEOFF FACTOR CHART.

The chase-thru lines on FA2-2 show a runway air temperature of 15°C and a pressure altitude of 4,000 feet which give takeoff factors of 3.45 and 5.25 for MAX and MIL thrust respectively.

TAKEOFF SPEED.

Takeoff speed is the speed at which the main gear lifts off the runway. The takeoff speed chart (FA2-3) enables the pilot to determine normal takeoff speed and the climb speed to be attained to clear a 50-foot obstacle.

USE OF TAKEOFF SPEED CHART.

The chase-thru lines on FA2-3 show the normal takeoff speed for an aircraft with a gross weight of 11,800 pounds is 154 KIAS.

TAKEOFF DISTANCE.

Takeoff distance is ground run distance in feet to liftoff. Takeoff distance to clear a 50-foot obstacle is ground run distance in feet to liftoff plus the air distance to clear a 50-foot obstacle. The takeoff distance charts (FA2-4, FA2-5), show ground run distance and total distance to clear a 50-foot obstacle as a function of takeoff factor, gross weight, wind velocity and runway slope, for takeoff on a dry, hard surface runway. The charts show data for normal takeoffs at MAX or MIL thrust, using the normal takeoff procedures given in section II. For large takeoff factors and heavy gross weights which occur with MIL thrust, the normal takeoff speed is increased by ΔV_M to assure 100 ft/min rate of climb with two engines operating. B It should be noted that drag associated with the external store does not significantly increase ground run distance.

USE OF TAKEOFF DISTANCE CHARTS.

The chase-thru lines on FA2-4 show a maximum thrust takeoff for a gross weight of 11,800 pounds, headwind of 10 knots, and a takeoff factor of 3.45. The resulting normal ground run distance is 3050 feet. The corresponding total distance to clear a 50-foot obstacle is 4600 feet (FA2-5).

EFFECT OF RUNWAY CONDITION READING (RCR).

Runway Condition Reading (RCR) is a number that indicates the degree of braking friction on the runway surface. RCR 5 is icy, RCR 12 is wet, and RCR 23 and above is dry. On slippery runways, the critical field length is increased, which may cause an increase in the minimum acceleration speed check. The refusal speed and critical engine failure speeds are decreased (when compared to dry, hard-surfaced runways).

CRITICAL FIELD LENGTH.

Critical field length is the total runway length required to accelerate with both engines operating to the critical engine failure speed, experience an engine failure, then either continue to takeoff or stop. The critical field length is shown for MAX thrust on FA2-6. For single-engine takeoff at large takeoff factors and heavy gross weights, the normal takeoff speed is increased by ΔV_{SE} to assure 100 feet per minute rate of climb.

USE OF CRITICAL FIELD LENGTH CHART.

The chase-thru lines on FA2-6 show that at a takeoff factor of 3.45 and a gross weight of 11,800 pounds, ΔV_{SE} is 9 knots. The chase-thru lines further show that with a 10-knot headwind, the Critical Field Length for an RCR of 23 is 5800 feet, and is increased to 6500 feet for an RCR of 12. The Single Engine Takeoff Speed is normal takeoff speed plus ΔV_{SE} ; 154 + 9 = 163 KIAS.

REFUSAL SPEED.

Refusal speed is the maximum speed to which the aircraft can accelerate and then stop in the remaining runway length. Stopping distance data in the refusal speed charts (FA2-7, FA2-8) are for two engines at MAX or MIL thrust on a dry hard surface runway. At refusal speed, a three second delay is allowed to recognize engine failure during which time acceleration continues. At the end of this period, throttles are pulled to idle and optimum braking is applied in a three-point attitude. While braking, one engine is windmilling and one engine is at idle thrust.

CRITICAL ENGINE FAILURE SPEED.

Critical engine failure speed is the speed to which the aircraft will accelerate with both engines, experience an engine failure, and permit either acceleration to takeoff or deceleration to a stop in the same distance. Data for critical engine failure speed is presented in FA2-7. If a critical engine failure speed computes to less than 110 KIAS, use 110 KIAS as the critical engine failure speed. When an RCR factor is present, use the full computed critical engine failure speed corrected for RCR.

USE OF REFUSAL SPEED CHARTS OR CRITICAL ENGINE FAILURE SPEED CHARTS.

The chase-thru lines on FA2-7 show a refusal speed of 133 KIAS for a takeoff factor of 3.45 at gross weight of 11,800 pounds on a 7,000-foot runway for an RCR of 23. Correcting for an RCR of 12 reduces the refusal speed to 106 KIAS. A 10-knot headwind increases the refusal speed to 143 KIAS for an RCR of 23 and 116 KIAS for an RCR of 12 For a takeoff factor of 3.45 at gross weight 11,800 and a critical field length of 5,800 feet, the critical engine failure speed is 122 KIAS for an RCR of 23. An RCR of 12 results in a critical engine failure speed of 102 KIAS. Adding the 10-knot headwind increases these speeds to 132 KIAS for an RCR of 23 and 112 KIAS for an RCR of 12. If critical engine failure speed computes to less than 110 KIAS, use 110 KIAS as critical engine failure speed. (Exception: If an RCR factor is present, use the actual computed speed as critical engine failure speed.)

TAKEOFF ABORT CHARTS (GENERAL).

The takeoff abort charts contained in FA2-6 thru FA2-10 provide the means of planning for a GO—NO-GO decision should an engine fail during takeoff. A discussion is provided to illustrate the factors which influence the decision to stop or go. A detailed description of each abort chart is provided in the preceding paragraphs. The principal factor affecting aborted takeoff is the relationship of actual runway length to critical field length. This relationship falls into three categories as follows:

CATEGORY I. Runway Length Greater than Critical Field Length. (Refusal speed exceeds critical engine failure speed.)

a. If engine failure occurs below critical engine failure speed:

Aircraft should be stopped, as runway length will be sufficient for stopping. Takeoff distance increases as engine failure speed decreases and may exceed the runway length under certain conditions.

b. If engine failure occurs between critical engine failure speed and refusal speed:

Takeoff should normally be continued; however aircraft can take off or stop within remaining distance.

c. If engine failure occurs above refusal speed:

Aircraft must continue takeoff as it would overrun runway in stopping. Sufficient runway for takeoff will be available.

CATEGORY II. Runway Length Same as Critical Field Length. Refusal speed and critical engine failure speed coincide; therefore, aircraft must be stopped if below critical engine failure speed and should continue takeoff if above the coincidence speed. Runway will be adequate for either condition.

CATEGORY III. Runway Length Less than Critical Field Length. (Refusal speed less than critical engine failure speed.) This is the most critical category. If flight operations are to be conducted under these conditions, decision speed (FA2-9) must be used as the Go-No-Go factor. If engine failure occurs between refusal speed and decision speed, the takeoff must be aborted, even though barrier engagement can be expected. If engine failure occurs after decision speed, sufficient runway for takeoff should be available, and takeoff should be continued.

DECISION SPEED.

Decision speed is the minimum speed at which the aircraft can experience an engine failure and still accelerate to single-engine takeoff speed in the remaining runway. If the decision speed is greater than the dual engine takeoff speed, then the decision speed is equivalent to the takeoff speed. The decision speed is found on FA2-9.

USE OF DECISION SPEED CHART.

The chase-thru line on FA2-9 shows a decision speed of 102 KIAS for a takeoff factor of 3.45 at a gross weight of 11,800 pounds on a 7000-foot runway with a 10-knot headwind, and $\Delta V_{SE} = 9$ knots (FA2-6).

VELOCITY DURING TAKEOFF GROUND RUN.

The velocity during takeoff ground run chart shows the relationship between KIAS and distance traveled during ground run on a dry, hard surface runway. The two-engine velocity during takeoff ground run chart (FA2-10), is used to check acceleration performance. Compute the minimum acceleration check speed for a point 2000 feet from brake release. If the takeoff run is less than 3000 feet, compute minimum acceleration check speed for a point 1000 feet from brake release. Under certain slippery runway conditions, the minimum acceleration check speed may be above the corrected critical engine failure speed. When this occurs, adjust the acceleration check distance to any usable value up to 2000 feet from brake release that will result in a minimum acceleration check speed equal to or less than the critical engine failure speed corrected for RCR. The forecast speed at this point is the normal acceleration check speed. Minimum accleration check speed (MACS, FA2-10) is the minimum acceptable speed at the check distance with which takeoff should be continued. The single-engine velocity during ground run (FA2-11) is used to evaluate single-engine takeoff acceleration performance.

USE OF TWO-ENGINE VELOCITY DURING TAKEOFF GROUND RUN CHART.

Assume a takeoff weight of 11,800 pounds, a runway temperature of 15°C, RCR of 12, a pressure altitude of 4000 feet, and a 10-knot headwind. Enter the chart at the takeoff speed 155 KIAS (FA2-3) and ground run distance of 3000 feet (FA2-4). From the point of intersection of these lines, draw a line parallel to the guideline. Enter FA2-10 at ground run distance of 2000 feet. Proceed vertically to intersection with constructed airspeed guideline and read airspeed of 129 knots from the left side of the chart. This is the velocity at a point 2000 feet from brake release. Since this acceleration check speed is above the corrected critical engine failure speed of 112 KIAS (FA2-7), reenter chart at ground run distance of 1500 feet. Proceed vertically to intersection with constructed airspeed guideline and read airspeed of 110 knots from the left side of the chart. This is the velocity at 1500 feet from brake release.

USE OF SINGLE-ENGINE VELOCITY DURING TAKEOFF GROUND RUN CHART.

Assume a takeoff weight of 11,800 pounds, a runway air temperature of 15°C, a pressure altitude of 4000 feet, and a 10-knot headwind. Enter FA2-11 at the runway temperature 15°C, right horizontally to the pressure altitude of 4000 feet, down vertically to the aircraft gross weight 11,800 pounds, left horizontally to the baseline. Draw a line that parallels the guideline. Assume an engine failure at 120 KIAS and it is desired to find the distance necessary to accelerate to 160 KIAS. Enter the chart at the no-wind groundspeed of 110 knots (120 minus 10 knots headwind) and 150 knots (160 minus 10 knots headwind). Read the distances for 110 knots no wind (3600) and 150 knots no wind (7400). The difference between the noted distances (7400 minus 3600) is 3800 feet and is the distance necessary to accelerate to 160 KIAS.

TAKEOFF AND LANDING
WIND COMPONENTS

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST** (20 & 10 KNOT CROSSWIND COMPONENTS ARE CALCULATED)

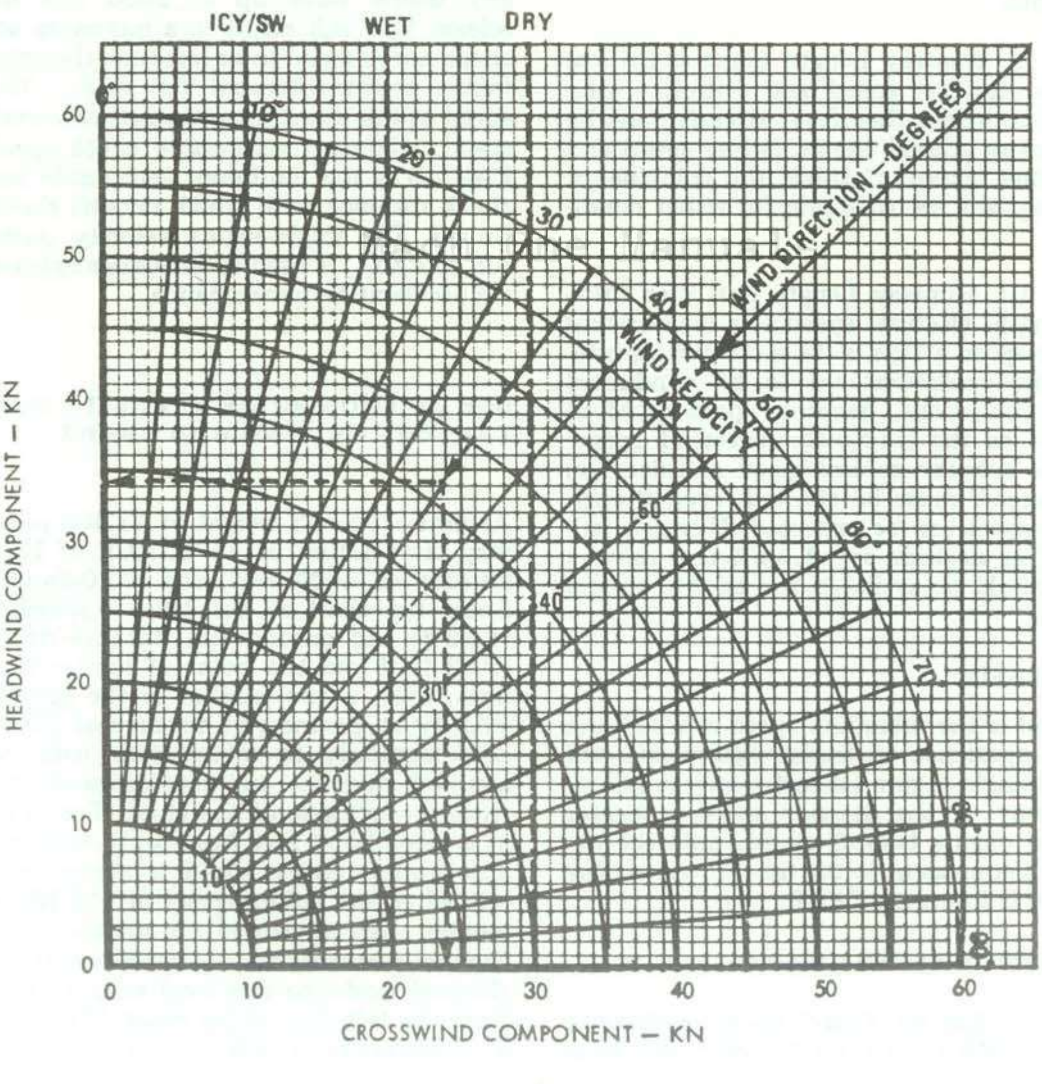
ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

Note

ENTER CHART WITH STEADY WIND TO DETERMINE HEADWIND COMPONENT AND WITH MAXIMUM GUST VELOCITY TO DETERMINE CROSSWIND COMPONENT.

MAXIMUM RECOMMENDED CROSSWIND COMPONENT — · — · — ·

SW – STANDING WATER



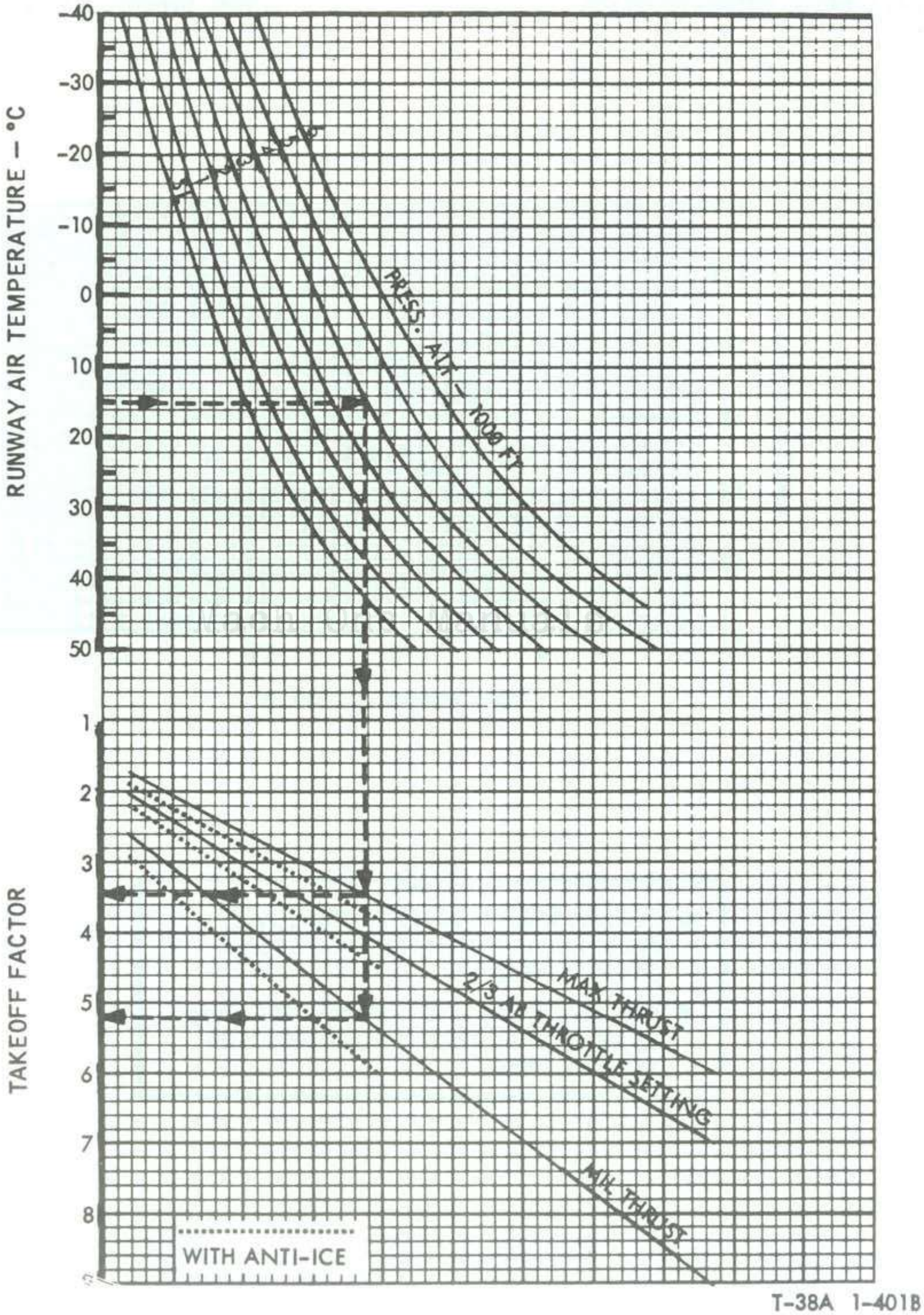
T-38A 1-400C

FA2-1.

TAKEOFF FACTOR

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



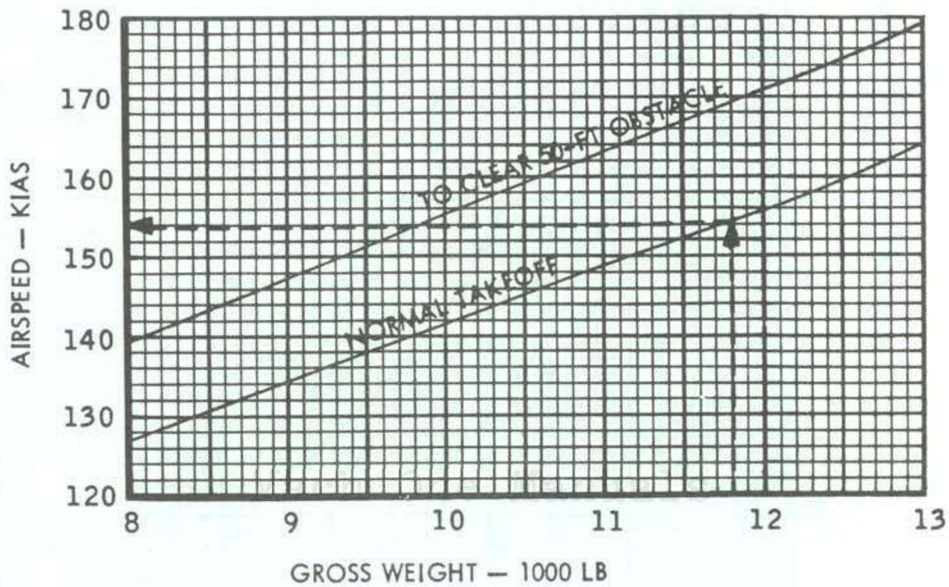
FA2-2.

TAKEOFF SPEED

FLAPS — 60%

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

- FOR MIL THRUST TAKEOFF, ADD ΔV_M FROM TAKEOFF DISTANCE CHART TO TAKEOFF SPEED.
- FOR SINGLE-ENGINE TAKEOFF, ADD ΔV_{SE} FROM CRITICAL FIELD LENGTH CHART TO TAKEOFF SPEED.

T-38A 1-402 E

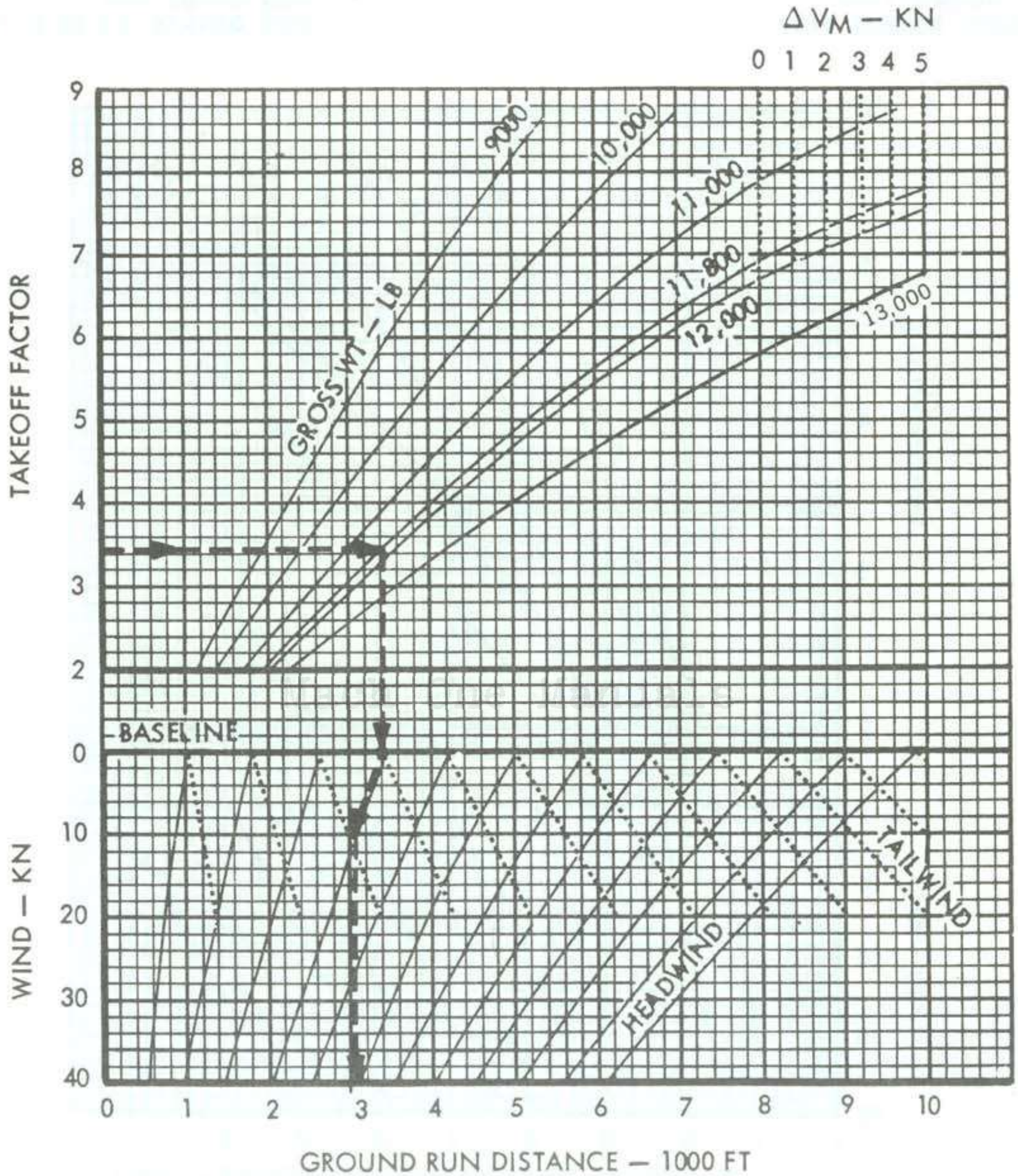
FA2-3.

TAKEOFF DISTANCE

DRY, HARD-SURFACED RUNWAY
FLAPS — 60%

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

- ADD ΔV_M TO TAKEOFF SPEED (FA2-3)
- INCREASE GROUND RUN DISTANCE 5 PERCENT FOR EACH PERCENT OF UPHILL RUNWAY SLOPE.
- WITH THE WSSP INSTALLED, ADD 6 PERCENT TO THE COMPUTED GROUND RUN DISTANCE

T-38A 1-403 D

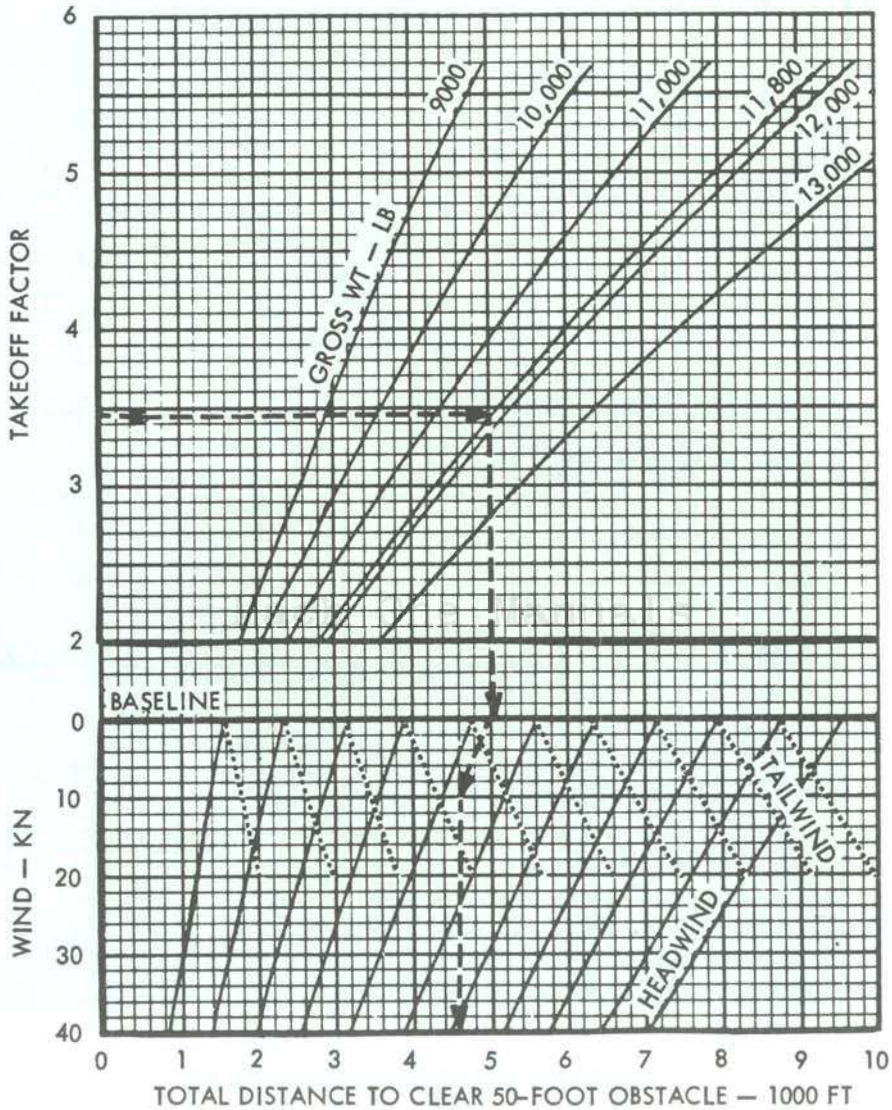
FA2-4.

TAKEOFF DISTANCE TO CLEAR 50-FOOT OBSTACLE

DRY, HARD-SURFACED RUNWAY
FLAPS — 60%

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

INCREASE TOTAL DISTANCE 5 PERCENT FOR EACH PERCENT OF UPHILL RUNWAY SLOPE.

T-38A 1-404 D

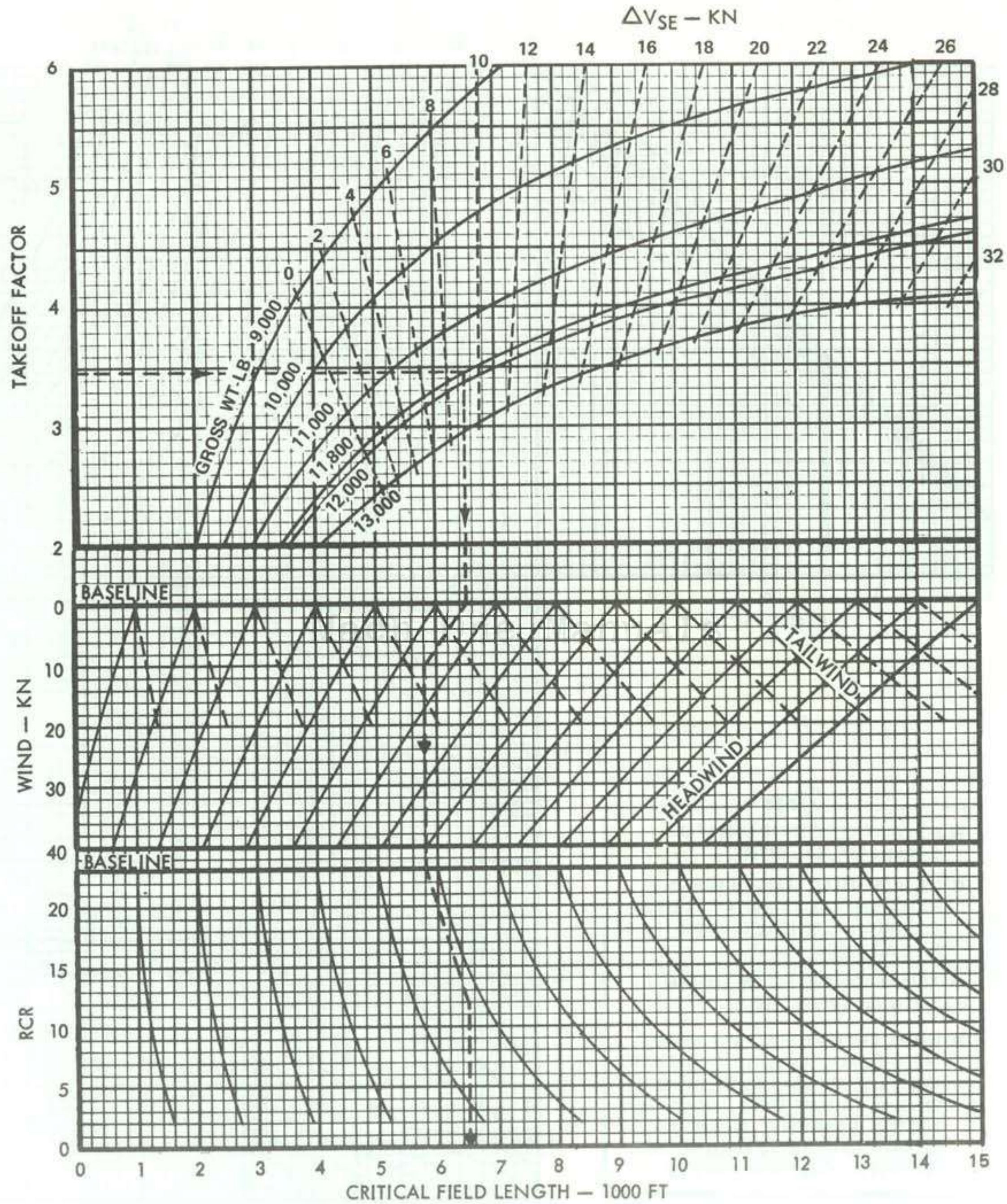
FA2-5.

CRITICAL FIELD LENGTH

MAX THRUST
FLAPS — 60%

MODEL: T-38A
DATE: 1 AUGUST 1981
DATA BASIS: ESTIMATED DATA

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

- FOR SINGLE-ENGINE TAKEOFF SPEED, ADD ΔV_{SE} TO TAKEOFF SPEED.
- INCREASE CRITICAL FIELD LENGTH 5 PERCENT FOR EACH PERCENT OF UPHILL RUNWAY SLOPE.

