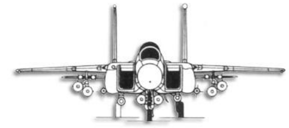
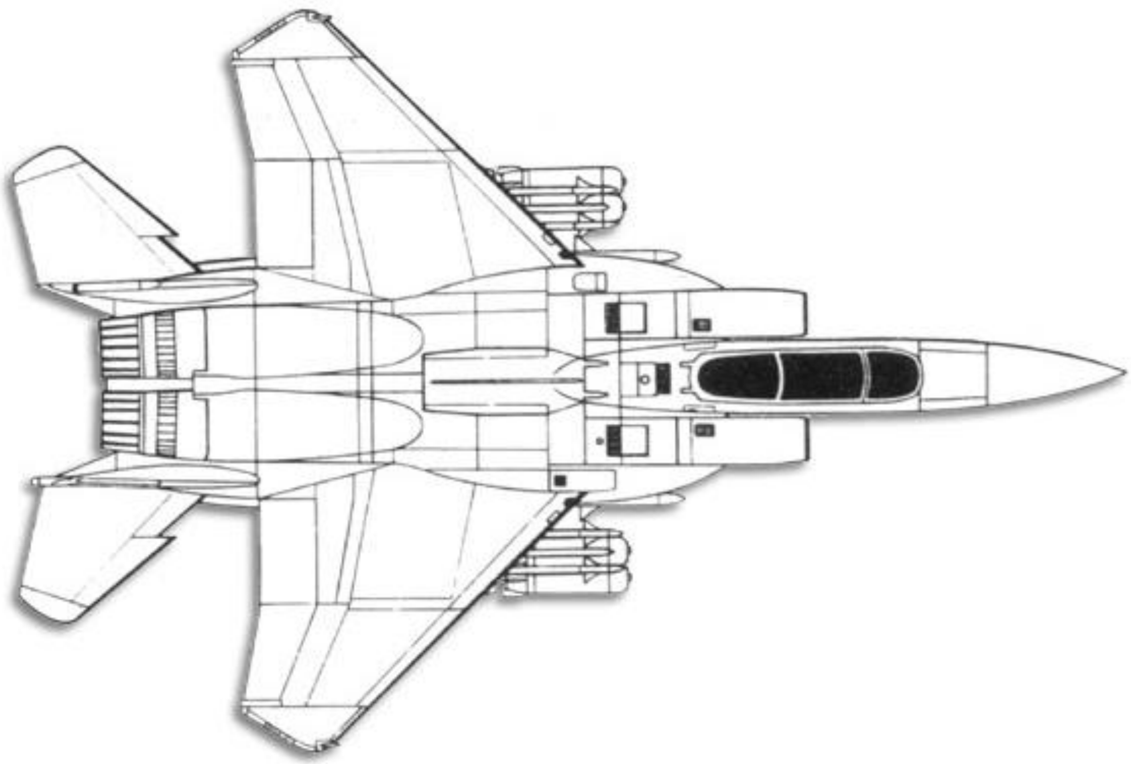
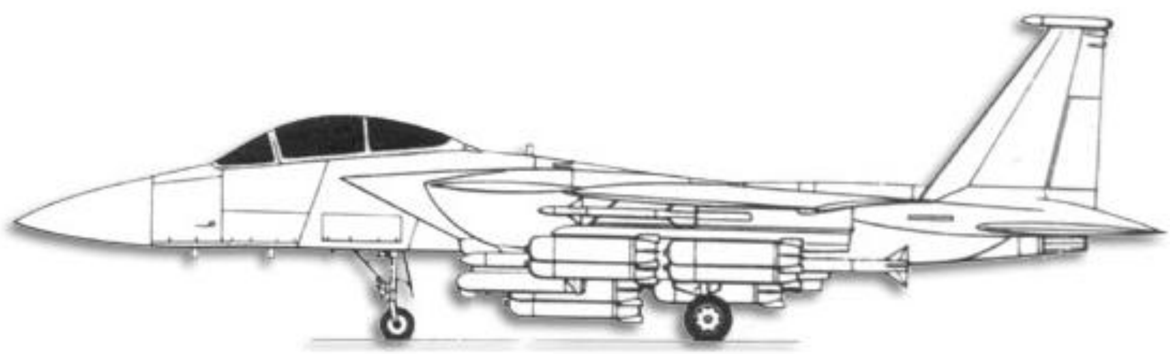


Military Visualizations McDonnell-Douglas F-15E





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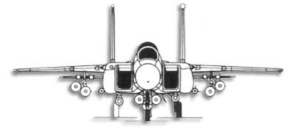

Pilot's Operating Handbook

Version 1.1

Contents

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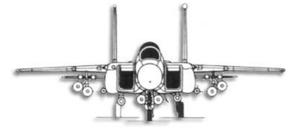


DESCRIPTION

DISCLAIMER

At Military Visualizations, we put a premium on quality and integrity. First on that list is our honesty to our customers. Therefore, we must say upfront that while we believe this F-15E is the best released for FSX, the coding of the weapons and radar systems were suspended with the sudden resignation of our primary coder on those systems, who kept the source code. Therefore, given that all other aspects of this virtual jet were crafted to our standards, we believed it was better to release the jet as it is vice cancel the program. We concluded that given the overall achievement of the project, our customers would wish to purchase the F-15E than have the project cancelled due to the issues with the radar and weapons.

While noteworthy for what it does in FSX, the weapons and radar frankly did not meet our expected performance fidelity, and there are inconsistencies that are fully documented in the radar and weapons addendum at the back of this manual. At this time, we cannot promise a patch to rectify the known issues with the weapons and radar, but should the opportunity present itself we will seek it and advise our customers.

Weapons and radar systems are NOT included in this manual. To use those, you will need to access the video tutorials which will be available from our forums and from our Youtube site here: www.youtube.com/user/milvizinc

AIRCRAFT

The F-15E is a high-performance, supersonic, all-weather, dual role fighter build by McDonnell Aircraft Company. In the air superiority role, its primary weapons are radar guided and infrared homing air-to-air missiles and a 20 MM gun. In the interdiction role, the aircraft carries LANTIRN or SNIPER targeting and navigation pods on dedicated sensor stations under the left and right engine inlets and can carry a variety of guided and unguided air-to-ground weapons. The MilViz F-15E is powered by two Pratt and Whitney F-100-PW-229 engines. Aircraft appearance is characterized by a high-mounted swept-back wing and twin vertical stabilizers. The cockpits are elevated to enhance visibility. Conformal fuel tanks with tangential carriage of air-to-air and air-to-ground weapons will be installed. A jet fuel starter (JFS) provides self-starting of the engines. Aircraft systems are designed and located for high maintainability and reliability. Refer to foldout section for general arrangement illustration.

