USAF SERIES

T-38A FLIGHT MANUAL

AIRCRAFT

AF33(600)39840, AF33(657)15122
(AF59-1603 AND
LATER AIRCRAFT)

THIS CHANGE INCLUDES SAFETY SUPPLEMENTS -45 AND -46 AND OPERATIONAL SUPPLEMENTS -12 AND -13. SEE TECHNICAL ORDER INDEX T.O. 0-1-1-5A FOR CURRENT STATUS OF TRAINER AIRCRAFT FLIGHT MANUALS, SAFETY AND OPERATIONAL SUPPLEMENTS, AND FLIGHT CREW CHECKLISTS.

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T-38A 1-1Z

AFPS SA JAN 68, 9000

1 MARCH 1967

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LIST OF EFFECTIVE PAGES

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CURRENT FLIGHT CREW CHECKLIST

1T-38A-1CL-1

1 MARCH 1967

CHANGE 2 – 1 NOVEMBER 1967

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

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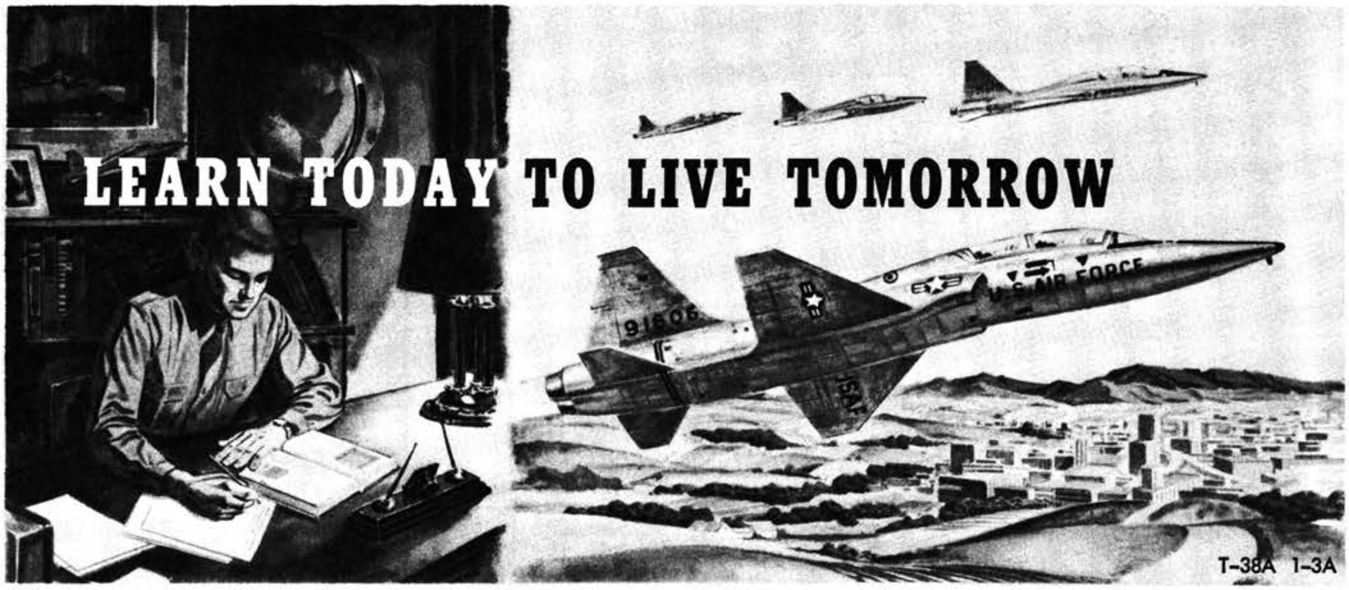


COMMENTS AND QUESTIONS. Comments, questions, or recommended changes regarding any phase of the Flight Manual program are invited and should be forwarded in accordance with AFR 60-9 thru your Command Headquarters to Hq ASD (ASZO), Wright-Patterson AFB, Ohio.

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.

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 may be issued as an interim method of providing non-safety of flight information regarding new requirements or aircraft changes. Either type supplement may replace the other as indicated.

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
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	and later

TIME COMPLIANCE TECHNICAL ORDERS

The following list contains only those TCTO's that apply to this Flight Manual. Those not yet released, or those known to be completed, are not included. For a complete list of TCTO's affecting T-38A aircraft, refer to Numerical Index, T.O. 0-1-1-5.

T.O. Number	*Title*
1T-38A-744	*Fuel Low Pressure Indicating System*
1T-38A-749	*Modification of Position and Formation Lighting System*
1T-38A-754	*Phase Reversal Elimination in Primary ADI Sphere*
1T-38A-768	*Canopy Safe Warning System Improvement*
1T-38A-771	*Nosewheel Steering Circuitry Rearrangement*
1T-38A-782	*Canopy Breaker Tool*
1T-38A-783	*Main Landing Gear Strut Door Modification*

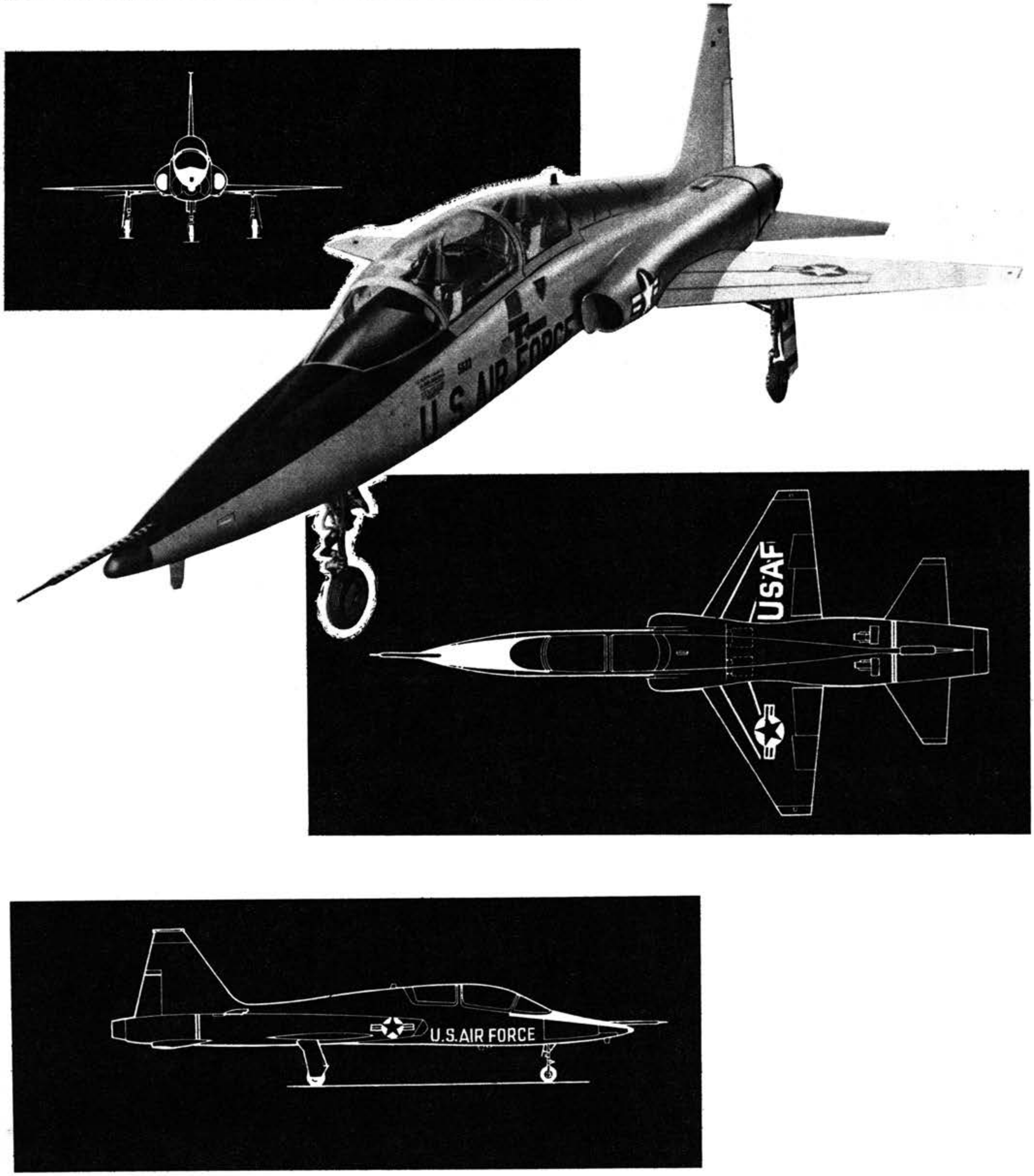
SAFETY AND OPERATIONAL SUPPLEMENT SUMMARY

Supplement technical order numbers are identified with (SS) for Safety Supplements, and (S) for operational Supplements immediately after the -1 contained in the basic publication and are assigned consecutive dash numbers (-1, -2, -3, etc.). See T.O. 0-1-1-5A for details. The Supplements you receive should follow in sequence. If you find you are missing one, check the supplement currency page attached to the last operational or Safety Supplement received, or publication index, T.O. 0-1-1-5 and -5A, to see if it was issued and if it is still in effect. It may have been replaced or rescinded before you received your copy. If it is still active, see your Publication Distribution Officer and get your copy. It should be noted that a Supplement number will never be used more than once.

SAFETY AND OPERATIONAL SUPPLEMENTS INCORPORATED IN THIS ISSUE

Number	*Date*	*Short Title*	*Sections Affected*
1T-38A-1SS-45	21 September 1967	*Stability Augmenter System*	III
1T-38A-1SS-46	29 September 1967	*Emergency Ground Egress*	III
1T-38A-1S-12	2 August 1967	*Additional Limitation For Landing Gear*	V
1T-38A-1S-13	31 August 1967	*Fast Erection Procedure*	II

THE AIRCRAFT



T-38A 1-5H

Figure 1-1.

DESCRIPTION

SECTION I

T-38A 1-100

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THE AIRCRAFT.

This aircraft, produced by Northrop Norair, a division of Northrop Corporation, 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), with moderately sweptback wings and empennage. The aircraft is equipped with an all movable horizontal tail. A speed brake is located at the lower center fuselage. The tricycle landing gear has a steerable nosewheel. All flight control surfaces are fully powered by two independent hydraulic systems. There are no provisions for external stores.

AIRCRAFT DIMENSIONS.

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

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

AIRCRAFT GROSS WEIGHT.

The average gross weight of the aircraft fully fueled and including two aircrew is 12,000 pounds.

GENERAL ARRANGEMENT DIAGRAM
(TYPICAL)

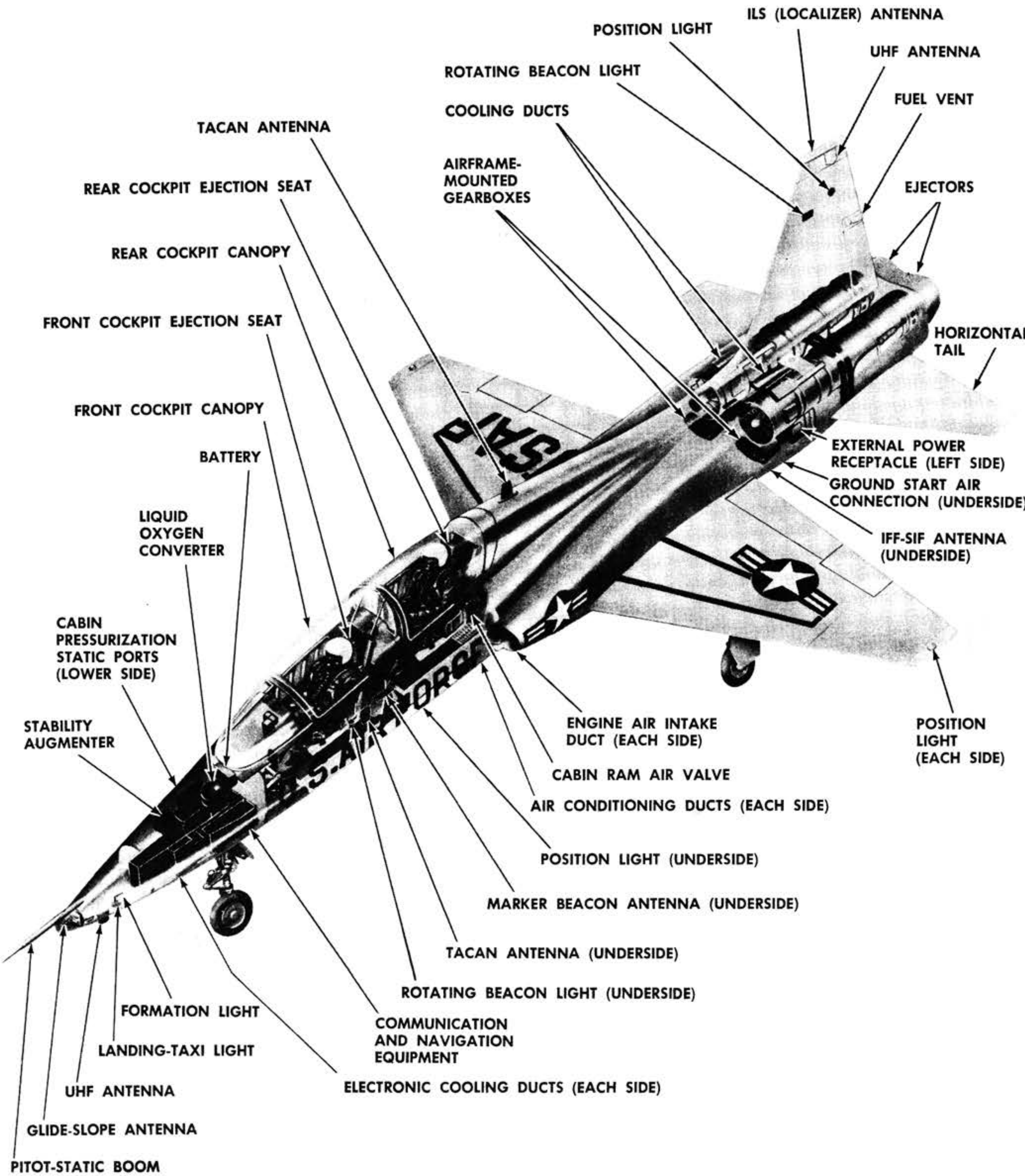


Figure 1-2

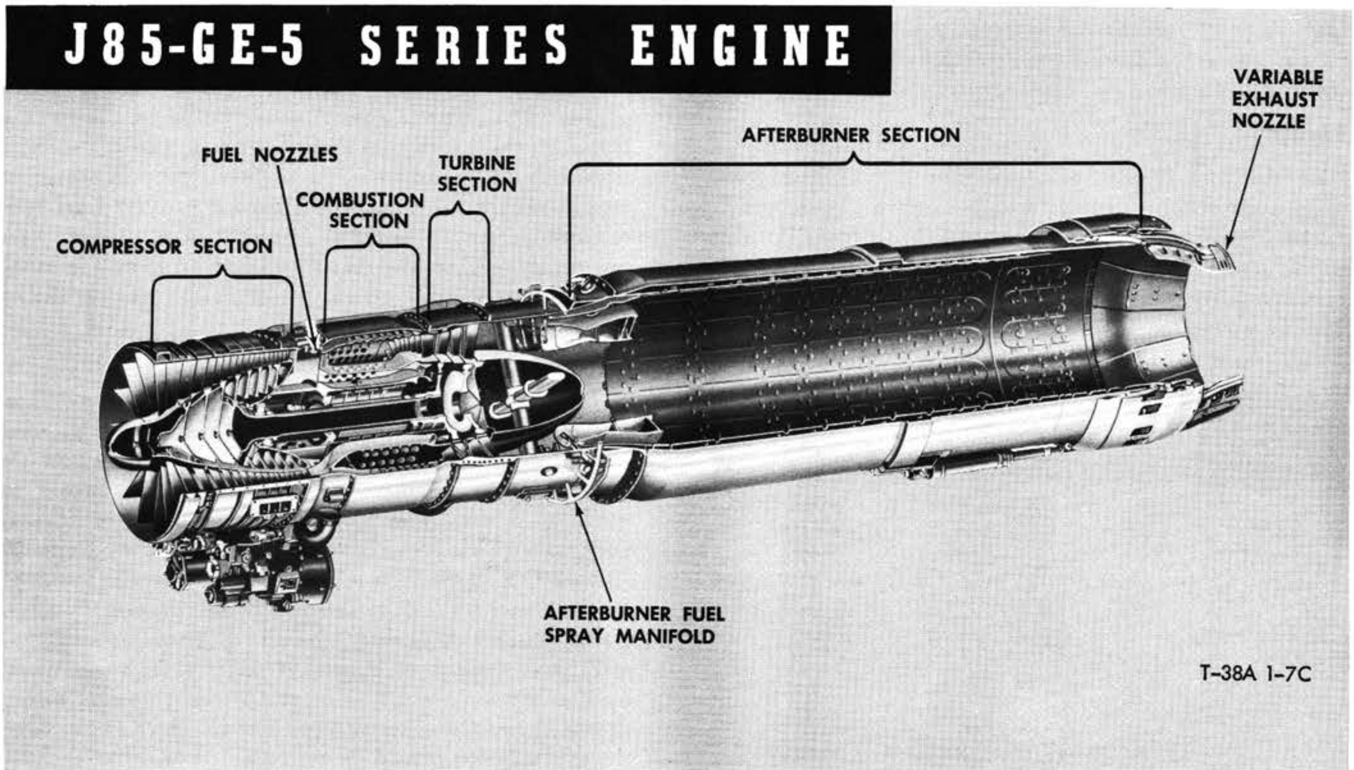


Figure 1-3.

ENGINES.

The aircraft is powered by two J85-GE-5 series, eight-stage axial-flow, turbojet engines (figure 1-3). Rated static thrust uninstalled is 2680 pounds at MIL and 3850 at MAX. Installed static thrust available (sea level, standard day) is approximately 2050 pounds at MIL and 2900 at MAX. 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 nozzle. An exhaust gas temperature (T_5) sensing system varies the nozzle area to maintain exhaust gas temperature within limits in both MIL and MAX throttle settings.

ENGINE FUEL CONTROL SYSTEM.

Each engine has a main fuel control system and an afterburner control system (figure 1-5). The main fuel control system consists primarily of a two-stage engine-driven pump, a main fuel control, and an overspeed governor.

MAIN FUEL CONTROL.

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

a. Regulates engine speed at the selected throttle position; limits minimum engine speed at IDLE and maximum engine speed at MIL and MAX 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 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.

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

AFTERBURNER SYSTEM.

Each afterburner system contains an igniter plug, pilot burner, afterburner spray 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 the afterburner range. The total rate of fuel flow at maximum afterburner operation 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 burner 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 to MAX afterburner.

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 to MAX 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.

THROTTLE QUADRANT

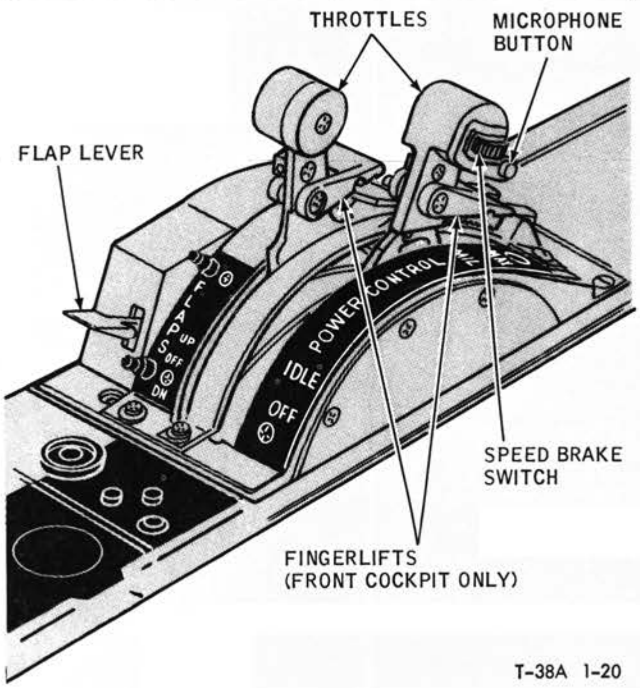


Figure 1-4.

PRESSURE AIR SYSTEM.

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

ENGINE START AND IGNITION SYSTEM.

Engine starts for this aircraft require compressor motoring (low pressure air supply) and ac power for igniter firing. Two push type engine start buttons (figures 1-10, 1-11) are located in the left vertical subpanel of each cockpit. For ground starts only, a diverter valve is automatically positioned to direct air to the selected engine. Momentarily pushing a start button positions the diverter valve and arms the ignition circuit 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. (If the second start button is pressed within the first engine 30-second start cycle, the diverter valve will move to the neutral position, reducing the air supply time and igniter firing time for starting the second engine. With the engine diverter valve in the neutral position, the air supply for starting is shut off to both engines.) AC power from a battery operated static inverter (figure 1-15) may be used for ground start (one engine) or air starts (both engines). 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 engine tachometers are ac powered by individual tachometer generators mounted on the engines. The exhaust gas temperature indicators require ac power. The front cockpit indicators have an OFF flag which is out of view when ac power is applied and a HOT flag which is in view when the EGT exceeds 890° C for 3 seconds or more. The nozzle position indicators require dc power. The oil pressure and fuel flow indicators require ac power. A static inverter, powered by the battery, supplies power for right engine instruments during engine ground or air start cycle when ac power is not available.

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 1-23 for oil specification.

FUEL SYSTEM.

The aircraft has an independent fuel supply system for each engine (figure 1-14), 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. 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 30,000 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.)

ENGINE FUEL CONTROL SYSTEM

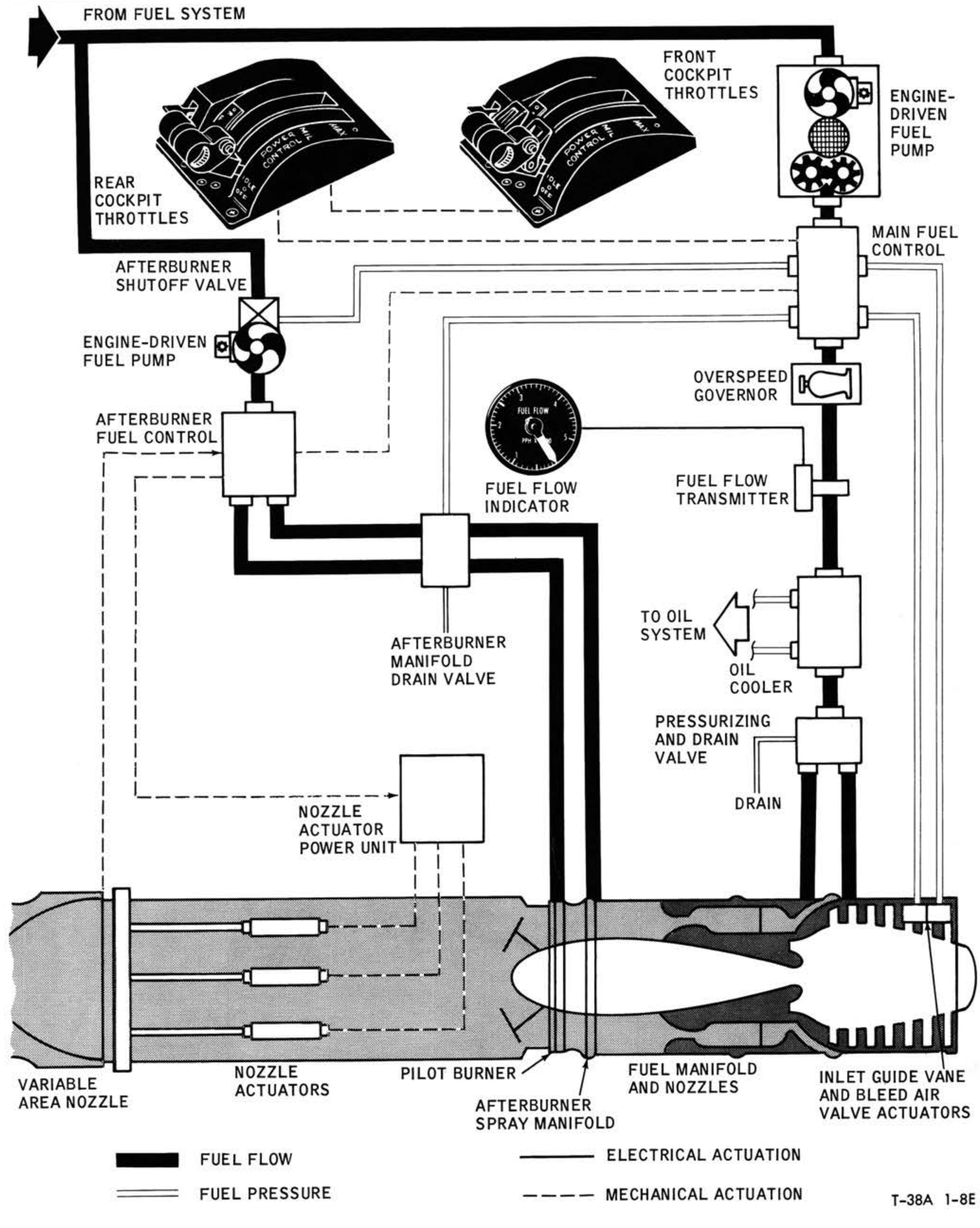


Figure 1-5.

COCKPIT ARRANGEMENT — FRONT (TYPICAL)

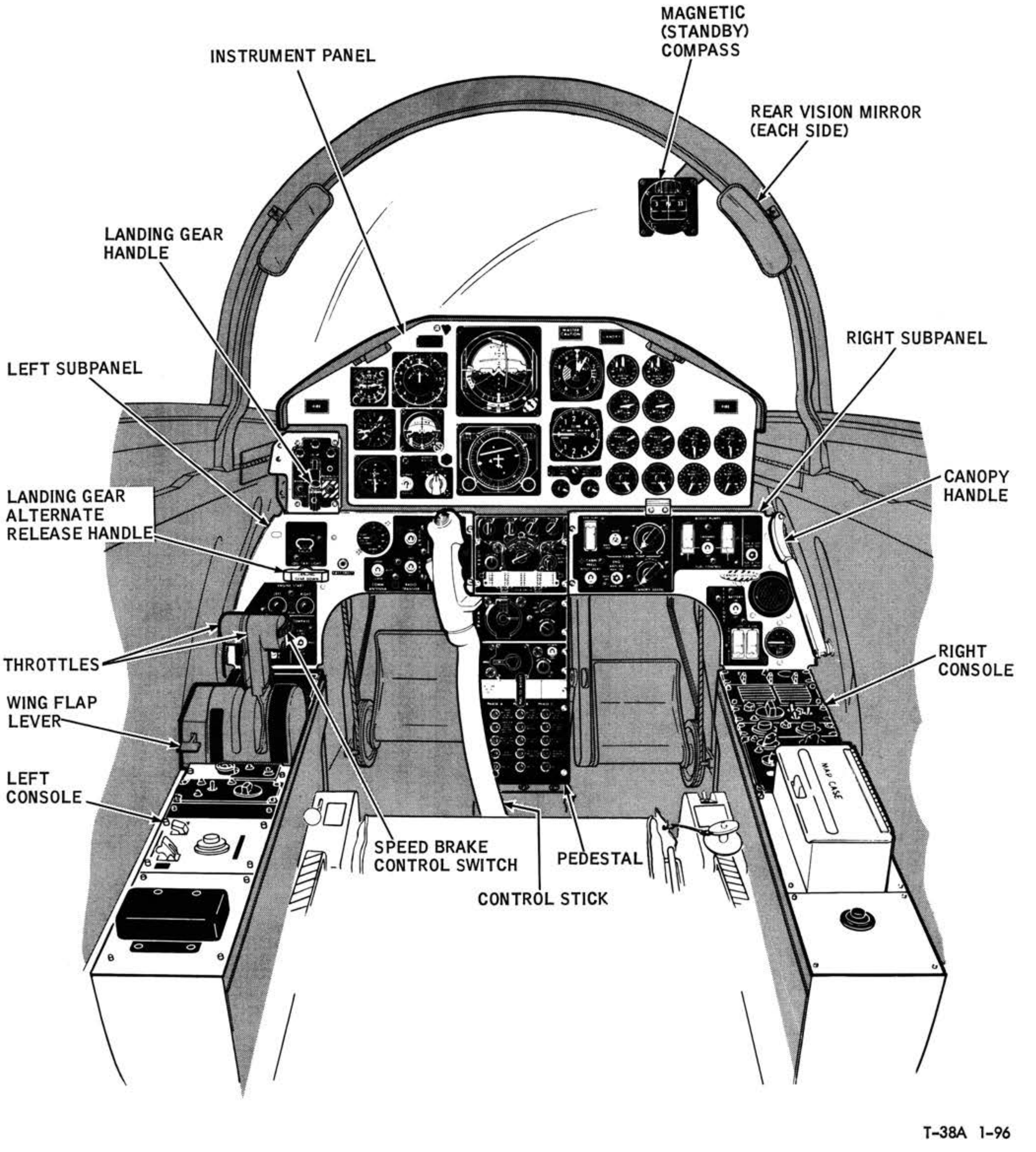


Figure 1-6.

COCKPIT ARRANGEMENT—REAR (TYPICAL)

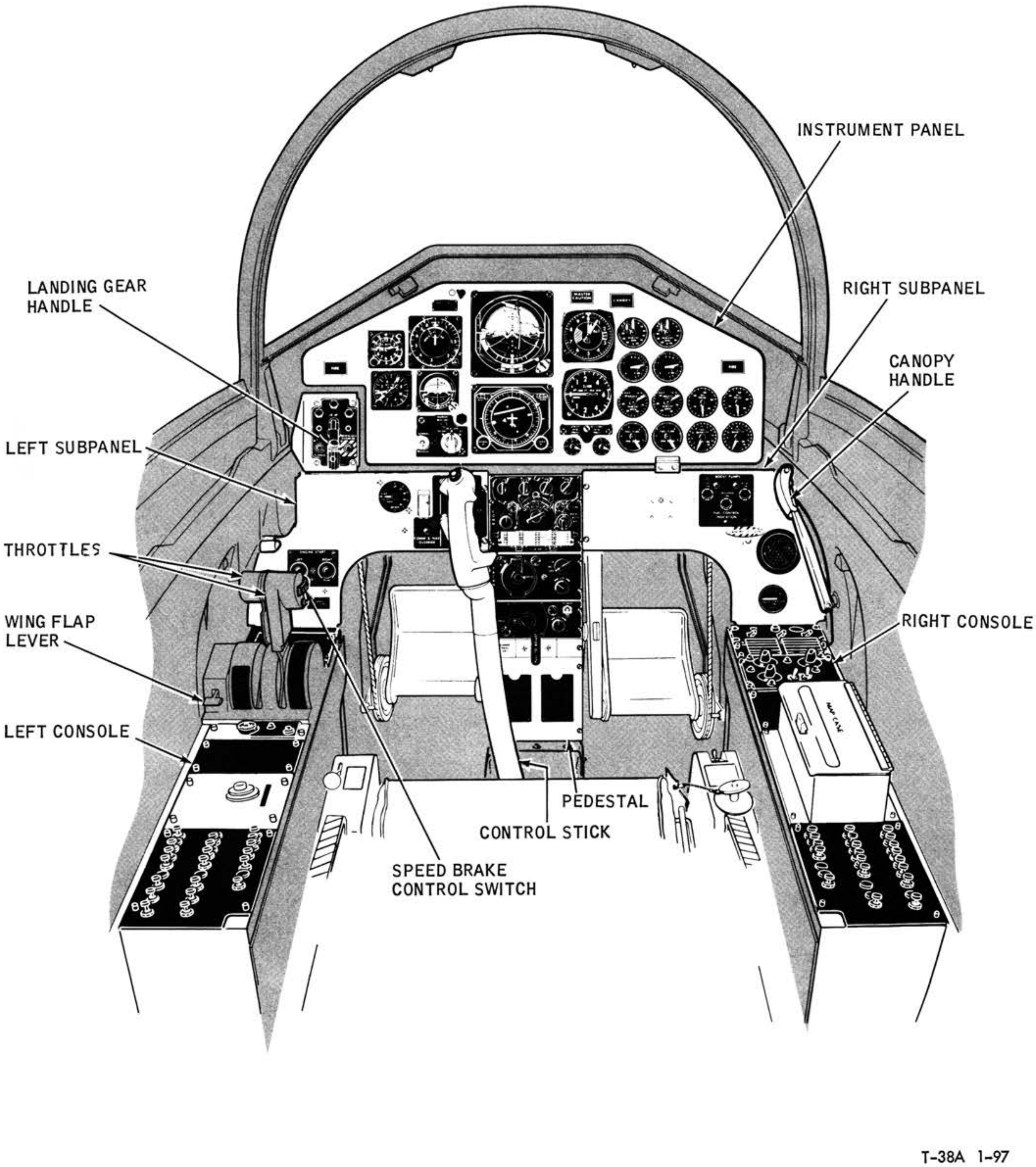
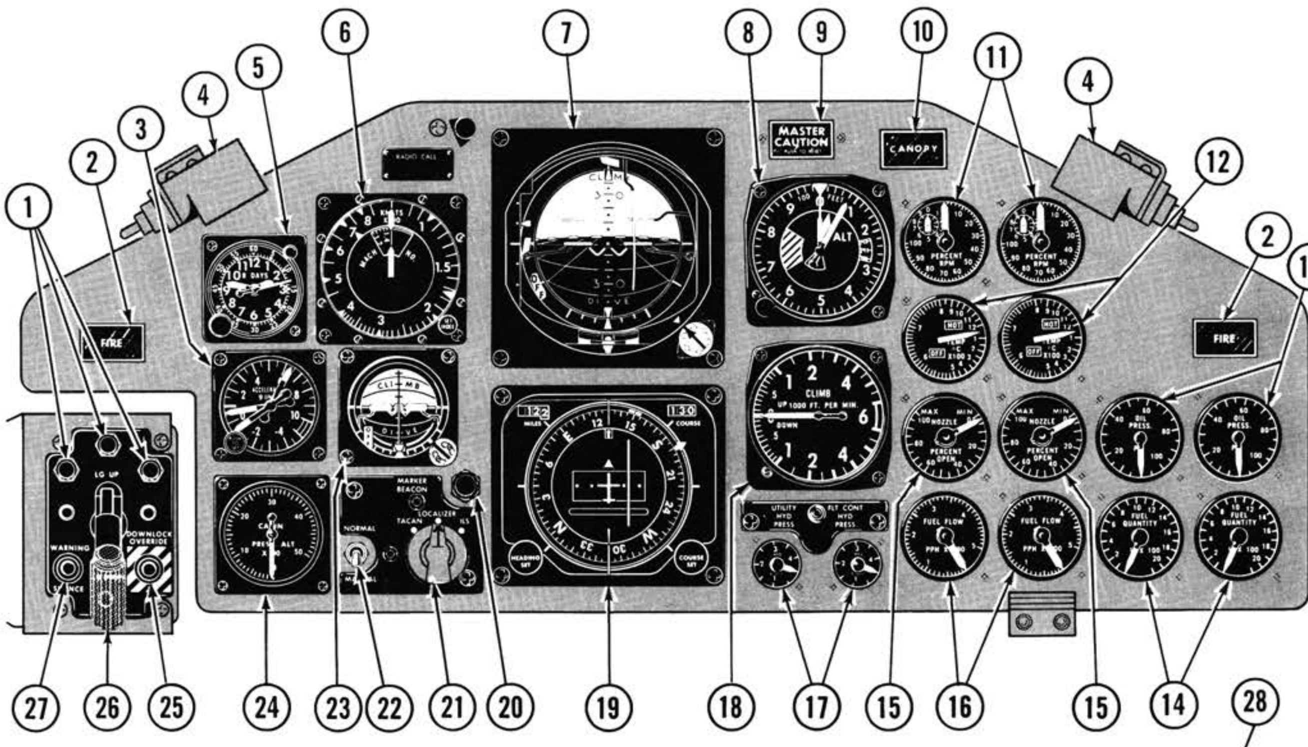
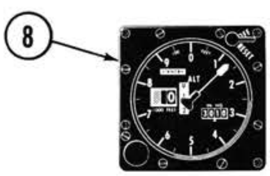


Figure 1-7.

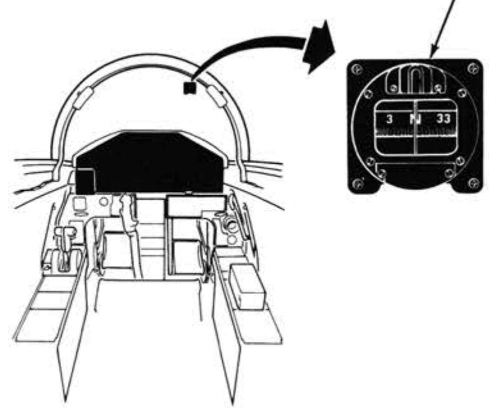
INSTRUMENT PANEL—BOTH COCKPITS (TYPICAL)





COUNTER-DRUM-POINTER ALTIMETER

(MODIFIED AND LATER AIRCRAFT)



1 LANDING GEAR POSITION INDICATOR LIGHTS
2 ENGINE FIRE WARNING LIGHT
3 ACCELEROMETER
4 FLOODLIGHT (Normal — AC; Emer — DC)
5 CLOCK
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 OIL PRESSURE INDICATORS
14 FUEL QUANTITY INDICATORS
15 NOZZLE POSITION INDICATOR
16 FUEL FLOW INDICATORS
17 HYDRAULIC PRESSURE INDICATORS
18 VERTICAL VELOCITY INDICATOR
19 HORIZONTAL SITUATION INDICATOR
20 MARKER BEACON LIGHT
21 NAVIGATION MODE SWITCH
22 STEERING MODE SWITCH
23 STANDBY ATTITUDE INDICATOR
24 CABIN ALTIMETER (Front cockpit only)
25 DOWNLOCK OVERRIDE BUTTON
26 LANDING GEAR LEVER
27 AUDIBLE WARNING SILENCE BUTTON
28 MAGNETIC COMPASS (Front cockpit only)

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Figure 1-8.

PEDESTALS (TYPICAL)

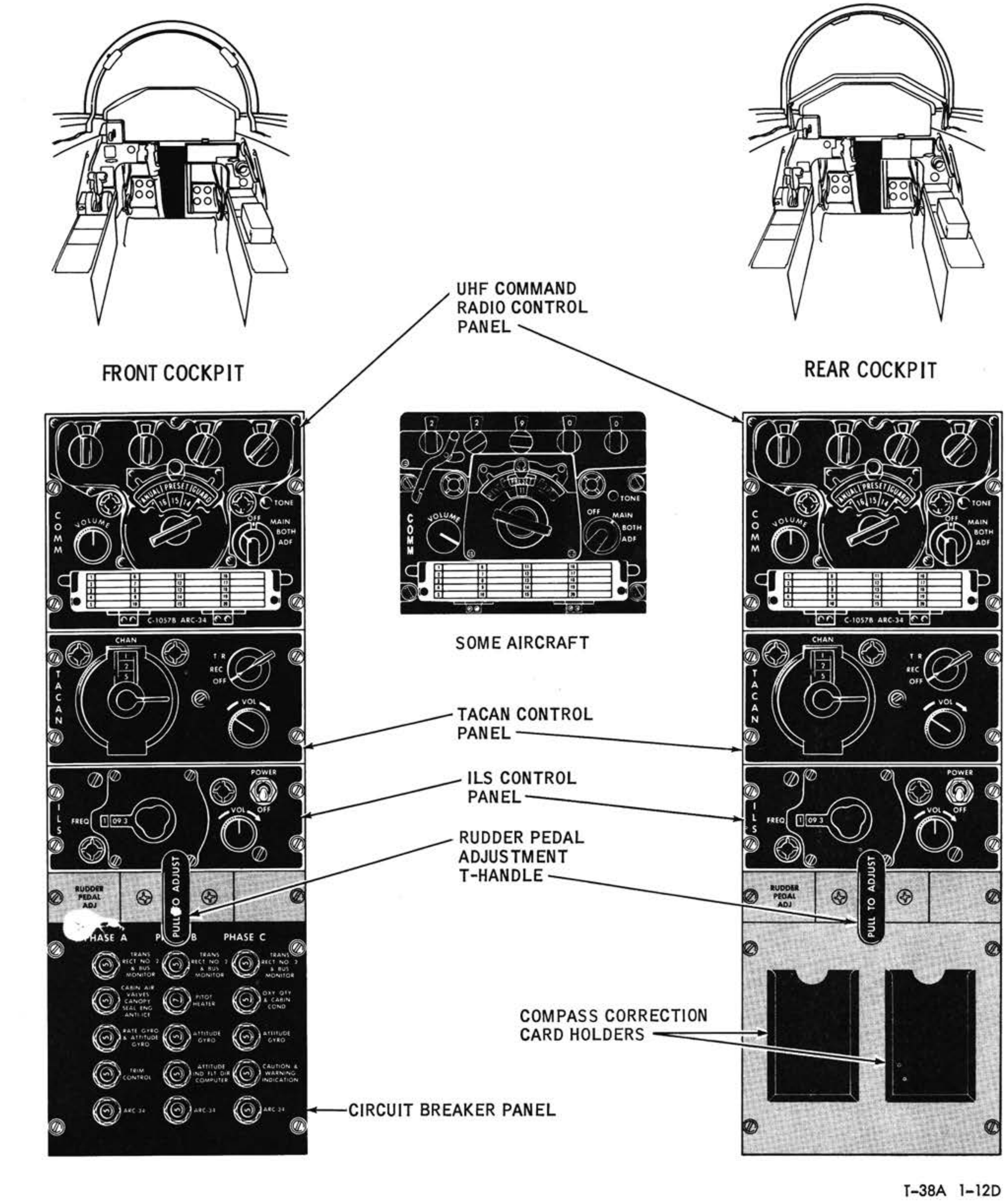


Figure 1-9.

SUBPANELS—FRONT COCKPIT (TYPICAL)

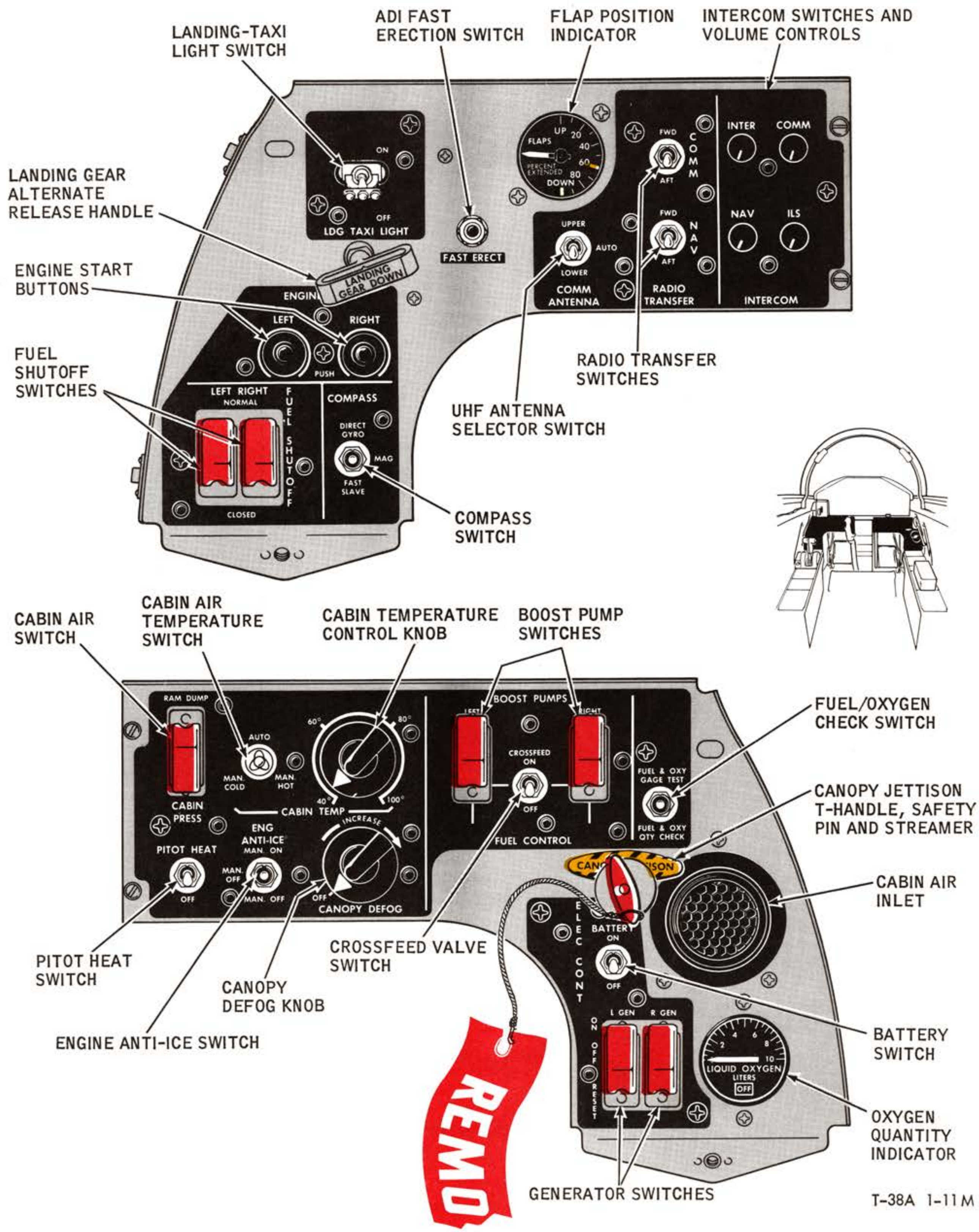


Figure 1-10.

SUBPANELS—REAR COCKPIT (TYPICAL)

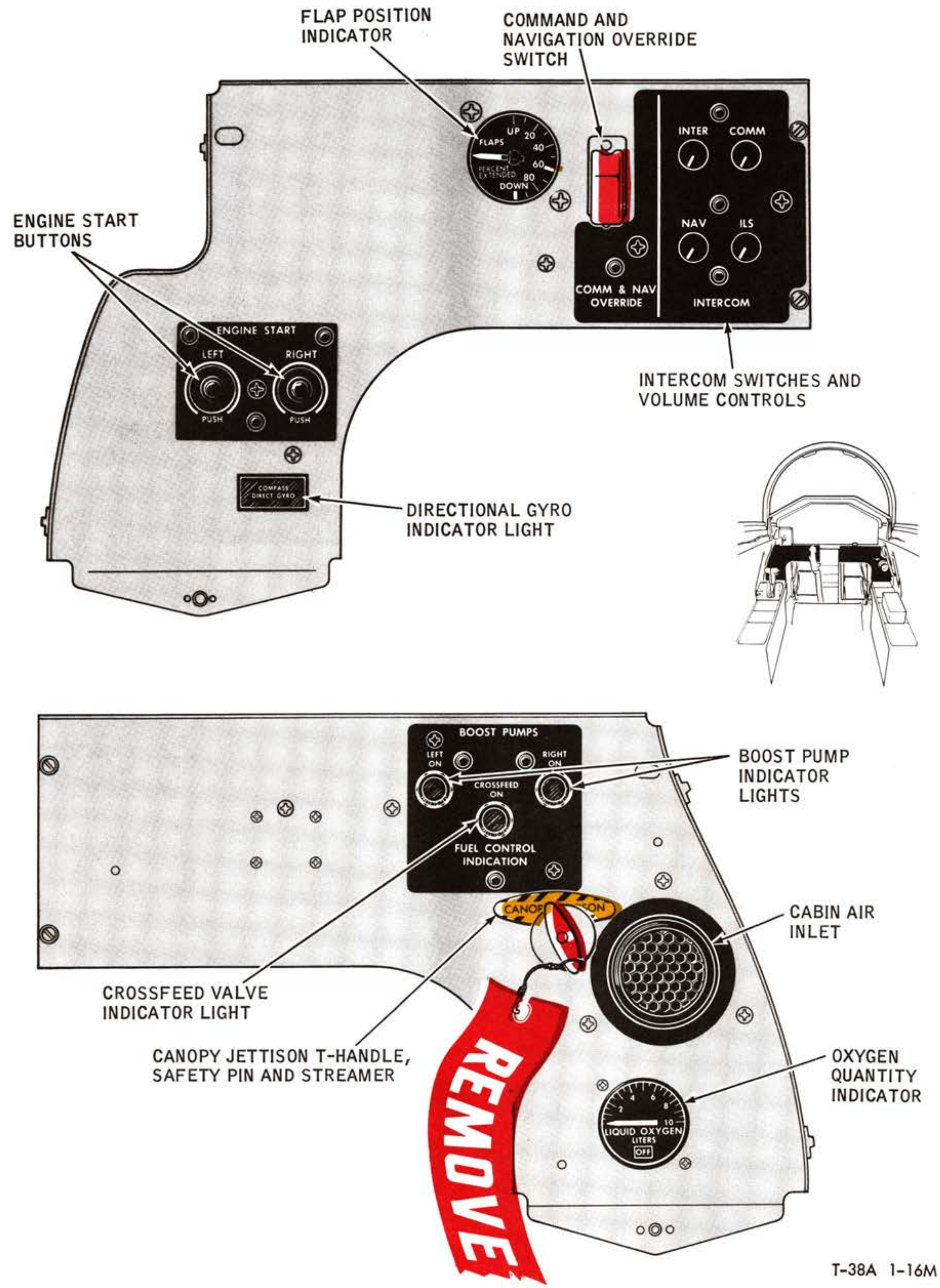


Figure 1-11.

CONSOLE PANELS – FRONT COCKPIT (TYPICAL)

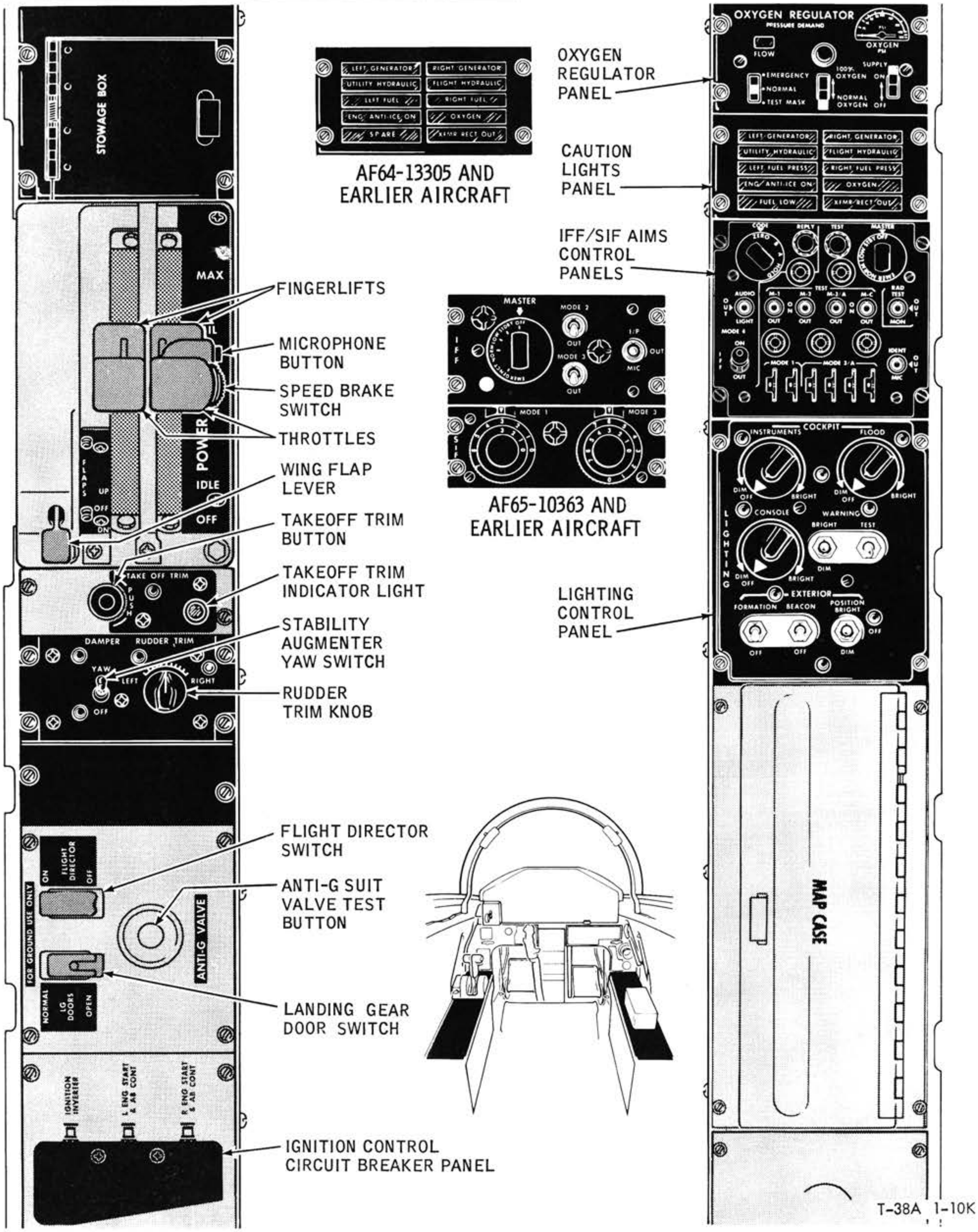


Figure 1-12.

CONSOLE PANELS – REAR COCKPIT (TYPICAL)

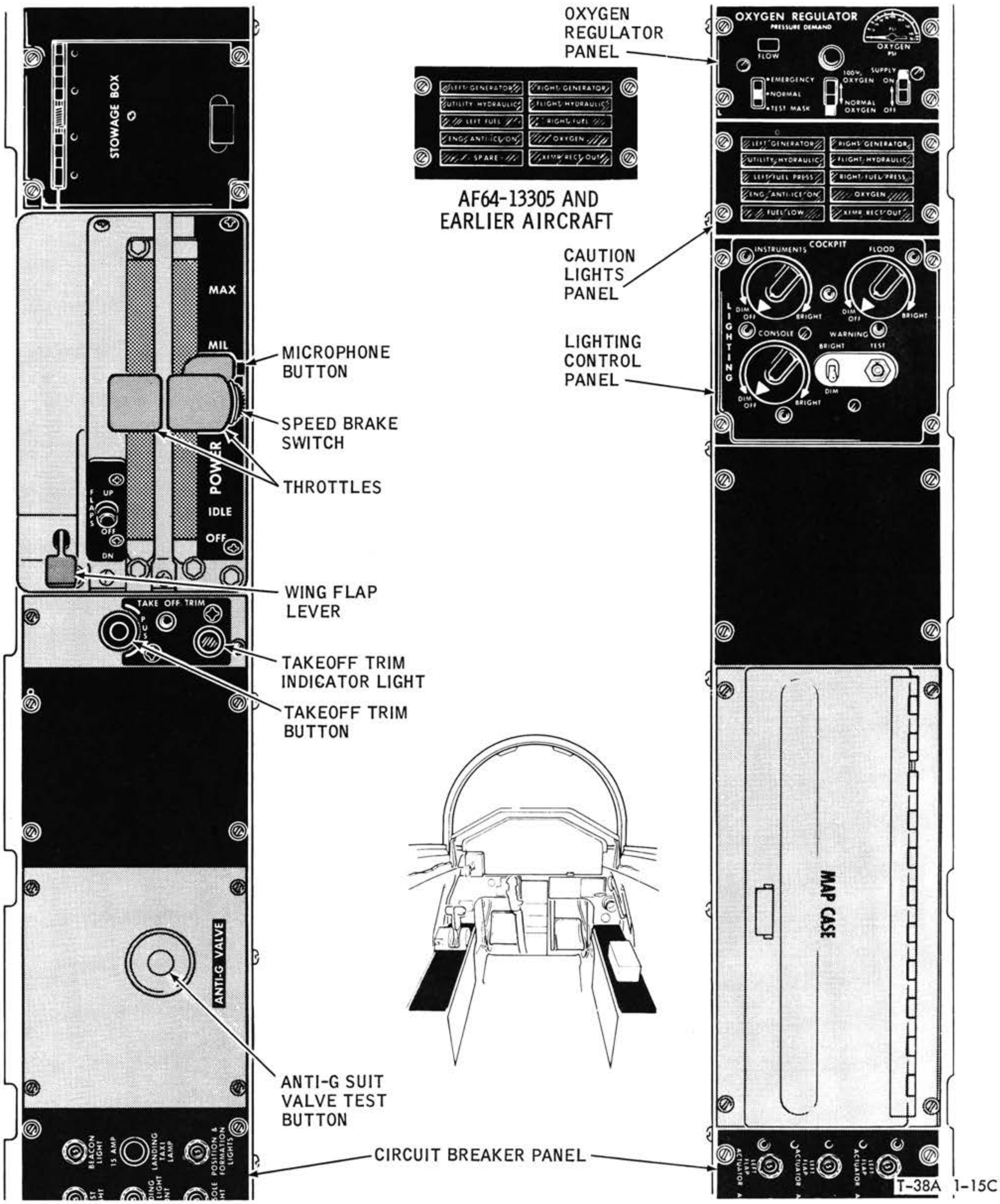


Figure 1-13.

Caution lights on early and unmodified aircraft indicate fuel low level conditions. On later and modified aircraft, caution lights indicate fuel low level and low pressure conditions See figure 1-23 for fuel specification and for fuel quantity data.

BOOST PUMP SWITCHES.

Two boost pump switches (figure 1-10), 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. If a circuit breaker pops during operation, turn off the appropriate boost pump switch before resetting the fuel pump circuit breakers in the rear cockpit.

BOOST PUMP INDICATOR LIGHTS.

Two boost pump indicator lights (figure 1-11), 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.

AF65-10316 and later and aircraft modified by T.O. 1T-38A-744 have fuel low pressure caution lights (LEFT FUEL PRESS, RIGHT FUEL PRESS) on the right console of each cockpit (figures 1-12, 1-13). The caution light will illuminate when the low-pressure warning system detects a differential of 6 psi. The master caution light on the instrument panel and the pressure caution lights may blink when afterburner power is selected on the ground, or in the air below 10,000 feet. The blink of the lights is caused by a momentary pressure differential when the afterburner fuel pump shutoff valve is opened and is not an indication of boost pump failure.

CROSSFEED VALVE SWITCH.

A crossfeed valve switch (figure 1-10), 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 which 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.

CROSSFEED VALVE INDICATOR LIGHT.

An amber crossfeed indicator light (figure 1-11) is located on the right subpanel of the rear cockpit. When the crossfeed valve switch in the front cockpit is placed at ON, the crossfeed indicator light illuminates.

FUEL SHUTOFF SWITCHES.

Two guarded fuel shutoff switches (figure 1-10), 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 enables the front cockpit crewmember to shut off fuel flow to either or both engines without using the throttles. The switches should be used only during an emergency.

FUEL QUANTITY INDICATORS.

Two fuel quantity indicators (figure 1-8), 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.

FUEL QUANTITY CAUTION LIGHTS.

Two fuel supply low-level caution lights (figures 1-12, 1-13), one for each fuel system, operate on dc in BRIGHT condition or ac in DIM condition. The lights are on the right console of each cockpit. When an indicator reads below 275 to 225 pounds, the fuel supply low-level caution light for that system illuminates. On AF65-10316 and later and aircraft modified by T.O. 1T-38A-744, a fuel low-level condition is indicated by the illumination of a FUEL LOW caution light (figures 1-12, 1-13). The left and right system fuel quantity indicators must be checked to determine which system is low (275-225 pounds).

FUEL/OXYGEN CHECK SWITCH.

Fuel and oxygen quantities and indicator operation can be checked by a switch in the front cockpit right subpanel (figure 1-10). 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. 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. (A static inverter operated by the battery supplies ac power to the indicating circuits.)

AIRFRAME-MOUNTED GEARBOX.