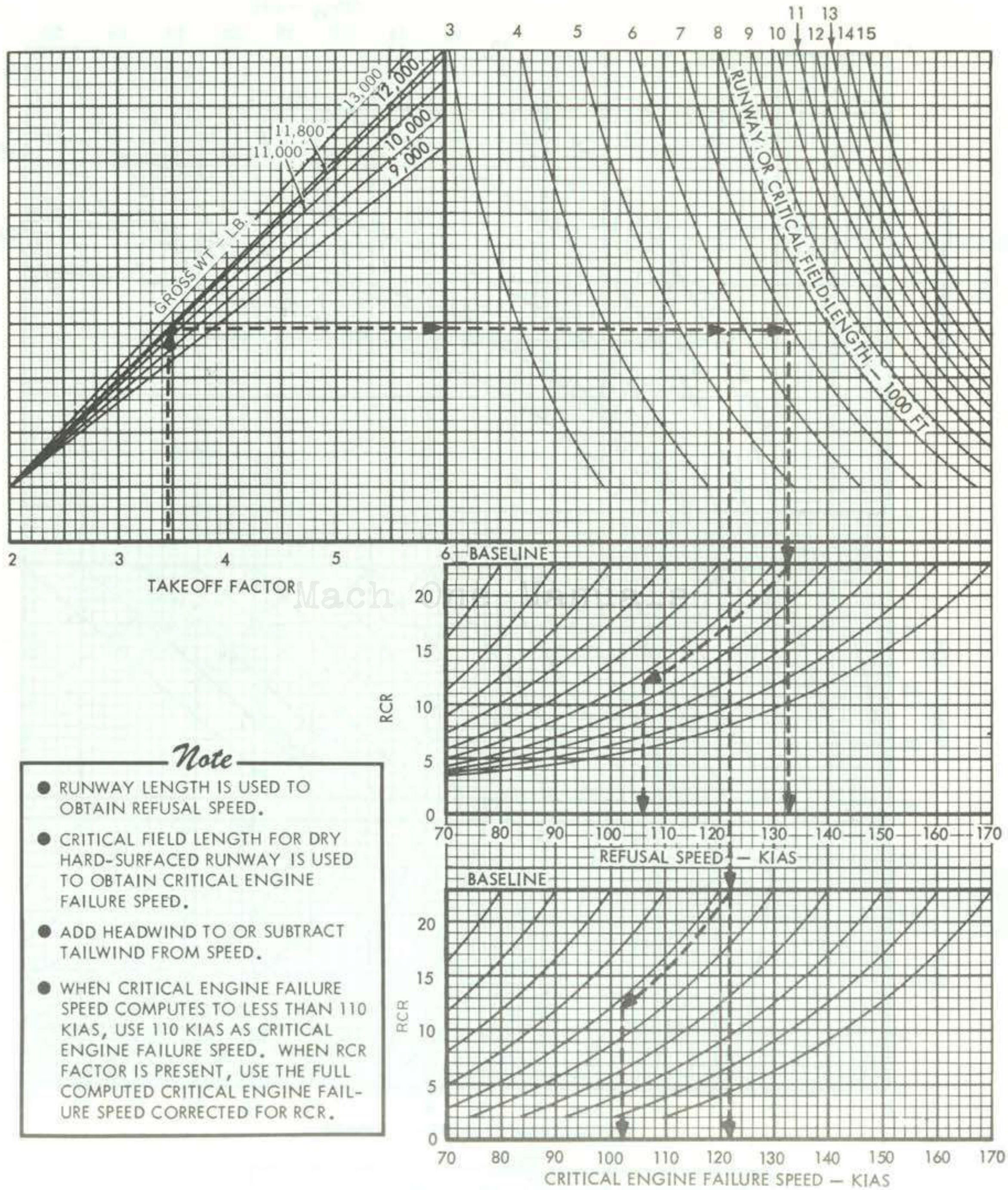
FA2-6.

REFUSAL SPEED OR CRITICAL ENGINE FAILURE SPEED

MAX THRUST
FLAPS — 60%

MODEL: T-38A
DATE: 1 AUGUST 1981
DATA BASIS: ESTIMATED DATA

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

- RUNWAY LENGTH IS USED TO OBTAIN REFUSAL SPEED.
- CRITICAL FIELD LENGTH FOR DRY HARD-SURFACED RUNWAY IS USED TO OBTAIN CRITICAL ENGINE FAILURE SPEED.
- ADD HEADWIND TO OR SUBTRACT TAILWIND FROM SPEED.
- WHEN CRITICAL ENGINE FAILURE SPEED COMPUTES TO LESS THAN 110 KIAS, USE 110 KIAS AS CRITICAL ENGINE FAILURE SPEED. WHEN RCR FACTOR IS PRESENT, USE THE FULL COMPUTED CRITICAL ENGINE FAILURE SPEED CORRECTED FOR RCR.

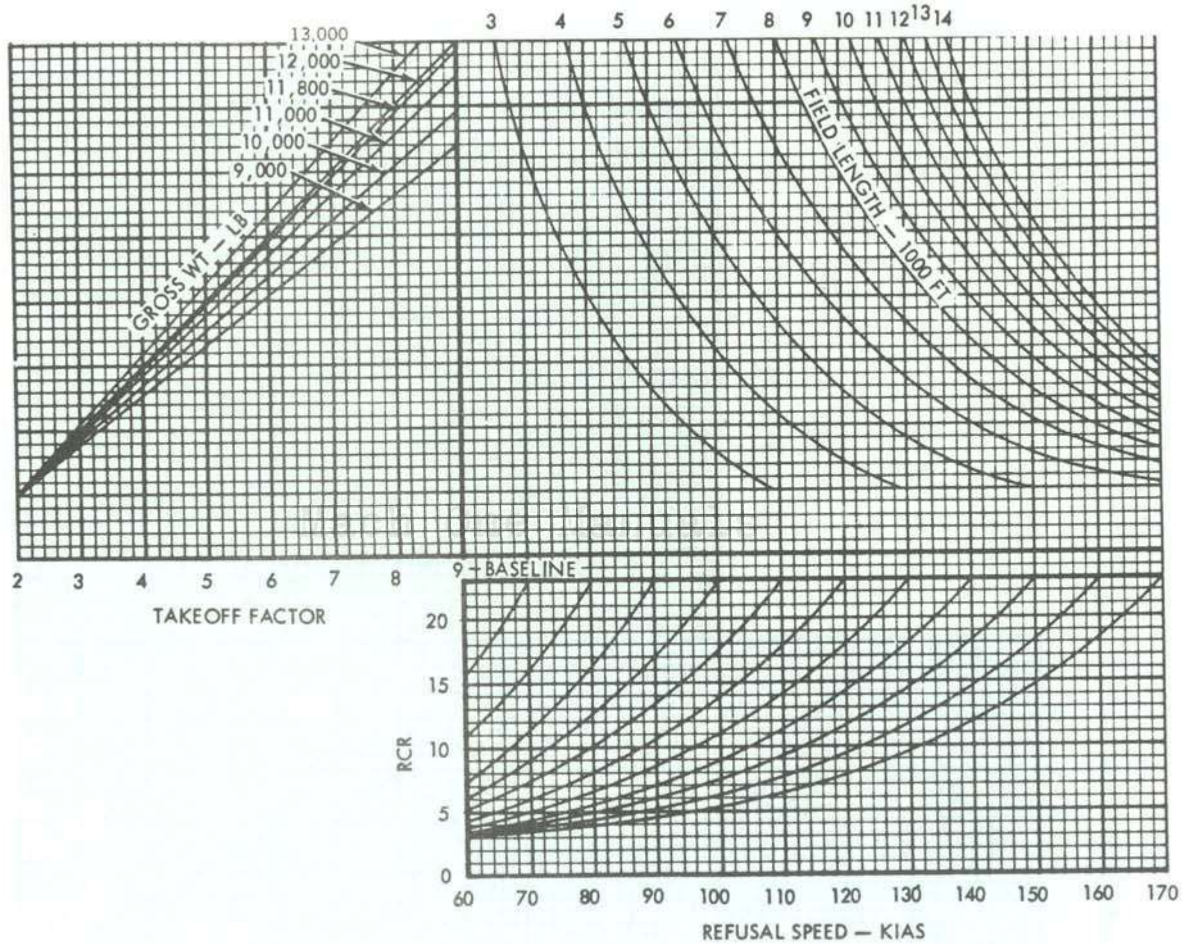
FA2-7

REFUSAL SPEED

MIL THRUST
FLAPS — 60%

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

ADD HEADWIND TO OR SUBTRACT TAILWIND FROM SPEED.

T-38A 1-407C

FA2-8.

DECISION SPEED

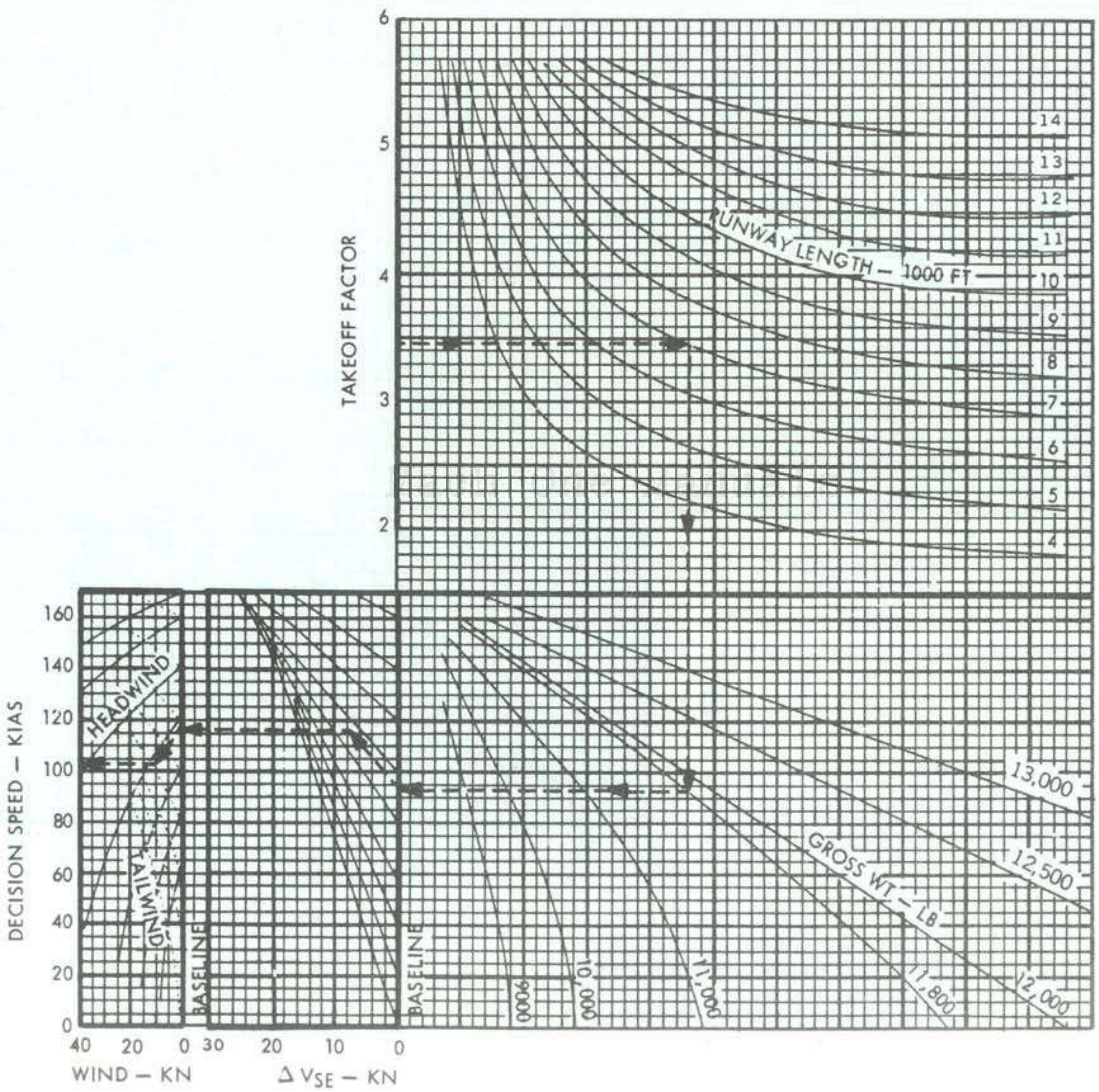
MAX THRUST
DRY, HARD-SURFACED RUNWAY
FLAPS – 60%

MODEL: T-38A
DATE: **1 JULY 1978**
DATA BASIS: **ESTIMATED DATA**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

Note

OBTAIN ΔV_{SE} FROM CRITICAL FIELD LENGTH CHART.



T-38A 1-409 A

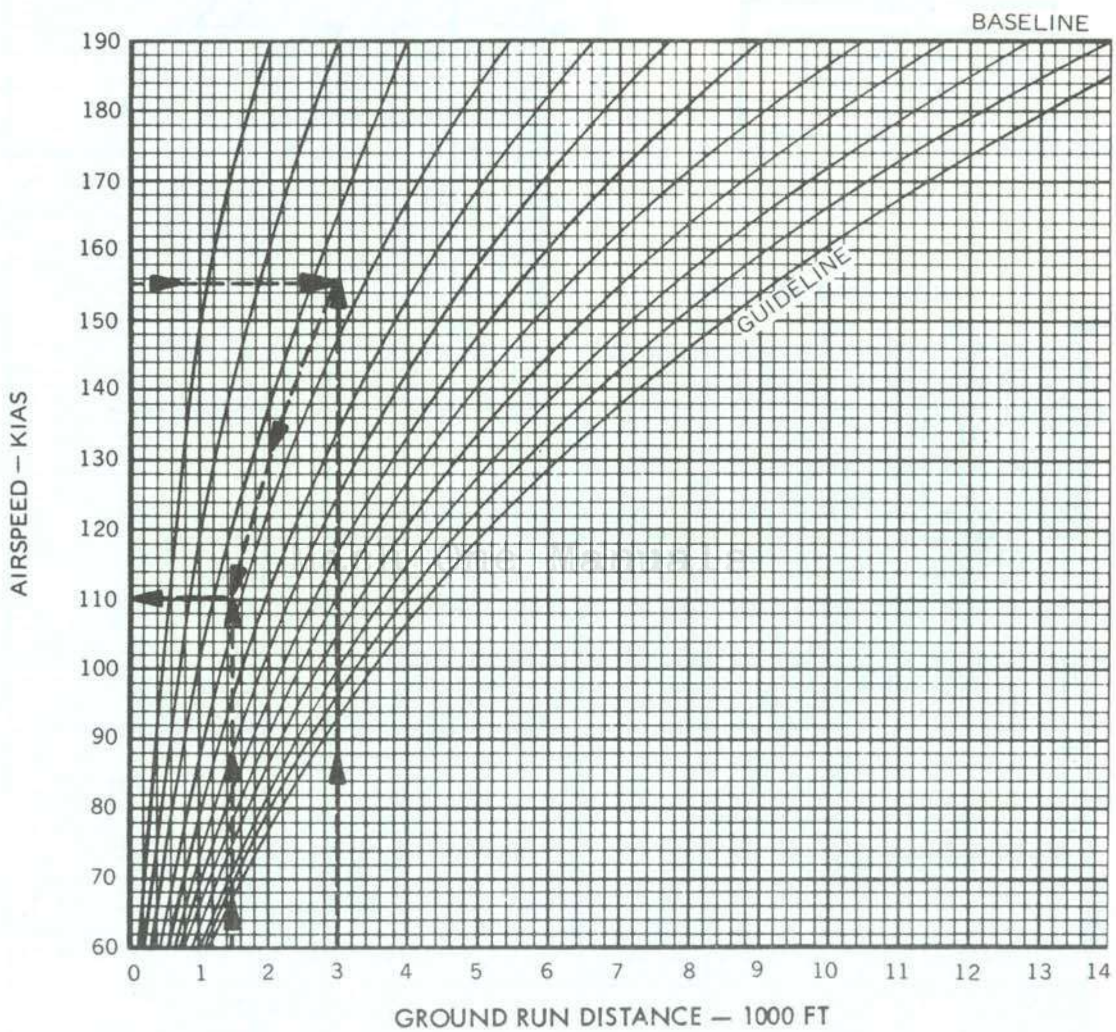
FA2-9.

VELOCITY DURING TAKEOFF GROUND RUN

DRY, HARD-SURFACED RUNWAY
FLAPS — 60%

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

TO COMPUTE MACS, SUBTRACT 3 KNOTS FOR EACH 1000 FEET OF RUNWAY IN EXCESS OF THE CRITICAL FIELD LENGTH, NOT TO EXCEED 10 KNOTS.

T-38A 1-410 F

FA2-10

VELOCITY DURING TAKEOFF GROUND RUN

MAXIMUM THRUST
FLAPS — 60%

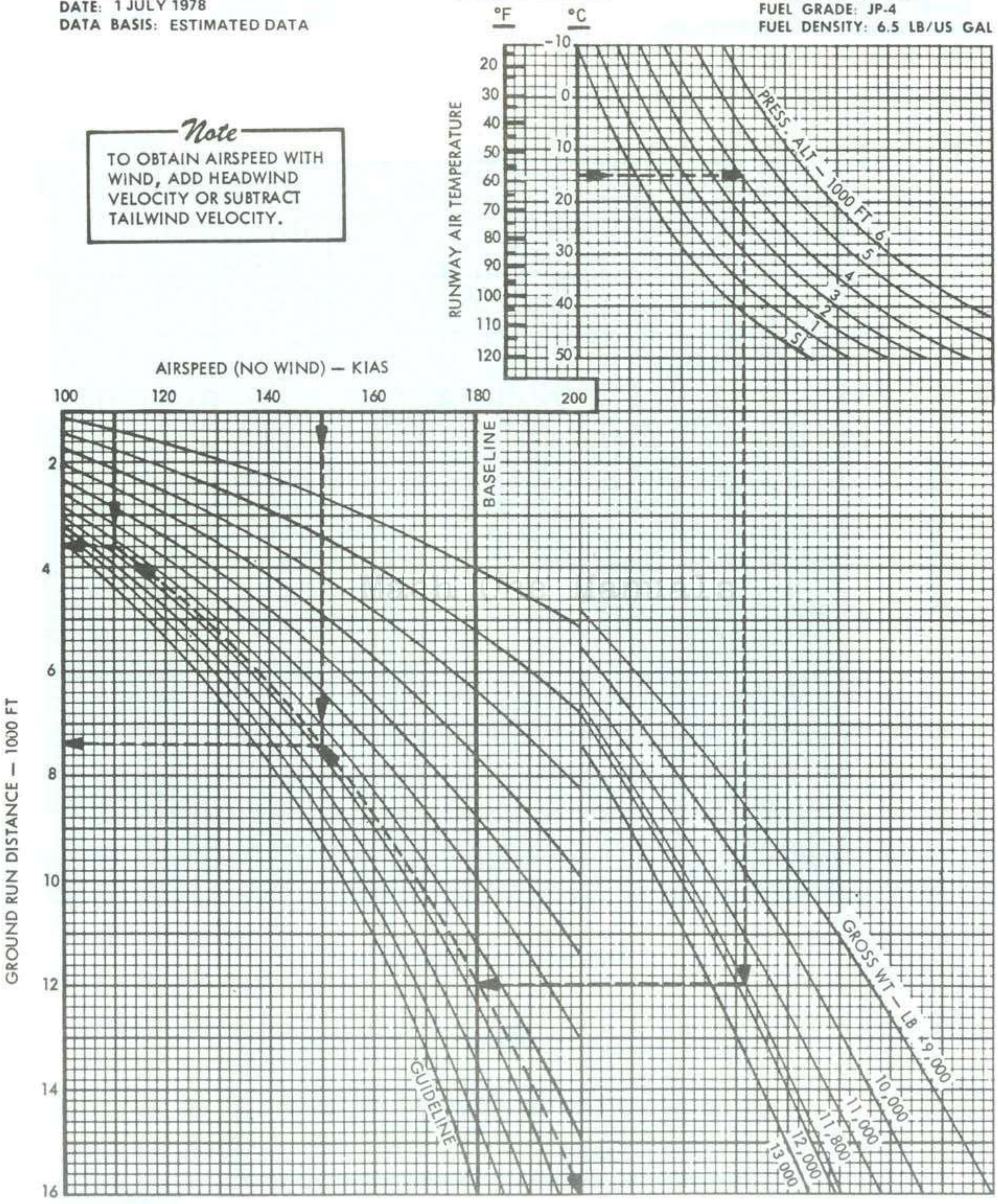
SINGLE ENGINE

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

Note

TO OBTAIN AIRSPEED WITH WIND, ADD HEADWIND VELOCITY OR SUBTRACT TAILWIND VELOCITY.



T-38A 1-411B

FA2-11.

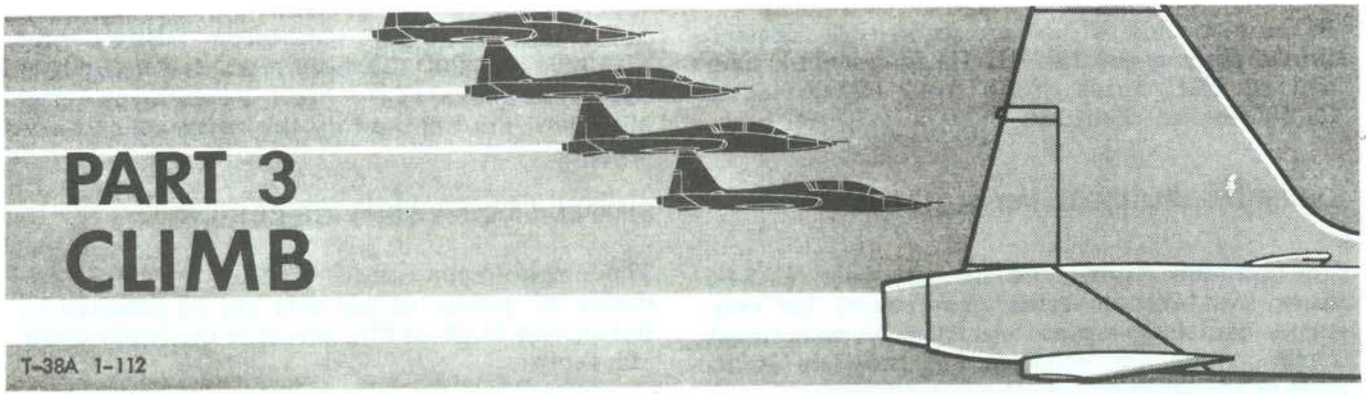


TABLE OF CONTENTS

PURPOSE OF CHARTS.

The charts provide a means of determining the aircraft climb performance. Included are ceilings to which the aircraft may climb in the performance of missions.

CLIMB CHARTS.

The climb charts (FA3-1 thru FA3-5) show the climb performance for MIL thrust for both two engines and single engine and MAX thrust for two engines. Two-engine MIL and MAX thrust climb charts are included for both restricted and unrestricted climb schedules. The restricted climb charts (FA3-1 and FA3-3) show performance data which reflects a MIL thrust climb at 300 KCAS to 10,000 feet followed by a level acceleration to unrestricted climb speed and continuation of climb. The restricted climb charts should be used for all climbs not performed in a military climb corridor. The unrestricted climb charts MIL and MAX THRUST CLIMB (FA3-2 and FA3-4) are used when a military climb corridor is available. All of the charts show climb performance in terms of gross weight versus fuel used, time, and distance. Climb speed schedules and allowances prior to climb are provided on each chart. The charts require successive approximations when climbing from an altitude other than sea level. The fuel, air distance, and time shown include the effects of kinetic energy change and weight reduction during climb. The fuel allowance for taxi, takeoff, and acceleration to climb speed is noted and should be subtracted from gross weight before entering the chart when climb follows a takeoff.

USE OF CLIMB CHARTS.

The chase-thru lines on the MIL thrust restricted climb chart (FA3-1) show 565 pounds of fuel used in climb from sea level to 35,000 feet pressure altitude at an initial gross weight of 11,500 pounds and a temperature 10°C hotter than standard day. The corresponding time and air distance are 8.3 minutes and 67 nautical miles, respectively. Had the initial altitude been 15,000 feet and the gross weight 11,270 pounds, by using successive approximations, the sea level gross weight would be 11,500 pounds (same as above). From sea level to 15,000 feet, the fuel used, time, and distance are 290 pounds, 3.0 minutes, and 23 miles, respectively. Then from 15,000 feet to 35,000 feet, the fuel used is 275 pounds (565 − 290), 5.3 minutes (8.3 − 3.0), and the distance is 44 nautical miles (67 − 23). The MIL thrust climb charts (FA3-2) show that 480 pounds of fuel are required in climb from sea level to 35,000 feet, and correspondingly, it takes 7.3 minutes and 62 nautical miles. This climb is started at 11,400 pounds; however, since

95 more pounds of fuel are required for acceleration to climb speed, the MIL thrust restricted climb and the MIL thrust climb from 15,000 feet to 35,000 feet are identical.

OPTIMUM CRUISE-CLIMB ALTITUDE.

The optimum cruise-climb altitude chart (FA3-6) shows this altitude versus gross weight for two-engine and single-engine operation. Normal thrust cruise ceilings are included and show the limitations of the optimum cruise-climb altitude.

USE OF OPTIMUM CRUISE-CLIMB ALTITUDE CHART.

Assume two-engine operation and a gross weight of 10,500 pounds at end of climb. The chase-thru lines show optimum cruise-climb altitude from FA3-6 is 41,200. The optimum cruise-climb altitude will increase as the fuel is used in cruise. This altitude is not limited by the normal thrust cruise ceiling.

SINGLE-ENGINE SERVICE CEILING.

The single-engine service ceiling chart (FA3-7) shows the service ceiling that can be attained by flying with MAX or MIL thrust at the climb schedules shown.

USE OF SINGLE-ENGINE SERVICE CEILING CHART.

The chase-thru lines in FA3-7 show a single-engine service ceiling of 24,500 feet for MIL thrust and a gross weight of 10,500 pounds.

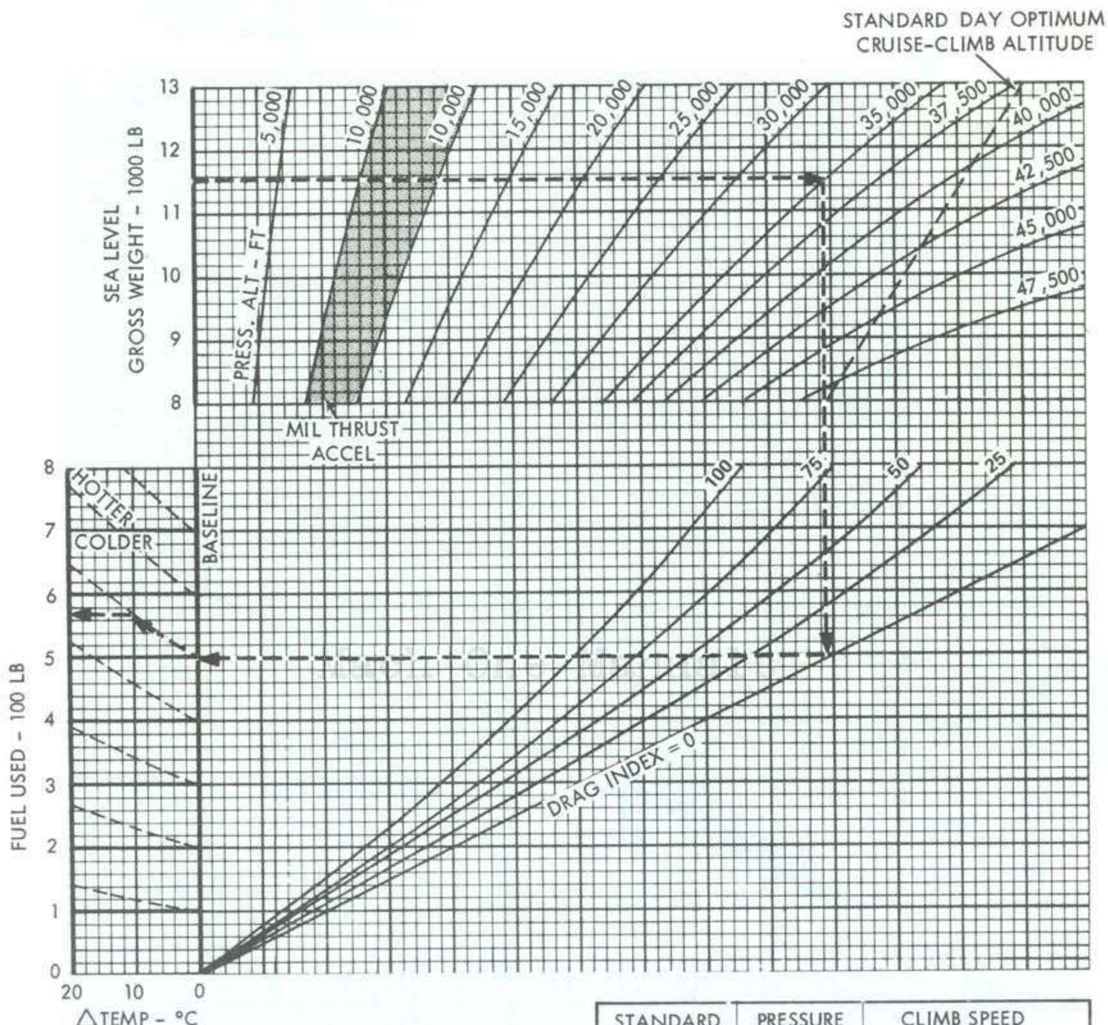
MIL THRUST CLIMB

MODEL: T-38A
DATE: **1 OCTOBER 1976**
DATA BASIS: **ESTIMATED DATA**

RESTRICTED CLIMB SCHEDULE

FUEL USED

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FUEL, TIME, AND DISTANCE ALLOWANCE PRIOR TO CLIMB	
GROUND TAXI: 18 LB/MIN	
FROM BRAKE RELEASE TO BEGIN CLIMB USING MAXIMUM THRUST	
FUEL (LB)	190
TIME (MIN)	0.6
DISTANCE (NMI)	2.0

STANDARD DAY TEMP - °C	PRESSURE ALTITUDE (FEET)	CLIMB SPEED SCHEDULE	
		KCAS	TMN
15.0	SL	300	0.45
5.1	5,000	300	0.50
-4.8	10,000	300	0.55
-4.8	10,000	435	0.78
-14.7	15,000	406	0.79
-24.6	20,000	377	0.81
-34.5	25,000	349	0.83
-44.4	30,000	322	0.84
-54.3	35,000	295	0.86
-56.5 AT	40,000	264	0.87
37,000 FT	45,000	236	0.87
& ABOVE	50,000	210	0.87

T-38A 1-506(1)

FA3-1. (Sheet 1)