DIMENSIONS

The approximate overall dimensions of the aircraft are:

Span – 42 feet, 10 inches
Length – 63 feet, 9 inches
Height – top of vertical tail – 18 feet, 8 inches; top of closed canopy – 12 feet
Distance between main landing gear – 9 feet

WEIGHTS

The following weights are approximate to the nearest 500 pounds and shall not be used for computing aircraft performance or for any type operation.

NOTE

Non-CFT fuel weight values do not apply to the MilViz F-15E as non-CFT configurations were not modeled. The decision to avoid modeling non-CFT configuration reflects the tactical doctrine that the F-15E is flown with CFT's installed as a normal condition.

Configuration	With CFT's pounds
Operating weight (basic weight plus crew)	37,000
Takeoff gross weight (operating weight plus full internal fuel, full centerline fuel tank, ammunition, LATIRN pods, wing pylons and 4 LAU-114 missile racks)	66,500
Takeoff gross weight as above plus 2 full external wing fuel tanks	75,000
Maximum gross weight	81,000

ENGINES

This MilViz F-15E is powered by two Pratt and Whitney F100-PW-229 turbofan engines with afterburners. All further references will be made using "-229 engine." The -229 engine is controlled by an improved digital electronic engine control (IDEEC). The IDEEC automatically trims to maintain performance as the engine deteriorates. In the remaining text the IDEEC will be referred to as the DEEC.

ENGINE STARTING SYSTEM

A self contained jet fuel starter (JFS) is used to crank the engines for starting. The JFS is a small jet engine mounted on the central gearbox and along the Airframe Mounted Accessory Drive (AMAD), and provides rotation and initial electrical power for start. The JFS itself is started by accumulated hydraulic pressure. External power is not required during engine start. The JFS provides the only means of engine rotation for start.

ENGINE AIR INDUCTION SYSTEM

The two independent air induction systems consist of three variable ramps, a diffuser ramp, and a variable bypass door. Refer to figure 1-1.

Variable Ramps

The variable ramps provide air, at optimum subsonic flow, to the face of the engine fan inlet throughout a wide range of aircraft speed. Ramp position is controlled by the air inlet controller.

Bypass Door

The bypass door automatically relieves excess pressure on the inlet duct. The air inlet controller positions the bypass door.

Air Inlet Controller

An air inlet controller (AIC), one for each inlet, uses angle of attack, aircraft Mach number and other air data systems outputs to automatically schedule the ramps and bypass door throughout the aircraft envelope. The first ramp is locked in the up position until the engine is started.

Inlet Ramp Switch

An inlet ramp switch for each inlet is the front cockpit on the miscellaneous control panel. The switch is lever locked, and has positions of AUTO and EMERG.

AUTO	The AIC automatically controls the air inlet system. This is the normal position
EMERG	Removes electrical power from the ramp and bypass door actuators, causing them to move hydraulically to the emergency positions (ramps locked up and bypass door closed). If hydraulic pressure fails, airloads will force the ramps and bypass door to the emergency position.

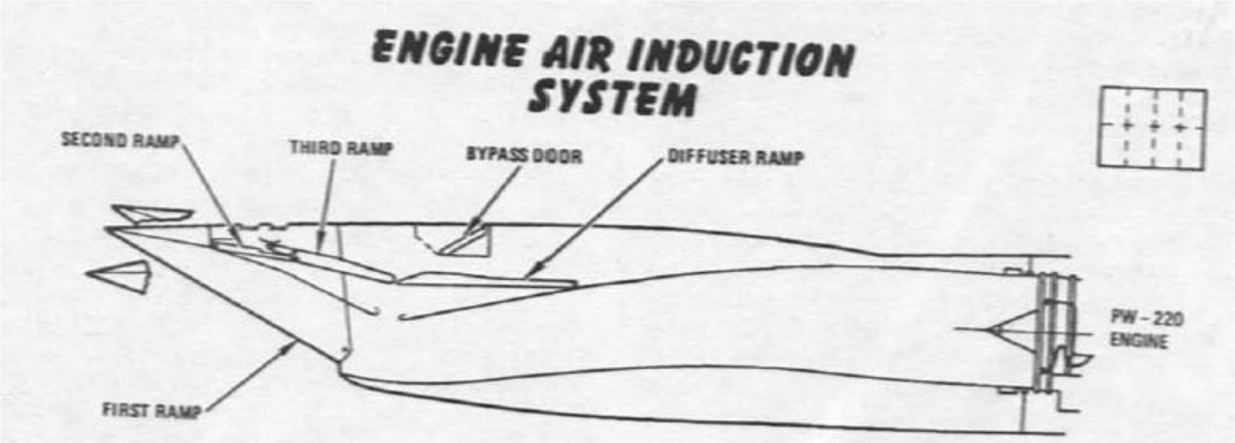


Figure 1-1

ENGINE OIL SYSTEM

Each engine is equipped with a completely self-contained oil system. Oil is supplied to the main pump element by gravity feed. Return of the engine oil to the pump reservoir is severely limited during 0 or negative G flight. Refer to the Servicing Diagram, this section, for oil specifications.

ENGINE FUEL SYSTEM

Refer to foldout section for airplane and engine fuel systems illustration.

IGNITION SYSTEM

The ignition system contains an independent engine mounted generator and four igniter plugs (two for the engine and two for the afterburner). During engine start, moving the throttle from OFF to IDLE causes the engine igniter plugs to discharge. Ignition then remains continuous during engine operation. When the throttle is moved into afterburner, afterburner ignition is activated for approximately 1.5 seconds. Ignition is automatically recycled up to three times in the event of no-light or blowout, without retarding the throttle to MIL.

ENGINE CONTROL SYSTEM

The engine control uses a digital primary control (PRI) with a backup hydrometrical secondary control (SEC). The secondary mode can be achieved either by an automatic primary mode fault action, or by the pilot manually selecting OFF on the cockpit ENG CONTR switch. During SBC mode operation, A/B is inhibited, and the engine thrust is limited to approximately 70% of primary mode MIL power. The pilot can attempt to restore primary mode operation by cycling the ENG CONTR switch. If the fault that caused the transfer has cleared, then engine will return to primary mode.

Improved Digital Electronic Engine Control (IDEEC)

The IDEEC contains the engine operating schedules for the same automatic control from start through MAX A/B as provided by the engine. The IDEEC includes a ground idle thrust setting to maintain equivalent engine taxi performance. Ground idle thrust requires both an airframe request (automatic) and engine authorization (based on gear handle position, Mach number and throttle position). Acceleration from ground IDLE to MIL will be approximately 1 second longer than from approach or flight idle.