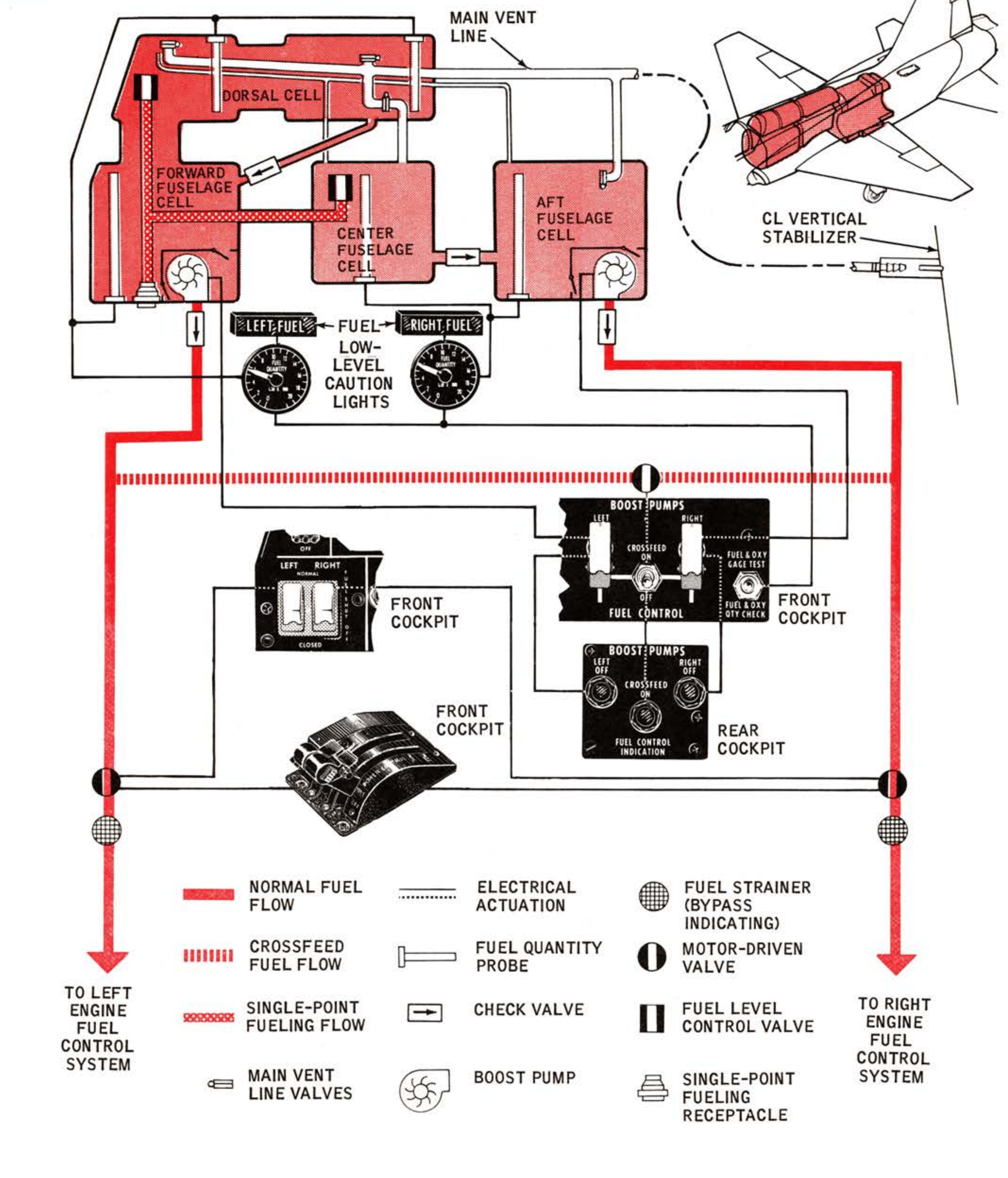
An airframe-mounted gearbox (figure 1-2) for each engine operates a hydraulic pump and an ac generator. A shift mechanism keeps ac generator output between 320 and 480 cycles per second. Gearbox shift occurs in the 65% to 70% rpm range.

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.

FUEL SYSTEM

AF64-13305 AND EARLIER AIRCRAFT



T-38A 1-21(1)H

Figure 1-14. (Sheet 1 of 2)

FUEL SYSTEM

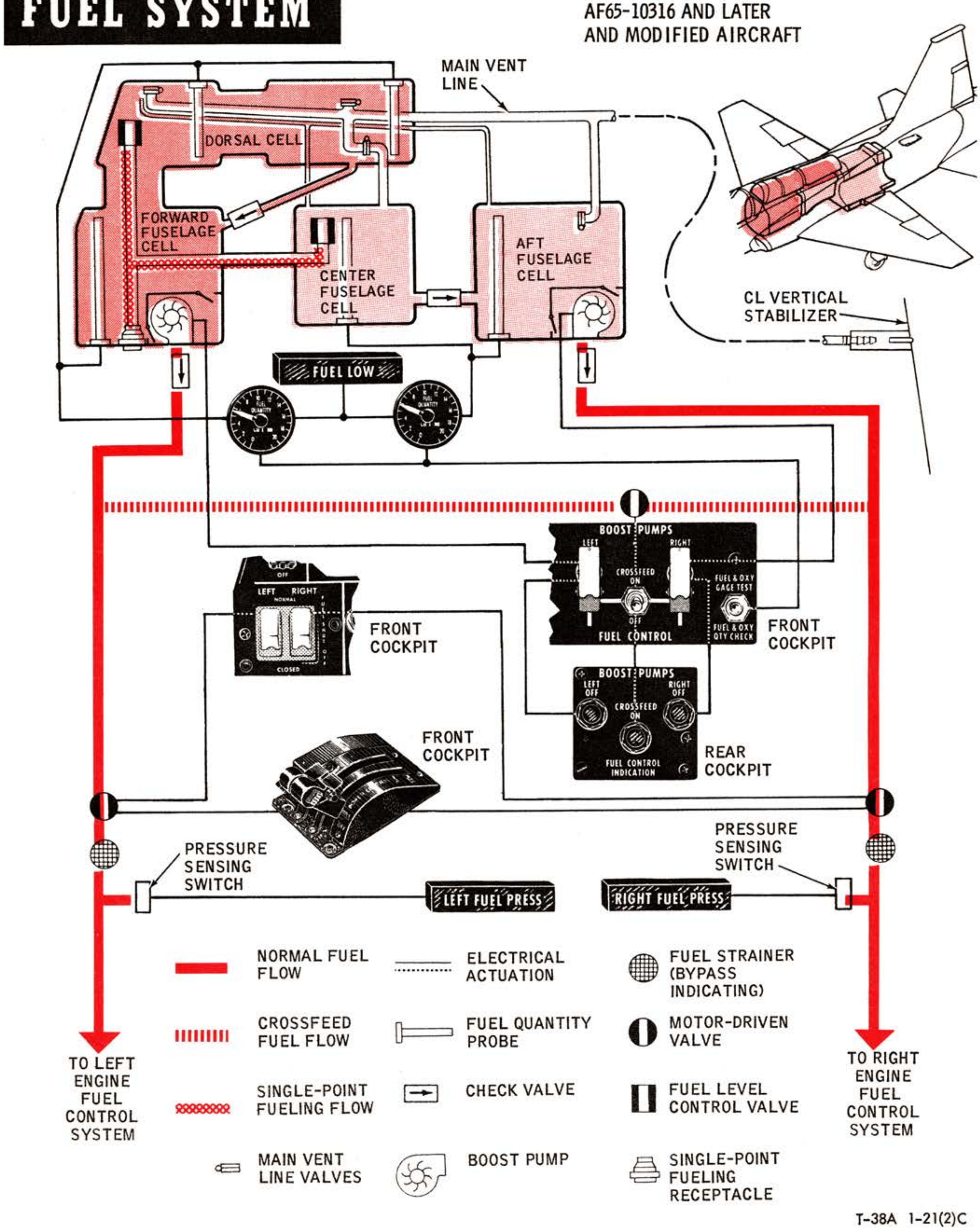


Figure 1-14. (Sheet 2 of 2)

AC POWER SYSTEM.

AC power is normally obtained from two engine-driven ac generators. The power distribution is divided into a right and left system. The generators are cut in individually when engine speed accelerates to approximately 43% to 48% rpm. Should this fail to occur, the changeover relay has failed. (Refer to figure 1-15 to determine inoperative systems.) If one generator should fail or is turned off, the functioning generator will automatically supply electrical power to both systems.

Generator Switch and Caution Light.

Two generator switches (figure 1-10), one for the left and one for the right generator, operate on dc. The generator switches are located on the right subpanel of the front cockpit. Generator caution lights are located on the right console of each cockpit. A caution light will illuminate when its generator switch is placed at OFF or when 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 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 1-10) 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.

CAUTION, WARNING, AND INDICATOR LIGHT SYSTEM.

CAUTION LIGHT PANEL.

A caution light panel (figures 1-12, 1-13) on the right console of each cockpit is provided to alert the crewmember to an abnormal condition. The caution light will remain illuminated until the condition is corrected.

MASTER CAUTION LIGHT.

A master caution light (figure 1-8) 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 1-12, 1-13) 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 light and the takeoff trim light. With the instrument lights turned on, 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 will return the lights to bright.

CAUTION, WARNING, AND INDICATOR LIGHT TEST SWITCH.

The landing gear audible warning signal and all caution, warning, and indicator lights except the takeoff trim indicator light and marker beacon light may be tested by placing the spring-loaded switch (figures 1-12, 1-13) at the TEST position.

Note

When the test switch is released in a cockpit, the fire warning lights in the other cockpit will illuminate momentarily.

ENGINE FIRE WARNING LIGHTS.

Two fire warning lights, one for each engine, on the instrument panels in both cockpits, 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. The lights can be tested with the warning test switch.

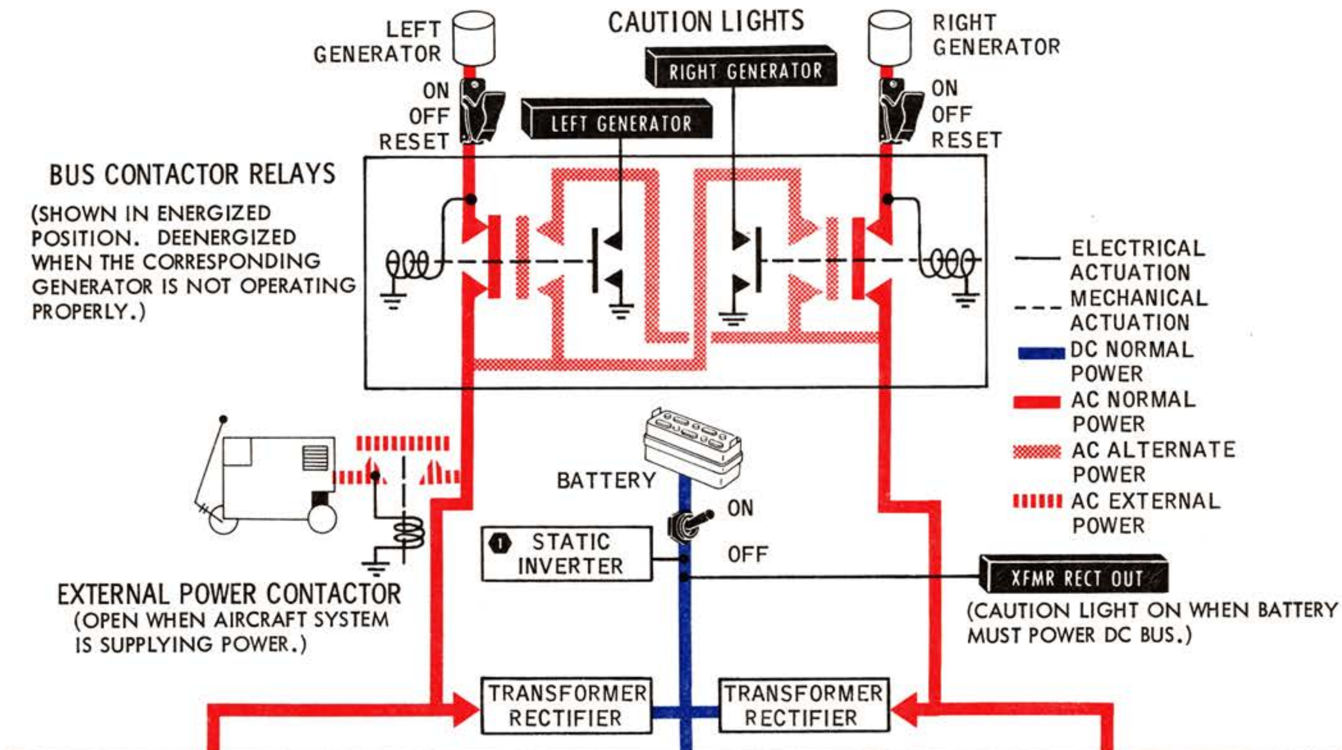
HYDRAULIC SYSTEMS.

The aircraft hydraulic power supply systems (figure 1-18) 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 low-pressure warning 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 1-23 for hydraulic fluid specification.

HYDRAULIC PRESSURE INDICATORS.

Two ac hydraulic pressure indicators (figures 1-8, 1-18), one for each hydraulic system, are located on the instrument panel in each cockpit.

ELECTRICAL SYSTEM



LEFT 115/200-VOLT AC BUS

CONSOLE LIGHTS
(3) FORMATION LIGHTS
IFF-SIF
IFF-SIF, AIMS (SOME AIRCRAFT)
INSTRUMENT LIGHTS
LANDING-TAXI LIGHT
▲3 (REQUIRES DC FOR EXTENSION)
LEFT AUTOSYN INDICATORS*
LEFT FUEL BOOST PUMP
(1) LEFT FUEL QUANTITY INDICATOR
(2) POSITION LIGHTS
ROTATING BEACONS
STABILITY AUGMENTER
STANDBY ATTITUDE INDICATOR

▲1 BLOCKS 20 THRU 30 AIRCRAFT
▲2 BLOCKS 20 THRU 35 AIRCRAFT
▲3 BLOCK 35 AND LATER AIRCRAFT
▲4 BLOCK 40 AND LATER AIRCRAFT
* AUTOSYN INDICATORS:
EXHAUST GAS TEMPERATURE INDICATORS
FUEL FLOW INDICATORS
HYDRAULIC PRESSURE INDICATORS
OIL PRESSURE INDICATORS
(1) NO EXT/GENERATOR AC, BATTERY SWITCH ON, INVERTER SUPPLIES 115 VAC FOR:
(A) GROUND START: IGNITION EXCITER (FIRST ENGINE)—RIGHT AUTOSYN INDICATORS, OR
(B) EMERGENCY AIR STARTS: IGNITION EXCITERS—RIGHT AUTOSYN INDICATORS, OR
(C) FUEL/OXYGEN QUANTITIES AND TEST-CHECK SWITCH OPERATED.

28-VOLT DC BUS

AIR DIVERTER VALVE
CAUTION, WARNING, AND INDICATOR LIGHTS—BRIGHT (DIM LIGHT IS AC)
CROSSFEED VALVE
EMERGENCY FLOODLIGHTS
(1) ENGINE START AND IGNITION CONTROL
FIRE DETECTORS
▲4 FLAP CONTROL (4)
FLAP POSITION INDICATOR
FLIGHT DIRECTOR MODE SELECTOR
FORMATION LIGHTS (SOME AIRCRAFT)
FUEL SHUTOFF VALVES
GENERATOR CONTROLS
(4) ILS RECEIVER, INDICATORS, AND FLAGS
INTERPHONE
▲3 LANDING GEAR AUDIBLE WARNING SIGNAL
▲3 LANDING GEAR CONTROL AND SAFETY CIRCUITS
LANDING GEAR DOOR SWITCH
MARKER BEACON LIGHT
MASTER CAUTION LIGHT CONTROL
▲3 NOSEWHEEL STEERING CONTROL
NOZZLE POSITION INDICATORS
▲3 SPEED BRAKE CONTROL
(1) STATIC INVERTER
(4) TACAN
TACAN ANTENNA SELECTOR
TURN NEEDLE

(2) POWERED BY 6-VOLT AC THRU TRANSFORMER
(3) POWERED BY 28-VOLT AC THRU TRANSFORMER
(4) (ALSO REQUIRES AC)
(5) (ALSO REQUIRES DC)

RIGHT 115/200-VOLT AC BUS

(5) ADI STEERING BARS
(5) ATTITUDE SPHERE
CABIN AIR-CONDITIONING
CANOPY SEAL
CAUTION, WARNING AND INDICATOR LIGHTS—DIM
(5) COMPASS CARD AND BEARING POINTER
ENGINE ANTI-ICE
EQUIPMENT COMPARTMENT COOLING
▲2 FLAP CONTROL
FLAP MOTORS
(1) IGNITION EXCITERS
(5) ILS RECEIVER, INDICATORS, AND FLAGS
▲1 LANDING GEAR AUDIBLE WARNING SIGNAL
▲1 LANDING GEAR CONTROL AND SAFETY CIRCUITS
NORMAL FLOODLIGHTS
▲1 NOSEWHEEL STEERING CONTROL
(1) OXYGEN QUANTITY AND LOW-LEVEL WARNING CIRCUIT
PITOT HEATER
RADIO TRANSFER CONTROL
(1) RIGHT AUTOSYN INDICATORS*
RIGHT FUEL BOOST PUMP
(1) RIGHT FUEL QUANTITY INDICATOR
SEAT ADJUSTMENT
▲1 SPEED BRAKE CONTROL
(5) TACAN
TRIM CONTROL AND LIGHT
UHF ANTENNA SELECTOR
UHF COMMAND RADIO
UTILITY LIGHTS

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Figure 1-15.

CIRCUIT BREAKER PANELS (TYPICAL)

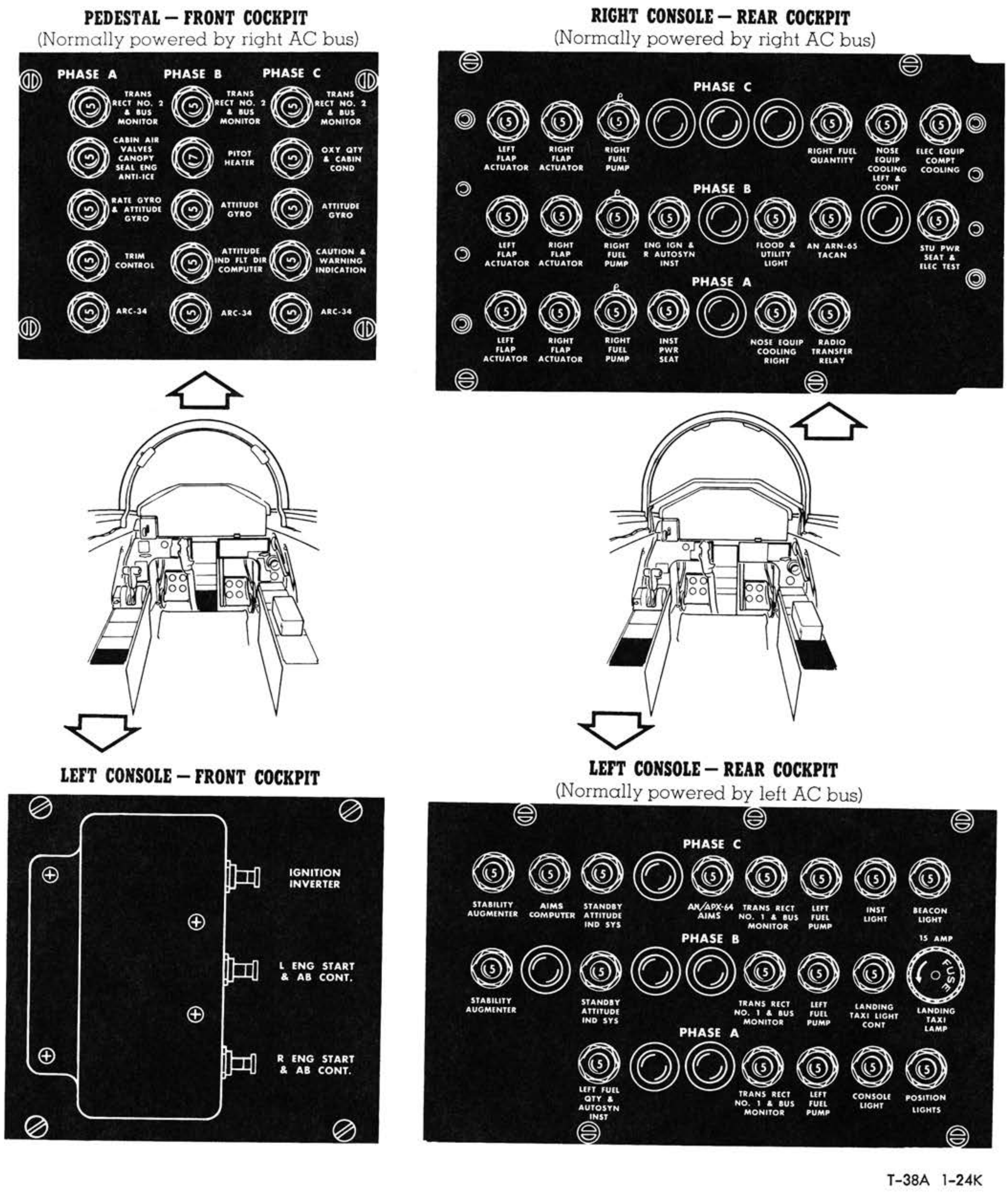


Figure 1-16.

HYDRAULIC PRESSURE CAUTION LIGHTS.

A caution light for each hydraulic system (figures 1-12, 1-13, 1-18) is located on the right console of each cockpit. 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.

FLIGHT CONTROL SYSTEM.

A conventional flight control system with artificial feel is provided. Each primary flight control surface is hydraulically actuated by two independently powered cylinders, one actuated by the utility system and one by the flight control system. The ailerons and horizontal tail are trimmed by electrical actuators which change the relationship of "feel" springs to the control sticks.

FLIGHT CONTROLS.

Each cockpit has a control stick with a standard stick grip (figure 1-17) which contains a trim switch and a nosewheel steering button. On Block 20 aircraft, a stability augmenter pitch cutoff switch is located below the stick grip.

Rudder Pedal Adjustment T-Handle.

A mechanical rudder pedal adjustment T-handle (figure 1-9) is located on the pedestal of each cockpit. To adjust rudder pedals, pull T-handle out and hold until pedals are repositioned. Then manually return the T-handle to the stowed position, locking the pedals in place. Allowing the handle to snap back may trip pedestal circuit breakers and cause cable to kink and wear excessively.

TAKEOFF TRIM BUTTON AND INDICATOR LIGHT.

A takeoff trim button (figures 1-12, 1-13), operating on ac, is located on the left console of each cockpit. The button enables either crewmember to trim the horizontal tail for takeoff. When either button is pressed, the horizontal tail trim motor moves the control surface and the control stick to a takeoff trim position. When the horizontal tail and the control stick reach the takeoff trim position, the indicator light on the left console of each cockpit will illuminate. The light will go out when the button is released.

FLIGHT TRIM SWITCH.

An ac electrical aileron and horizontal tail trim switch is located on each control stick grip (figure 1-17). Horizontal tail trim is interrupted when control stick pressure is exerted against the direction of trim.

RUDDER TRIM KNOB.

An ac electrical rudder trim knob (figure 1-12) on the left console of the front cockpit provides the means of trimming the rudder. The stability augmenter yaw system must be turned on before rudder trim can be accomplished.

RUDDER LIMITER SYSTEM.

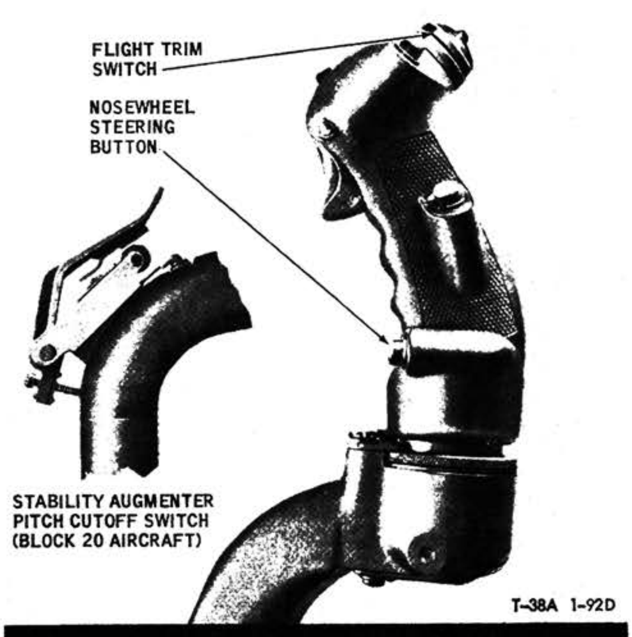
Deflection of the rudder is limited by a mechanical linkage between the rudder control system and the nose gear trunnion. When the nose gear is less than 3/4 extended, rudder deflection is limited to 6 degrees from neutral in either direction. When the nose gear is more than 3/4 extended, full rudder 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 positions the rudder to reduce yaw oscillations. Manual rudder trim is accomplished thru the yaw augmenter. A stability augmenter yaw damper switch is located on the left console of the front cockpit (figure 1-12). The switch is spring-loaded to the OFF position and is held in the YAW position by ac power. The yaw augmenter is disengaged by returning the switch to OFF. 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 augmenter is disengaged either by returning the switch to OFF or by actuating the pitch cutoff switch on the control stick (figure 1-17).

WING FLAP SYSTEM.

The wing flaps are electrically controlled by a flap lever. Two ac electric motors operate the flaps thru



CONTROL STICK

(TYPICAL)

Figure 1-17.

gear reduction units. The flaps are interconnected by a rotary flexible shaft. If one flap motor fails, both flaps are actuated thru the rotary shaft. Full flap extension or retraction takes from 10 to 17 seconds. Flaps are mechanically interconnected to the horizontal tail. The flap-to-horizontal tail interconnecting linkage moves the tail trailing edge down as the flaps are lowered, and moves the trailing edge up as the flaps

HYDRAULIC SYSTEMS

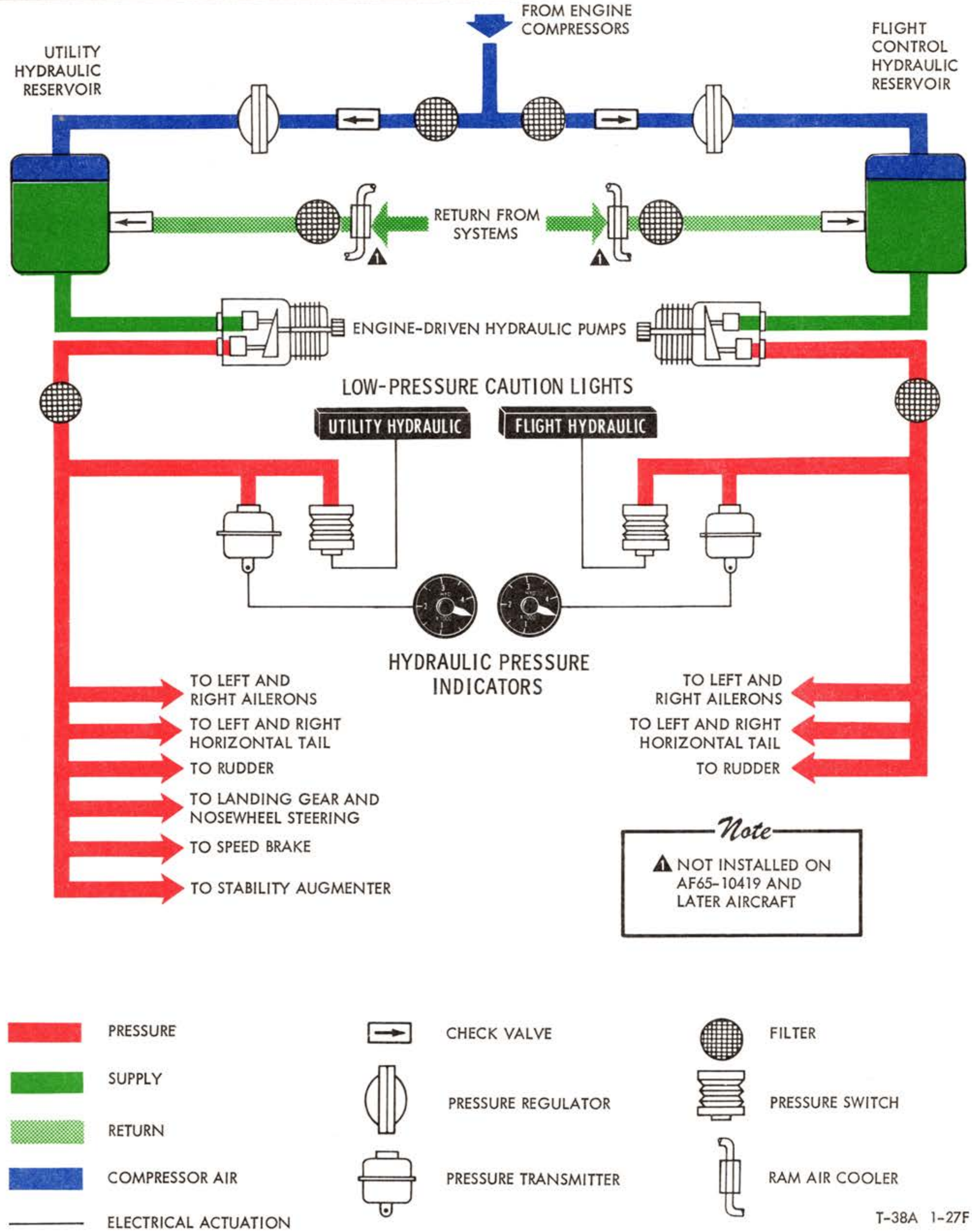


Figure 1-18.

are raised. This coordinated movement reduces aircraft trim changes as the flaps are lowered or raised.

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 which operates the two flap motors. Flap extension or retraction is stopped by moving the lever to OFF when the flaps have reached the desired position, or by limit switches when the flaps have fully extended or retracted. The flap position indicator which operates on dc is located on the left subpanel of each cockpit (figures 1-10, 1-11). Flap extension is indicated as a percentage of full flap travel.

SPEED BRAKE SYSTEM.

An electrically controlled, hydraulically actuated speed brake is located in the lower center fuselage. The speed brake is a variable position type, opening fully in approximately 4 seconds and closing in approximately 3 seconds. At high speeds, the speed brake may not fully extend, but as airspeed decreases, it will move to the fully extended position.

SPEED BRAKE SWITCH.

A three-position speed brake switch (figure 1-4) is provided on the right throttle in each cockpit. The switch in the rear cockpit is spring-loaded to the center position and takes control from the front cockpit when actuated. To regain control in the front cockpit, the front cockpit switch must be returned to the center position. Speed brake creep down may occur in flight unless the front cockpit switch is left in the closed (forward) position. After closing speed brake from the rear cockpit, the front cockpit switch should be moved to the center and then to the closed position.

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 AND WARNING LIGHT.

A landing gear lever (figure 1-8) is located on the instrument panel of each cockpit. The wheel-shaped end of the lever will illuminate at an airspeed of 210 KIAS or less if the landing gear is not down and locked, with the aircraft below 9400 feet pressure altitude, and with both throttles below 96% rpm. When airspeed is decreasing, the light should come on in the range of 210 to 180 KIAS. With the light on and the aircraft accelerating, the light may not go out until speed reaches approximately 240 KIAS.

Landing Gear Lever Downlock Override Button.

A landing gear lever downlock override button (figure 1-8) 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, and the front cockpit downlock button operates mechanically.

LANDING GEAR POSITION INDICATOR LIGHTS.

Three landing gear position indicator green lights (figure 1-8) on each instrument panel illuminate when the gear is down and locked.

LANDING GEAR WARNING SIGNAL AND SILENCE BUTTON.

A landing gear warning signal, consisting of an intermittent tone (beeper) over the interphone system, is audible thru the headset of each crewmember to indicate an unsafe landing gear condition. The signal sounds at an airspeed of 210 KIAS or less if the landing gear is not down and locked, with the aircraft below 9400 feet pressure altitude and with both throttles below 96% rpm. When airspeed is decreasing, the signal should sound in the range of 210 to 180 KIAS. With the signal activated and the aircraft accelerating, the tone may continue until speed reaches approximately 240 KIAS. A landing gear warning signal silence button (figure 1-8) is located on the instrument panel of each cockpit. Pressing either button silences the audible warning signal.

LANDING GEAR ALTERNATE RELEASE HANDLE.

A landing gear alternate release handle (figure 1-10) on the left subpanel of the front cockpit permits gear extension without hydraulic pressure or electrical power. On AF66-4353 thru AF66-4389, AF66-8373 and later, and aircraft modified by T.O. 1T-38A-768, the T-handle has been replaced by a D-handle. 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. 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. If alternate gear 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 until the system is reactivated. The nosewheel door assumes a springloaded closed position after alternate extension.

Note

If the gear is lowered by the alternate release with the landing gear lever 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 1-12). 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 in the OPEN position, the gear doors will remain open until the gear is retracted or the gear door switch is placed in the NORMAL position.

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 (figure 1-17). Steering is available only when the button is held in the pressed position. On AF66-4328 and later and aircraft modified by T.O. 1T-38A-771, with button depressed, nosewheel steering is deactivated when one or both throttles are advanced to MAX and restored when both throttles are retarded below MAX. 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.

CAUTION

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.

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 which 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 powered clamshell type canopy, operated by levers (figure 1-19) from either inside or outside each cockpit. Each canopy is counterbalanced throughout its travel limits, and each canopy drive mechanism is protected against excessive loads by a hydraulic canopy damper which also restricts canopy opening and closing speeds during manual operation. An inflatable pressurization seal installed on each canopy is inflated only when both canopies are locked and an engine is operating.

CAUTION

To prevent a rear canopy out-of-rig condition and possible loss of canopy in flight, the rear canopy external handle should be used to actuate the locking mechanism only. After initial movement of canopy mechanism, assist canopy thru opening and closing cycle with hand pressure applied at the forward frame.

CANOPY WARNING LIGHT.

A canopy warning light (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.

A canopy jettison system is provided to permit canopy jettison by the following means: A T-handle (figure 1-19) on the right subpanel of each cockpit enables each crewmember to jettison his canopy; raising either handgrip exposes the catapult firing triggers (figure 1-20), and squeezing either or both firing triggers jettisons the canopy of that cockpit 0.3 second prior to

CANOPY CONTROLS

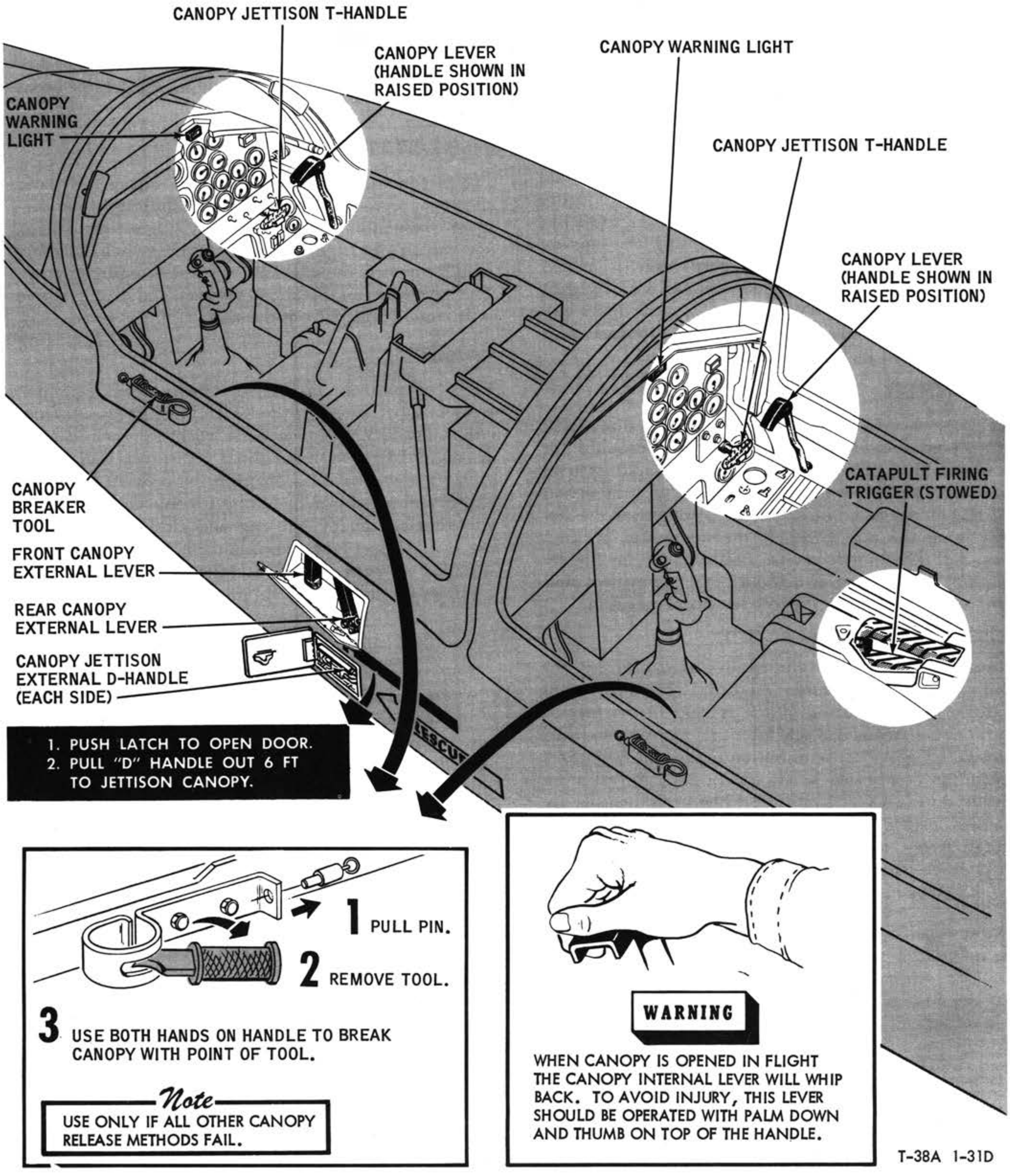


Figure 1-19.

seat ejection; when the canopy is opened manually at high speeds, it is automatically released by the canopy damper; a canopy jettison D-handle is located externally on each side of the forward fuselage to permit external jettisoning of both canopies. Pulling either D-handle jettisons both canopies. The front canopy jettisons with the pull of the D-handle, and the rear canopy jettisons 1 second later. A safety pin is provided for each canopy jettison T-handle. Installation of these safety pins prevents jettisoning the canopy by inadvertent actuation of the T-handles. On AF66-4353 thru AF66-4389, AF66-8350 and later, and aircraft modified by T.O. 1T-38A-768, a spring clip latch has been added to the canopy jettison T-handle. A pull of approximately 20 pounds is required to overcome the spring clip when pulling the T-handle out.

CANOPY BREAKER TOOL.

On AF66-4381 thru AF66-4389, AF67-14825 and later, and aircraft modified by T.O. 1T-38A-782, a canopy breaker tool (figure 1-19) 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. The tool is released by pulling the ring attached to a spring-loaded pin which locks the tool in place. To break the plexiglas, 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; normally three to four blows with the canopy breaker tool will open an adequate escape hole. Reversing the tool to hammer with the butt end produces ragged and unpredictable cracking.

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 catapult firing triggers. During the first part of seat ejection, initial seat movement simultaneously disconnects the oxygen, anti-G suit, and communication disconnects, pulls the calfguards down, fires the seatbelt delay initiator, and disconnects the seat adjuster power cable. 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 each ejection seat (one on each side), and are linked together mechanically so that they rise simultaneously. Each legbrace contains a handgrip and a firing trigger. Raising either legbrace locks the shoulder harness and exposes the catapult firing triggers. The first 10 degrees of travel of either handgrip releases the downlock on both legbraces. When actuated, the legbraces are held in the raised position by an uplock.

EJECTION SEAT SAFETY PIN.

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

CATAPULT FIRING TRIGGERS.

The catapult firing triggers (figure 1-20) are locked in the stowed position when the legbraces are down. When the legbraces are raised, the triggers move to the exposed position. Squeezing either or both catapult firing triggers jettisons the canopy of that cockpit, followed in 0.3 second by seat ejection.

SEAT ADJUSTMENT SWITCH.

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

OXYGEN/COMMUNICATION LEAD DISCONNECT.

The disconnect block 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 hose length, to obtain freedom of movement without disconnecting the hose.

WARNING

Do not disconnect this retention strap from the oxygen hose during flight.

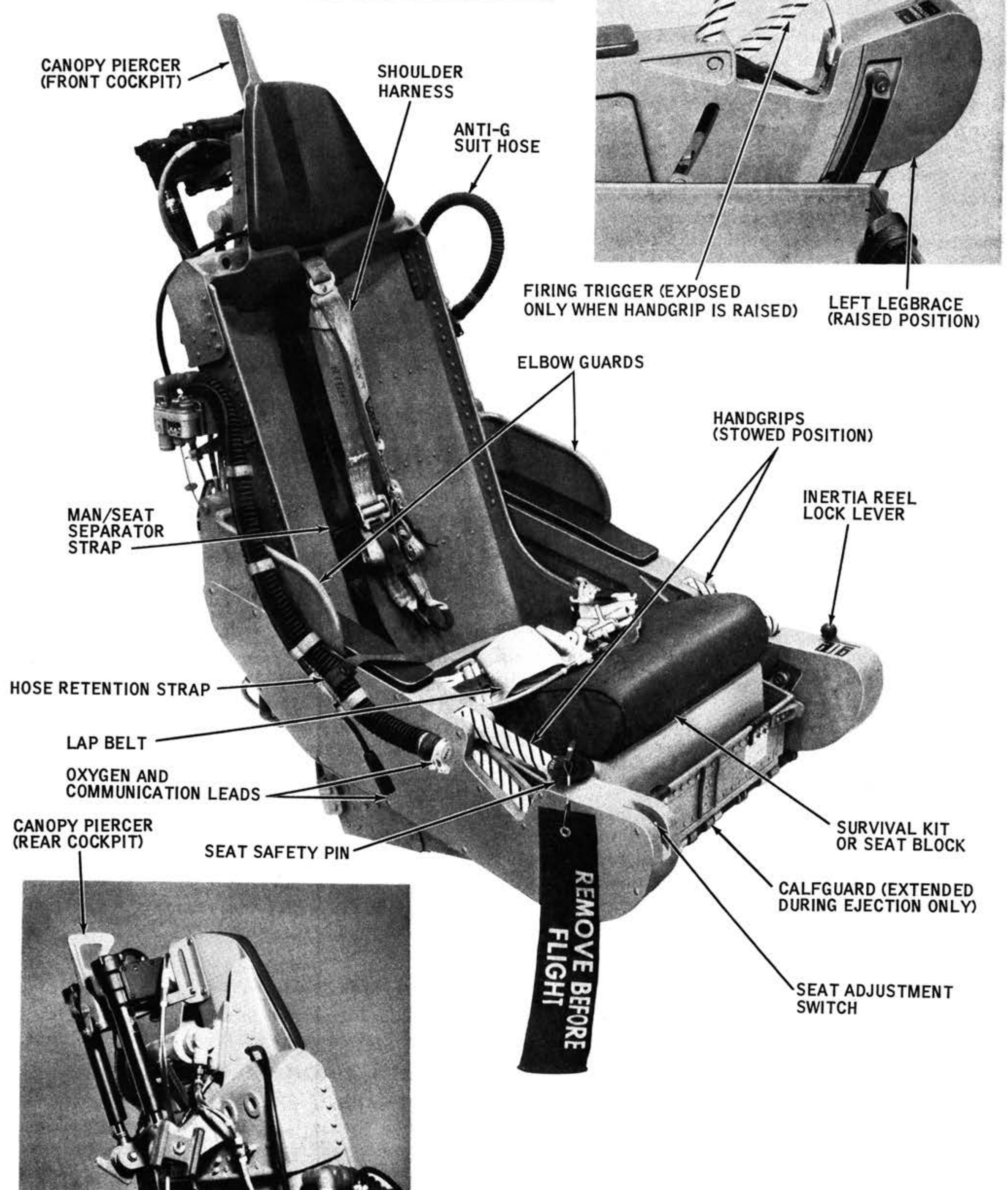
INERTIA REEL LOCK LEVER.

A shoulder harness inertia reel lock lever (figure 1-20) is located on the left legbrace of each ejection seat.

SEAT BELT AUTOMATIC RELEASE.

The seat is equipped with an MA-5 automatic release safety belt (figure 1-21). In a low altitude ejection, use of the automatic system greatly reduces the time required for separation from the seat and deployment of the parachute and consequently reduces the altitude required for safe ejection. The automatic belt has been thoroughly tested and is completely reliable.

EJECTION SEAT
(TYPICAL)



T-38A 1-32G

Figure 1-20.

AUTOMATIC-OPENING SAFETY BELT

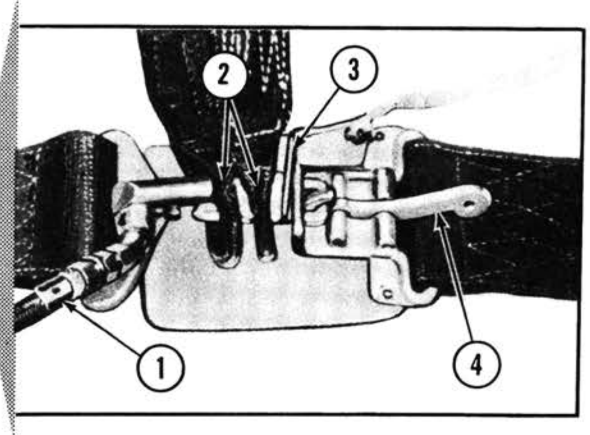
LOCKED

1. Initiator hose to automatic release mechanism.
2. Shoulder harness loops over swivel link.
3. Anchor (from automatic parachute arming lanyard) slipped over swivel link.

WARNING

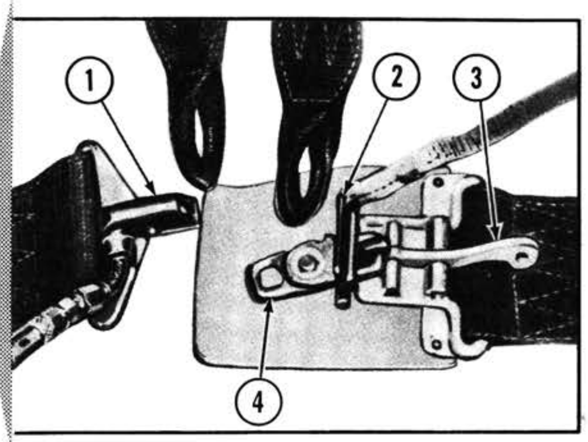
- Anchor must be installed as shown or parachute will not open automatically if ejection is necessary.
- Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.

4. Manual release lever closed.



AUTOMATICALLY OPENED

1. Automatic release mechanism actuated by gas pressure from initiator; swivel link detached on automatic release side.
2. Anchor (from automatic parachute arming lanyard) retained by swivel link.
3. Manual release lever closed.
4. Swivel link retained by manual release lever.



MANUALLY OPENED

1. Swivel link released by manual release lever (automatic release mechanism not actuated).
2. Anchor (from automatic parachute arming lanyard) freed from swivel link.

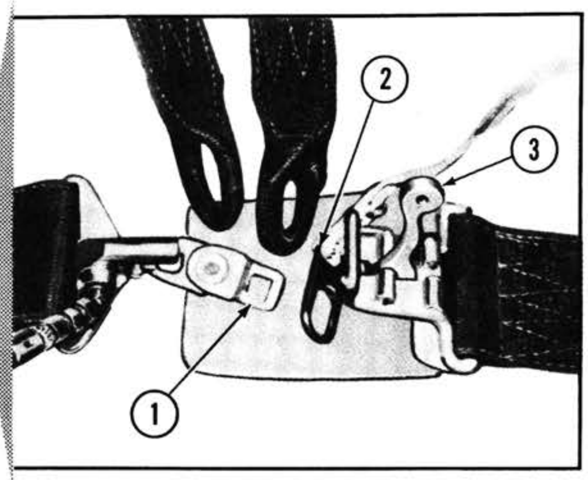
WARNING

If the belt is manually open during ejection, the parachute will not open automatically upon separation from the seat.

3. Manual release lever opened.

Note

Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence has been initiated.



T-38A 1-33C

Figure 1-21.

LOW ALTITUDE "ONE AND ZERO" EJECTION SYSTEM.

To provide an improved low-altitude escape capability, a system incorporating a 1-second safety-belt initiator, a pilot-seat separator, and a zero-delay parachute arming lanyard (1-0 system) has been developed. The zero-delay parachute is accomplished by means of a hook and lanyard which is attached to the parachute arming lanyard at one end and can be attached to the parachute ripcord handle (figure 1-22). The "one and zero" system makes use of a detachable hook and lanyard that connects the parachute timer lanyard to the parachute ripcord handle. At very low altitude and airspeeds, the hook must be connected to the parachute ripcord handle, thus providing parachute actuation immediately after separation from the ejection seat. At other altitudes and airspeeds, the hook must be disconnected from the parachute ripcord handle, thus allowing the parachute timer to actuate the parachute below the critical parachute opening speed and below the parachute timer altitude setting. A ring, attached to the parachute harness, is provided for stowage of the hook when it is not connected to the ripcord handle. This hookup must be done manually. Refer to INFLIGHT emergency procedures of Section III for proper use of ejection equipment.

MAN/SEAT SEPARATION SYSTEM.

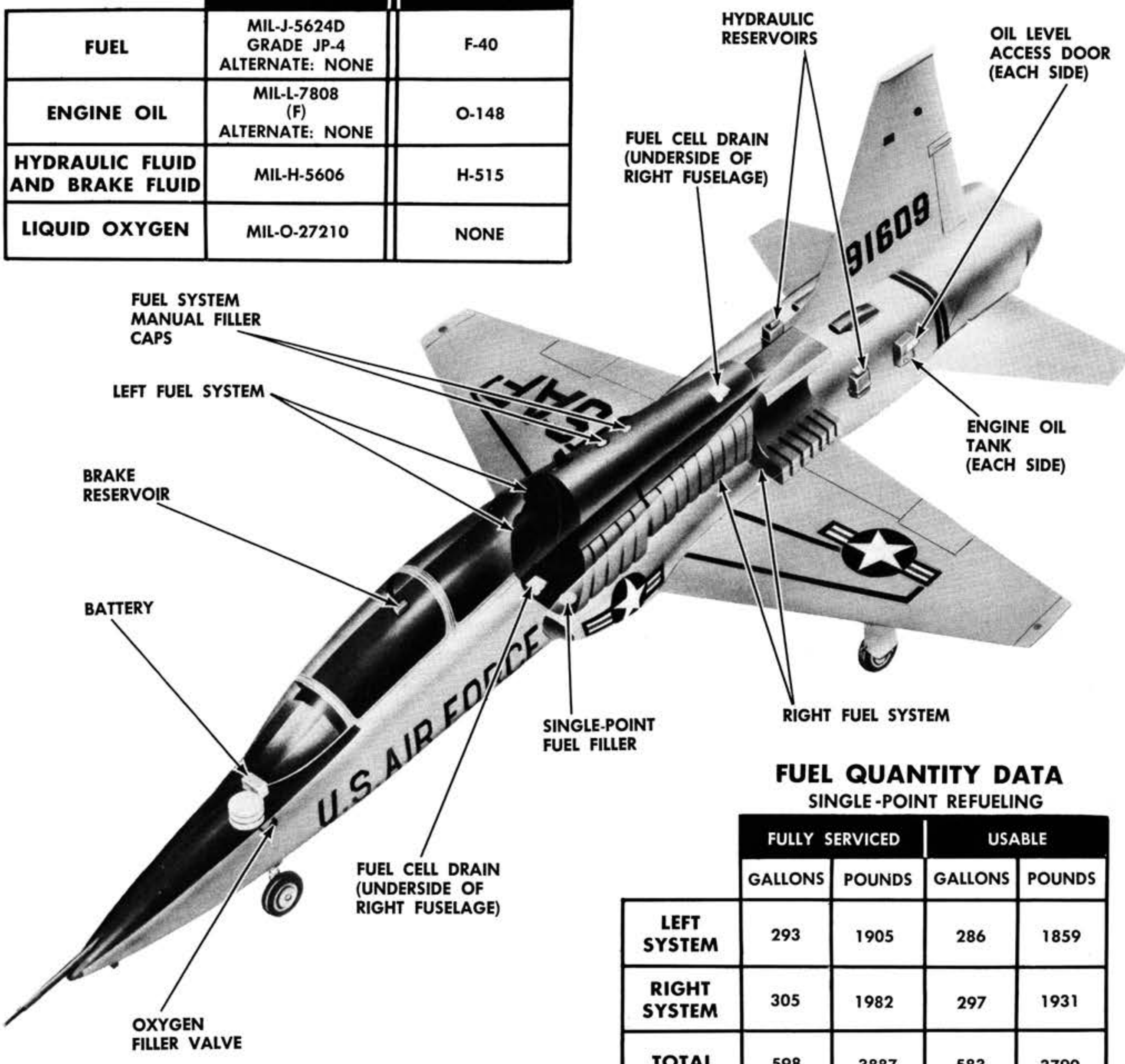
A man/seat separation system forcibly separates the crewmember from the ejection seat when the seat belt initiator fires after ejection.

Figure 1-22.

SERVICING DIAGRAM

FLUID SPECIFICATIONS

	USAF	NATO SYMBOL
FUEL	MIL-J-5624D GRADE JP-4 ALTERNATE: NONE	F-40
ENGINE OIL	MIL-L-7808 (F) ALTERNATE: NONE	O-148
HYDRAULIC FLUID AND BRAKE FLUID	MIL-H-5606	H-515
LIQUID OXYGEN	MIL-O-27210	NONE



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

DATA BASIS: **ACTUAL**

DATE: 1 DECEMBER 1961

Note

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

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Figure 1-23.

NORMAL PROCEDURES

SECTION II

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PREFLIGHT CHECK.

BEFORE EXTERIOR INSPECTION.

1. Form 781—Check for both aircraft status and proper servicing.
2. Ejection Seat and Canopy Safety Pins—Installed.
3. Publications—Check to ensure that all required navigational publications are on board.

EXTERIOR INSPECTION.

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

INTERIOR INSPECTION.

Rear Cockpit (Solo Flights).

1. Ejection Seat and Canopy Safety Pins—Check Installed, Streamers Fastened Together.
2. Survival Kit—Remove, or Secure.

WARNING

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

3. Seat Belt, Shoulder Harness, and Oxygen Hose—Secure and Lock.
4. Stowage Box Cover—Closed and Secured.
5. Communication and Navigation Equipment—Check.
   a. Command radio: Power Switch—BOTH; Manual Preset Guard Button—GUARD.
   b. TACAN: Function Switch—T/R; Channel Selector Knobs—Desired Channel.
   c. ILS: Steering Mode Switch—NORMAL; Navigation Mode Switch—LOC; Power Switch—ON; Channel Selector—Desired Channel.
6. Command and Navigation Override Switch—OFF.
7. Loose Equipment—Check Securely Stowed.
8. Circuit Breakers—Check.
9. Lights—Off.
10. Oxygen—NORMAL-NORMAL—OFF.
11. Canopy—Closed and Locked.

Front Cockpit (All Flights).

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

EXTERIOR INSPECTION

DURING THE EXTERIOR INSPECTION, THE AIRCRAFT SHOULD BE CHECKED FOR GENERAL CONDITION, WHEELS CHOCKED, ACCESS DOORS AND FILLER CAPS SECURED, AND FOR HYDRAULIC, OIL, AND FUEL LEAKS, AS WELL AS FOR THE FOLLOWING SPECIFIC ITEMS:

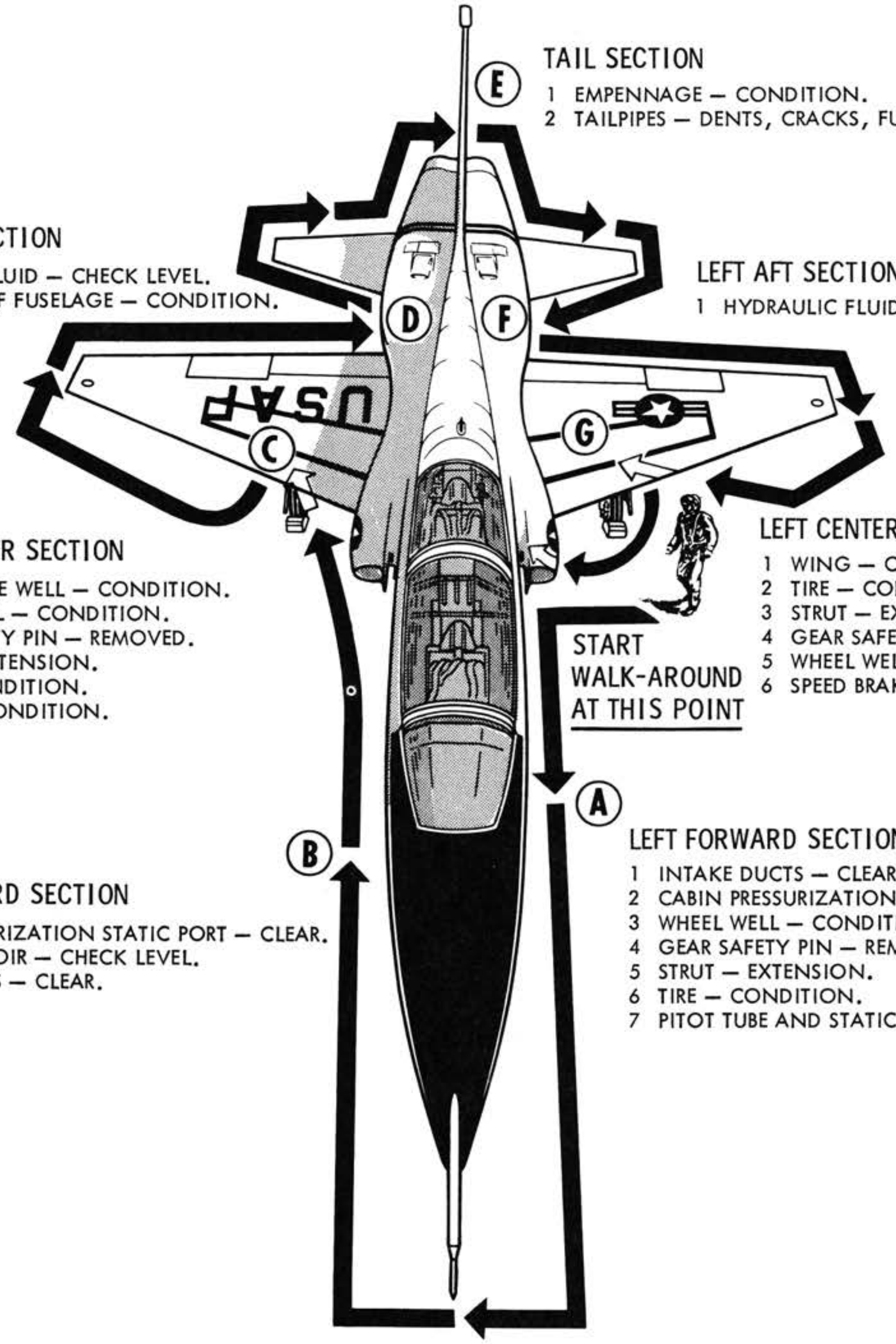

Figure 2-1.

*1. Seat Belt, Shoulder Harness, Seat Belt Lanyard, Zero Lanyard, Oxygen Connectors, Hose Retention Strap, and Helmet Chin Strap—Fasten and Adjust.
*2. Ejection Seat Handgrips—Push (to ensure full down).
*3. Oxygen System—Check (PRICE).
4. Battery Switch—ON.
5. Left Console—Check.
   a. Gear Door Switch—NORMAL.
   b. Flight Director Switch—ON.
   c. Rudder Trim Knob—CENTERED.
   d. Wing Flap Lever—OFF.
   e. Throttles—OFF.
   f. Speed Brake Switch—OPEN.
6. Landing Gear Lever—LG DOWN.
7. External Power—Connect (if required).
8. Instrument and Subpanels—Check.
   a. Compass Switch—MAG.
   b. Fuel Shutoff Switches—NORMAL (guarded position).
   c. Landing Gear Alternate Release Handle—IN.
   d. Landing Light Switch—OFF.
   *e. Clock—Set.
   *f. Accelerometer—Check.
   g. Cabin Altimeter—Check.
   *h. Airspeed Indicator—Check.
   *i. Steering Mode Switch—As Required.
   *j. Navigation Mode Switch—As Required.
   *k. Marker Beacon Light—Test.
   *l. Radio Transfer Switches—As Required.
   *m. Intercom Switches—As Required.
   *n. Circuit Breakers—Check.
   *o. Altimeter—Set.
   *p. Vertical Velocity Indicator—Check.
   q. Cabin Air Switch—CABIN PRESS.
   r. Pitot Heat Switch—OFF.
   s. Cabin Air Temperature Switch—AUTO.
   t. Engine Anti-Ice Switch—As Required.
   u. Magnetic Compass—Check.
   v. Fuel Boost Pump Switches—ON.
   w. Crossfeed Switch—OFF.
   x. Generator Switches—ON.
9. Fuel and Oxygen Quantity—Check.
*10. Warning Light Test Switch—TEST.
   (Without ac power on Block 30 and earlier aircraft, no landing gear audible warning signal.)
11. Interior and Position Lights—As Required.

STARTING ENGINES.

RIGHT ENGINE.

Start the right engine first, using the following procedure:

1. Signal for air supply.
2. Engine Start Button—Actuate Momentarily.
3. Throttle—Advance to IDLE at 14% minimum RPM.

CAUTION

- **Prior to moving either throttle to IDLE, assure that respective EGT OFF flag (front cockpit only) is out of view. An engine start cannot be properly monitored with OFF flag in view.**
- If ignition does not occur before fuel flow reaches 360 phr, retard throttle to OFF. When all fuel and vapors have been purged from the engine, signal ground crew to turn off air flow. Wait at least 2 minutes to permit fuel to drain before attempting another start.

Note

Engine speed must reach a minimum of 14% RPM within 15 seconds. If engine speed does not reach 14% RPM within 15 seconds, abort the start and have crew chief change start carts before attempting another start.

4. Engine Instruments—Check.
   a. Exhaust Gas Temperature—Check Within Limits.
   b. Engine RPM—Check at IDLE.
   c. Oil Pressure—Check.
5. Caution Light Panel—Check.

LEFT ENGINE.

1. Crew Retractable Steps—Assure Stowed.
   Crew chief will indicate visually that steps are stowed.

CAUTION

Do not actuate left engine start switch until a minimum of 30 seconds has elapsed after right engine start switch actuation. Shortening of the left engine start cycle may result in a hot start due to loss of external air.

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

BEFORE TAXIING.

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

*1. UHF, TACAN, ILS—ON.
2. IFF/SIF—STDBY.
3. Canopy Defog, Cabin Temp and Pitot Heat—Check (check Pitot Heat if required).