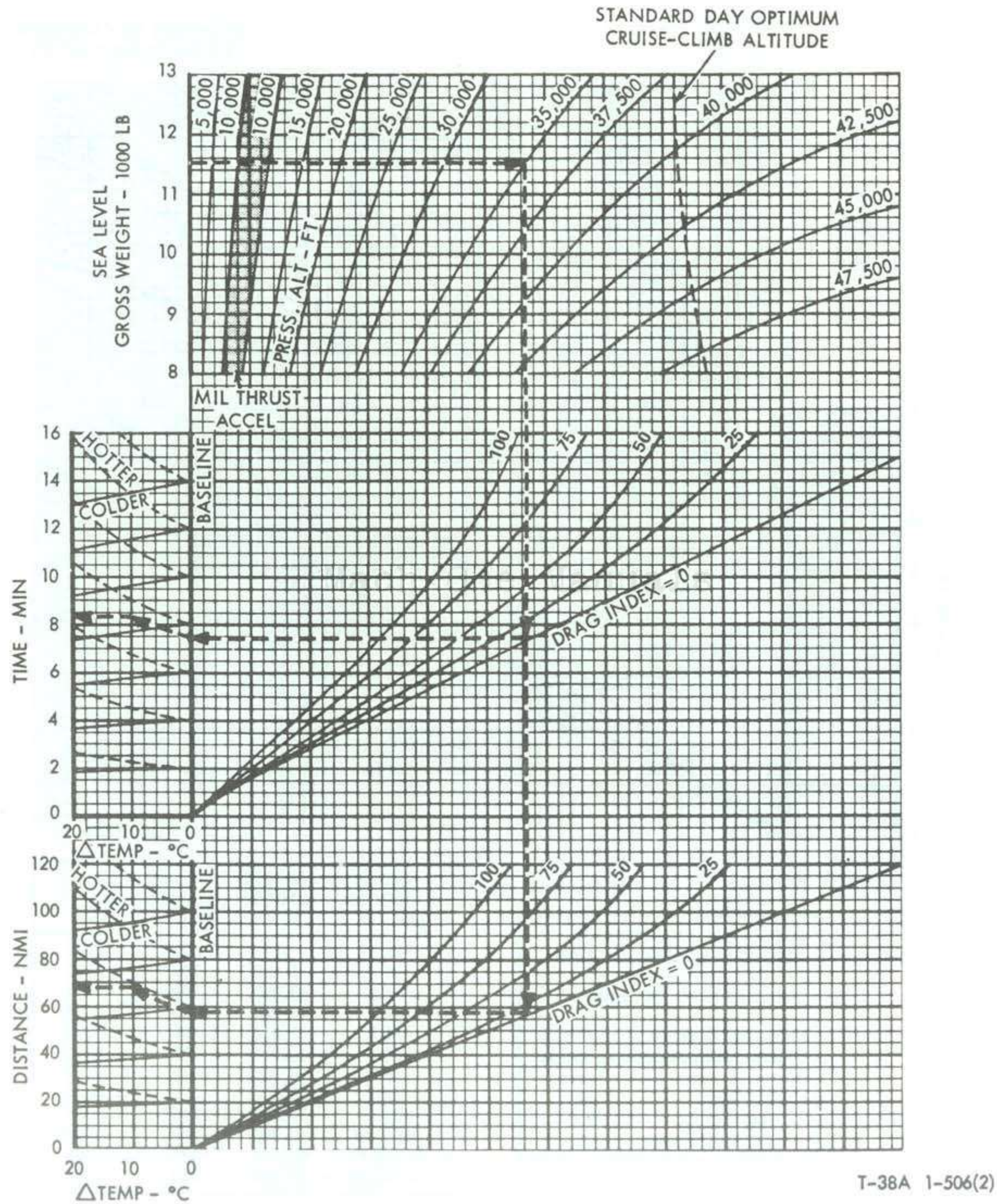
MIL THRUST CLIMB

RESTRICTED CLIMB SCHEDULE

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

TIME TO CLIMB AND DISTANCE TRAVELED

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

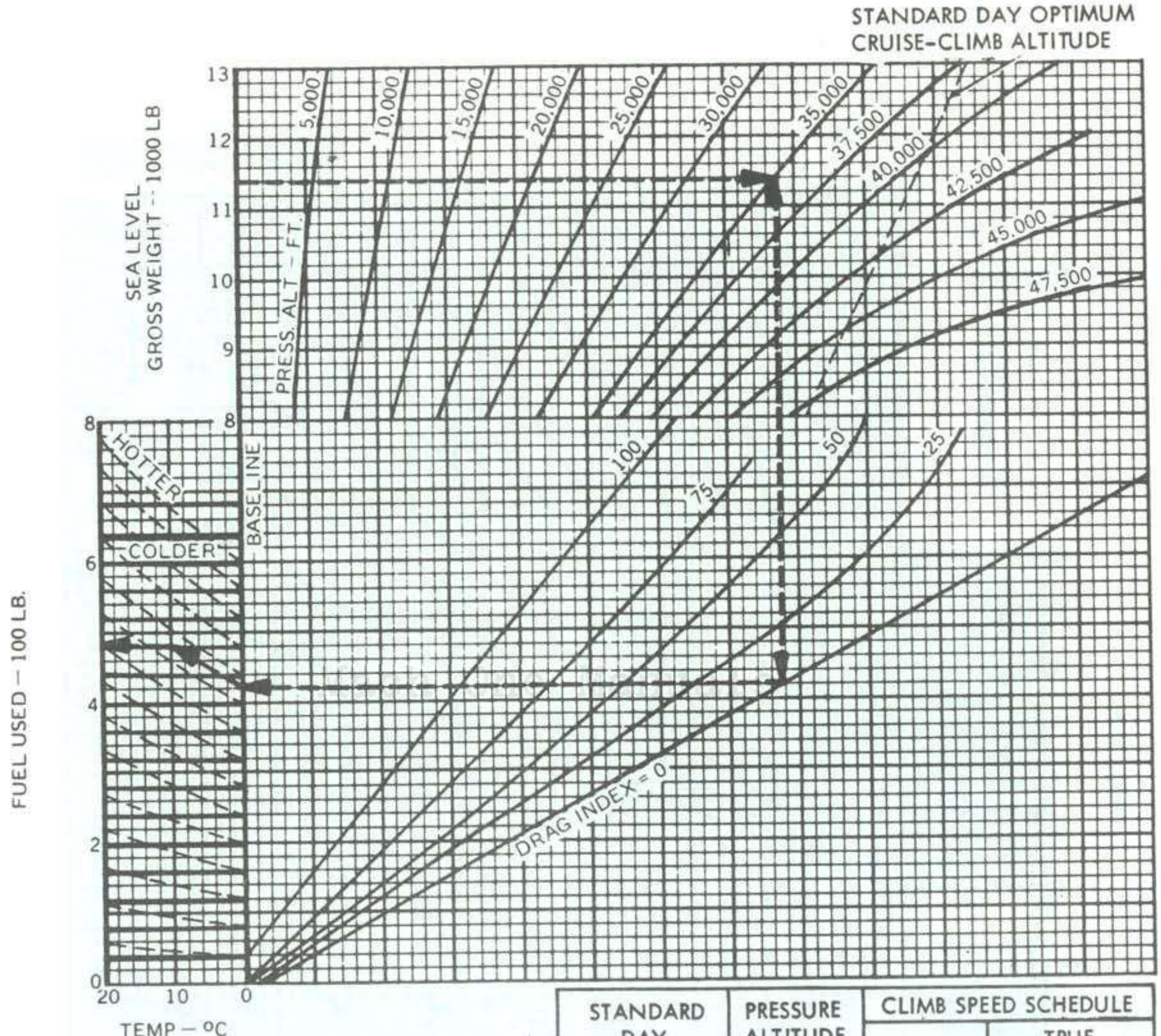


FA3-1. (Sheet 2 of 2)

MIL THRUST CLIMB
FUEL USED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FUEL, TIME, AND DISTANCE ALLOWANCE PRIOR TO CLIMB	
GROUND TAXI: 18 LB/MIN	
FROM BRAKE RELEASE TO BEGIN CLIMB USING MAXIMUM THRUST	
FUEL (LB)	285
TIME (MIN)	1.0
DISTANCE (NMI)	4.0

STANDARD DAY TEMP — °C	PRESSURE ALTITUDE — FEET	CLIMB SPEED SCHEDULE KCAS	CLIMB SPEED SCHEDULE TRUE MACH NO.
15.0	SEA LEVEL	496	0.75
5.1	5,000	466	0.76
-4.8	10,000	435	0.78
-14.7	15,000	406	0.79
-24.6	20,000	377	0.81
-34.5	25,000	349	0.83
-44.4	30,000	322	0.84
-54.3	35,000	295	0.86
-56.5 AT	40,000	264	0.87
37,000 FT	45,000	236	0.87
AND ABOVE	50,000	210	0.87

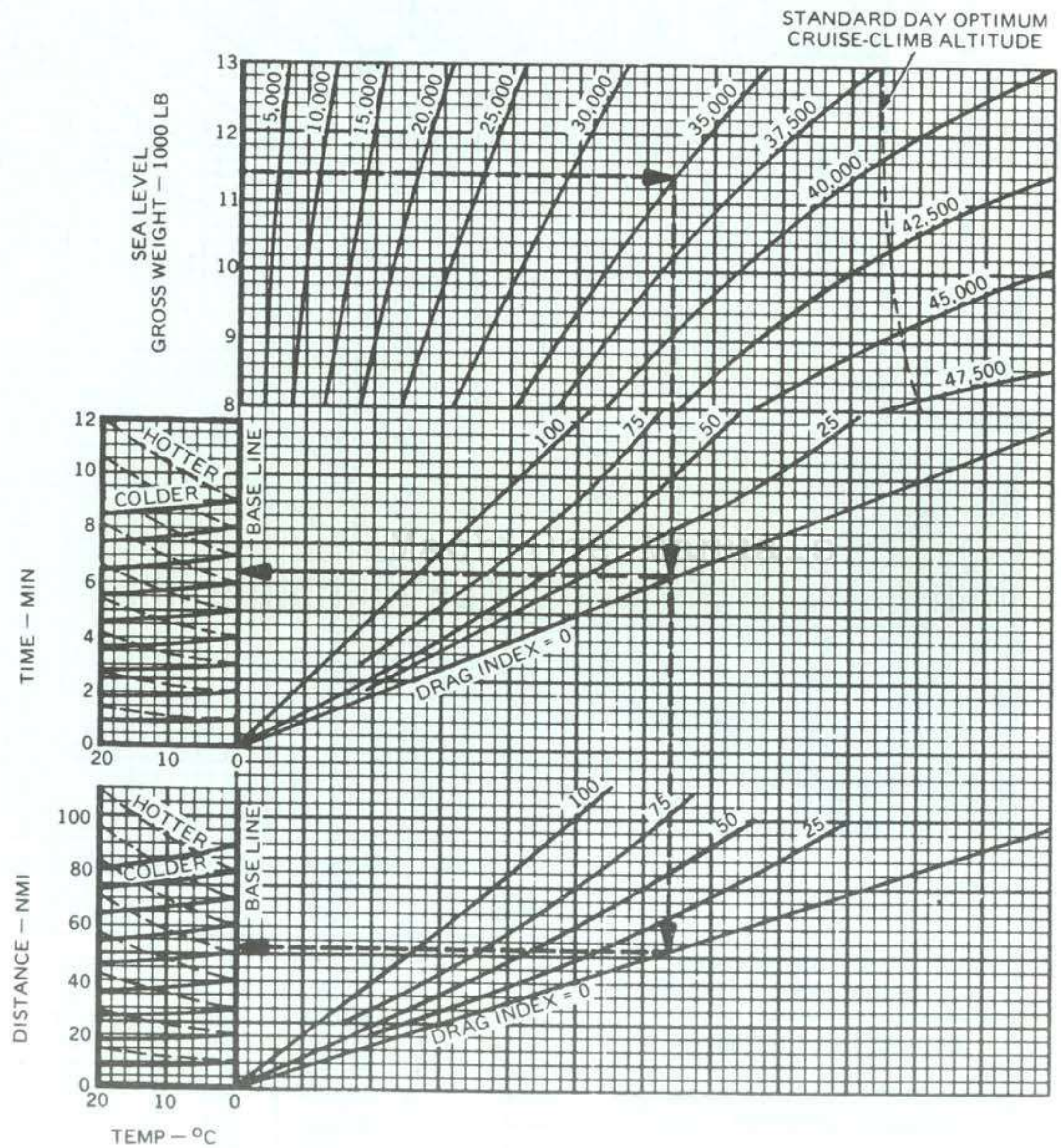
T-38A 1-501(1)C

FA3-2. (Sheet 1 of 2)

MIL THRUST CLIMB
TIME TO CLIMB AND DISTANCE TRAVELED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-501(2) C

FA3-2. (Sheet 2 of 2)

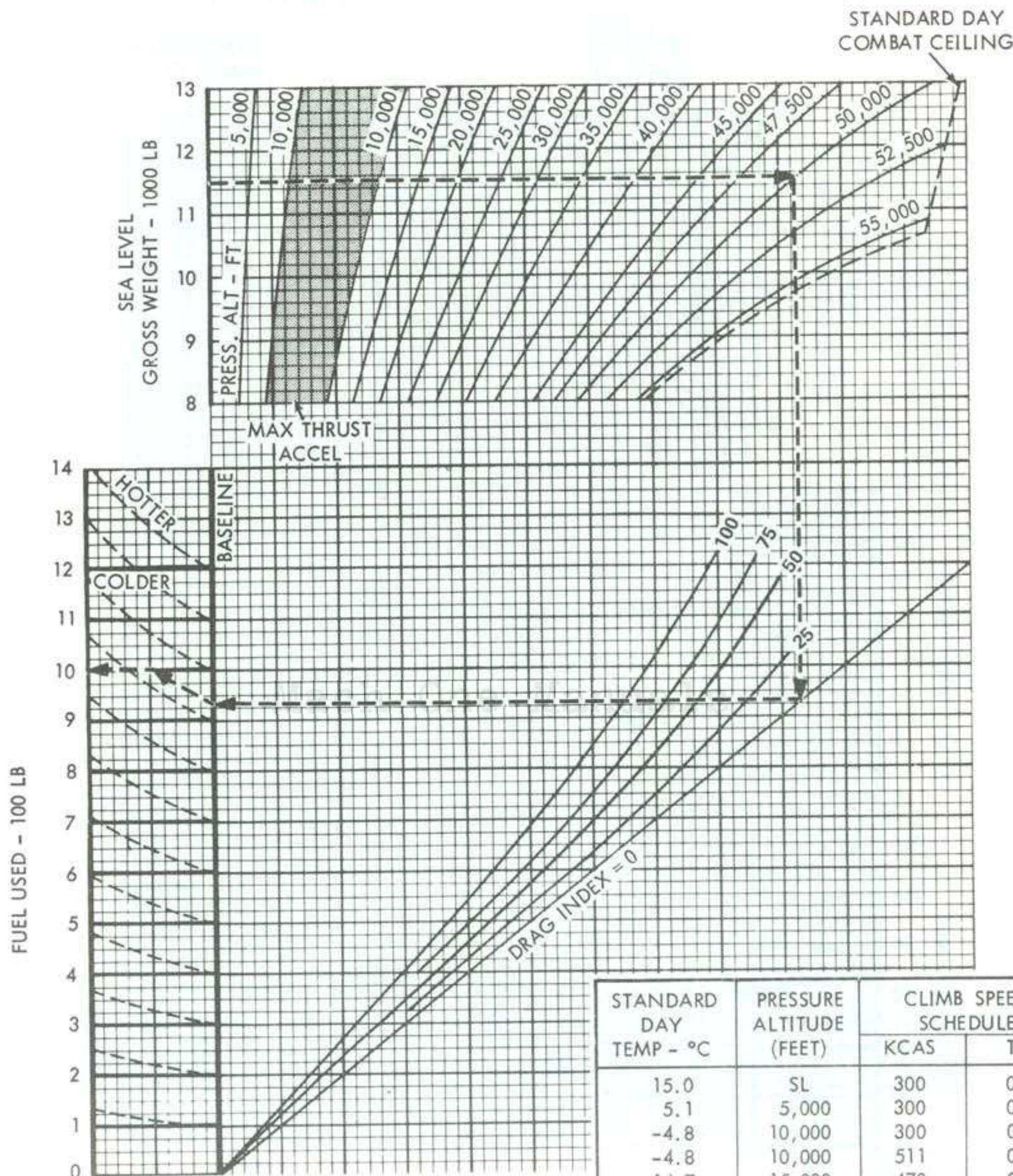
MAX THRUST CLIMB

RESTRICTED CLIMB SCHEDULE

FUEL USED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: **ESTIMATED DATA**

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



STANDARD DAY TEMP - °C	PRESSURE ALTITUDE (FEET)	CLIMB SPEED SCHEDULE	
		KCAS	TMN
15.0	SL	300	0.45
5.1	5,000	300	0.50
-4.8	10,000	300	0.55
-4.8	10,000	511	0.91
-14.7	15,000	470	0.91
-24.6	20,000	431	0.92
-34.5	25,000	393	0.92
-44.4	30,000	357	0.93
-54.3	35,000	322	0.93
-56.5 AT	40,000	287	0.93
37,000 FT	45,000	256	0.93
& ABOVE	50,000	228	0.93
	55,000	203	0.93

FUEL, TIME, AND DISTANCE ALLOWANCE PRIOR TO CLIMB	
GROUND TAXI: 18 LB/MIN	
FROM BRAKE RELEASE TO BEGIN CLIMB USING MAXIMUM THRUST	
FUEL (LB)	190
TIME (MIN)	0.6
DISTANCE (NMI)	2.0

T-38A 1-507(1)

FA3-3. (Sheet 1)

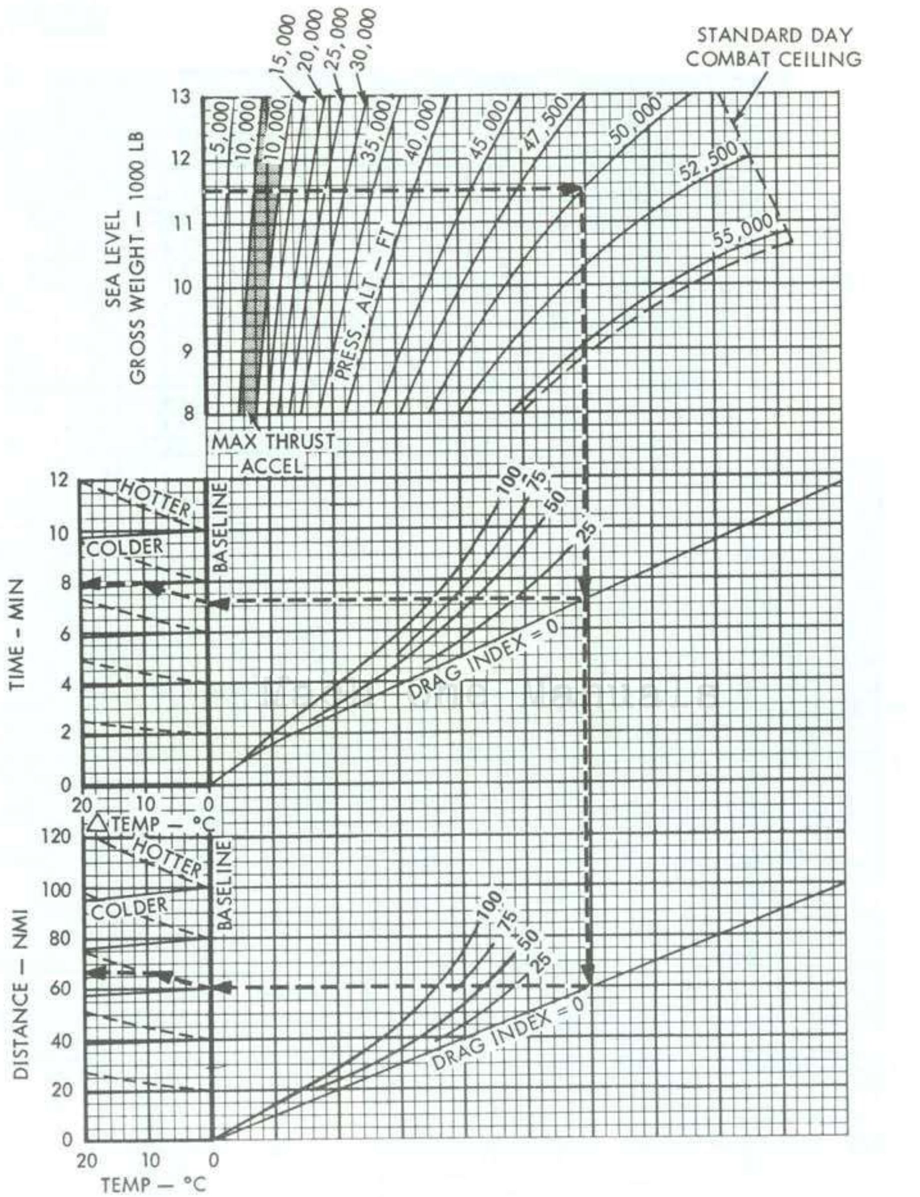
MAX THRUST CLIMB

RESTRICTED CLIMB SCHEDULE

TIME TO CLIMB AND DISTANCE TRAVELED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



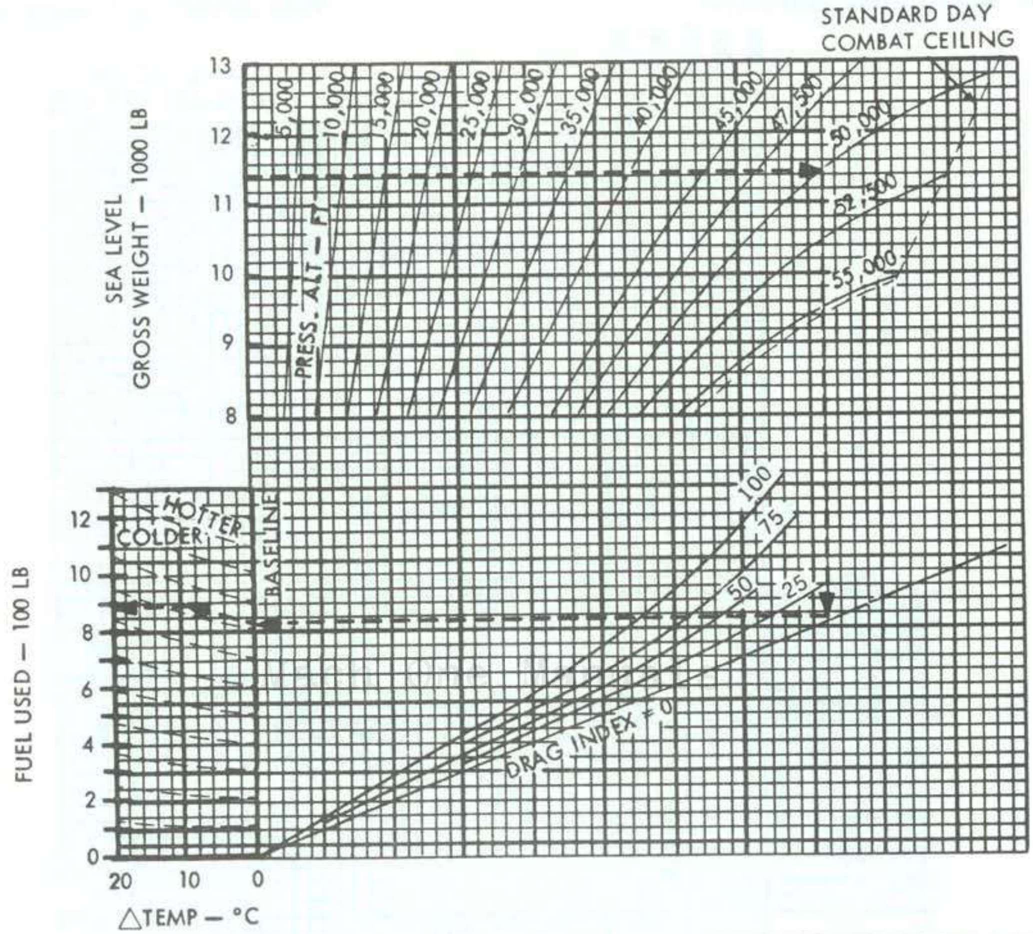
FA3-3. (Sheet 2)

T-38A 1-507(2)

MAX THRUST CLIMB
FUEL USED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FUEL, TIME, AND DISTANCE ALLOWANCE PRIOR TO CLIMB	
GROUND TAXI: 18 LB/MIN	
FROM BRAKE RELEASE TO BEGIN CLIMB USING MAXIMUM THRUST	
FUEL (LB)	315
TIME (MIN)	1.2
DISTANCE (NMI)	6.0

STANDARD DAY TEMP — °C	PRESSURE ALTITUDE — FEET	CLIMB SPEED SCHEDULE	
		KCAS	TRUE MACH NO.
15.0	SEA LEVEL	596	0.90
5.1	5,000	553	0.90
-4.8	10,000	511	0.91
-14.7	15,000	470	0.91
-24.6	20,000	431	0.92
-34.5	25,000	393	0.92
-44.4	30,000	357	0.93
-54.3	35,000	322	0.93
-56.5 AT	40,000	287	0.93
37,000 FT	45,000	256	0.93
AND ABOVE	50,000	228	0.93
	55,000	203	0.93

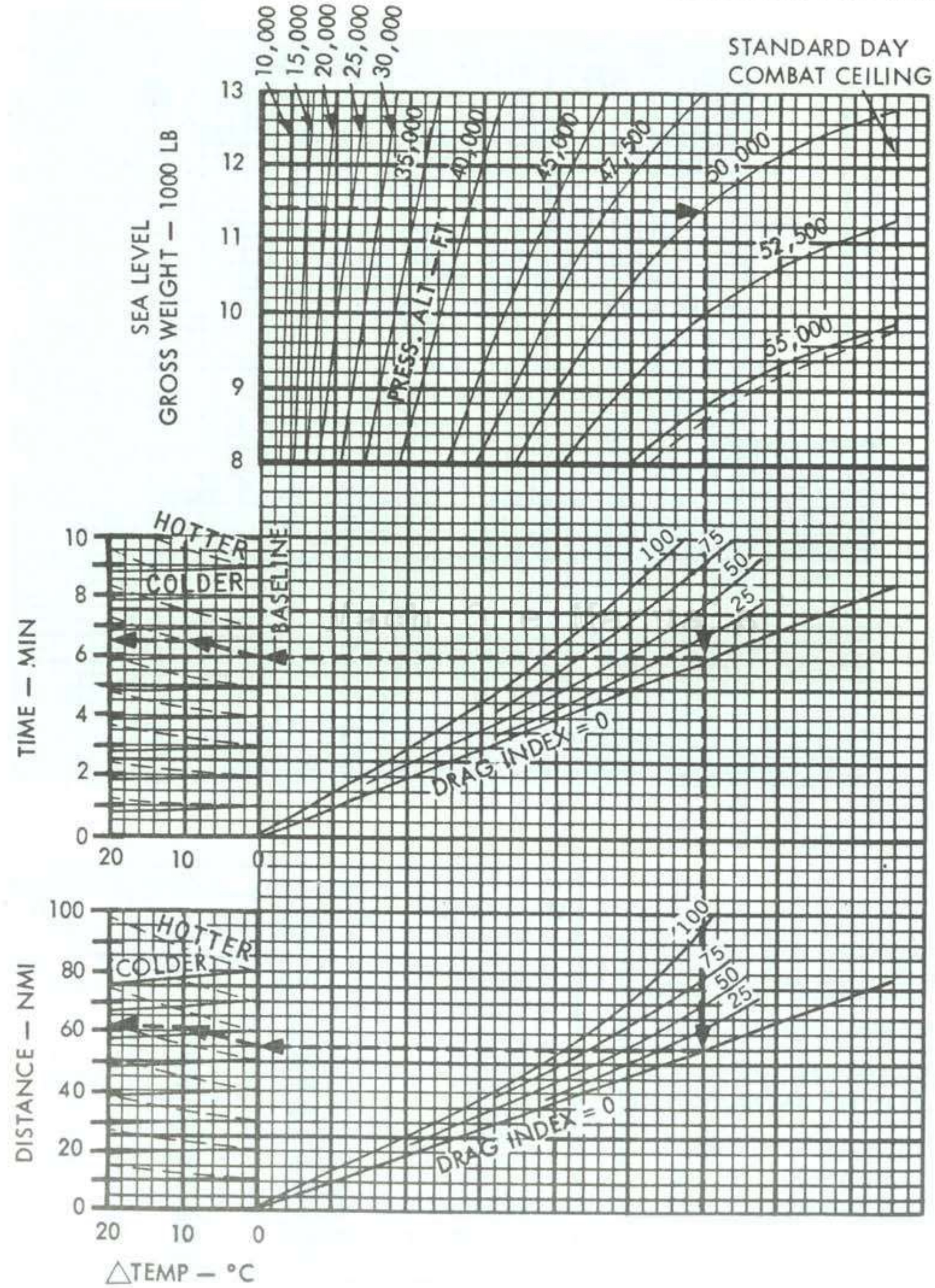
T-38A 1-500(1) C

FA3-4. (Sheet 1 of 2)

MAX THRUST CLIMB
TIME TO CLIMB AND DISTANCE TRAVELED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-500(2) C

FA3-4. (Sheet 2 of 2)

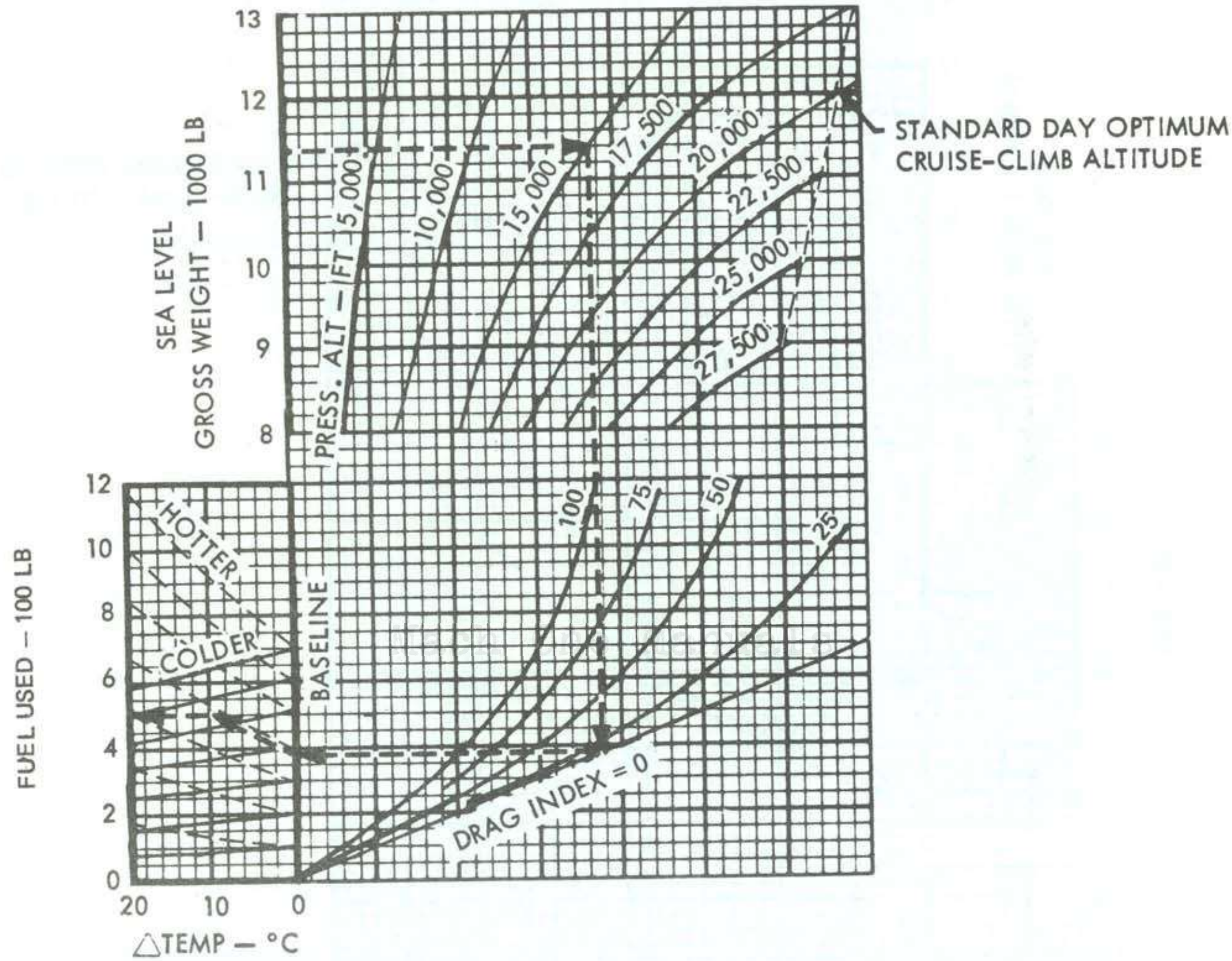
MIL THRUST CLIMB

FUEL USED

SINGLE ENGINE

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



STANDARD DAY TEMP — °C	PRESSURE ALTITUDE — FEET	CLIMB SPEED SCHEDULE	
		KCAS	TRUE MACH NO.
15.0	SEA LEVEL	281	0.43
5.1	5,000	278	0.46
- 4.8	10,000	271	0.49
-14.7	15,000	264	0.52
-24.6	20,000	256	0.56
-34.5	25,000	246	0.59
-44.4	30,000	227	0.61

T-38A 1-502(1) C

FA3-5. (Sheet 1 of 2)

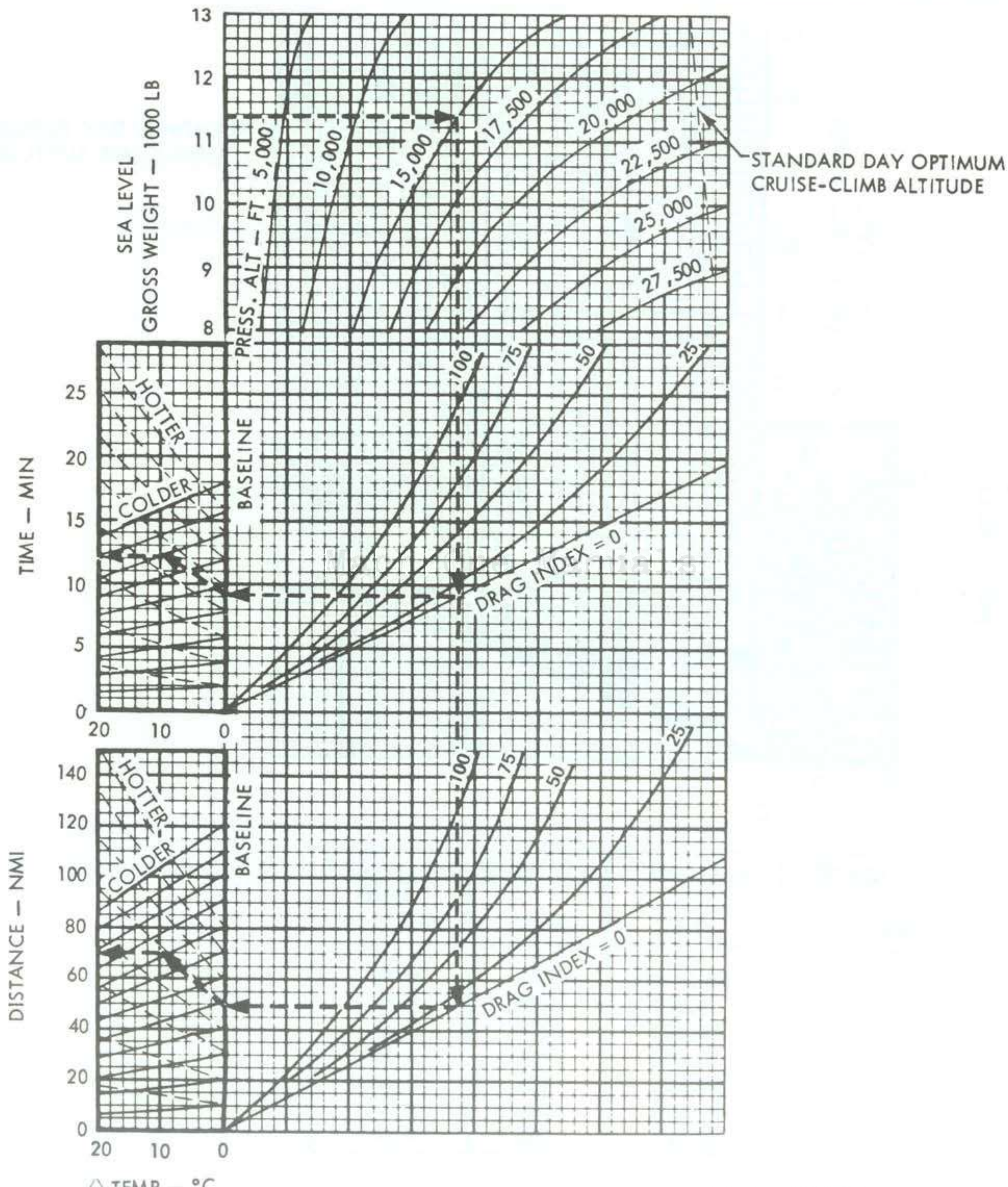
MIL THRUST CLIMB

TIME TO CLIMB AND DISTANCE TRAVELED

SINGLE ENGINE

MODEL: T-38A
DATE: 1 OCTOBER 1978
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-502(2)C

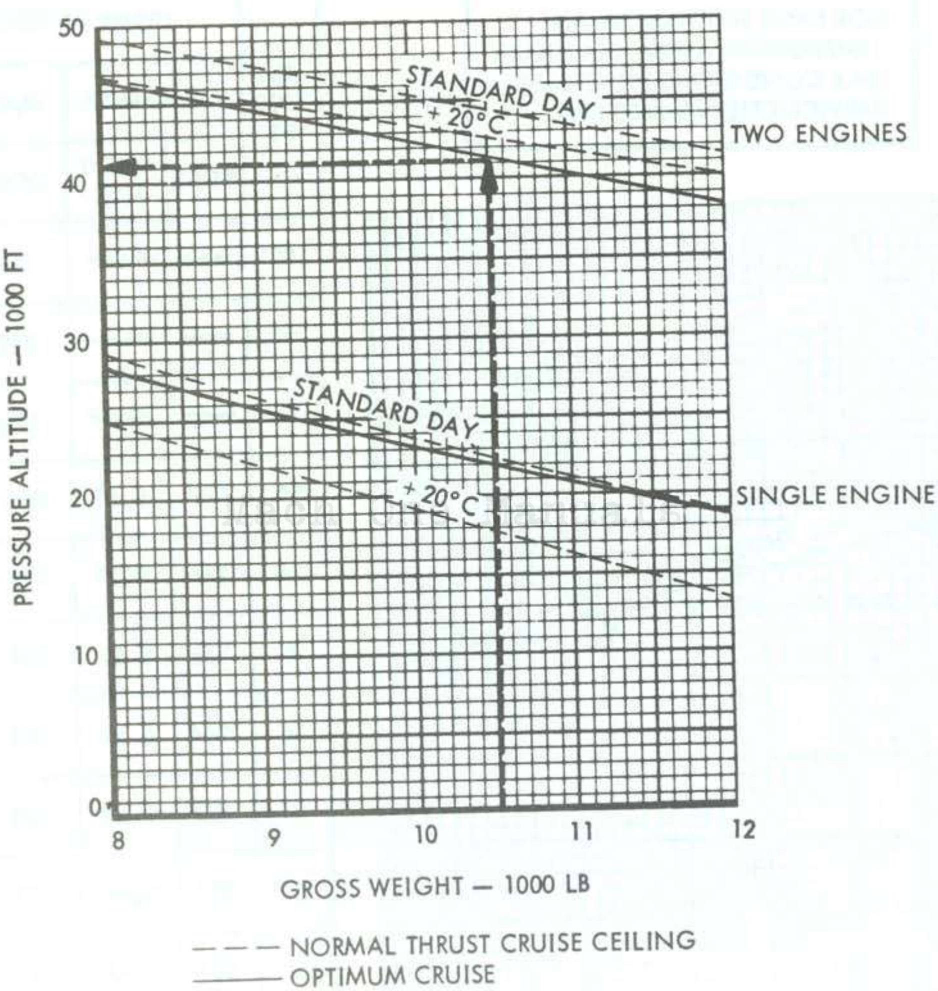
FA3-5. (Sheet 2 of 2)

OPTIMUM CRUISE-CLIMB ALTITUDE

DRAG INDEX = 0

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-503 B

FA3-6.