After a snap deceleration, engine RPM will initially decrease to approximately 79% RPM, then if the throttle is not advanced for 20 seconds, RPM will further decrease to the normal flight idle RPM. This control feature extends engine life and improved bodie (MAX-IDLE-MAX, and MIL-IDLE-MIL) response times.

Engine Control Switches

The L and R ENG CONTR (engine control) switches are located in the front cockpit on the engine control panel. The switches have two positions ON and OFF.

ON	DEEC provides normal engine control
OFF	Engine control is transferred to secondary mode (hydromechanical MFC). Afterburner inhibited, engine thrust reduced to 70-80% MIL, and exhaust nozzle will remain closed with gear handle down.

Main Fuel Control

The main fuel control (MFC) houses the hydromechanical components that are controlled by the DEEC in the ENG CONTR ON mode. If the DEEC is transferred to the secondary mode or the ENG CONTR switch is OFF the MFC schedules the engine fuel flow, start bleed position and RCVV position hydromechanically in response to throttle movement, inlet static pressure and engine inlet total temperature.

ENGINE MONITORING SYSTEM

The engine incorporates an engine monitoring system which consists of the DEEC and the engine diagnostic unit (EDU). The DEEC and EDU continuously monitor electrical control components and engine operation to detect engine failures. Abnormal engine operation and either intermittent or hard failures of components are detected and flagged for maintenance.

During abnormal engine operation or component failure, the EDU will record engine and aircraft data as an aid to maintenance troubleshooting. The EDU also maintains engine life cycle information. Airframe mounted engine life cycle information. Airframe mounted LEFT or RIGHT ENGINE and L or R ENG MON SYS fail indicators, located on the avionics status panel in the nose wheel well, are latched if a fault is detected which requires maintenance attention.

AFTERBURNER SYSTEM

The afterburner has 11 segments that are progressively selected as the throttle is advanced from the MIL to MAX settings. The number of selectable afterburner segments is automatically reduced as the aircraft moves towards the upper left corner of the afterburner operating envelope. During snap acceleration the first segment of the afterburner may, depending on the flight condition, light at just above IDLE RPM and the succeeding segments will light as speed approaches MIL RPM.

The engine uses a light-off detector (LOD) to signal the DEEC if a light-off occurs. The DEEC then schedules the AFC fuel flow for the remaining segments. If the LOD does not sense a light-off or a blowout occurs, the DEEC automatically resets the MFC to MIL, terminates afterburner fuel flow and a check of the LOD is performed. If the LOD checks good, the DEEC will automatically attempt two more relights. If the afterburner still fails to light, retarding the throttle to MIL or below will reset the DEEC and the system will operate normally when afterburner is reselected. If the LOD checks failed, the DEEC will attempt one relight, bypassing the LOD, using tailpipe pressure to verify an afterburner light-off. Afterburner light-off may take longer and appear to hesitate if the LOD failed. Afterburner is inhibited in the ENG CONTR OFF mode.

VARIABLE AREA EXHAUST NOZZLE

The engine has a convergent-divergent nozzle system which is continuously variable between minimum and maximum opening. The nozzle is positioned pneumatically by engine bleed air.

Exhaust Nozzle Control

The exhaust nozzle is used to control engine pressure ratio (EPR) in response to throttle position and landing gear handle inputs. With the gear handle down, throttle in IDLE and IDEEC ON, the nozzle will be approximately 90-100% open. As the throttle is advanced, the nozzles close to near minimum area. With the landing gear handle UP, the nozzle is near minimum area (10%) at all times except at MIL or above. At MIL, the nozzle indicator will show the nozzle slightly open (6-20%). As the throttle is advanced in the afterburner fuel flow, the nozzle will schedule further open to compensate for increasing afterburner fuel flow. During SEC mode operation, nozzle position will be closed to near the minimum area (less than or equal to 5%) inflight or on the ground. This will result in higher idle thrust and taxi speeds.

ENGINE ANTI-ICE

The engine anti-ice system is comprised of the inlet ice detector and the engine anti-ice valve. The engine anti-ice valve and the inlet ice detector are functionally unrelated. The detector only senses engine inlet ice buildup and turns on the INLET ICE caution. The engine heat switch, on the front cockpit ECS panel, controls the engine anti-ice airflow to the engine nose cone and stationary inlet guide vanes and electrically heats the inlet pressure probe. The DEEC will automatically shut off the engines anti-ice when the altitude is above 30,000 feet or the engine inlet temperature is above 15C (60F) regardless of switch position.

Engine ANTI-ICE Switch

The engine ANTI-ICE switch is a three position switch. The functions are described below:

ON	Activates the engine anti-ice system.
OFF	Deactivates the engine anti-ice system.
TEST	Checks detector operation, and turns on the INLET ICE caution.

INLET ICE Caution

The INLET ICE caution indicates an ice build up on the engine inlet ice probe located in the left engine inlet duct. The INLET ICE caution remains on as long as the icing condition exists and will not be extinguished by activating the engine anti-ice system.

ASYMETRIC THRUST DEPARTURE PREVENTION SYSTEM (ATDPS)

On F-15E 90-0233 and up, the ATDPS prevents aircraft damage or loss in the event of augmentor loss while operating at high dynamic pressures. In the event of a large thrust loss on one engine in a critical flight region, the system automatically commands both engines to secondary (SEC) mode to quickly equalize thrust from both engines. After the aircraft exits the critical region, ATDPS will automatically enable primary operation of both engines.

ENGINE CONTROLS AND INDICATORS

ENGINE MASTER SWITCHES

Two guarded engine master switches are in the front cockpit on the engine control panel. Placing either switch to ON (with electrical power available), opens its corresponding airframe mounted engine fuel shutoff valve and directs power to the fuel transfer pumps. The engine master switch must be ON before the corresponding engine can be coupled to the JFS. Placing the switch OFF decouples the engine from the JFS. If engine control/essential power is not available, placing an engine master switch OFF will not shut off its airframe mounted engine fuel shutoff valve.

VMAX Switch -229 ENGINES

The PW -229 engine does not respond to changes in the VMAX switch position.

THROTTLE QUADRANTS

The front throttle quadrant contains the front throttles, finger lifts, friction adjusting lever, rudder trim switch, and flap switch. Additionally, the throttle grips contain switches to provide various system controls without moving the left hand from the grips. The rear throttle quadrant contains the rear throttles and rudder trim switch. The rear right throttle grip provides control switches for the microphone and speed brake. Refer to figure 1-2. A detailed description of switch functions is in the Front Cockpit Controls or Rear Cockpit Controls portions of this section.