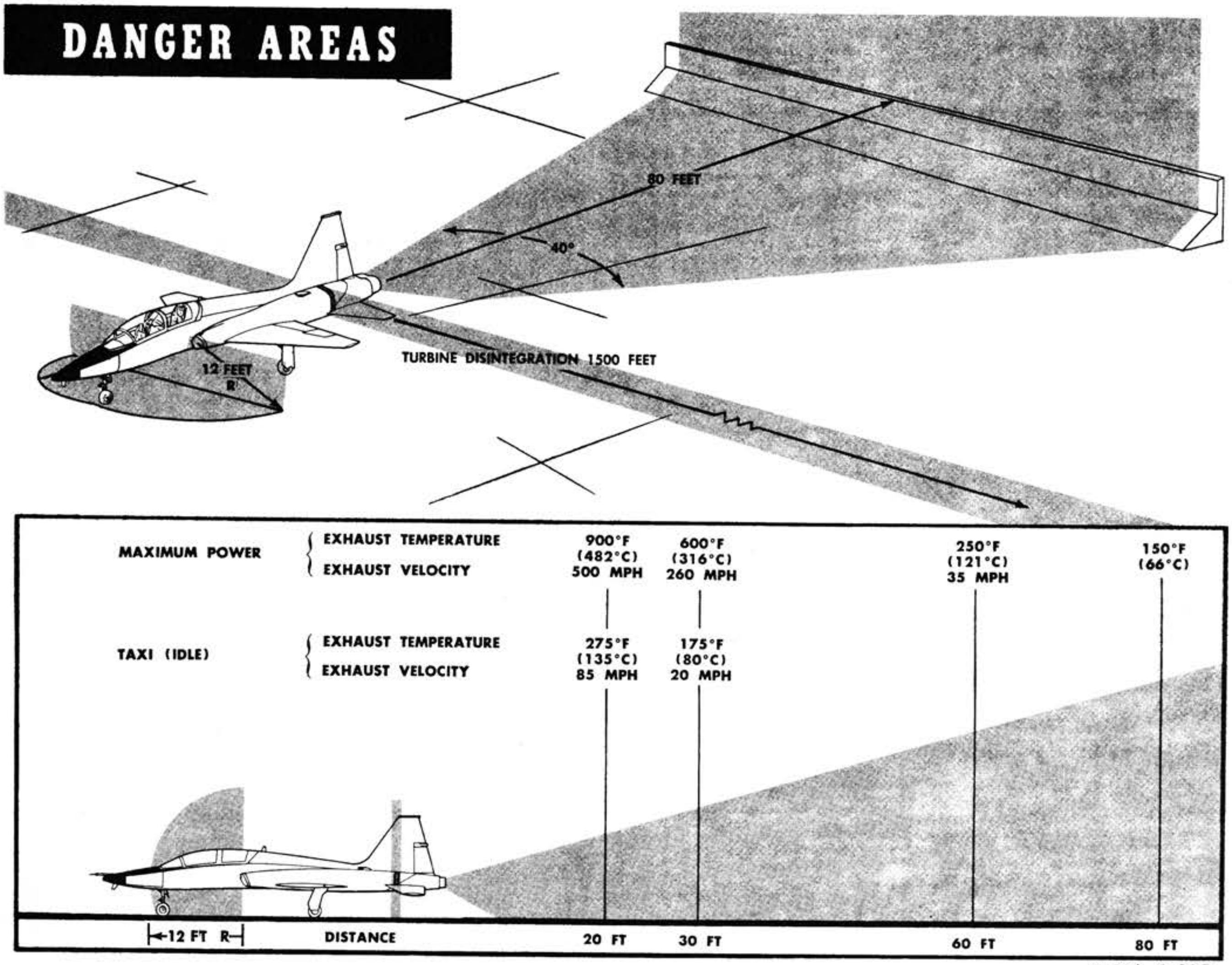

Figure 2-2.

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WARNING

For night or anticipated weather operation with conditions of high humidity and narrow temperature-dewpoint spread, the canopies should be closed and the cockpit 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.

*4. Circuit Breaker Panels—Check.
5. Stability Augmenter Yaw Switch—YAW.
6. (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.
7. Flight Trim Switch—Check.
   Actuate trim switch forward and allow stick to travel slightly, then freeze stick and allow pressure to build up. Hold trim switch with stick frozen until pressure ceases to increase. Actuate trim switch aft and make the same check.
8. Takeoff Trim Button—Press.
   Check that indicator light illuminates.
9. Flight Controls—Check.
   With normal movement, hydraulic pressure should not drop below 1500 psi.
10. Speed Brake—Closed.
11. Wing Flaps—Down, then retract to 60%.
   Check visually for trailing-edge movement of horizontal tail as flaps are actuated. Trailing edge moves down as flaps are lowered, up as flaps are retracted. Verify horizontal tail position with ground crew.
11A. Fast Erection switch—Press and Hold until ADI sphere stabilizes.

*12. Communication and Navigation Equipment—Check.
Check for proper operation of the ADI, HSI, Standby Attitude Indicator, TACAN, ILS, and Flight Director System. Refer to Section IV for description of proper system operation.
13. Fuel/Oxy Check Switch—FUEL&OXY GAGE TEST.
*14. Seat and Canopy Safety Pins—Remove.
*15. Brakes—Check Pedal Pressure.
16. Chocks—Removed.

TAXIING.

CAUTION

If brake drag is encountered or suspected, the aircraft should be aborted.

1. Turn Needle—Check.

WARNING

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

CAUTION

Simultaneous use of wheel brakes and nosewheel 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.

BEFORE TAKEOFF.

1. Battery Switch—Check ON.
2. IFF/SIF—As Required.
3. Fuel Boost Pumps—Check ON.
4. Canopy Defog, Cabin Temp, and Pitot Heat—As Required.
5. Engine Anti-Ice—As Required.
6. Rotating Beacon—ON.
7. Seat Belt Lanyard and Zero Lanyard—Check Attached.
8. Cockpit Loose Items—Check Secured.

CAUTION

Both cockpits should be checked for loose items (cockpit utility light, instrument hood bungee cords, etc). Check secured before closing canopy.

9. Canopy—Closed, Locked; Warning Light—Out.

CAUTION

Should the canopy jam in the full "up" position, the aircraft should not be taxiied 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.

10. Takeoff Data—Review.

LINE-UP CHECK.

1. Nosewheel Steering—Check Disengaged.
2. IFF/SIF—As Required.
3. Throttles—MIL.
4. Master Caution Light—Out.
5. Engine Instruments—Check.
6. Hydraulic Pressure—Check.

TAKEOFF.

The following takeoff procedure, and that given in figure 2-3, will produce the results stated in the takeoff distance charts of Part 2 of Appendix I:

1. Wheel Brakes—Release.
2. Throttles—MAX.

CAUTION

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

3. Engine Instruments—Check for Proper Indication.

CROSSWIND TAKEOFF.

Follow normal takeoff procedure.

AFTER TAKEOFF.

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

CLIMB.

1. Zero Lanyard—Disconnect When Passing Thru 10,000 Feet.

Note

Leave zero delay lanyard connected at all times below 10,000 feet pressure altitude, including flights in which 10,000 feet may be exceeded temporarily. Disconnect the lanyard when passing thru 10,000 feet pressure altitude, when this altitude will be exceeded for prolonged periods. If operating above terrain over 8000 feet high, the zero delay lanyard should remain connected until the aircraft is at least 2000 feet above the terrain.

NORMAL TAKEOFF (TYPICAL)

BASED ON GROSS WEIGHT OF 11,800 LB

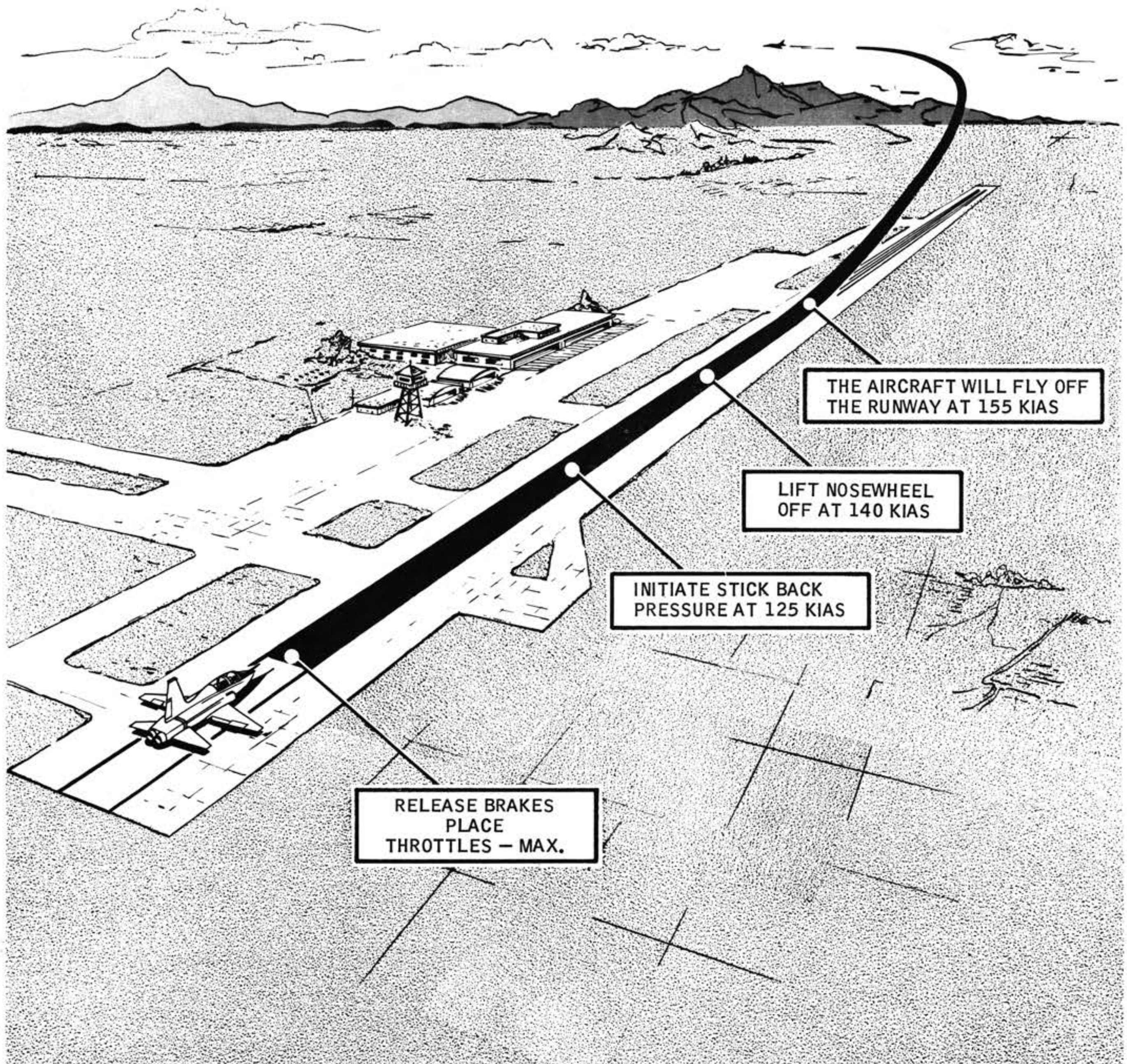


Figure 2-3.

2. Oxygen System—Check.
3. Cabin Pressurization—Check.
4. Canopy Defog and Cabin Temp—As Required.
5. IFF/SIF—As Required.
6. Altimeter—Reset As Required.

LEVEL-OFF AND CRUISE.

1. Oxygen System—Check.
2. Cabin Pressurization—Check.
3. Fuel Quantity—Check.

FUEL MANAGEMENT.

Avoid crossfeed operation above 30,000 feet unless necessary. Below 30,000 feet, 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—Check.
2. Crossfeed Switch—ON.
3. Boost Pump Switch (on side of lower fuel quantity)—OFF.

WARNING

If crossfeed operation is continued until the active system runs dry, dual engine flameout will occur.

4. Boost Pump Switches—Both ON When Fuel Quantities Are Equal.
5. Crossfeed Switch—OFF.

DESCENT.

1. Canopy Defog, Cabin Temp, and Pitot Heat—As Required.
2. Altimeter—Reset As Required.
3. Zero Lanyard—Attach before high fix for penetration or 10,000 feet normal descent.

Note

If operating above terrain over 8000 feet high, the zero lanyard should be connected at least 2000 feet above the terrain.

BEFORE LANDING.

The following procedures should be accomplished before landing. See figure 2-4 for pattern speeds:

1. Crossfeed Switch—OFF.
2. Zero Lanyard—Check Attached.
3. Gear—Down and Check Down.
4. Wing Flaps—Down.

LANDING.

NORMAL LANDING.

Refer to figure 2-4 for recommended landing and go-around pattern procedures. Maintain precise airspeed control throughout the final approach and touchdown. After touchdown, the landing attitude angle should be increased, without flying the aircraft off the runway, until the nose is level with the horizon. The stick position should be moved aft gradually until full back stick is obtained. Just prior to reaching 100 KIAS, lower the nosewheel to the runway and begin wheel braking. A single smooth brake application should be used to stop, taking full advantage of the available runway. Refer to section V for landing rate of descent and to the appendix for landing distance.

MINIMUM ROLL LANDING (DRY RUNWAY).

To make a minimum roll landing, decrease airspeed 10 knots on final approach to assure touchdown at speeds noted in the appendix landing distance charts. Immediately after touchdown and while the nosewheel is still off the runway, commence optimum braking. Smoothly lower the nosewheel to the runway while continuously applying optimum braking.

LANDING (WET OR SLIPPERY RUNWAY).

Decrease airspeed 10 knots on final approach to assure touchdown at speeds noted in the appendix landing distance charts. After touchdown, the landing attitude angle should be increased, without flying the aircraft off the runway, until the nose is level with the horizon. The stick position should be moved aft gradually until full back stick is obtained. Maintain the nose high attitude to 100 KIAS, then lower the nosewheel to the runway and apply optimum braking. On a wet or slippery runway, extreme caution should be used when applying brakes to avoid skidding, slipping, or blowing a tire due to hydroplaning action.

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 until touchdown. Do not exceed 500 FPM sink rate at contact. In crosswinds above 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.

After Touchdown.

The landing attitude angle should be increased until the nose is level with the horizon. The stick position should be moved aft gradually until full back stick is

LANDING AND GO-AROUND PATTERN

(TYPICAL)

NORMAL LANDING GROSS WEIGHT OF 9200 LB

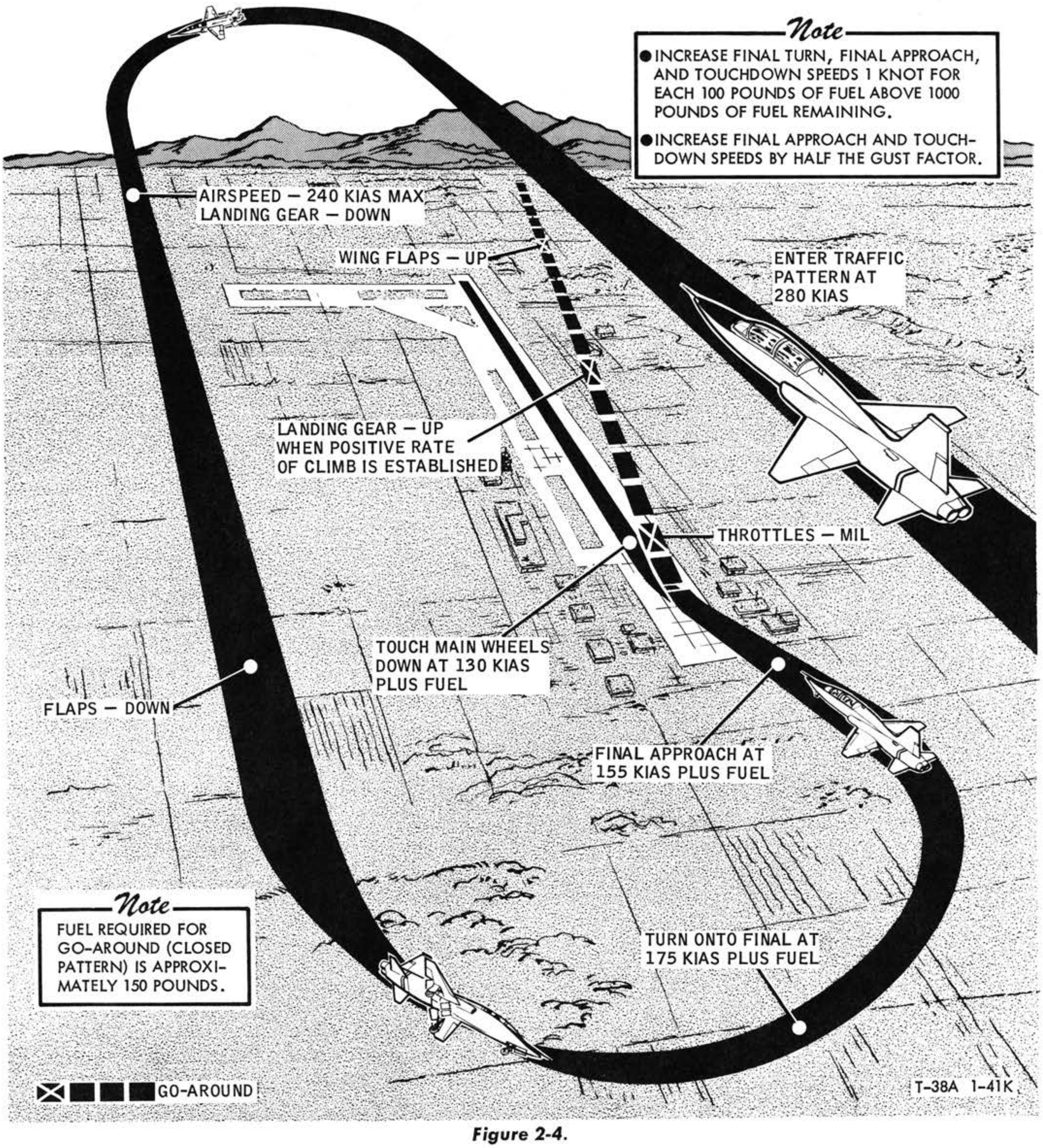


Figure 2-4.

obtained. Maintain directional control of the aircraft with the rudder. A too rapid increase in the landing attitude angle may cause the aircraft to become airborne and drift across the runway. Drift will create a high probability of tire damage. When the airspeed decreases to 100 KIAS, lower the nosewheel to the runway. Lowering the nose immediately after touchdown in a crosswind will produce a compression of the downwind strut, causing the aircraft to weathervane into the wind. This motion usually results in damage to the downwind tire.

USE OF LANDING WHEEL BRAKES.

Wheel Brake Operation.

To minimize brake wear, the brakes should be used as little and as lightly as possible. Care should be exercised to take full advantage of the length of runway during landing or aborted takeoff, to minimize use of brakes during turns, and to 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. A wheel once locked will remain locked if the same or greater brake pressure is maintained, even though weight on the wheels increases as lift decreases. Optimum braking occurs when the wheel is in an incipient skid—i.e., the wheel is still rotating but only a slight increase in brake pressure would cause a complete skid. A complete skid decreases braking action because of a decrease in the coefficient of friction between the sliding tire and the runway surface; the scuffing action causes small bits of rubber to act as rollers under the tire, and as skidding continues, the heat generated starts to melt the rubber and the molten rubber acts as lubricant. Further application of brake pressure during a skid could increase the tendency for the aircraft to turn away from the wheel developing the greater skid, the end result possibly being a blown tire with no braking action on that wheel but a tendency for the aircraft to turn in the direction of the blown tire.

Optimum Braking Action.

Apply brakes in a single, smooth application with constantly increasing pedal pressure. If skidding occurs, momentarily release brake pressure and immediately reapply brakes. This procedure will provide the shortest stopping distance possible from wheel braking action. If runway length is insufficient to completely stop the aircraft, prepare for barrier engagement.

Brake Operation at High Speed.

Extreme care should be used in applying brakes at high speed to prevent skidding of the tires. As discussed above, very little pressure is required to develop a skid while considerable lift is on the wings. If skidding is believed to be occurring, momentarily release pressure and again gradually apply increasing brake pressure.

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. 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 this procedure:

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

Note

If a touchdown is made, lower the nose slightly and accelerate to takeoff airspeed, then establish takeoff attitude and allow the aircraft to fly off the runway.

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.

Note

Touch-and-go landings will be performed only under conditions authorized by the major air command.

AFTER LANDING (CLEAR OF RUNWAY).

1. Cabin Altimeter—Check.
   If reading is below field elevation, place cabin air switch at RAM DUMP before opening either canopy.
2. Cockpit Loose Items—Check Secured (before opening canopy).
3. Gear Door Switch—OPEN.
4. Takeoff Trim Button—Press.
5. Wing Flaps—Up.
6. Speed Brake—Open.
7. Pitot Heat—OFF.
8. TACAN, ILS, IFF/SIF—OFF.
9. Rotating Beacon—OFF.

CAUTION

Ensure that instrument hood bungee cords are hooked before opening rear canopy.

ENGINE SHUTDOWN.

1. Operate engines at IDLE for minimum of 1 minute.
2. Throttles—OFF.
3. Seat and Canopy Safety Pins—Install.
4. All Unguarded Switches—OFF.

BEFORE LEAVING AIRCRAFT.

1. Wheels—Chocked.

STRANGE FIELD PROCEDURES.

The following checklist provides guidance for operation at fields that do not normally support the T-38A:

1. Oil: Use MIL-L-7808 (F), (NATO O-148). Alternate: None.

   Check oil level immediately after flight.
2. Fueling: Use MIL-J-5624D, Grade JP-4, (NATO F-40). Alternate: None.

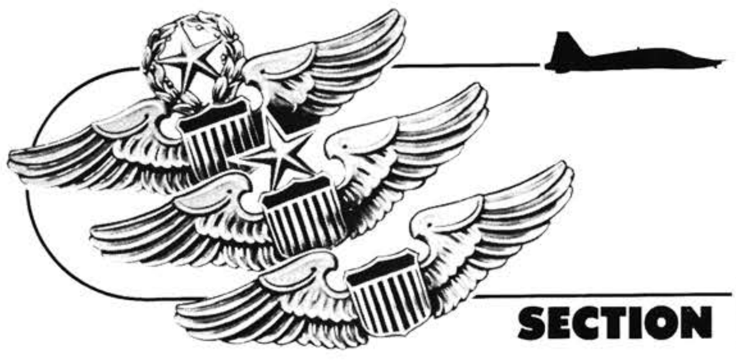
   Single-Point—Use a 45-55 psi system. Start fuel flowing and then move the precheck valve handle, located adjacent to the single-point fueling adapter, to the PRIM (primary) position. All fuel flow should stop within 10 seconds. Stoppage is indicated by fuel flow not greater than 10 gallons per minute at fuel truck meter. Return precheck valve to OFF. Allow fuel flow to continue for a short duration and then place precheck valve handle in the SEC (secondary) position. All fuel flow should stop within 10 seconds. Return precheck valve 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.

2A. Oxygen: Use MIL-O-27210.

3. Hydraulic Fluid: Use MIL-H-5606 (NATO H-515).
4. Tire Pressure:

   Main—225 psi. Nose—75 psi.
5. Loose Fasteners: Use Torq-set bit.
6. Air Starting Units—MA-1A, MA-2, MA-2MP, MA-3MP, Boeing 502, Navy type (a), (MA-1 if other units not available).
7. Electrical Units—(115/200 volts, 3-phase, 400-cycle required).



EMERGENCY PROCEDURES

SECTION III

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Note

- Critical emergency checklist items are those actions which must be performed immediately if the emergency is not to be aggravated. To permit immediate identification, these Section III critical procedure steps appear in boldface capital letters. Section III does not cover multiple emergencies.
- 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 Practicable.

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. Keep Air Flowing to the Engine—Starter Button Depressed.

CAUTION

To assure maximum airflow to affected engine, do not press both start buttons or the start button of the engine not indicating fire.

3. Fuel Shutoff Switches—CLOSED.

Note

To keep air flowing to the engine for more than the original 30-second start cycle, the starter button must be held until the cycle is completed. This will rearm the system and provide an additional 30 seconds of airflow to the affected engine.

EMERGENCY EXIT ON THE GROUND.

If immediate exit is necessary and the canopy cannot be opened by the normal procedure, pull the canopy jettison T-handle. Actuation of the T-handle will jettison the corresponding cockpit canopy. On aircraft modified by T.O. 1T-38A-782, if either canopy cannot be opened, break thru the canopy glass, using the canopy breaker tool.

NOSEWHEEL VIBRATION OR SHIMMY.

If nosewheel vibration or shimmy is experienced, disengage the nosewheel steering system. Shimmy may be reduced by relieving weight on the nosewheel.

TAKEOFF EMERGENCIES

ABORT.

If decision is made to abort takeoff or a touch-and-go landing, use the following procedure:

1. **THROTTLES—IDLE.**
2. Wheel Brakes—APPLY.

CAUTION

- 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.
- Heavy braking after a heavy gross weight abort may result in extremely hot brakes, and the possibility of a tire fire should be anticipated.

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

BARRIER ENGAGEMENT.

1. **SPEED BRAKE—CLOSED.**
2. **STEER—STRAIGHT FOR BARRIER;** engage perpendicular to barrier; discontinue braking before engagement.
3. **CONTROL STICK—AFT TO RAISE NOSE SLIGHTLY. AVOID NOSEWHEEL LIFTOFF.**

ENGINE FAILURE DURING TAKEOFF.

If an engine fails on takeoff prior to reaching the critical engine failure speed, use the procedure in this section titled ABORT. If an engine fails after reaching critical engine failure speed, the takeoff can normally be continued. Limited, excess thrust is available for takeoff, acceleration, and climbout when operating on a single engine. The available runway should be used to accelerate the aircraft above single-engine takeoff speed. 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. After becoming airborne allow the aircraft to accelerate straight ahead, climbing only as necessary, until reaching 190 KIAS. The gear can be safely retracted at speeds above single-engine takeoff speed plus 10 knots. The flaps should be raised after gear retraction and above 190 KIAS.

If Decision Is Made to Stop:

1. **ABORT.**

If Takeoff Is Continued:

1. **THROTTLES—MAX.**
2. **ATTAIN AIRSPEED ABOVE SINGLE-ENGINE TAKEOFF SPEED** (10 knots desired).
3. Gear—UP (as required above single-engine takeoff speed plus 10 knots).
4. Flaps—UP (as required above 190 KIAS).
5. Throttle (inoperative engine)—OFF.

WARNING

- Continuing a takeoff on a single engine should be attempted only at maximum thrust.
- 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.

Note

- If engine failure occurs after rotation, it will probably be necessary to lower the nose to attain speed above single-engine takeoff speed. If engine failure occurs after takeoff, it may be necessary to allow the aircraft to settle back to the runway.
- If the left engine is inoperative but windmilling, gear retraction can be accomplished but will require an extended time period. Gear retraction, when initiated between single-engine takeoff speed plus 10 knots and 190 KIAS, requires from 30 to 50 seconds.
- 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.

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.
3. Unsafe Gear Indication Remains—Use Landing Gear Alternate Extension procedure.

INFLIGHT EMERGENCIES

SINGLE-ENGINE FLIGHT CHARACTERISTICS.

Single-engine directional control can 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. 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. Single-engine performance is shown in FA7-3 for various conditions of temperature and gross weight. 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 (FA3-5) can be attained by following the climb schedule shown.

ENGINE FAILURE 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. (Refer to FA4-7, Diversion Range Summary Table, Single-Engine.) 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. Throttle (inoperative engine)—OFF for 10 seconds before attempting a start if conditions permit.

DUAL ENGINE FAILURE AT LOW ALTITUDE.

In case of dual engine failure and if sufficient airspeed is available, the aircraft should be pulled up to exchange airspeed for altitude. Air starts should be attempted immediately upon detection of dual engine flameout and repeated as many times as possible during the pullup and climb. Terminate the climb before airspeed drops below 230 KIAS in order to maintain engine windmilling rpm above minimum required for air start. If the decision is to eject, the positive rate of climb should be continued and ejection accomplished while the nose of the aircraft is above the horizon (approximately 20 degrees nose up attitude), but prior to reaching a stall or rate of sink condition. If dual engine failure occurs at low altitude, proceed as follows:

1. **THROTTLES—MAX.**
2. **START BUTTON (2)—PUSH.**
3. Establish positive rate of climb.
4. Eject—Unless indications of a start are detected and sufficient altitude is available to complete the start.

ENGINE RESTART DURING FLIGHT.

Air starts can be expected below 30,000 feet between 230 KIAS and 0.8 mach; 250 KIAS affords optimum air start capability. If both engines flame out, restart one engine at a time. If engine flameout is experienced, use the following procedure:

1. Descend to 30,000 feet or below.
2. Airspeed—250 KIAS (optimum).

Note

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

3. Battery and Boost Pump—Check ON.
4. Engine Start Switch—Actuate Momentarily.
5. Throttle (windmilling engine)—Advance to slightly above IDLE, then retard to IDLE.

Note

- Leave throttle at IDLE for 30 seconds before aborting a start.
- In the event of dual engine flameout, right engine start should be attempted first as right engine instruments will operate normally as soon as ignition switch is actuated.

6. If Restart Attempt Fails—Place throttle in OFF position for approximately 10 seconds, turn crossfeed switch ON, check ignition control, and attempt another start.

Note

- The rpm may hang up during restart after combustion occurs at low altitude below 190 KIAS. RPM hangup during an airstart may be eliminated by increasing airspeed.
- If it appears that a boost pump has failed, remain below 30,000 feet to obtain full range of engine operation. Turn crossfeed OFF to avoid having to use an abnormal fuel balancing procedure. If impractical to remain below 30,000 feet, engine operation above 30,000 feet with gravity fuel flow is possible at reduced power settings.

ALTERNATE AIR START.

The alternate air start is primarily designed for use at low altitude when thrust requirements are critical. An air start 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.

Note

After advancing the throttle to the MAX range, or if dual flameout occurs while throttle is in MAX range, actuate the engine start button to provide more assurance of starting.

ENGINE STALL/ROLLBACK.

If an engine compressor stall is encountered, proceed as follows:

1. **THROTTLE—IDLE.**
2. Increase airspeed and advance throttle slowly.

Note

If engine FOD is suspected, slow throttle advance is necessary to regain sustained engine power.

3. Throttle—OFF (if engine will not recover).
4. Land as soon as conditions permit. If the engine is shut down, an airstart may be attempted as applicable.

MAXIMUM GLIDE

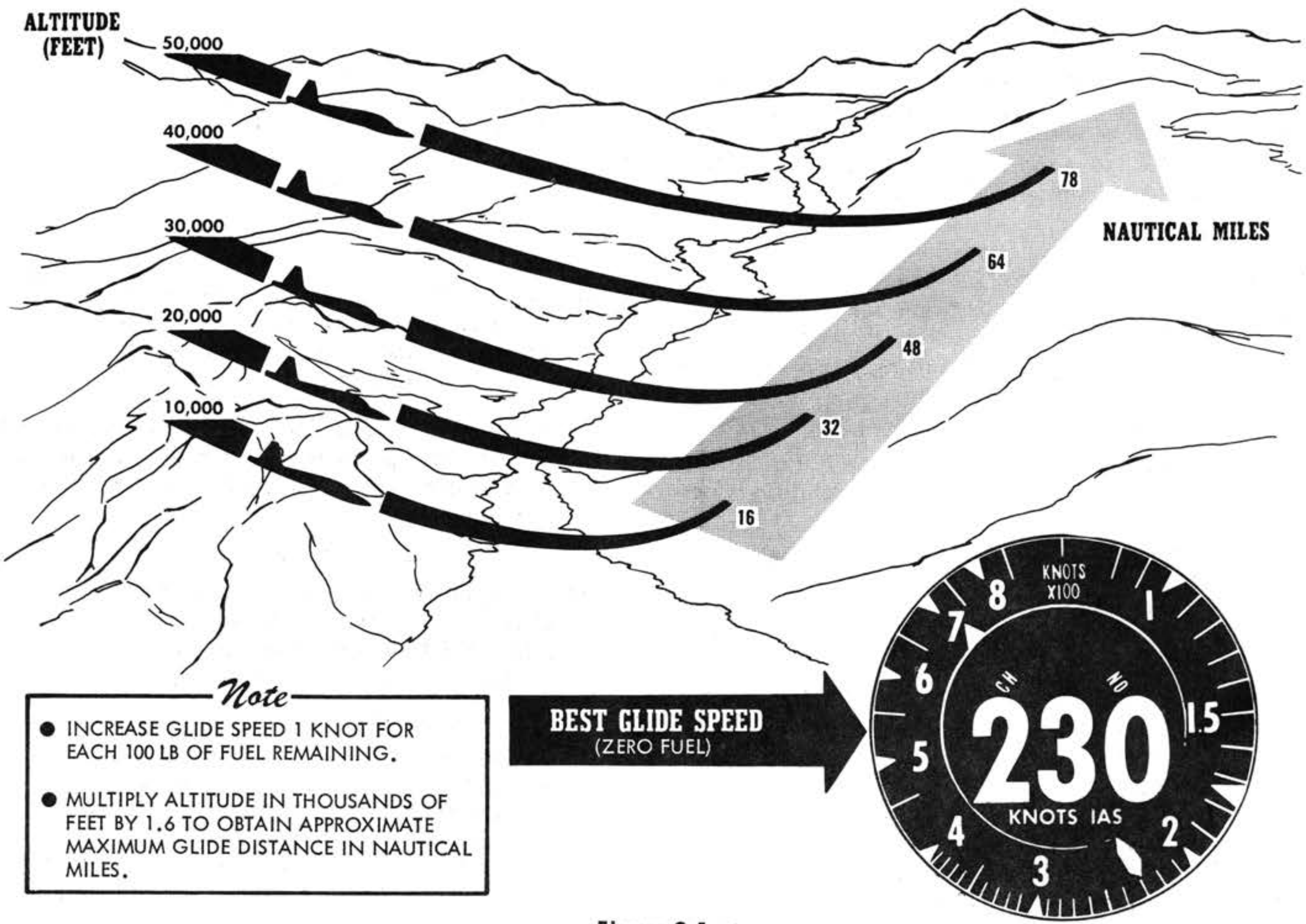
(BOTH ENGINES WINDMILLING)

DATE: 1 MAY 1967

DATA BASIS: **FLIGHT TEST**

CLEAN CONFIGURATION

(NO WIND)



Note

- INCREASE GLIDE SPEED 1 KNOT FOR EACH 100 LB OF FUEL REMAINING.
- MULTIPLY ALTITUDE IN THOUSANDS OF FEET BY 1.6 TO OBTAIN APPROXIMATE MAXIMUM GLIDE DISTANCE IN NAUTICAL MILES.

Figure 3-1.

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ENGINE FIRE WARNING DURING FLIGHT.

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

1. THROTTLE (AFFECTED ENGINE)—RETARD TO IDLE.

2. THROTTLE (AFFECTED ENGINE)—OFF, IF FIRE WARNING LIGHT REMAINS ILLUMINATED.

WARNING

If engine cannot be shut down with the throttle, the fuel shutoff switch (affected engine) should be closed.

3. If Fire Cannot Be Confirmed—Land As Soon as Practicable.

CAUTION

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

4. If Fire Is Confirmed and Cannot Be Extinguished —Eject.

ELECTRICAL FIRE.

If an electrical fire occurs, proceed as follows:

1. Battery and Generator Switches—OFF.

Note

With fuel pumps inoperative, engine flameout may occur if above 30,000 feet.

2. All Electrical Equipment—OFF.
3. Battery and Generator Switches—ON, as Required.

Note

Turn on battery and generator(s) and operate only those units necessary for flight and landing.

4. Land as soon as practicable.

SMOKE OR FUMES IN COCKPIT.

If smoke or fumes are encountered in the cockpit, proceed as follows:

1. OXYGEN—100%.

2. Check for Fire.
3. Cabin Air Switch—RAM DUMP, Below 25,000 Feet, If Possible.

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 procedure shown in figure 3-2. After ejection, the safety belt automatically releases and a man/seat separation system forcibly separates the crewmember from the ejection seat. A one-and-zero escape system is provided to improve low-altitude escape capability. Under level flight conditions, eject at least 2,000 feet above the terrain whenever possible. The Zero Delay lanyard may be disconnected for completely controlled ejections if time and altitude permit. The Zero Delay lanyard should be connected in accordance with present directives. However, if 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. Under uncontrollable conditions, eject at least 15,000 feet above the terrain whenever possible.

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 flameout landing. Accident statistics emphatically show a progressive decrease in successful ejections as altitude decreases below 2000 feet above the terrain.

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. If rate of climb cannot be accomplished, level flight ejection should be accomplished immediately to avoid ejection with a 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. The automatic safety belt must not be opened prior to ejection regardless of altitude. If the safety belt is opened manually, the automatic feature of the parachute is eliminated.

EJECTION PROCEDURE

BEFORE EJECTION

IF TIME AND CONDITIONS PERMIT . . . .

- STOW ALL LOOSE EQUIPMENT.
- ATTAIN PROPER AIRSPEED, ALTITUDE, AND ATTITUDE.

1 ASSUME PROPER POSITION.

Sit erect, head firmly against headrest, chin tucked in; feet held back against seat.

Note

Recommend crewmember in rear cockpit eject first.

EJECTION

WARNING

Position elbows close to body when raising handgrips to ensure that elbows will be protected during ejection.

2 HANDGRIPS — RAISE.

Raise either or both handgrips (legbraces) to expose triggers.

3 FIRING TRIGGERS — SQUEEZE.

Squeezing either or both triggers jettisons canopy, followed in 0.3 second by seat ejection. If canopy fails to jettison, the seat will eject thru canopy.

IF SEAT AND CANOPY FAIL TO JETTISON

CANOPY JETTISON T-HANDLE — PULL.

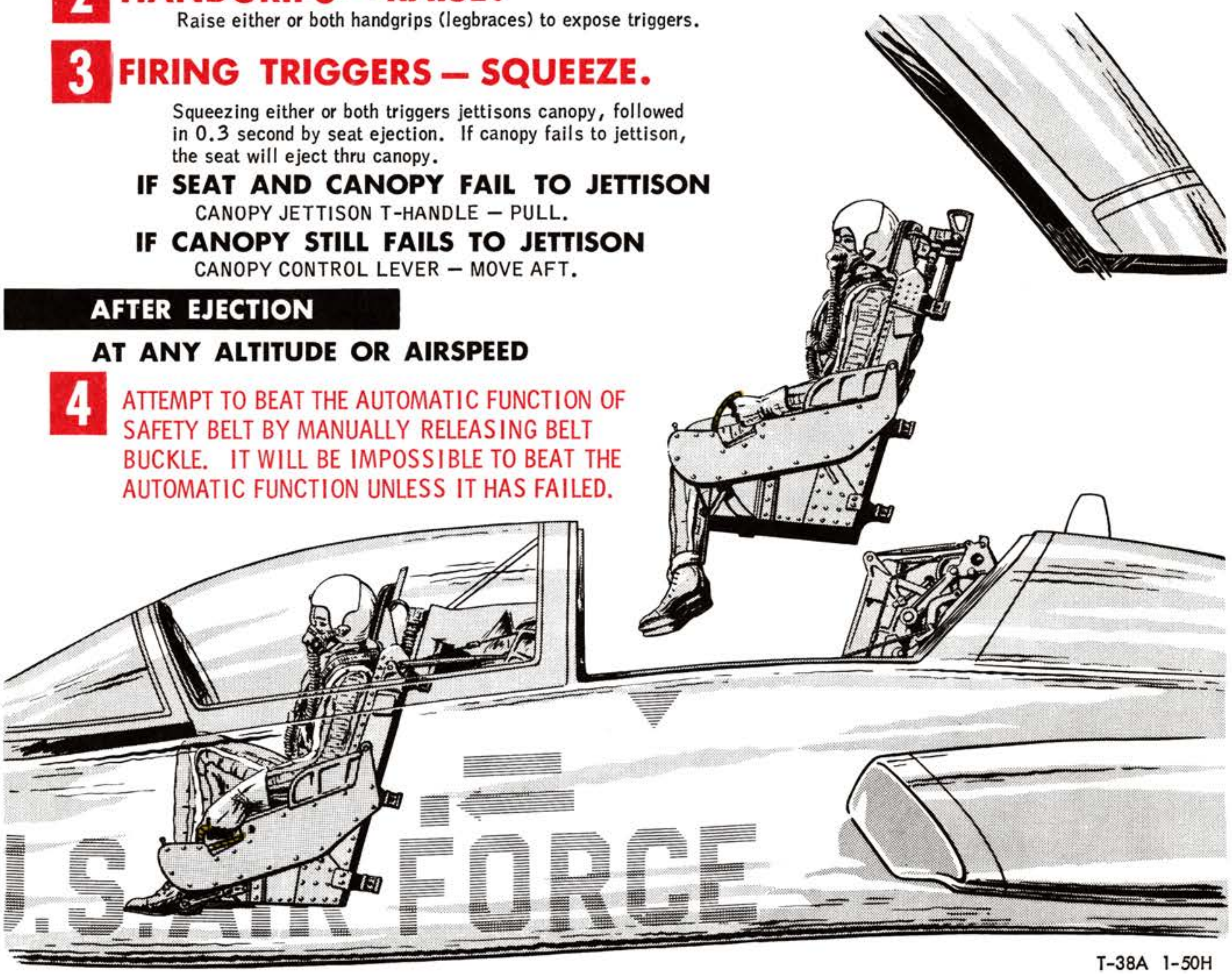
IF CANOPY STILL FAILS TO JETTISON

CANOPY CONTROL LEVER — MOVE AFT.

AFTER EJECTION

AT ANY ALTITUDE OR AIRSPEED

4 ATTEMPT TO BEAT THE AUTOMATIC FUNCTION OF SAFETY BELT BY MANUALLY RELEASING BELT BUCKLE. IT WILL BE IMPOSSIBLE TO BEAT THE AUTOMATIC FUNCTION UNLESS IT HAS FAILED.



T-38A 1-50H

Figure 3-2.

WARNING

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

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 will exert minor forces on the body up to about 525 knots, appreciable forces from about 525 to 600 knots, and excessive forces at higher speeds. As altitude increases, these speed ranges will be proportionately lower.

LOW-ALTITUDE "ONE AND ZERO" EJECTION.

The emergency minimum ejection conditions, based on a level attitude, with no sink rate, and use of the BA-15/BA-18 parachute, are as follows:

1-Second Automatic Safety Belt

1-Second Parachute BA-15/BA-18 Pack, C-9 Canopy	Altitude 100 Feet
0-Second Parachute (Lanyard to Ripcord Grip) BA-15/BA-18 Pack. C-9 Canopy.	Ground Level at 120 KIAS

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 of 120 KIAS at ground level is given 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.)*

BEFORE EJECTION.

If time and conditions permit . . .

Note

When ejecting under controlled conditions and at more than 2000 feet AGL, disconnect the Zero Delay lanyard.

1. IFF—EMERGENCY.
2. Turn aircraft toward uninhabited area.
3. Notify other pilot of decision to eject.
4. Actuate bailout bottle for high altitude ejection.
5. Disconnect oxygen hose, G-suit, and radio cord; lower visor.
6. Attain proper airspeed, altitude, and attitude.
7. Assume proper ejection position.

EJECTION.

1. HANDGRIPS—RAISE.

WARNING

Raise handgrips with both hands, elbows retained in elbow guards to prevent arm injury during ejection and as a protection against wind blast after ejection.

2. FIRING TRIGGERS—SQUEEZE.

AFTER EJECTION.

a. Immediately after ejection, attempt to manually open the seat belt as a precaution against the belt failing to open automatically.

b. As soon as the belt releases, 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 ejection.

c. If belt has been opened manually, pull the parachute arming lanyard if above 14,000 feet or the ripcord grip if below 14,000 feet.

LOSS OF CANOPY.

If either or both canopies are lost, immediately slow the aircraft down to 300 KIAS or less to minimize turbulence and noise. Reestablish inter-cockpit communications. Land as soon as conditions permit.

ENGINE OIL SYSTEM MALFUNCTION.

If engine oil pressure exceeds the operating limits, proceed as follows:

1. Throttle—IDLE.
2. Throttle—OFF, if indication of seizure is noted.

LANDING EMERGENCIES

LANDING WITH ONE ENGINE INOPERATIVE.

1. Landing Gear Lever—LG DOWN, Below 240 KIAS (Check Gear Down).

Note

If left engine is inoperative, normal windmilling rpm will provide adequate utility hydraulic pressure for a normal landing gear extension in a slightly longer extension time. If utility hydraulic system pressure is depleted, use the alternate landing gear extension system to extend the gear. Allow additional time for gear extension by delaying the breakpoint.

2. Wing Flaps—60%.
3. Normal Landing Pattern Speeds—Maintain.
4. Wing Flaps—100% when landing is assured (optional).

WARNING

Use maximum power, if necessary, to maintain single-engine pattern airspeeds.

SINGLE-ENGINE GO-AROUND.

If a single-engine go-around is necessary, use the procedure for engine failure during takeoff.

ROLLING OFF RUNWAY OR EMERGENCY GROUND EGRESS.

If time and circumstances allow, shut the engines down, turn battery switch off, insert ejection seat safety pin, disconnect personal leads (oxygen, communication and anti-G suit), and evacuate the aircraft.

Note

Crewmembers should consider removing the parachute when unstrapping from the aircraft to facilitate ease of egress.

WING FLAP ASYMMETRY.

If lateral rolling and yawing is experienced during operation of the wing flaps, an asymmetric wing flap condition probably exists. If this occurs, use the following procedure:

1. **AIRSPEED—180 KIAS, MINIMUM.**
2. Wing Flap Lever—Actuate to eliminate or minimize the wing flap asymmetric condition.
3. If Step 2 Fails—Land as soon as conditions permit, maintaining airspeed 20 KIAS above the normal turn onto final, final approach, and touchdown airspeeds. In any event, do not touch down below 160 KIAS.

WING FLAP-HORIZONTAL TAIL LINKAGE MALFUNCTION.

If the linkage fails as flaps are lowered, a smooth but definite pitch up will result. If the linkage fails as flaps are raised, the horizontal tail will not reposition from the trailing edge down position and a definite pitch down results. Full horizontal tail travel is available in either case, but heavy stick pressure will be required to counteract the pitch change. If unusual forces are noted as flaps are raised or lowered, the direction of flap travel should be reversed to counteract stick forces. If the malfunction occurs in the landing pattern, initiate a go-around prior to repositioning the flaps. Flaps may then be extended or retracted in increments, as required, as trim and control pressures are applied to offset the pitch tendency. If comfortable control pressures cannot be maintained with flaps retracted, lower flaps as required at or below appropriate airspeed for the flap configuration. Land as soon as practicable. For landing, a wide pattern or a straight-in approach should be flown, using as much flap as is available without creating uncomfortable control pressures.

LANDING WITH WING FLAPS RETRACTED.

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 by 10 KIAS the turn onto final, final approach, and touchdown airspeeds.

LANDING WITH GEAR PARTLY EXTENDED.

The aircraft may be landed with nose gear retracted or partly extended if both main gears are down and locked. If the main landing gear cannot be extended to the down and locked position, ejection is recommended.

LANDING WITH BLOWN TIRE.

The aircraft may be safely landed with a blown tire using normal landing procedures. Go-around after touchdown on a blown tire 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, land on the side of the runway away from the flat tire.

SINGLE-ENGINE LANDING PATTERN
(TYPICAL)
LANDING GROSS WEIGHT OF 9200 LB

Note

- INCREASE FINAL TURN, FINAL APPROACH, AND TOUCHDOWN SPEEDS 1 KNOT FOR EACH 100 POUNDS OF FUEL ABOVE 1000 POUNDS OF FUEL REMAINING.
- INCREASE FINAL APPROACH AND TOUCHDOWN SPEEDS BY HALF THE GUST FACTOR.

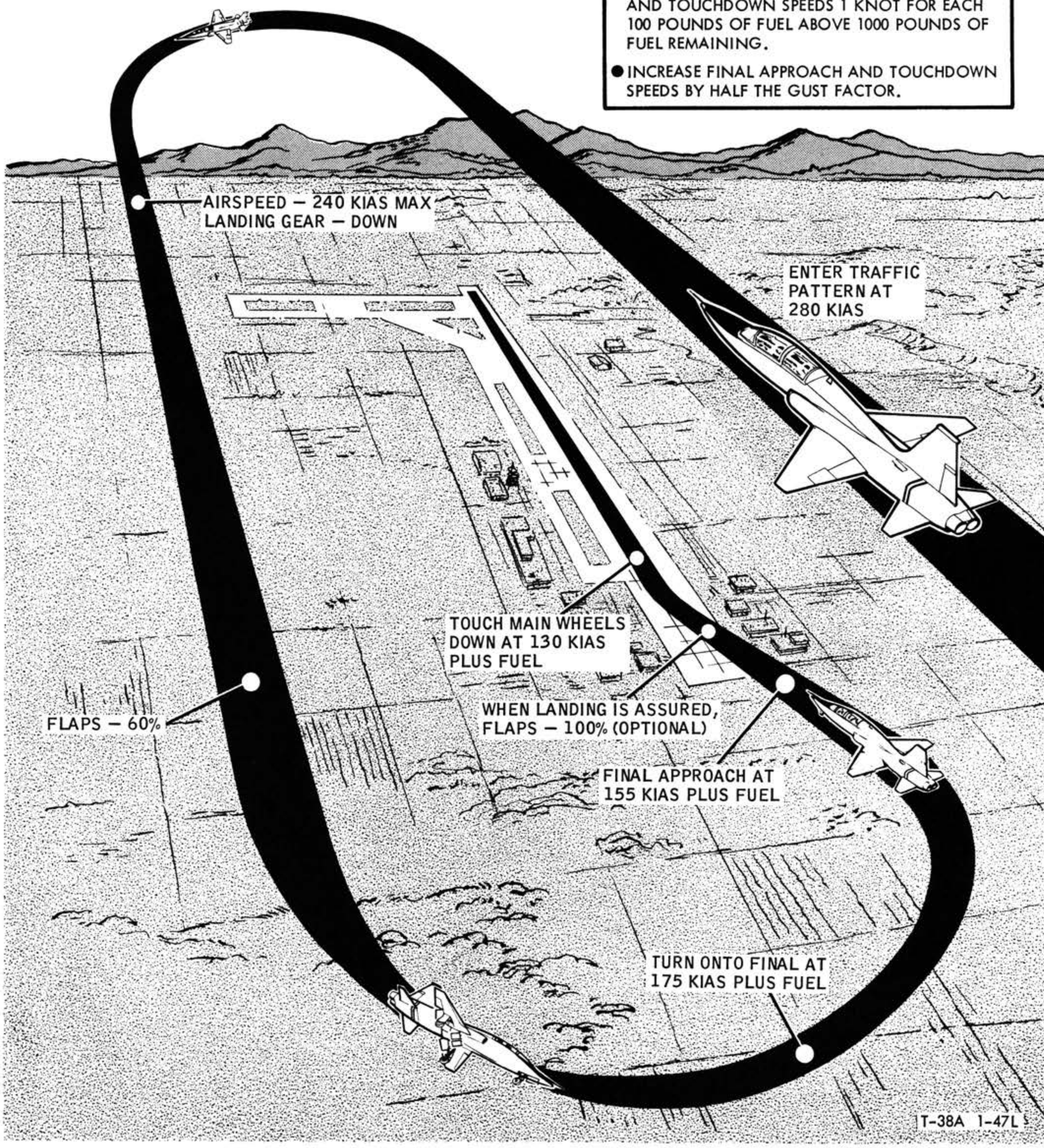


Figure 3-3.

DIRECTIONAL CONTROL DIFFICULTY.

In the event of a blown tire, locked brake, or similar directional control difficulty, make maximum use of rudder and brake. Nosewheel steering should be engaged only as a final attempt to maintain or regain directional control.

CAUTION

Assure that the rudder pedals are neutral prior to engaging nosewheel steering.

LANDING GEAR ALTERNATE EXTENSION.

If the normal landing gear extension procedure fails to extend the gear to a down and locked position, the cause of the malfunction should be investigated. If corrective action cannot be taken, the alternate landing gear system may be utilized to extend the gear without hydraulic pressure by using the following procedure:

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

If the landing gear cannot be lowered by the normal or alternate procedures the landing gear door selector valve may have failed. The landing gear will not lower due to the pressure in the utility hydraulic system. Dissipating this pressure will allow the gear uplocks to release and the gear to extend. To dissipate the hydraulic pressure and extend the landing gear proceed as follows:

1. Left Engine—Shut Down.
2. Control Stick—rapid lateral stick movements to deplete utility hydraulic pressure.
3. Landing Gear Lever—LG DOWN.
4. Landing Gear Alternate Release Handle—Pull, approximately 10 inches, while pressure is depleted, and hold until gear unlocks; then stow handle.
5. Landing Gear Lever—LG UP, then LG DOWN.
6. Gear Position—Check.
7. Left Engine—Restart (see ENGINE RESTART DURING FLIGHT).

Note

- If the main gear fails to extend fully, yawing the aircraft will 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.

CAUTION

- After lowering the landing gear with the alternate release handle, do not attempt to reset the switches by cycling the landing gear lever until the alternate release handle lanyard has been fully stowed.
- If the alternate gear extension system does not provide safe gear indication and utility hydraulic pressure is available, the landing gear system should be reset by recycling the landing gear lever to the LG UP position momentarily and returning it to the LG DOWN position to place utility hydraulic pressure on the down side of the landing gear system.
- If utility hydraulic pressure is not available. stop straight ahead on the runway and have the landing gear safety pins installed.
- Do not make practice landings after an alternate gear extension until the system has been recycled to provide pressure on the "down" side of the system.

SECONDARY MALFUNCTIONS

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.

FUEL VENTING OVERBOARD.

Under certain conditions of fuel vent malfunction during a climb, fuel may be lost overboard thru the vent on the vertical stabilizer. If fuel overboarding occurs during a climb, proceed as follows:

1. Aircraft—Level Immediately.
2. If Overboarding Continues—Enter a Shallow Dive.
3. If Overboarding Continues—Land As Soon As Practicable.

STABILITY AUGMENTER MALFUNCTION.

A stability augmenter yaw system failure at high airspeeds may cause an abrupt yaw followed by a moderate rudder roll. Correct with opposite aileron, reduce airspeed, and place stability augmenter yaw switch at

OFF. If the stability augmenter 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 stability augmenter switch. Note the discrepancy on Form 781 after termination of the flight. On Block 20 aircraft, if yaw or pitch oscillations are induced by the stability augmenter, the affected augmenter should be turned OFF.

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 warning system is indicated when remaining fuel supply is less than 275 to 225 pounds and the low-level light does not illuminate. Fuel quantity should be monitored closely and the aircraft landed as soon as possible when this condition exists.

DC ELECTRICAL SYSTEM ALTERNATE OPERATION.

TRANSFORMER-RECTIFIER FAILURE.

When the XFMR RECT OUT caution light illuminates, it indicates a possible failure of both transformer-rectifiers. To confirm transformer-rectifier failure, the battery switch should be cycled to OFF momentarily, then back to ON. If the MASTER CAUTION light and the XFMR RECT OUT light remains on, the transformer-rectifiers have failed. Use the following procedure:

1. Battery Switch—OFF momentarily, then ON.
2. If XFMR RECT OUT light remains on—Land as soon as practicable.

Note

Battery life is limited to approximately 17 minutes.

GENERATOR FAILURE.

If a generator caution light illuminates, attempt to reset generator by adjusting engine rpm of engine with failed generator to opposite side of shifting range and momentarily place generator switch to RESET and back to ON position one time.

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

1. AC Generator Switch—OFF.
2. Pilot will immediately terminate mission.
3. After landing, engine of affected generator will be shut down after clearing runway.

COMPLETE ELECTRICAL FAILURE.

With complete electrical failure, all warning systems, flight instruments, engine instruments (except engine tachometers), radio equipment, speed brake, flaps, normal landing gear lowering, landing gear indicators, nosewheel steering, fuel boost pumps, and engine ignition system are inoperative. Use the following procedures:

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

If AC generators fail to reset, proceed as follows:

2a. AC Generator Switches—OFF.

3. Descend—To below 15,000 (if above 15,000 feet).
   Without fuel boost pressure engine flameouts can occur as low as 15,000 feet.
4. 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).

LOW FUEL PRESSURE.

If a low fuel pressure caution light comes on, the appropriate fuel boost pump circuit breakers should be checked and a landing made as soon as conditions permit.

Note

Without fuel boost pressure, engine flameouts can occur as low as 15,000 feet.

AIRFRAME-MOUNTED GEARBOX FAILURE TO SHIFT.

A gearbox failure to shift is indicated when the generator caution light illuminates when accelerating or decelerating thru the shift range of 65% to 70% rpm. If the gearbox fails to shift, proceed as follows:

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

GEARBOX INOPERATIVE.

If the generator and hydraulic system caution lights for the same engine illuminate, land as soon as conditions permit.

EMERGENCY ENTRANCE

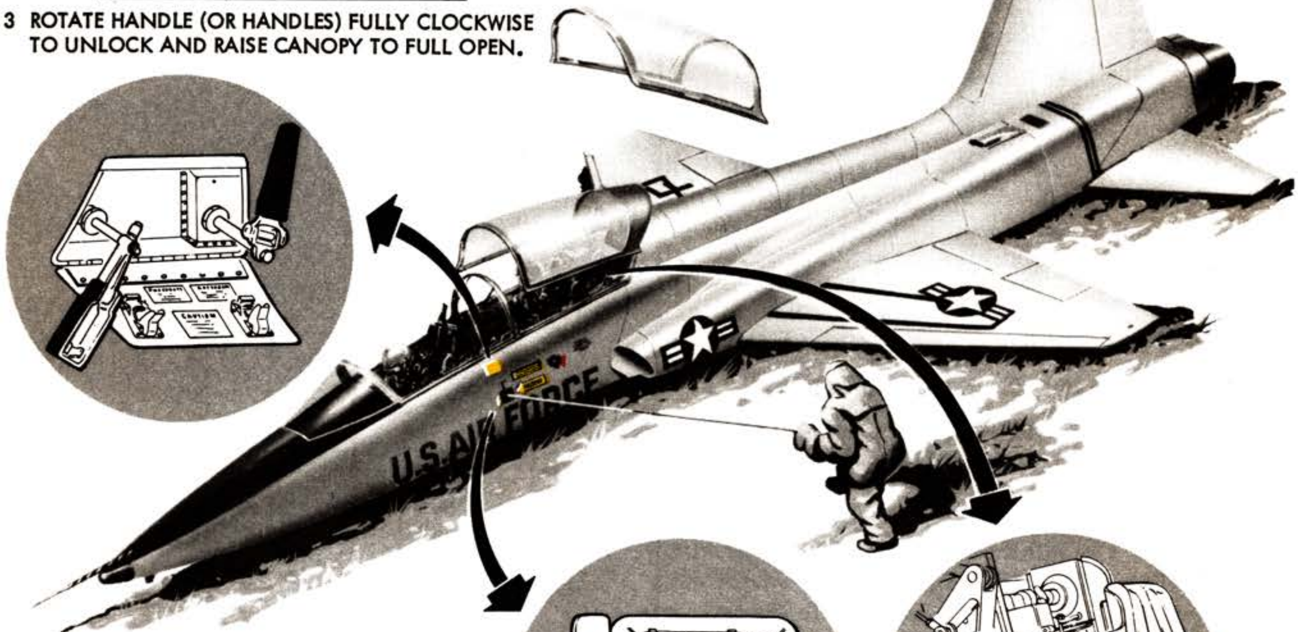
NORMAL ENTRANCE (LEFT SIDE OF FUSELAGE)

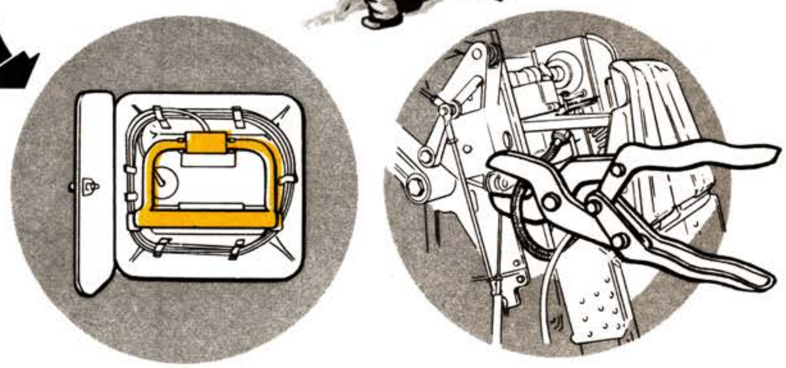
1 PUSH TWO LATCHES TO OPEN DOOR.
2 PULL HANDLE (OR HANDLES) OUT UNTIL ENGAGED.

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 PLEXIGLAS 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, 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 3-4.

AUXILIARY EQUIPMENT

SECTION IV

T-38A 1-103

TABLE OF CONTENTS

CABIN AIR-CONDITIONING AND PRESSURIZATION SYSTEM.

CABIN PRESSURE REGULATOR.

The aircraft may be equipped with either of two cabin pressure regulators. On some aircraft the cabin is not pressurized below 12,500 feet. From 12,500 feet to approximately 31,000 feet, the air pressure regulator maintains normal cabin pressure at 12,500 feet. Rapid changes in aircraft altitude can result in fluctuations of cabin pressure due to cabin pressure regulator response. Above approximately 31,000 feet, the regulator maintains 5.0 psi above ambient pressure. Later pressure regulators initiate pressurization at 8,000 feet, maintain 8,000-foot cabin pressure to approximately 23,000 feet, and maintain 5.0 psi above ambient at higher altitudes (see figure 4-2). 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.

CABIN AIR SWITCH AND CABIN TEMPERATURE CONTROL KNOB.

A guarded cabin air switch (figure 1-10) is loiated 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 air switch is placed at RAM DUMP, the anti-G suit, defog, cabin pressurization and air-conditioning systems, and canopy seal are deactivated, and ram air enters the cabin for ventilating purposes.

CABIN AIR TEMPERATURE SWITCH.