SINGLE ENGINE SERVICE CEILING

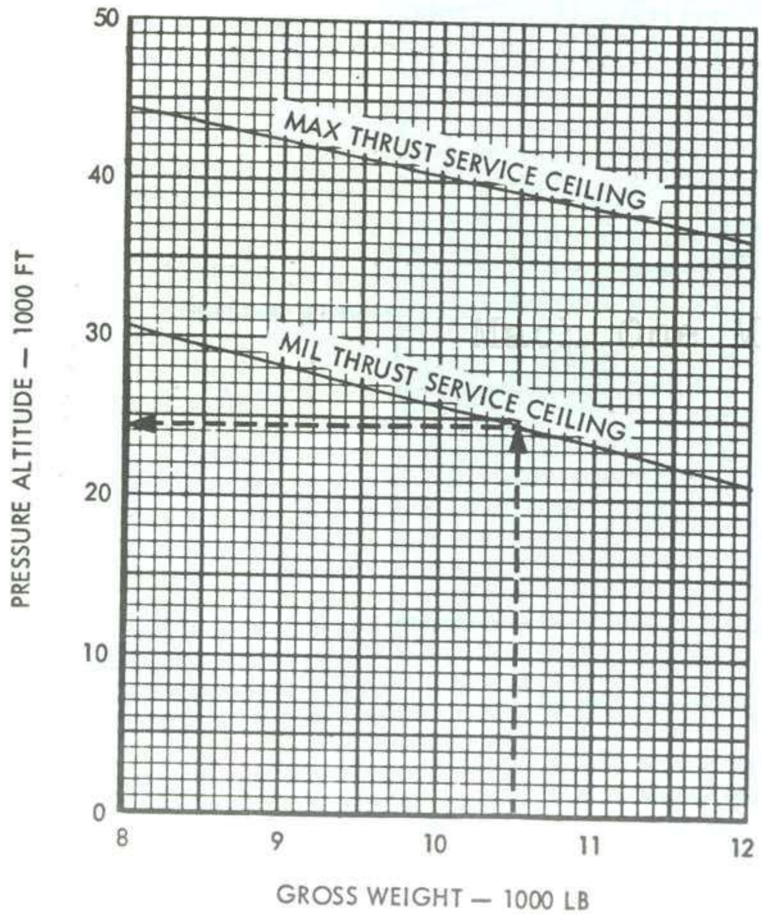
STANDARD DAY
DRAG INDEX = 0

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

Note

FOR EACH 10°C RISE IN AIR TEMPERATURE ABOVE STANDARD DAY CONDITIONS, DECREASE SERVICE CEILING 2600 FEET.



ALT 1000 FT	CLIMB SCHEDULE			
	MIL THRUST		MAX THRUST	
	KCAS	MACH NO.	KCAS	MACH NO.
45	—	—	216	0.80
40	—	—	242	0.80
35	—	—	270	0.80
30	227	0.61	295	0.78
25	246	0.59	313	0.75
20	256	0.56	331	0.72
15	264	0.52	349	0.69
10	272	0.49	365	0.65
5	278	0.46	377	0.62
SL	281	0.43	394	0.60

T-38A 1-505B

FA3-7.

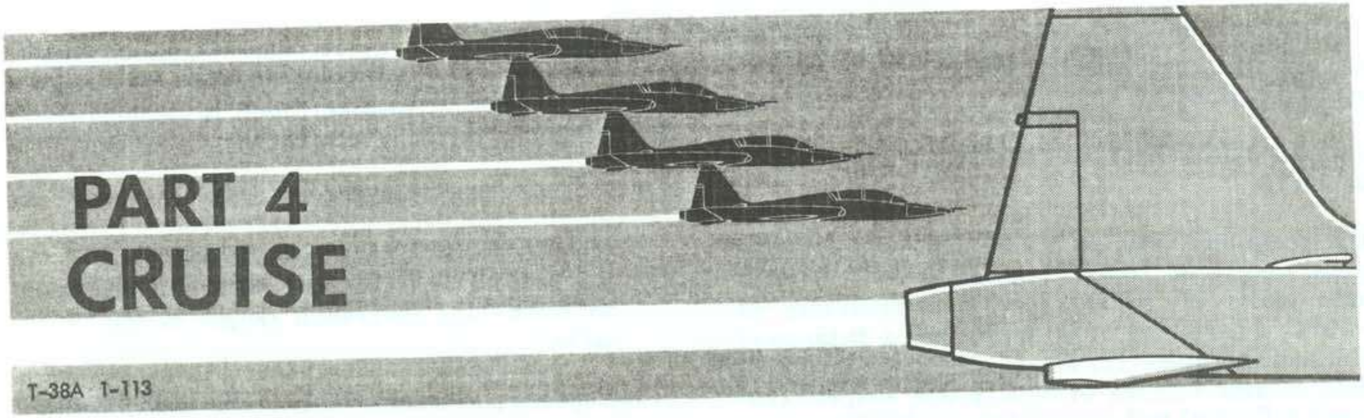


TABLE OF CONTENTS

PURPOSE OF CHARTS.

The cruise charts provide cruise and loiter data which can be used to determine the subsonic cruise and loiter portions of any type of flight plan. Charts for constant altitude cruise and optimum cruise altitude for short range missions are included. Diversion range summary tables are provided in tabular form for two-engine and single-engine operation.

CRUISE CHARTS.

The cruise charts (FA4-1 and FA4-2) are for two-engine and single-engine operation. They provide cruise and loiter data throughout the speed range from maximum endurance to military thrust. Each chart is composed of three pages whose parameters are weight, altitude, mach number, ambient temperature, true airspeed, fuel flow, drag number, and nautical miles per pound of fuel. The average gross weight used in the charts is the average of the gross weights at the beginning and the end of the cruise or cruise interval. This average gross weight is equal to the gross weight at the beginning of cruise less one half of the fuel necessary for cruise. An ICAO standard day temperature table is included on sheet 3 of each chart.

USE OF CRUISE CHART.

Assume a constant altitude cruise at 0.8 mach number and a pressure altitude of 20,000 feet when the temperature is $-20^{o}C$ and the average gross weight is 10,400 pounds. The chase-thru lines on sheet 1 of FA4-1 show the maximum range mach number of 0.702. Then, by following the guidelines from the intersection with the baseline (maximum range) to the assumed mach number (0.8), the basic reference number is 2.75. The chase-thru lines on sheet 3 show 0.225 nautical mile per pound of fuel for the assumed mach number and the basic reference number determined on sheet 1 and 2. Entering sheet 4 with the assumed mach number and the nautical miles per pound from sheet 3 the chase-thru lines show a true airspeed of 495 knots and fuel flow of 1100 pounds per hour per engine. If the fuel available is 1000 pounds, the cruise distance is 225 nautical miles (0.225 X 1000) and the time is 27 minutes (1000 X 60 ÷ 1100 X 2). When the distance is known instead of the fuel available, the fuel required is computed by the reverse process (225 ÷ 0.225 = 1000) and the average gross weight is obtained by successive approximations, knowing the gross weight at the start of the cruise.

CONSTANT ALTITUDE CRUISE.

The constant altitude cruise charts (FA4-3 and FA4-4) are for two-engine and single-engine operation. The charts are used to 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. When the fuel required is unknown, the average gross weight is obtained by successive approximations.

USE OF CONSTANT ALTITUDE CRUISE CHARTS.

The chase-thru lines on FA4-3 are for an average gross weight of 10,020 pounds, a constant altitude cruise of 35,000 feet, a temperature of −46°C, a headwind of 50 knots, and a distance of 400 nautical miles. On sheet 1, the chase-thru lines show a mach number of 0.83, a true airspeed (airspeed reflector) and groundspeed of 485 knots and 435 knots, respectively, and a time of 55 minutes. Using the airspeed of 485 knots and the time of 55 minutes, the chase-thru lines on sheet 2 show 0.338 nautical mile per pound of fuel, a fuel flow of 720 pounds per hour per engine, and 1320 pounds of fuel. Since 1320 pounds of fuel is required, the gross weight at the start of the cruise is 10,680 pounds (10,020 + 1/2 X 1320).

OPTIMUM CRUISE ALTITUDE FOR SHORT RANGE MISSIONS.

For short-range flights, it is not economical to climb to the same optimum cruise altitude as used for long range missions. FA4-5 presents the optimum constant altitude cruise for short-range missions and also indicates when the mission is in the short-range category; that is, below the optimum cruise-climb altitude.

USE OF OPTIMUM CRUISE ALTITUDE FOR SHORT RANGE MISSIONS CHART.

For a short-range mission 100 nautical miles from base and a start climb gross weight of 11,400 pounds, the chase-thru lines show the optimum cruise at constant altitude (FA4-5) is 28,000 feet. Had the distance been 150 nautical miles, the optimum cruise-climb altitude would be the most economical.

DIVERSION RANGE SUMMARY TABLES.

Diversion range summary tables are presented in FA4-6 thru FA4-13 for two-engine and single-engine operation. These tables show, in quick reference form, the range available and the time required to return to base with 600, 800, 1000 or 1400 pounds of fuel available. The range is based on having 300 pounds of fuel remaining for the approach and landing after the descent is completed. The 300 pounds of fuel is ample for one missed approach. Range and time data are shown in the tables for three optional return profiles, together with the optimum altitudes for cruise. The optimum altitude is the constant cruise altitude which provides the maximum range for the particular type of flight profile. Climb is made to the cruise altitude, using military thrust.

NOTE

The Mil Thrust Climb Speed Schedule at the bottom of each table must be used to obtain the maximum ranges in the table.

Cruise speeds and descent data are provided at the bottom of the tables.

The three types of flight profiles are:

1. a. Cruise at initial altitude to base.
   b. Descend to sea level with idle thrust and speed brake closed after arrival over base.

2. a. Climb on course to optimum cruise altitude.
   b. Cruise at optimum altitude to base.
   c. Descend to sea level with idle thrust and speed brake open after arrival over base.

3. a. Climb on course to optimum cruise altitude.
   b. Cruise at optimum altitude.
   c. Descend on course to sea level with idle thrust and speed brake closed.

USE OF DIVERSION RANGE SUMMARY TABLES.

Assume the following conditions prevail: Single-engine operation, fuel remaining is 1240 pounds, and the aircraft is 200 nmi from the base at 15,000 feet altitude. Drag Index = 0.

Determine which flight profiles in FA4-10 provide necessary range in return to base.

1. In FA4-10, enter the chart at the top of the column marked 15,000 feet initial altitude.

2. Proceed downward to the section of the chart for 1000 pounds of fuel shown at the left side of the page.

3. The ranges available with the three profile options are as follows:

First option	168 nmi.
Second option	179 nmi.
Third option	211 nmi.

4. As the required range is 200 nmi, the flight profile for the third option must be used.

5. Climb with MIL thrust from 15,000 at mach number 0.52 (footnote number 5) to 25,000 at mach number 0.59. At 25,000 feet, cruise at 0.62 mach; engine fuel flow will be approximately 1275 lb/hr. At 40 nmi from the base, descend on course at 240 KCAS, idle thrust, with the speed brake closed.

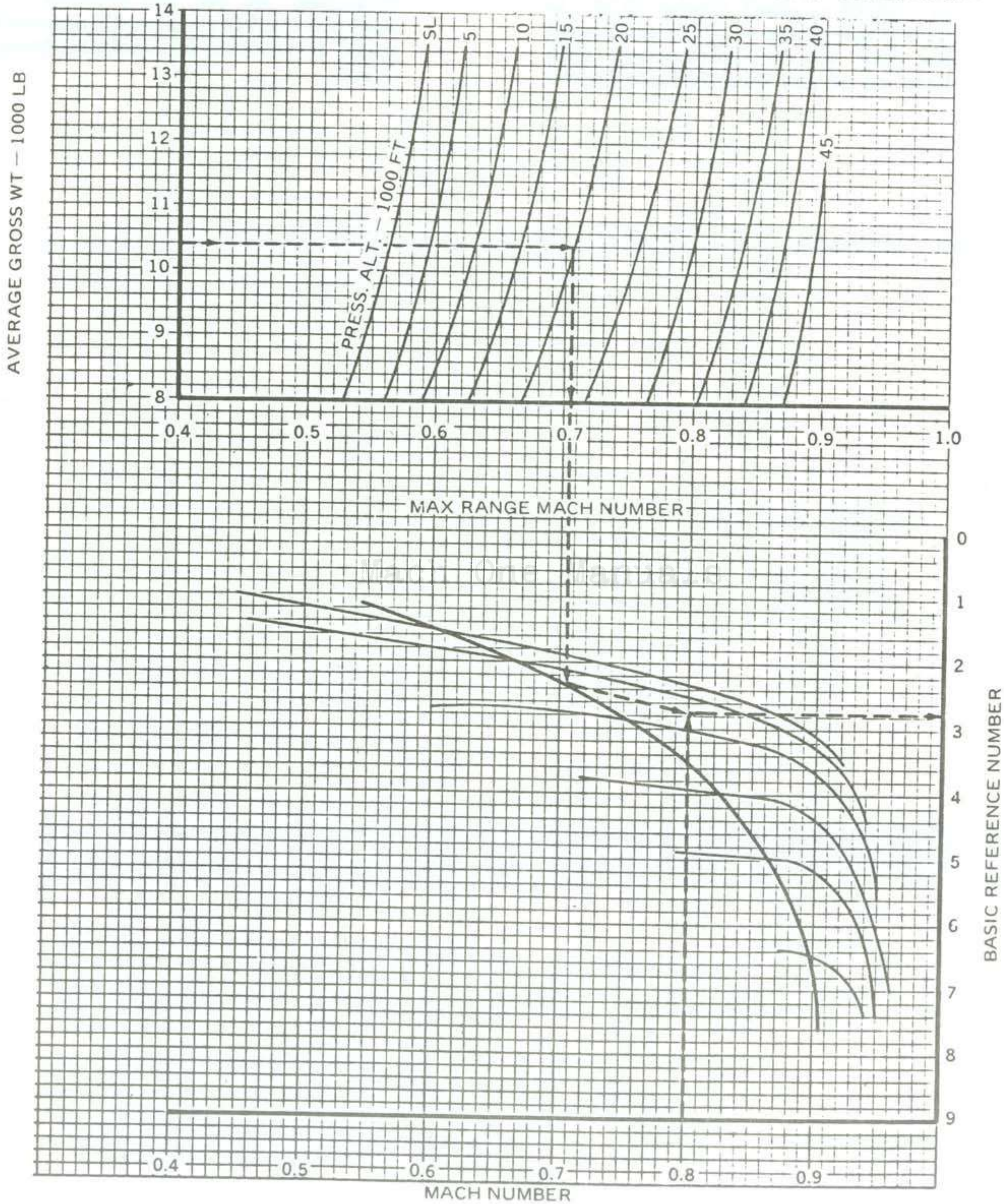
6. The time required with no wind is 36 minutes for 211 nmi, and the fuel used is 1000 pounds by the time the landing is completed. As the fuel available was 1240 pounds, 240 pounds of this amount would be available for headwind conditions.

CRUISE

MACH NUMBER AND REFERENCE NUMBER

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



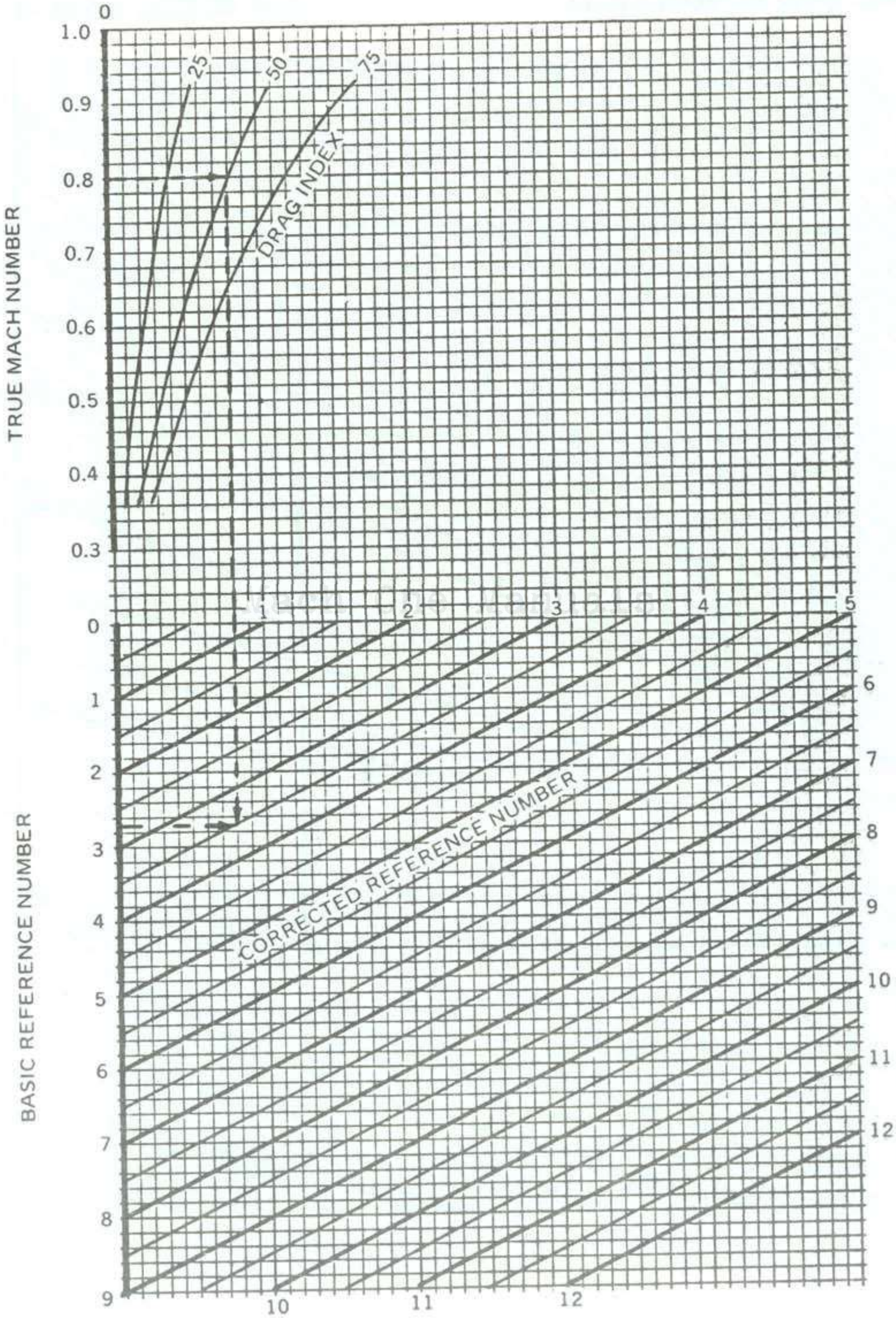
FA4-1. (Sheet 1 of 4)

CRUISE

CORRECTED REFERENCE NUMBER
FOR EXTERNAL STORES

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



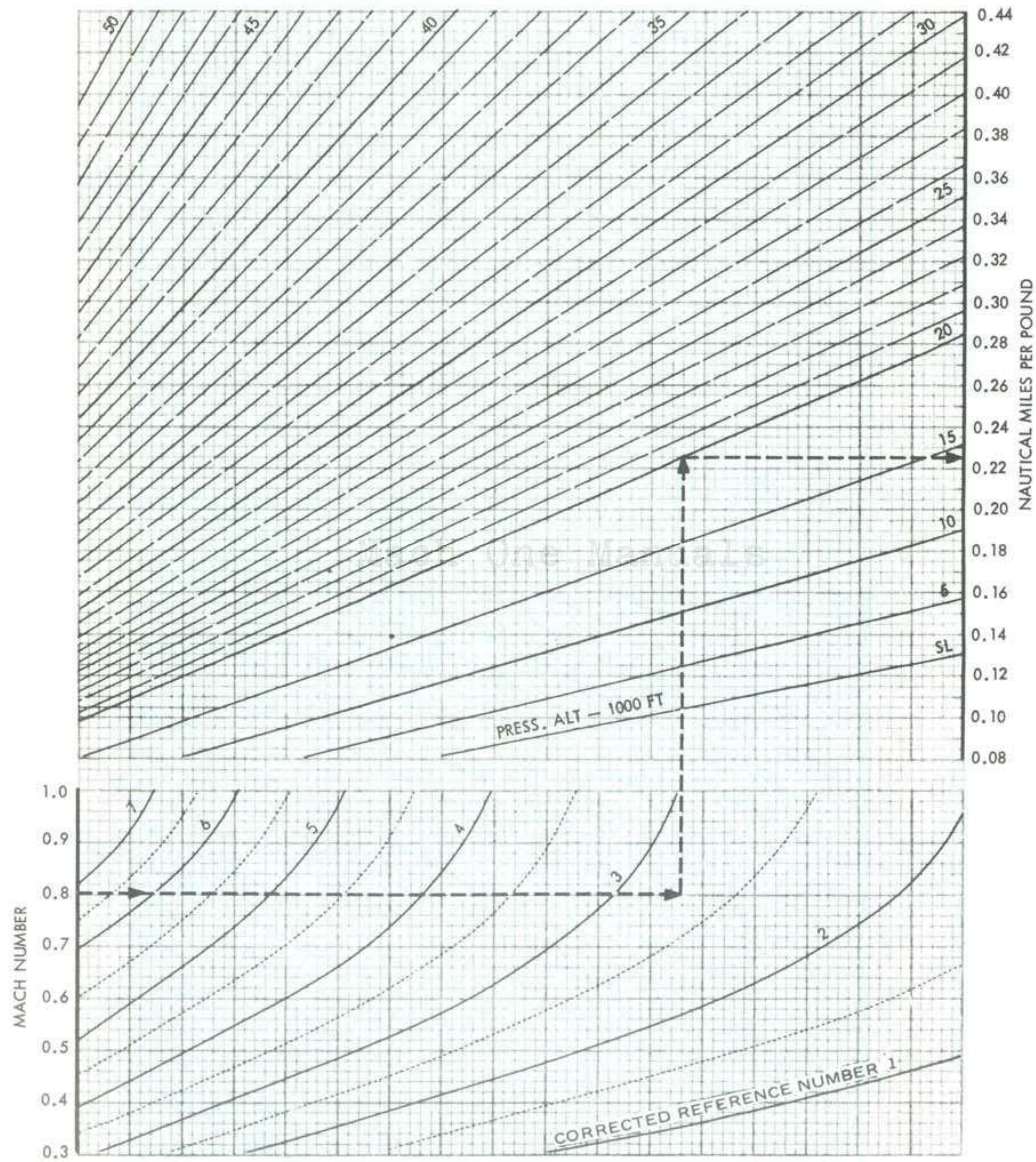
FA4-1. (Sheet 2 of 4)

CRUISE

NAUTICAL MILES PER POUND

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



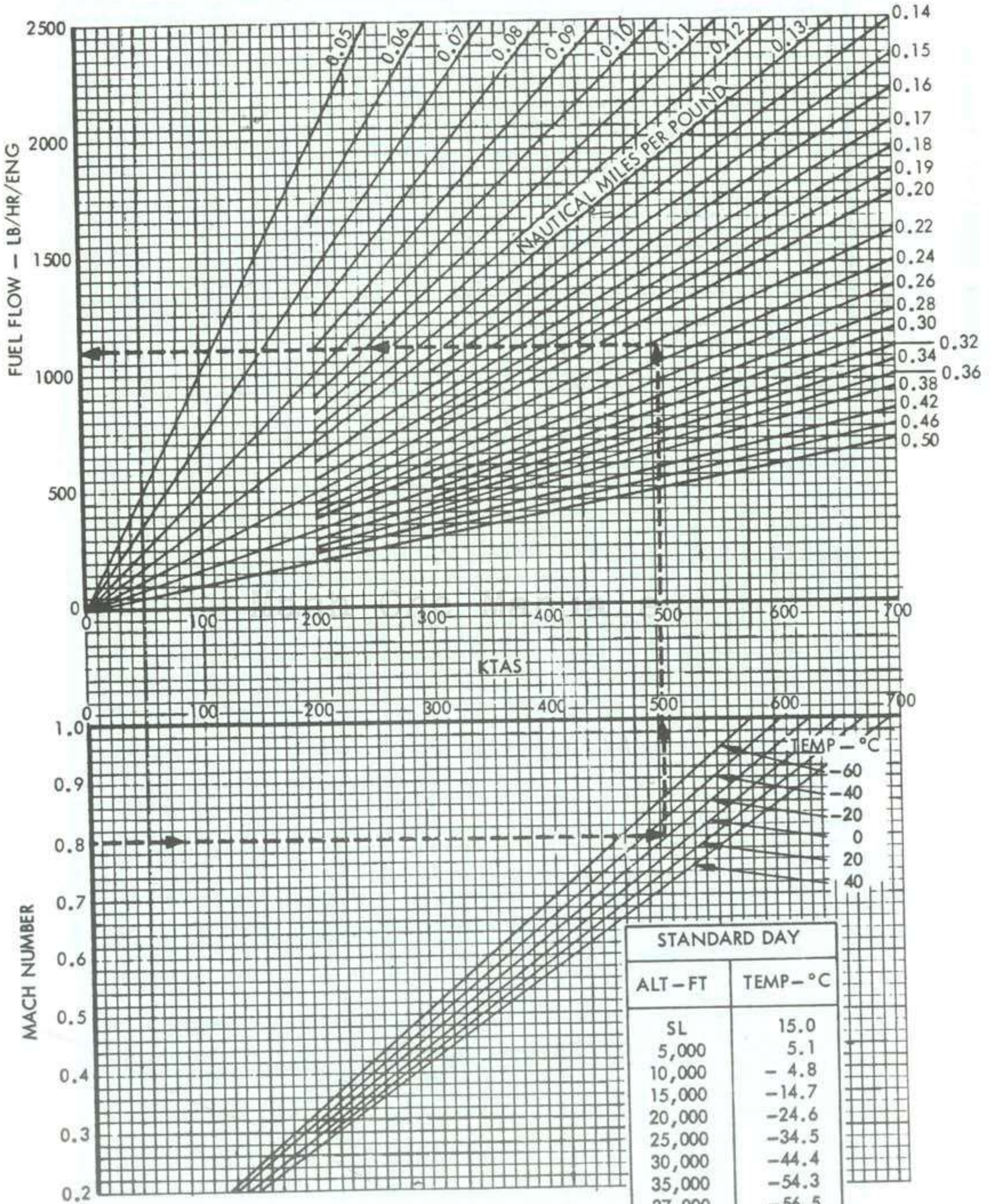
T-38A 1-652(2)C

FA4-1. (Sheet 3)

CRUISE
FUEL FLOW AND TRUE AIRSPEED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



STANDARD DAY	
ALT – FT	TEMP – °C
SL	15.0
5,000	5.1
10,000	– 4.8
15,000	–14.7
20,000	–24.6
25,000	–34.5
30,000	–44.4
35,000	–54.3
37,000 & ABOVE	–56.5

T-38A 1-652(3)C

FA4-1. (Sheet 4 of 4)

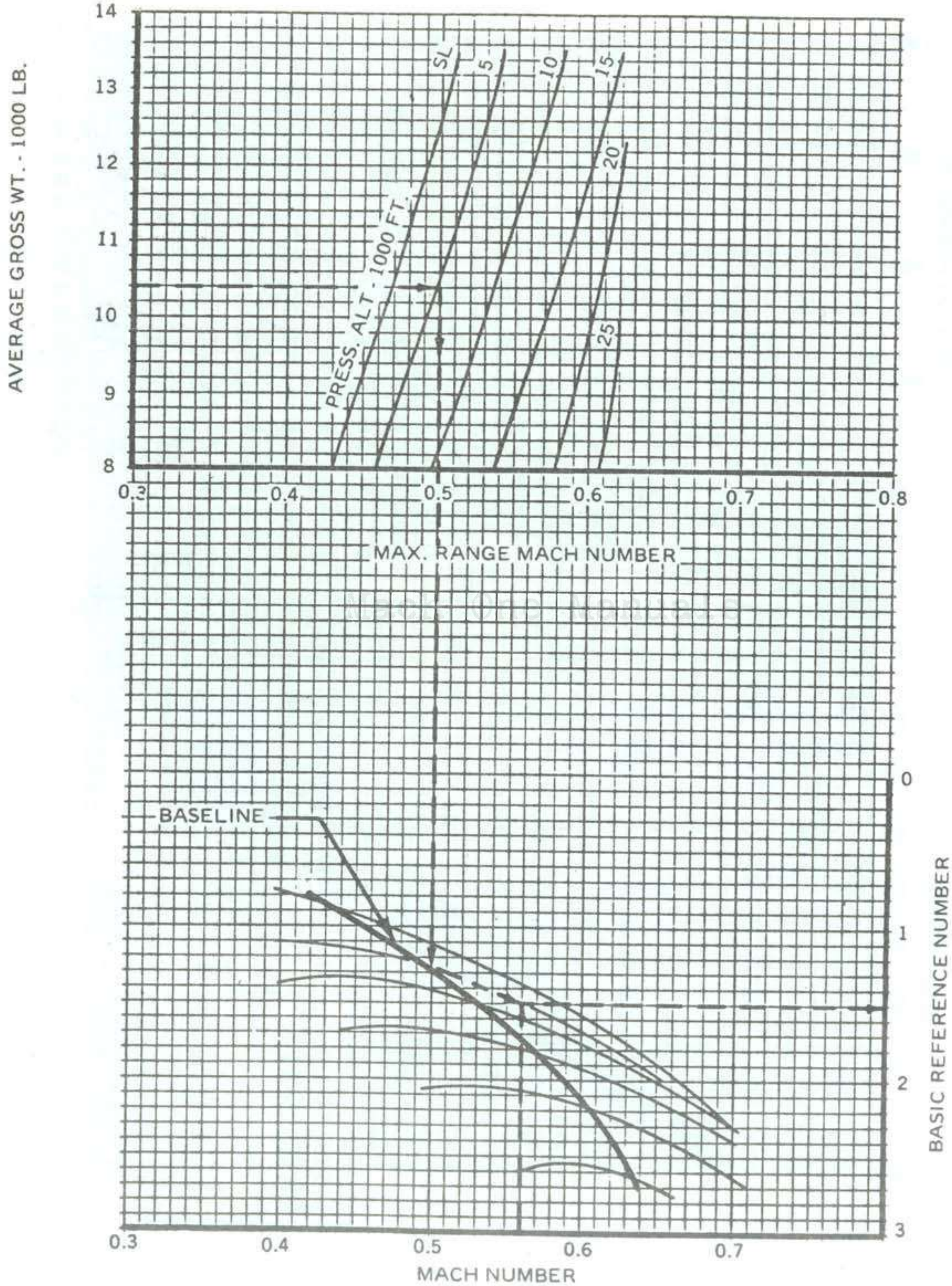
CRUISE

MACH NUMBER AND REFERENCE NUMBER

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

SINGLE ENGINE

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FA4-2. (Sheet 1 of 4)