Throttles
Movement of the throttle is transmitted by mechanical linkage to the main fuel control. A friction adjusting lever is mounted adjacent to the front cockpit right throttle. Finger lifts on the front cockpit throttles couple the JFS to the engine during starting; they must also be lifted to move the throttles below IDLE and must then be released to move the throttles to OFF. Advancing the throttle from OFF to IDLE (during engine start) opens the main fuel shutoff valve in the fuel control and turns on engine ignition. Movement of the throttles from IDLE to OFF closes the main fuel shutoff valve in the fuel control, stopping fuel flow to the engine. Afterburner light-off is initiated by advancing the throttle forward of the afterburner detent.

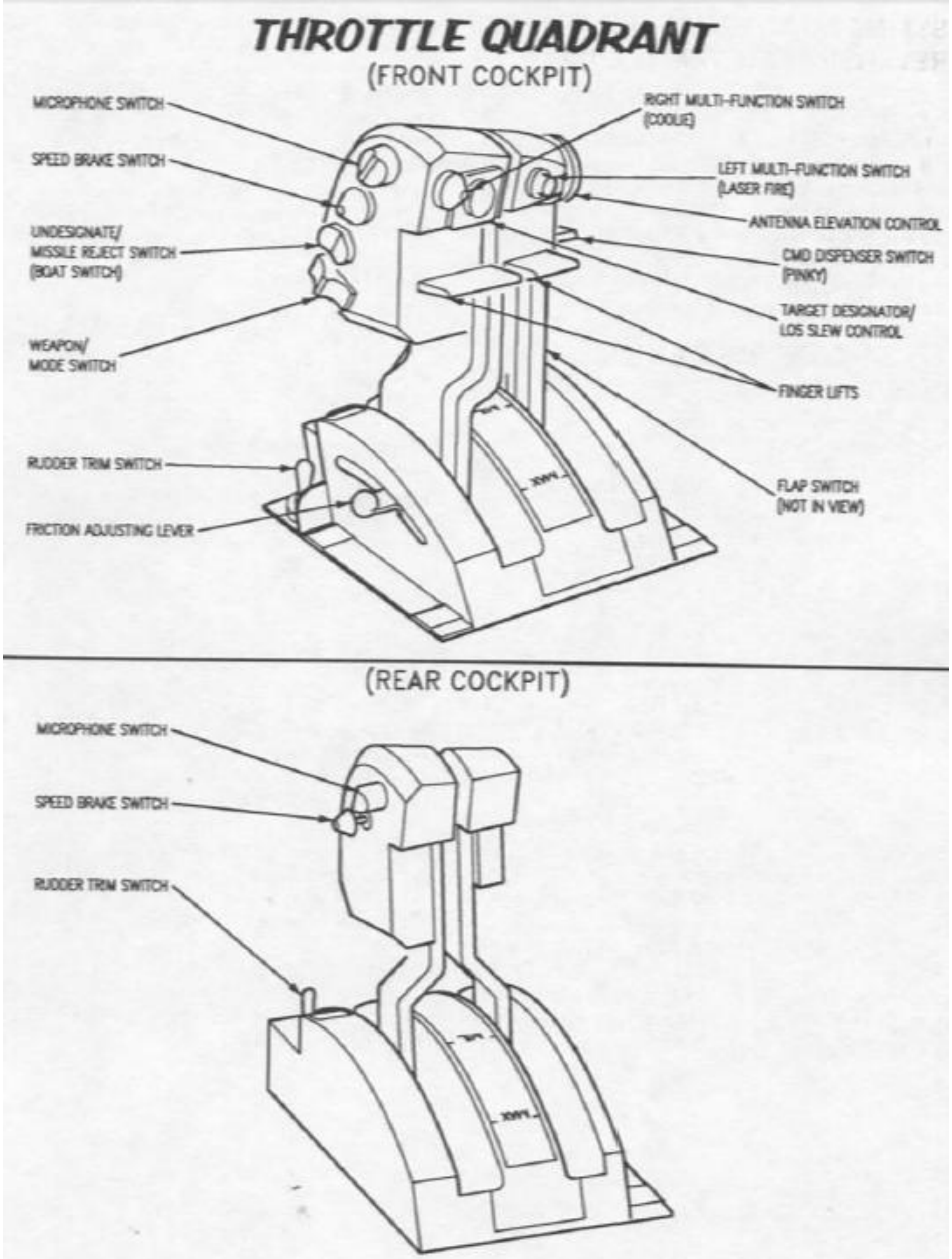

THROTTLE QUADRANT
(FRONT COCKPIT)
MICROPHONE SWITCH
SPEED BRAKE SWITCH
UNDESIGNATE/
MISSILE REJECT SWITCH
(BOAT SWITCH)
WEAPON/
MODE SWITCH
RUDDER TRIM SWITCH
FRICTION ADJUSTING LEVER
RIGHT MULTI-FUNCTION SWITCH
(COOLIE)
LEFT MULTI-FUNCTION SWITCH
(LASER FIRE)
ANTENNA ELEVATION CONTROL
CMD DISPENSER SWITCH
(PINKY)
TARGET DESIGNATOR/
LOS SLEW CONTROL
FINGER LIFTS
FLAP SWITCH
(NOT IN VIEW)
(REAR COCKPIT)
MICROPHONE SWITCH
SPEED BRAKE SWITCH
RUDDER TRIM SWITCH

Figure 1-2

ENGINE MONITOR DISPLAY

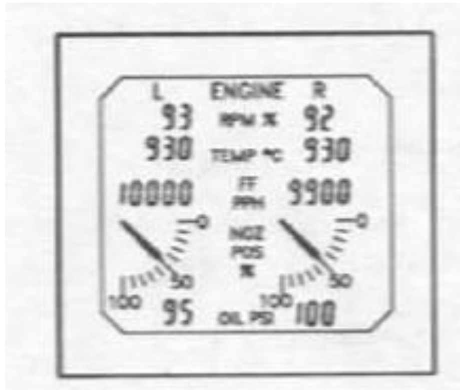


Figure 1-3

ENGINE MONITOR DISPLAY (EMD)

The engine monitor display (EMD) located on the front cockpit lower main instrument panel has a left and right liquid crystal display for RPM, temperature, fuel flow, nozzle position, and oil pressure (see Figure 1-3). In the MilViz F-15E, all information on the EMD is displayed whenever battery power is applied. If an engine data item exceeds the range of a parameter (as shown below) then that parameter will go blank until it is within the display range.

RPM %	Displays compressor RPM from 0 to 96% is 1% increments.
TEMP C	Displays FTIT from 200 to 1400 C in 10C increments.
FF PPH	Displays main engine fuel flow from 0 to 99,900 pounds per hour in 100 pph increments.
NOZ POS %	Displays exhaust nozzle position from 0 to 100% open in 10% increments.
OIL PSI	Displays oil pressure from 0 to 100 psi in 5 psi increments.