A cabin air temperature switch (figure 1-10) is located on the right subpanel of the front cockpit. The MAN HOT and MAN COLD positions provide for manual temperature control when the automatic temperature 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 1-10).

CABIN AIR-CONDITIONING AND PRESSURIZATION SYSTEM

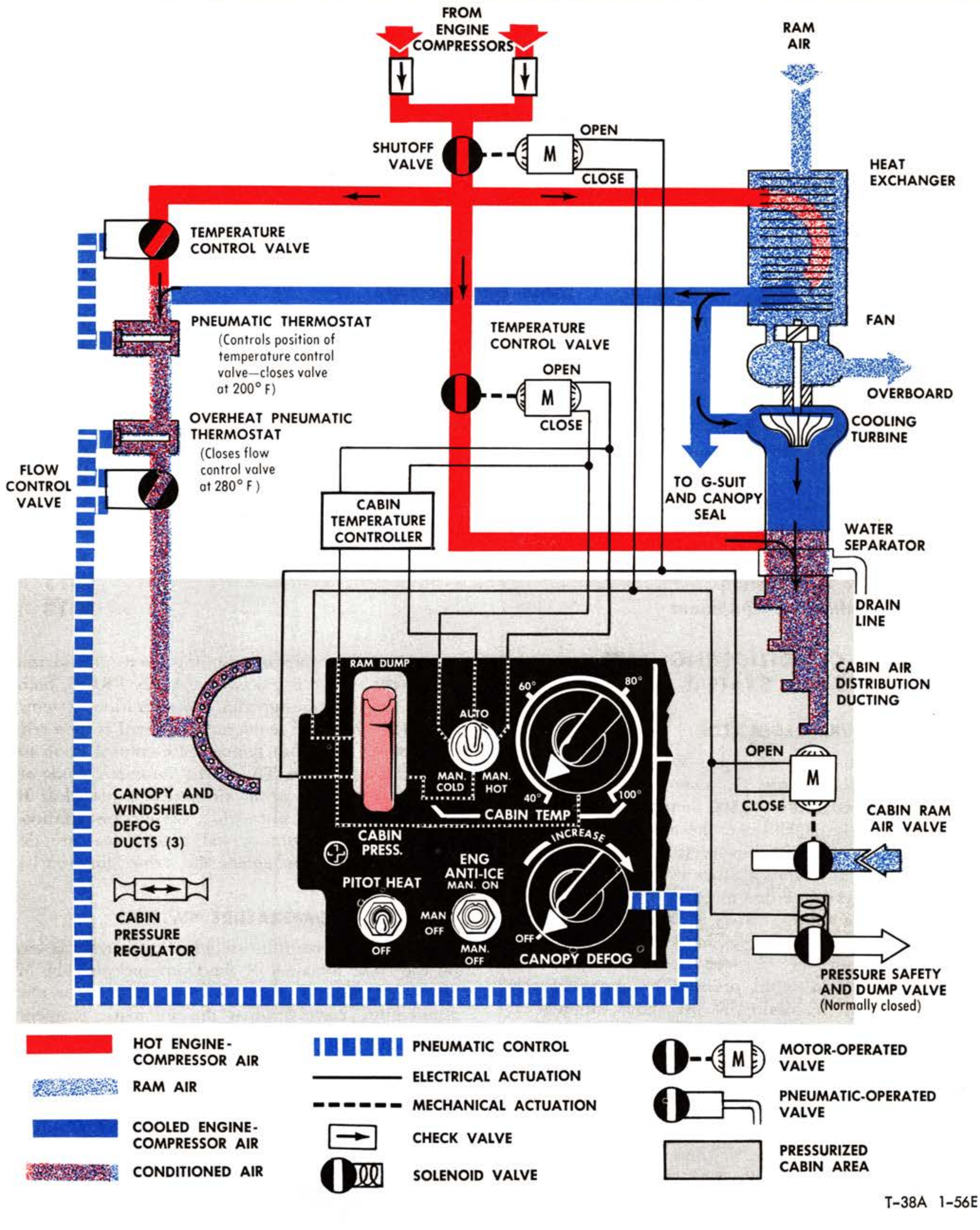

Figure 4-1.

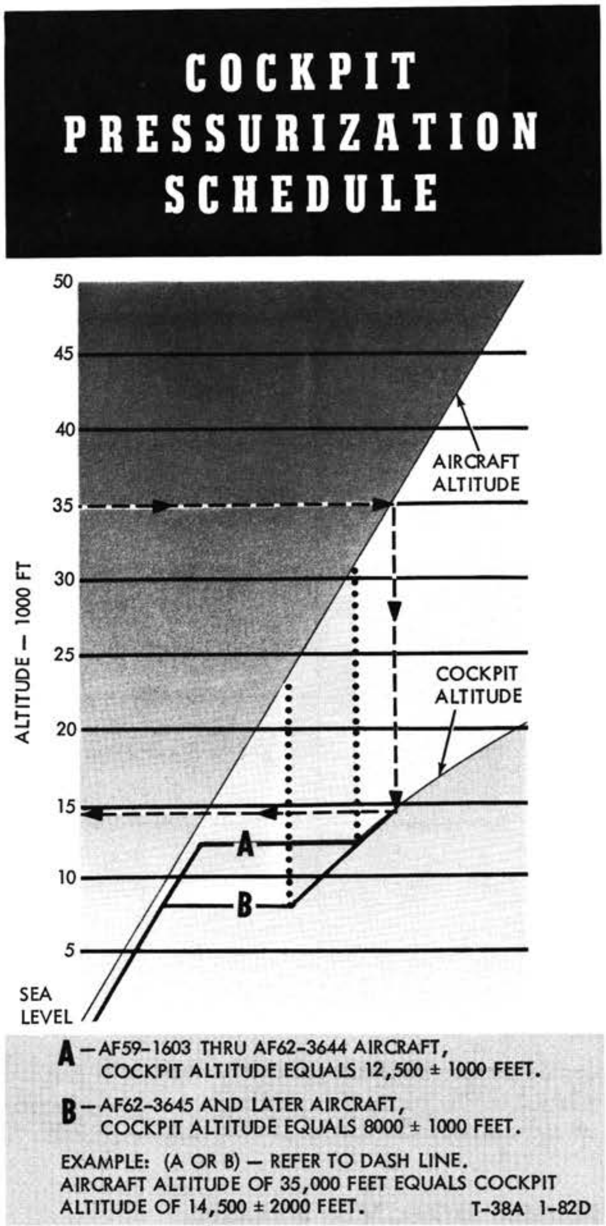

Figure 4-2.

ENGINE ANTI-ICE SYSTEM.

An engine anti-ice switch (figure 1-10) on the right subpanel of the front cockpit controls the engine anti-icing system. Placing the switch at MAN. ON ensures continuing anti-icing action and illuminates the ENG ANTI-ICE ON light in each cockpit. The MASTER CAUTION light also illuminates but may be extinguished (reset) by pressing the light. A 9% loss in MIL thrust and a 6.5% loss in MAX thrust can be expected during anti-icing action. There is no ice detection system in the aircraft. Engine anti-ice is provided by engine bleed air to the inlet guide vanes only. The engine anti-ice system fails to the ON position with a complete loss of ac electrical power.

PITOT BOOM ANTI-ICING.

The pitot boom is de-iced by an electrical heating system. The heater is controlled by a pitot heat switch (figure 4-1) on the right subpanel in the front cockpit.

COMMUNICATION AND NAVIGATION EQUIPMENT.

All communication and navigation equipment requires ac electrical power. (See figure 1-15.) See figure 4-3 and applicable T.O. for particular system.

UHF COMMAND RADIO SYSTEM AN/ARC-34.

The UHF command radio set provides voice or tone transmission and reception within the 225.0 to 399.9 megacycle range. Twenty operating frequencies can be preset in the radio prior to flight in addition to the 1750 frequencies which can be manually selected without disturbing any of the preset frequencies. An ARC-34 or ARC-34C radio control is located on the pedestal of each cockpit (figure 1-9). The two controls are similar with one exception, the ARC-34C has five manual frequency selector knobs. A restrainer prevents the use of the fifth digit selector knob. A four-position function control switch selects, OFF, MAIN, BOTH, and ADF (inactive). A three-position frequency control switch selects MANUAL, PRESET, and GUARD. MANUAL permits use of the manual frequency selector knobs. In PRESET, the channel selector knob selects any of the 20 preset frequencies. When GUARD is selected, the receiver operation is automatically switched from the main receiver to a guard receiver preset to 243.0 megacycles. The tone button provides continuous tone transmission to aid ground stations in obtaining a directional fix on the aircraft.

UHF ANTENNA SELECTOR SWITCH.

The aircraft is equipped with an upper and a lower UHF antenna. A UHF antenna selector switch is located on the left subpanel of the front cockpit (figure 1-10). Placing the switch at UPPER or LOWER permits reception and transmission thru the antenna manually selected. The switch is normally left at AUTO. In this position, a remote antenna selector selects and locks on to the antenna that will provide optimum reception.

COMMAND 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 (figure 1-10). The switches enable the front cockpit crewmember to transfer control of command radio and navigation equipment to either cockpit. The cockpit selected by the navigation transfer switch has control of the flight director system for both cockpits.

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-34	Air-to-air and air-to-ground communication.	Both crewmembers.	Line of sight.	Pedestal and left subpanel—both cockpits.
TACAN	AN/ARN-65	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	AN/APX-46	Automatic coded replies to ground interrogation for aircraft identification and air traffic control.	Front cockpit crewmember.	Line of sight.	Right console, front cockpit.
* IFF-SIF, AIMS	AN/APX-64	Automatic coded replies to ground interrogation for aircraft identification, altitude, and air traffic control.	Front cockpit crewmember.	Line of sight.	Right console, front cockpit

* Later and modified aircraft.

Figure 4-3.

T-38A 1-57F

COMMAND AND NAVIGATION OVERRIDE SWITCH (REAR COCKPIT).

A guarded command and navigation override switch (figure 1-11) 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 and navigation transfer switch positions.

INTERCOM PANEL.

An intercom panel (figures 1-10, 1-11) 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 4-4), a shutoff switch (figure 1-12), a navigation mode switch (figure 1-8), a steering mode switch (figure 1-8), a compass switch (figure 1-10), a directional gyro indicator light (figure 1-11), 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 fast erection switch for 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 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 except vertical flight. As the aircraft passes thru vertical flight (loop, Immelman, split-S), the attitude sphere and the compass card rotate 180 degrees. On AF65-10407 and later and aircraft modified by T.O. 1T-38A-754, a reverse rotation of the attitude sphere is eliminated. An accurate display of flight attitude is continuously provided.

FLIGHT DIRECTOR SYSTEM SHUTOFF SWITCH.

A guarded flight director system shutoff switch (figure 1-12) 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 controls power to the standby attitude indicator.

COMPASS SWITCH AND INDICATOR LIGHT.

A compass switch (figure 1-10) 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 1-11) on the left subpanel of the rear cockpit illuminates when the compass switch is placed at DIRECT GYRO.

FAST ERECTION SWITCH (ADI GYRO).

A vertical gyro fast erection switch (figure 1-10) is located on the left subpanel in the front cockpit. Pressing the pushbutton switch erects the vertical gyro at a minimum rate of 15 degrees/minute.

Note

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

HORIZONTAL SITUATION INDICATOR (HSI).

An HSI (figure 4-4) 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, it 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, 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.

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 if 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 4-4) 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° of pitch, lines each 10° of pitch, and numbered lines each 30° 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° increments up to 30° and in 30° increments up to 90° 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 will appear whenever electrical power to the system has failed or is interrupted. The flag will also appear during the 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

FLIGHT DIRECTOR SYSTEM DISPLAY

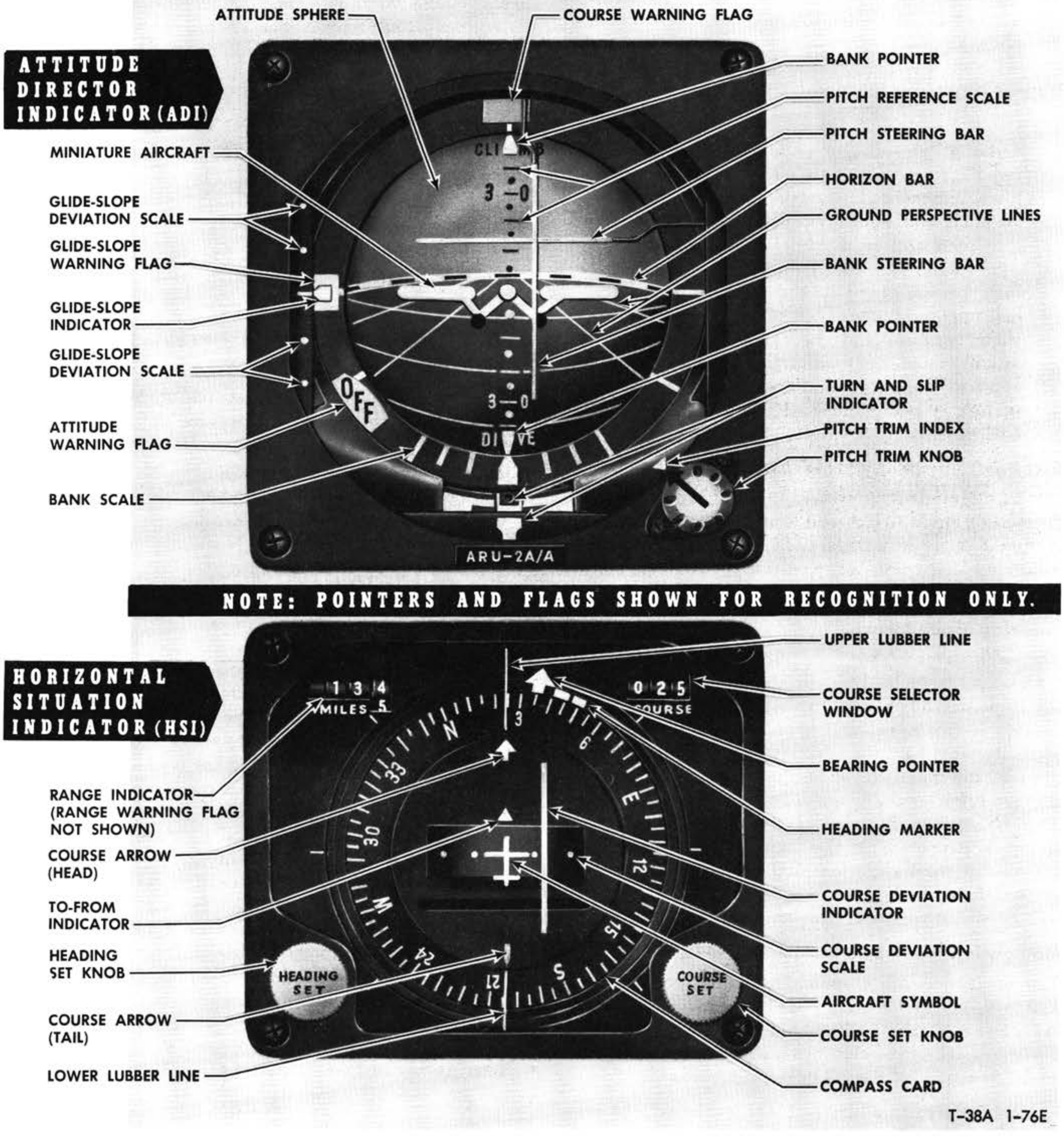

Figure 4-4.

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 1-8) 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 (LOC), 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.

LOC Selected. When LOC 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 LOC, except that the bank required to center the bank steering bar is reduced from a maximum of 35° to 15° and 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 SYSTEM OPERATION SUMMARY.

1. With the steering mode switch at MANUAL, the maximum bank required to center the bank steering bar is 35°.

2. Situation: Steering Mode Switch—NORMAL. Navigation Mode Switch—TACAN. No steering bars are in view. All radio information presented on the HSI is relative to the TACAN station.

3. Situation: Steering Mode Switch—NORMAL. Navigation Mode Switch—LOC. Course arrow and course window must be set to published localizer front course. The course deviation indicator shows aircraft position relative to the localizer course. This information is directional regardless of a front or back course approach providing the published front course heading is set under the course arrow and in the course set window. The bank steering bar is in view and when the aircraft is flown in such a manner as to keep the steering bar centered, the aircraft will roll in, turn to intercept the localizer course at a 45° angle and, when the course is approached, continue to turn until the aircraft is positioned on the localizer course. The bank steering bar may only be used for a front course approach and will not function for a back course approach. The bank steering bar will always direct an interception of the localizer to fly in the direction of the front course approach heading, but may intercept the front or back course depending on aircraft position. The maximum bank required to center the bank steering bar in LOC—NORMAL is 35°.

Note

The flight director will direct up to a 45-degree angle of intercept to the localizer course without regard to the location of the outer marker. Therefore, the pilot is responsible for properly positioning the aircraft by use of other navigation aids or radar before following the bank steering bar commands to the localizer course.

4. Situation: Steering Mode Switch—NORMAL. Navigation Mode Switch—ILS. As in LOC operation, the course arrow and course window must be set on the published localizer front course. The CDI and GSI provide the same information as in LOC. Bank angle to center the bank steering bar in this mode is reduced to 15°. The pitch steering bar is in view and, if centered, functions in the same manner as the bank steering bar, except relative to the glide slope. The ILS function should only be used when intercepting the localizer approach course at no greater than 15° either side of centerline and when the aircraft is positioned near the centerline of the localizer (CDI indicating on scale).

5. The navigation mode switch must be in LOC or ILS in order to obtain localizer and glide-slope information on the CDI and GSI. The course and glide-slope warning flags function to give warning only in LOC and ILS and are out of view in TACAN.

6. In both LOC and ILS positions, TACAN bearing (as indicated by the bearing pointer) and TACAN range are available.

Note

Gyro erection time for both the ADI and HSI is 90 seconds. The system should be reliable for flight after the 90-second erection period. However, the gyros do not reach full speed until 13 to 15 minutes after ac power is applied. Some precession can be expected during the gyro acceleration period or following "over the top" aerobatic maneuvers. Normally, precession, under these circumstances, will not exceed 4 degrees in pitch, bank or heading.

TACAN.

Channel Selector Switch.

Any desired operating TACAN channel from 01 to 126 may be selected by actuating the channel selector switch located on the pedestal in the cockpit selected by the position of the navigation transfer switch.

Function Switch.

A TACAN function switch on each pedestal has positions marked T/R, REC, and OFF. When the switch is placed at T/R, the set is energized to receive both bearing and distance signals. With the switch at REC, only bearing data is received.

Note

Actuating the TACAN function switch in either cockpit energizes the TACAN equipment, regardless of the position of the navigation transfer switch.

WARNING

- It is possible for TACAN equipment to malfunction and lock on to a false bearing. The error will probably be plus or minus 40°, but can be any value which is a multiple of 40°. If false lock-on is suspected, switching to another channel and then back to the desired channel may correct the situation.
- TACAN bearing accuracy should be verified by cross-checking against radar position whenever radar monitor is available. This is especially advisable during departure or recovery in instrument conditions.

ILS.

Refer to figure 4-3 for the ILS equipment provided in the aircraft.

Note

If unable to receive ILS, move frequency selector knob to another frequency, then return to desired frequency.

IFF/SIF.

Refer to figure 4-3 for the IFF/SIF equipment provided in the aircraft. AF65-10364 thru AF66-4389, AF66-8349 thru AF66-8404, and AF67-14825 thru AF67-14838 aircraft are equipped with a modified AN/APX-64 IFF/SIF system. The control panel on the right console in the front cockpit is the same as used with the AIMS. Mode 4, M-C/OUT switch, RAD TEST/OUT/MON switch and all TEST functions are inoperative.

AIMS.

On AF67-14839 and later aircraft, the AIMS (AN/APX-64) provides the functions of IFF/SIF, including altitude reporting. The control panel (figure 1-12) on the right console in the front cockpit provides selection of the modes and codes of operation. The master control knob has five positions: OFF, STDBY, LOW, NORM, and EMER. In the STBY position, the system is inoperative but ready for immediate 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 position, the system operates at full sensitivity which provides maximum performance. In the EMER position, a special coded transmitted signal indicates an emergency. To select the emergency position, the dial must be pulled out and rotated to EMER. Four mode switches marked M-1, M-2, M-3/A, and M-C are used to select the modes of operation. Each switch TEST position is spring-loaded to the ON position. Modes M-1 and M-2 are assigned for use as directed locally. Selections for MODE 1 discrete coded identification are obtained by setting the two MODE 1 wheels just below the four mode selector switches. Mode M-3/A is used for common air traffic control and has the capability of 4096 code selections for discrete coded identification by use of the four Mode 3/A wheels just below the four mode selector switches. Mode M-C is used to automatically report altitudes in increments of 100 feet up to 80,000 feet. System interrogations are controlled by a switch marked RAD TEST/OUT/MON. In the RAD TEST position, spring-loaded to the OUT position, the selected mode can be self-interrogated. In the MON position, the system will monitor replies to external interrogations. The switch marked IDENT/OUT/MIC provides control of selected codes transmitted. In the IDENT position, signals are transmitted continuously. The transmission of signals will continue for 15 to 30 seconds after the switch is released (spring-loaded to the OUT position). In the MIC position, signals are transmitted when either front or rear cockpit microphone button is depressed. Mode 4 is not applicable to the T-38A aircraft; all switches and dials are inoperative.

COUNTER-DRUM-POINTER ALTIMETER.

A servo/pneumatic type AAU-19/A altimeter (figure 4-5) in each cockpit consists of a precision pressure altimeter combined with a motor and controlled by the altitude computer. The altimeter provides a continuous display of corrected altitude information as transmitted from the computer. In case of power interruption or system failure, the word STANDBY will appear in the upper left portion of the instrument face, indicating that the altimeter has automatically reverted to standby operation (barometric altimeter) and uncorrected altitude is displayed.

STANDBY ATTITUDE INDICATOR.

A standby attitude indicator (figure 1-8) 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 separated 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. Hori-

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

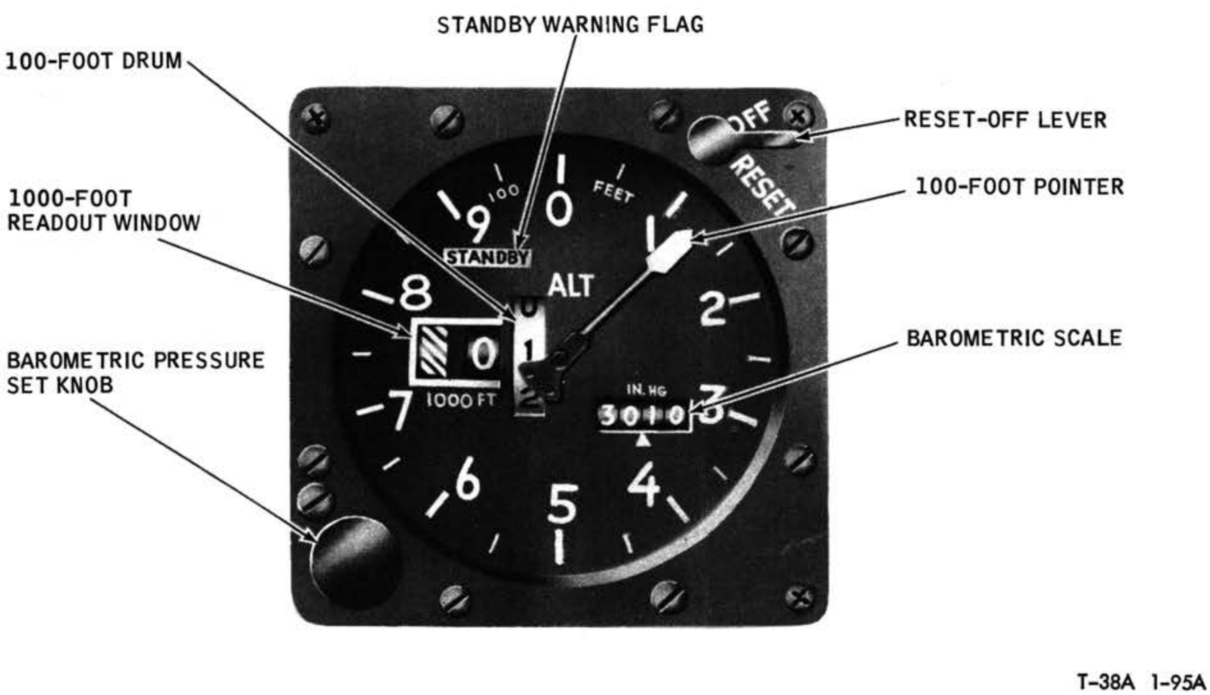

Figure 4-5.

zontal 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. In the lower left corner of the instrument, the word "OFF" appears whenever the instrument is not operating.

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 1-12) on the right console of the front cockpit.

Position Lights and Switch.

The position lights, operating on 28-volt ac, are individually located in each wingtip, in the vertical stabilizer, and in the lower fuselage. The position lights are controlled by a switch (figure 1-12) on the right console of the front cockpit. On AF65-10356 and later and aircraft modified by 1T-38A-749, the position lights operate on 6-volt ac.

Formation Lights and Switch.

Formation lights, operating on 28-volt ac, are individually located on each side of the forward nose section. Formation lights are controlled by a switch (figure 1-12) on the right console of the front cockpit. On AF65-10356 and later and aircraft modified by 1T-38A-749, the formation lights operate on dc bus power.

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 1-10) 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, 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 1-12, 1-13) 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 1-12, 1-13) on the right console of each cockpit. The two floodlights over each cockpit instrument panel (figure 1-8) 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 1-12, 1-13) on each right console.

UTILITY LIGHTS.

The two utility lights, one in each cockpit, operate on ac power.

OXYGEN SYSTEM.

The aircraft uses a liquid oxygen system to supply breathing oxygen to crewmembers. The oxygen regulators (Type CRU-48/A, automatic diluter demand) control the flow and pressure of the oxygen and distribute it in the proper proportions to the masks. An oxygen regulator (figure 1-12) on the right console of each cockpit contains a pressure gage, a blinker type flow indicator, emergency flow lever, 100% oxygen lever, and a supply lever.

OXYGEN QUANTITY INDICATOR.

An oxygen quantity indicator, operating on ac and located on the right subpanel of each cockpit (figures 1-10, 1-11), 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 (figure 1-12) on the right console of each cockpit illuminates when 1 liter or less of liquid oxygen remains in the oxygen converter. 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 and should agree with the opposite cockpit pressure gage.

R—REGULATOR.

Check regulator supply ON. Perform a blowback check on the regulator hose for 5 seconds on both the NORMAL and 100% OXYGEN positions. Little or no resistance to blowing indicates a leaking regulator diaphragm, faulty check valve in diluter air inlet, or a leak between regulator and quick-disconnect. Hook up mask and perform a pressure check. Place the emergency lever to the EMERGENCY position, take a deep breath and hold it. If mask leakage occurs, readjust mask and reaccomplish the check. The oxygen should stop flowing. If the mask appears to be properly fitted, but the oxygen continues flowing, the valve

OXYGEN DURATION HOURS TABLE

CREWMEMBER DURATION IN HOURS

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

is not holding pressure and should be replaced. Return the emergency lever to NORMAL. If you cannot exhale, the valve is obstructed, defective, or improperly seated and should be corrected or replaced.

I—INDICATOR.

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

C—CONNECTIONS.

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

E—EMERGENCY.

Check bailout bottle 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.

Note

Do not route the anti-G suit hose under the seat belt or in any other manner which would interfere with disconnecting the hose if required.

ANTI-G SUIT TEST BUTTON.

An anti-G suit press-to-test button in the top of each regulator (figures 1-12, 1-13) 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.

OPERATING LIMITATIONS

SECTION V

T-38A 1-104

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INTRODUCTION.

Cognizance must be taken of instrument markings, 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 are to 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 670°C, 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 indicated:

0 to 45%	300 KIAS
45% to 60%	240 KIAS
Over 60%	220 KIAS

LANDING GEAR.

Do not exceed 240 KIAS with the landing gear and/or landing gear doors extended. On AF65-10364 thru AF65-10475, AF66-4320 thru AF66-4345, and AF66-8359 aircraft, do not exceed 490 KIAS below 8000 feet pressure altitude. When the above aircraft are modified by T.O. 1T-38A-783, the limitation will no longer apply.

CAUTION

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

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.

In clean configuration, with speed brake closed or open, do not exceed the following (see figure 5-3):

SYMMETRICAL FLIGHT.

Load Factor (G's)	*Weight of Fuel Remaining (Pounds)*
−2.4 to +6.0	Fully fueled
−2.6 to +6.4	2900
−3.0 to +7.33	1600 or less

INSTRUMENT MARKINGS

BASED ON FUEL GRADE JP-4

EXHAUST GAS TEMPERATURE

- 150°C MINIMUM
- 150°C TO 670°C CONTINUOUS OPERATION
- 685°C MAXIMUM STEADY STATE
- 980°C MAXIMUM DURING START OR ACCELERATION, MOMENTARY

(670°C TO 685°C — MIL AND MAX THRUST RANGE)

OIL PRESSURE

- 5 PSI MINIMUM (IDLE)
- 20 TO 50 PSI NORMAL OPERATING RANGE
- 55 PSI MAXIMUM

ENGINE TACHOMETER

- 83% TO 98.5% RPM CONTINUOUS
- 104% RPM MIL AND MAX THRUST

(99% TO 104% RPM — MIL AND MAX THRUST RANGE)

OXYGEN PRESSURE

- 50 TO 120 PSI NORMAL RANGE

HYDRAULIC PRESSURE

- 1500 PSI MINIMUM
- 2500 TO 3050 PSI NORMAL RANGE
- 3150 PSI MAXIMUM

ACCELEROMETER

- −2.4 G'S FULLY FUELED
- +6.0 G'S FULLY FUELED
- +7.33 G'S FOR 1600 POUNDS OR LESS OF FUEL REMAINING

AIRSPEED-MACH NO. INDICATOR

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	980 (MAX) ✱890	---	---	360 (MAX)	INDICATION	---
IDLE	---	46.5-49.5	77-90	400-600 (STD DAY)	5-20	---
MILITARY	670-685	99-101	0-20	---	20-55	30
(MAX) AFTERBURNER	670-685	99-101	50-85	---	20-55	5
FLIGHT STEADY STATE						
START	980 (MAX) ✱890	---	---	360 (MAX)	INDICATION	---
IDLE	150 (MIN)	---	---	200 (MIN) (STD DAY)	5-20	---
MILITARY	670-685	99-104	0-20	---	20-55	30
(MAX) AFTERBURNER	670-685	99-104	50-85	---	20-55	15
FLUCTUATION LIMITS						
IDLE (GROUND)	±15	46.5-49.5	NONE ALLOWED	±25	±2	---
GROUND AND FLIGHT MILITARY AND AB	670-685	± 1% WITHIN STEADY STATE LIMITS	± 3	±50	±2	---

OTHER LIMITATIONS

EGT:

✱ 1. ABORT START IF **EGT** REACHES **890°C** TO PRECLUDE EXCEEDING TEMPERATURE LIMITS.
2. ABORT AIRCRAFT DURING GROUND START IF **EGT** EXCEEDS **980°C** MOMENTARILY, OR IF THE **HOT FLAG** APPEARS.
3. AT LOW AMBIENT TEMPERATURES, MILITARY AND AFTERBURNER **EGT** AND **RPM** MAY BE BELOW NORMAL OPERATING LIMITS. (SEE SECTION VII.)
4. AN **EGT** VARIATION FROM **665°** TO **690°C** FOR STEADY-STATE **MIL** AND **MAX AB EGT** IS PERMISSIBLE. (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.

OIL PRESSURE:

1. DURING COLD WEATHER STARTS, OIL PRESSURE USUALLY EXCEEDS 55 PSI. TO EXPEDITE OIL WARMUP, ENGINE MAY BE OPERATED AT MILITARY POWER OR BELOW. IF OIL PRESSURE DOES NOT RETURN TO NORMAL 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 PRESSURE MALFUNCTION PROCEDURES IN SECTION III.

T-38A 1-93H

Figure 5-2.

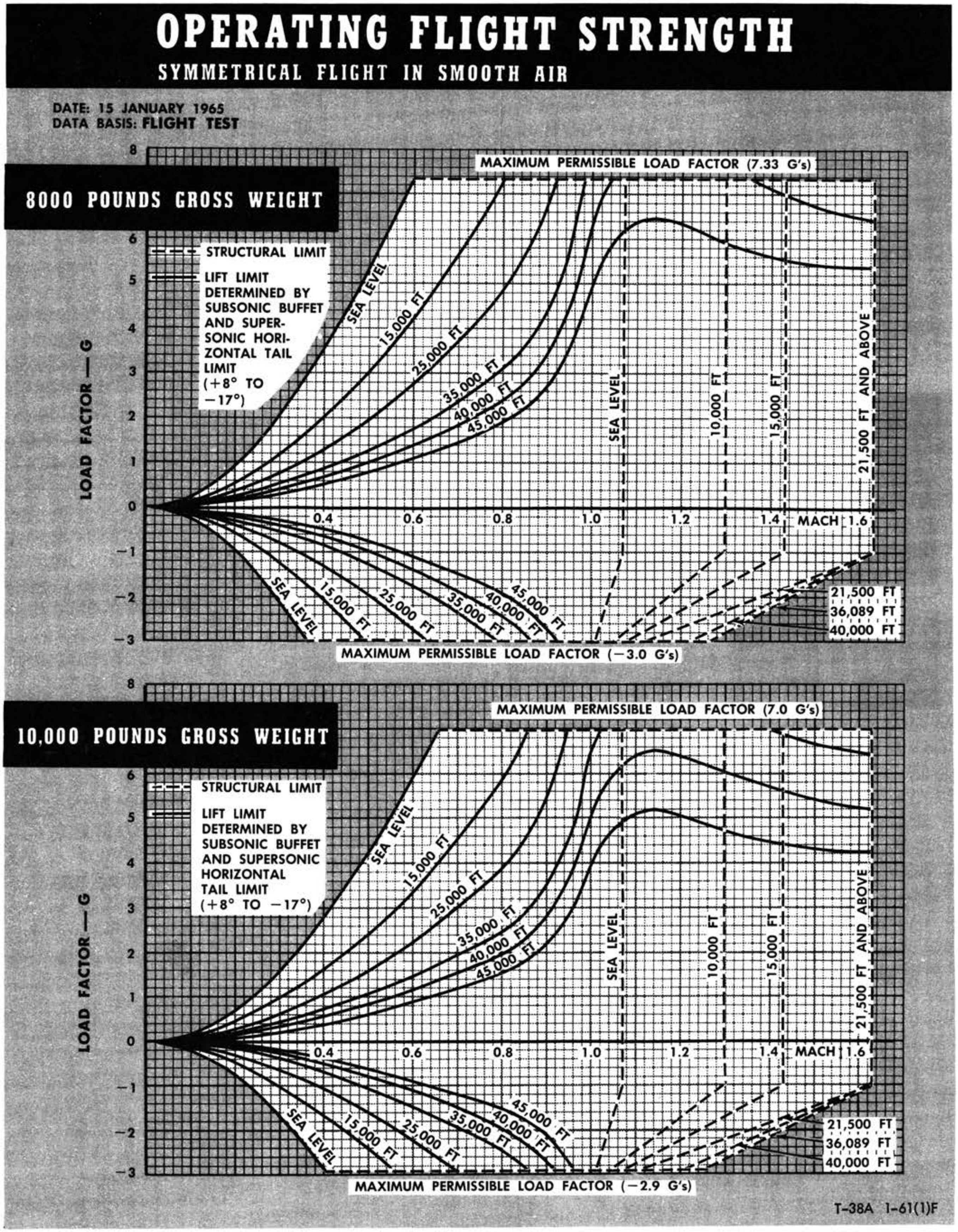

Figure 5-3. (Sheet 1 of 2)

ASYMMETRICAL FLIGHT.

Load Factor (G's)	*Weight of Fuel Remaining (Pounds)*
−0 to +4.4	Fully fueled
−0 to +4.7	2900
−0 to +5.2	1600 or less

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.

OPERATING FLIGHT STRENGTH
(Continued)

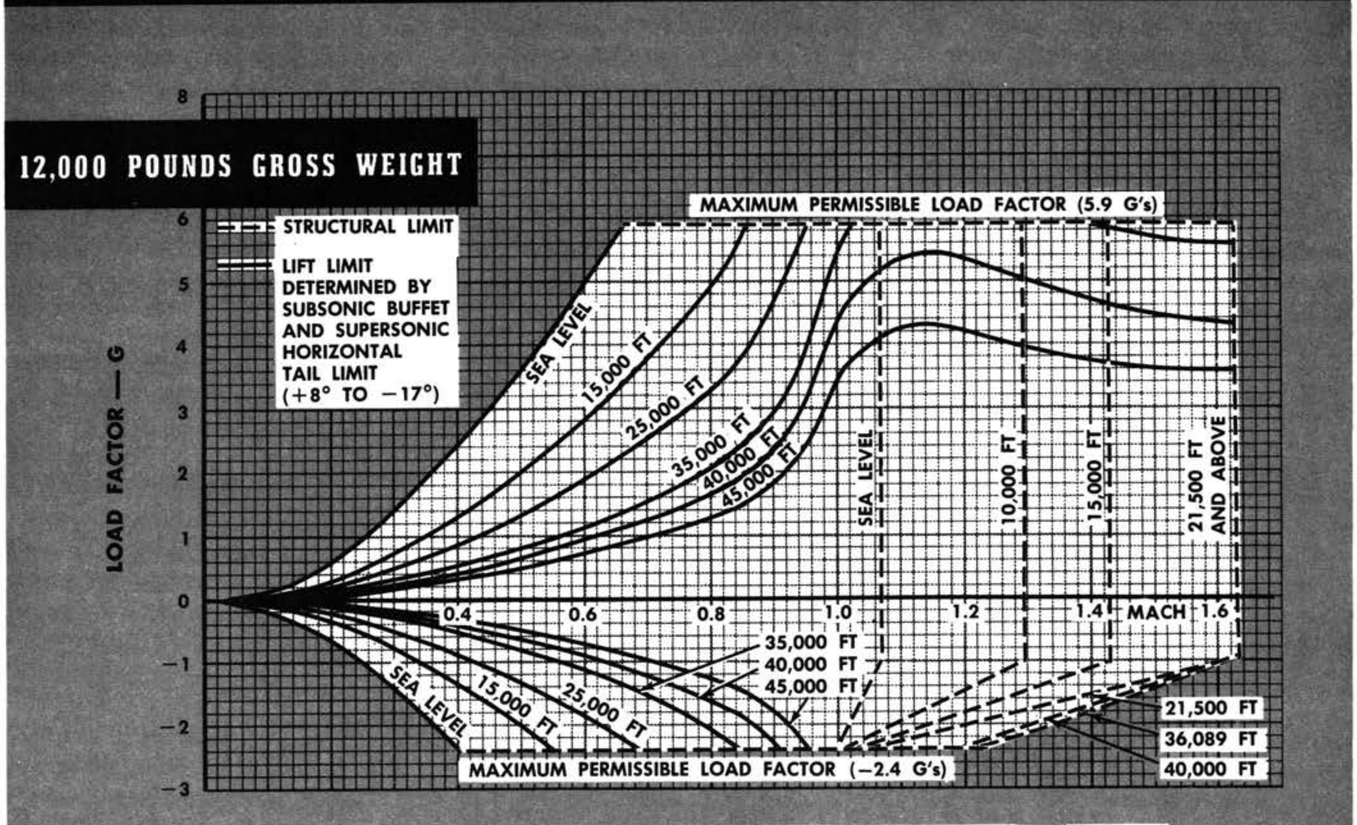

Figure 5-3. (Sheet 2 of 2)

MISCELLANEOUS LIMITATIONS.

FUEL SYSTEM.

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

1. Maximum thrust dives with less than 650 pounds of fuel in each fuel supply system.
2. Maximum thrust flight inverted or at negative load factors exceeding 10 seconds at 10,000 feet or 30 seconds at 30,000 feet.

Note

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

With less than 650 pounds of fuel in each supply system, maximum thrust flight at negative load factors should be avoided since time for successful engine operation is further reduced.

Note

Prolonged 0-G maneuvers are prohibited.

ENGINE OIL SYSTEM.

Due to engine oil supply and pressure requirements, zero-G, negative-G and inverted flight conditions are restricted to 10 seconds at zero-G and 60 seconds at negative-G or inverted flight. 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.

ENGINE OIL PRESSURE.

Abnormal engine oil pressure indications frequently are an early indication of some engine trouble. The engine oil pressure indicator is marked for normal operating conditions on the ground or in the air. Military power setting may cause an indication as high as 55 psi, which is within operating limits. This reading is acceptable provided it returns to within the 20 to 50-psi range after engine oil has warmed and has had sufficient time to circulate.

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:

500 feet per minute normal landing fully fueled and crab landing at any weight.

600 feet per minute normal landing with less than 2900 pounds of 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 subsonic flight or landings.

PITCH STABILITY AUGMENTER (BLOCK 20 AIRCRAFT).

Engage the pitch stability augmenter during flight only under the following conditions:

1. Airspeed 400 KIAS or less.
2. Load Factor 1.0 G.
3. Altitude 5000 feet AGL or more.

FLIGHT CHARACTERISTICS

SECTION VI

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STALLS.

The stall is not accompanied by any abrupt aircraft motion. The stall condition is preceded by heavy low speed buffet and moderate wing roll. Complete lateral control is available to well below stall speed. The actual stall is accompanied by a very high sink rate. Low speed buffet is most severe with full flaps extended.

STALL RECOVERIES.

Low altitude stalls can be terminated by addition of power and a decrease in back stick pressure. It is not necessary to allow the nose to pitch down.

SUBSONIC ACCELERATED STALLS.

Accelerated stalls are similar to 1-G stalls.

SPINS.

The aircraft exhibits a high degree of resistance to spin entry. However, the aircraft can be forced into an erect or an inverted spin. The area of possible entry is shown in figure 6-1. Avoid abrupt full aft stick movement, or a spin entry may result. Entry will occur without use of rudder.

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 anti-spin control is the aileron, and it is imperative that full aileron deflection be held during recovery.

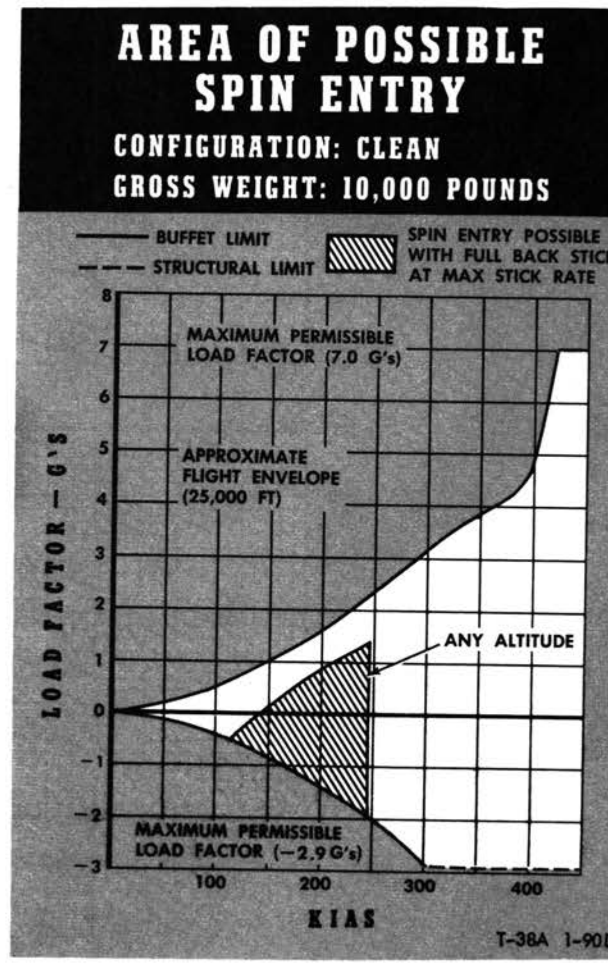


Figure 6-1.

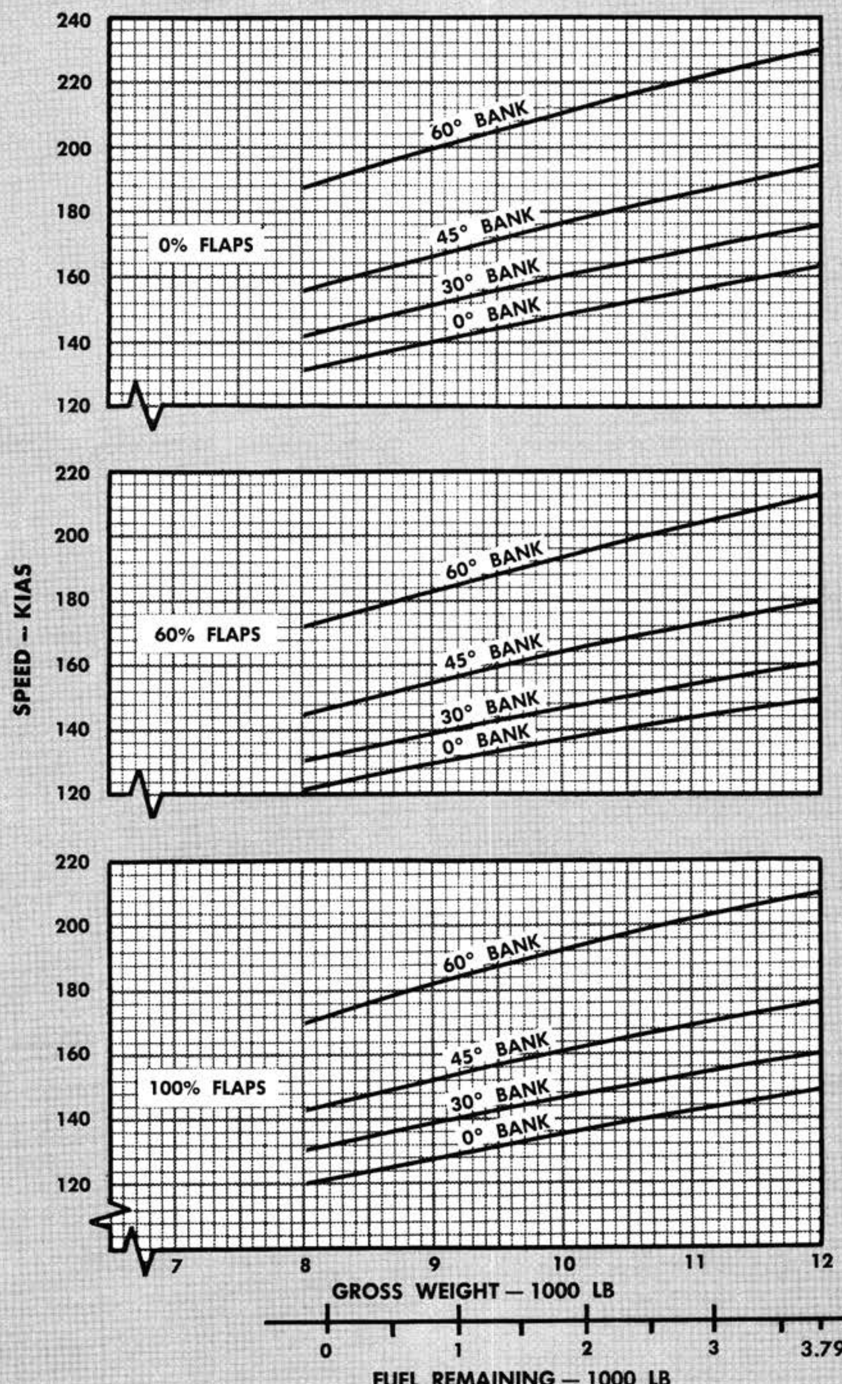
STALL SPEED CHART

POWER—OFF (IDLE THRUST)

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

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 1-62G

Figure 6-2.

WARNING

If full aileron deflection in the direction of the spin is not maintained throughout the recovery, the 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 15,000 feet above the terrain, or if transverse G-loads preclude maintaining anti-spin controls, whichever occurs first.

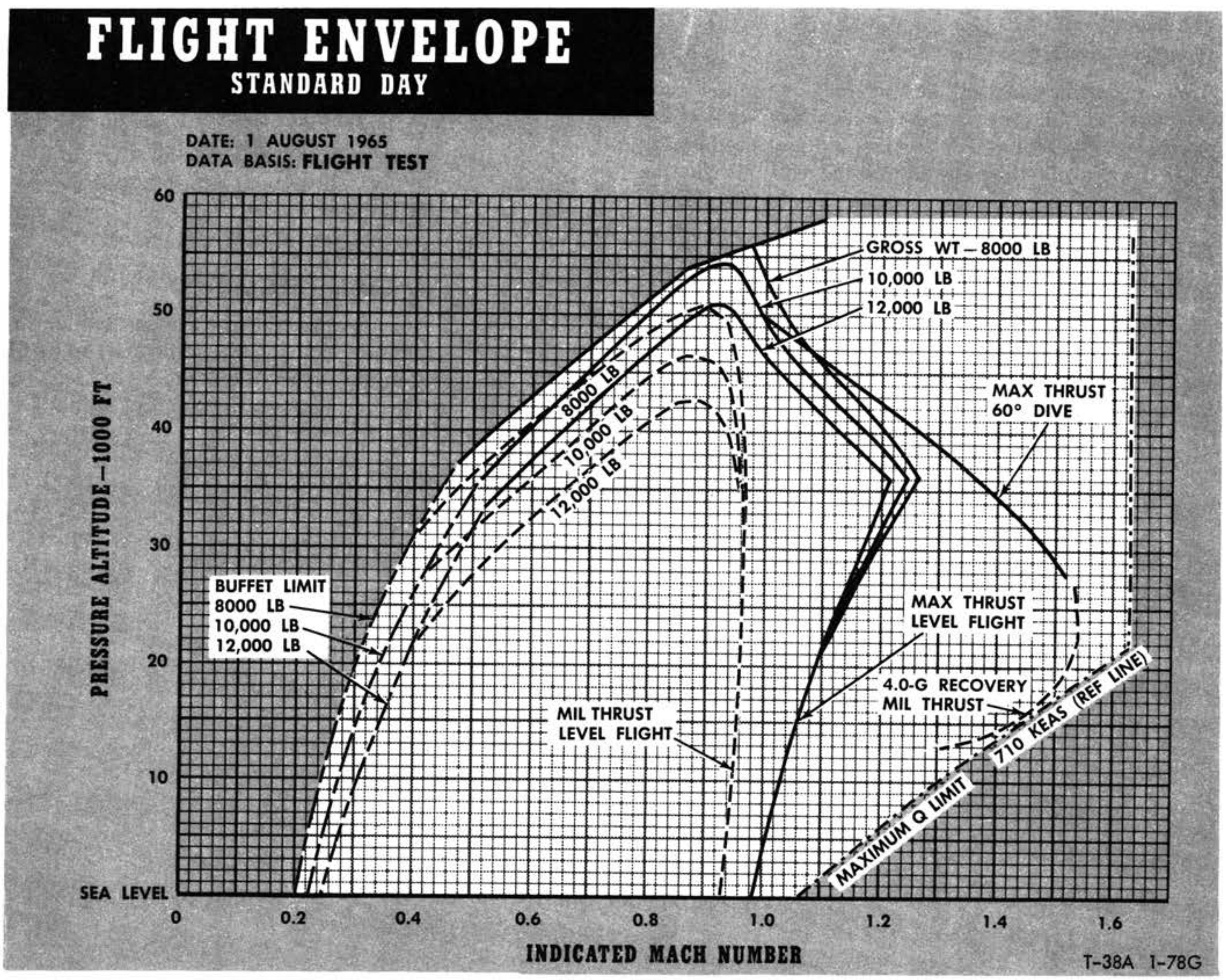


Figure 6-3.

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 bobweight to increase stick forces under G-loads. Since the pilot does not feel the effect of the bobweight 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.

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. If severe pitch oscillations are encountered in flight, proceed as follows:

1. Control Stick—Release Immediately.
2. If Absolutely Unable To Release Stick—Attempt to apply and rigidly hold back-pressure on stick.

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.

HIGH SPEED DIVE RECOVERY.

To recover from a high speed dive when altitude loss is not critical, simultaneously reduce throttles to IDLE, open the speed brake, level the wings, and pull out with sufficient G-forces for a safe recovery.

HIGH MACH 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.

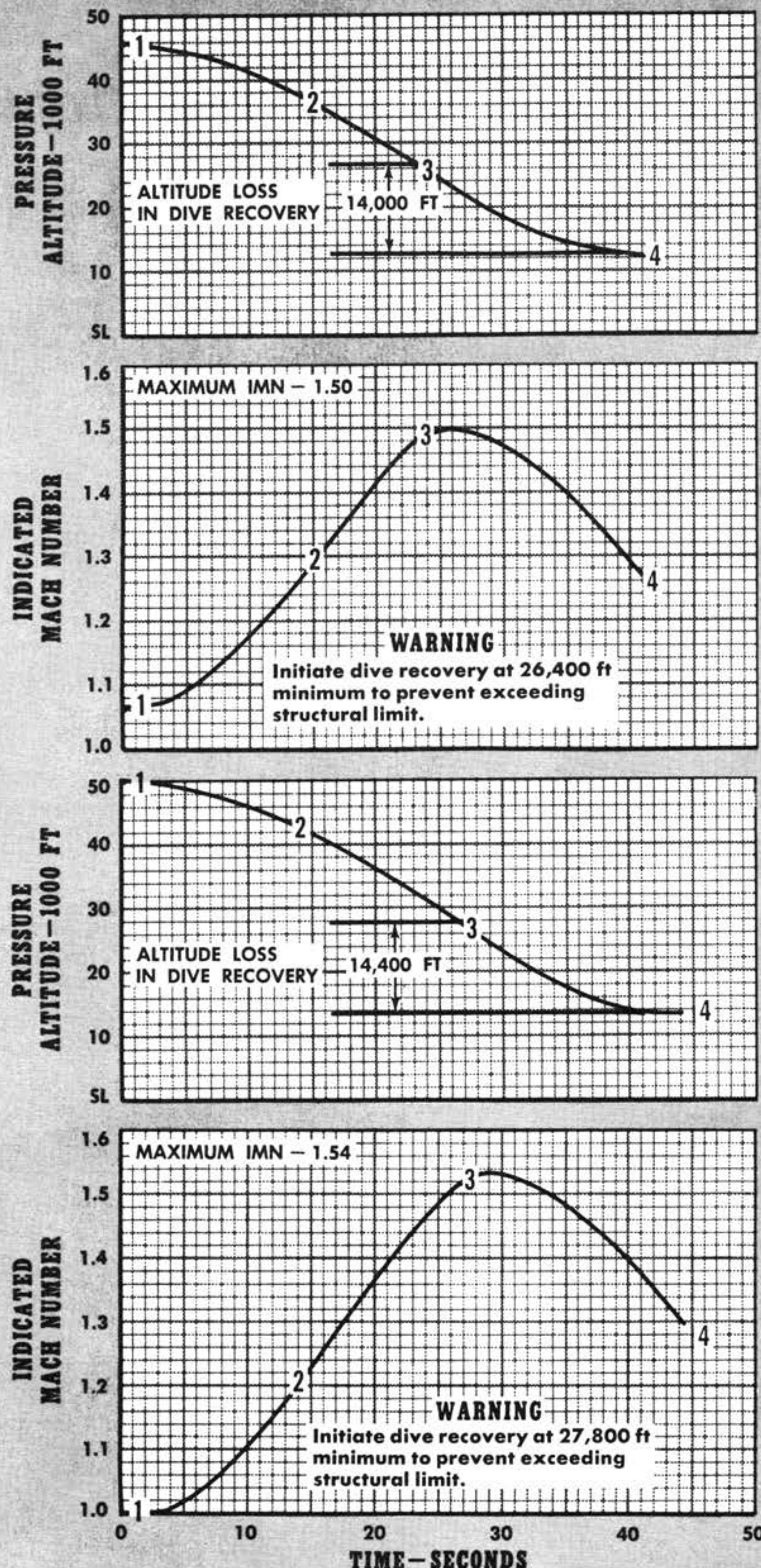


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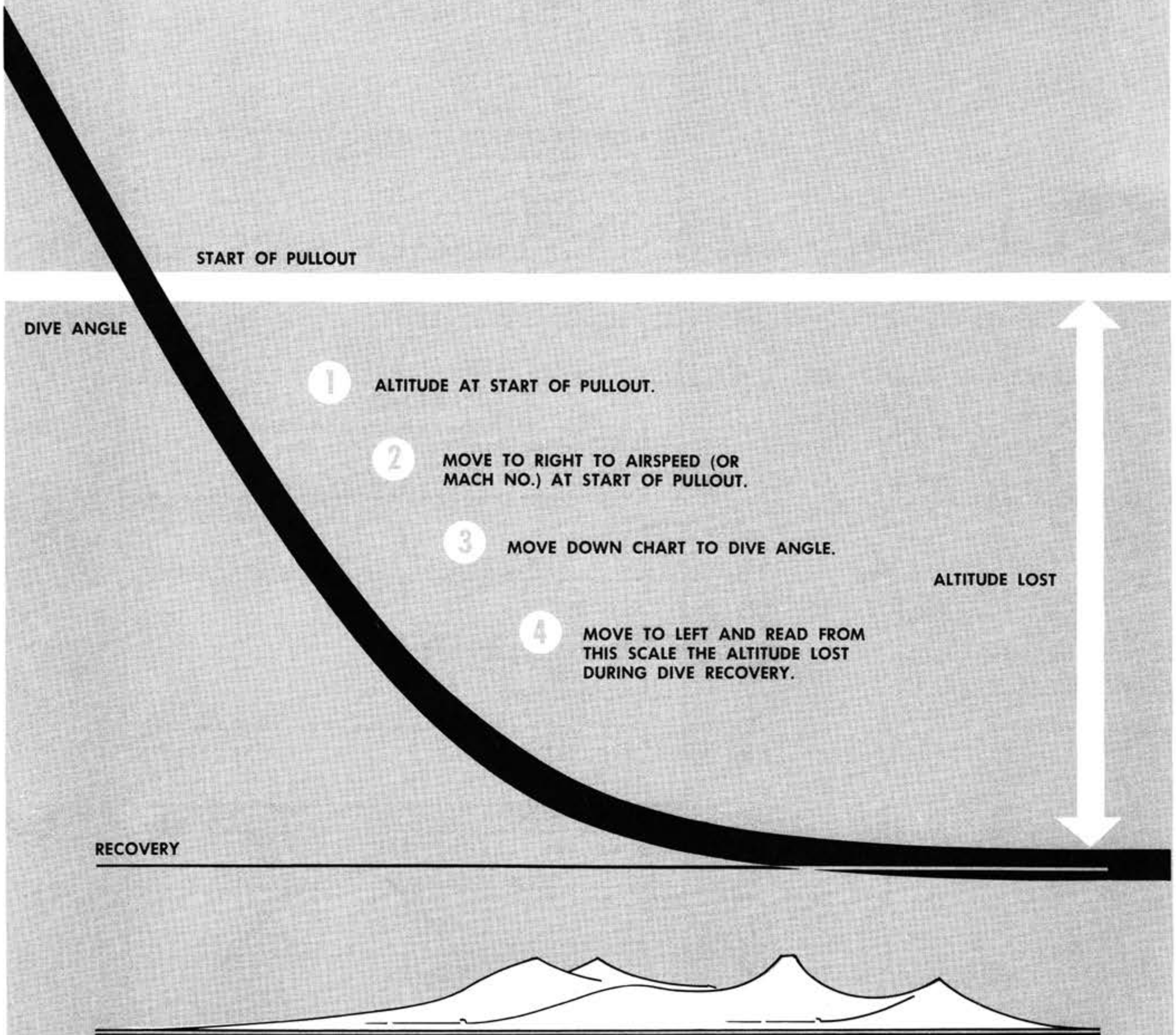
Figure 6-4.

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 6-5. (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 RANGE (+8° TO −17°).
- 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.