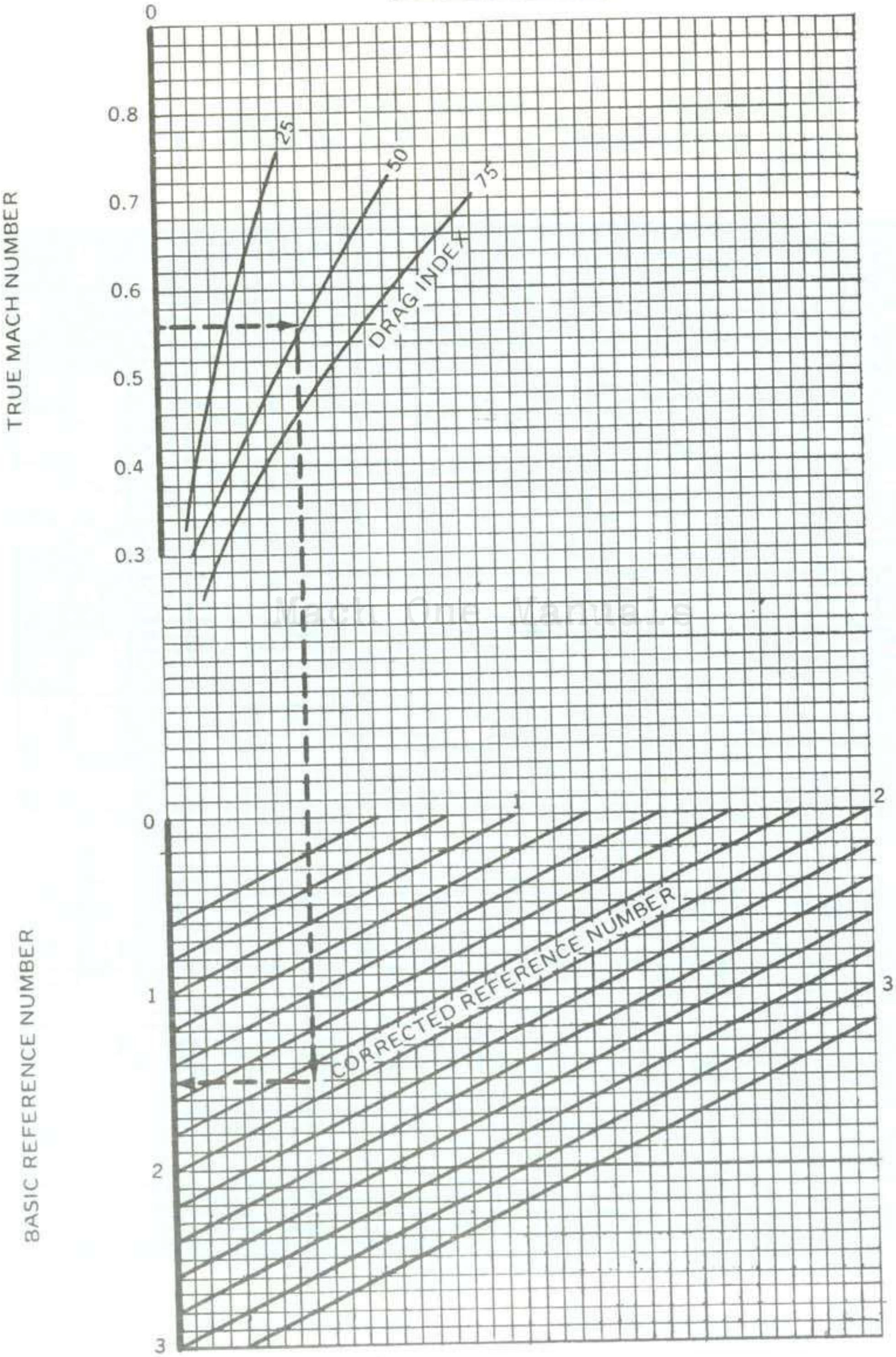
CRUISE

CORRECTED REFERENCE NUMBER FOR EXTERNAL STORES

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: FLIGHT TEST

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

SINGLE ENGINE



FA4-2. (Sheet 2 of 4)

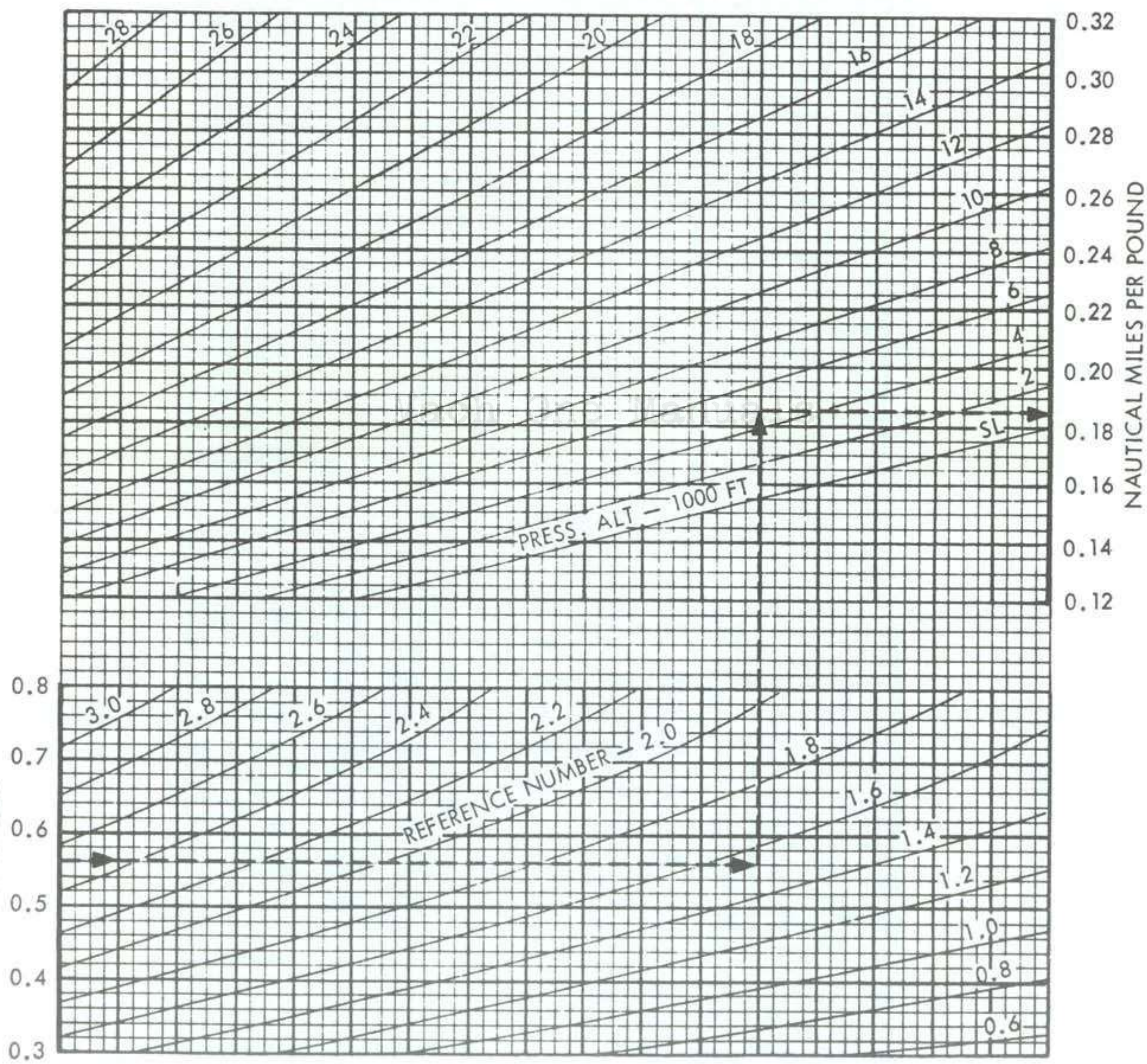
CRUISE

NAUTICAL MILES PER POUND

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

SINGLE ENGINE



T-38A 1-653(2) B

FA4-2. (Sheet 3 of 4)

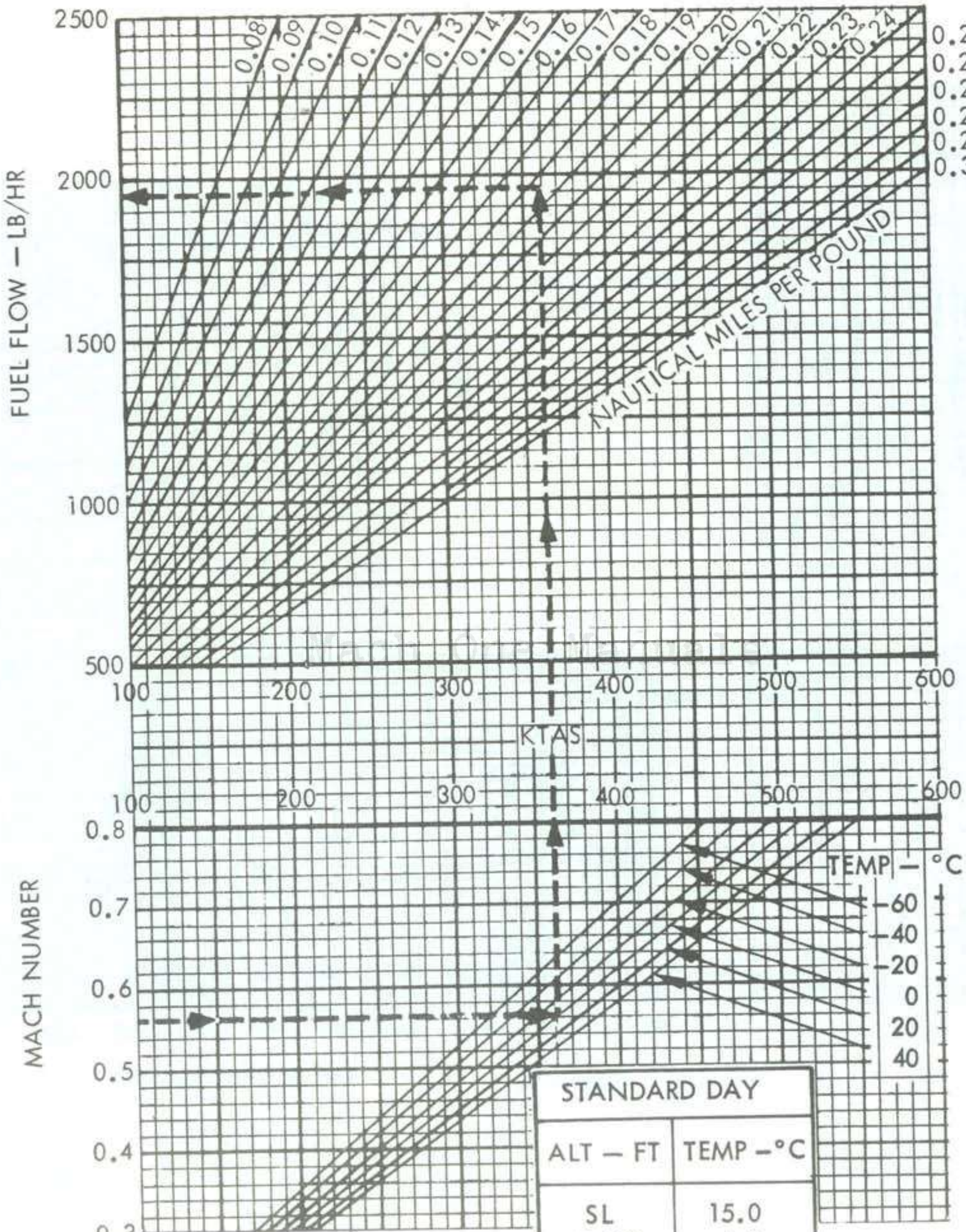
CRUISE

FUEL FLOW AND TRUE AIRSPEED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

SINGLE ENGINE

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



STANDARD DAY	
ALT — FT	TEMP —°C
SL	15.0
5,000	5.1
10,000	– 4.8
15,000	–14.7
20,000	–24.6
25,000	–34.5
30,000	–44.4

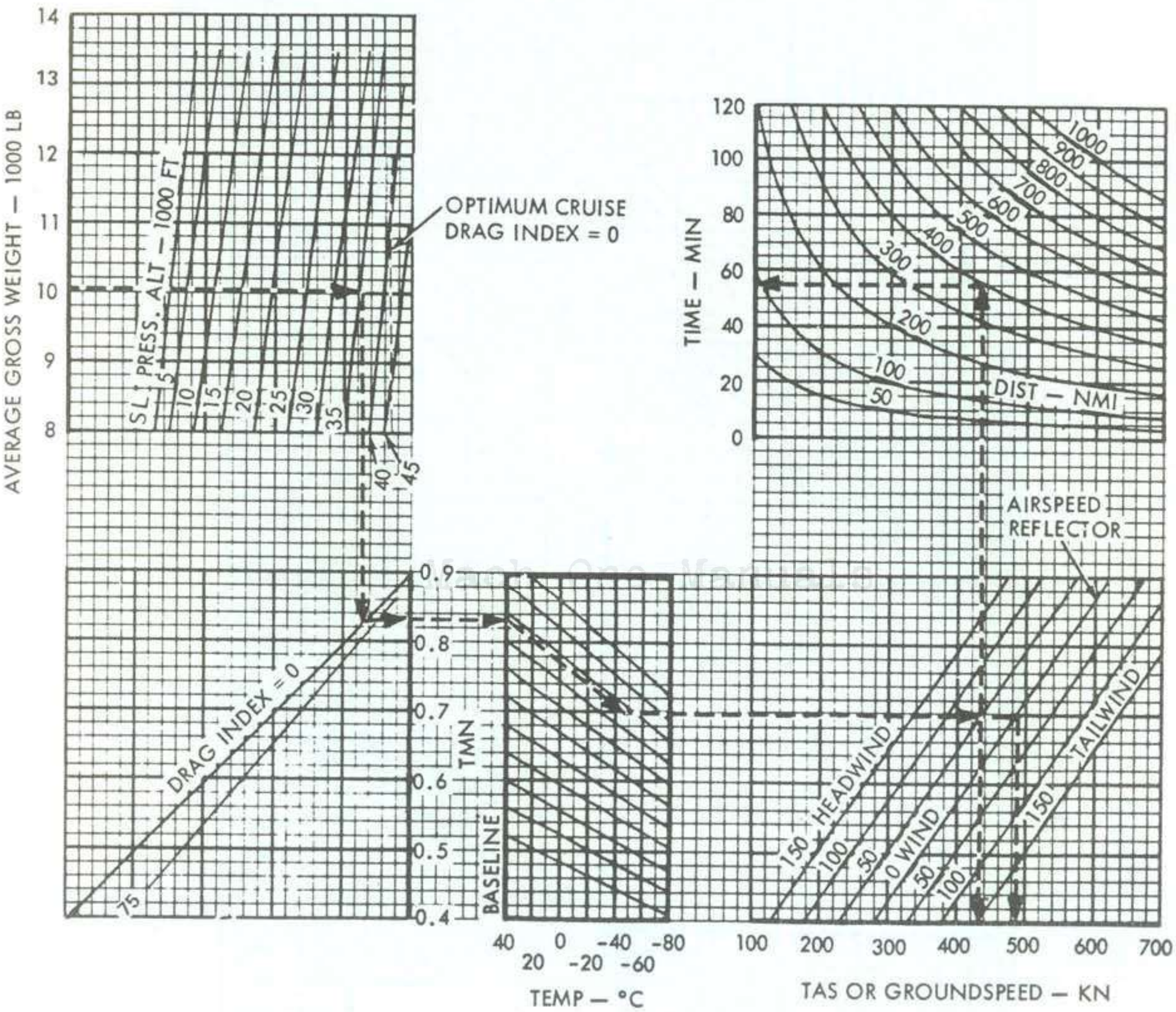
T-38A 1-653(3)C

FA4-2. (Sheet 4 of 4)

CONSTANT ALTITUDE CRUISE
TIME AND AIRSPEED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



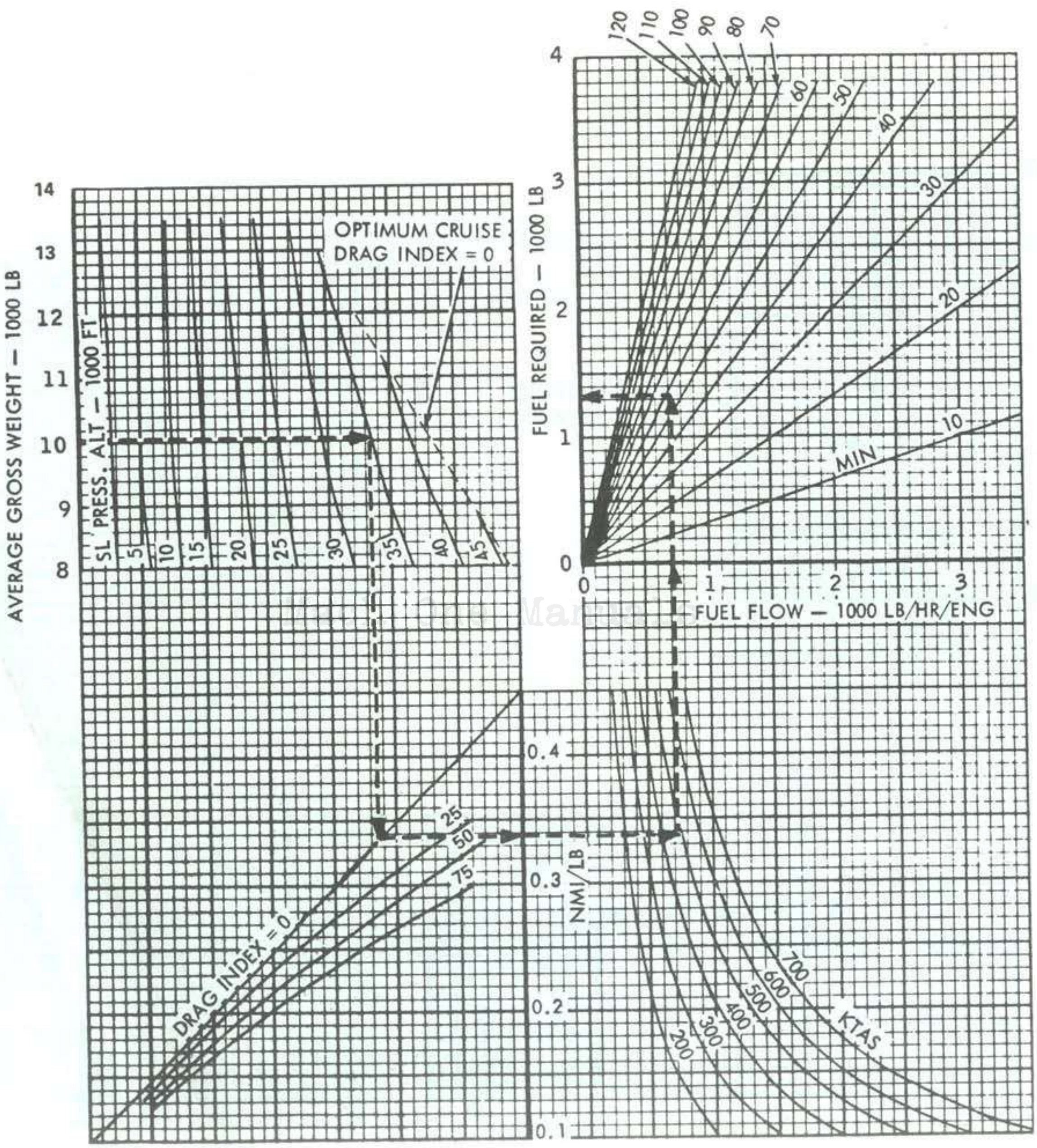
T-38A 1-551(1)C

FA4-3. (Sheet 1 of 2)

CONSTANT ALTITUDE CRUISE
FUEL FLOW AND FUEL REQUIRED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-551(2)C

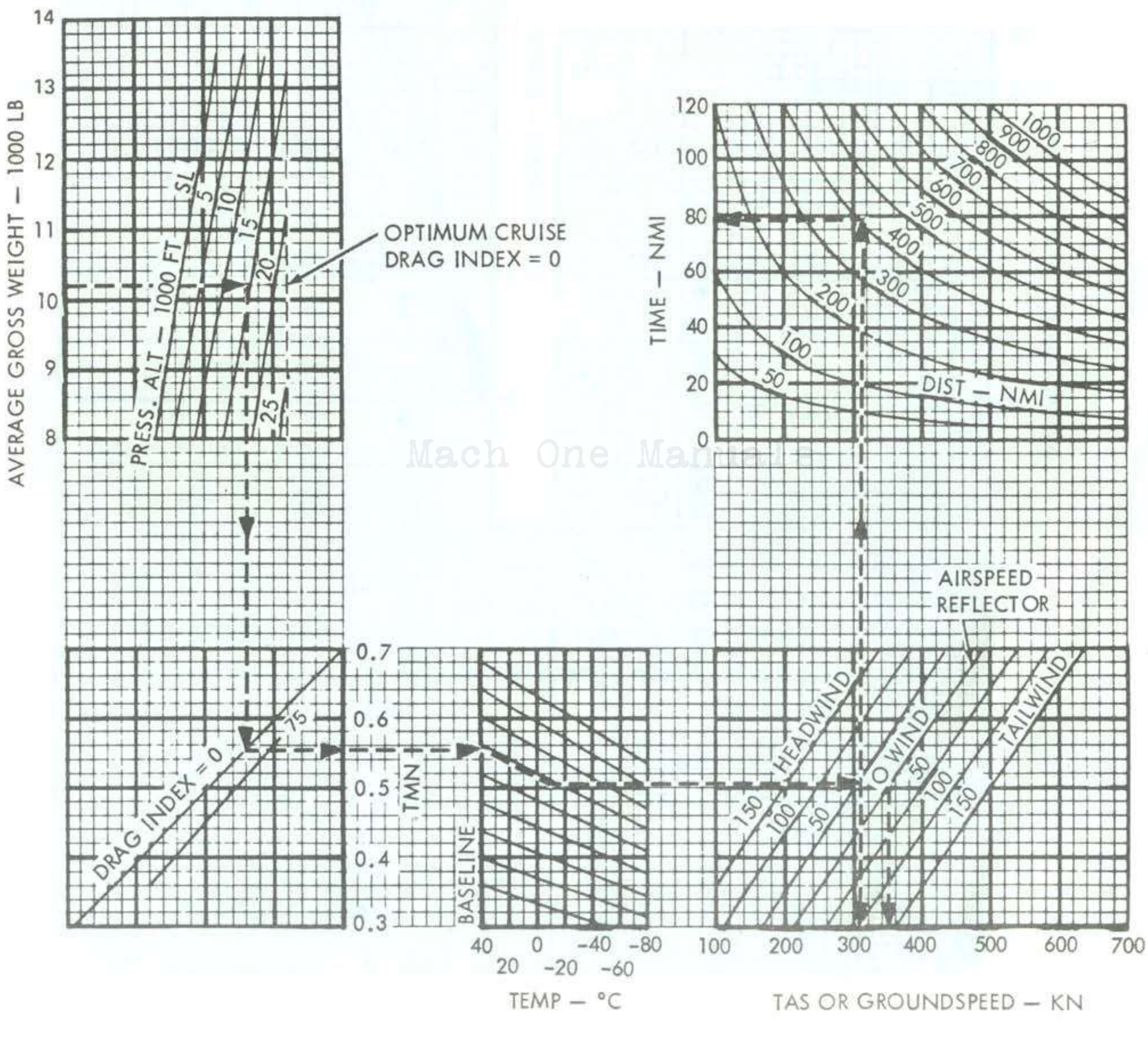
FA4-3. (Sheet 2 of 2)

CONSTANT ALTITUDE CRUISE
TIME AND AIRSPEED

SINGLE ENGINE

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



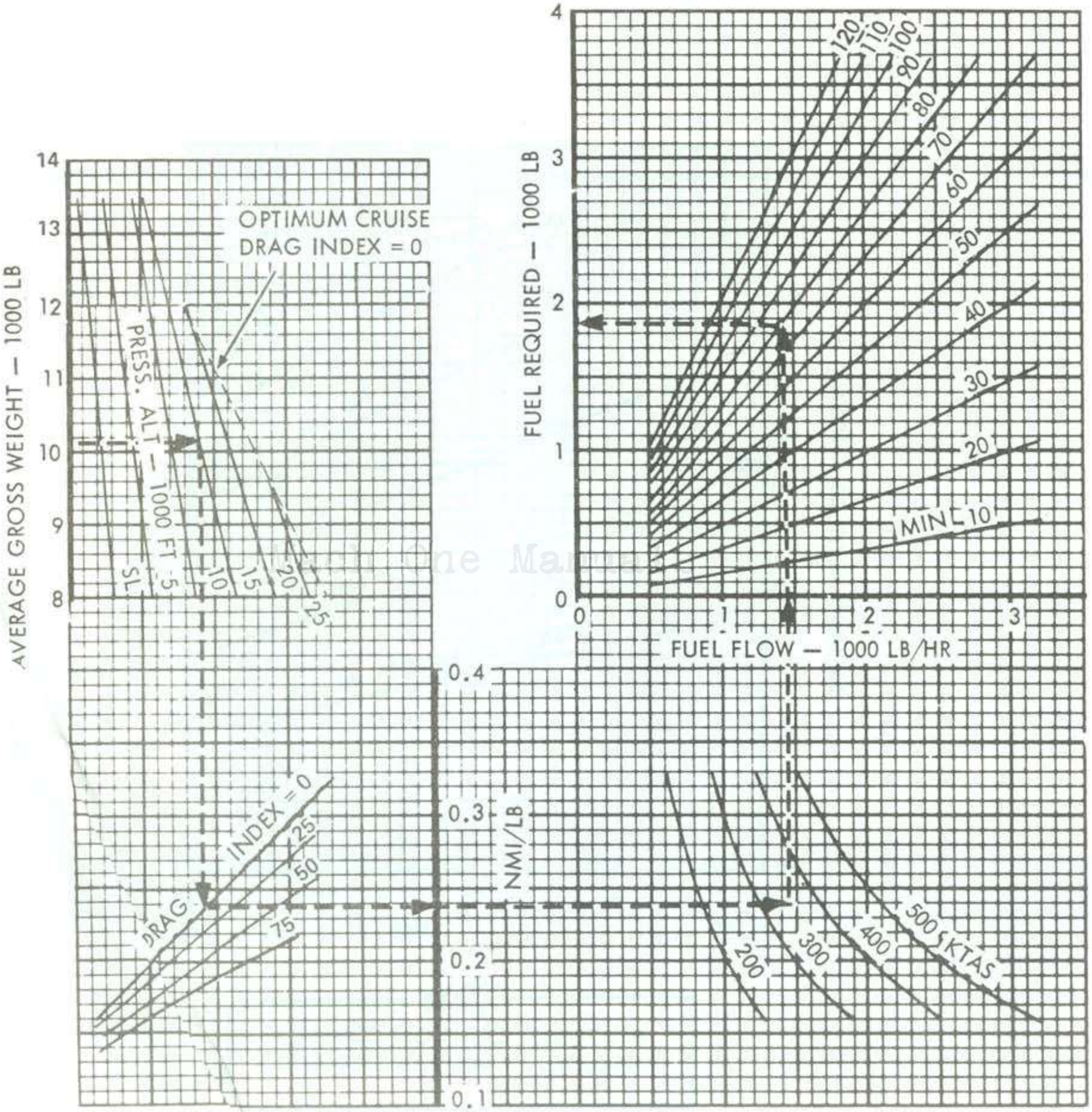
FA4-4. (Sheet 1 of 2)

CONSTANT ALTITUDE CRUISE
FUEL FLOW AND FUEL REQUIRED

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

SINGLE ENGINE

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



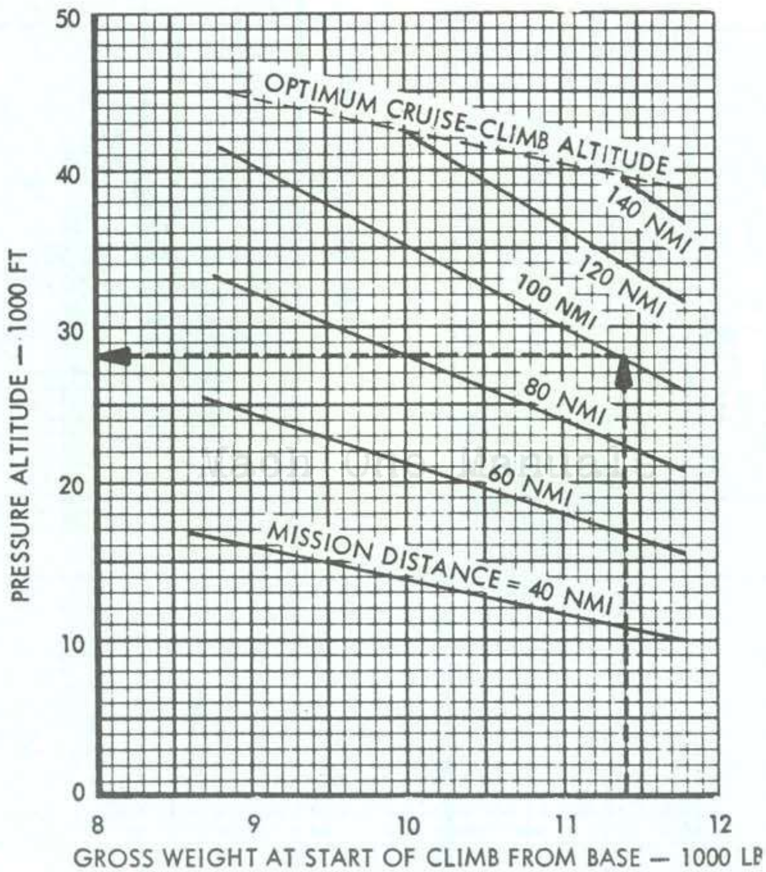
FA4-4. (Sheet 2 of 2)

OPTIMUM CRUISE ALTITUDE FOR SHORT RANGE MISSIONS

CONSTANT ALTITUDE CRUISE
DRAG INDEX = 0

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



Note

MIL THRUST CLIMB ON COURSE INCLUDED IN MISSION DISTANCE.