MPD/MPCD ENGINE DISPLAY

The MPD/MPCD engine display format provides an alternate source for engine data displayed on the EMD by displaying data on selected multi-purpose display/multi-purpose color display (MPD/MPCD). Refer to figure 1-4. The display is selected by pressing the ENG button on the MENU display. If engine data exceeds the range of a parameter the maximum or minimum limit will be displayed, on an MPCD the parameter will displayed in yellow and boxed. If on the MFD, they are displayed at a greater intensity level and boxed. If any engine data is invalid or no signal is received. OFF will be displayed for that engine parameter.

On F-15E 90-0233 and up, an additional test is available for the ATDPS. The ATDPS can only be tested during low speed ground operation. When ATDP TEST is selected (from the MPD/MPCD engine display format), switching one engine control to OFF will result in both engines transferring to secondary mode. The engines will return to primary mode only after engine control switches are set to ON and ATDP TEST is deselected.

RPM %	Compressor RPM from 0 to 110% in 1% increments.
TEMP C	FTIT from 100 to 1375C in 1C increments.
FF/PPH	Main Engine fuel flow from 0 to 150,000 pph in 10 pph increments.
NOZ POS	Exhaust nozzle position from 0 to 100% open in 1% increments.
OIL PSI	Oil pressure from 0 to 100 psi in 1 psi increments.

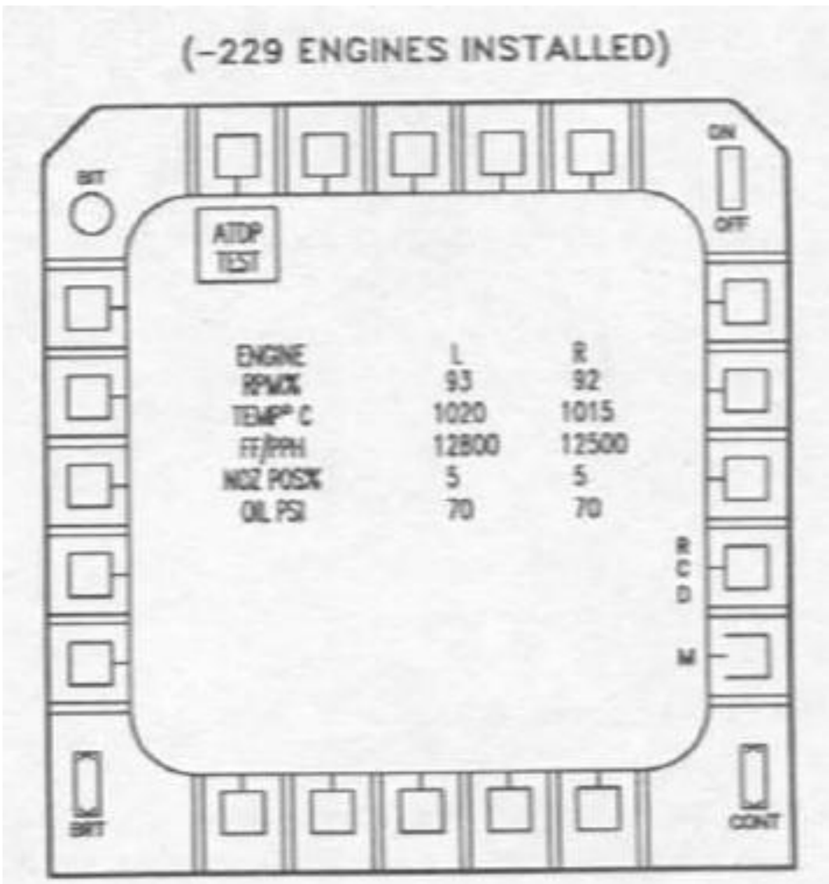


Figure 1-4

ENGINE CAUTION LIGHTS

The ENGINE caution light is in the front cockpit on the caution lights panel and in the rear cockpit on the warning/caution/advisory light panel. The ENGINE caution light, MASTER CAUTION light and MPD/MPCD caution come on when any of the following cautions are activated: L INLET, R INLET, L ENG CONTR, R ENG CONTR, L OIL PRESS, R OIL PRESS, INLET ICE, FIRE SENSOR, FUEL HOT, L BST PUMP, R BST PUMP, L BLEED AIR, R BLEED AIR, or ATDP. The light remains on until the problem is corrected.

L/R INLET Cautions

The L or R INLET caution comes on with left or right engine inlet controller falure.

L/R Engine Control Cautions

The L or R ENG CONTR caution comes on with left or right DEEC failure, loss of Mach number signal, afterburner inhibit (either the last 3 segments or a total afterburner inhibit), or switch off.

L/R OIL Pressure Cautions

The L or R OIL PRESS caution comes on with a low left or right engine oil pressure (less than or equal to 8 psi).

FUEL HOT Caution

The FUEL HOT caution is displayed when the engine fuel inlet temperature is too high.

L/R BOOST PUMP Cautions

The boost pump cautions are used. These cautions are: L BST PMP (for left main boost pump) and R BST PMP (for right main boost pump) and are displayed if the associated boost output pressure is low.

L/R BLEED AIR Cautions

These cautions come of when there is a left/right bleed air leak or overtemperature.

ATDP Caution

The ATDP caution comes on when system operating mode is other than commanded or when air data is invalid.

FIRE WARNING/EXTINGUISHING SYSTEM

The fire warning and extinguishing system consists of three illuminating pushbutton switches, one fire extinguish bottle, a discharge/test switch, and fire sensors located in the engine and AMAD compartments, and various warning/caution lights. The system provides engine and AMAD fire warning, emergency engine and JFS shutdown, and selective fire extinguishing. The extinguisher is a gaseous system which provides one-shot, one-compartment, extinguishing capability. The gas is non-toxic, non-corrosive, and will not damage aircraft components. Electrical power is required to operate the fire warning and extinguisher system. During JFS operation, before the emergency generator comes on the line, only the AMAD system is operative.

FIRE LIGHTS

Three fire lights on the fire warning/extinguishing panel in the front cockpit are combination warning lights and fire extinguisher arming buttons. Two fire warning lights in the rear cockpit provide warning of L FIRE and R FIRE but have no extinguisher function. The three lights in the front cockpit are labeled AMAD FIRE PUSH, L ENG FIRE PUSH and R ENG FIRE PUSH. The appropriate fire light(s) comes on when a fire or overheat condition exists.

Pressing the L ENG FIRE PUSH or R ENG FIRE PUSH light shuts off bleed air from, and fuel flow to, the corresponding engine, and arms the extinguisher bottle for release into the selected engine compartment. After the L or R ENG FIRE PUSH light is pressed, the engine decelerates but may continue running at sub-idle RPM for up to e 120 seconds until the fuel is consumed downstream of the airframe mounted fuel shutoff valve. After first lifting a spring loaded metal guard, pressing the AMAD FIRE PUSH light arms the extinguisher bottle for release into the AMAD/JFS compartment but will not prevent normal JFS operation.