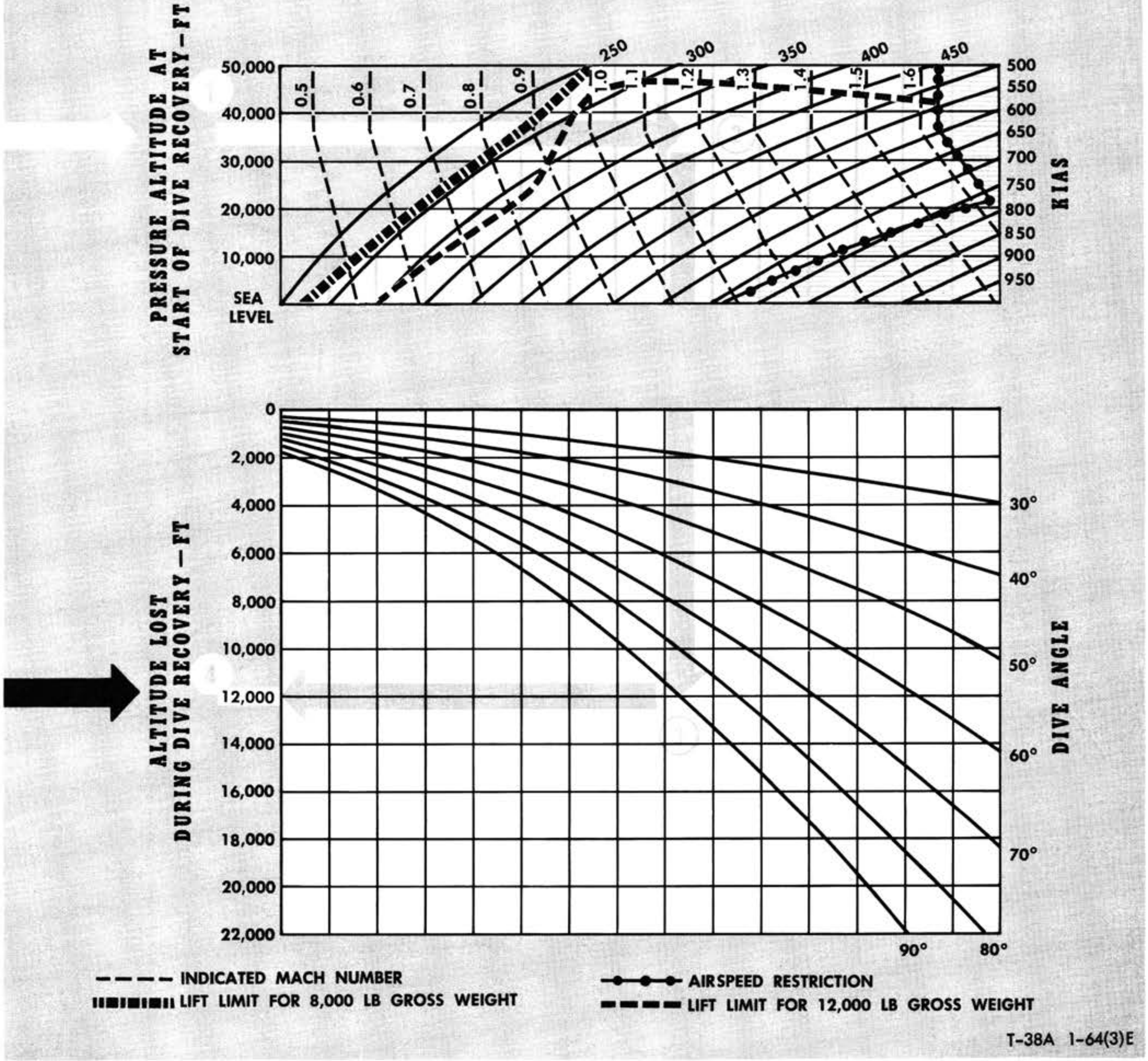
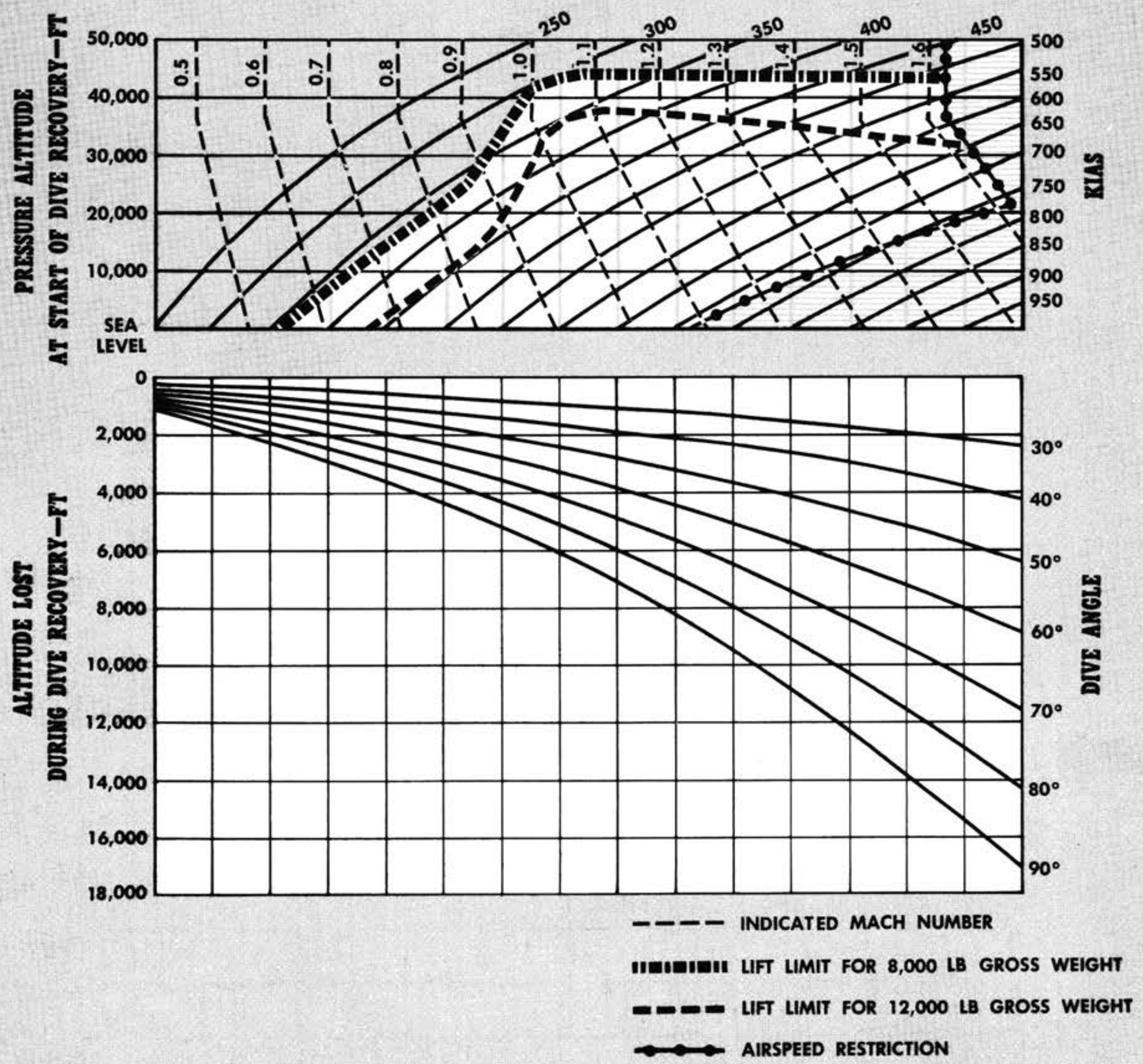


Figure 6-5. (Sheet 2 of 4)

ALTITUDE LOST DURING DIVE RECOVERY

CONSTANT 6.0 G ACCELERATION

- SUBSONIC LIFT LIMIT IS DETERMINED BY BUFFET.
- SUPERSONIC LIFT LIMIT IS DETERMINED BY HORIZONTAL TAIL RANGE (+8° TO −17°).
- 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.



DATE: 15 JANUARY 1965
DATA BASIS: FLIGHT TEST

T-38A 1-64(5)C

Figure 6-5. (Sheet 3 of 4)

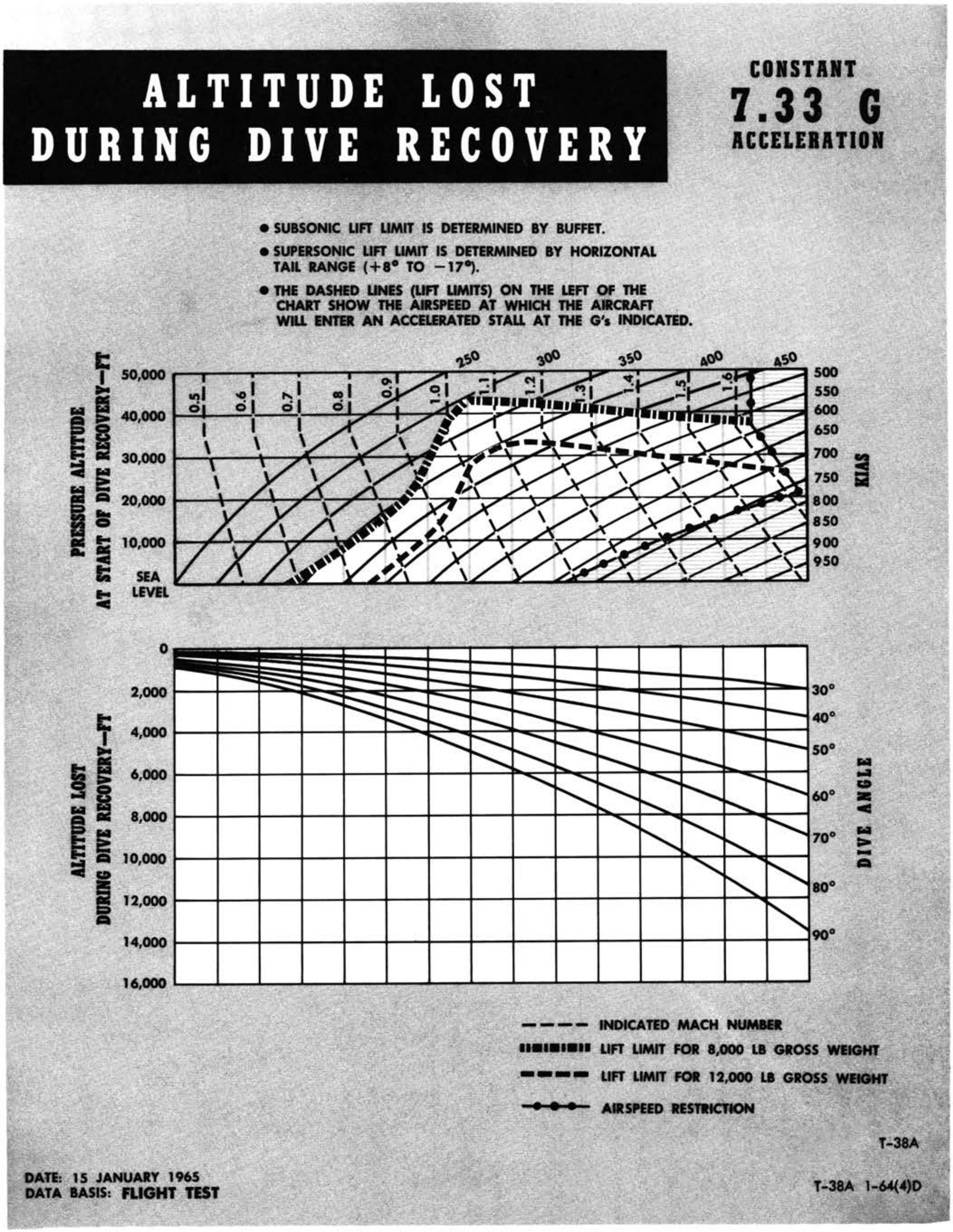


Figure 6-5. (Sheet 4 of 4)

SECTION VII SYSTEMS OPERATION

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COMPRESSOR STALL.

Engine compressor stalls can be caused by various factors, such as main fuel control malfunction, afterburner malfunction, variable inlet guide vanes out of rig, or throttle bursts at high altitudes and low airspeed. Other contributing causes are foreign object damage, incorrect fuel scheduling, high angles of attack at low airspeeds and high altitudes, abrupt yaw at low airspeeds (below 150 KIAS), ice formation on the inlet ducts, or ice formation on the inlet guide vanes, destroying their ability to direct the flow of air to the compressor section correctly. A compressor stall occurs whenever the axial flow of air thru the compressor section is stopped or interrupted, thus stalling the airfoil-shaped compressor blades. If a compressor stall is suspected, check engine RPM for hang-up or excessive rollback (unwinding), EGT for higher than normal indication and possibly increasing, and nozzle position indicator for a more nearly closed indication than normal. Any or all of these indications are reasonable indications that a stall has occurred. In most cases, the engine will recover if the throttle (stalled engine) is immediately retarded below setting at which stall occurred.

VARIABLE INLET GUIDE VANES.

Variable inlet guide vanes and bleed valves have been incorporated in the J85 engine to reduce the possibility of a compressor stall throughout the operating range of the engine. The vanes function automatically to direct the flow of air to the compressor blades at the proper angle.

THROTTLE MOVEMENT.

Abrupt or rapid throttle movement to MIL or MAX range in the area above 35,000 feet as indicated in figure 7-1 may result in engine flameout.

Note

Unnecessary abrupt or rapid throttle movement from any power setting reduces engine life and should be avoided.

AFTERBURNER INITIATION (HIGH ALTITUDE).

Afterburner initiation attempts at less than 250 KIAS in the light red area indicated in figure 7-1 may drive the engine rpm down (rollback) and possibly cause engine flameout. On engines incorporating the IP3 prime combustor, afterburner lightoff above 35,000 feet in the light red area is not guaranteed. For example, afterburner lightoff may not be possible at 45,000 feet and 0.93 mach. But at 35,000 feet and 0.85 mach, afterburner lightoff should occur.

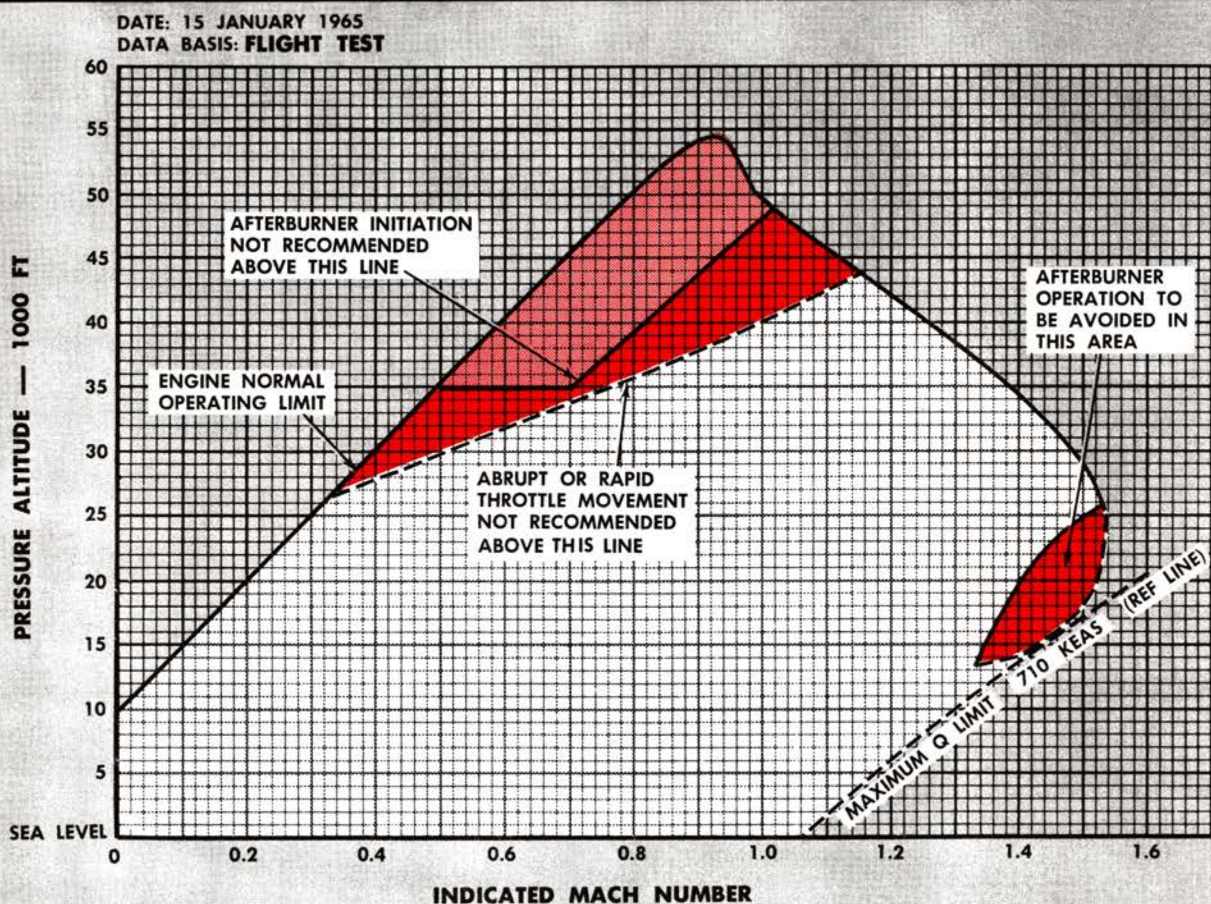
HIGH MACH DIVE.

CAUTION

Avoid afterburner operation as indicated in figure 7-1. Engine stall or damage to the variable nozzles may occur.

T-38A ENGINE ENVELOPE

J85-GE-5 SERIES ENGINES GROSS WEIGHT 10,000 LB STANDARD DAY CONDITIONS



Note

TO INCREASE THE PROBABILITY OF AFTERBURNER LIGHTOFF ABOVE 35,000 FEET, INCREASE AIRSPEED AS MUCH AS PRACTICAL BEFORE INITIATING AFTERBURNER.

T-38A 1-83G

Figure 7-1.

EFFECTS OF COMPRESSOR INLET TEMPERATURE (T-2 CUTBACK).

The T-2 sensor automatically reduces rpm and egt (exhaust gas temperature) to prevent overpressurization in the engine compressor section at low compressor inlet temperatures. As a result, rpm and egt indications may be below normal operating limits at MIL and MAX power at −2° F and below.

EGT DRIFT AT MIL AND MAX AB.

An egt drift (noncyclic) from 665° to 690° C, noticed only on the egt indicator and with no noticeable out-of-limits changes on remainder of applicable engine indicators (rpm, fuel flow, nozzle position, and oil pressure), is acceptable.

HIGH ALTITUDE-LOW AIRSPEED.

At altitudes of 20,000 feet and above at an indicated airspeed of 200 knots or below, the in-flight idle rpm can decay to less than normal ground idle speed (46.5 to 49.5 percent rpm) and the generator lights will come on. This condition occurs when performing 1.0 G stalls. 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 rpm or above when airspeeds of less than 200 knots (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.

CAUTION

Retarding throttles below IDLE detent may cause engine flameout.

SECTION VIII

CREW DUTIES

(Not Applicable)

ALL-WEATHER OPERATION

SECTION IX

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INSTRUMENT FLIGHT PROCEDURES

INSTRUMENT TAKEOFF.

For an instrument takeoff (MAX thrust), 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. Takeoff at MIL thrust is not recommended because of the lengthened ground roll required. Throttle application and brake release are the same as those given for normal takeoff procedure in Section II. 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. Use wheel brakes until rudder becomes effective; then use rudder for directional control.

Note

> Nosewheel steering is not recommended for instrument takeoffs. Maintain directional control with light braking until rudder becomes effective.

Apply initial back pressure as the airspeed approaches 140 KIAS to change the pitch from a 3-degree nose low to a 5-degree nose high indication 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 KIAS above 14,000 feet. At or below 14,000 feet, hold at 220 KIAS. 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. Fuel consumption in holding patterns between 20,000 and 40,000 feet averages approximately 1500 pounds per hour.

PENETRATION DESCENTS.

To enter a penetration descent, reduce both throttles to 80% rpm and lower the nose approximately 10 degrees on the attitude sphere. Extend speed brake (if required) at 280 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 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 gate.

Note

For formation penetration, 85% rpm is recommended.

INSTRUMENT APPROACHES.

Note

The T-38A is a Category E aircraft by air traffic control definition.

Figure 9-1 shows a typical TACAN penetration and approach. Normally, 220 KIAS will be maintained during approach maneuvering prior to extending the gear. Recommended airspeeds from the gate will depend upon the type of approach being made. At or prior to the gate, lower the landing gear and set the flaps at 60%. For a circling approach to the landing runway, maintain 175 KIAS plus fuel until aligned with the landing runway. For a straight-in approach, maintain 155 KIAS plus fuel. When on final, 100% flaps may be used for the landing, if desired.

INSTRUMENT LANDING SYSTEM (ILS).

Refer to figures 9-5 and 9-6 for ILS procedures. Normally, transition from the penetration level-off to the initial localizer interception will be made at 220 KIAS. For proper steering information, the ILS final approach course must be set in the course selector window. Use the LOC navigation mode to capture the localizer course. Select ILS navigation mode when established on the localizer course. Monitor the course deviation and glide-slope indicators when pitch and bank steering bars are used on ILS approaches.

WARNING

For proper localizer or ILS bank steering, select NORMAL steering mode.

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 220 KIAS. Reduce power to approximately 95% and climb at 220 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 engine failure during takeoff.

ICE AND RAIN

Anti-icing equipment for the wings, empennage, and inlet ducts is not provided. Each aircraft is provided with engine anti-ice, pitot heat, and canopy and windshield heat for adverse weather operation. Icing conditions which may be encountered are trace, light, moderate, and heavy. Moderate and heavy 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.

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 sompressor blades. Engine instrument indications may remain normal, even though engine damage from ice ingestion has been experienced.

CAUTION

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.

When icing conditions are unavoidable, the pitot heat switch should be placed at PITOT HEAT and the canopy defog rheostat switch turned to full increase.

TYPICAL TACAN HOLDING, PENETRATION, AND APPROACH

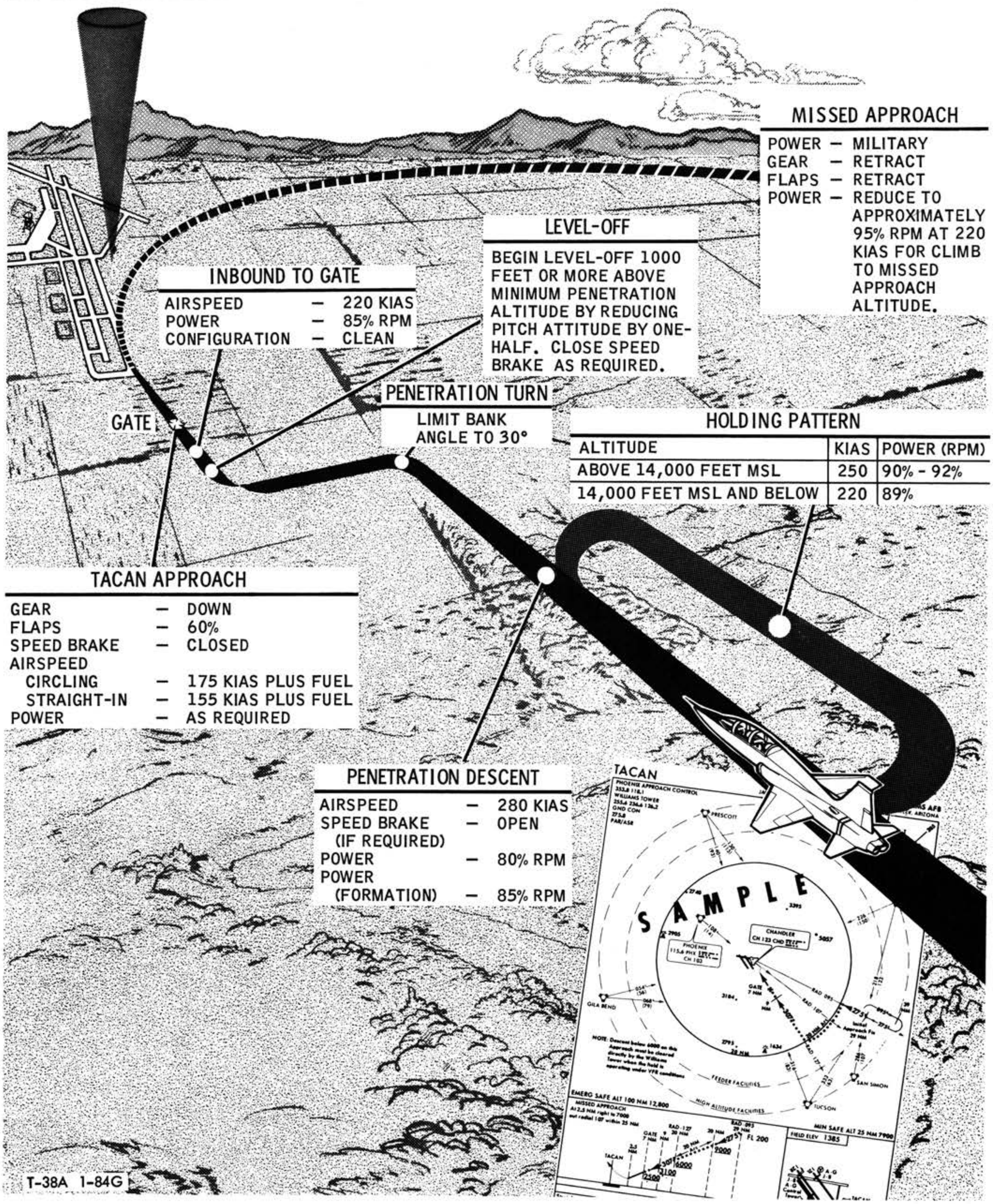

Figure 9-1.

TYPICAL TACAN HOLDING, PENETRATION, AND APPROACH
SINGLE-ENGINE

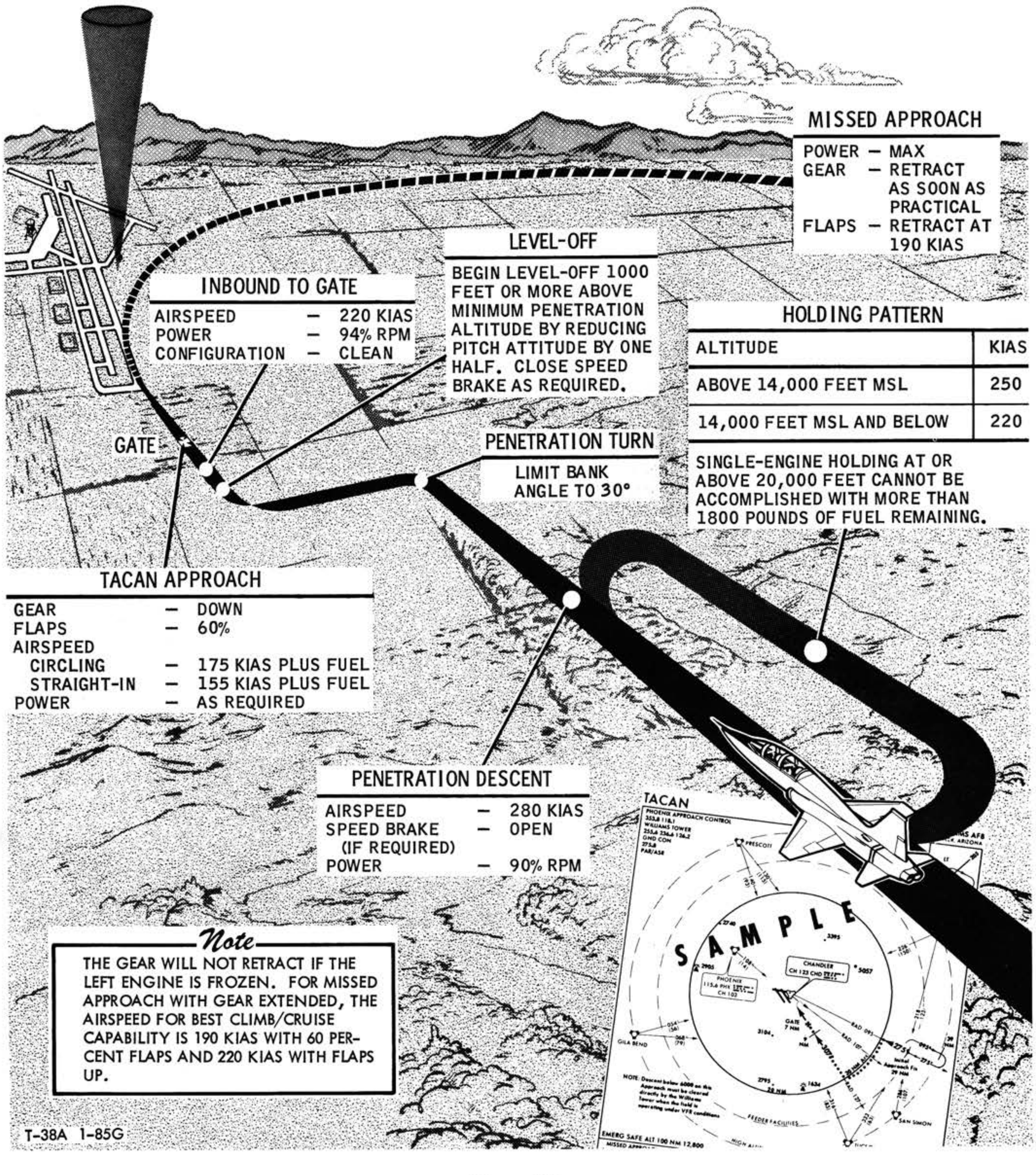

Figure 9-2.

TYPICAL RADAR APPROACH

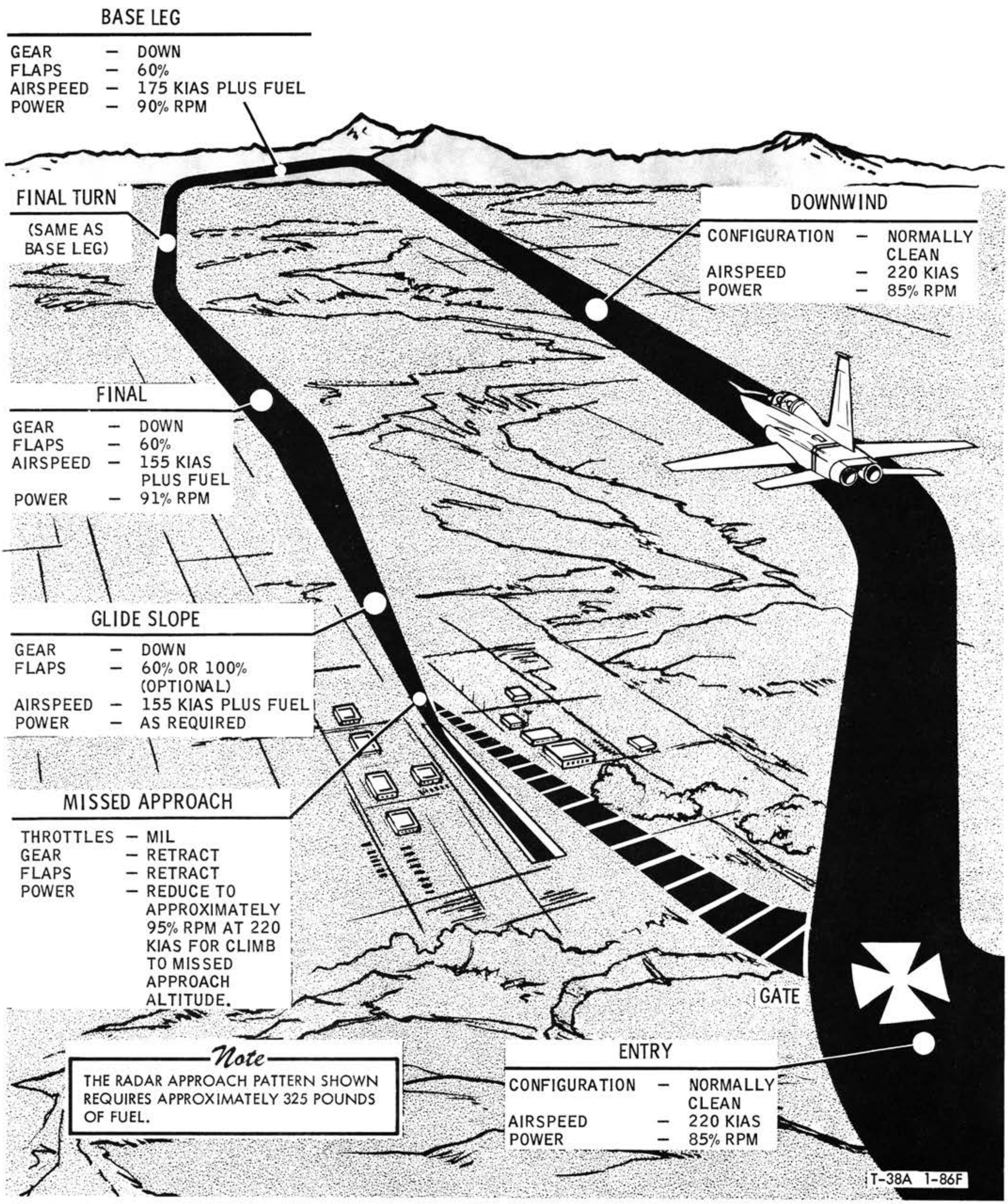

Figure 9-3.

TYPICAL RADAR APPROACH
SINGLE-ENGINE

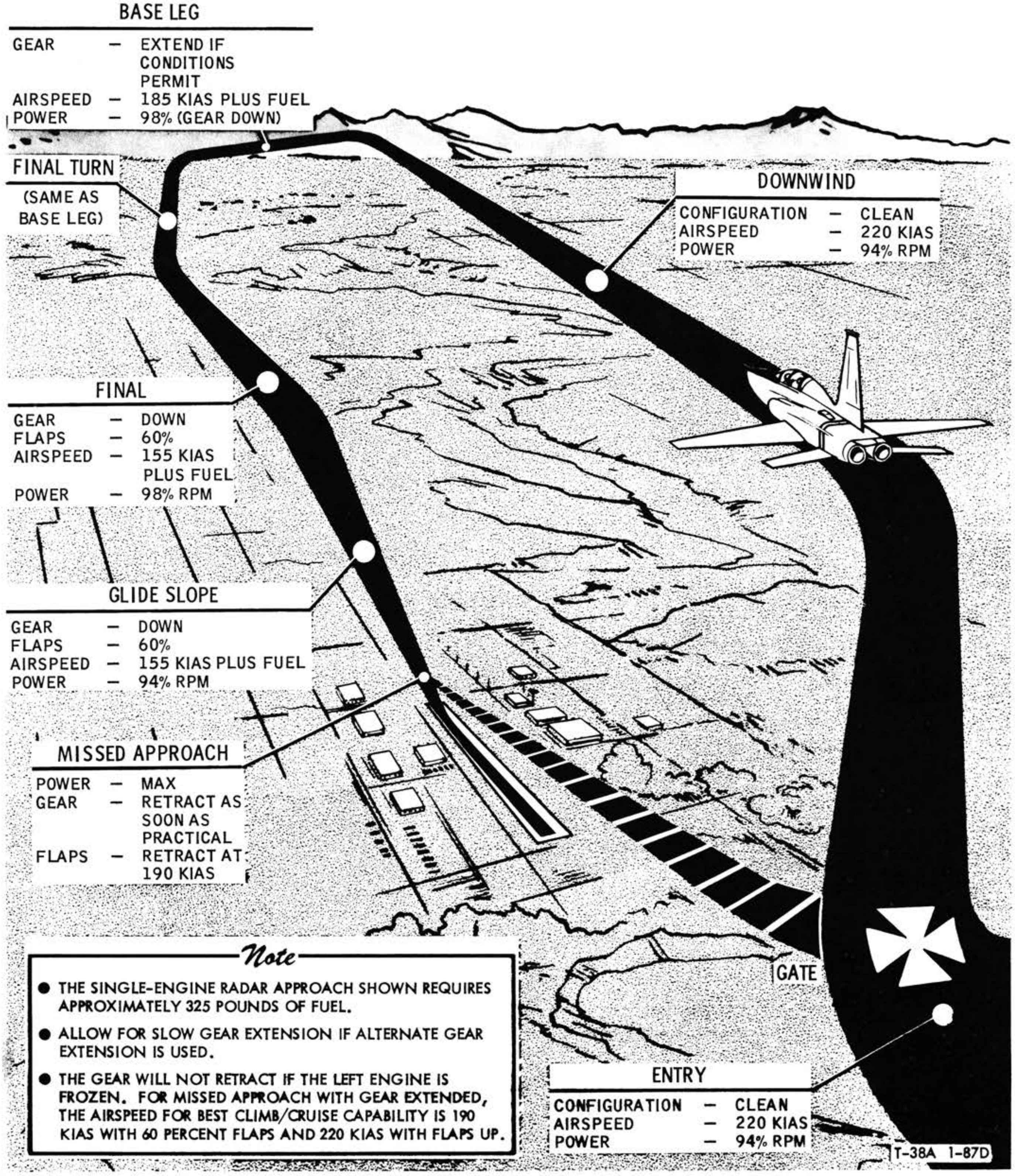

Figure 9-4.

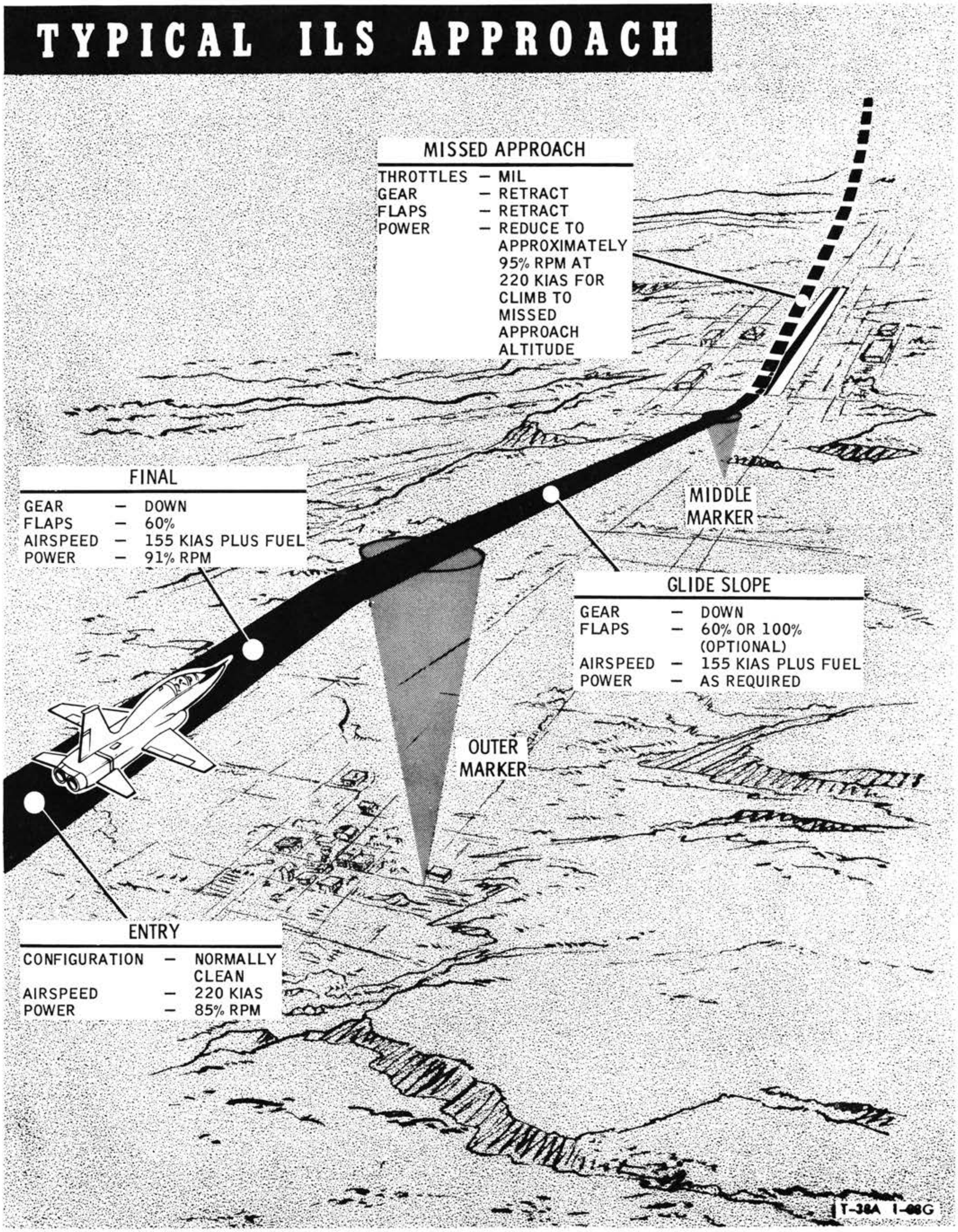
TYPICAL ILS APPROACH
MISSED APPROACH
THROTTLES — MIL
GEAR — RETRACT
FLAPS — RETRACT
POWER — REDUCE TO APPROXIMATELY 95% RPM AT 220 KIAS FOR CLIMB TO MISSED APPROACH ALTITUDE
FINAL
GEAR — DOWN
FLAPS — 60%
AIRSPEED — 155 KIAS PLUS FUEL
POWER — 91% RPM
MIDDLE MARKER
GLIDE SLOPE
GEAR — DOWN
FLAPS — 60% OR 100% (OPTIONAL)
AIRSPEED — 155 KIAS PLUS FUEL
POWER — AS REQUIRED
OUTER MARKER
ENTRY
CONFIGURATION — NORMALLY CLEAN
AIRSPEED — 220 KIAS
POWER — 85% RPM

Figure 9-5.

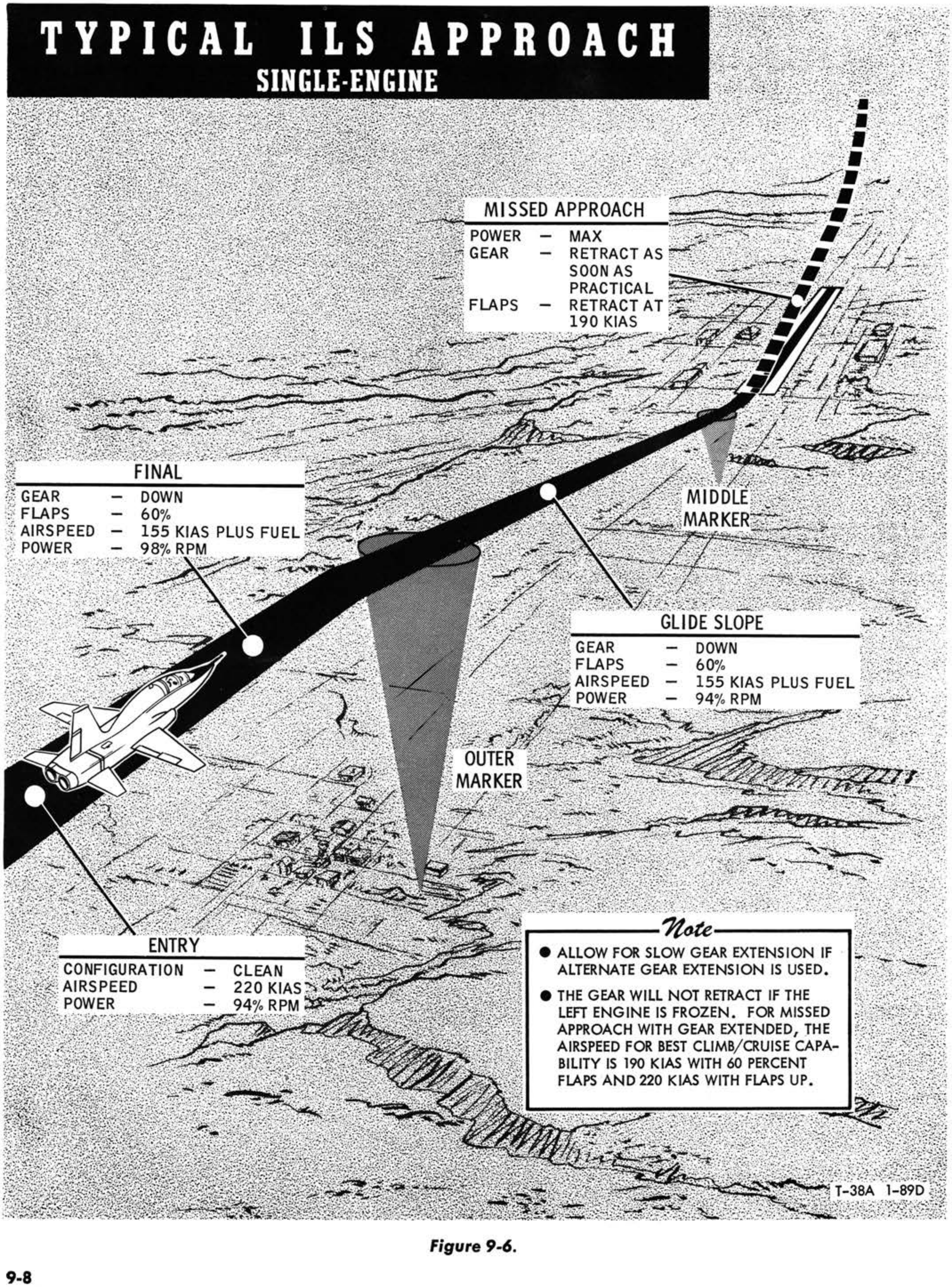
TYPICAL ILS APPROACH
SINGLE-ENGINE
MISSED APPROACH
POWER — MAX
GEAR — RETRACT AS SOON AS PRACTICAL
FLAPS — RETRACT AT 190 KIAS
FINAL
GEAR — DOWN
FLAPS — 60%
AIRSPEED — 155 KIAS PLUS FUEL
POWER — 98% RPM
MIDDLE MARKER
GLIDE SLOPE
GEAR — DOWN
FLAPS — 60%
AIRSPEED — 155 KIAS PLUS FUEL
POWER — 94% RPM
OUTER MARKER
ENTRY
CONFIGURATION — CLEAN
AIRSPEED — 220 KIAS
POWER — 94% RPM
Note
● ALLOW FOR SLOW GEAR EXTENSION IF ALTERNATE GEAR EXTENSION IS USED.
● THE GEAR WILL NOT RETRACT IF THE LEFT ENGINE IS FROZEN. FOR MISSED APPROACH WITH GEAR EXTENDED, THE AIRSPEED FOR BEST CLIMB/CRUISE CAPABILITY IS 190 KIAS WITH 60 PERCENT FLAPS AND 220 KIAS WITH FLAPS UP.
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Figure 9-6.

The aircraft is not equipped with windshield deicing 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.

ENGINE ICING.

Engine inlet guide vane icing may occur when the ambient temperature is below 40° F and either the temperature-dewpoint spread is less than 5° or when flying 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.

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. Do not exceed maximum penetration airspeed of 380 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, and vents are free of all snow, ice, and frost. Brush off all light snow and frost. Remove all ice and encrusted snow either by a direct flow of air from a portable ground heater or by using de-icing fluid.

WARNING

- All accumulated ice and snow 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.

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 as the nosewheel may sling slush into the intake ducts causing engine flameout and/or damage.

LANDING.

Use minimum roll landing technique 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.

BEFORE LEAVING AIRCRAFT.

Leave the canopy partly open, to allow circulation of air within the cockpit to prevent the canopy from cracking and to reduce windshield and canopy frosting.

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. Nosewheel liftoff should not be accomplished until slightly below the recommended liftoff speed to prevent additional drag caused by excessive angle of attack.
2. Be alert for gusts and wind shifts near the ground.

DURING FLIGHT.

The canopy defog system should be operated at the highest flow possible (consistent with crewmember's comfort) during high altitude flight to preheat the transparent surfaces and prevent the formation of frost or fog during descent.

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.

APPENDIX I

PERFORMANCE DATA

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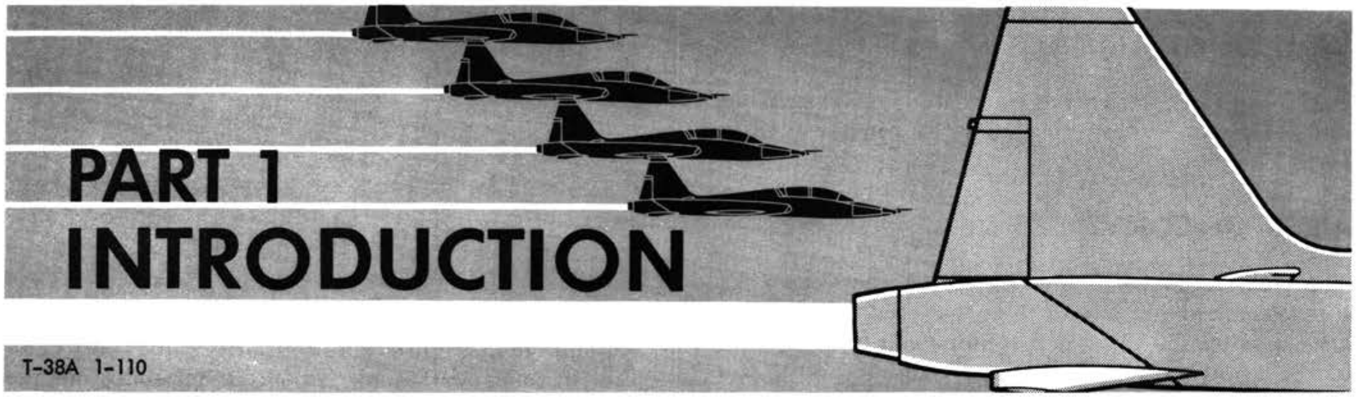
ABBREVIATIONS AND DEFINITIONS

KBAS	Basic airspeed (knots). Indicated airspeed corrected for instrument error (negligible in T-38A).
KIAS	Indicated airspeed (knots). Airspeed indication uncorrected for instrument error.
KCAS	Calibrated airspeed (knots). Indicated airspeed corrected for instrument error and position 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 in the air surrounding it with the speed of sound.
IMN	Indicated mach number. Indicated mach reading uncorrected for instrument error (instrument error assumed to be zero in all performance charts of this appendix).
TMN	True mach number. Indicated mach reading corrected for position error.
Mmax	Maximum mach number.
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 position error ($H_p = H_i - \Delta H_p$).
ΔH_p	Altimeter position error correction.
ΔV_p	Airspeed position error correction.
ΔV	Refusal speed minus decision speed.
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.
V_w	Wind velocity in knots (+ is headwind).
V_D	Decision speed.
V_R	Refusal speed.
μ_b	Braking coefficient of friction.
% rpm	Engine speed expressed as a percentage of maximum engine speed (16,500 rpm = 100%).
Δ TEMP	Temperature correction.
ρ	Ambient air density.
ρ_o	Air density at sea level.
σ	Relative air density, ρ/ρ_o.
MAC	Mean aerodynamic chord.
CG	Center-of-gravity.
kn	Knot.
fpm	Feet-per-minute.
nmi	Nautical miles.
nmi/lb	Nautical miles per pound.
SL	Sea level.
ALT	Altitude.
Temp	Temperature.
STD	Standard.
G	Load factor or G-loading.
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.

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, which has no external stores capability, has a drag index of zero.

ALTIMETER AND AIRSPEED POSITION CORRECTION.

Static pressure, which affects both airspeed and altimeter indications, is not always accurately measured because of the location of the static vent. This pressure error is a function of both airspeed and altitude. CAS is obtained from IAS by correcting for the position error in static pressure (airspeed position error). Knowing indicated airspeed and pressure altitude, both airspeed and altimeter position error corrections may be read from FA1-1.

USE OF ALTIMETER POSITION 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 feet 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 the mach number correction chart, FA1-2.

COMPRESSIBILITY CORRECTION TO CALIBRATED AIRSPEED.

The compressibility correction chart (FA1-3) provides the necessary airspeed correction to convert CAS to EAS (EAS = CAS − ΔV_c).

AIRSPEED CONVERSION.

The chart in FA1-4 is used to convert between CAS, true mach number, and true airspeed. If CAS 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 true airspeed for standard atmosphere conditions is interpolated between the sloping speed lines whose scale is located at the sea level pressure altitude line. To correct true airspeed for nonstandard temperatures, move horizontally from the intersection of CAS and the known altitude to the sea level pressure altitude line, then vertically downward to the known ambient temperature, and read the corrected true airspeed 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 chart, find the equivalent airspeed in knots in standard atmosphere corresponding to 0.85 mach number at 30,000 feet pressure altitude. In figure A1-5, at 30,000 feet read a/a_o = 0.8909, read $1/\sqrt{\sigma}$ = 1.6349, and at the top of the chart read a_o = 661.7 knots.

Then: $a = a_o \times a/a_o = 661.7 \times 0.8909 = 589.5$ knots.

$TAS = Ma = 0.85 \times 589.5 = 501.1$ knots.

$EAS = TAS \div 1/\sqrt{\sigma} = 501.1 \div 1.6349 = 306.5$ 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.

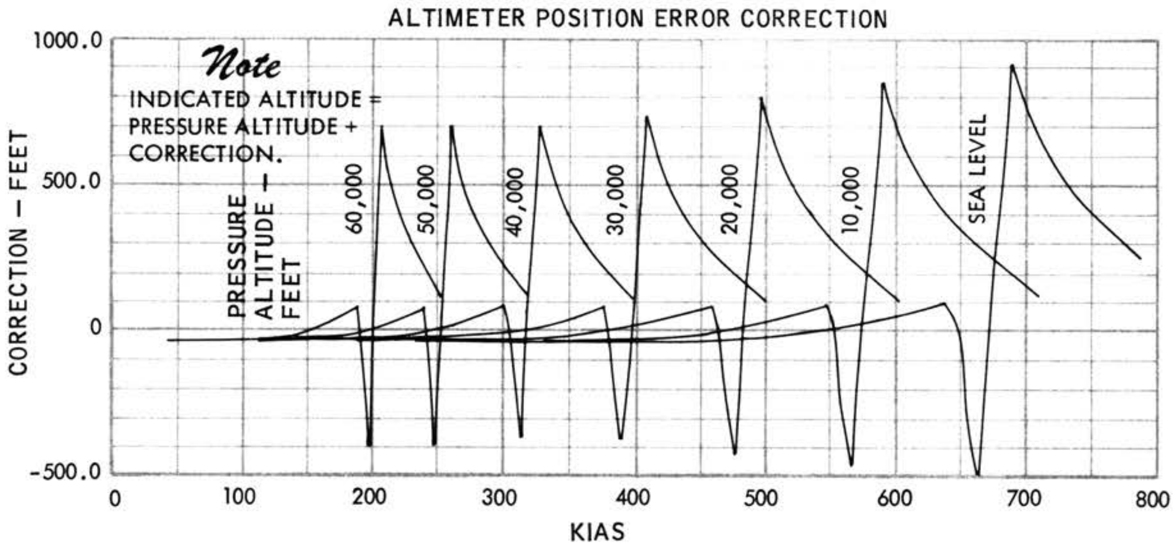
STANDARD CONVERSION TABLE.

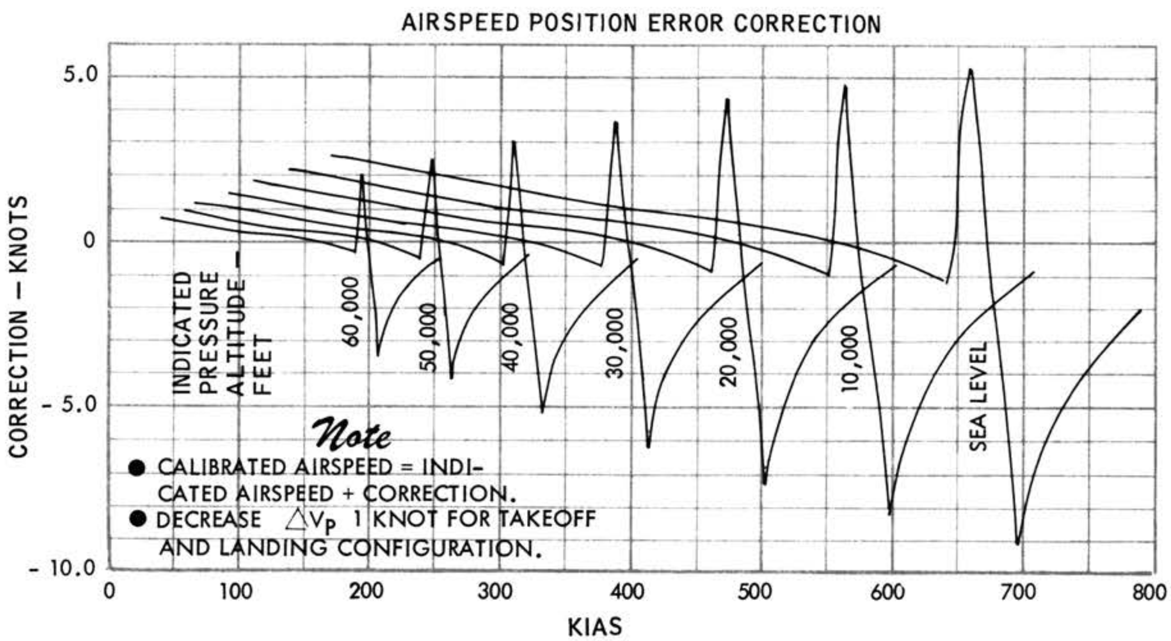
Linear scales for converting units of temperature, distance, and speed from one measurement system to another are provided in FA1-7. Additional conversion factors for volume, pressure, and weight are listed at the bottom of the chart.

ALTIMETER AND AIRSPEED POSITION 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





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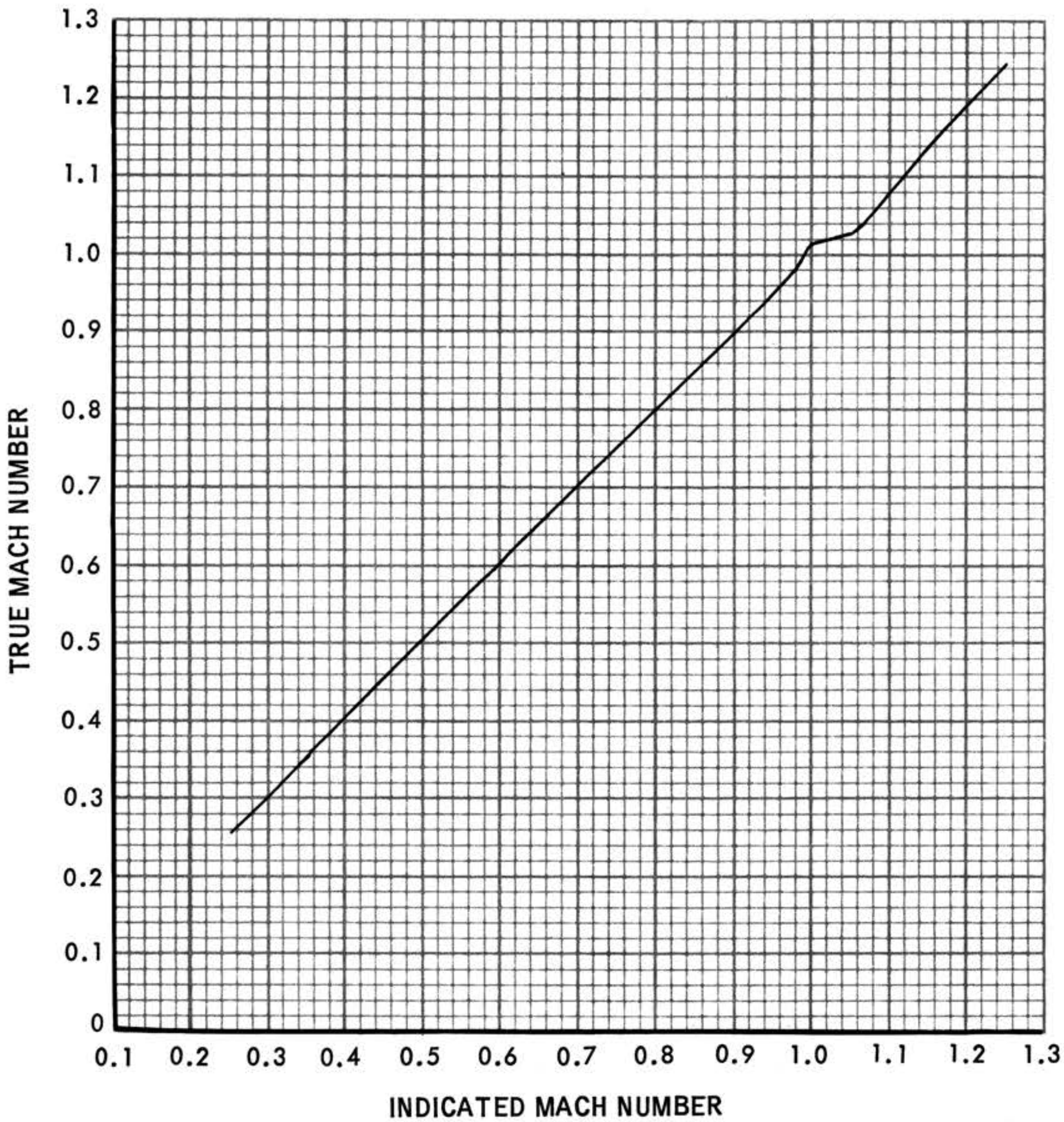
FA1-1.