T-38A 1-550 B

FA4-5.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

TWO ENGINE

DRAG INDEX = 0

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL												PROCEDURE
		INITIAL ALTITUDE										
FUEL	1000 FT.	SL	5	10	15	20	25	30	35	40	45	
600 LB	NMI	39	46	51	56	60	65	70	73	76	73	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	7	10	12	13	16	17	18	20	21	23	
	1000 FT	10/20	10/25	15/30	20/35	25/35	30/40	30/40	35/45	40/45	40/45	OPTIMUM ALTITUDE
	NMI	43	48	54	60	66	74	82	87	94	95	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	8	9	10	12	13	14	15	17	18	18	
	NMI	64	74	84	95	105	117	128	138	148	154	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	11	12	13	16	17	18	19	21	22	23	
800 LB	NMI	65	76	86	96	106	118	130	139	148	147	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	11	15	18	20	22	24	26	29	30	31	
	1000 FT	25/35	30/40	30/40	30/45	35/45	40/45	40/45	40/45	40/45	45	OPTIMUM ALTITUDE
	NMI	84	95	106	116	126	137	148	157	166	168	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	15	17	18	20	22	23	24	25	26	27	
	NMI	124	139	152	166	179	191	203	213	222	228	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	19	20	22	24	26	27	29	30	31	31	
1000 LB	NMI	90	106	121	137	152	170	189	204	219	220	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	15	20	23	26	29	31	34	37	39	40	
	1000 FT	35/45	40/45	40/45	40/45	40/45	40/45	40/45	40/45	40/45	45	OPTIMUM ALTITUDE
	NMI	143	157	171	185	197	208	219	229	237	240	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	24	25	27	29	30	32	33	34	35	35	
	NMI	196	212	226	240	252	264	276	286	295	301	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	28	30	31	33	34	36	37	38	39	40	
1400 LB	NMI	142	166	192	217	244	273	306	332	360	360	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	24	29	34	38	42	45	50	54	56	56	
	1000 FT	40/45	40/45	40/45	40/45	40/45	40/45	40/45	40/45	40/45	45	OPTIMUM ALTITUDE
	NMI	282	297	311	324	337	348	359	369	378	381	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	41	43	44	46	47	49	50	51	52	53	
	NMI	339	352	369	382	395	406	418	428	437	441	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	45	47	48	50	51	53	54	55	56	56	
CRUISE ALT		SL	5	10	15	20	25	30	35	40	45	*Note*
CRUISE MACH NO.		0.54	0.56	0.59	0.64	0.68	0.73	0.77	0.81	0.85	0.89	WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.90 MACH, PRESSURE ALTITUDE 43,000 FEET.
APPROX FUEL FLOW LB/HR		1325	1200	1050	975	900	825	750	700	675	650	
DECEND 240 KCAS IDLE (4)	NMI REMAINING	8	16	24	32	40	49	59	70	81		
	MIN REMAINING	2	4	5	7	8	9	11	12	14		
	FUEL REMAINING	312	328	340	352	363	375	386	397	407		

(1) FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.

(2) TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.

(3) TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.

(4) DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.

5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25	30	35	40	45
TRUE MACH	0.75	0.76	0.78	0.79	0.81	0.83	0.84	0.86	0.87	0.87
KCAS	496	466	435	406	377	349	322	295	264	236

FA4-6.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

TWO ENGINE

DRAG INDEX = 25

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL

FUEL	1000 FT.	INITIAL ALTITUDE SL	5	10	15	20	25	30	35	40	45	PROCEDURE
600 LB	NMI MIN	37 7	43 9	48 11	53 13	57 14	62 16	68 18	71 19	75 20	75 21	CRUISE AT INITIAL ALTITUDE TO BASE ①
	1000 FT	5/15	10/20	10/25	15/30	20/35	25/40	30/40	35/40	40/45	45	OPTIMUM ALTITUDE
	NMI MIN	39 7	44 8	50 10	56 11	63 12	70 13	77 15	82 16	89 16	89 17	USE OPTIMUM ALTITUDE UNTIL OVER BASE ②
	NMI MIN	54 10	66 11	74 12	87 14	98 16	108 17	119 18	128 19	138 20	142 21	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ③
800 LB	NMI MIN	61 11	72 14	81 16	91 19	101 21	111 23	124 26	132 27	141 28	141 29	CRUISE AT INITIAL ALTITUDE TO BASE ①
	1000 FT	20/35	25/35	30/40	30/40	35/40	40/45	40/45	40/45	40/45	45	OPTIMUM ALTITUDE
	NMI MIN	75 14	85 15	96 17	107 19	116 20	126 21	137 22	147 24	155 25	157 25	USE OPTIMUM ALTITUDE UNTIL OVER BASE ②
	NMI MIN	108 17	123 19	137 20	151 22	163 23	175 25	187 26	197 27	207 28	210 29	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ③
1000 LB	NMI MIN	86 16	100 19	114 22	129 25	144 27	160 30	179 33	192 35	207 36	208 36	CRUISE AT INITIAL ALTITUDE TO BASE ①
	1000 FT	30/40	35/45	40/45	40/45	40/45	40/45	40/45	40/45	45	45	OPTIMUM ALTITUDE
	NMI MIN	126 21	140 23	154 25	168 26	180 28	191 29	203 30	212 32	222 32	224 32	USE OPTIMUM ALTITUDE UNTIL OVER BASE ②
	NMI MIN	171 25	188 27	204 28	218 30	231 31	243 33	255 34	265 35	275 36	277 36	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ③
1400 LB	NMI MIN	134 24	156 29	180 32	204 36	230 40	257 43	288 48	310 50	336 52	— —	CRUISE AT INITIAL ALTITUDE TO BASE ①
	1000 FT	40/45	45	45	45	45	45	45	45	45	45	OPTIMUM ALTITUDE
	NMI MIN	251 36	268 38	284 40	298 42	312 43	325 45	339 46	341 48	350 49	355 49	USE OPTIMUM ALTITUDE UNTIL OVER BASE ②
	NMI MIN	304 40	321 42	337 44	352 46	365 47	378 49	392 51	395 51	398 52	400 53	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ③
CRUISE ALT		SL	5	10	15	20	25	30	35	40	45	
CRUISE MACH NO.		0.50	0.54	0.58	0.63	0.67	0.71	0.76	0.80	0.85	0.89	
APPROX FUEL FLOW LB/HR		1350	1225	1100	1025	950	875	800	750	725	725	
DECEND 240 KCAS IDLE ④	NMI REMAINING		7	15	22	30	38	45	53	62	69	
	MIN REMAINING		2	3	5	6	7	9	10	11	12	
	FUEL REMAINING		312	225	337	347	356	365	373	382	390	

Note

WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.88 MACH, PRESSURE ALTITUDE 42,000 FEET.

1. FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.
2. TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.
3. TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.
4. DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.
5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25	30	35	40	45
TRUE MACH	0.75	0.76	0.78	0.79	0.81	0.83	0.84	0.86	0.87	0.87
KCAS	496	466	435	406	377	349	322	295	264	236

FA4-7.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: **T-38A**
DATE: **1 JULY 1978**
DATA BASIS: **ESTIMATED DATA**

TWO ENGINE

DRAG INDEX = 50

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL

FUEL	1000 FT.	SL	5	10	15	20	25	30	35	40	45	PROCEDURE
		INITIAL ALTITUDE										
600 LB	NMI	35	48	45	50	55	59	65	68	71	—	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	MIN	7	8	11	12	14	16	17	18	19	—	
	1000 FT	5/15	5/20	10/25	15/30	20/30	25/35	30/40	35/40	40	40	OPTIMUM ALTITUDE
	NMI	36	42	47	53	59	66	73	77	82	83	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	MIN	6	8	10	10	12	13	14	15	15	15	
	NMI	48	59	69	80	89	99	110	120	128	131	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
	MIN	8	10	12	13	14	15	17	18	19	19	
800 LB	NMI	58	68	77	86	96	106	117	124	132	—	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	MIN	11	13	16	18	21	22	24	25	26	—	
	1000 FT	15/30	20/30	25/35	30/40	30/40	35/40	40	40	40	40	OPTIMUM ALTITUDE
	NMI	67	77	87	98	107	116	126	135	143	144	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	MIN	12	14	15	17	18	20	21	22	23	23	
	NMI	94	108	122	136	148	160	171	181	189	192	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
	MIN	15	17	18	20	21	23	24	25	26	27	
1000 LB	NMI	81	95	108	122	137	151	169	180	192	—	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	MIN	16	18	21	23	27	29	31	33	34	—	
	1000 FT	30/40	30/40	35/40	40	40	40	40	40	40	40	OPTIMUM ALTITUDE
	NMI	110	125	138	151	163	175	186	196	204	204	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	MIN	19	21	22	24	25	27	28	29	30	31	
	NMI	148	166	182	196	208	220	232	241	249	252	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
	MIN	21	24	25	27	29	30	32	33	34	35	
1400 LB	NMI	127	148	170	193	218	242	271	289	311	—	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	MIN	24	27	32	34	39	41	45	47	49	—	
	1000 FT	40	40	40	40	40	40	40	40	40	40	OPTIMUM ALTITUDE
	NMI	221	239	255	269	282	294	305	314	322	323	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	MIN	32	35	37	38	40	41	43	44	45	45	
	NMI	226	284	300	314	327	339	350	360	368	370	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
	MIN	36	38	40	42	44	45	46	48	49	49	

CRUISE ALT	SL	5	10	15	20	25	30	35	40	45
CRUISE MACH NO.	0.47	0.52	0.56	0.61	0.65	0.70	0.75	0.79	0.84	DESCEND TO 40,000 FT.
APPROX FUEL FLOW LB/HR	1350	1250	1125	1075	1000	900	850	775	775	
DESCEND 240 KCAS IDLE ❹ NMI REMAINING		7	14	20	27	34	42	49	57	64
MIN REMAINING		1	3	4	6	7	8	9	10	11
FUEL REMAINING		310	323	333	342	352	360	368	375	382

Note

WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.86 MACH, PRESSURE ALTITUDE 41,000 FEET.

❶ FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.

❷ TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.

❸ TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.

❹ DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.

5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25	30	35	40	45
TRUE MACH	0.75	0.76	0.78	0.79	0.81	0.83	0.84	0.86	0.87	0.87
KCAS	496	466	435	406	377	349	322	295	264	236

FA4-8.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

TWO ENGINE

DRAG INDEX = 75

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL

FUEL	1000 FT.	SL	5	10	15	20	25	30	35	40	45	PROCEDURE
		INITIAL ALTITUDE										
600 LB	NMI MIN	33 6	39 8	44 10	48 12	52 13	57 14	62 16	64 17	67 17	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	0/10	5/15	10/20	15/25	20/30	25/30	30/35	35/40	40	40	OPTIMUM ALTITUDE
	NMI MIN	33 6	39 8	45 9	50 10	56 11	62 12	69 13	73 14	77 14	77 14	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	42 7	52 9	62 10	72 11	83 13	92 14	101 15	112 16	120 17	123 18	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
800 LB	NMI MIN	55 11	64 13	73 15	82 17	91 19	100 20	110 22	117 24	123 25	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	10/25	15/30	20/30	25/35	30/40	30/40	30/40	35/40	40	40	OPTIMUM ALTITUDE
	NMI MIN	60 11	69 13	79 14	88 15	99 17	108 18	117 20	125 21	133 21	134 22	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	80 12	95 14	109 16	121 18	135 19	147 21	159 22	168 23	176 25	179 26	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
1000 LB	NMI MIN	77 15	90 17	103 20	116 23	129 24	143 27	159 29	169 31	179 32	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	25/30	30/35	30/40	30/40	35/40	40	40	40	40	40	OPTIMUM ALTITUDE
	NMI MIN	96 16	110 18	125 20	137 22	149 23	160 24	172 26	181 27	189 28	189 29	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	126 18	144 21	162 22	177 24	191 26	203 28	215 29	224 30	232 32	234 32	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
1400 LB	NMI MIN	121 23	141 27	162 30	183 33	205 36	228 39	254 42	272 44	289 45	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	40	40	40	40	40	40	40	40	40	40	OPTIMUM ALTITUDE
	NMI MIN	191 28	211 31	229 33	244 35	258 37	270 38	282 40	291 41	299 42	301 43	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	234 31	254 34	272 36	287 38	301 40	313 41	325 43	334 44	342 45	346 46	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)

CRUISE ALT		SL	5	10	15	20	25	30	35	40	
CRUISE MACH NO.		0.47	0.52	0.56	0.61	0.65	0.70	0.75	0.79	0.84	DESCEND TO 40,000 FT.
APPROX FUEL FLOW LB/HR		1400	1300	1200	1125	1050	975	900	850	825	
DECEND 240 KCAS IDLE (4)	NMI REMAINING		6	13	19	25	32	39	45	53	
	MIN REMAINING		1	3	4	5	6	7	8	9	
	FUEL REMAINING		310	320	330	339	348	356	363	370	

Note

WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.86 MACH, PRESSURE ALTITUDE 39,000 FEET.

1. FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.
2. TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.
3. TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.
4. DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.
5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25	30	35	40	45
TRUE MACH	0.75	0.76	0.78	0.79	0.81	0.83	0.84	0.86	0.87	0.87
KCAS	496	466	435	406	377	349	322	295	264	236

FA4-9.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

SINGLE ENGINE

DRAG INDEX = 0

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL												
		INITIAL ALTITUDE										PROCEDURE
FUEL	1000 FT.	SL	5	10	15	20	25	30	35	40	45	
600 LB	NMI MIN	53 11	60 14	65 16	71 18	76 20	78 21	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	5/15	10/20	10/20	15/20	20/25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	55 12	60 14	67 15	73 16	80 17	83 17	88 18	97 20	106 20	116 22	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	70 14	80 16	91 17	100 19	110 20	118 21	124 21	132 23	142 24	151 25	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
800 LB	NMI MIN	87 18	99 22	110 25	119 26	131 29	134 30	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	10/20	15/25	20/25	20/25	20/25	25	20/25	20/25	20/25	20/25	OPTIMUM ALTITUDE
	NMI MIN	97 21	106 22	116 24	126 25	134 26	139 26	146 27	155 29	164 30	174 32	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	123 23	134 25	146 26	156 28	166 29	174 30	180 30	188 32	198 33	208 34	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
1000 LB	NMI MIN	122 25	138 29	154 33	168 35	185 38	189 38	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	20/25	20/25	20/25	20/25	20/25	25	20/25	20/25	20/25	20/25	OPTIMUM ALTITUDE
	NMI MIN	148 29	159 31	169 33	179 34	188 35	194 35	200 36	209 38	218 39	228 41	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	178 32	190 34	201 35	211 36	221 38	229 38	235 39	244 41	253 42	263 43	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
1400 LB	NMI MIN	189 39	214 44	239 49	261 51	288 55	294 55	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	20/25	20/25	20/25	20/25	20/25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	250 47	261 48	272 50	282 51	291 53	299 52	304 53	313 54	322 55	332 57	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	282 49	294 51	305 52	316 53	325 55	334 55	339 56	348 58	358 58	367 60	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸

CRUISE ALT		SL	5	10	15	20	25	DESCEND TO 20,000 OR 25,000 FT.
CRUISE MACH NO.		0.44	0.47	0.50	0.54	0.58	0.62	
APPROX FUEL FLOW LB/HR		1650	1550	1400	1350	1300	1275	USE IDLE THRUST AND 240 KCAS WITH SPEED BRAKE CLOSED.
DECEND 240 KCAS IDLE ❹	NMI REMAINING		8	16	24	32	40	
	MIN REMAINING		2	4	5	7	8	
	FUEL REMAINING		306	314	320	326	332	

Note

WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.62 MACH, PRESSURE ALTITUDE 23,000 FEET.

❶ FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.

❷ TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.

❸ TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.

❹ DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.

5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25
TRUE MACH	0.43	0.46	0.49	0.52	0.56	0.59
KCAS	281	278	271	264	256	246

FA4-10.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

SINGLE ENGINE

DRAG INDEX = 25

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL												
		INITIAL ALTITUDE										
FUEL	1000 FT.	SL	5	10	15	20	25	30	35	40	45	PROCEDURE
600 LB	NMI MIN	49 11	55 13	61 15	65 17	71 18	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	5/15	5/15	10/20	15/20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	50 11	56 12	62 13	67 15	74 16	76 16	85 18	92 19	100 20	106 21	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	63 13	72 14	84 16	93 17	101 18	107 19	112 21	119 21	127 22	133 23	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
800 LB	NMI MIN	81 18	92 21	102 23	110 25	120 27	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	10/20	15/20	20	20	20/25	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	89 19	97 20	106 22	116 23	123 24	126 25	135 27	142 27	150 28	156 29	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	111 21	123 23	133 24	143 26	153 26	156 27	162 29	169 30	177 31	183 32	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
1000 LB	NMI MIN	113 25	128 28	142 30	154 33	169 35	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	20	20/25	20/25	20/25	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	133 27	144 29	155 30	165 31	172 33	174 33	183 35	190 36	198 37	204 37	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	160 29	171 31	185 32	194 33	199 35	205 36	210 37	217 38	225 39	231 40	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸
1400 LB	NMI MIN	176 39	198 43	221 45	240 48	262 51	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE ❶
	1000 FT	20	20	20	20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	226 43	237 45	248 46	257 47	265 48	267 49	276 51	283 52	291 53	297 53	USE OPTIMUM ALTITUDE UNTIL OVER BASE ❷
	NMI MIN	253 45	264 47	275 49	284 50	292 51	297 52	303 53	310 54	318 55	324 56	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE ❸

CRUISE ALT		SL	5	10	15	20	25	DESCEND TO 20,000 FT.
CRUISE MACH NO.		0.41	0.45	0.49	0.53	0.57	0.62	USE IDLE THRUST AND 240 KCAS WITH SPEED BRAKE CLOSED.
APPROX FUEL FLOW LB/HR		1650	1575	1500	1450	1375	1400	
DECEND 240 KCAS IDLE ❹	NMI REMAINING		7	15	22	30	28	
	MIN REMAINING		2	3	5	6	7	
	FUEL REMAINING		306	313	319	325	330	

Note

WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.60 MACH, PRESSURE ALTITUDE 20,000 FEET.

❶ FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.

❷ TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.

❸ TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.

❹ DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.

5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25
TRUE MACH	0.43	0.46	0.49	0.52	0.56	0.59
KCAS	281	278	271	264	256	246

FA4-11.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

SINGLE ENGINE

DRAG INDEX = 50

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL

FUEL	1000 FT.	INITIAL ALTITUDE SL	5	10	15	20	25	30	35	40	45	PROCEDURE
600 LB	NMI MIN	46 10	52 12	56 14	60 15	64 17	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	5/10	5/15	10/15	15/20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	47 10	52 11	58 13	62 14	67 15	69 15	79 16	85 17	92 18	98 19	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	57 12	66 13	74 14	85 16	91 17	96 18	103 19	109 20	117 21	123 22	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
800 LB	NMI MIN	77 17	86 19	95 22	102 23	109 25	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	10/15	10/20	15/20	20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	82 18	89 19	97 20	105 22	111 23	113 23	123 24	130 25	137 26	143 27	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	98 19	111 21	121 23	130 24	136 25	141 26	148 27	154 28	161 29	168 29	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
1000 LB	NMI MIN	107 24	120 26	133 29	143 31	153 33	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	15/20	20	20	20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	121 25	130 27	140 28	149 30	155 31	157 31	167 32	174 33	181 34	187 35	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	145 28	155 29	165 31	174 32	180 33	185 34	192 35	198 36	205 36	212 37	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
1400 LB	NMI MIN	165 37	185 40	206 43	221 46	236 48	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	20	20	20	20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	204 40	215 42	225 43	233 44	239 45	241 46	251 47	257 48	265 49	271 50	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	229 43	239 44	249 46	258 47	263 48	269 49	276 50	282 50	289 51	295 52	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)

CRUISE ALT		SL	5	10	15	20	25	DESCEND TO 20,000 FT
CRUISE MACH NO.		0.41	0.45	0.49	0.53	0.57		USE IDLE THRUST AND 240 KCAS WITH SPEED BRAKE CLOSED.
APPROX FUEL FLOW LB/HR		1850	1700	1625	1575	1525		
DECEND 240 KCAS IDLE (4)	NMI REMAINING		7	14	20	27		
	MIN REMAINING		1	3	4	6		
	FUEL REMAINING		305	312	317	321		

Note

WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.58 MACH, PRESSURE ALTITUDE 20,000 FEET.

(1) FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.

(2) TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.

(3) TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.

(4) DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.

5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25
TRUE MACH	0.43	0.46	0.49	0.52	0.56	0.59
KCAS	281	278	271	264	256	246

FA4-12.

DIVERSION RANGE SUMMARY TABLE
CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

SINGLE ENGINE
DRAG INDEX = 75

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

RANGE AND TIME REMAINING WITH 300-LB RESERVES AT SEA LEVEL												PROCEDURE
		INITIAL ALTITUDE										
FUEL	1000 FT.	SL	5	10	15	20	25	30	35	40	45	
600 LB	NMI MIN	44 10	48 11	53 13	56 15	59 16	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	5/10	5/10	10/15	15	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	44 10	49 11	54 12	58 13	61 13	63 14	73 15	78 16	85 17	91 18	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	53 11	60 12	69 13	75 15	84 16	89 16	96 17	101 18	108 19	113 20	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
800 LB	NMI MIN	72 16	81 18	89 20	95 22	100 23	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	10/15	10/15	15	20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	76 17	83 18	90 19	97 20	102 21	104 21	114 22	119 23	126 24	132 25	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	91 18	100 19	108 21	120 22	125 23	130 24	136 24	142 25	149 26	154 27	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
1000 LB	NMI MIN	101 23	113 25	124 27	133 29	131 28	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	10/15	15/20	20	20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	111 23	120 25	129 26	138 27	140 27	144 28	154 30	159 30	166 31	172 32	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	129 25	142 27	152 28	161 29	156 28	170 31	177 32	182 33	189 33	195 34	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
1400 LB	NMI MIN	156 35	174 38	192 41	206 43	210 44	— —	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	1000 FT	20	20	20	20	20	20	20	20	20	20	OPTIMUM ALTITUDE
	NMI MIN	187 37	197 38	208 40	217 41	220 41	224 42	229 43	234 44	237 45	242 46	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	NMI MIN	210 39	220 40	231 42	236 43	240 43	244 44	250 45	254 46	261 47	265 48	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)

CRUISE ALT		SL	5	10	15	20	25	DESCEND TO 20,000 FT
CRUISE MACH NO.		0.40	0.44	0.48	0.51	0.55		USE IDLE THRUST AND 240 KCAS WITH SPEED BRAKE CLOSED.
APPROX FUEL FLOW LB/HR		1825	1750	1700	1625	1600		
DESCEND	NMI REMAINING		6	13	19	25		
240 KCAS	MIN REMAINING		1	3	4	5		
IDLE (4)	FUEL REMAINING		305	310	315	320		

Note

WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.56 MACH, PRESSURE ALTITUDE 18,000 FEET.

(1) FUEL AND TIME INCLUDED FOR DESCENT AT DESTINATION WITHOUT DISTANCE CREDIT, SPEED BRAKE CLOSED.
(2) TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION; NO DISTANCE CREDIT FOR DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE OPEN.
(3) TIME AND FUEL INCLUDED FOR CLIMB TO OPTIMUM ALTITUDE AND DESCENT AT DESTINATION, RANGE INCLUDES DISTANCE FOR ON-COURSE DESCENT TO SEA LEVEL DESTINATION, SPEED BRAKE CLOSED.
(4) DESCENT DATA TABULATED FOR SPEED BRAKE CLOSED; WITH SPEED BRAKE OPEN, USE ONE-HALF OF THE VALUES.
5. CLIMB USING FOLLOWING MIL THRUST CLIMB SPEED SCHEDULE:

PRESS. ALT (1000 FT.)	SL	5	10	15	20	25
TRUE MACH	0.43	0.46	0.49	0.52	0.56	0.59
KCAS	281	278	271	264	256	246

FA4-13.

PART 5 ENDURANCE

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PURPOSE OF CHARTS.

Endurance charts determine the optimum mach number and fuel required to loiter at a given altitude for a specific period of time. A correction grid to gross weight for bank angle and a temperature correction grid (hotter-than-standard conditions) to fuel flow are provided for optional use.

NOTE

> The effects of temperature for colder-than-standard day conditions are considered negligible. Use standard day (baseline) for temperatures below standard day.

The altitude for maximum loiter time is defined in the charts by the drag index curves titled "optimum maximum endurance altitude" contained in the gross weight grid. The endurance chart for two-engine operation provides data for drag indices of 0 thru 75. The single-engine endurance chart provides data for drag indices of 0 thru 75.

USE.

Enter the appropriate two-engine or single-engine chart (FA5-1 or FA5-2) with gross weight. If the loiter period requires turning flight, gross weight should be corrected for bank angle. To use the bank angle correction grid, enter with gross weight and contour the nearest guideline to the right while simultaneously entering the bank angle scale with desired degree of bank angle and projecting up. At the point of intersection of the two projections, proceed left and read gross weight corrected for bank angle.

Gross weight (corrected for bank angle, if required) is then projected right from the gross weight scale of the chart to the pressure altitude. If maximum loiter time is desired, stop momentarily at the optimum maximum endurance altitude drag index curve (interpolate, if necessary). Mark this position location on the chart for further use.

From the point of intersection with pressure altitude, proceed up to the configuration drag index in the upper left grid of the chart, then left to read the indicated mach number for loiter. Return to the plotted point intersection of the gross weight and pressure altitude and proceed down to the drag index at the lower left portion of the chart, then right to the gross weight curve. From this point proceed up to the baseline of the temperature correction grid (standard day). For hotter-than-standard day condition, contour the guidelines to the temperature increase. (If no increase is required, proceed directly thru.) Fuel flow can be read while proceeding up to the desired loiter time. Project right to read fuel required for loiter.

If loiter is already known, project left from the fuel required scale and simultaneously intersect the vertical plot projected from the temperature grid to read loiter time.

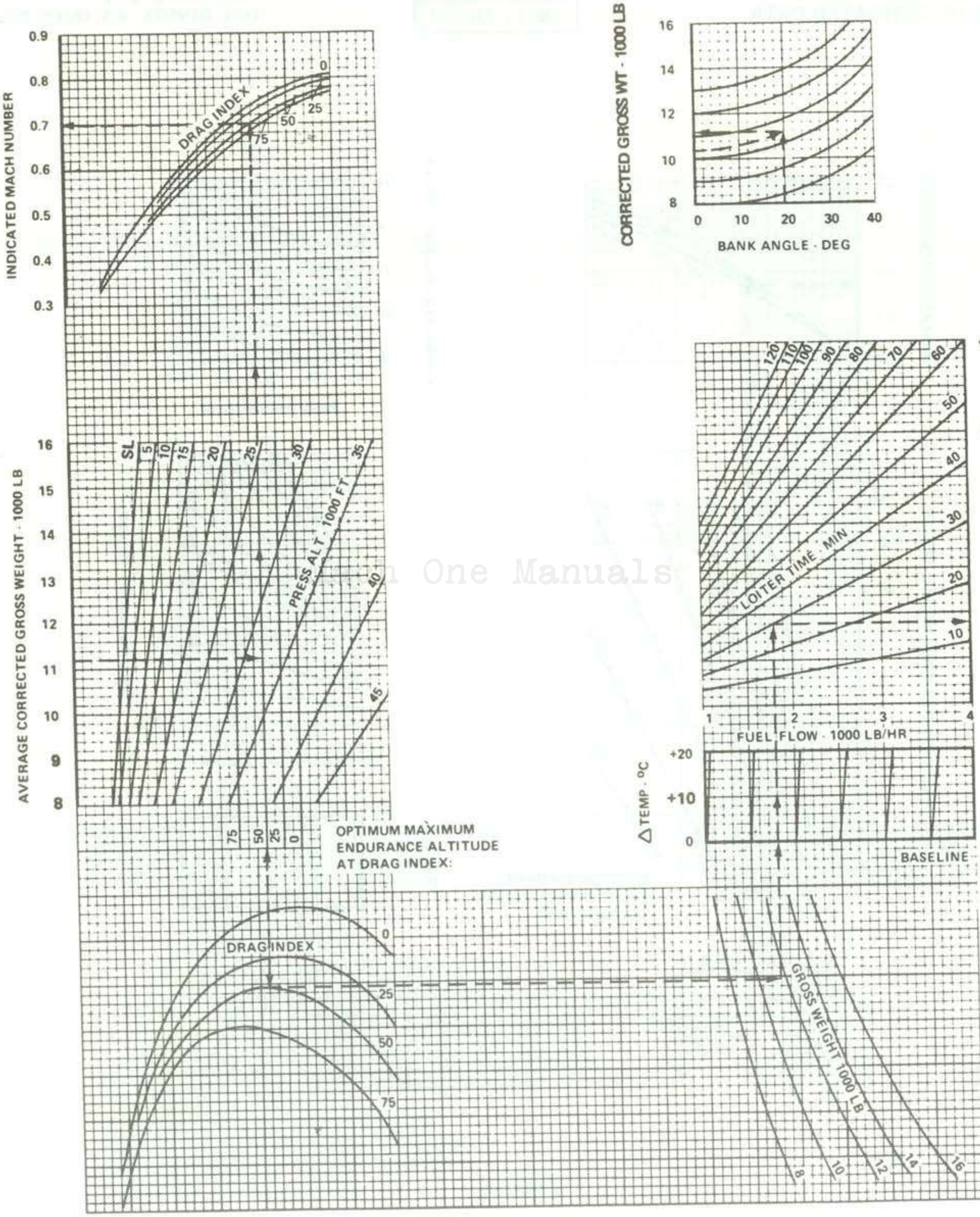
The chase-thru lines on FA5-1 represent an average gross weight of 10,500 pounds, bank angle of 20 degrees, drag index of 50, loiter time of 30 minutes, and a temperature deviation of 10°C hotter than standard. These lines show corrected gross weight of 11,200, an optimum maximum endurance altitude for a drag index of 50 of 32,000 feet, a loiter speed of 0.71 mach, a fuel flow of 1800 lbs/hr, and 900 pounds of fuel required. For loiter times of long duration greater accuracy requires use of average gross weight during loiter to calculate the fuel required. To obtain average loiter weight, the fuel required to loiter must first be determined based on gross weight at start or end of loiter and then is recalculated based on start or end gross weight, decreased or increased, respectively, by half the calculated loiter fuel.

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

MAXIMUM ENDURANCE FLAPS UP

FUEL REQUIRED AND MACH NUMBER
STANDARD DAY
DRAG INDEX= 0 TO 75

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FA5-1.

MAXIMUM ENDURANCE
FLAPS UP

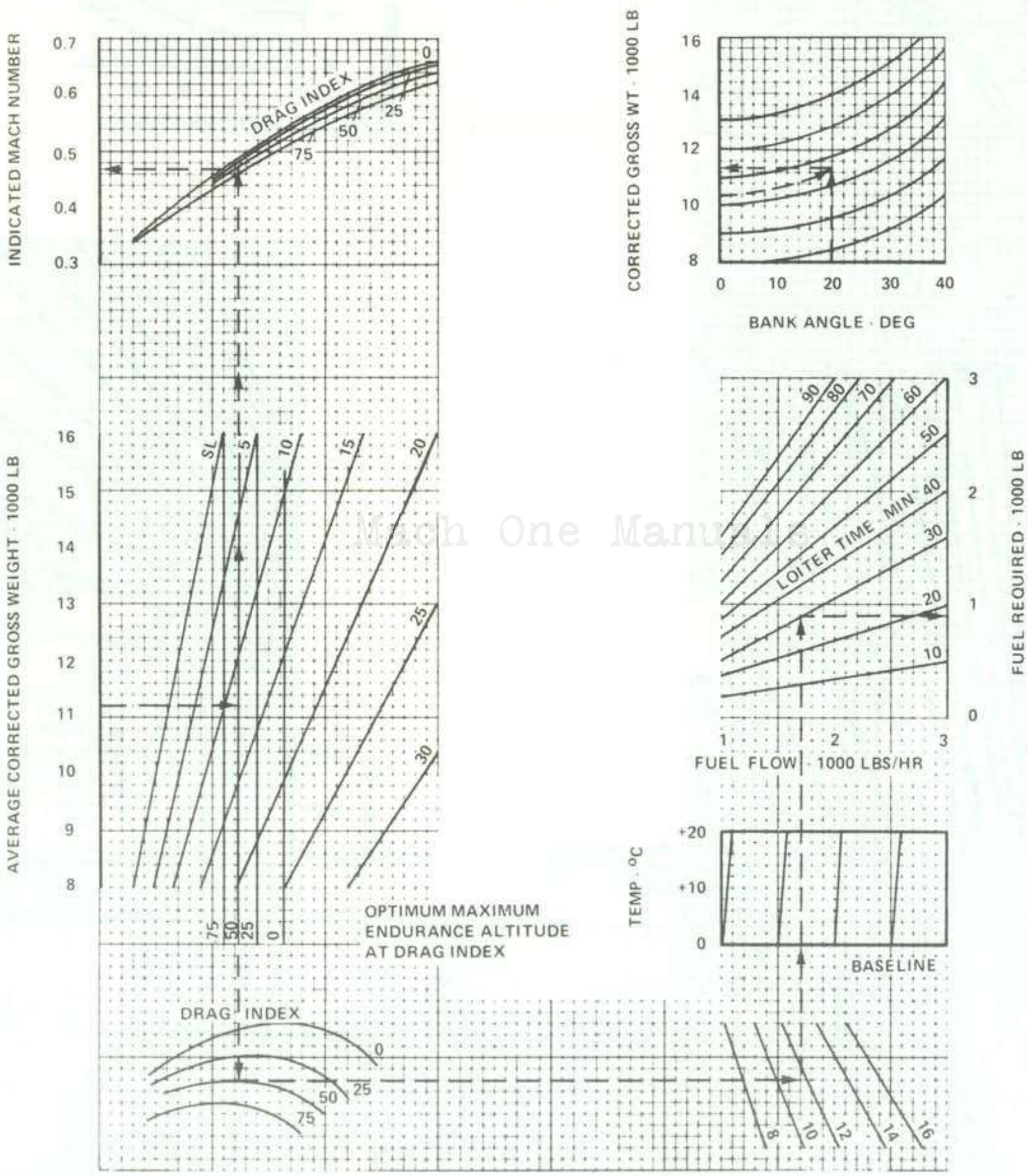
FUEL REQUIRED AND MACH NUMBER

STANDARD DAY
DRAG INDEX = 0TO 75

SINGLE ENGINE

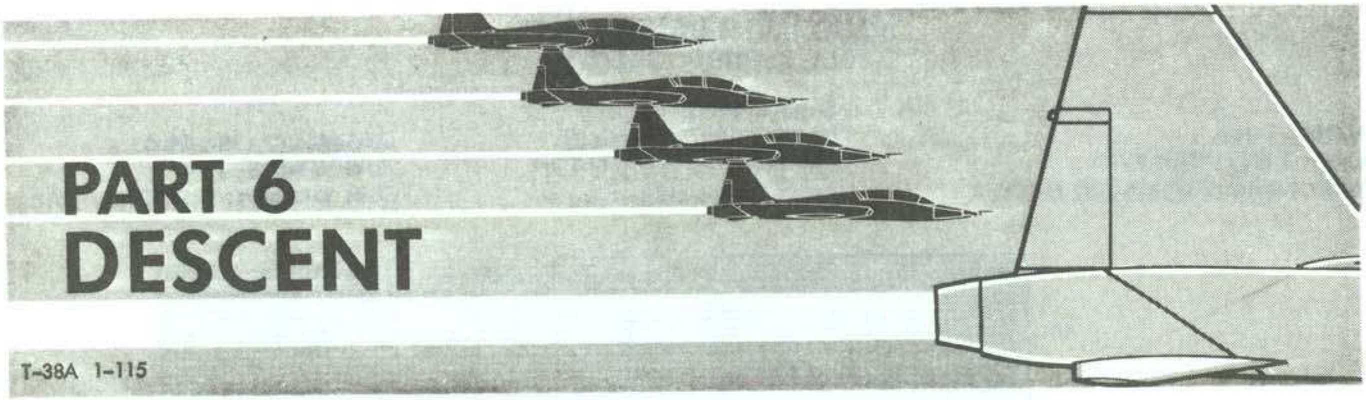
MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FA5-2.