When arm is selected, the fire lights must be pressed again to dearm the extinguisher and restore the selected system to normal operation. On aircraft 87-0201 and up the front cockpit firewarning/extinguisher panel contains left and right AFTERBURNER BURNTHRU warning lights. The respective light comes on to indicate a fire. Refer to Voice Warning System in this section for voice warnings associated with FIRE lights.

FIRE VOICE WARNINGS

The fire voice warning system is activated when either or both engines FTIT exceed 1107C (overheat) or a fire condition exists. For an FTIT overtemperature condition the voice warning states: WARNING, OVERTEMP LEFT or WARNING OVERTEMP RIGHT, pauses then repeats the warning again. For an engine/AMAD fire condition the voice warning states: WARNING, ENGINE FIRE LEFT or WARNING, ENGINE FIRE RIGHT or WARNING, AMAD FIRE pauses, then repeats the warning again. For a single-point burn through or overtemperature condition in the afterburner section the voice warnings states: AB BRUN THRU LEFT or AB BURN THRU RIGHT, pauses then repeats the warning again.

FIRE TEST/EXTINGUISHER SWITCH

A discharge/test switch is located on the fire warning/extinguishing panel in the front cockpit. The switch has three positions, labeled and functions as:

OFF	System provides normal fire warning.
TEST	Turns of the three fire lights (only the AMAD light if the JFS is providing electrical power) and the left/right AB BURN THRU lights, indicating the fire sensors are operational. Also turns on the rear cockpit lights. Each fire light has four sections with an individual light bulb in each section. The top two bulbs of the MAD light are associated with the AMAD fire sensor loop and the bottom two bulbs with the JFS fire sensor loop. The top bulbs of the engine fire lights are associated with the forward transponder loop of the corresponding engine, and the bottom two bulbs with the aft transponder loop. Failure of any of the above pairs of lights to come on during test indicates failure of the corresponding sensor loop. Switch is spring loaded to OFF.
DISCHARGE	Momentary contact immediately discharges the extinguisher into the selected compartment. If the AMAD circuit was selected, the discharge switch also shuts off fuel flow to the JFS. The switch is lever-locked from OFF to DISCHARGE and is spring loaded to OFF.

FIRE SENSOR CAUTION

Appearance of the FIRE SENSOR caution on the MPD/MPCD indicates one or more fire sensors have failed. The MASTER CAUTION and ENGINE caution also come on.

SECONDARY POWER SYSTEM

The secondary power system provides power for starting the aircraft engines and transmits power from the engine to the aircraft accessories. It consists of an accumulator-powered hydraulic motor, central gearbox (CGB), JFS, and left and right AMAD gearboxes.

CENTRAL GEARBOX (CGB)

During JFS start, the CGB provides the mechanical connection between the hydraulic motor and the JFS. After the JFS is started, the CGB then provides the gearing and clutching functions necessary to transmit power from the JFS to the left or right AMAD gearboxes.

AIRFRAME MOUNTED ACCESSORY DRIVE (AMAD)

The left and right AMAD gearboxes are directly connected to their respective engine, utility hydraulic pump, power control (PC) hydraulic pump, and integrated drive generator (IDG). During engine start, power is transmitted from the JFS through the CGB and through the applicable AMAD gearbox to the engine. Once the engine is started, the CGB decouples from the AMAD gearbox and its associated accessories. The accessories on either AMAD gearbox are sufficient to support the aircraft systems if one engine or its associated AMAD gearbox fails. Refer to figure 1-5.

JET FUEL STARTER (JFS)

A JFS, mounted on the central gearbox, is used for engine starting. It can start either engine, but not both simultaneously. JFS operation is controlled by the JFS starter switch and the JFS control handle. Fuel is provided by the main aircraft fuel system. JFS ignition and electrical power are provided by the JFS generator (permanent magnet). Starting power to the JFS is provided by a hydraulic motor that is driven by hydraulic pressure accumulators. The accumulators are charged automatically by circuit B of the utility hydraulic system, or manually by hand pump. The JFS automatically shuts down when the second engine reaches approximately 50% RPM. The JFS may be used inflight to perform a JFS Assisted Restart, refer to Section 3 of this POH.

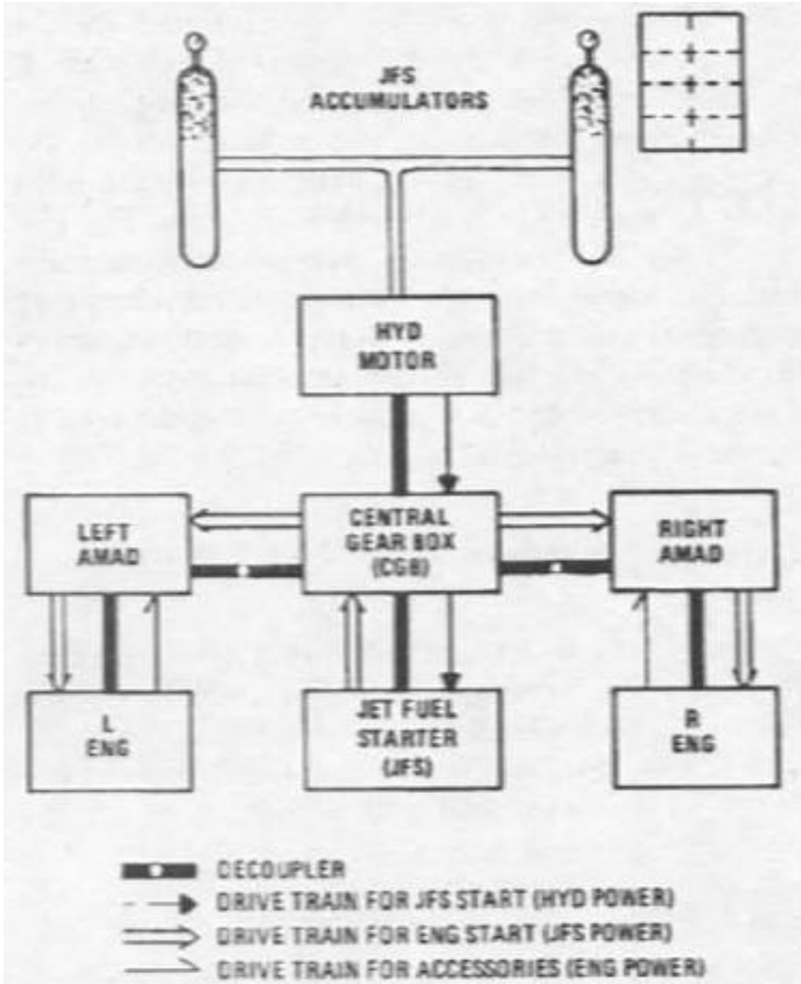


Figure 1-5

JFS Starter Switch

The JFS starter switch is in the front cockpit on the right console engine control panel. It has positions of ON and OFF. During engine start, the JFS is automatically shut down after both engines are started. However, it can be shut down at any time by placing the switch to OFF.