MACH NUMBER CORRECTION

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

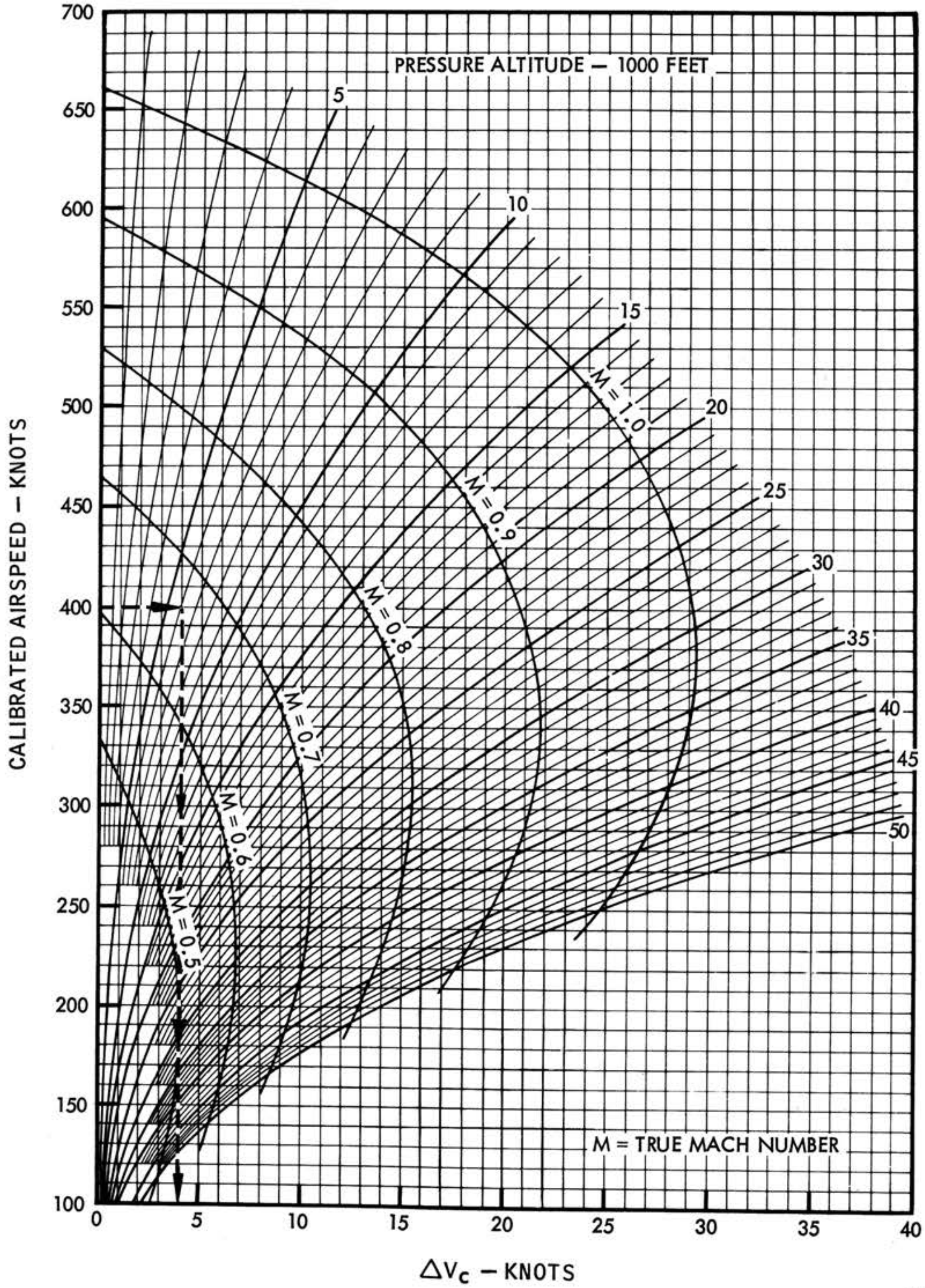
ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-301A

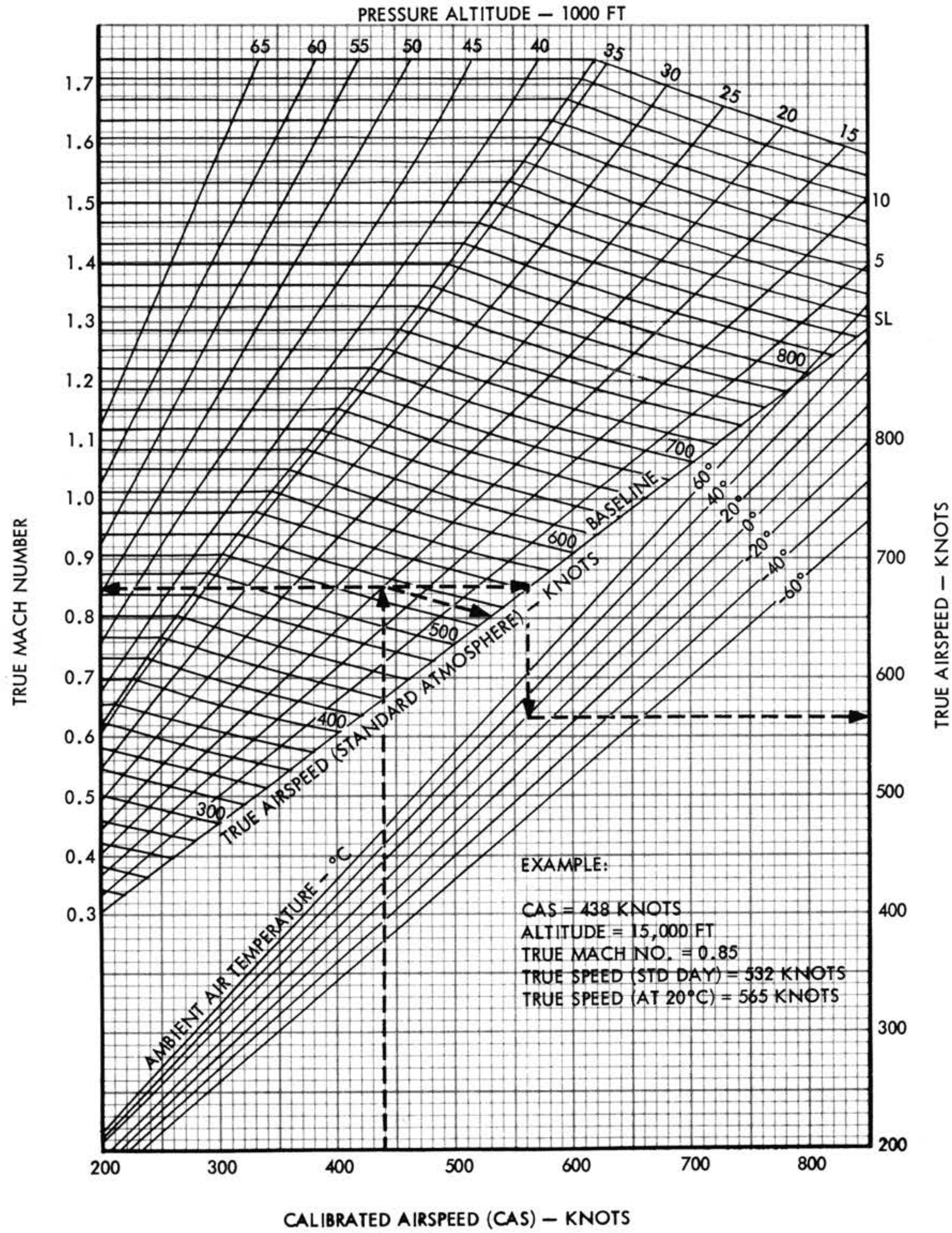
FA1-2.

COMPRESSIBILITY CORRECTION
TO CALIBRATED AIRSPEED



FA1-3.

AIRSPEED CONVERSION



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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

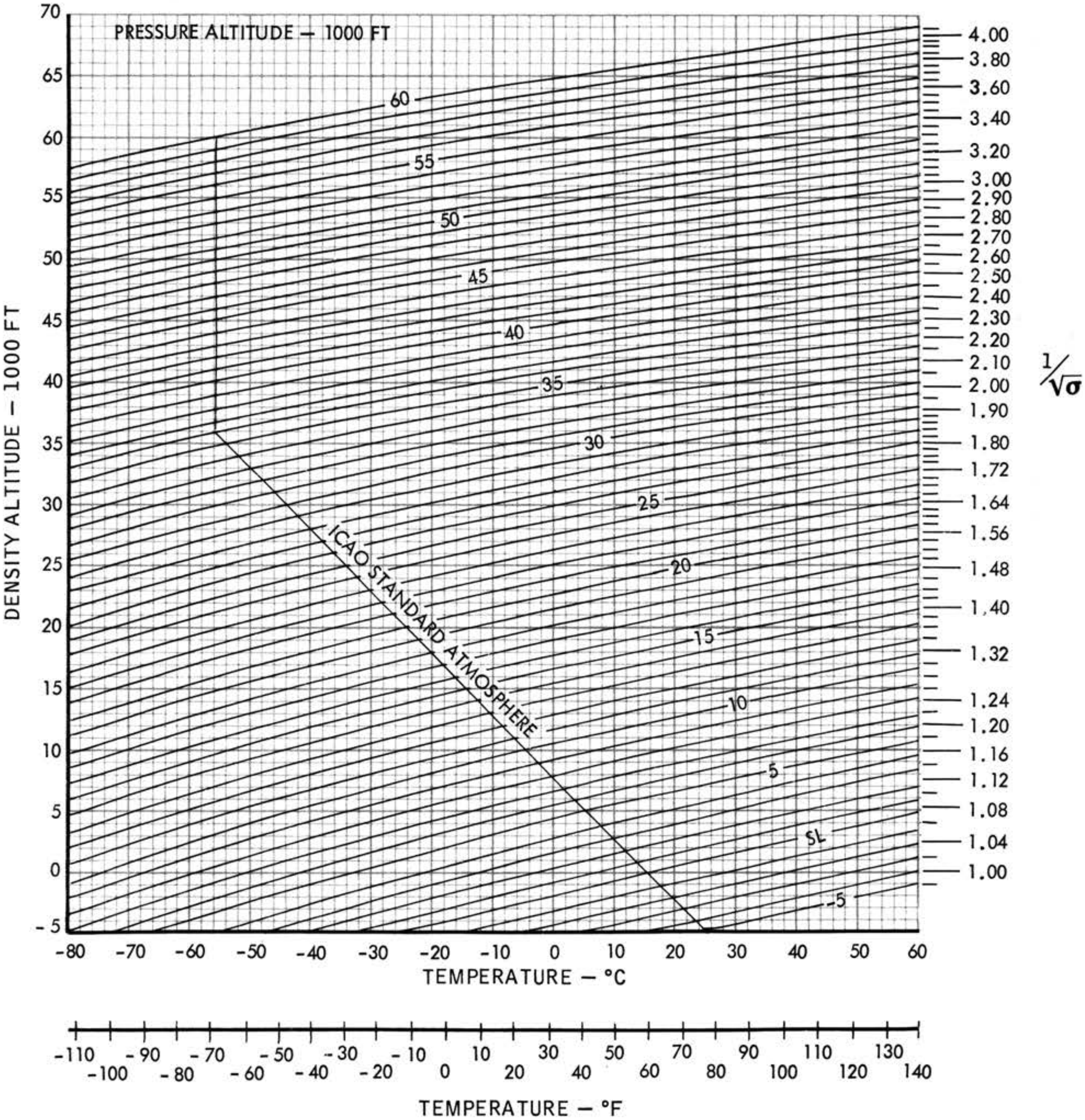
STANDARD ATMOSPHERE
(NACA TECHNICAL REPORT NO. 1235)

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

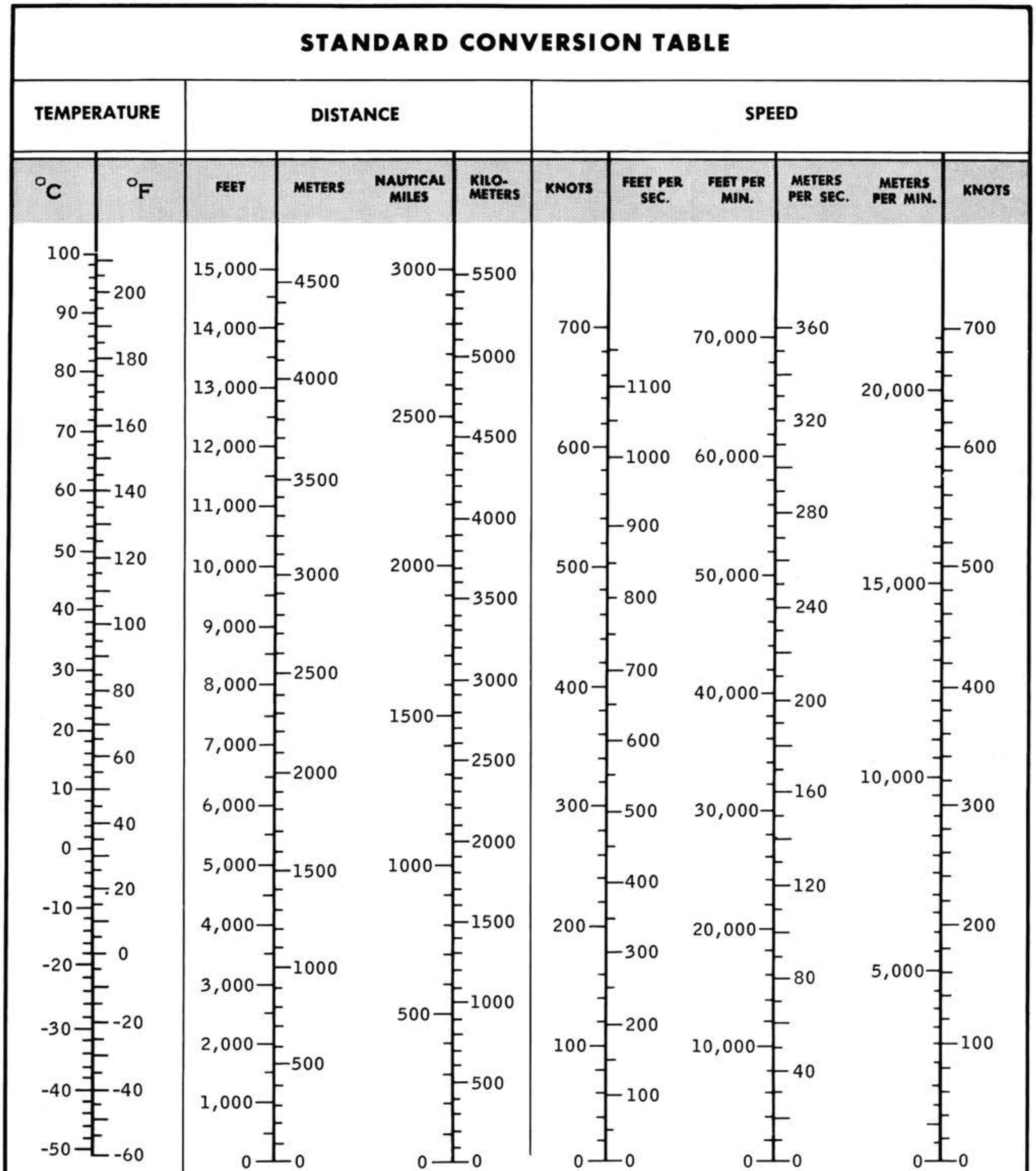
FA1-5.

DENSITY ALTITUDE



T-38A 1-305A

FA1-6.



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

T-38A 1-306A

FA1-7.

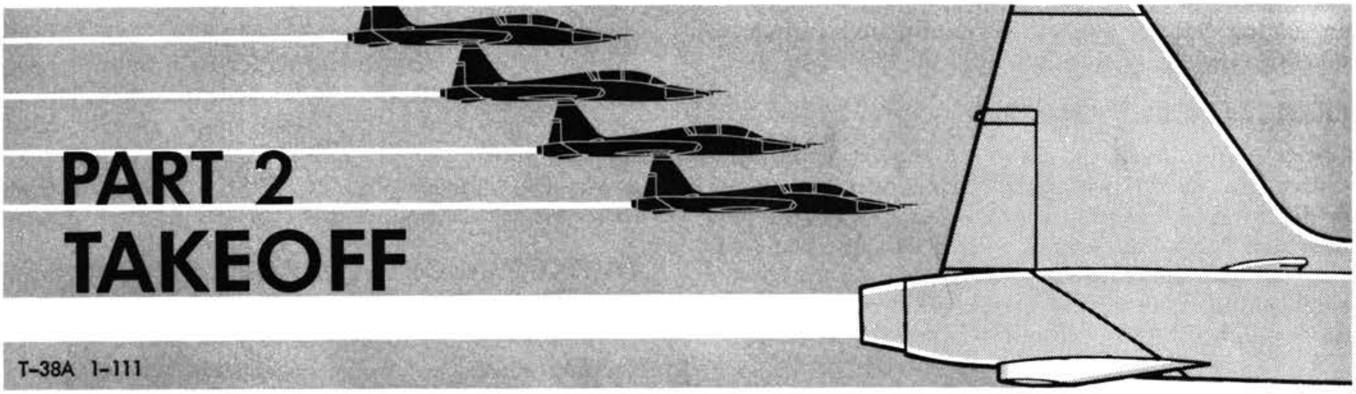


TABLE OF CONTENTS

WIND COMPONENTS.

A 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.

USE OF WIND COMPONENTS CHART.

The chase-thru lines (FA2-1) show a 30° right crosswind of 39 knots. The headwind component is 34 knots, and the crosswind component is 20 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, temperature, and thrust rating, including the effect of the anti-ice system.

USE OF TAKEOFF FACTOR CHART.

The chase-hru lines on FA2-2 show a 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 normal takeoff speed is the conventional takeoff speed for the aircraft and applies to the other takeoff charts. 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.

TAKEOFF DISTANCE.

Takeoff distance is ground run in feet to liftoff. Takeoff distance to clear a 50-foot obstacle is ground run 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 distance to clear a 50-foot obstacle as a function of takeoff factor, gross weight, and wind velocity 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.

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 is 3050 feet. The corresponding total distance to clear a 50-foot obstacle is 4600 feet (FA2-5).

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 either permit acceleration to takeoff or deceleration to a stop in the same distance.

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 a takeoff factor of 3.45, a gross weight of 11,800 pounds, and a 10-knot headwind. These conditions indicate a critical field length of 5,700 feet and ΔV_{SE} of 8 knots. Therefore the single-engine takeoff speed is 154 + 8 = 162 KIAS.

REFUSAL SPEED.

Refusal speed is the maximum speed to which the aircraft can accelerate and then stop in the remaining runway length. Data in the refusal speed charts (FA2-7, FA2-8) are for two engines at MAX and MIL thrust on a dry, hard-surfaced runway, and include a pilot reaction time of 3 seconds.

USE OF REFUSAL SPEED CHARTS OR CRITICAL ENGINE FAILURE SPEED CHARTS.

The chase-thru lines on FA2-7 show a refusal speed of 145 KIAS for a takeoff factor of 3.45 at gross weight of 11,800 pounds on a 7,000-foot runway with a 10-knot headwind. For a takeoff factor of 3.45 at gross weight 11,800 and a critical field length of 5,700 feet, the critical engine failure speed is 130 KIAS. If critical engine failure speed computes to less than 110 KIAS, use 110 KIAS as critical engine failure speed.

EFFECT OF RUNWAY SURFACE CONDITION.

The effect of runway surface condition chart (FA2-9) shows the variation of critical field length and refusal speed with runway surface condition (RCR). Critical field length and refusal speed are presented on the figure for the range of runway condition readings. The refusal speed correction chart can also be used to determine the RCR effects on critical engine failure speed when used in conjunction with FA2-7. On slippery runways, the critical field length is increased and the refusal speed and critical engine failure speeds are decreased (when compared to dry, hard-surfaced runways).

USE OF RUNWAY SURFACE CONDITION CHART.

Assume a RCR of 12 under the conditions given in the critical field length chart and refusal speed chart discussions. For this RCR, the critical field length is increased from 5700 feet to 6400 feet, and the refusal speed is decreased from 145 KIAS to 115 KIAS. Critical engine failure speed is corrected for RCR by reentering FA2-7, using the new critical field length of 6400 feet, and reading a new critical field length for dry, hard-surfaced runway of 137 KIAS. Enter the refusal speed correction chart (FA2-9) at 137 KIAS and read the corrected critical engine speed of 108 KIAS.

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:

   Aircraft can take off or stop within remaining distance. However, takeoff is preferable as less distance is required.

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 hazardous situation and takeoff is not recommended. If takeoff is imperative, and an engine failure occurs, the aircraft must be stopped, as remaining runway may be inadequate for a safe single-engine takeoff.

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. The forecast speed at this point is the normal acceleration check speed. Minimum acceleration check speed is the minimum acceptable speed at which takeoff should be continued. Minimum acceleration check speed is computed by subtracting 3 knots for each 1000 feet of runway in excess of normal critical field length or 10 knots from normal acceleration check speed, whichever is less. 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, a pressure altitude of 4000 feet, and a 10-knot headwind. Enter the chart at the takeoff speed 154 KIAS (FA2-3) and ground run distance 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 at 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 the 2000-foot marker (the second 100-foot marker after brake release).

USE OF SINGLE-ENGINE VELOCITY DURING TAKEOFF GROUND RUN CHART.

Assume a takeoff weight of 11,800 pounds, a runway 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 ground speed 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.

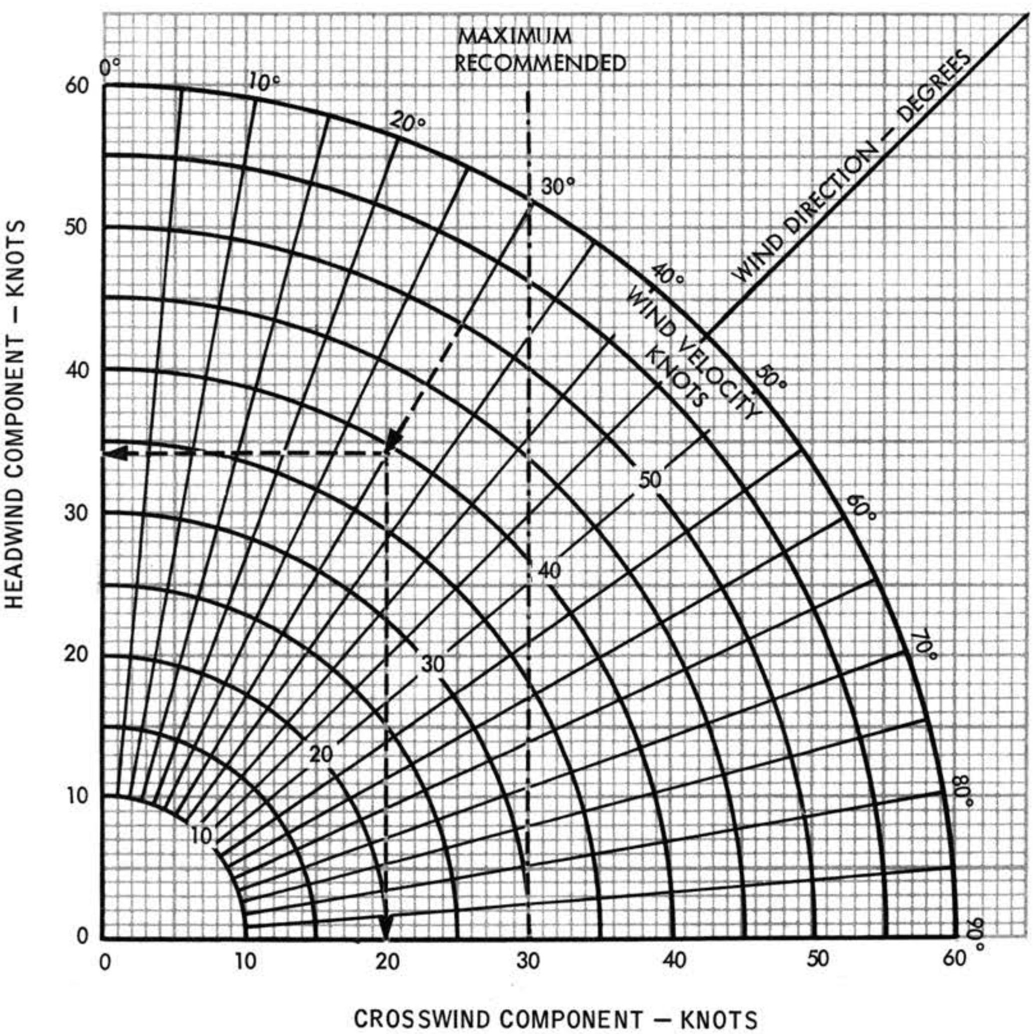
TAKEOFF AND LANDING WIND COMPONENTS

MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

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.



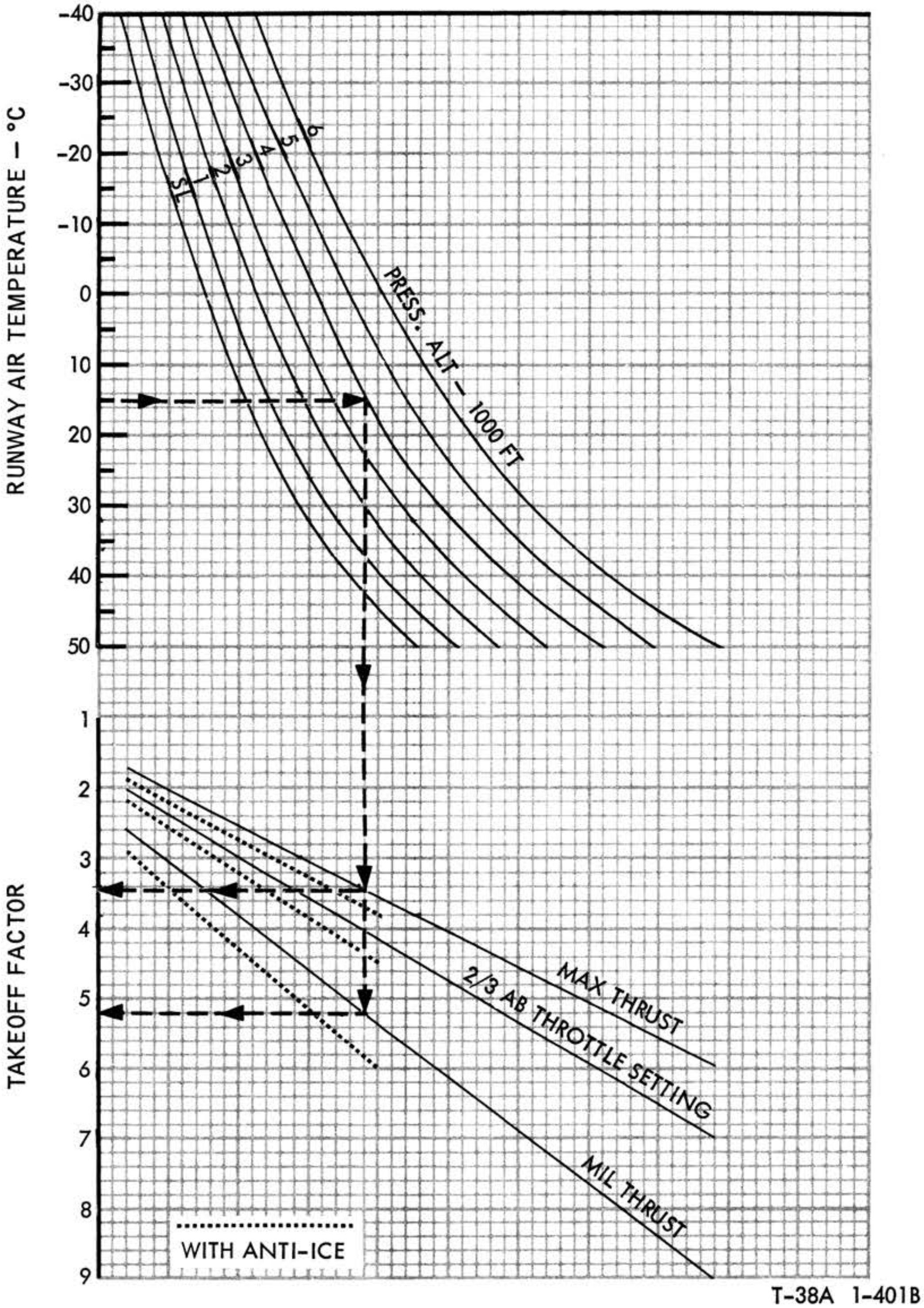
T-38A 1-400B

FA2-1.

TAKEOFF FACTOR
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



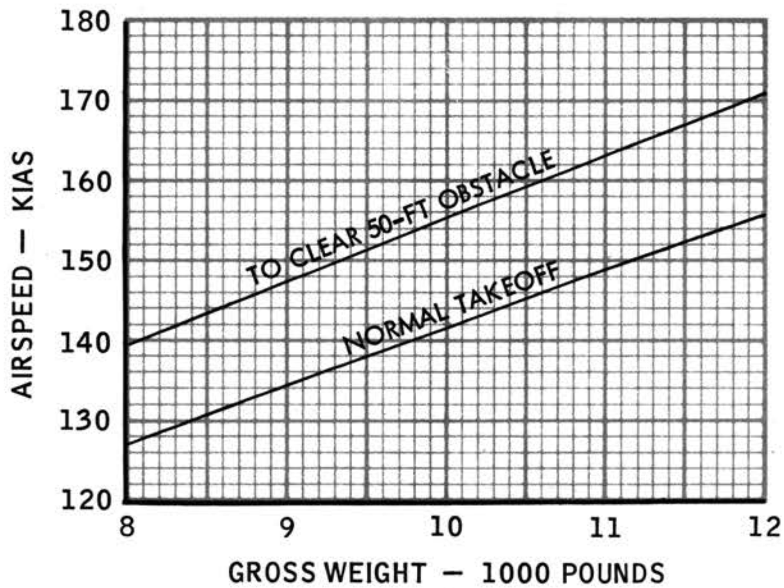
FA2-2.

TAKEOFF SPEED

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

- FOR TWO-ENGINE MAX THRUST TAKEOFF, USE $\Delta V = 0$.
- FOR MIL THRUST TAKEOFF, ADD ΔV_M FROM CHART FA2-4 TO TAKEOFF SPEED.
- FOR SINGLE-ENGINE TAKEOFF, ADD ΔV_{SE} FROM CHART FA2-6 TO TAKEOFF SPEED.

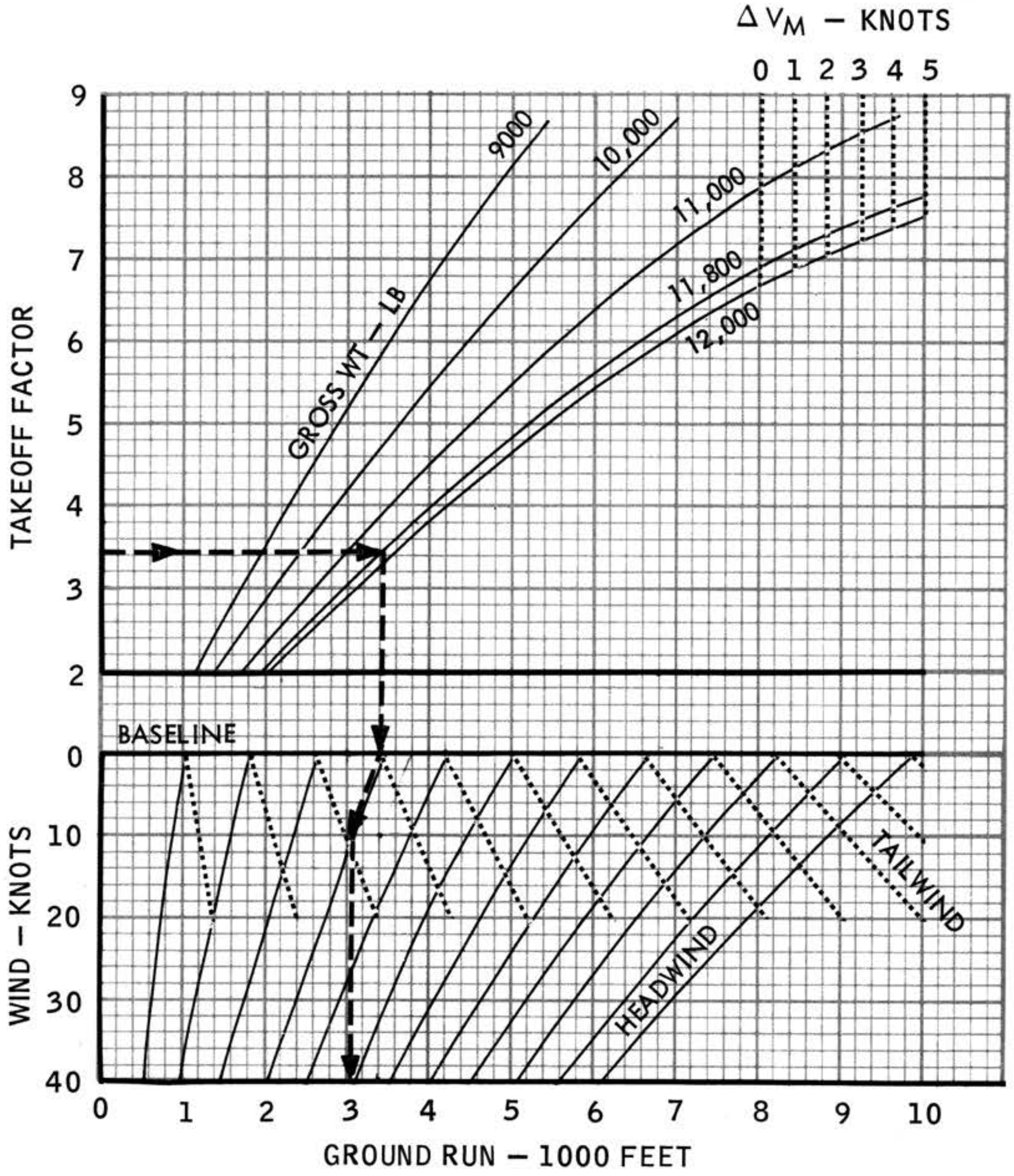
T-38A 1-402D

FA2-3.

TAKEOFF DISTANCE
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

ADD ΔV_M TO TAKEOFF SPEED (FA2-3).

T-38A 1-403B

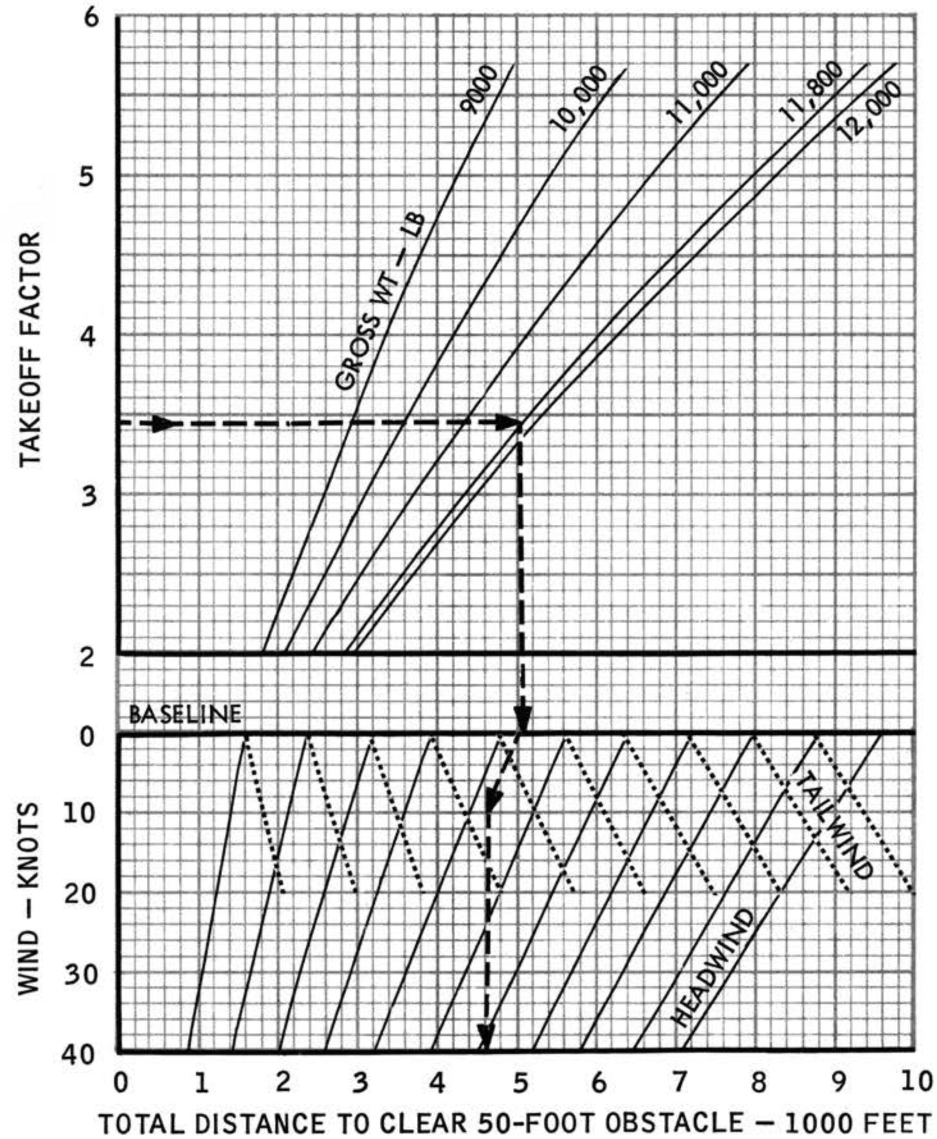
FA2-4.

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



T-38A 1-404B

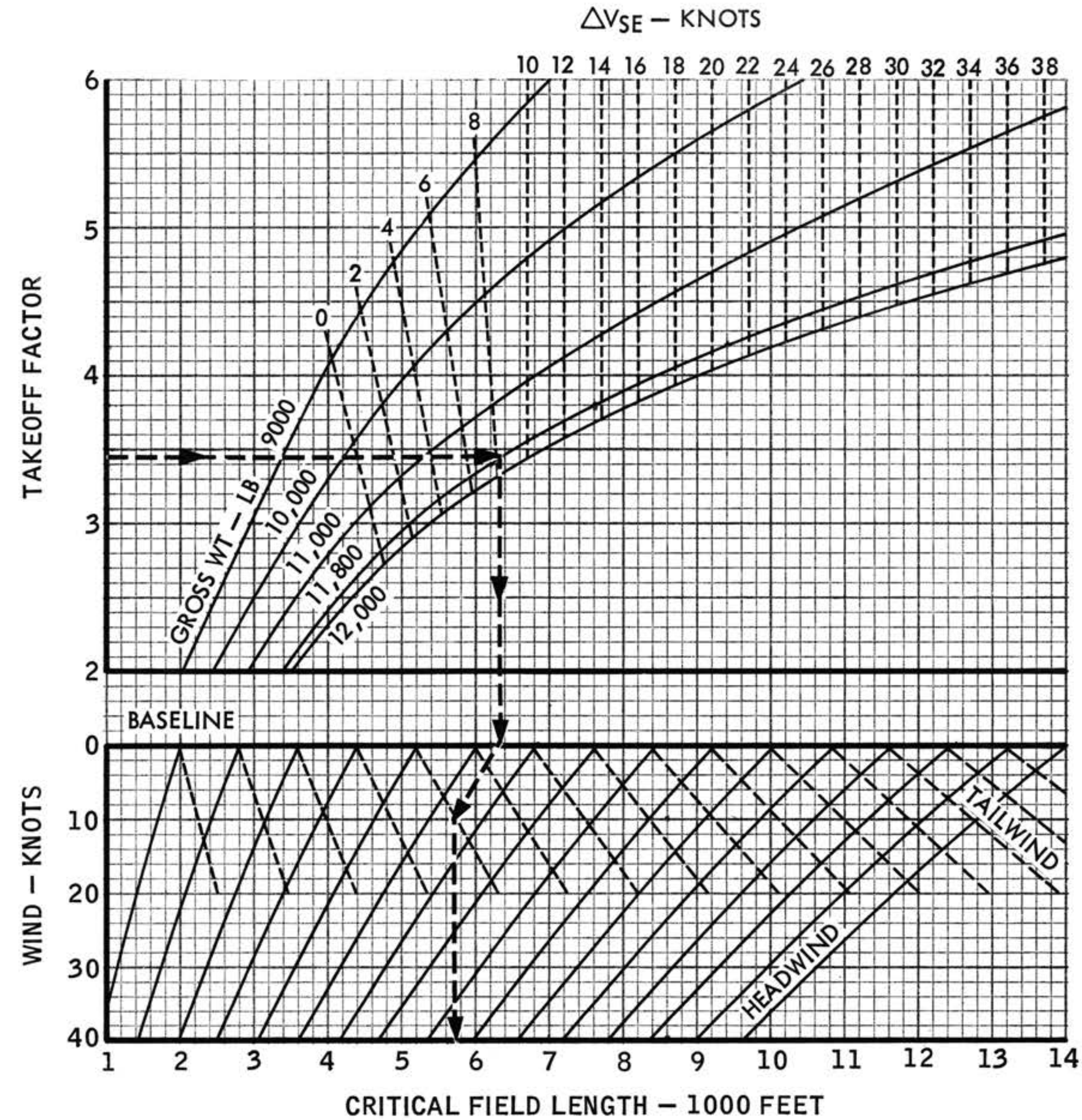
FA2-5.

CRITICAL FIELD LENGTH

MAX THRUST
DRY, HARD-SURFACED RUNWAY
FLAPS — 60%

MODEL: T-38A
DATE: 1 APRIL 1967
DATA BASIS: FLIGHT TEST

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL

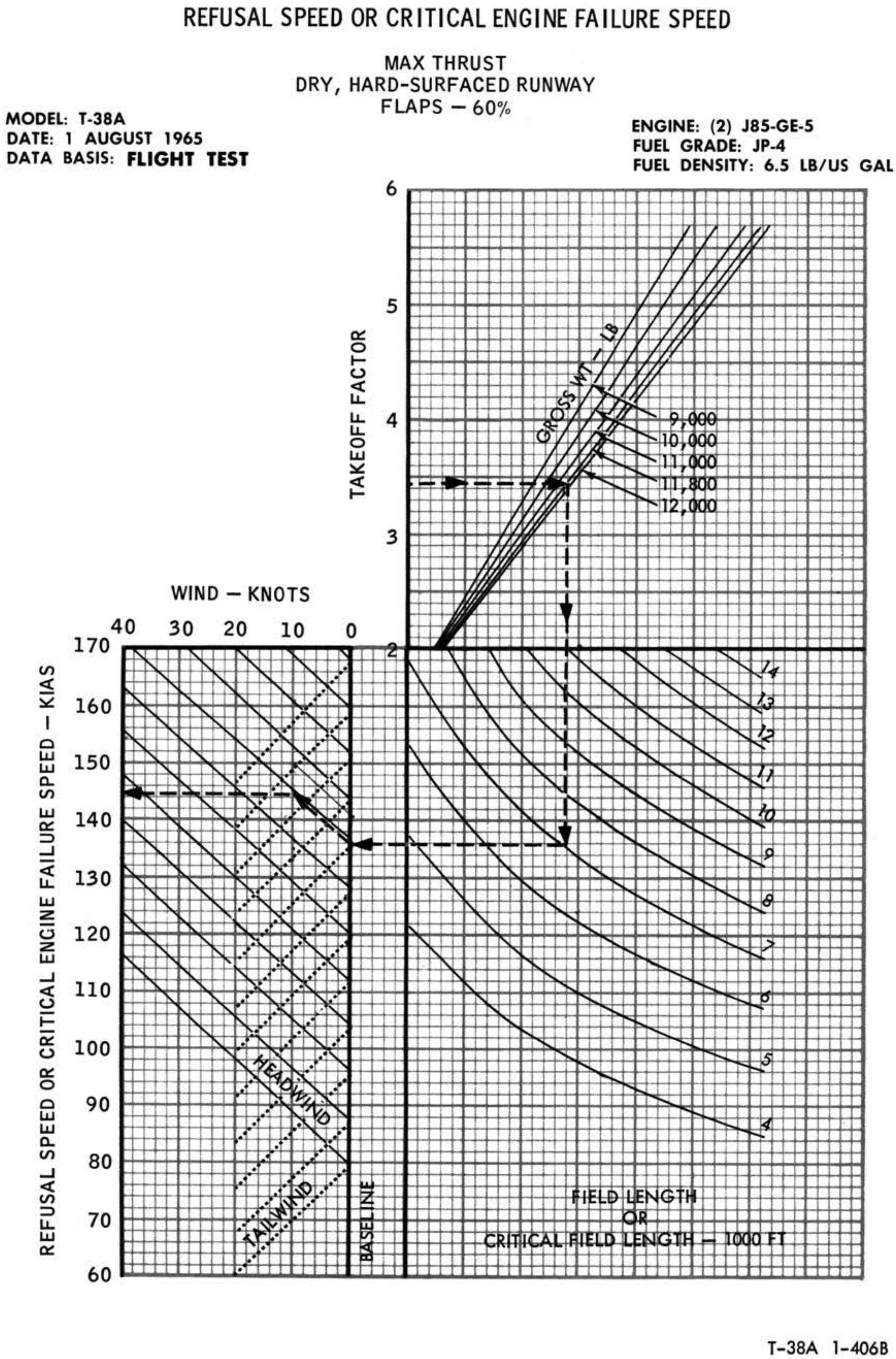


Note

FOR SINGLE-ENGINE TAKEOFF SPEED, ADD ΔV_{SE} TO TAKEOFF SPEED (FA2-3).

T-38A 1-405B

FA2-6.


REFUSAL SPEED OR CRITICAL ENGINE FAILURE SPEED
MAX THRUST
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
TAKEOFF FACTOR
GROSS WT — LB
9,000
10,000
11,000
11,800
12,000
WIND — KNOTS
40 30 20 10 0
REFUSAL SPEED OR CRITICAL ENGINE FAILURE SPEED — KIAS
HEADWIND
TAILWIND
BASELINE
FIELD LENGTH
OR
CRITICAL FIELD LENGTH — 1000 FT
T-38A 1-406B

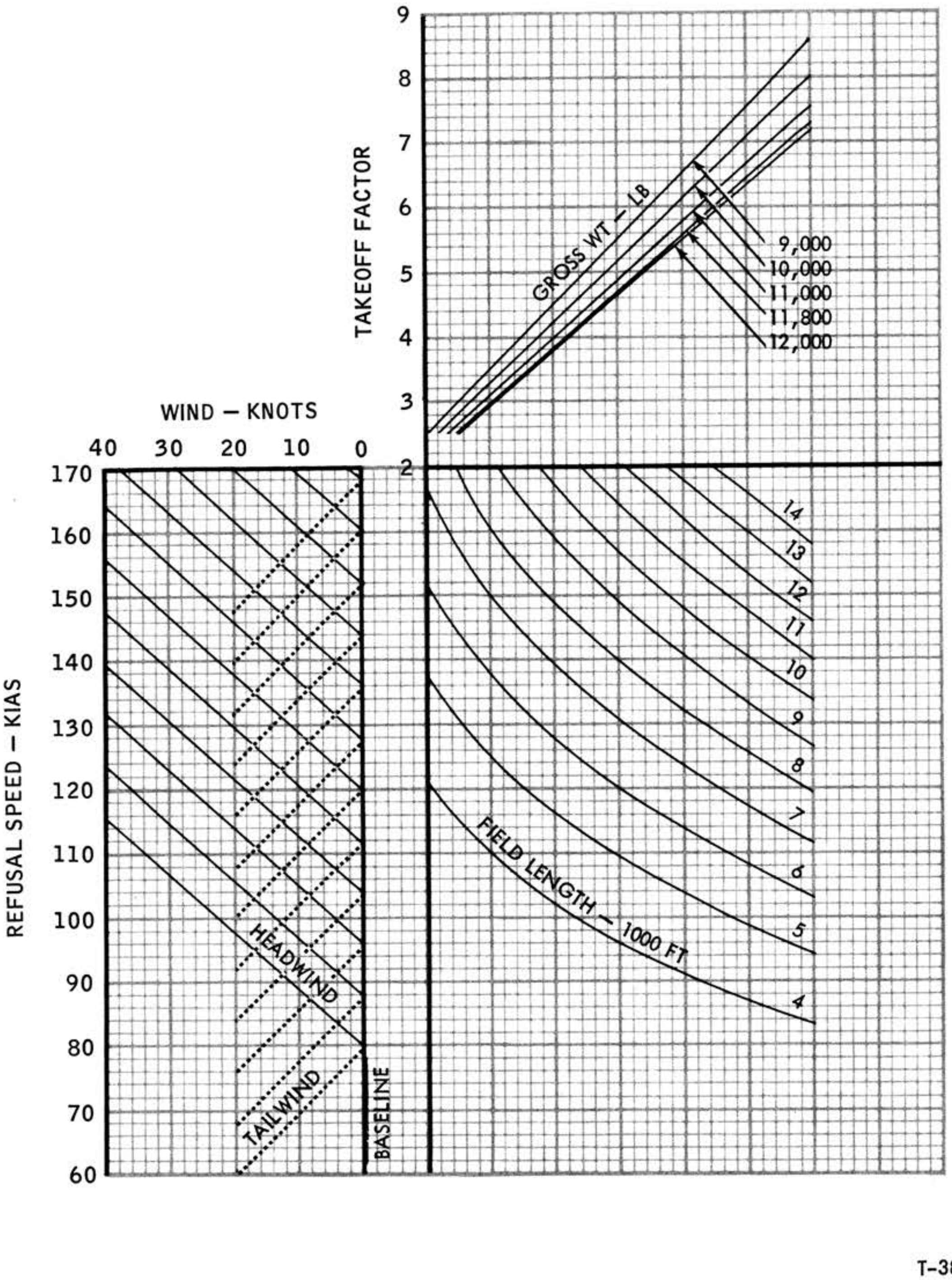
FA2-7.

REFUSAL SPEED

MIL THRUST
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



T-38A 1-407B

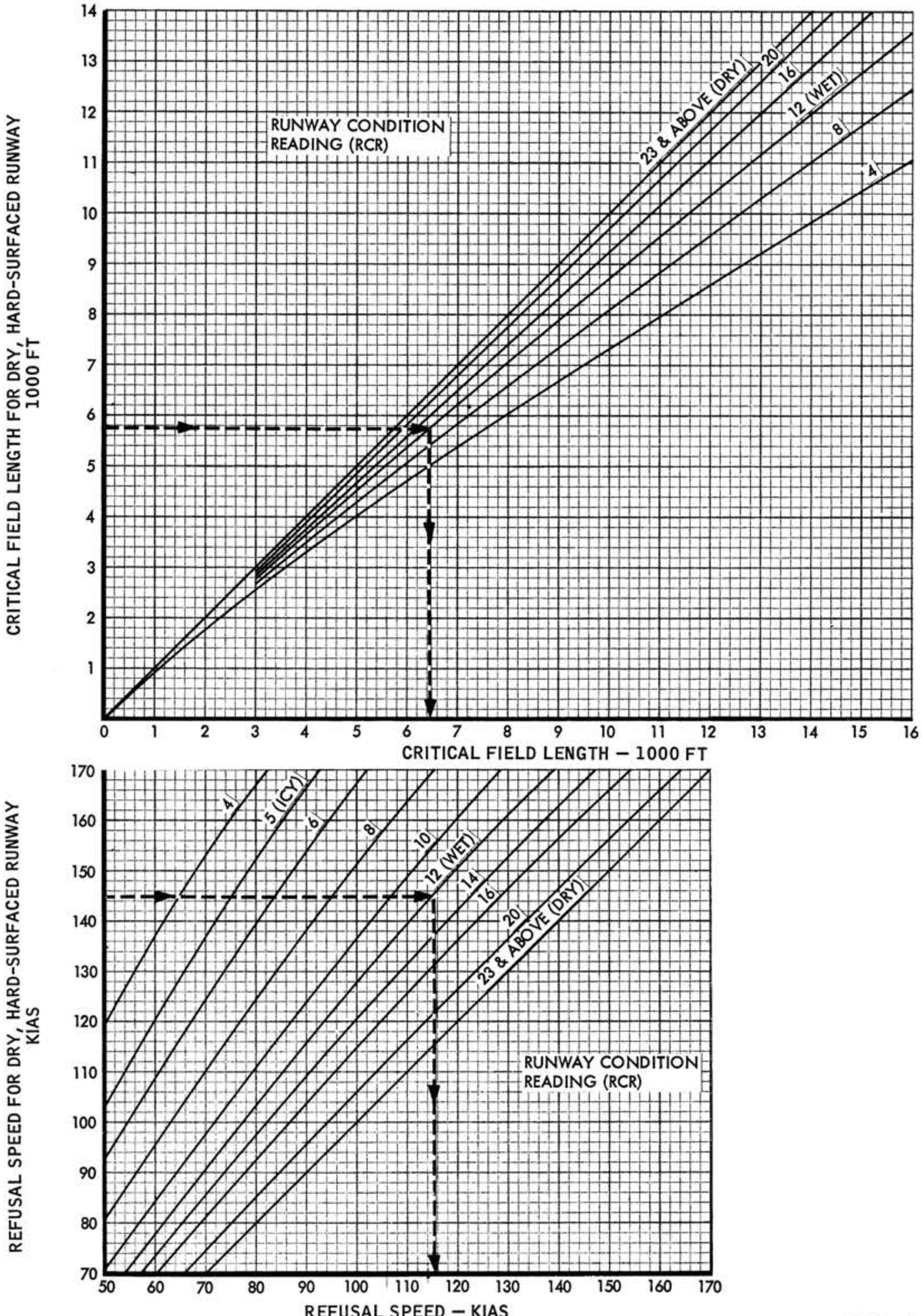
FA2-8.

EFFECT OF RUNWAY SURFACE CONDITION

MAX THRUST
FLAPS 60%

MODEL: T-38A
DATE: 1 APRIL 1967
DATA BASIS: FLIGHT TEST

ENGINES: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-408B

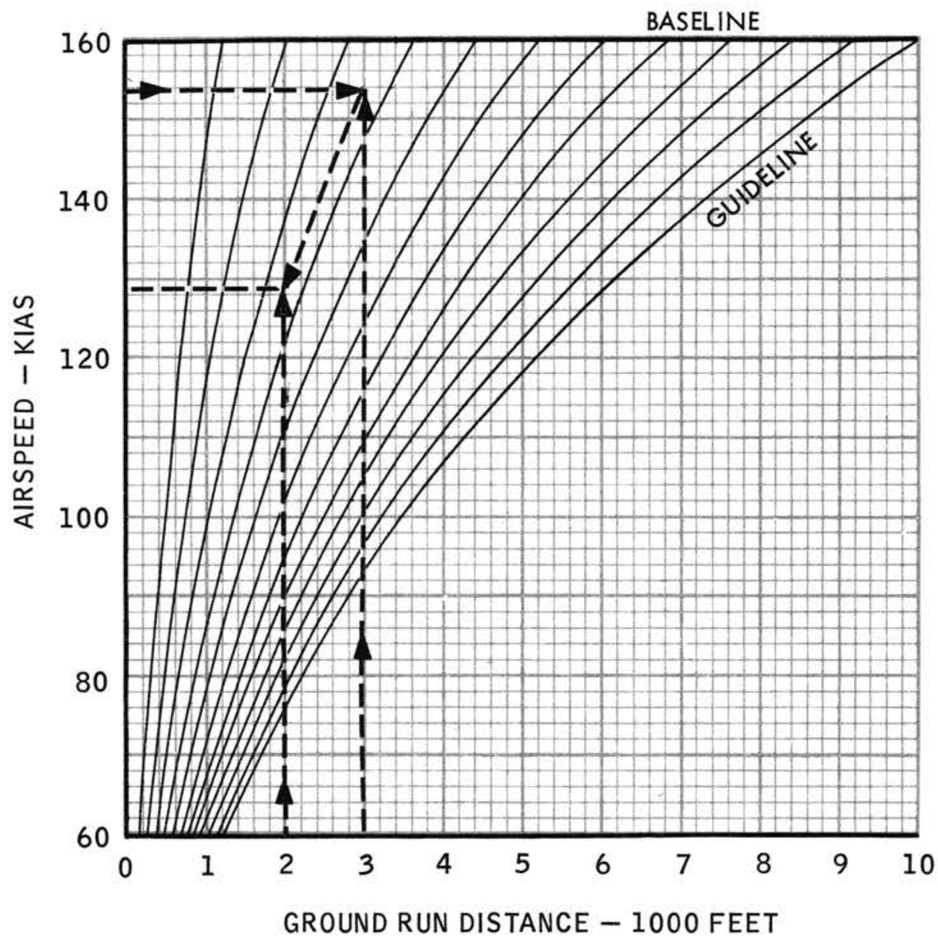
FA2-9.

VELOCITY DURING TAKEOFF GROUND RUN

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

TOLERANCE OF 3 KNOTS FOR EACH 1000 FEET OF RUNWAY IN EXCESS OF ~~NORMAL~~ ACTUAL CRITICAL FIELD LENGTH, NOT TO EXCEED 10 KNOTS.

T-38A 1-410B

FA2-10.

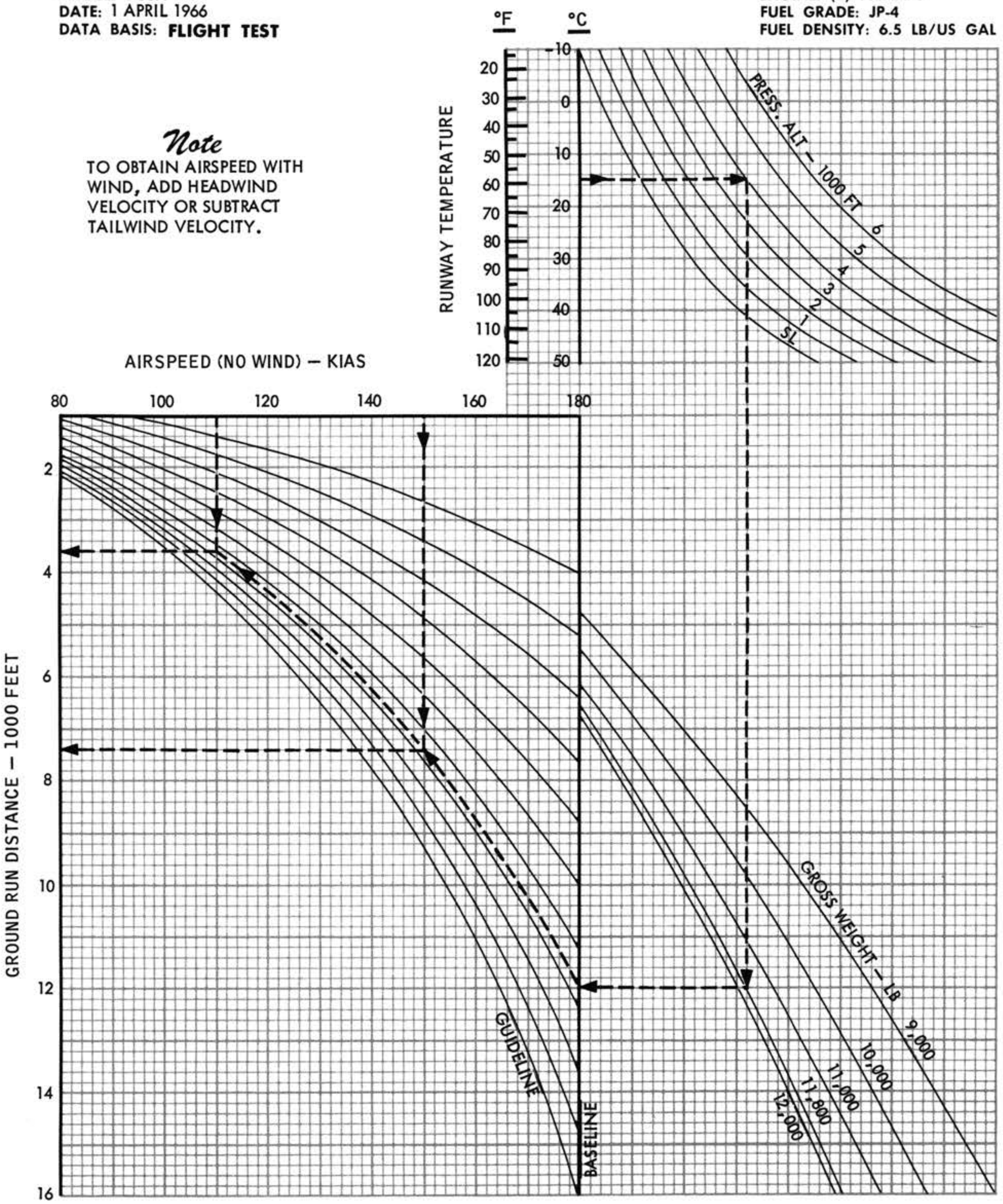
VELOCITY DURING TAKEOFF GROUND RUN

MAXIMUM THRUST
FLAPS — 60%
SINGLE ENGINE

MODEL: T-38A
DATE: 1 APRIL 1966
DATA BASIS: **FLIGHT TEST**

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.



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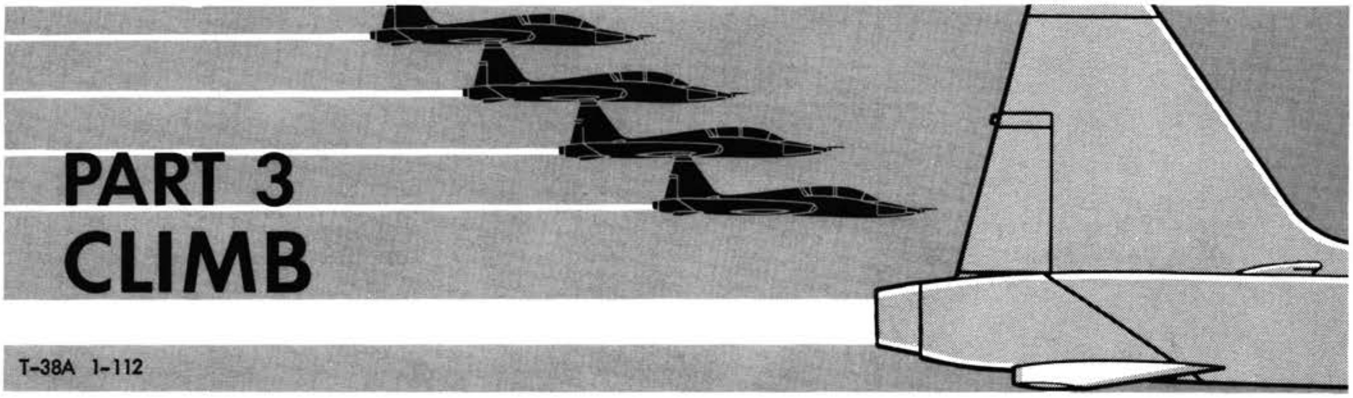
FA2-11.



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PURPOSE OF CHARTS.

The charts provide a means of determining the aircraft climb performance in clean configuration (drag index of 0). Included are ceilings to which the aircraft may climb in the performance of missions.

CLIMB CHARTS.