PART 6 DESCENT



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PURPOSE OF CHARTS.

The descent charts provide a means of determining the fuel, time, and distance required to descend from altitude with speed brake closed or open.

DESCENT CHARTS.

The maximum range descent chart (FA6-1) shows the performance for maximum range. This range is obtained by using idle thrust and maintaining an airspeed of 240 KCAS. FA6-2 and FA6-3 give the performance for penetration descent. This chart requires 80% RPM and an airspeed of 280 KCAS. The descent charts may be used for descending from one altitude to another by reading the incremental values between the initial and final altitudes.

USE OF DESCENT CHARTS.

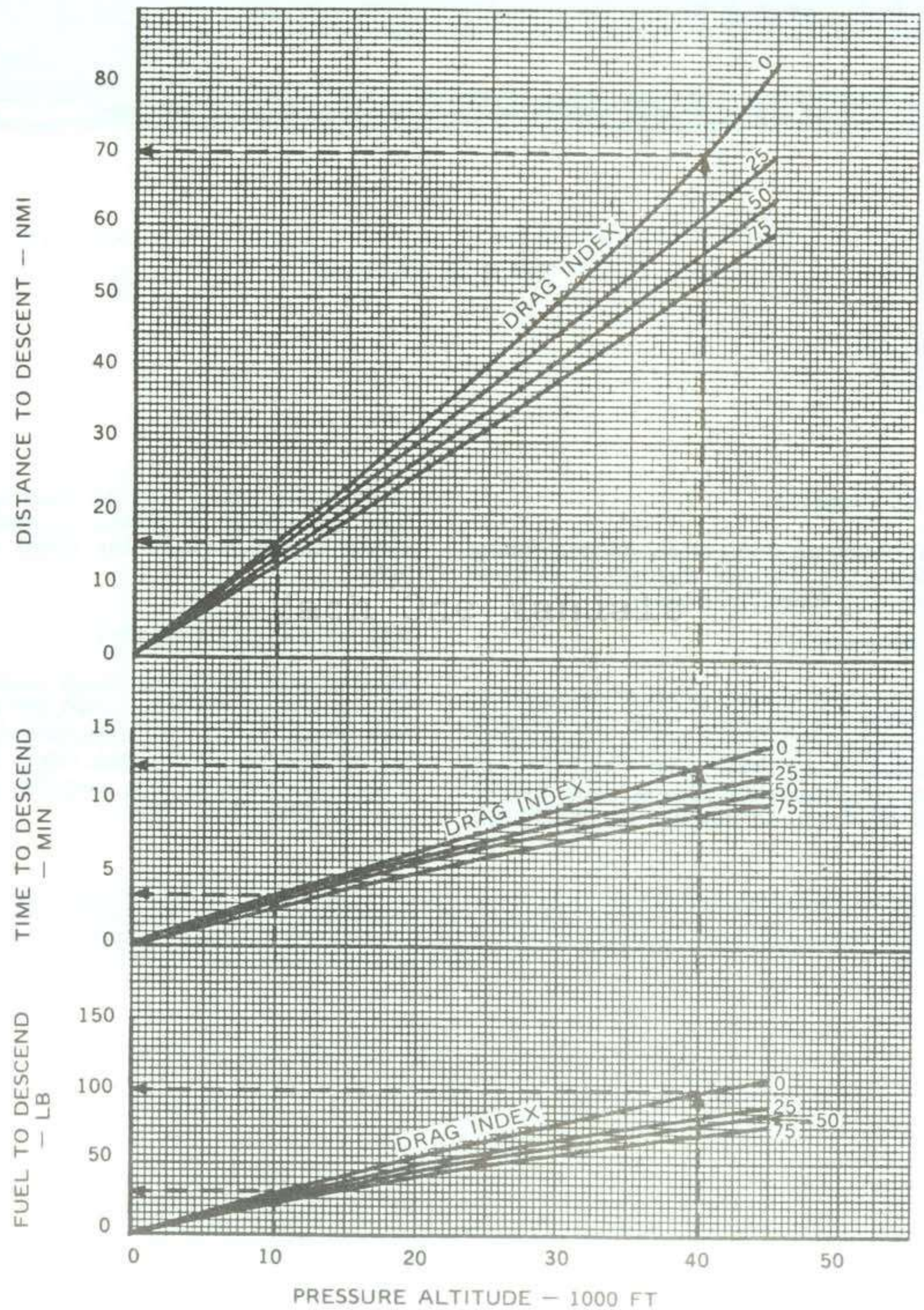
Assume that maximum range descent is desired from a pressure altitude of 40,000 feet to 10,000 feet. From FA6-1, the chase-thru lines show the fuel to descend is 70 pounds (98 − 28), the time is 9 minutes (12.5 − 3.5), and the distance is 54 nautical miles (70 − 16).

MAXIMUM RANGE DESCENT
IDLE THRUST 240 KCAS

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

STANDARD DAY
DRAG INDEX 0 TO 75
ALL GROSS WEIGHTS
SPEED BRAKE IN

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FA6-1.

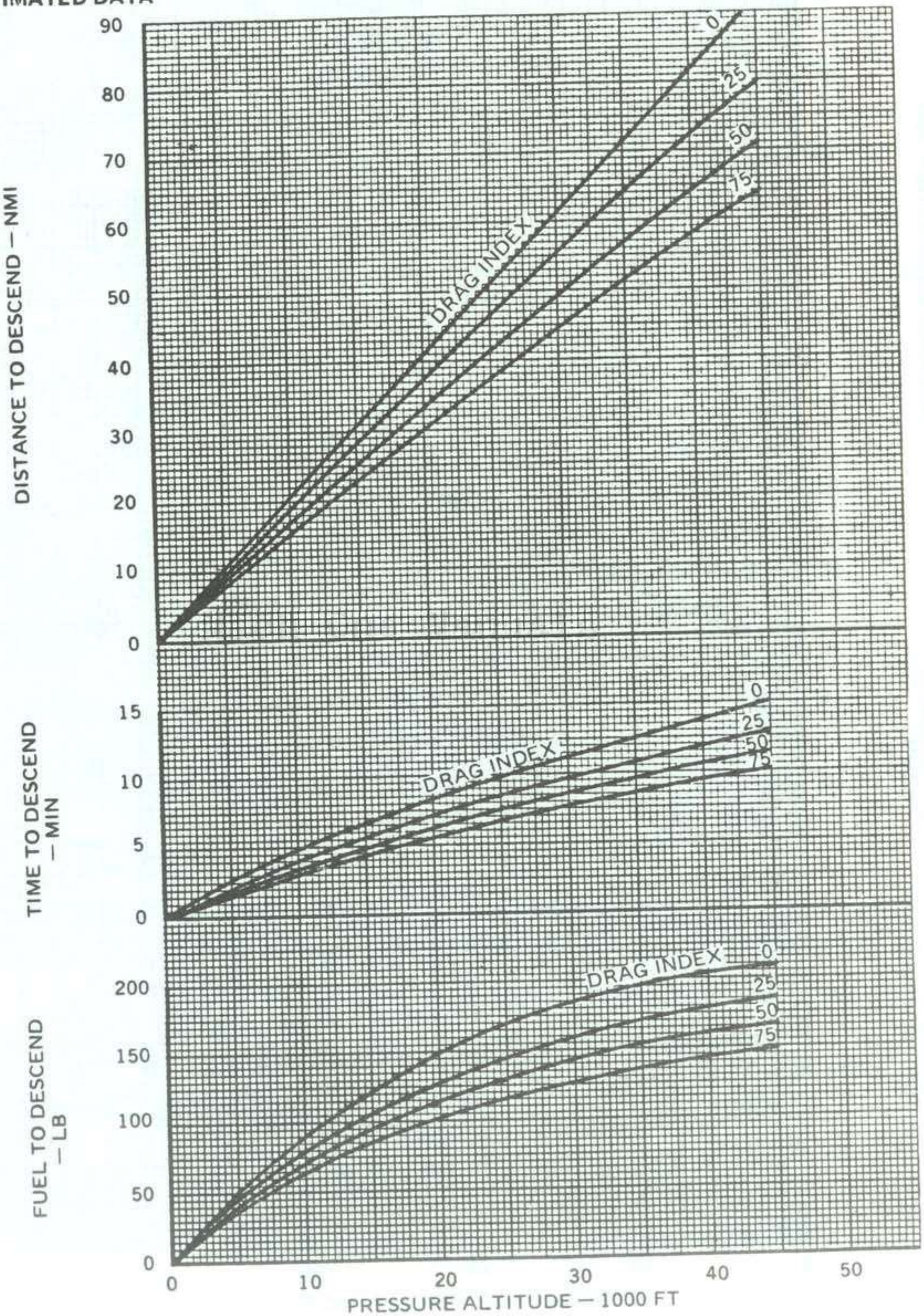
PENETRATION DESCENT

80% RPM 300 KCAS
STANDARD DAY

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

DRAG INDEX 0 TO 75
SPEED BRAKE--CLOSED

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



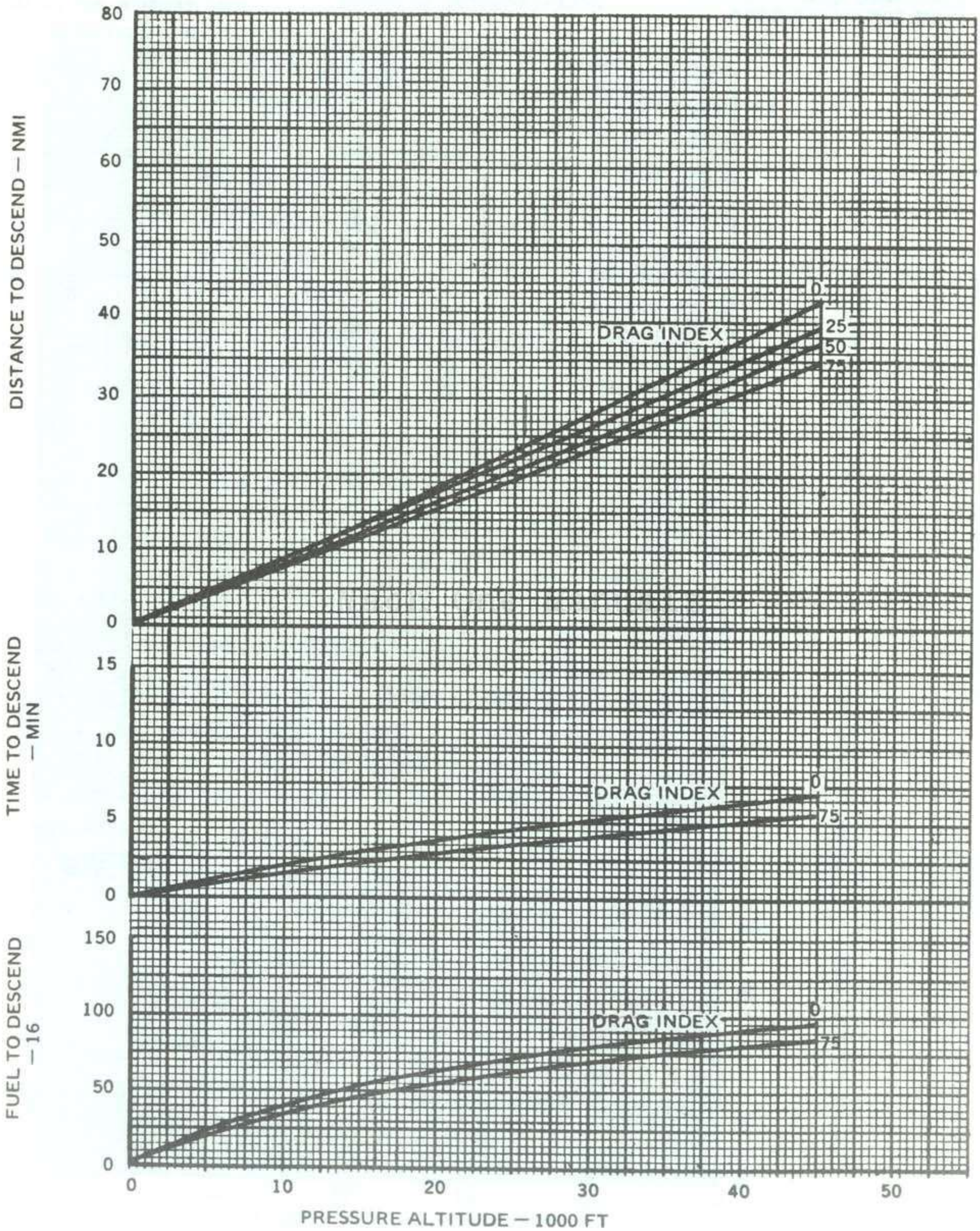
FA6-2.

PENETRATION DESCENT

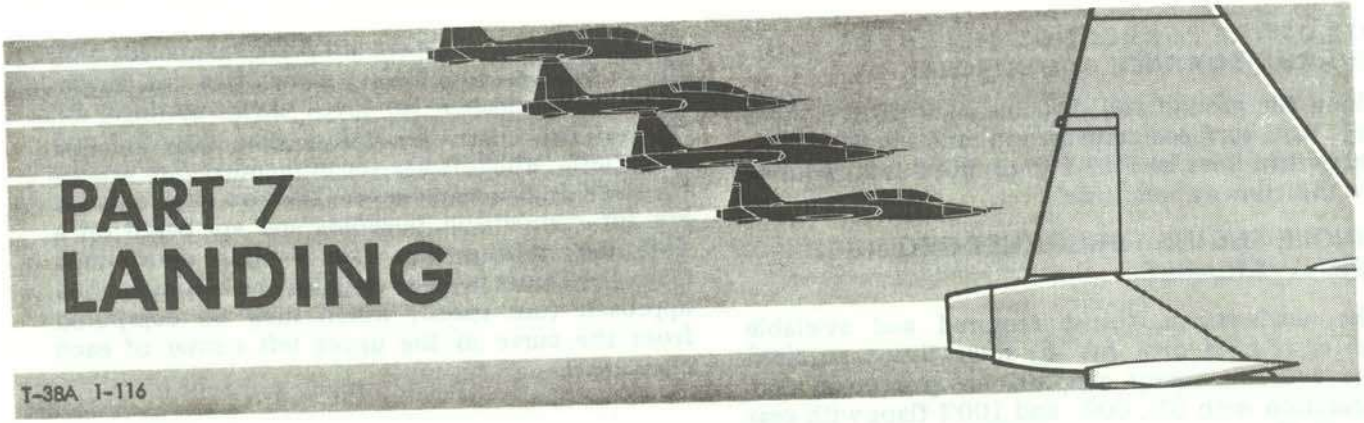
80% RPM — 300 KCAS — STANDARD DAY
SPEED BRAKE — OUT
DRAG INDEX 0 TO 75

MODEL: T-38A
DATE: 1 OCTOBER 1976
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FA6-3.



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LANDING DISTANCE.

The landing distance chart (FA7-1) shows ground distance and associated landing speeds. The ground roll distance is based on full flaps. The chart shows data for landing at the appropriate chart landing speeds, maintaining a 12-degree nose high attitude until just prior to loss of elevator authority, then lowering the nosewheel to the runway, and applying optimum braking. If the landing technique differs, landing distances will vary from those given in the charts. A 5-percent variation in touchdown speed causes approximately a 10-percent variation in landing distance. Insufficient aerodynamic or wheel braking could further increase the ground roll distance by as much as 50 percent.

LANDING SPEED.

The landing speed chart (FA7-1) shows the normal landing final approach speed, minimum roll landing final approach speed, and touchdown speed. The landing speeds in the normal landing distance chart (FA7-1) are compatible with the normal landing pattern speed rule in section II, which indicates that final turn, final approach, and touchdown speeds be increased 1 knot for each 100 pounds of fuel above 1000 pounds of fuel remaining.

USE OF LANDING DISTANCE CHART.

The chase-thru lines in the landing distance chart (FA7-1) show a landing with two engines operating, with a runway air temperature of 15°C at 2000 feet pressure altitude, a gross weight of 9000 pounds, and a 20-knot headwind.

EFFECT OF RUNWAY CONDITION (RCR) ON GROUND ROLL DISTANCE.

FA7-2 provides the means of correcting the landing ground roll distance for the effect of various runway surface conditions. The corrections are shown as a function of Runway Condition Readings (RCR), which is a number indicating the degree of braking effectiveness available during the ground roll. RCR values vary from 23 to 5 for dry to icy runways. RCR of 12 is provided for a wet runway but for conditions of heavy rain or standing water lower RCR values should be selected to determine the approximate stopping distance. When wet conditions prevail the runway will be reported as wet (no RCR provided).

CAUTION

RCR values provide an approximation of the required stopping distance. RCR is only valid for dry or icy runways. Selection of an RCR for a wet runway does not insure a safe landing and stopping distance. If hydroplaning occurs, it is not possible to predict the actual stopping distance.

USE OF THE CORRECTION CHART FOR RUNWAY SURFACE CONDITIONS.

Using the ground roll distance of 2700 feet for a dry, hard surfaced runway and an RCR of 12, the chase-thru lines in FA7-2 show 3600 feet required for this runway condition.

SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE.

The single-engine thrust required and available charts (FA7-3 thru FA7-5) show thrust required and available versus airspeed for go-around configuration with 0%, 60%, and 100% flaps with gear down. These charts are for several weights and temperatures from sea level to 6,000 feet and include both single-engine MAX and MIL thrusts.

USE OF SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE CHART.

Assume an airspeed of 160 KIAS, a weight of 11,000 pounds, and an ambient temperature of 30°C with MAX thrust. The chase-thru lines in FA7-3 show the thrust required is 2230 pounds for all altitudes, and the thrust available is 2810 pounds at sea level. When the pressure altitude is 2000 feet, the thrust available is 2625 pounds.

EFFECT OF BANK ANGLE ON VERTICAL VELOCITY.

The effect of bank angle on vertical velocity charts show the climb capability of the aircraft as a function of ambient temperature, gross weight (fuel remaining), bank angle, and thrust setting. FA7-6 shows two and single-engine performance for MIL thrust settings and FA7-7 shows two and single-engine performance for MAX thrust settings. All of the charts are for landing gear extended and 60% flaps, which is the recommended flap setting for single-engine approaches. The two engine charts are for comparison purposes and are based on a 60% flap setting. The rate-of-climb determined from the charts is valid only for the recommended approach turn speed, which may be computed from the curve in the upper left corner of each chart.

USE OF EFFECT OF BANK ANGLE ON VERTICAL VELOCITY CHARTS.

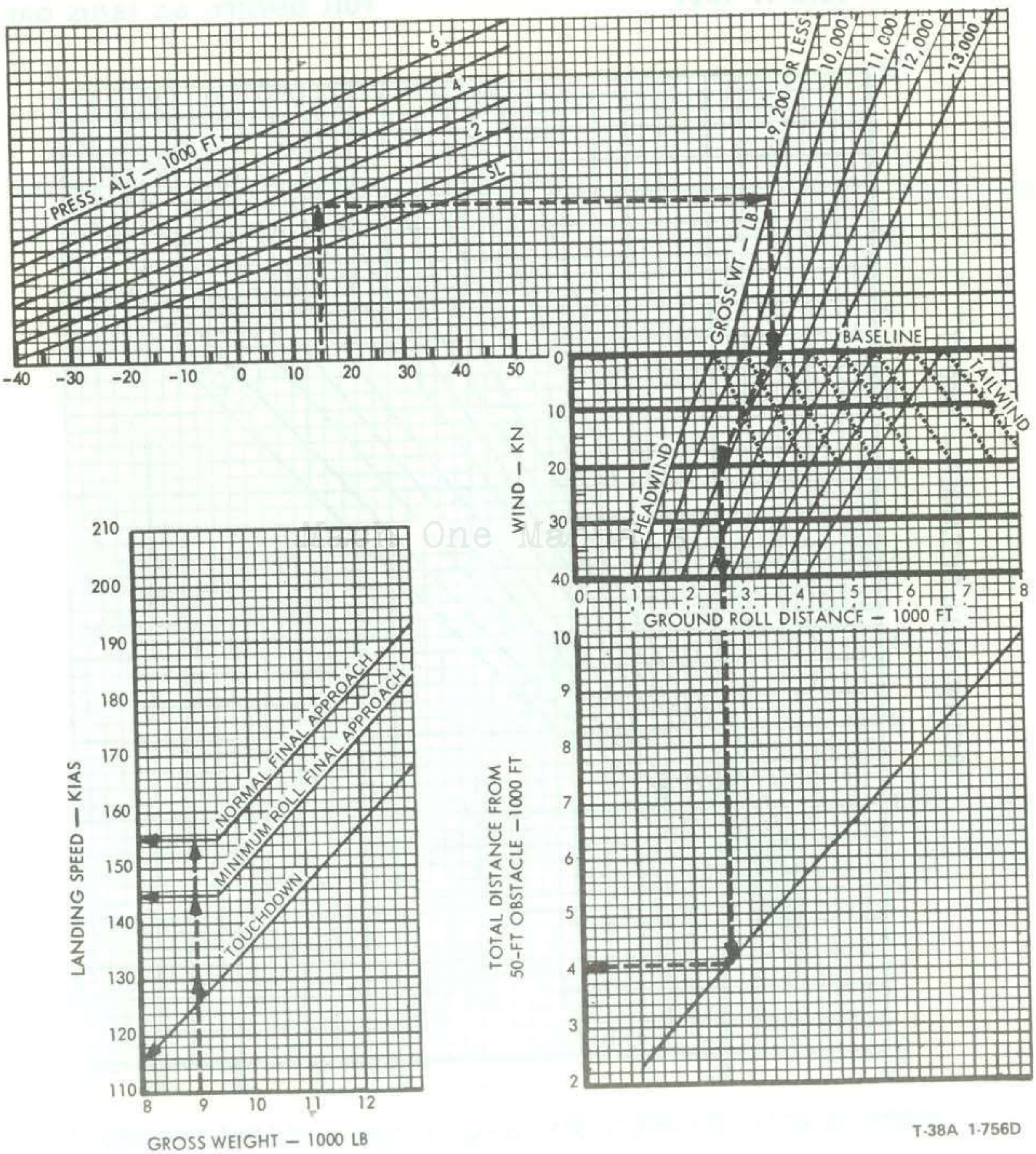
Assume a pattern altitude at 2000 feet, ambient temperature of 25°C and 1000 pounds of fuel remaining. Entering the MIL thrust, single-engine chart, FA7-6 (sheet 2), the chase-thru lines show an approach turn speed of 175 KIAS. Reentering the chart at an ambient temperature of 25°C the chase-thru lines show a climb capability of 300 fpm with a 0° bank angle. If a 30° bank angle were used in turn, the chase-thru lines show a negative climb capability of −300 fpm in the gray area. In the MAX thrust, single-engine chart FA7-7 (sheet 2), for the same conditions, the chase-thru lines show a 2300 fpm climb capability at 0° bank angle and 1700 fpm climb capability at a 30° bank angle.

LANDING DISTANCE

DRY, HARD SURFACED RUNWAY
FULL FLAPS

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

ENGINES: (2)J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



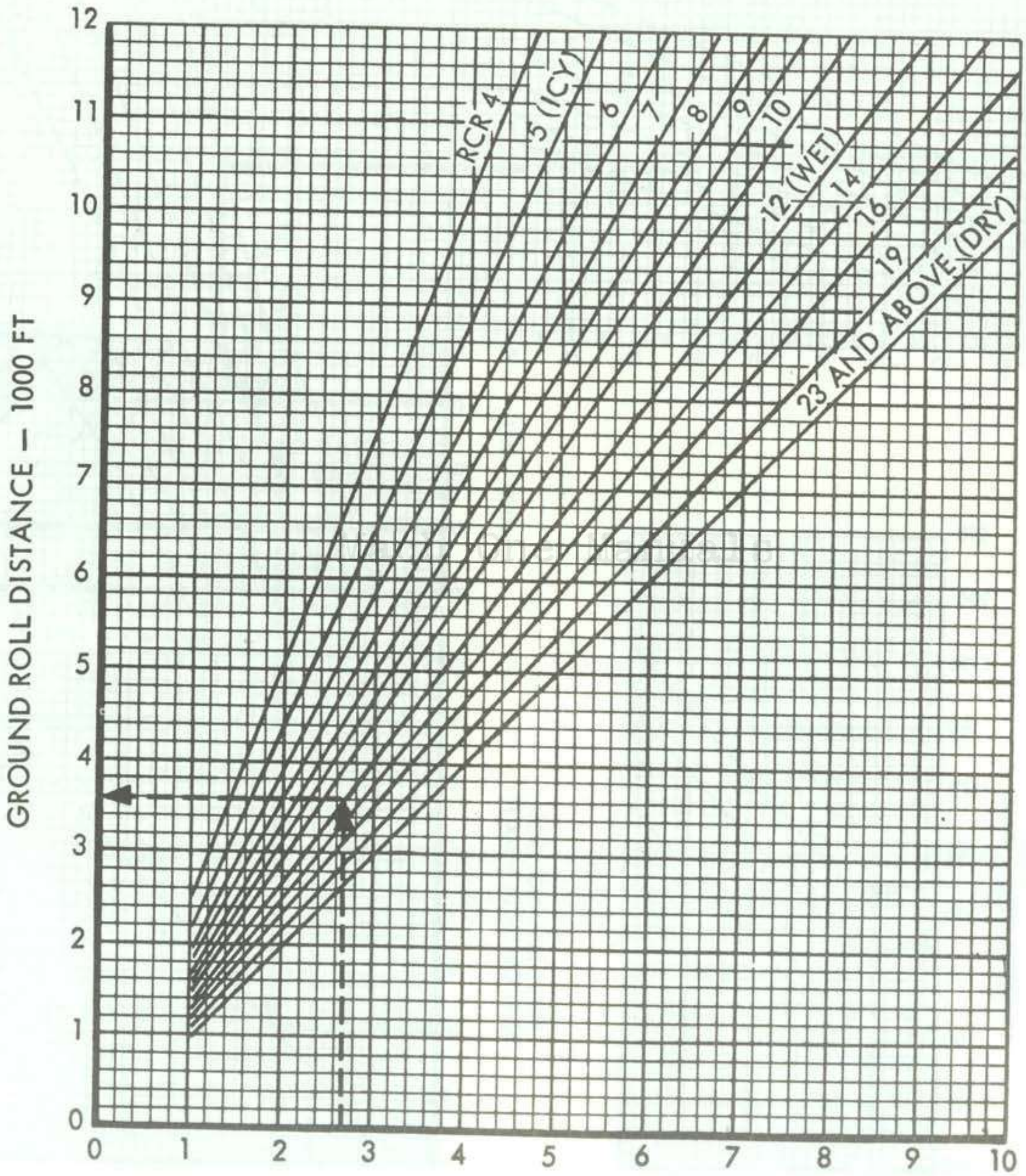
FA7-1.

EFFECT OF RUNWAY CONDITION (RCR)

ON GROUND ROLL DISTANCE
FULL FLAPS

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-752 D

FA7-2.

SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE

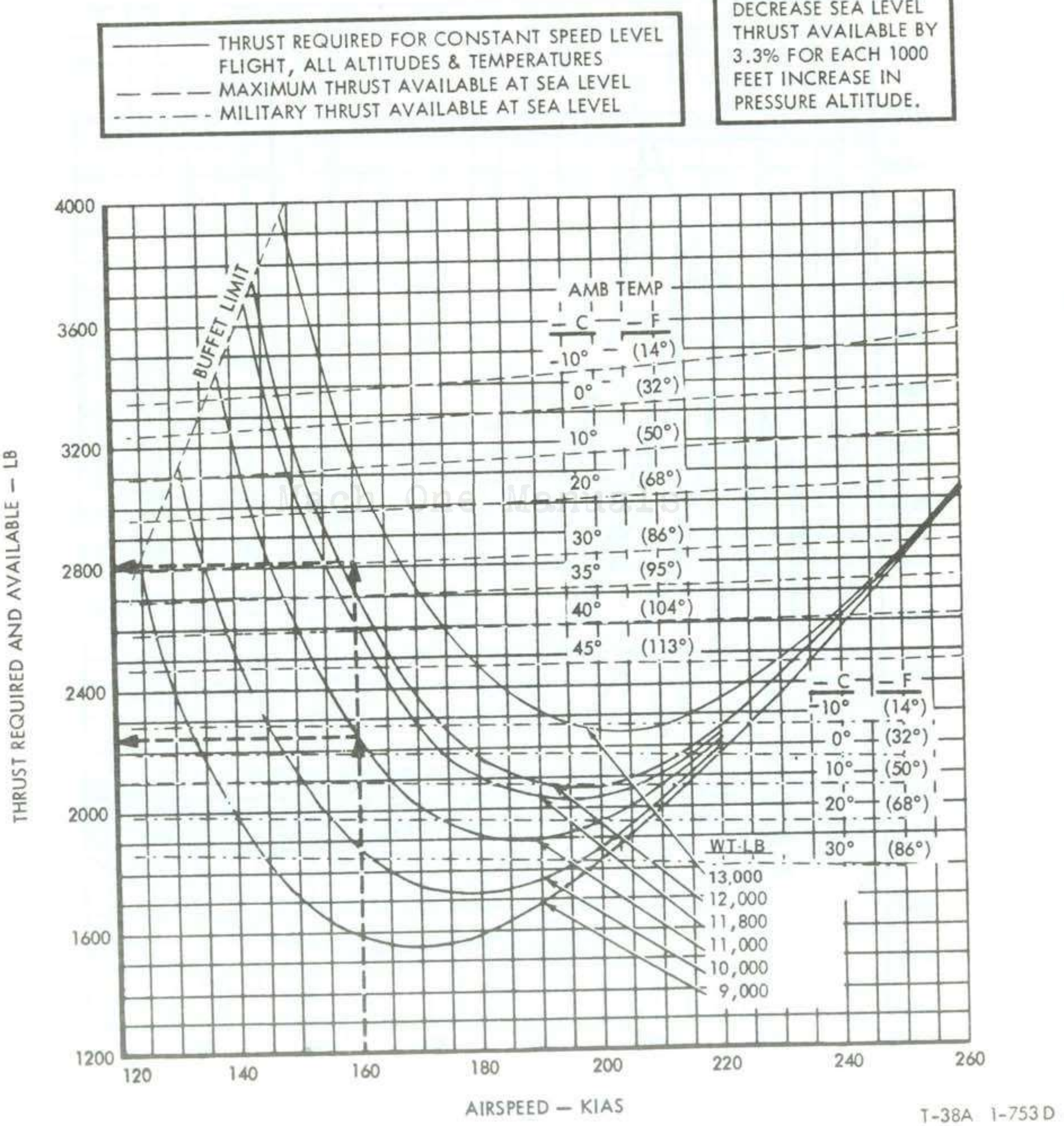
WITH 60% FLAPS AND GEAR DOWN
SEA LEVEL TO 6000 FEET

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATE

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

Note

DECREASE SEA LEVEL THRUST AVAILABLE BY 3.3% FOR EACH 1000 FEET INCREASE IN PRESSURE ALTITUDE.



FA7-3.

SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE

0% FLAPS, GEAR DOWN

SEA LEVEL TO 6000 FEET

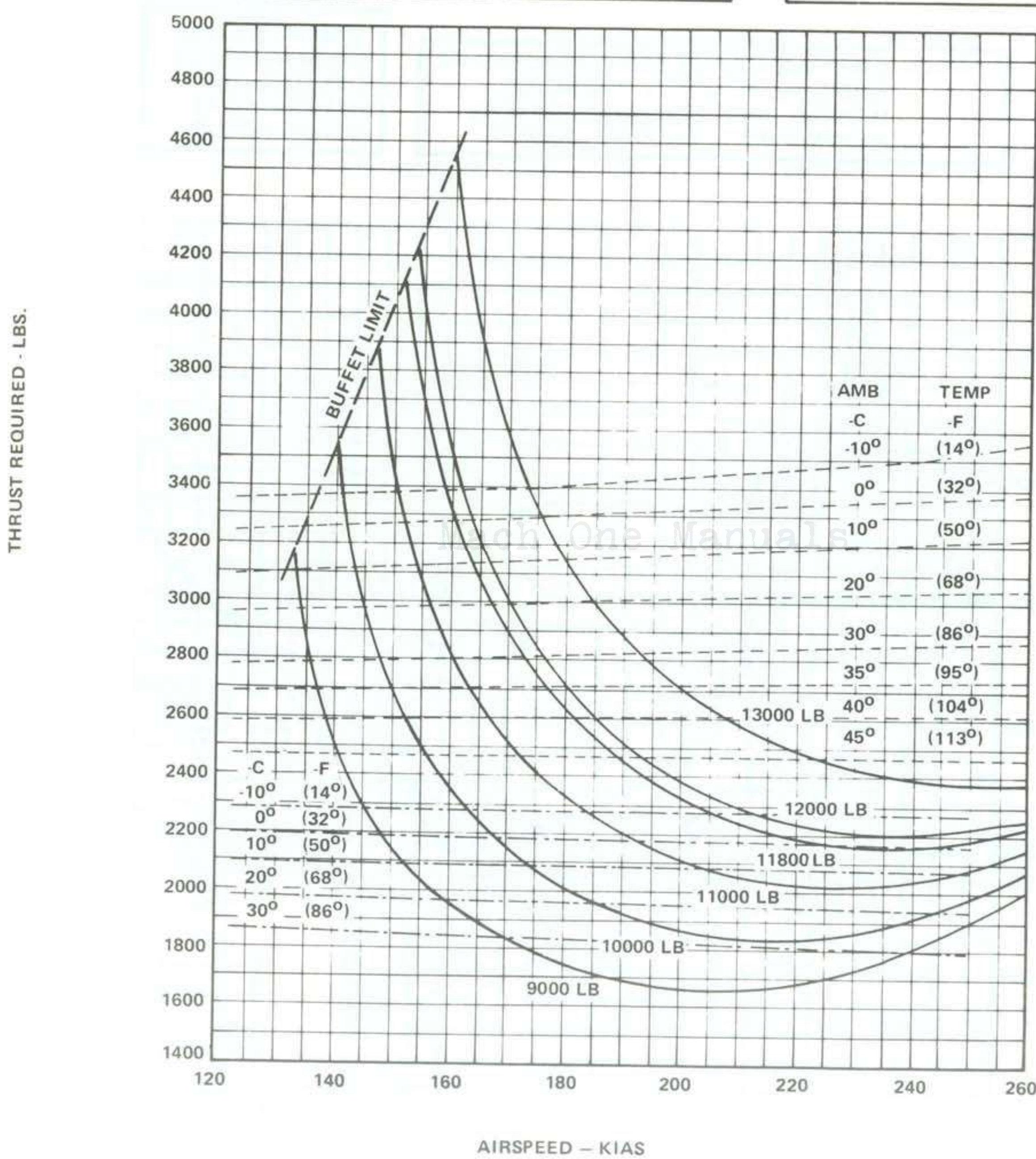
MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

———— THRUST REQUIRED FOR CONSTANT SPEED LEVEL FLIGHT, ALL ALTITUDES & TEMPERATURES
– – – – MAXIMUM THRUST AVAILABLE AT SEA LEVEL
— - — MILITARY THRUST AVAILABLE AT SEA LEVEL

Note

DECREASE SEA LEVEL THRUST AVAILABLE BY 3.3% FOR EACH 1000 FEET INCREASE IN PRESSURE ALTITUDE.



FA7-4.

SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE

100% FLAPS, GEAR DOWN

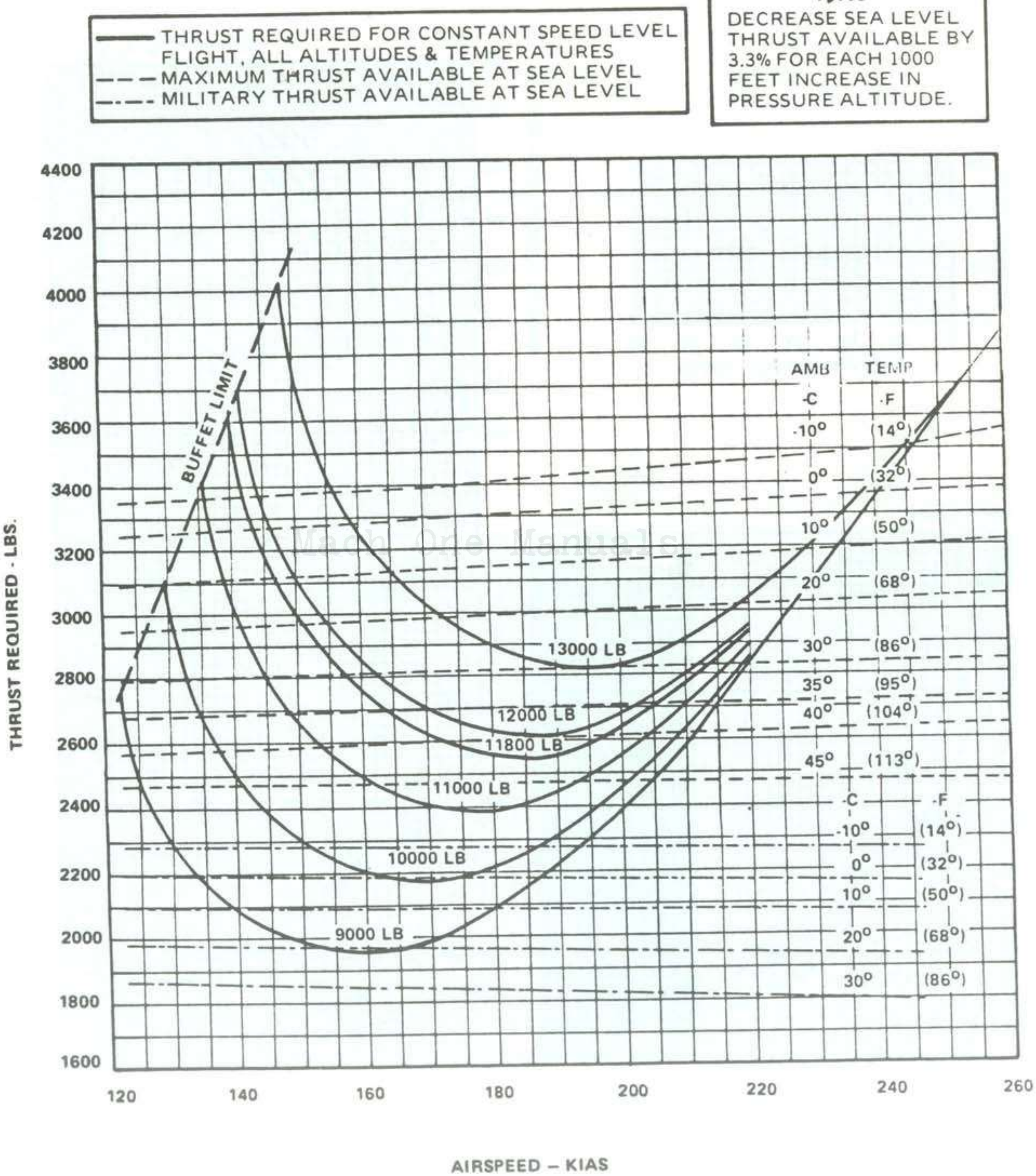
SEA LEVEL TO 6000 FEET

MODEL: T-38A
DATE: 1 JULY 1978
DATA BASIS: ESTIMATED DATA

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL.

Note

DECREASE SEA LEVEL THRUST AVAILABLE BY 3.3% FOR EACH 1000 FEET INCREASE IN PRESSURE ALTITUDE.



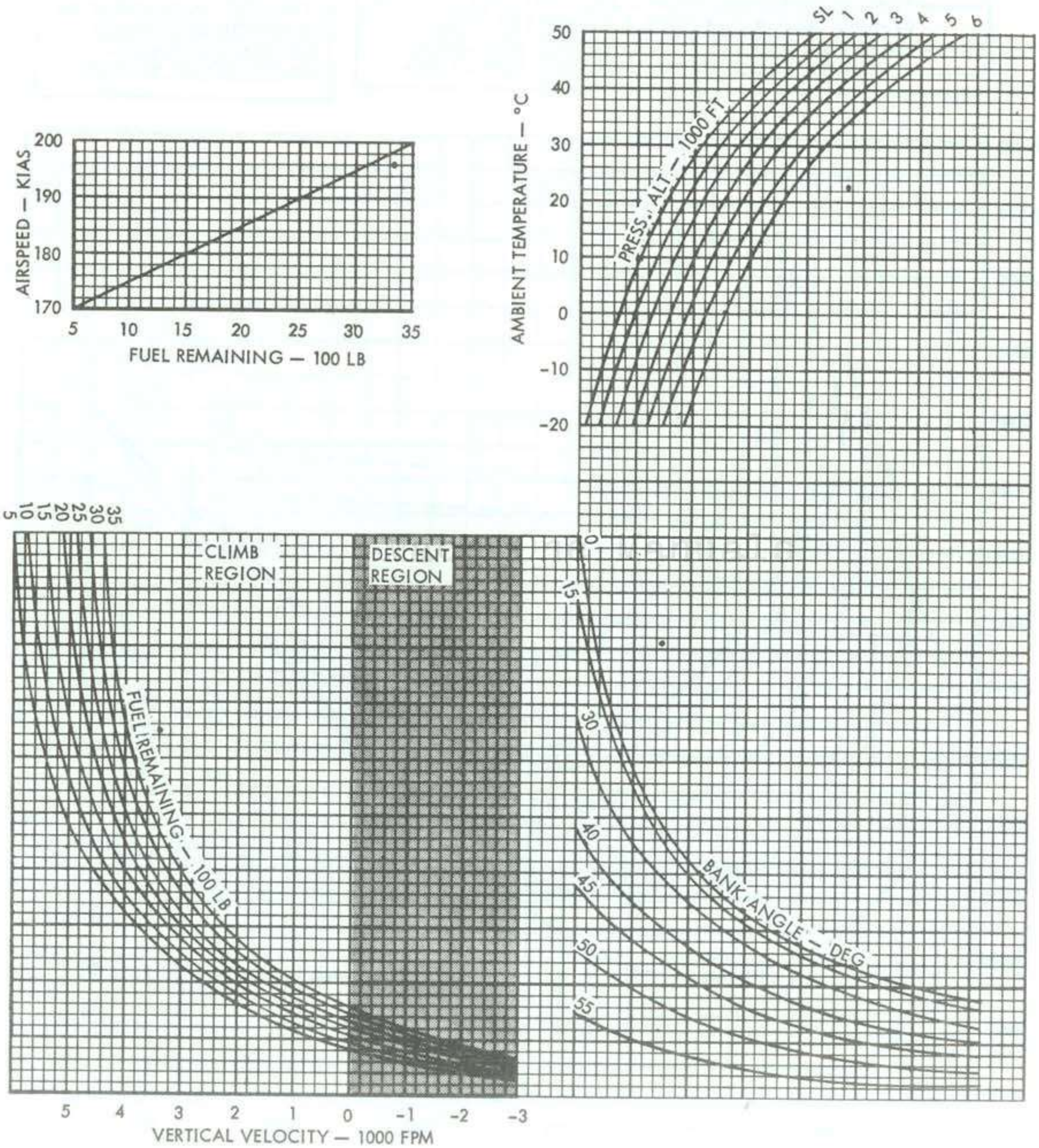
FA7-5.

EFFECT OF BANK ANGLE ON VERTICAL VELOCITY

MIL THRUST
WITH 60% FLAPS AND GEAR DOWN

MODEL: T-38A
DATE: 1 APRIL 1969
DATA BASIS: **FLIGHT TEST**

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-754(1)

FA7-6. (Sheet 1)

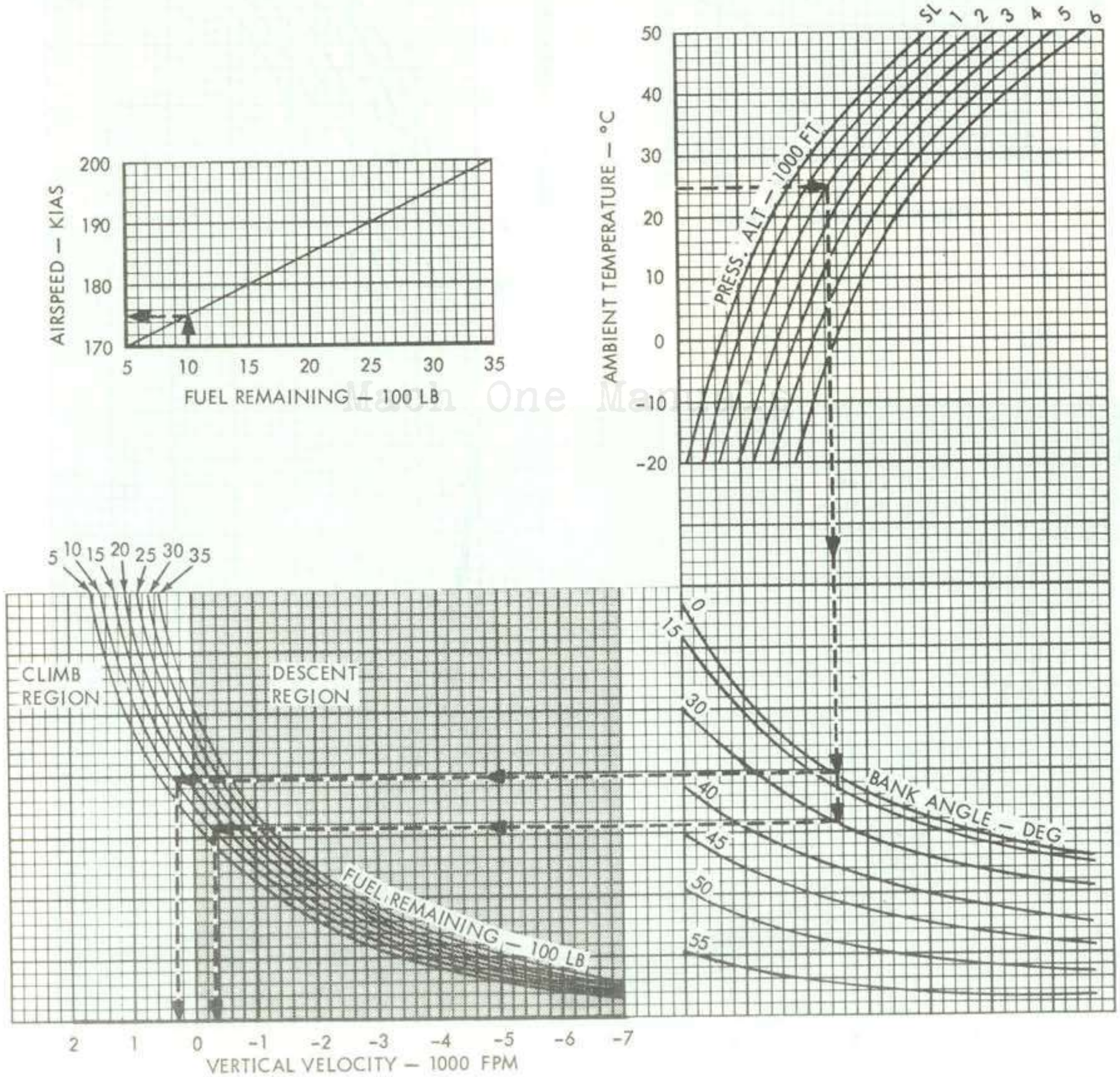
EFFECT OF BANK ANGLE ON VERTICAL VELOCITY

MIL THRUST
WITH 60% FLAPS AND GEAR DOWN

SINGLE ENGINE

MODEL: T-38A
DATE: 1 APRIL 1969
DATA BASIS: **FLIGHT TEST**

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-754(2)

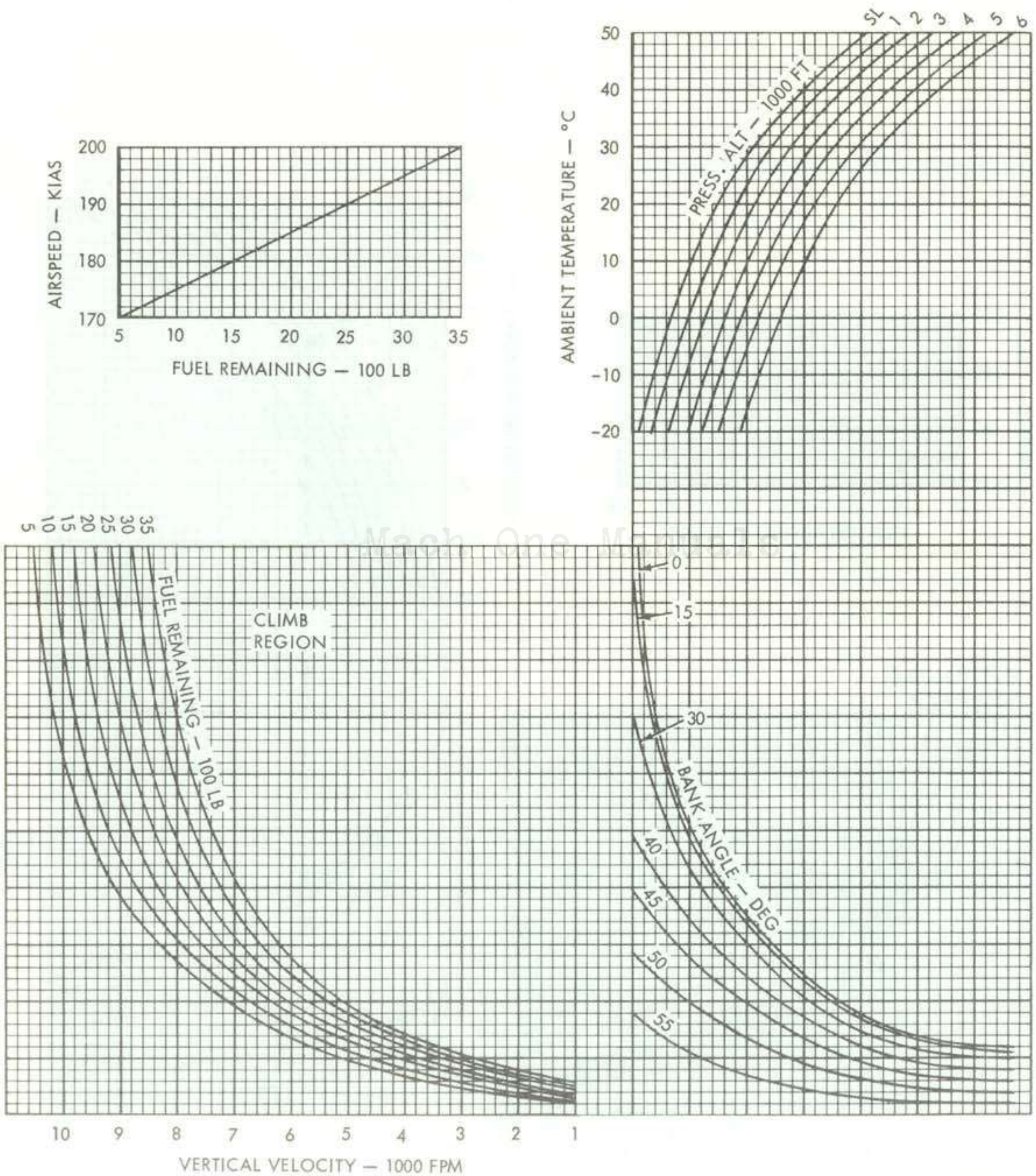
FA7-6. (Sheet 2)

EFFECT OF BANK ANGLE ON VERTICAL VELOCITY

MAX THRUST
WITH 60% FLAPS AND GEAR DOWN

MODEL: T-38A
DATE: 1 APRIL 1969
DATA BASIS: **FLIGHT TEST**

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-755(1)

FA7-7. (Sheet 1)

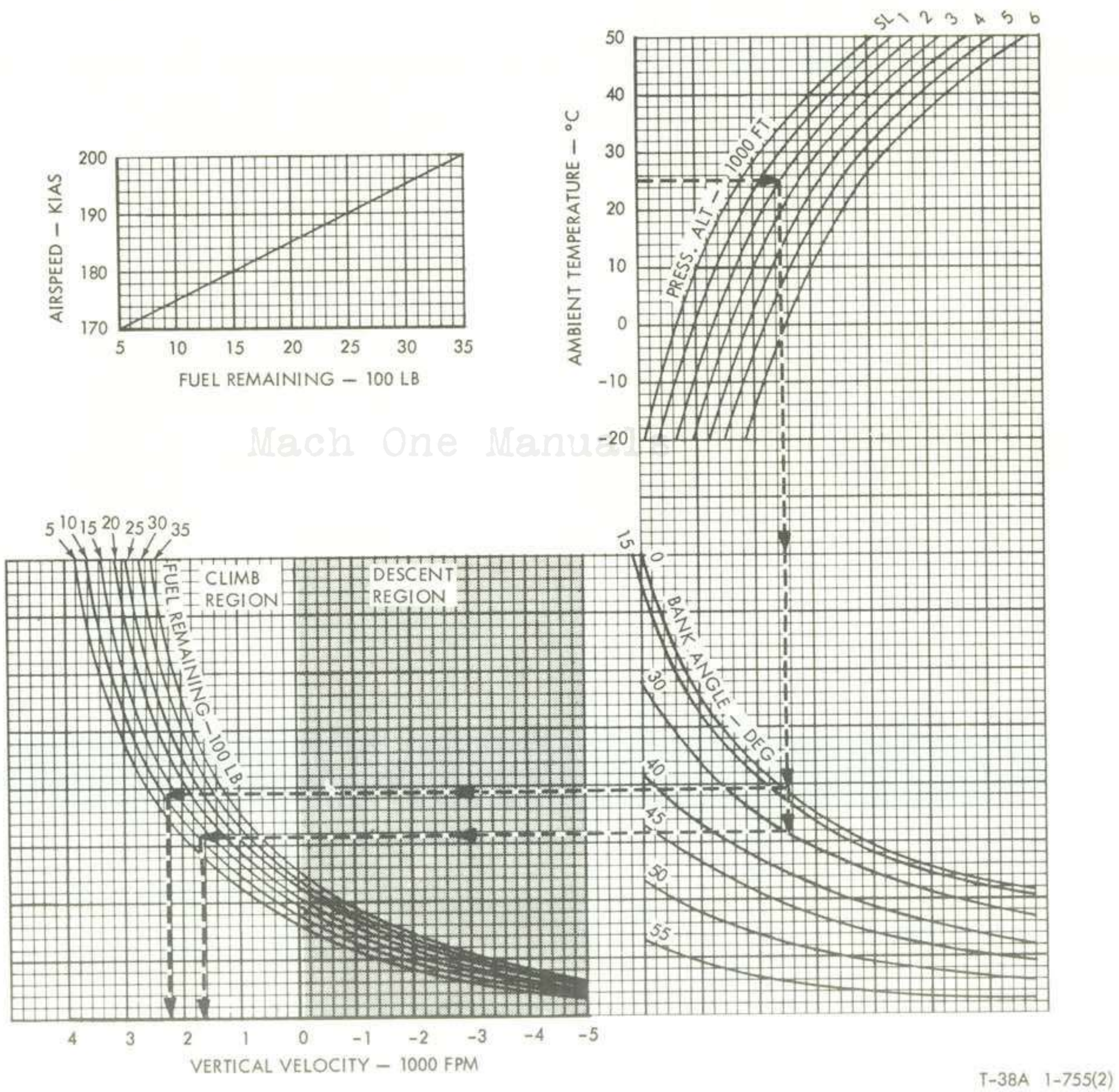
EFFECT OF BANK ANGLE ON VERTICAL VELOCITY

MAX THRUST
WITH 60% FLAPS AND GEAR DOWN

SINGLE ENGINE

MODEL: T-38A
DATE: 1 APRIL 1969
DATA BASIS: **FLIGHT TEST**

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



FA7-7. (Sheet 2 of 2)

PART 8 MISSION PLANNING

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PURPOSE OF MISSION PLANNING.

Mission planning can be termed preflight planning. The purpose of preflight planning is to obtain optimum performance from the aircraft for any specific mission. Optimum performance will vary, for example, from maximum time on station to maximum radius with no time on station. Exact requirements will vary, depending upon the types of missions to be flown.

MISSION PLANNING SAMPLE PROBLEM.

The following problem is an exercise in the use of the performance charts. It is not intended to reflect actual or proposed missions employing this aircraft on a typical cross country flight.

FLIGHT PLAN DATA.

A mission profile is to be flown, assuming the following conditions:

1. Takeoff data.

   a. Takeoff weight (solo) . . . . . 11,800 lb.
   b. Wind . . . . 10-knot headwind.
   c. Runway temperature . . . . . . 15°C.
   d. Pressure altitude . . . . 4000 ft.
   e. Runway . . . . 7000 ft.
   f. RCR . . . . 12.

2. Climb data to 35,000 ft.

   a. Temperature deviation from standard +10°C.
   b. Wind. . . . . 15-knot headwind.

3. 35,000 ft. cruise data.

   a. Temperature. . . . . —46°C.
   b. Wind . . . . 50-knot headwind.
   c. Speed . . . . Optimum.

4. Descent data to 3000 ft.

   a. Temperature deviation from standard . . . . Zero.
   b. Wind . . . . 15-knot tailwind.

5. Enter pattern 1000 ft above terrain with 1000 lb. fuel reserve.

6. Landing data.

   a. Landing weight. . . . . 9000 lb.
   b. Wind . . . . 20-knot headwind.
   c. Temperature . . . . 15°C.
   d. Pressure altitude . . . . 2000 ft.
   e. Runway length . . . . 7000 ft.
   f. RCR . . . . 12.

TAKEOFF.

1. MAX thrust takeoff factor (FA2-2) . . . 3.45.
2. Takeoff speed (FA2-3) . . . . . 154 KIAS.
3. Takeoff distance (FA2-4) . . . . . 3050 ft.
4. Critical field length (FA2-6).
   a. RCR = 23 . . . . 5800 ft.
   b. RCR = 12 . . . . 6500 ft.

5. Critical engine failure speed (FA2-7).

   a. RCR = 23 . . . . 132 KIAS.
   b. RCR = 12 . . . . 112 KIAS.

6. Acceleration check speed at 1500 feet from brake release.

   a. Normal (FA2-10) . . . . 110 KIAS.
   b. Minimum (7000 − 6500) = 500,

   $110 - (\frac{500}{1000} \times 3)$ . . . . . . 108 KIAS.

7. Single-engine takeoff speed (FA2-3). (154 + 8) . . . . 162 KIAS.

8. Refusal speed (FA2-7).

   a. RCR = 23 . . . . 143 KIAS.
   b. RCR = 12 . . . . 116 KIAS.

INITIAL CLIMB FROM 4000 FT TO FLIGHT LEVEL 350.

(Using MIL Thrust Climb Chart FA3-1)

1. Aircraft weight at start of climb is 11,800 lb minus the allowance for taxi, takeoff, and acceleration to climb speed (11,800 − 300) . . . . 11,500 lb.

2. Obtain time to climb, fuel to climb, and climb range.
   Time (8.2 − 0.6) . . . . . . 7.6 min.
   Fuel (565 − 55) . . . . . . 510 lb.
   Range (67 − 3) . . . . . . 64 nmi.

3. Compute distance lost due to headwind (15 X 7.6/60) . . . . 2 nmi.

4. Adjusted climb range (64 − 2) . . . . 62 nmi.

5. Weight at level-off (11,500 − 510) . . . . 10,990 lb.

PENETRATION DESCENT TO 3000 FT, SPEED BRAKE OPENED (280 KCAS, 80% RPM).

1. Obtain time, fuel, and no wind range from FA6-3.
   Fuel (85 − 15) . . . . 70 lb.
   Time (5.6 − 0.6) . . . . . . 5.0 min.
   Range (32 − 2) . . . . . . 30 nmi.

2. Compute distance gained due to tailwind (15X 5.0/60) . . . . 1 nmi.

3. Compute ground range (30 + 1) . . . 31 nmi.

4. Weight at end of descent (8010 + 1000) . . . . 9010 lb.

AVERAGE GROSS WEIGHT.

1. Weight at beginning of cruise . . . 10,990 lb.

2. Weight at end of cruise (9010 + 70) . . . . 9080 lb.

3. Compute fuel for cruise (10,990 − 9080) . . . . 1910 lb.

4. Average weight (10,990 − 1/2 X 1910) . . . . . 10,035 lb.

CRUISE AT FLIGHT LEVEL 350.

(Using Cruise chart FA4-1).

1. Maximum range mach number 0.83

2. Basic reference number 4

3. Nautical miles per pound 0.338

4. True airspeed . . . . 485 kn.

5. Fuel flow lb/hr/eng. 715

6. Groundspeed (485 − 50) . . . . . . 435 kn.

7. Time $(\frac{1980 \times 60}{715 \times 2})$ . . . . 83 min.

8. Ground distance $(83 \times \frac{435}{60})$ . . . . 602 nmi.

CRUISE AT FLIGHT LEVEL 350.

(Using Constant Altitude Cruise chart FA4-3).

1. True mach number 0.83

2. True airspeed . . . . 485 kn.

3. True groundspeed . . . . 435 kn.

4. Fuel flow lb/hr/eng 715

5. Time $(\frac{1980 \times 60}{715 \times 2})$ . . . . 83 min.

6. Ground distance $(83 \times \frac{435}{60})$ . . . . 602 nmi.

LANDING.

(Using Normal Landing Distance chart FA7-1).

1. Final turn speed . . . . 175 KIAS.

2. Normal landing final approach speed . . . . 155 KIAS.

3. Minimum roll landing final approach speed . . . . 145 KIAS.

4. Touchdown speed . . . . 125 KIAS.

5. Ground roll distance
   a. RCR = 23 . . . . 2700 ft.
   b. RCR = 12 (FA7-2) . . . . 3600 ft.

MISSION SUMMARY.

1. Total time . . . . 95.6 min.

2. Total range . . . . 695 nmi.

TAKEOFF AND LANDING DATA CARD.

The takeoff and landing data card is included in the Flight Crew Checklist normal procedures. The takeoff and landing data was computed during mission planning from Part 2 and Part 7 respectively. The landing weight for immediately after takeoff is the takeoff gross weight less an average fuel allowance of 300 lb for takeoff and go-around. Landing immediately after takeoff for the conditions stated in the mission planning takeoff data is computed as follows:

LANDING (Immediately After Takeoff).

1. Landing gross weight . . . . . . 11,500 lb.

2. Final turn speed . . . . 198 KIAS.

3. Normal landing final approach speed (FA7-1) . . . . 178 KIAS.

4. Touchdown speed (FA7-1) . . . 153 KIAS.

5. Ground roll distance.
   a. RCR = 23 (FA7-1) . . . . 5100 ft.
   b. RCR = 12 (FA7-2) . . . . 6800 ft.

The takeoff and landing information for mission planning is entered on the data card as a ready reference for review prior to takeoff and landing as shown in figure FA8-1.

TAKEOFF & LANDING DATA CARD

CONDITIONS

RUNWAY LENGTH	7000	FT
WIND COMPONENT	10 HW	KN
RUNWAY TEMPERATURE	15	°C
PRESSURE ALTITUDE	4000	FT

TAKEOFF

ACCELERATION CHECK	108	KIAS	1500	FT
CRITICAL ENGINE FAILURE SPEED			112	KIAS
REFUSAL SPEED			116	KIAS
SINGLE-ENGINE TAKEOFF SPEED			162	KIAS
TAKEOFF DISTANCE			3050	FT

LANDING

		IMMEDIATELY AFTER TAKEOFF		FINAL	
FINAL TURN SPEED		198	KIAS	175	KIAS
FINAL APPROACH SPEED		178	KIAS	155	KIAS
TOUCHDOWN SPEED		153	KIAS	125	KIAS
GROUND ROLL:	DRY	5100	FT	2700	FT
	WET	6800	FT	3600	FT

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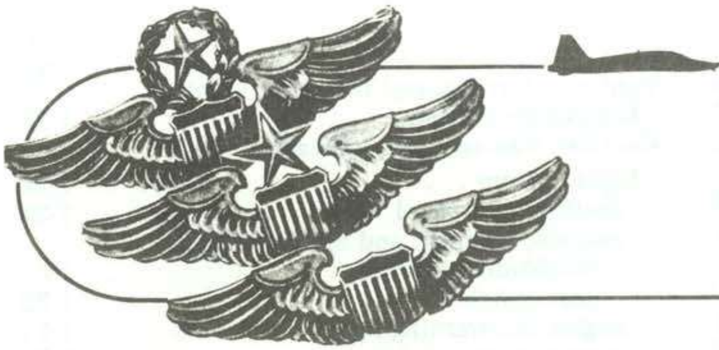
FA8-1.



ALPHABETICAL INDEX

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A

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