NOTE

On aircraft 86-0183 thru 87-0200, a manual JFS shutdown may result in the CAS and MPDP temporarily dropping off the line.

JFS Ready Light

The JFS ready light is in the front cockpit on the right console engine control panel. The light indicates the JFS is ready to be engaged. The light goes out when the JFS shuts down.

JFS Control Handle

The JFS control handle is in the front cockpit on the lower right corner of the main instrument panel. Pulling the handle straight out discharges one JFS accumulator. The handle is spring loaded to return to its normal position.

AIRCRAFT FUEL SYSTEM

Refer to the foldout section for airplane and engine fuel system illustration. Fuel is carried internally in four interconnected fuselage tanks, and two internal (wet) wing tanks. External fuel can be carried in three external tanks and two conformal fuel tanks. The external tanks are mounted on the centerline and inboard wing station pylons and are completely interchangeable.

Conformal fuel tanks (CFT) are mounted on the outboard side of each engine nacelle. All tanks may be refueled on the ground through a single pressure refueling point, airborne they can be refueled through the aerial refueling receptacle. External tanks may also be refueled through external filler points on each tank. Tank 1 consists of one main tank and a right auxiliary tank. The tanks are so arranged that all internal fuel will transfer even if the transfer pumps fail. CFT fuel is transferred by transfer pumps to any internal tank that will accept it.

Regulated engine bleed air pressure transfers fuel from any external tanks to any internal tank that will accept it and also provides a positive pressure on all internal fuel tanks. Each CFT is pressurized by a self-contained ram air pressurization and vent system. Float type fuel level control valves control fuel level during refueling or fuel transfer operations. All internal, CFT, and external fuel (except engine feed tanks) may be dumped overboard from an outlet at the trailing edge of the right wing tip. All internal fuel tanks are vented through the vent outlets at each wing trailing edge. The external tanks are vented through the vent outlets in their individual pylons. Each CFT is vented through its vent outlet near the back of the CFT. The fuel quantity indicating systems provides fuel quantity, in pounds, of all internal, CFT and external fuel. Refer to Servicing Diagram, this section, for fuel grade and specifications.

NOTE

Due to limitations with FSX's designation and naming of fuel tanks, the standard FSX fuel menu will only affect fuel quantities for tanks actually loaded on the aircraft. Fuel loadout is specified using the Aircraft Fuel & Stores Menu (Shift-4) to set initial fuel quantities and external tank loadouts. If the standard FSX fuel menu is used, any changes in tank quantities for tanks that were not loaded on the aircraft using the AFSM will not have those quantities actually added to the aircraft's total fuel quantity.

SURVIVABILITY

The internal fuel tanks, all of which are located forward of the engines, contain foam for fire/explosion protection. The feed tanks are self-sealing. Fuel lines are routed inside tanks where possible, and most have self-sealing protection when outside the tanks. All CFT compartments incorporate explosion suppression foam slabs for enhanced survivability. Dry bay areas (voids) around fuel cells on the sides and bottom of fuselage fuel tanks are filled with explosion suppression polyether foam.

FUEL TRANSFER SYSTEM

The fuel transfer system provides for internal fuel transfer and external fuel transfer. Internal fuel consists of L and R internal wing tank, L and R engine feed tanks, right aux tank, and tank 1. External fuel consists of L and R CFT, L and R external wing tanks, and the external centerline tank. Any sustained fuel imbalance greater than 200 pounds between internal wing tanks or 1,000 pounds between CFT lasting over 5 minutes should be reported on AFTO Form 781.

Internal Fuel Transfer

Internal fuel transfer is accomplished by three electric transfer pumps (L and R internal wing tanks and tank 1) and one fuel ejector pump (right aux tank). The electric pumps automatically transfer internal wing and tank 1 fuel to the engine feed tanks when the level control valve(s) is open in either of the two feed tanks. The transfer pumps run continuously when electrical power is applied to the aircraft and an engine master switch is on. In the MilViz F-15E, external fuel is also automatically transferred during all phases of flight.

External Wing and Centerline Tank Transfer

External wing and centerline fuel is transferred by engine bleed air pressure providing the landing gear handle is UP.

CFT Transfer

Each CFT contains two transfer pumps, one in the center compartment sump and one in the aft compartment sump. The sumps are connected by a float controlled interconnect valve which isolates the sumps until the aft compartment is almost empty or the aft transfer pump fails. Each CFT also contains an ejector pump that transfers fuel from the forward compartment to the center compartment. Each CFT also contains an ejector pump that transfers fuel from the forward compartment to the center compartment. The center pump transfers forward/center compartment fuel and the aft pump transfers aft compartment fuel.

When the aft compartment fuel level drops below and interconnect float valve level, the interconnect valve opens to connect the two sumps. The CFT transfer pumps run continuously when electrical power is applied to the aircraft and the engine master switch is on. Fuel transfers within the CFT are sequenced to automatically maintain the aircraft center of gravity within limits.

External Transfer Switch

The external transfer switch has switch positions of WING/CTR and CONF TANK. The switch is provided to select the transfer sequence of the external fuel. Whichever tank is selected, the opposite tank position will not transfer unless the selected tank position transfer rate is insufficient to maintain full internal fuel or the fuel in the selected tank is depleted.

If the transfer rate of the selected tanks is insufficient to maintain full internal tanks, all the external tanks (wing, centerline, and CFT) will transfer simultaneously until the internal tanks are full. Once full, the simultaneous transfer will cease until the transfer rate of the selected tank again fails to keep the internal tanks full.

Fuel Control Switches

Three fuel control switches, labeled WING (external wing tanks), CTR (centerline tank), and CONF TANK are on the fuel control panel.

NORM	Provides normal transfer and refuel of corresponding tanks.

STOP TRANS	Stops transfer from corresponding tanks, including automatic external transfer, unless FUEL LOW light is on, in which case fuel will transfer regardless of position of this switch.
STOP REFUEL	Will prevent filling of the tank(s) selected.

CFT Emergency Transfer Switch

In the MilViz F-15E, the CFT Emergency Transfer Switch is selectable, but the functionality has been deliberately disabled.