The climb charts (FA3-1 thru FA3-3) show the climb performance for MIL thrust for both two engines and single engine and MAX thrust for two engines. These 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 start, takeoff, or 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 MIL thrust climb chart (FA3-1) shows 480 pounds of fuel used in climb from sea level to 35,000 feet pressure altitude at an initial gross weight of 11,400 pounds and a temperature 10° C hotter than standard day. The corresponding time and air distance are 7.3 minutes and 62 nautical miles, respectively. Had the initial altitude been 15,000 feet and the gross weight 11,190 pounds, by using successive approximations, the sea level gross weight would be 11,400 pounds (same as above). From sea level to 15,000 feet, the fuel used, time and distance are 210 pounds, 2.0 minutes, and 18 nautical miles, respectively. Then from 15,000 feet to 35,000 feet, the fuel used is 270 pounds (480 − 210), the time is 5.3 minutes (7.3 − 2.0), and 44 nautical miles (62 − 18).

OPTIMUM CRUISE-CLIMB ALTITUDE.

The optimum cruise-climb altitude chart (FA3-4) 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 optimum cruise-climb altitude from FA3-4 is 41,200 feet and 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 (FA3-5) shows the service ceiling that can be attained by flying with MAX or MIL thrust at the climb schedules shown.

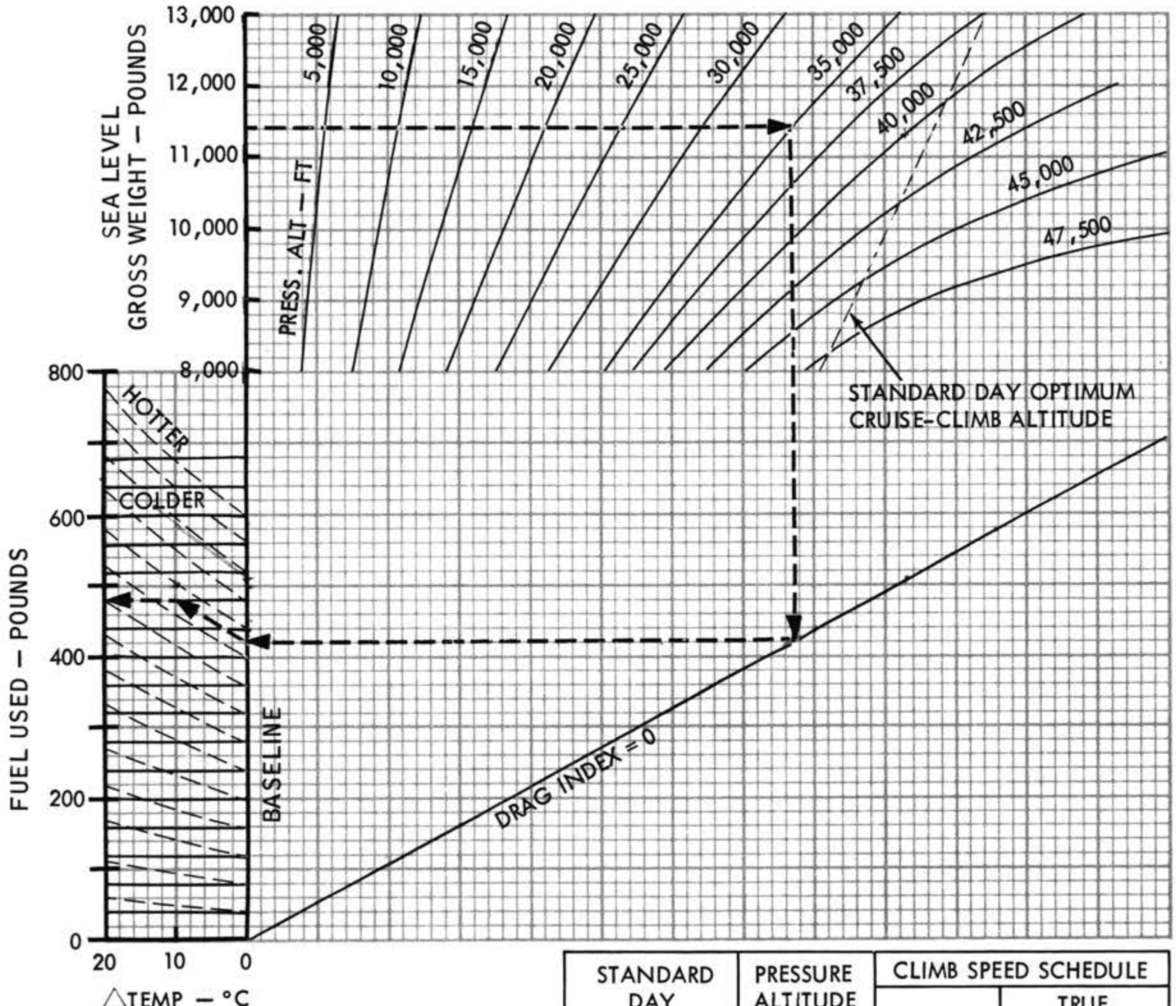
USE OF SINGLE-ENGINE SERVICE CEILING CHART.

FA3-5 shows a single-engine service ceiling of 24,500 feet for MIL thrust and a gross weight of 10,500 pounds.

MIL THRUST CLIMB
FUEL USED
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



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	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

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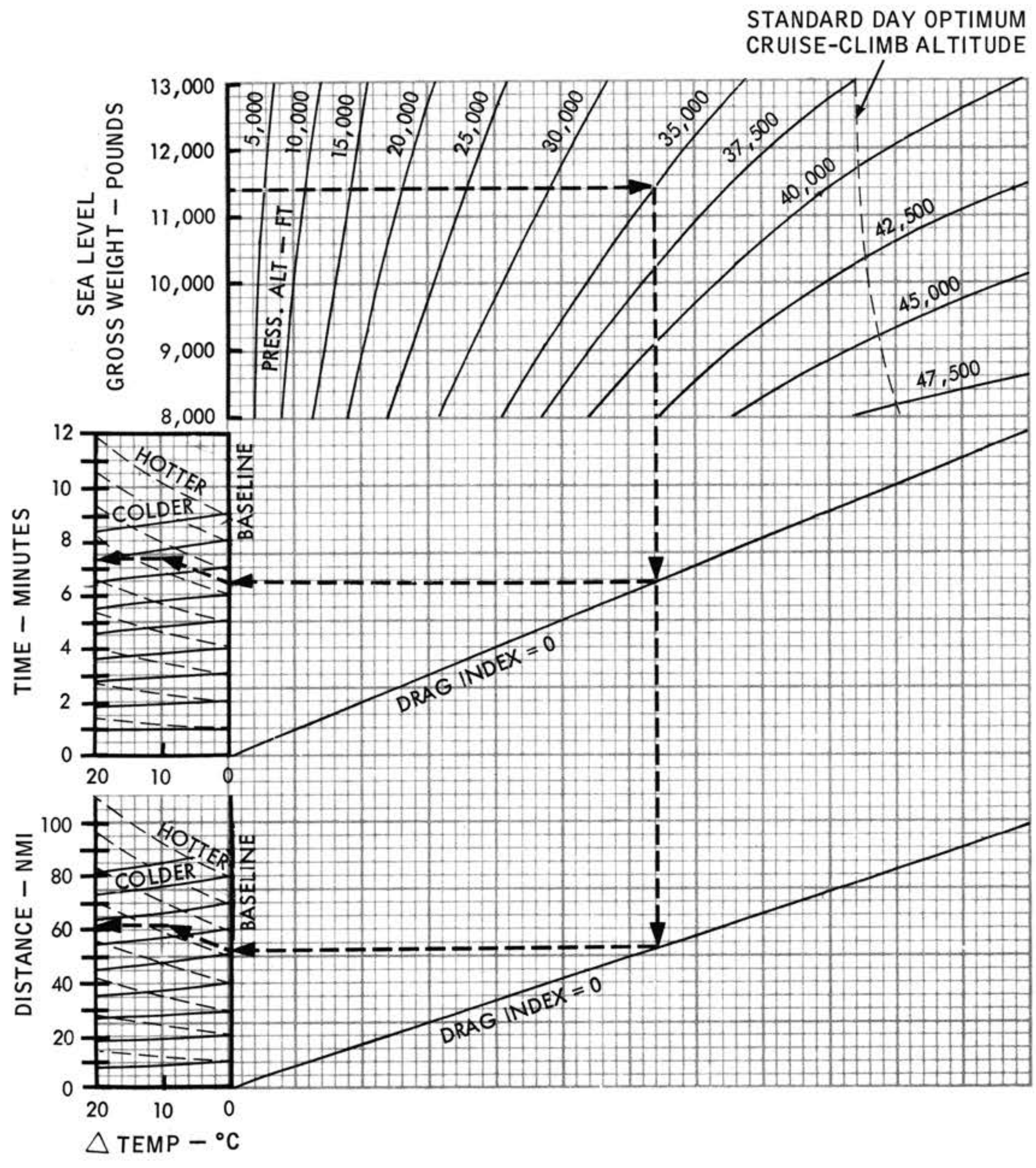
FA3-1. (Sheet 1 of 2)

MIL THRUST CLIMB
TIME TO CLIMB AND DISTANCE TRAVELED
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



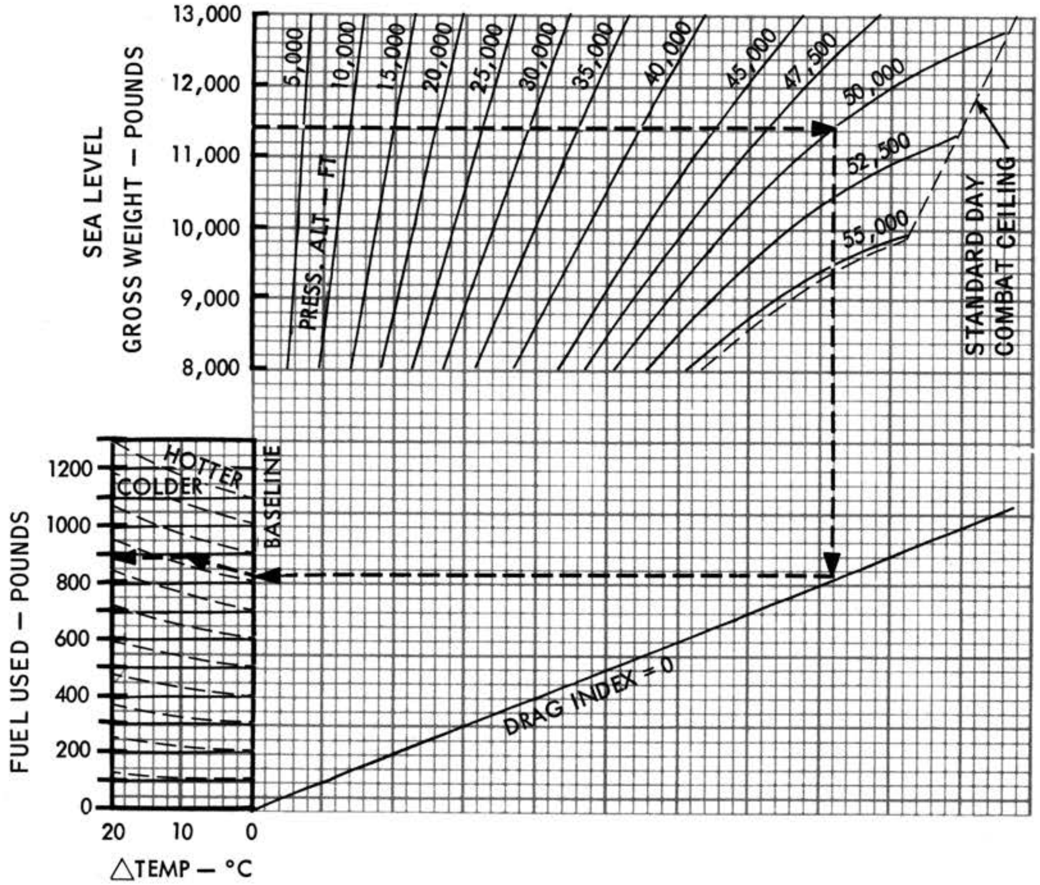
T-38A 1-501(2)B

FA3-1. (Sheet 2 of 2)

MAX THRUST CLIMB
FUEL USED
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



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

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FA3-2. (Sheet 1 of 2)

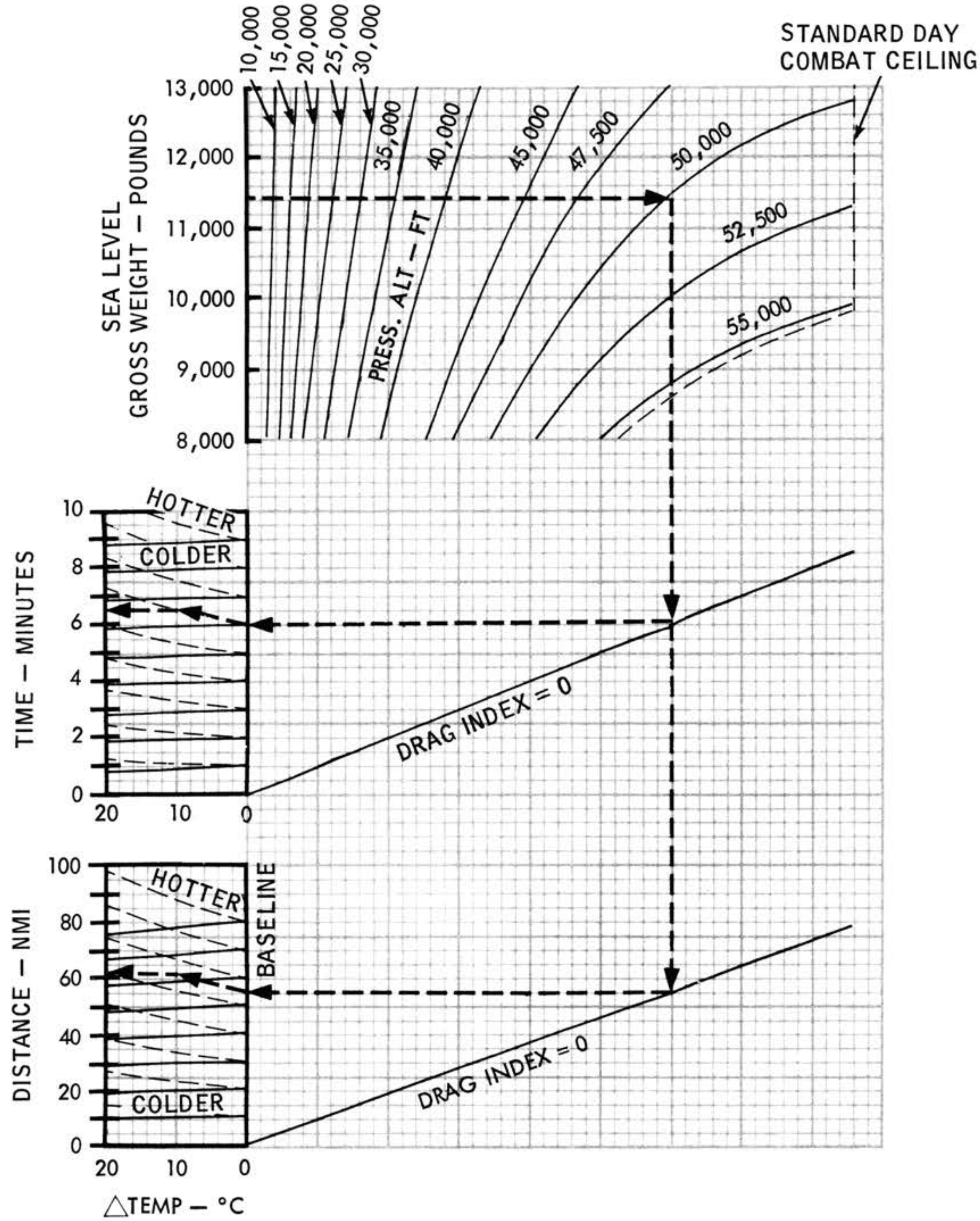
MAX THRUST CLIMB

TIME TO CLIMB AND DISTANCE TRAVELED

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



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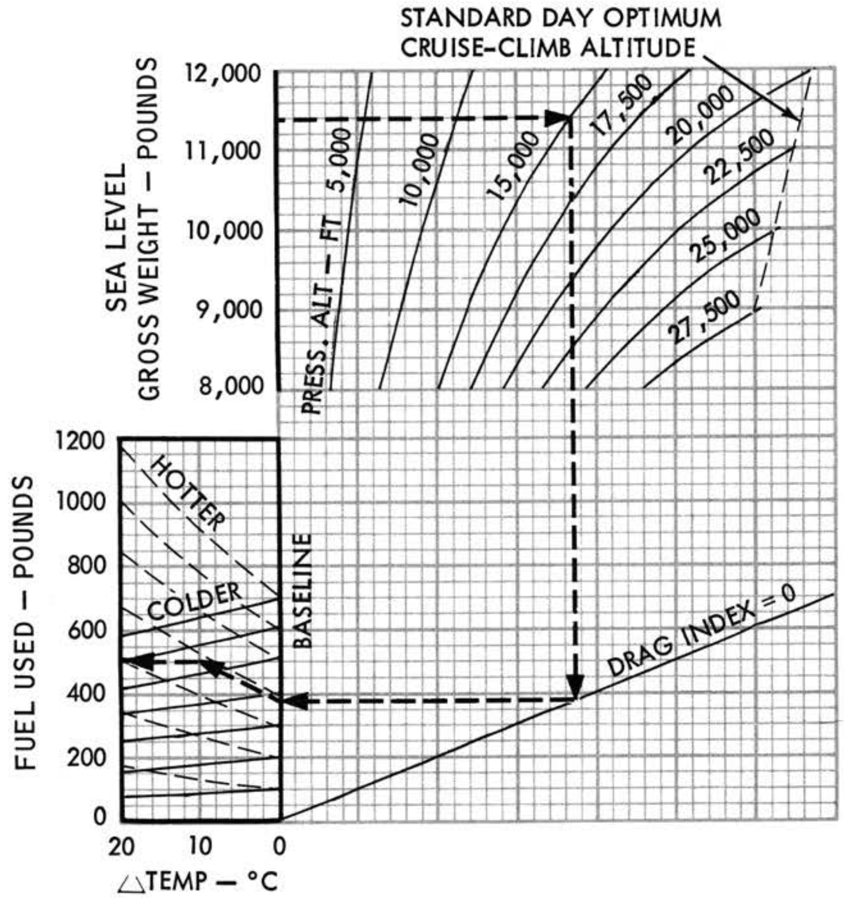
FA3-2. (Sheet 2 of 2)

MIL THRUST CLIMB

FUEL USED
DRAG INDEX = 0
SINGLE ENGINE

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



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

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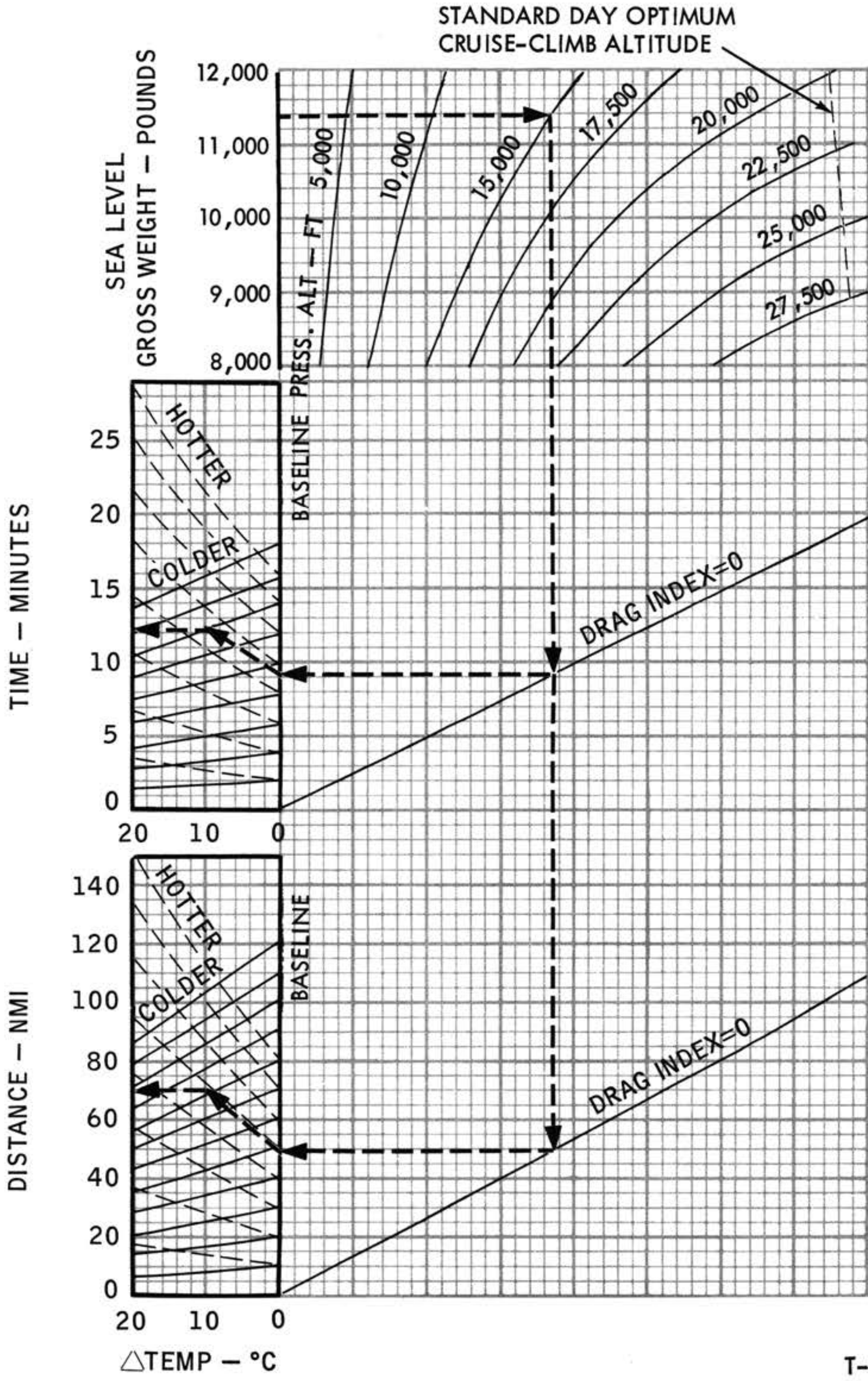
FA3-3. (Sheet 1 of 2)

MIL THRUST CLIMB
TIME TO CLIMB AND DISTANCE TRAVELED
DRAG INDEX = 0
SINGLE ENGINE

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



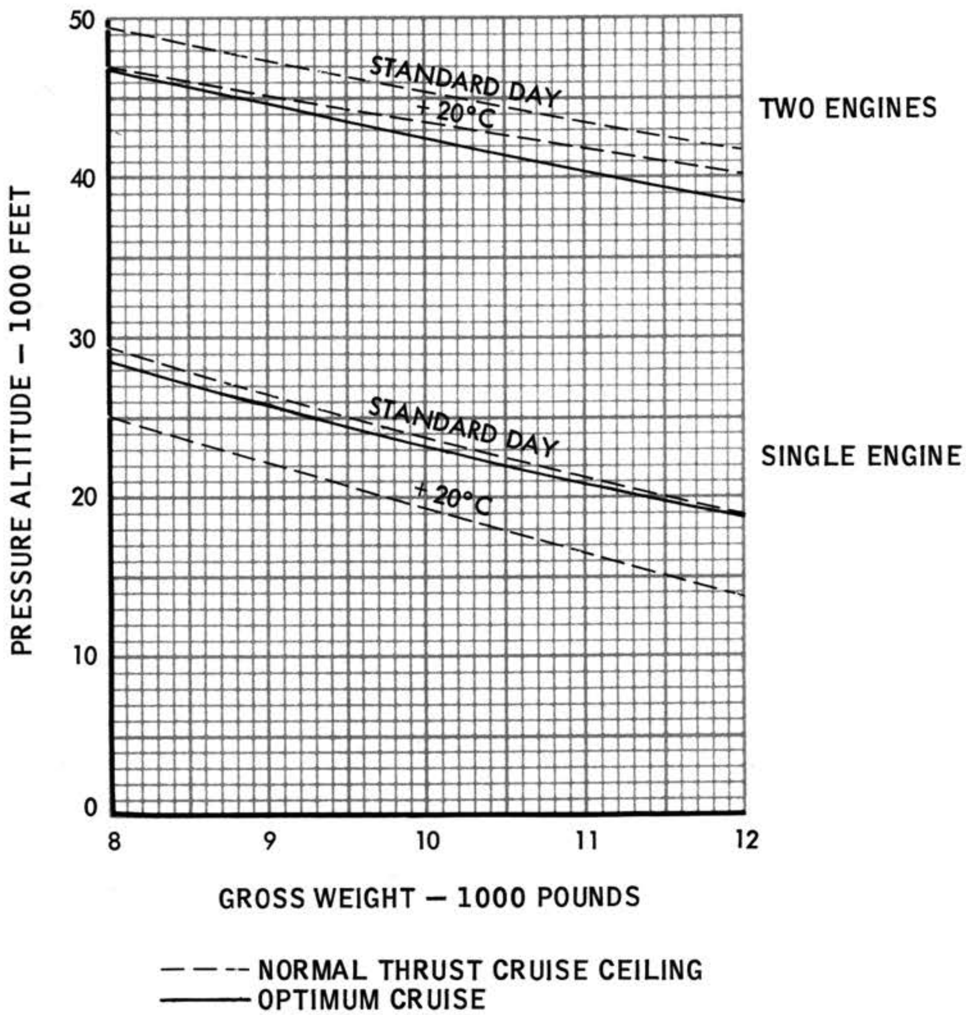
FA3-3. (Sheet 2 of 2)

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



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FA3-4.

SINGLE ENGINE SERVICE CEILING

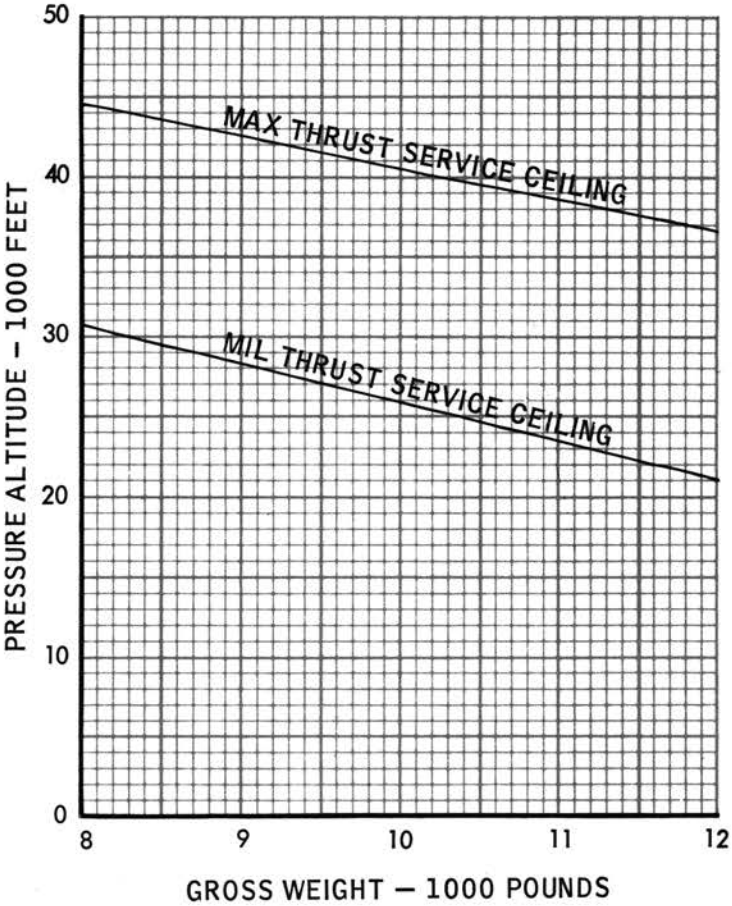
STANDARD DAY
DRAG INDEX = 0

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

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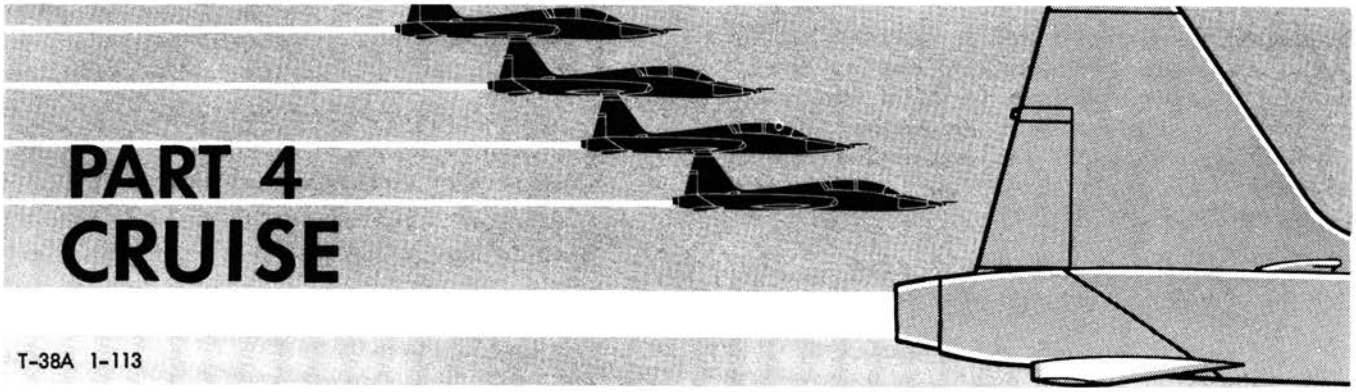
FA3-5.

PART 4 CRUISE



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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 with clean configuration (drag index 0). 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, 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 $-20°$ 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 2 show 0.223 nautical mile per pound of fuel for the assumed mach number and the basic reference number determined on sheet 1. Entering sheet 3 with the assumed mach number and the nautical miles per pound from sheet 2, the chase-thru lines show a true airspeed of 495 knots and fuel flow of 1110 pounds per hour per engine. If the fuel available is 1000 pounds, the cruise distance is 223 nautical miles (0.223×1000) and the time is 27 minutes ($1000 \times 60 \div 1110 \times 2$). When the distance is known instead of the fuel available, the fuel required is computed by the reverse process ($223 \div 0.223 = 1000$) and the average gross weight is obtained by successive approximations, knowing the gross weight at the start of the cruise.

CONSTANT ALTITUDE CRUISE CHARTS.

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 milts. On sheet 1, the chase-thru lines show a mach number of 0.83, a true airspeed and ground speed 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 + ½ × 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 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 and FA4-7 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. 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. Determine which flight profiles in FA4-7 provide necessary range in return to base.

1. In FA4-7, 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	173 nmi.
Second option	184 nmi.
Third option	214 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 until 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 37 minutes for 214 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.

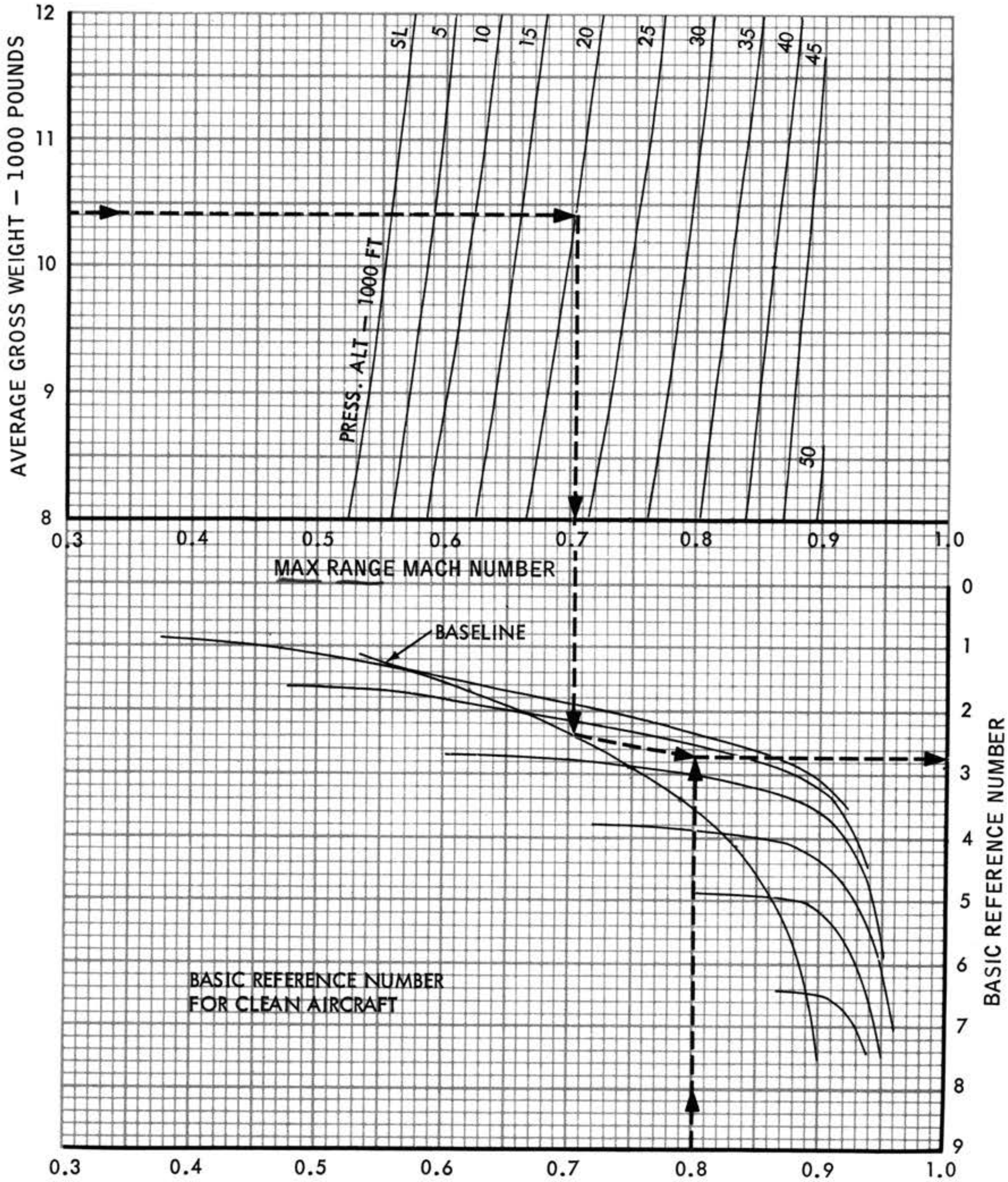
CRUISE

MACH NUMBER AND REFERENCE NUMBER

DRAG INDEX = 0

MODEL: T-38A
DATE: 1 DECEMBER 1965
DATA BASIS: FLIGHT TEST

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-652(1)B

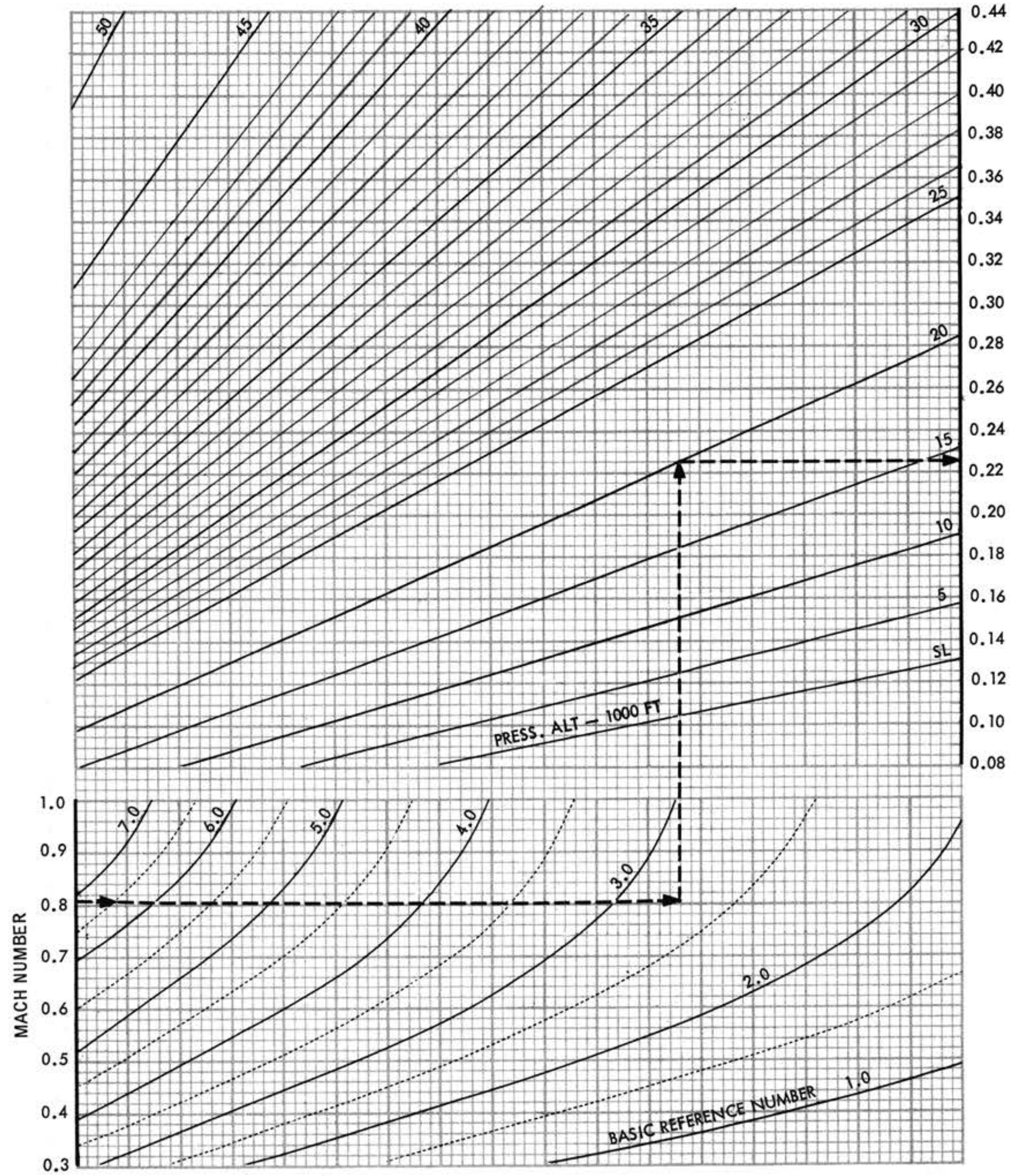
FA4-1. (Sheet 1 of 3)

CRUISE

NAUTICAL MILES PER POUND

MODEL: T-38A
DATE: 1 DECEMBER 1965
DATA BASIS: FLIGHT TEST

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-652(2) A

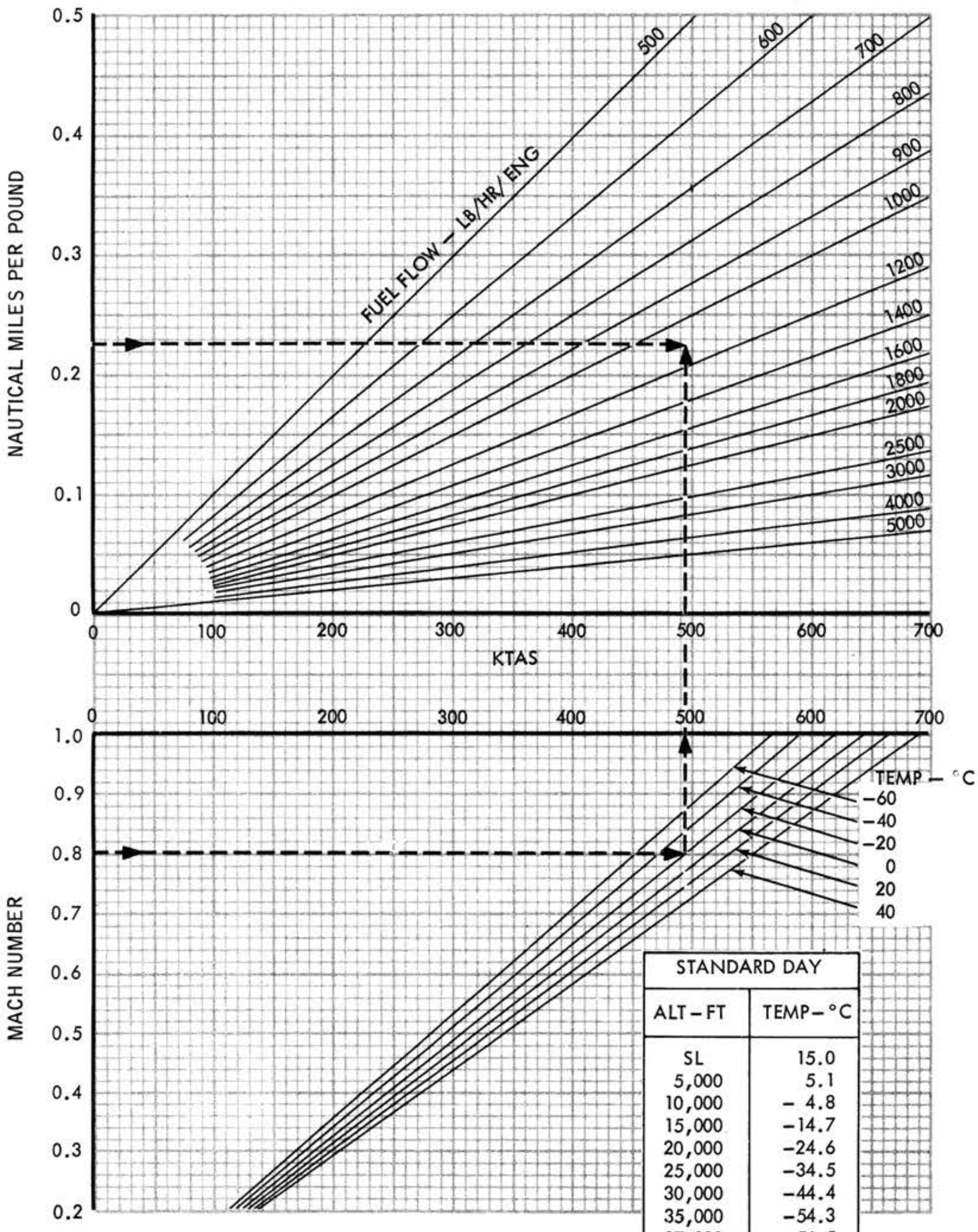
FA4-1. (Sheet 2 of 3)

CRUISE

FUEL FLOW AND TRUE AIRSPEED

MODEL: T-38A
DATE: 1 DECEMBER 1965
DATA BASIS: FLIGHT TEST

ENGINE: 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)A

FA4-1. (Sheet 3 of 3)

CRUISE

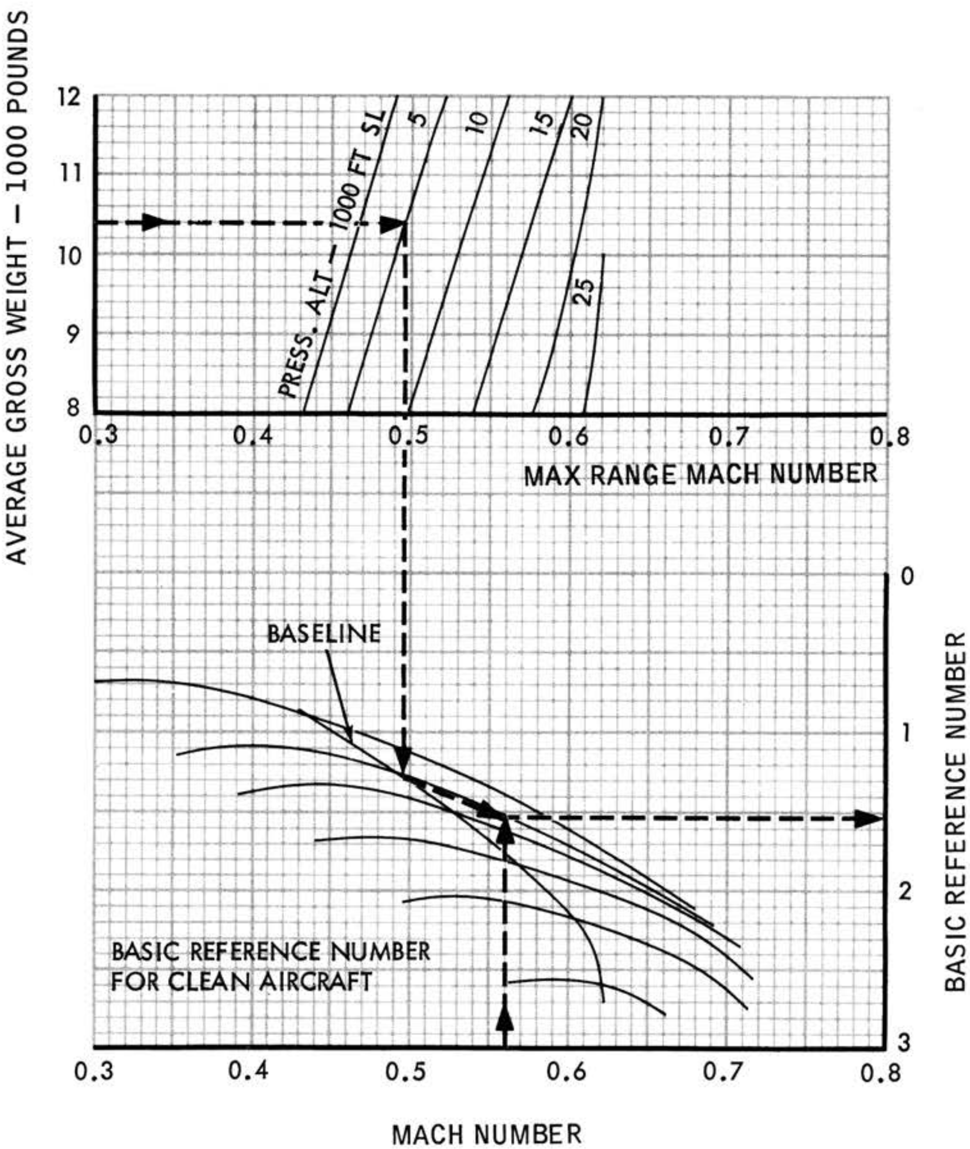
MACH NUMBER AND REFERENCE NUMBER

DRAG INDEX = 0

SINGLE ENGINE

MODEL: T-38A
DATE: 1 DECEMBER 1965
DATA BASIS: FLIGHT TEST

ENGINE: J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



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FA4-2. (Sheet 1 of 3)

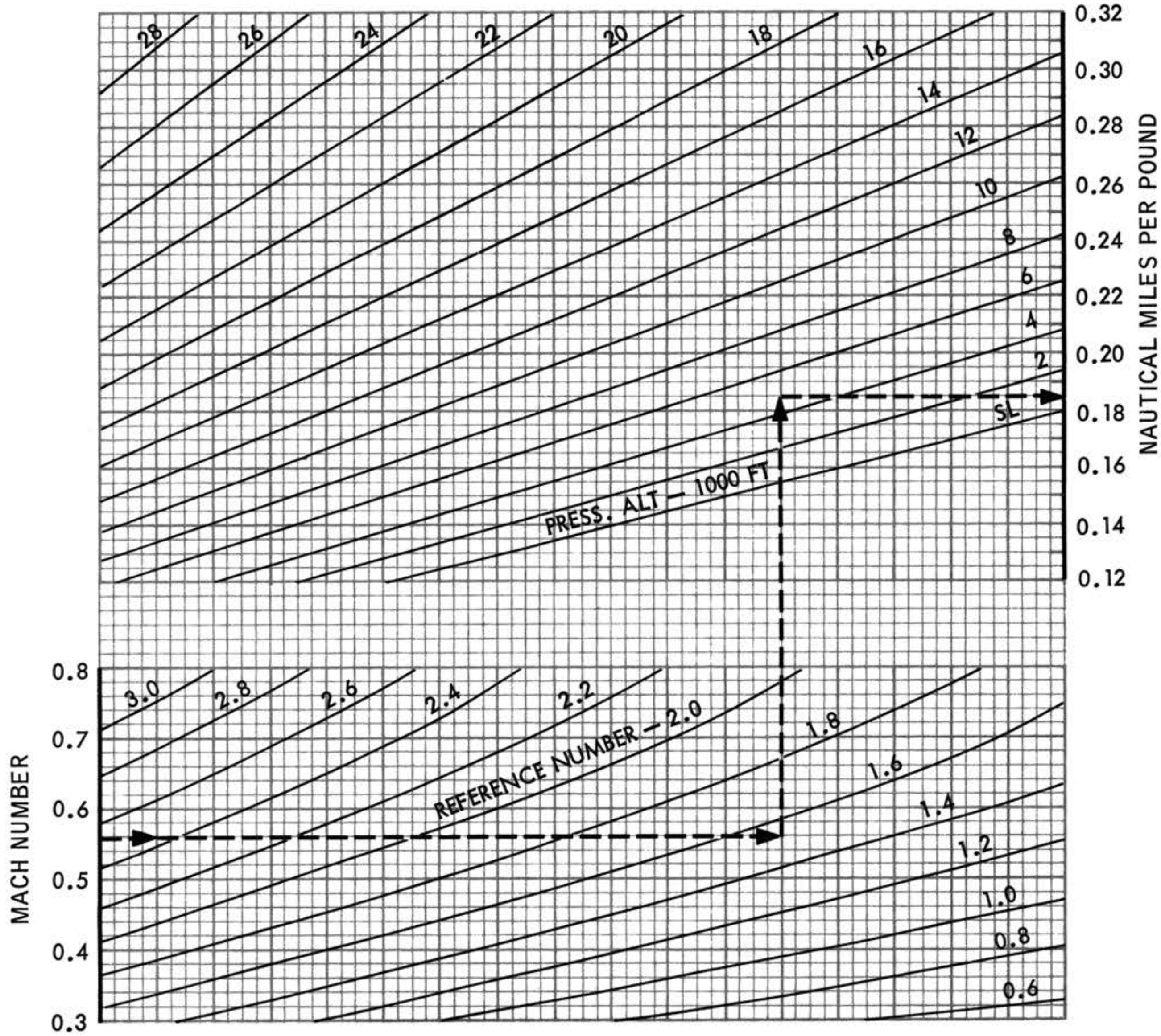
CRUISE

NAUTICAL MILES PER POUND

SINGLE ENGINE

MODEL: T-38A
DATE: 1 DECEMBER 1965
DATA BASIS: FLIGHT TEST

ENGINE: J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-653(2)A

FA4-2. (Sheet 2 of 3)

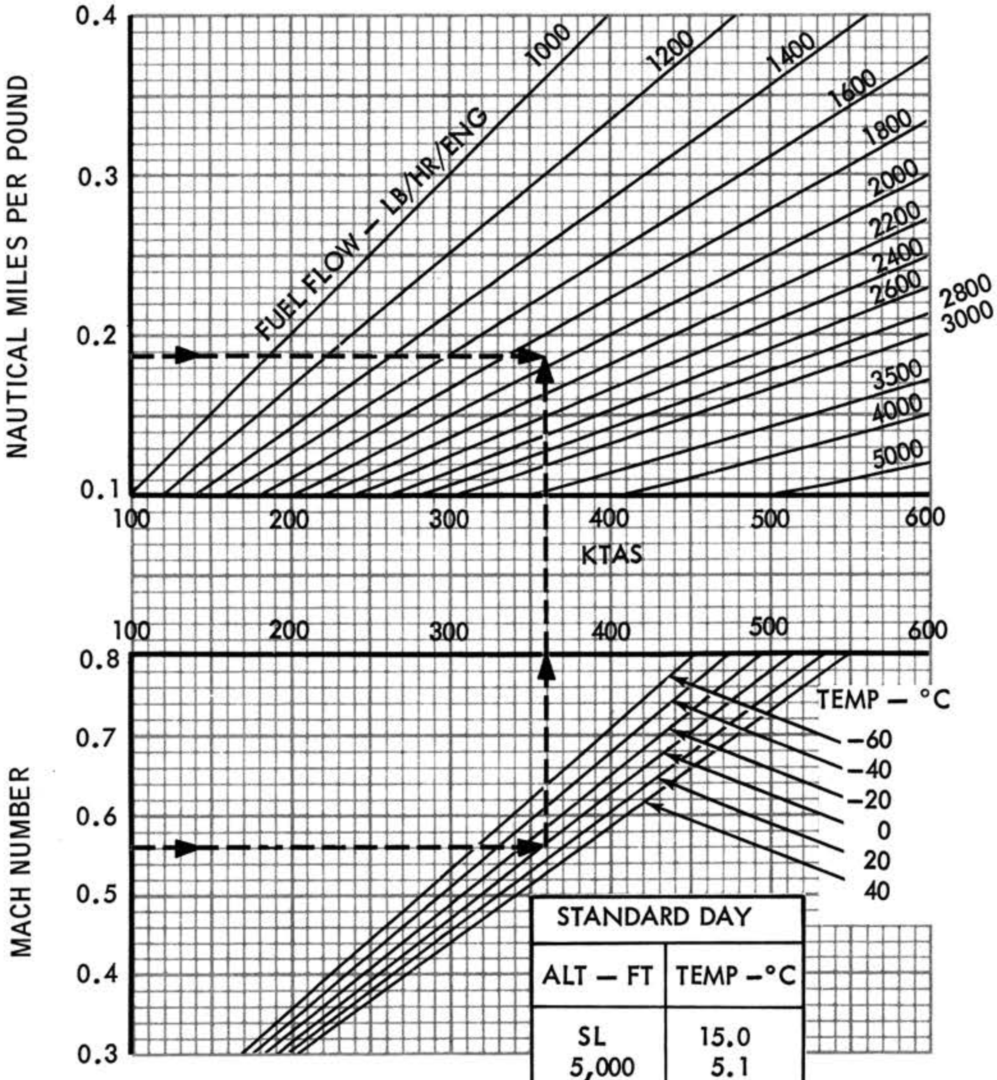
CRUISE

FUEL FLOW AND TRUE AIRSPEED

SINGLE ENGINE

MODEL: T-38A
DATE: 1 DECEMBER 1965
DATA BASIS: FLIGHT TEST

ENGINE: 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

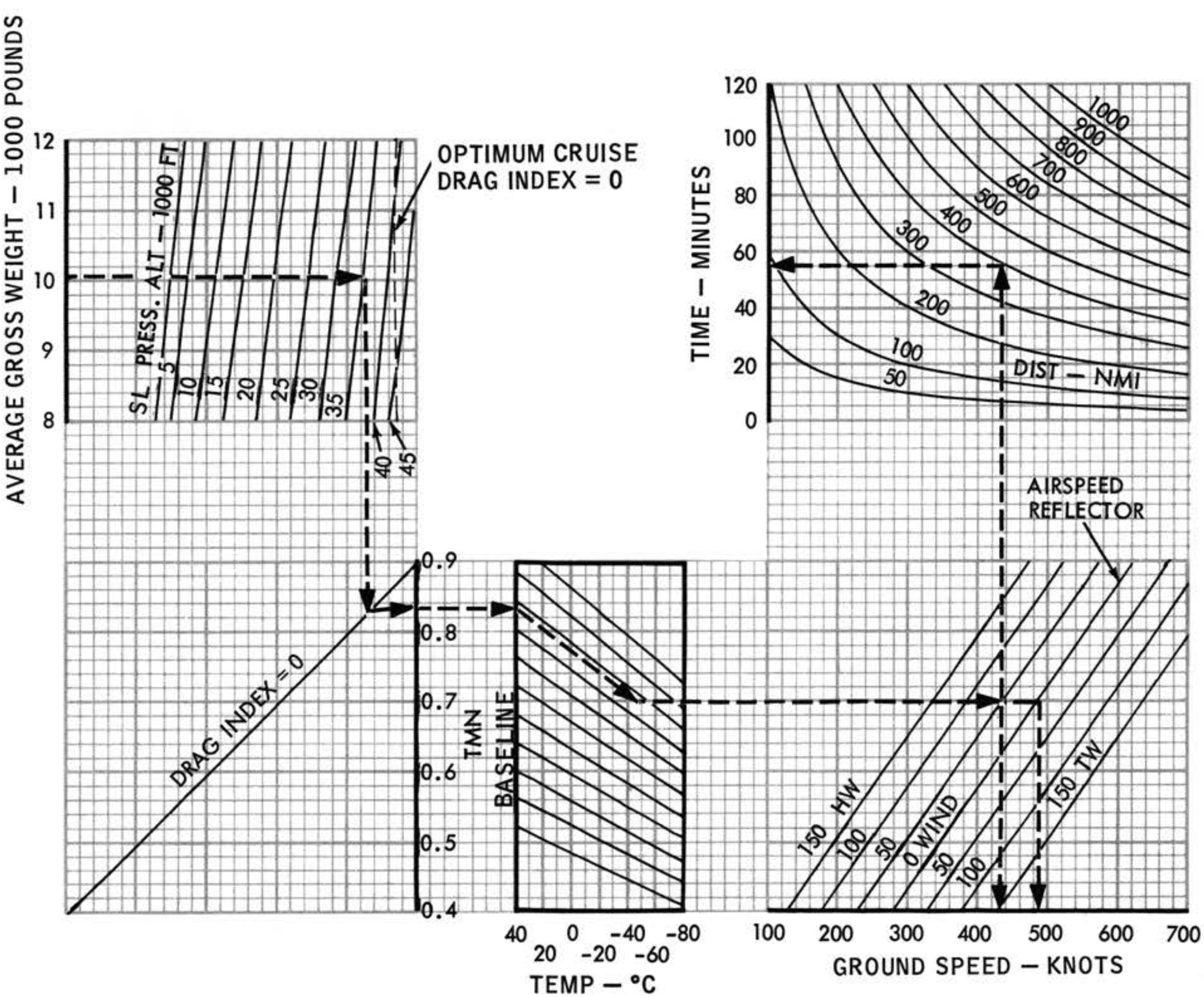
T-38A 1-653(3)A

FA4-2. (Sheet 3 of 3)

CONSTANT ALTITUDE CRUISE
TIME AND AIRSPEED
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



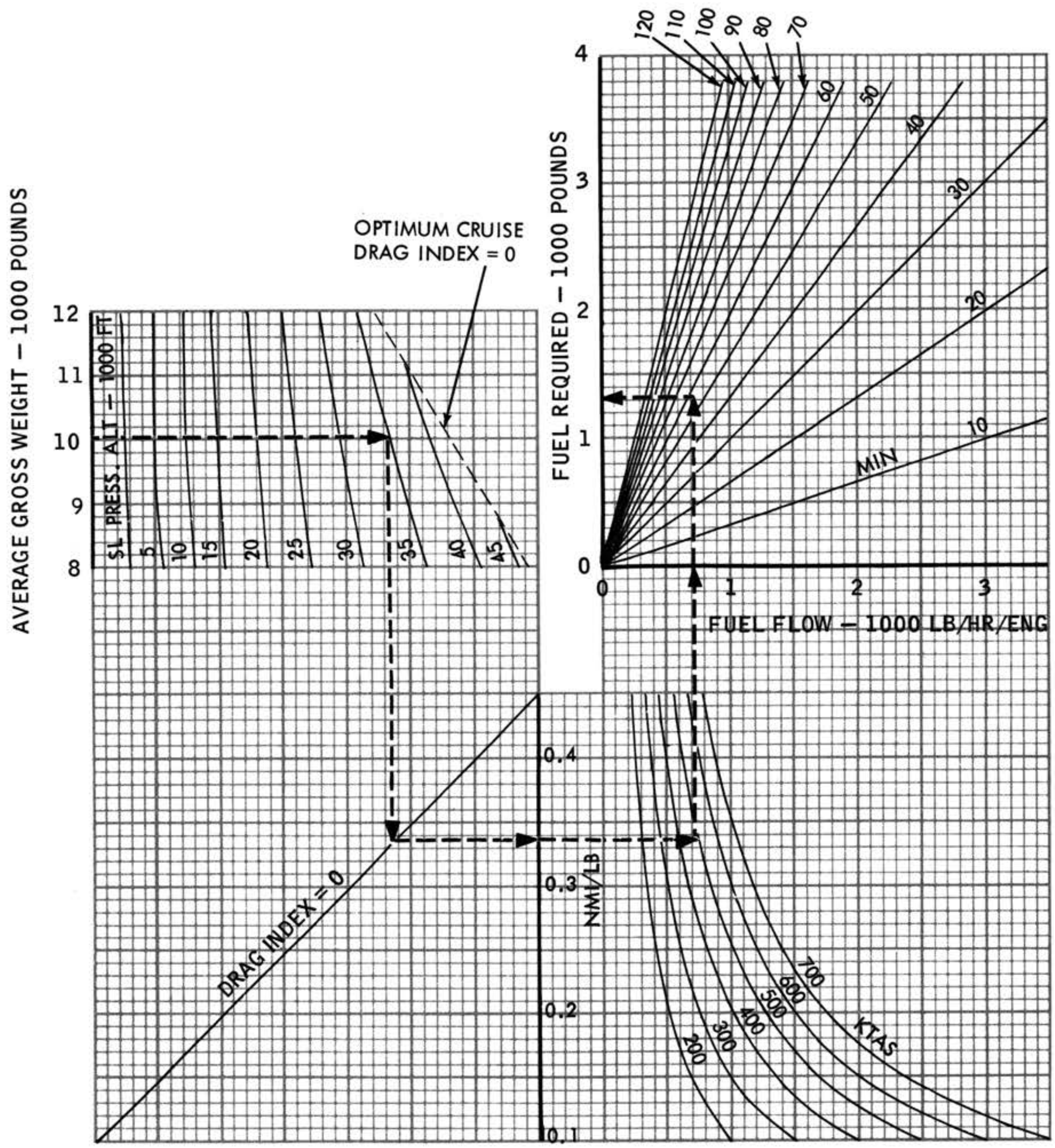
T-38A 1-551(1)B

FA4-3. (Sheet 1 of 2)

CONSTANT ALTITUDE CRUISE
FUEL FLOW AND FUEL REQUIRED
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 1-551(2)B

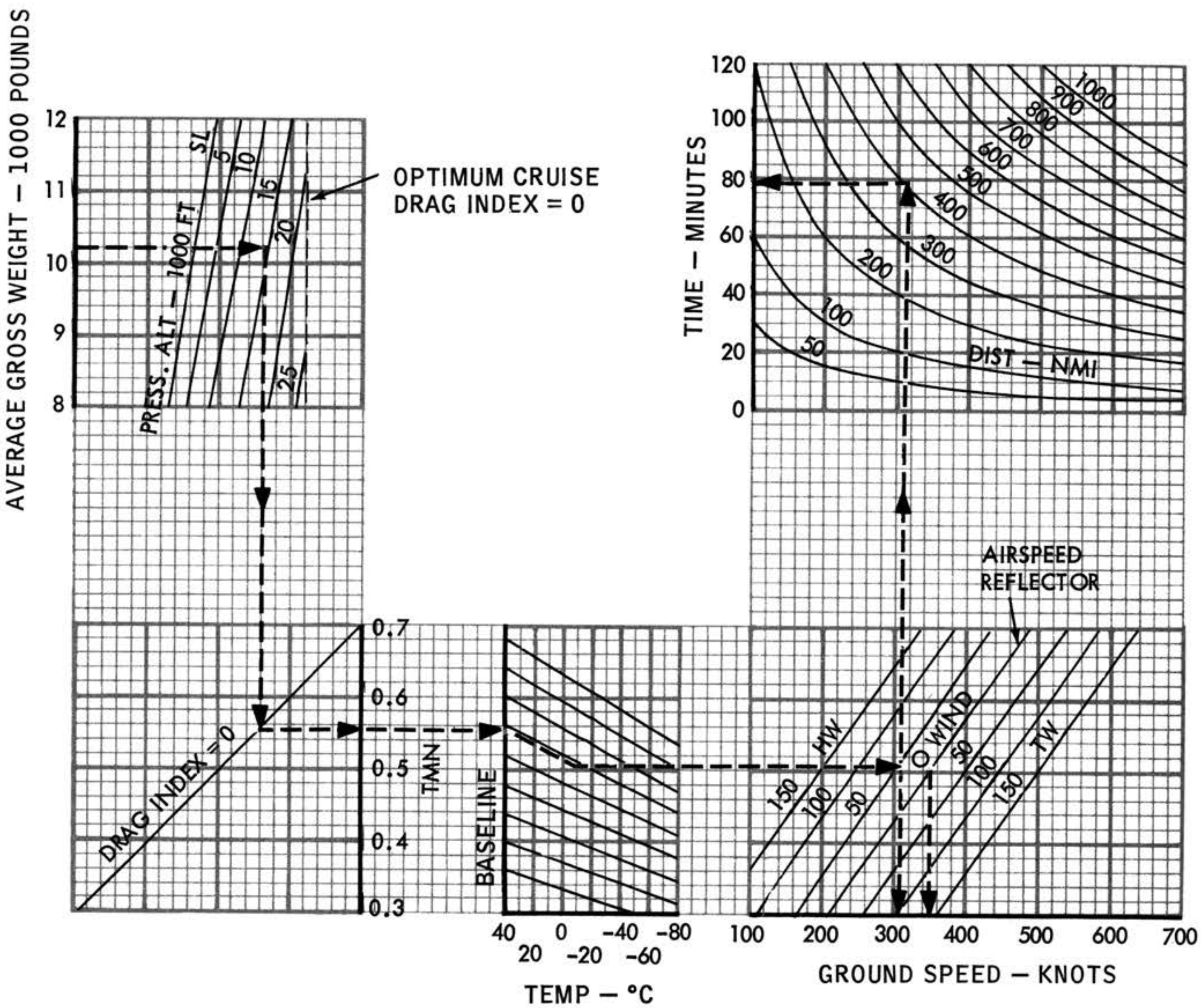
FA4-3. (Sheet 2 of 2)

CONSTANT ALTITUDE CRUISE

TIME AND AIRSPEED
DRAG INDEX = 0
SINGLE ENGINE

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 1-553(1)A

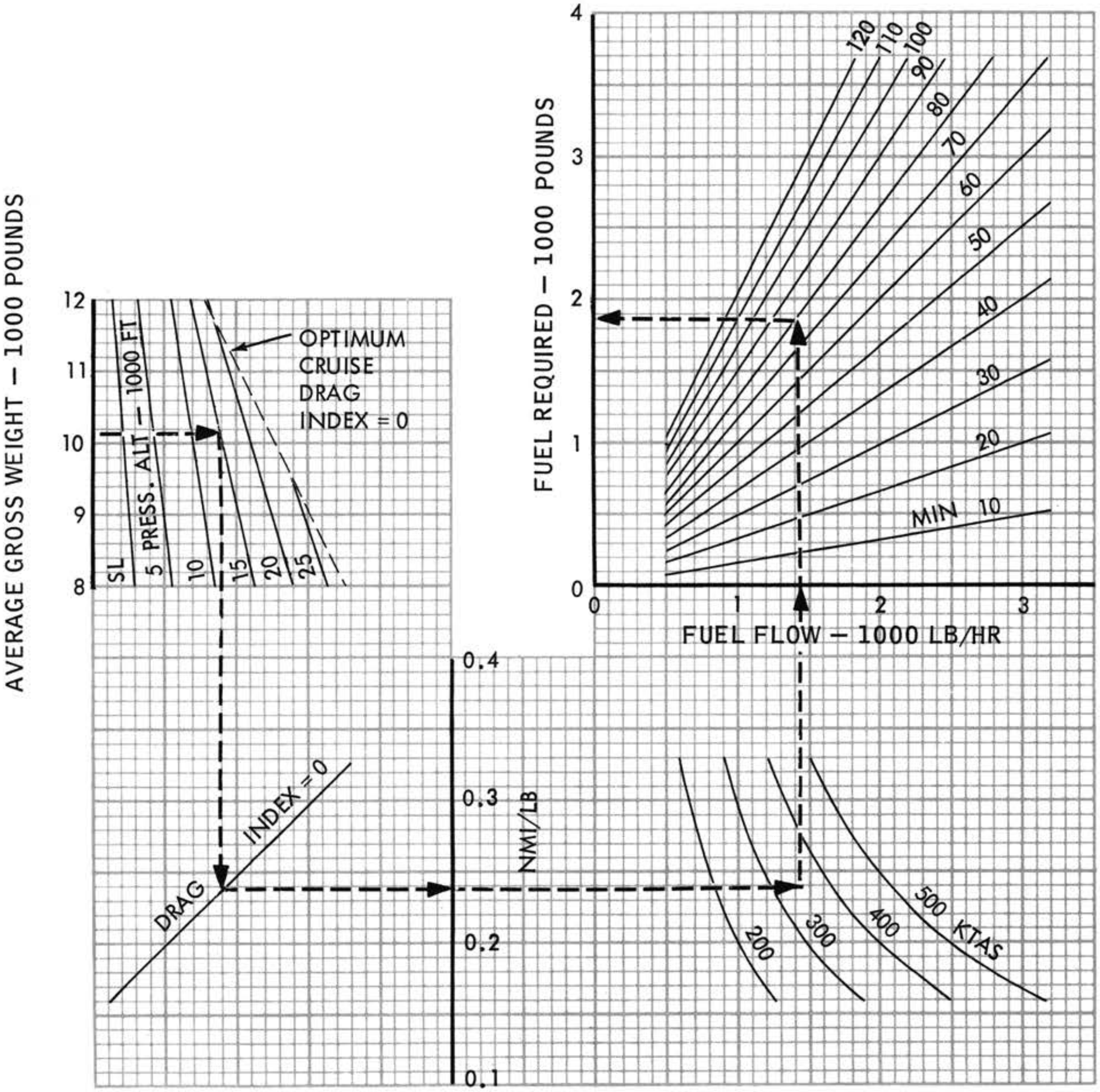
FA4-4. (Sheet 1 of 2)

CONSTANT ALTITUDE CRUISE

FUEL FLOW AND FUEL REQUIRED
DRAG INDEX = 0
SINGLE ENGINE

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 1-553(2)B

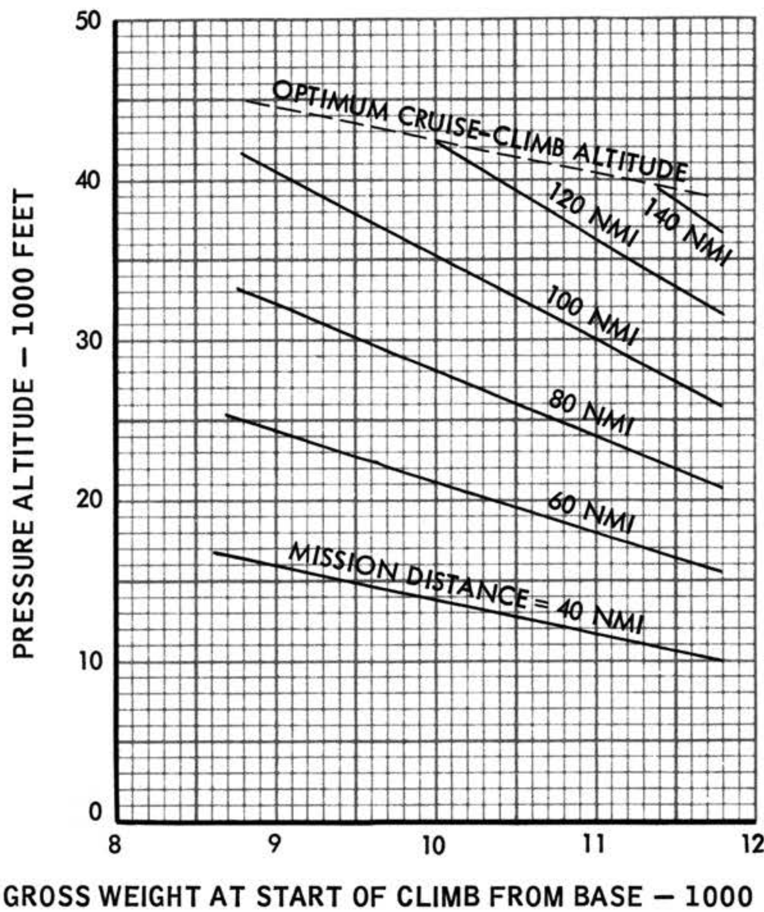
FA4-4. (Sheet 2 of 2)

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 1-550A

FA4-5.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND
TWO ENGINE

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

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	39	44	49	54	59	64	69	74	79	83	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	7	9	11	13	15	17	19	21	23	25	
	1000 FT	10/25	15/30	20/35	25/35	25/40	30/40	35/45	40/45	40/45	45	OPTIMUM ALTITUDE
	NMI	43	48	54	60	67	74	82	90	98	104	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	9	10	11	12	13	14	15	17	19	20	
	NMI	70	79	89	99	109	120	132	145	156	163	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	12	13	15	16	18	19	20	21	23	25	
800 LB	NMI	65	75	85	95	106	118	131	144	156	167	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	11	14	16	19	22	24	26	30	32	34	
	1000 FT	25/35	25/40	30/40	30/45	35/45	40/45	40/45	40/45	45	45	OPTIMUM ALTITUDE
	NMI	89	99	111	122	133	144	155	166	177	188	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	16	18	20	22	24	25	27	28	29	30	
	NMI	136	150	164	178	191	203	215	227	238	247	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	22	23	24	26	27	29	30	32	33	34	
1000 LB	NMI	91	105	119	134	152	171	191	213	236	252	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	15	19	22	25	29	32	35	39	42	45	
	1000 FT	45	45	45	45	45	45	45	45	45	45	OPTIMUM ALTITUDE
	NMI	162	174	187	201	215	227	238	245	260	271	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	27	28	30	31	33	35	36	38	39	40	
	NMI	219	233	247	261	274	286	297	308	320	331	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	31	32	33	36	37	39	40	41	42	44	
1400 LB	NMI	141	164	189	216	245	278	313	352	387	413	CRUISE AT INITIAL ALTITUDE TO BASE (1)
	MIN	24	29	33	37	42	46	51	56	61	65	
	1000 FT	45	45	45	45	45	45	45	45	45	45	OPTIMUM ALTITUDE
	NMI	319	334	348	362	375	387	399	411	423	435	USE OPTIMUM ALTITUDE UNTIL OVER BASE (2)
	MIN	45	47	49	50	53	54	55	56	57	59	
	NMI	377	394	408	422	435	448	452	468	482	495	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE (3)
	MIN	50	52	54	55	56	58	59	60	62	64	
CRUISE ALT		SL	5	10	15	20	25	30	35	40	45	***Note*** WITH MORE THAN 1400 POUNDS FUEL, CRUISE AT 0.87 MACH, PRESSURE ALTITUDE 43,000 FEET.
CRUISE MACH NO.		0.54	0.56	0.60	0.64	0.68	0.73	0.77	0.81	0.85	0.87	
DESCEND 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 EXTENDED.
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 EXTENDED, 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

T-38A 1-555D

FA4-6.

DIVERSION RANGE SUMMARY TABLE

CONSTANT ALTITUDE CRUISE
STANDARD DAY ZERO WIND
SINGLE ENGINE

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

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	53 11	60 13	66 15	72 18	77 20	82 22	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE 1
	1000 FT	0/10	5/15	10/20	15/25	20/25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	53 11	61 13	68 14	75 16	81 17	87 18	94 19	102 21	111 22	121 23	USE OPTIMUM ALTITUDE UNTIL OVER BASE 2
	NMI MIN	67 13	78 15	89 17	100 19	111 20	120 21	129 22	138 24	147 25	156 26	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE 3
800 LB	NMI MIN	88 18	100 21	112 24	123 27	133 30	142 32	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE 1
	1000 FT	5/10	10/15	15/20	20/25	20/25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	94 20	105 22	116 24	127 25	138 26	147 28	155 30	163 31	172 32	181 33	USE OPTIMUM ALTITUDE UNTIL OVER BASE 2
	NMI MIN	105 22	125 24	142 26	156 28	168 30	179 32	189 33	198 34	207 35	216 36	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE 3
1000 LB	NMI MIN	122 25	140 29	157 33	173 36	188 39	202 42	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE 1
	1000 FT	10/15	15/20	20/20	20/25	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	143 29	157 31	171 33	184 25	195 37	205 38	214 40	223 41	232 42	241 43	USE OPTIMUM ALTITUDE UNTIL OVER BASE 2
	NMI MIN	171 31	186 33	200 35	214 37	227 39	240 41	250 43	258 44	266 45	276 46	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE 3
1400 LB	NMI MIN	191 39	219 45	249 50	272 54	296 58	320 61	— —	— —	— —	— —	CRUISE AT INITIAL ALTITUDE TO BASE 1
	1000 FT	15/20	15/20	20/25	20/25	25	25	25	25	25	25	OPTIMUM ALTITUDE
	NMI MIN	245 47	256 49	269 51	288 53	307 56	321 58	331 60	340 61	349 62	358 63	USE OPTIMUM ALTITUDE UNTIL OVER BASE 2
	NMI MIN	281 51	297 53	313 55	329 57	344 59	357 61	367 62	377 63	387 64	397 65	USE OPTIMUM ALTITUDE AND DESCEND ON COURSE 3

		SL	5	10	15	20	25	30–45
CRUISE ALT		SL	5	10	15	20	25	DESCEND TO 25,000 FT
CRUISE MACH NO.		0.44	0.47	0.50	0.54	0.58	0.62	USE IDLE THRUST AND 240 KCAS WITH SPEED BRAKE CLOSED.
DESCEND 240 KCAS IDLE	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.

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 EXTENDED.
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 EXTENDED, 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

T-38A 1-556C

FA4-7.

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PURPOSE OF CHARTS.

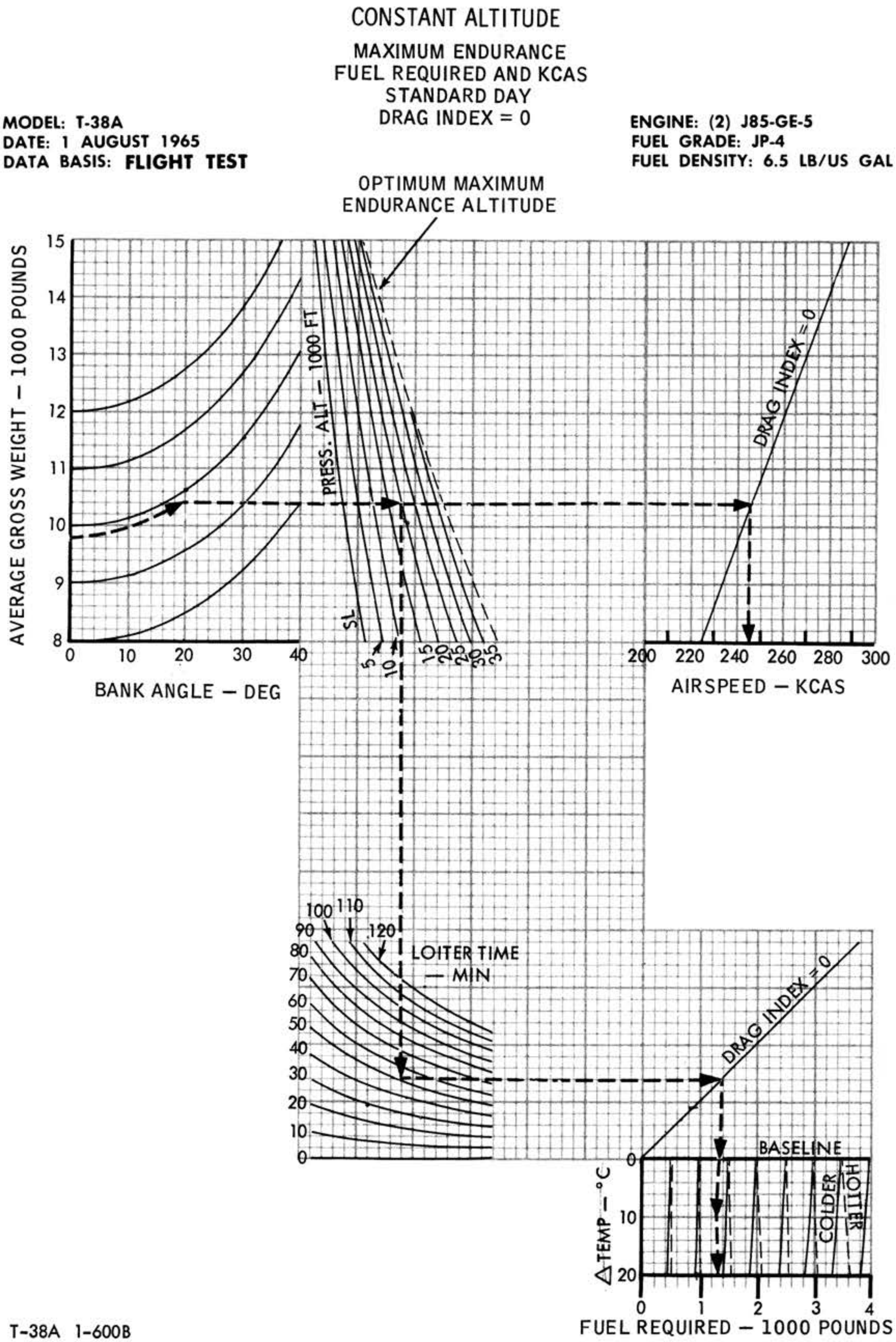
The endurance charts provide a means of determining the optimum mach number and the fuel required to loiter at a given altitude for a specified length of time. Data are presented for operation with clean configuration (drag index 0).

CONSTANT ALTITUDE MAXIMUM ENDURANCE.

The constant altitude maximum endurance charts FA5-1 and FA5-2) are for two-engine and single-engine operation. They show the endurance performance in terms of average gross weight, bank angle, pressure altitude, and deviation of temperature from standard. Also, the optimum maximum endurance altitude is shown on each chart and represents the maximum endurance for a given weight and bank angle. When the fuel required is unknown, the average weight is obtained by successive approximations.

USE OF CONSTANT ALTITUDE MAXIMUM ENDURANCE CHARTS.

The chase-thru lines on FA5-1 represent an average gross weight of 9800 pounds, bank angle of 20 degrees, pressure altitude of 20,000 feet, loiter time of 50 minutes, and a temperature deviation of 10° C colder than standard. These lines show a loiter speed of 246 KCAS, and 1350 pounds of fuel required. The gross weight at start of loiter is 10,475 pounds (9800 + ½ × 1350).


CONSTANT ALTITUDE
MAXIMUM ENDURANCE
FUEL REQUIRED AND KCAS
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
OPTIMUM MAXIMUM ENDURANCE ALTITUDE
AVERAGE GROSS WEIGHT — 1000 POUNDS
PRESS. ALT — 1000 FT
SL
5
10
15
20
25
30
35
DRAG INDEX = 0
BANK ANGLE — DEG
AIRSPEED — KCAS
LOITER TIME — MIN
100
110
90
120
BASELINE
COLDER
HOTTER
ΔTEMP — °C
FUEL REQUIRED — 1000 POUNDS
T-38A 1-600B

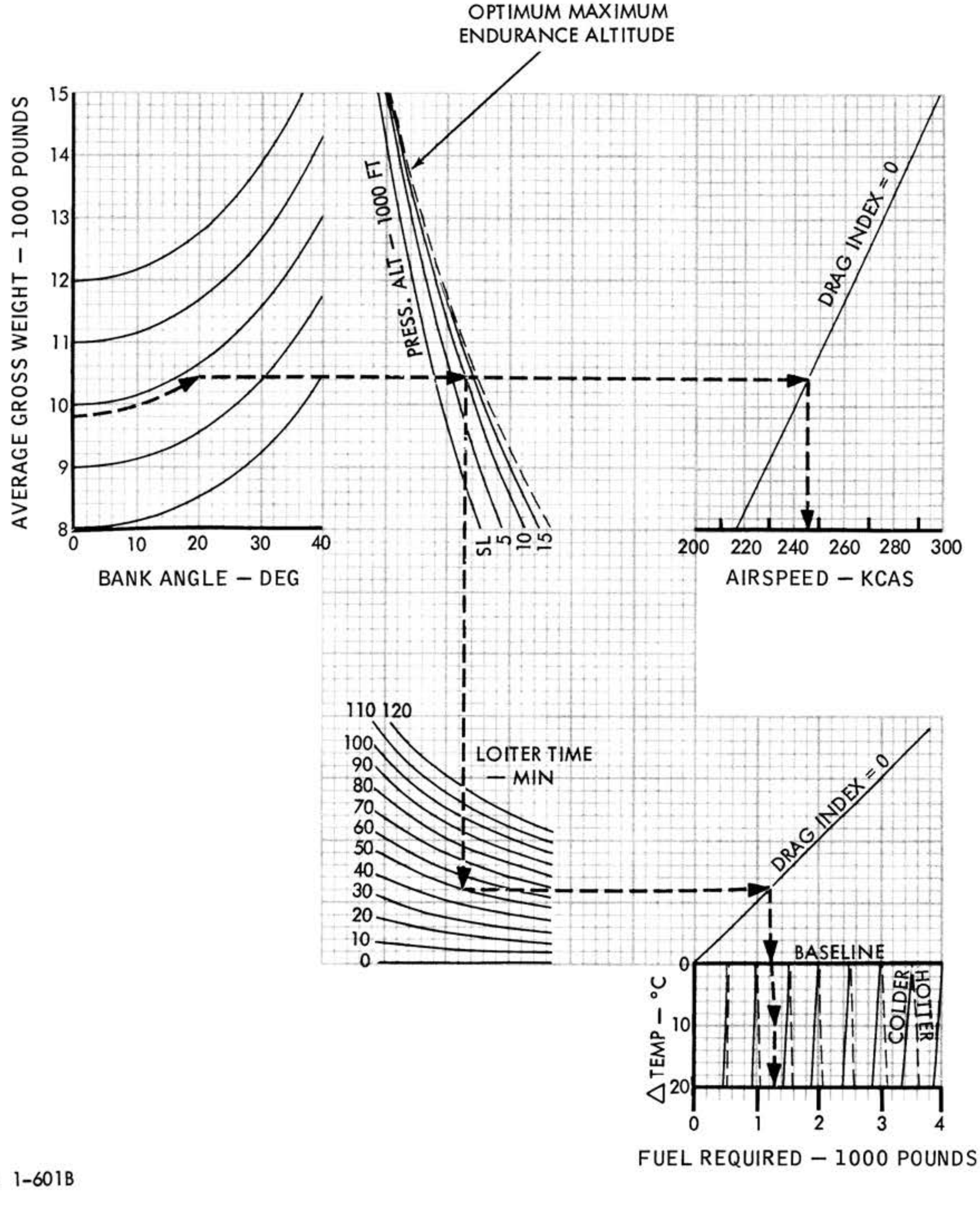
FA5-1.

CONSTANT ALTITUDE

MAXIMUM ENDURANCE
FUEL REQUIRED AND KCAS
STANDARD DAY
DRAG INDEX = 0
SINGLE ENGINE

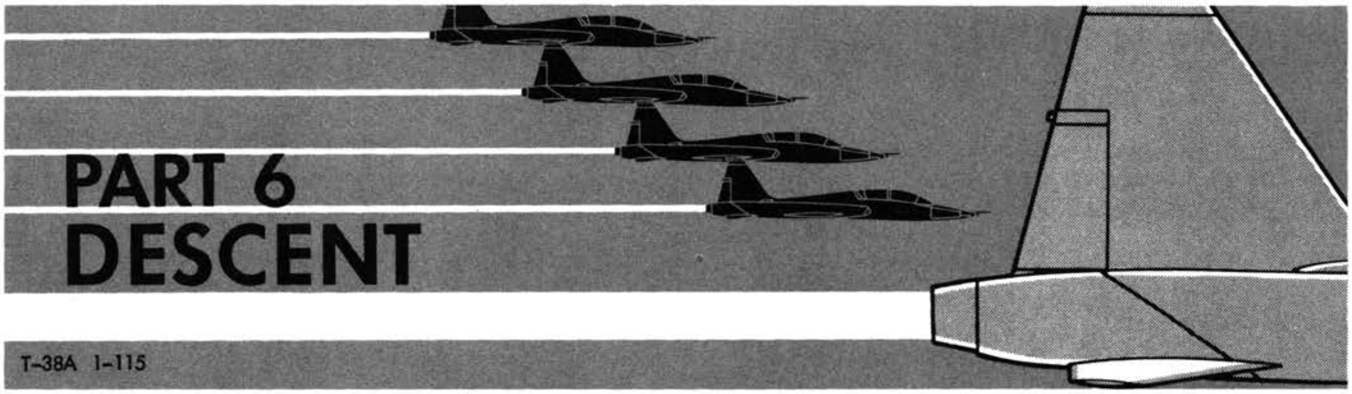
MODEL: T-38A
DATE: 1 AUGUST 1965
DATA BASIS: **FLIGHT TEST**

ENGINE: (2) J85-GE-5
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/US GAL



T-38A 1-601B

FA5-2.



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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 opened. These charts are for operation with clean configuration (drag index of 0).

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 gives 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.

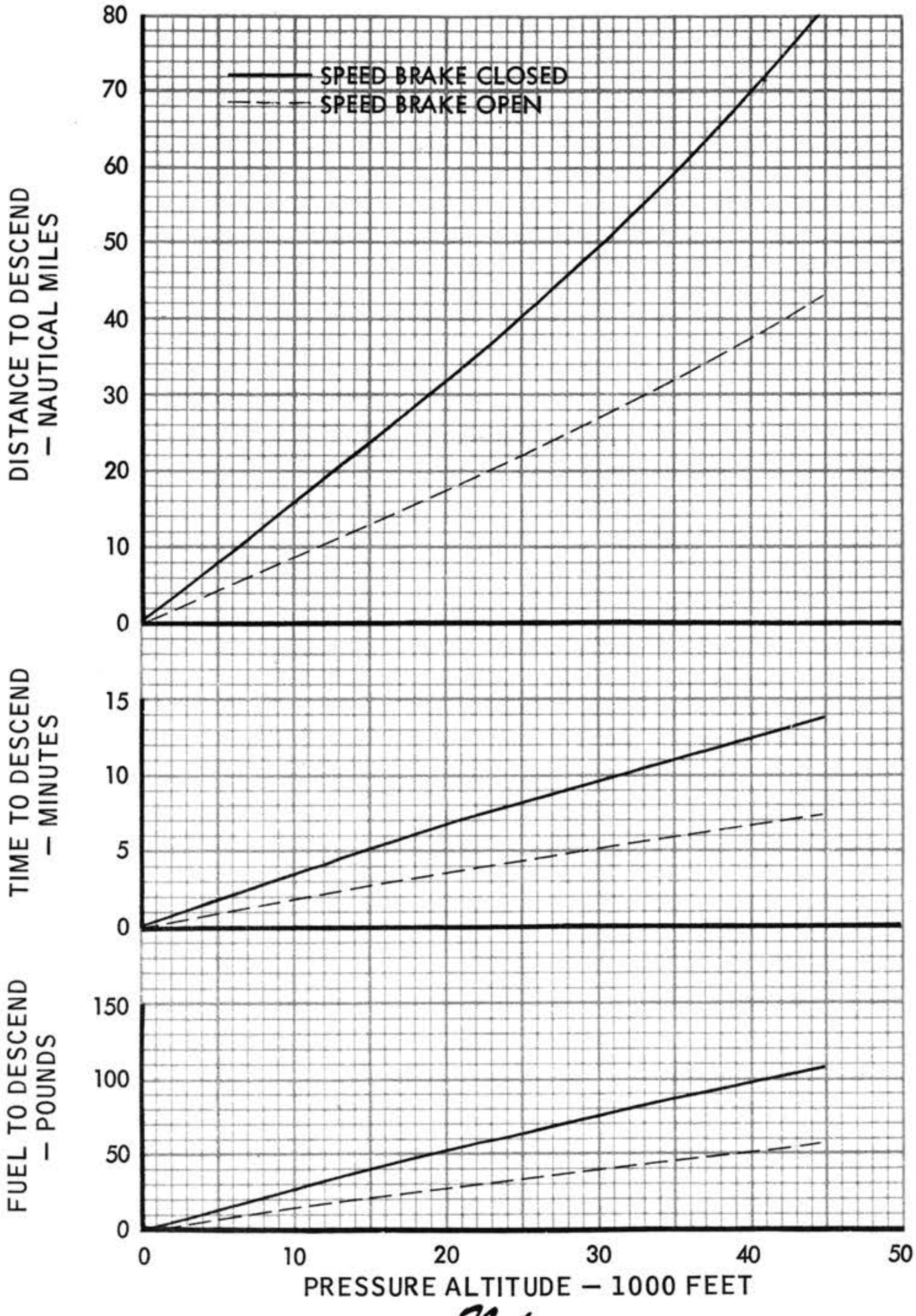
USE OF DESCENT CHARTS.

Assume that maximum range descent is desired from a pressure altitude of 40,000 feet to 10,000 feet. From FA6-1, with speed brake closed, 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
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

IF ONE ENGINE IS WINDMILLING, FUEL USED IS REDUCED BY A FACTOR OF 2; ALL OTHER PARAMETERS REMAIN UNCHANGED.

T-38A 1-700B

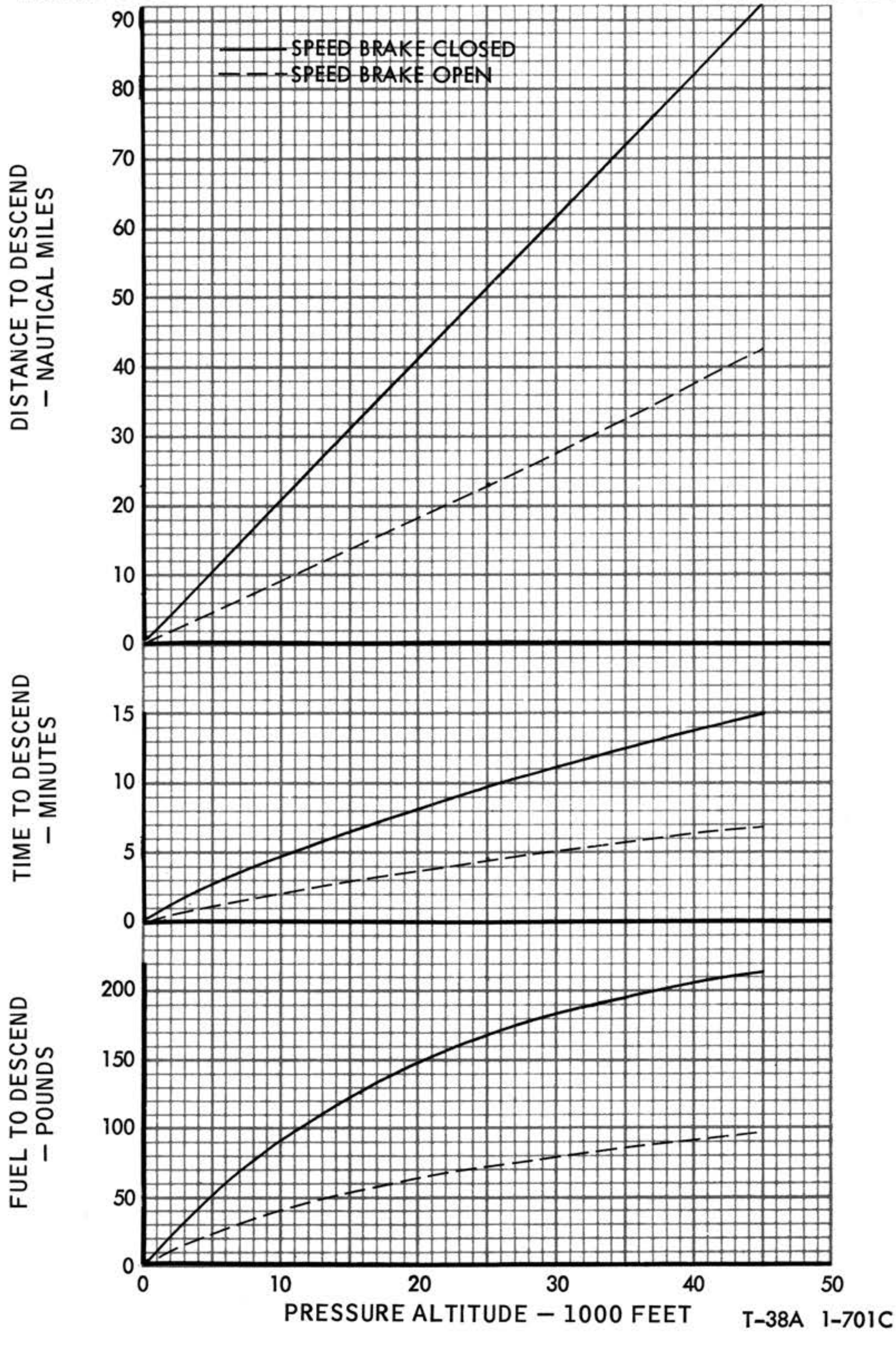
FA6-1.

PENETRATION DESCENT

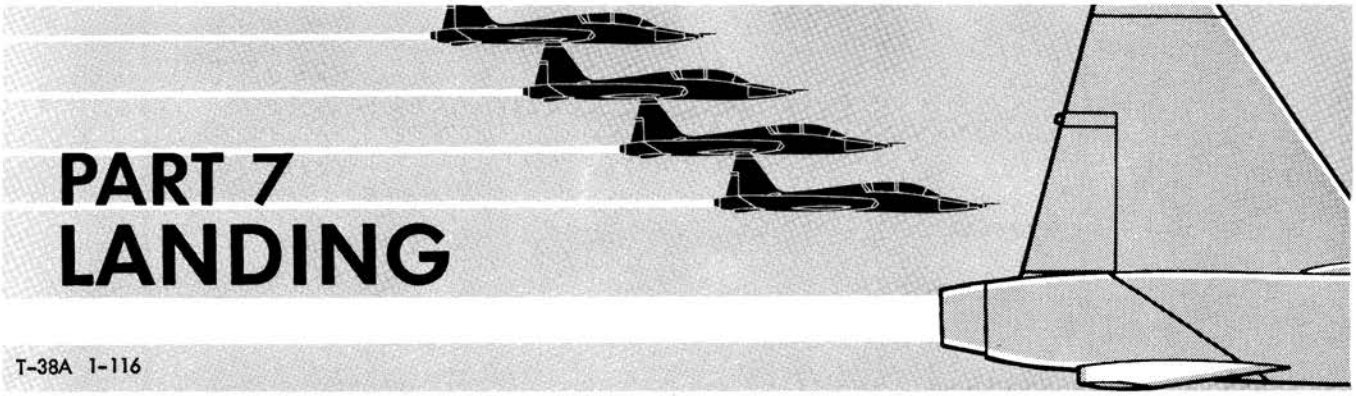
80% RPM 280 KCAS
STANDARD DAY
DRAG INDEX = 0

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



FA6-2.



PART 7 LANDING

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LANDING DISTANCE.

The landing distance chart (FA7-1) shows the ground roll and total distance to clear a 50-foot obstacle with 100% flaps for a dry, hard surface runway as a function of gross weight, pressure altitude, wind velocity, and ambient temperature. The total landing distance shown to clear a 50-foot obstacle is based on passing over the obstacle at 10 knots less than the final approach speed at a 3-degree flight path angle to the point of flare initiation, then landing at the touchdown speed. The pressure altitude of the landing runway can be determined by setting the altimeter to 29.92, which is sea level standard day pressure in inches of mercury. The chart shows data for landing, using a normal touchdown speed, 12 degrees nose high attitude until 100 knots, 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 speed causes approximately 10 percent variation in landing distance, and insufficient braking may increase ground roll by 50 percent.

USE OF LANDING DISTANCE CHART.

The chase-thru lines in the landing distance chart (FA7-1) show a landing with two engines operating, with an ambient air temperature of 15° C at 2,000 feet pressure altitude, a gross weight of 9,000 pounds and a 20-knot headwind. These conditions require a ground roll of 2,600 feet and a total distance of 4,100 feet from a 50-foot obstacle to the end of the ground roll.

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 Reading (RCR) which is a number indicating the degree of braking effectiveness available during the ground roll. The RCR number for the existing runway condition at a particular field is available from base operations.

USE OF THE CORRECTION CHART FOR RUNWAY SURFACE CONDITIONS.

Using the ground roll distance of 2,600 feet for a dry, hard surfaced runway and an RCR of 12, FA7-2 shows 3,500 feet required for this runway condition.

SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE.

The single-engine thrust required and available chart (FA7-3) shows thrust required and available versus airspeed for go-around configuration with 60% flaps and gear down. The chart is for several weights and temperatures from sea level to 6,000 feet, and includes both single-engine MAX and MIL thrusts.

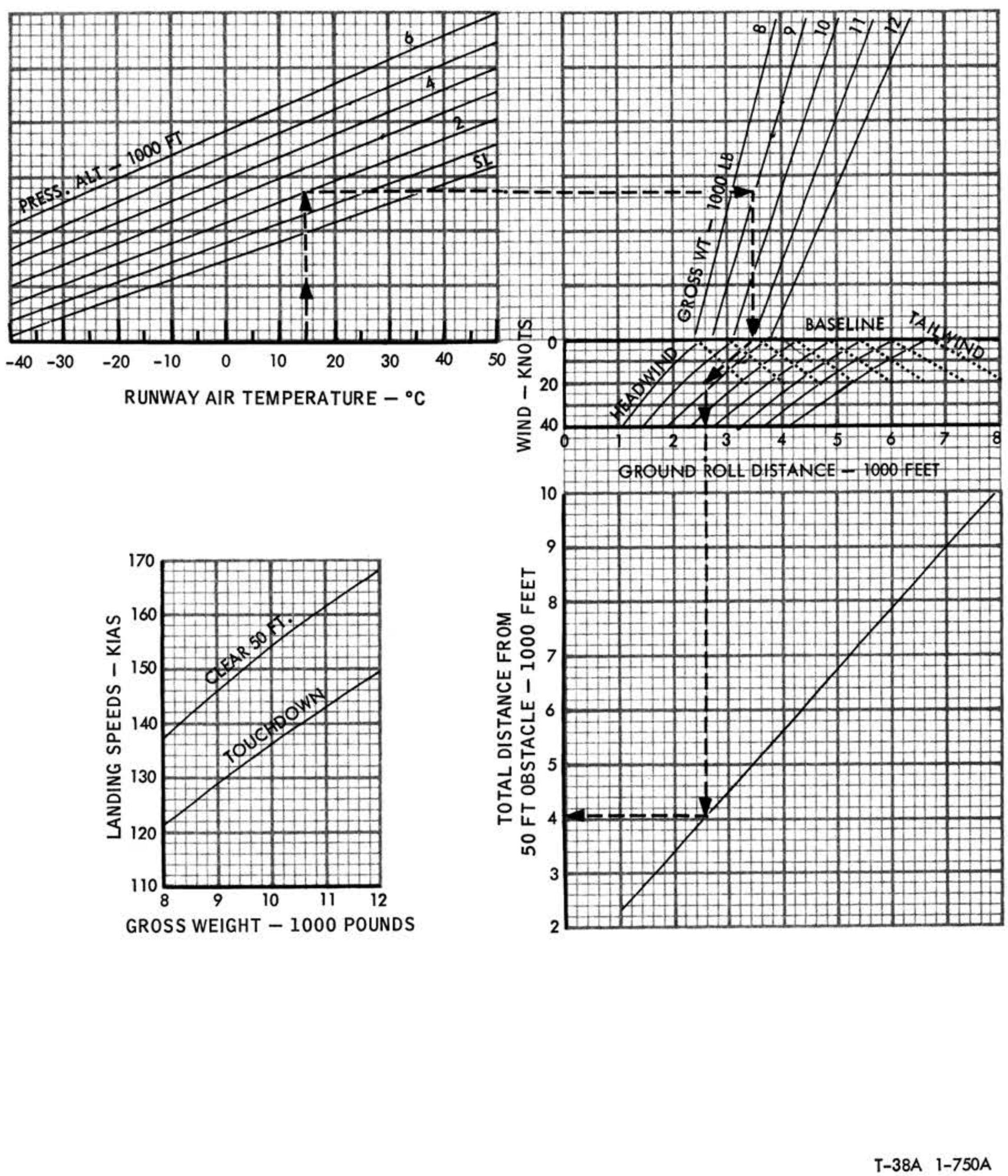
USE OF SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE CHART.

Assume an airspeed of 160 KIAS, a weight of 11,000 pounds, and an ambient temperature of 35° C with MAX thrust. The thrust required is 2,220 pounds for all altitudes, and the thrust available is 2700 pounds at sea level. When the pressure altitude is 2,000 feet, the thrust available is 2520 pounds.

LANDING DISTANCE
DRY, HARD SURFACED RUNWAY
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



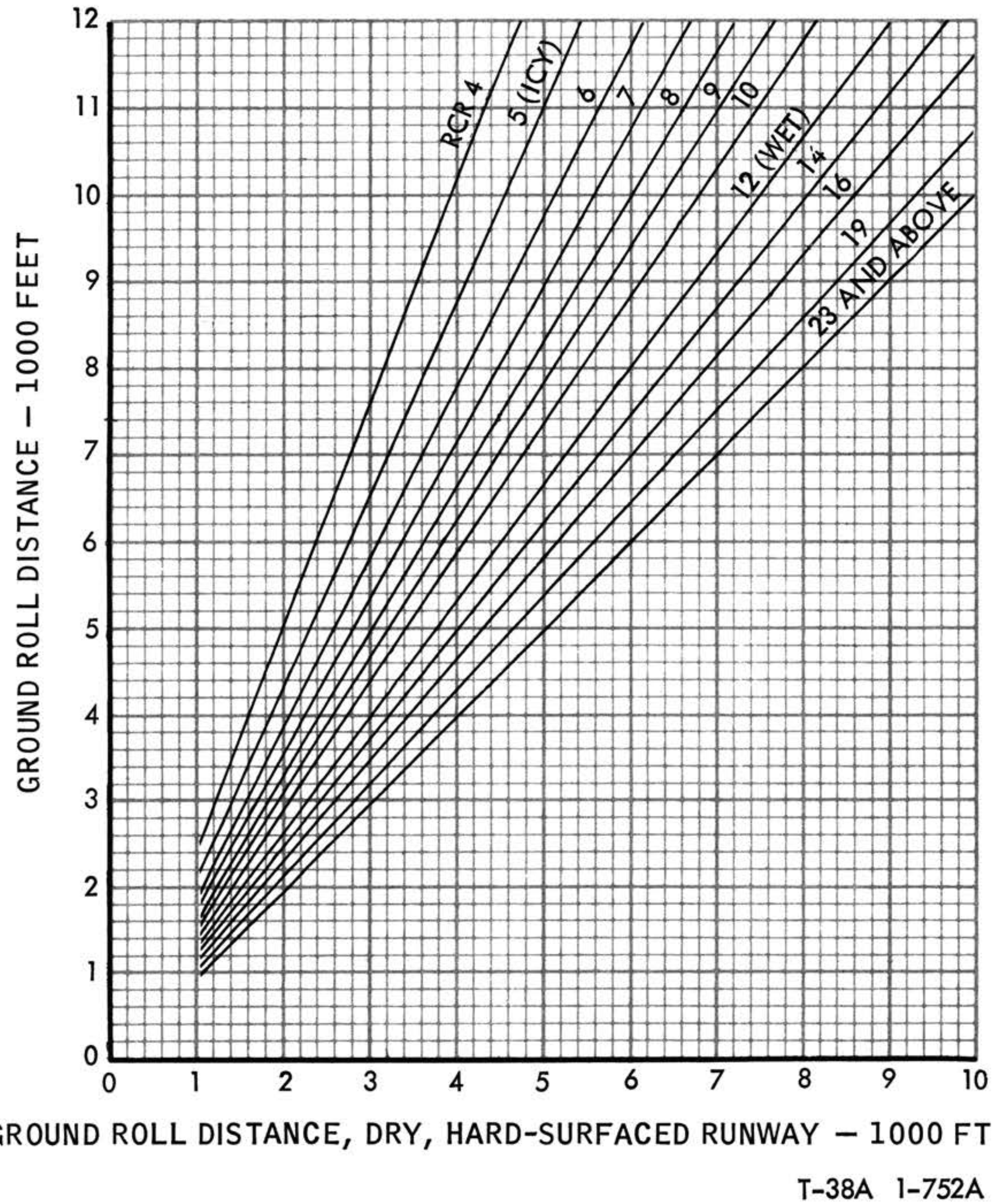
FA7-1.

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



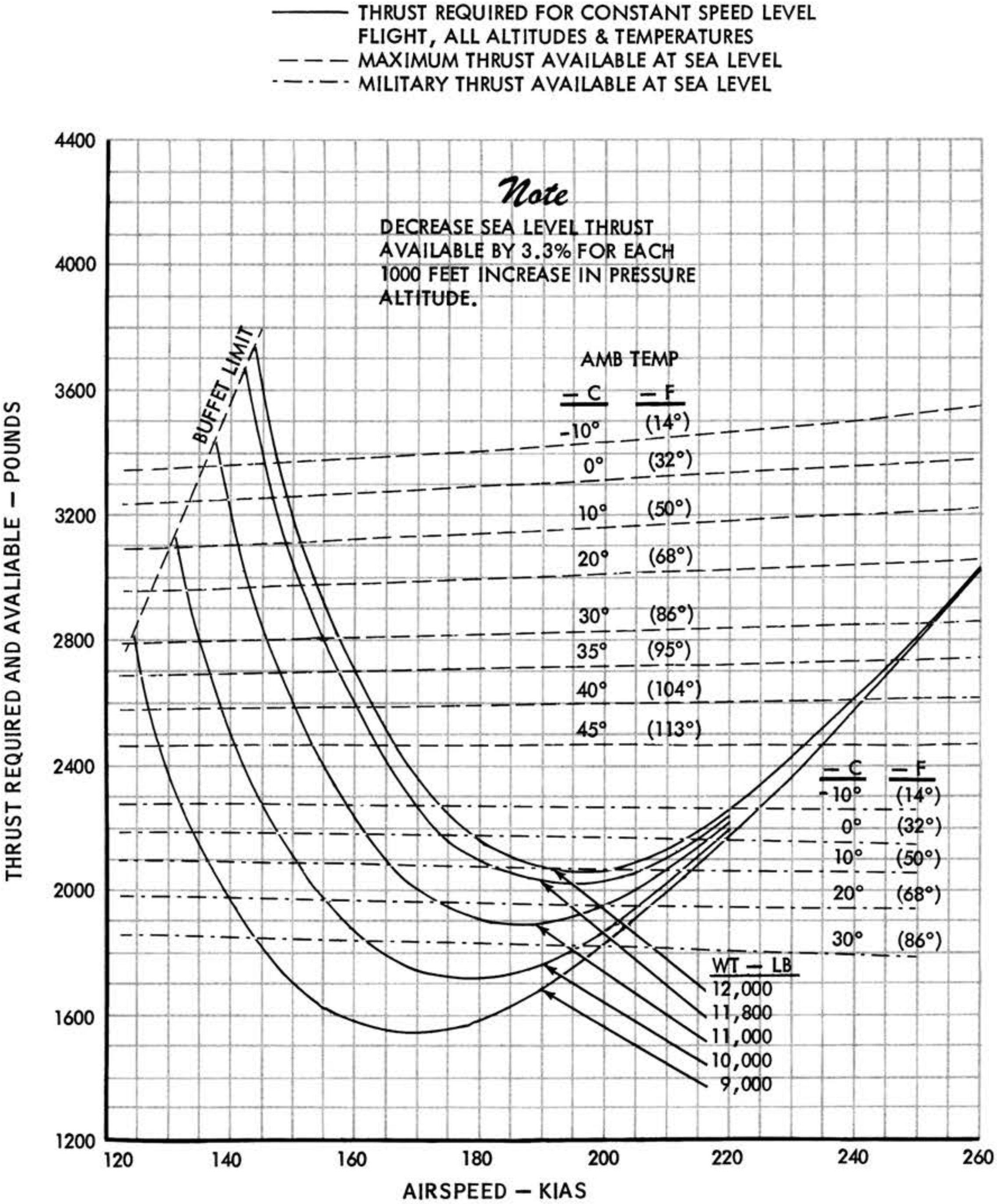
FA7-2.

SINGLE-ENGINE THRUST REQUIRED AND AVAILABLE

WITH 60% FLAPS AND GEAR DOWN
SEA LEVEL TO 6000 FEET

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



FA7-3.

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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.

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.
   a. RCR = 23 (FA2-6) . . . . 5700 ft.
   b. RCR = 12 (FA2-9) . . . . 6400 ft.
5. Acceleration check speed at 2000-ft marker run.
   a. Normal (FA2-10) . . . . 129 KIAS.
   b. Minimum (7000 − 6400 = 600, $129 - \frac{600}{1000}\,3$) . . . . 126 KIAS.
6. Single-engine takeoff speed (FA2-3, 154 + 8) . . . . 162 KIAS.
7. Refusal speed.
   a. RCR = 23 (FA2-7) . . . . 145 KIAS.
   b. RCR = 12 (FA2-9) . . . . 115 KIAS.

INITIAL CLIMB FROM 2000 FT TO FLIGHT LEVEL 350.

1. Aircraft weight at start of climb is 11,800 lb minus the allowance for taxi, takeoff, and acceleration to climb speed (11,800 − 400) . . . . 11,400 lb.

2. Obtain time to climb, fuel in climb, and climb range (FA3-1).
   Time (7.3 − 0.5) .... 6.8 min.
   Fuel (480 − 40) ...... 440 lb.
   Range (62 − 5) ...... 57 nmi.
3. Compute distance lost due to headwind (15 × 6.8/60) .... 2 nmi.
4. Adjusted climb range (57 − 2) .... 55 nmi.
5. Weight at level-off (11,400 − 440) .... 10,960 lb.

PENETRATION DESCENT TO 3000 FT, SPEED BRAKE OPENED (280 KCAS, 80% RPM).

1. Obtain time, fuel, and no wind range from FA6-2.
   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 (15 × 5.0/60) .... 1 nmi.
3. Compute ground range (30 + 1) ...... 31 nmi.
4. Weight at end of descent (8210 + 1000) .... 9210 lb.

AVERAGE GROSS WEIGHT.

1. Weight at beginning of cruise ...... 10,960 lb.
2. Weight at end of cruise (9210 + 70) .... 9280 lb.
3. Compute fuel for cruise (10,960 − 9280) .... 1680 lb.
4. Average weight (10,960 − ½ × 1680) .... 10,120 lb.

CRUISE AT FLIGHT LEVEL 350.

(Using 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. Ground speed (485 − 50)............ 435 kn.
7. Time ($\frac{1680 \times 60}{715 \times 2}$) .... 70 min.
8. Ground distance (70 × $\frac{435}{60}$) .... 508 nmi.

CRUISE AT FLIGHT LEVEL 350.

(Using 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 ($\frac{1680 \times 60}{715 \times 2}$) .... 70 min.
6. Ground distance (70 × $\frac{435}{60}$) .... 508 nmi.

LANDING.

1. Approach speed (50 ft height + 10 kn) .... 156 KIAS.
2. Speed at 50-ft height (start flare speed, figure FA7-1) .... 146 KIAS.
3. Touchdown speed (FA7-1) .... 130 KIAS.
4. Ground roll distance
   RCR = 23 (FA7-1) .... 2600 ft.
   RCR = 12 (FA7-3) .... 3400 ft.

MISSION SUMMARY.

1. Total time .... 82 min.
2. Total range .... 594 nmi.

ALPHABETICAL INDEX

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Operational and Safety Supplements

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL
USAF SERIES
T-38A
AIRCRAFT

THIS PUBLICATION SUPPLEMENTS T.O. 1T-38A-1.

COMMANDERS ARE RESPONSIBLE FOR BRINGING THIS SUPPLEMENT TO THE ATTENTION OF ALL AFFECTED AIR FORCE PERSONNEL.

PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

26 MARCH 1968

NOTICE TO PILOTS

- Insert the attached pages in your Flight Manual.

1. PURPOSE.

To clarify the required aircraft attitude for maximum aerodynamic braking.

2. GENERAL.

Increasing the landing attitude until the nose is level with the horizon does not provide maximum aerodynamic breaking.

3. INSTRUCTIONS.

Insert attached pages in the flight manual and remove and discard the replaced pages.

THE END

AIR FORCE, AFPS, SAAMA, 26 MAR 68-8000

FLIGHT MANUAL, SAFETY SUPPLEMENT, OPERATIONAL SUPPLEMENT STATUS

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CURRENT FLIGHT MANUAL	DATE	CHANGED
T.O. 1T-38A-1	1 Mar 67	Change 2 – 1 Nov 67

CURRENT FLIGHT CREW CHECKLIST	DATE	CHANGED
T.O. 1T-38A-1CL-1	1 Mar 67	Change 2 – 1 Nov 67

CURRENT SAFETY SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
–47	7 Nov 67	Descent Fuel Balance Check	2-7, N-9
–48	19 Feb 68	Engine Operating Envelope	7-2
–49	28 Feb 68	Dual Engine Failure at Low Altitudes and Alternate Airstart	3-3, 3-4

CURRENT OPERATIONAL SUPPLEMENTS

–16	21 Nov 67	Crew Retractable Steps	2-3, N-7
–17	25 Mar 68	Cockpit Smoke Elimination	3-5
–18	26 Mar 68	Landing Attitude	2-7, 2-8, 2-9, 2-10

REPLACED OR RESCINDED SUPPLEMENTS

–15	20 Nov 67	RPM Fluctuation Limits	Incorporated in Change 2 – 1 Nov 67

OPERATIONAL SUPPLEMENT

FLIGHT MANUAL

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

25 MARCH 1968

NOTICE TO PILOTS

- Write the number of this supplement alongside the affected portion of the Flight Manual.

1. PURPOSE.

To advise canopy jettison if smoke in the cockpit cannot be eliminated.

2. GENERAL.

A recent accident has shown that under certain conditions it is possible to get smoke in the cockpit where the Ram Dump position of the cabin air switch will not remove the smoke.

3. INSTRUCTIONS.

In Section III of the Flight Manual, under the paragraph, "SMOKE OR FUMES IN COCKPIT," add:

NOTE

If smoke becomes severe and cannot be cleared in a reasonable length of time by going to the Ram Dump position, jettison a canopy, below 300 KIAS if possible.

THE END

AIR FORCE, AFPS, SAAMA, 26 MAR 68 - 8400

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

21 NOVEMBER 1967

NOTICE TO PILOTS

- Write the number of this supplement alongside the changed portion of the Flight Manual.
- This publication affects your checklist.

1. PURPOSE.

To change Step #1 under ENGINE START Left Engine in Section II.

2. INSTRUCTIONS.

Under STARTING ENGINES Left Engine procedures of Section II:

Step #1 should read:

1. Crew Retractable Steps - Assure Stowed (if required). If the steps are used, the pilot will assure that they are stowed to prevent flight with steps extended.

THE END

AIR FORCE, AFPS, SAAMA, 27 NOV 67 - 8600

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T.O. 1T-38A-1	1 Mar 67	Change 1 - 1 Jul 67

CURRENT FLIGHT CREW CHECKLIST	DATE	CHANGED
T.O. 1T-38A-1CL-1	1 Mar 67	Change 1 - 1 Jul 67

CURRENT SAFETY SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
-45	21 Sep 67	Stability Augmentor System	
-46	29 Sep 67	Emergency Ground Egress	3-8
-47	7 Nov 67	Descent Fuel Balance Check	2-7, N-9

CURRENT OPERATIONAL SUPPLEMENTS

NUMBER	DATE	SHORT TITLE	FLIGHT MANUAL PAGES AFFECTED
-12	2 Aug 67	Additional Limitation For Landing Gear Extension/Retraction	5-1
-13	31 Aug 67	Fast Erection Procedure	2-4, N-7
~~-14~~	~~17 Nov 67~~	~~Fuel and Oxygen Quantity Check~~	~~2-3, N-6~~ TWX 072048
-15	20 Nov 67	RPM Fluctuation Limits	5-3, P-2
-16	21 Nov 67	Crew Retractable Steps	2-3, N-7

REPLACED OR RESCINDED SUPPLEMENTS

SAFETY SUPPLEMENT

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

28 FEBRUARY 1968

NOTICE TO PILOTS

- Write the number of this supplement alongside the affected portion of the Flight Manual.
- This supplement affects your checklist. Cut out the attached page and insert it in your checklist.

1. PURPOSE.

To revise the DUAL ENGINE FAILURE AT LOW ALTITUDE and ALTERNATE AIRSTART procedure of Section III of the Flight Manual.

2. INSTRUCTIONS.

a. If both engines fail during flight at low altitude and sufficient airspeed, the aircraft should be zoomed (approximately 20° nose up attitude) to exchange airspeed for altitude and to allow additional time to accomplish subsequent emergency procedures.

AIR FORCE, AFPS, SAAMA, 29 FEB 68 – 9000

ALTERNATE AIRSTARTS should be attempted immediately upon detection of dual engine flameout and repeated as often as possible during the zoom. If the decision is made to eject, ejection should be accomplished during the zoom while the aircraft is in a nose high attitude with a positive rate of climb. It is imperative that the ejection sequence be initiated prior to reaching a stall or sink. If continued airstarts are to be attempted, terminate the climb before airspeed drops below 230 KIAS in order to maintain engine wind-milling RPM above the minimum required for air start.

b. ALTERNATE AIR START - 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 the 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 the engine start, the throttle may be left in MAX range if afterburner operation is desired. To obtain an alternate airstart proceed as follows:

1. THROTTLE(S) - MAX

WARNING

If throttle(s) are already in MAX recycle MIL to MAX.

NOTE

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

THE END

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PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE

19 FEBRUARY 1968

NOTICE TO PILOTS

- Write the number of this supplement alongside the affected portion of the Flight Manual.

1. PURPOSE.

To explain the Engine Operating Envelope in Section VII of the Flight Manual.

2. GENERAL.

When a jet engine is operating at high altitude or near the boundaries of the engine operating envelope, unusual attitudes or maneuvers will create turbulence in the engine inlet which can cause the engine to flame out. Accordingly, the engine performance charts can only show the envelope for smooth air flow through the engine inlet.

3. INSTRUCTIONS.

The Engine Operating Envelope of Section VII, page 7-2, should be considered to be representative of straight and level flight operating conditions on a standard day. When other than the above conditions exist, the stall margin is reduced.

THE END

AIR FORCE, AFPS, SAAMA, 21 FEB 68 - 10,000

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CH#2	~~-45~~	~~21 Sep 67~~	~~Stability Augmentor System~~	
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	-47	7 Nov 67	Descent Fuel Balance Check	2-7, N-9
	-48	19 Feb 68	Engine Operating Envelope	7-2

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	~~-13~~	~~31 Aug 67~~	~~Fast Erection Procedure~~	2-4, N-7

~~REPLACED OR RESCINDED SUPPLEMENTS~~
(08 14 18Z MARCH 68)

NUMBER	DATE	SHORT TITLE	PAGES
-15	20 NOV 67	RPM FLUCTUATION LIMITS	5-3, P-2
-16	21 NOV 67	CREW RETRACT. STEPS	2-3, N-7

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7 NOVEMBER 1967

NOTICE TO PILOTS

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1. PURPOSE.

To add an item to the DESCENT procedures of SECTION II.

2. INSTRUCTIONS.

In the DESCENT procedures of SECTION II, add after Step #3:

4. Fuel Balance – CHECK

THE END

AIR FORCE, AFPS, SAAMA, 13 NOV 67 – 8500

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