FUEL FEED SYSTEM

There are two separate fuel feed systems, one for each engine. During normal operation, fuel temperature is controlled by fuel recirculation to the internal wing tanks. The internal wing tanks act as a heat exchanger to lower the fuel temperature before it again transfers to the feed tanks. Baffles in the feed tanks provide limited fuel supply for the left and right main boost pumps during negative G or inverted flight.

During normal operation, the right main boost pump supplies fuel to the right engine only, and the left main boost pump supplies fuel to the left engine only. Below 1,000 pounds total feed tank fuel, feed tanks may not feed simultaneously. The main boost pumps are capable of providing pressurized fuel flow to the engines at all power settings throughout the flight envelope. If either or both main boost pumps fail, or either or both main generators are inoperative, or both main transformer-rectifiers fail, the emergency boost pump is activated and a system of tank interconnect and crossfeed valves allows the remaining operating pump(s) to supply all usable fuel in the feed tanks to both engines.

With one main boost pump and the emergency boost pump operating, pressurized fuel is supplied to both engines at all non-afterburner power settings throughout the entire flight envelope. With double boost pump failure (any two), the remaining pump is capable of supplying fuel to both engines at all non-afterburner power settings from sea level to 30,000 feet.

If both main boost pumps and the emergency boost pumps are inoperative, fuel is available to the engines by suction feed only. Under most flight conditions the engines require pressurized (boosted) fuel to preclude fuel vaporization. Therefore, loss of both main pumps and the emergency boost pump may cause dual engine flameout.

During single-engine operation, the feed tank of the inoperative engine will not feed to the operative engine until the fuel level of the good engine feed tank is well below FUEL LOW light activation.

L/R BOOST PUMP Cautions

The L and R Boost Pump cautions are displayed on the MPD/MPCD if the associated boost output pressure is low.

EMERGENCY BOOST PUMP ON Caution

The EMER BST ON caution on both the caution light panel, and the MPD/MPCD come on any time the emergency generator is operating and sufficient emergency boost pump output pressure is available.

BOOST SYSTEM MALFUNCTION Caution

The BST SYS MAL caution on both the caution light panel and the MPD/MPCD come on any time the emergency fuel boost pump output is insufficient.

TRANSFER PUMP Caution

The XFER pump caution is displayed on the MPD/MPCD and comes on when a failure of a CFT or a wing fuel transfer pump occurs. There is no differentiation between left or right transfer pump or between external wing tanks and CFT.

TRANSFER PUMP Voice Warning

Failure of the CFT or wing fuel transfer pump will activate the transfer voice warning. When a failure is detected the voice warning states: "WARNING TRANSFER PUMP" pauses, then repeats the warning.

FUEL TANK PRESSURIZATION AND VENT

The pressurization and vent system provides regulated engine bleed air pressure to all internal tanks to prevent fuel boil-off at altitude and to the external tanks for fuel transfer. The system also provides pressure relief of the fuel tanks during climbs, and vacuum relief of the fuel tanks, as required, during descents. The internal and external tanks are pressurized when the landing gear handle is UP. Internal and external tanks are depressurized when the landing gear handle is DOWN.

The pressurization and vent system is self-contained for each CFT. Each CFT provides regulated ram air pressure (from a flush inlet on the side of the CFT) to all three compartments to maintain positive tank pressures. The system also provides pressure relief of the CFT through the overboard vents during climb and air refueling, and vacuum relief during ground operation.

FUEL QUANTITY INDICATING SYSTEM

The fuel quantity indication system provides readings, in pounds, of usable internal, CFT, and external fuel. Refer to figure 1-6. The system components include the fuel quantity indicator, a built-in test (BIT), a BINGO caution display, and an independent FUEL LOW caution light.

Fuel Quantity Indicator

A combination pointer-counter fuel quantity indicator is on the lower right side of the main instrument panel. Refer to figure 1-6. The pointer indicates total internal fuel (with readings multiplied by 1,000). The upper counter marked TOTAL LBS indicates total internal fuel plus CFT and external fuel. The two lower counters, marked LEFT and RIGHT, and a selector switch provide individual tank monitoring and a check of the indicator. Erroneous fuel indications resulting from fuel slosh will occur during and immediately following maneuvering flight.

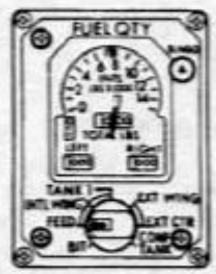
NOTE

The non-CFT fuel values in figure 1-6 do not apply to the MilViz F-15E as again, non-CFT configurations were not modeled. The decision to avoid modeling non-CFT configuration reflects the tactical doctrine that the F-15E is flown with CFT's installed as a normal condition.

FUEL QUANTITIES

(F-15E)

TANK		USABLE FUEL				
		GALLONS	JP-4		JP-8	JP-5
			POUNDS AT 6.5 LB/GAL	POUNDS AT 6.3 LB/GAL	POUNDS AT 6.7 LB/GAL	POUNDS AT 6.8 LB/GAL
TANK 1		604	3,900 ±150	3,800 ±150	4,050 ±150	4,100 ±150
RIGHT ENG FEED (TANK 2)		234	1,500 ±100	1,450 ±100	1,550 ±100	1,590 ±100
LEFT ENG FEED (TANK 3)		189	1,250 ±100	1,150 ±100	1,250 ±100	1,290 ±100
INTERNAL WING TANKS	L	496	3,200 ±250	3,150 ±250	3,300 ±250	3,370 ±250
	R	496	3,200 ±250	3,150 ±250	3,300 ±250	3,370 ±250
INTERNAL FUEL LESS CONFORMAL TANKS		2,019	13,100 ±500	12,700 ±500	13,550 ±500	13,750 ±500
EXTERNAL WING TANKS	L	610	3,950 ±300	3,800 ±300	4,100 ±300	4,150 ±300
	R	610	3,950 ±300	3,800 ±300	4,100 ±300	4,150 ±300
INT FUEL PLUS EXT WING TANKS LESS CONFORMAL TANKS		3,239	21,050 ±850	20,400 ±850	21,700 ±850	22,000 ±850
EXTERNAL ℄ TANK		610	3,950 ±300	3,800 ±300	4,100 ±300	4,150 ±300
INT FUEL PLUS EXT ℄ TANK LESS CONFORMAL TANKS		2,629	17,100 ±750	16,550 ±750	17,600 ±750	17,900 ±750
INT FUEL PLUS 3 EXT TANKS LESS CONFORMAL TANKS		3,849	25,000 ±950	24,250 ±950	25,800 ±950	26,150 ±950
CONFORMAL TANKS	L	728	4,750 ±300	4,600 ±300	4,900 ±300	4,950 ±300
	R	728	4,750 ±300	4,600 ±300	4,900 ±300	4,950 ±300
INTERNAL FUEL PLUS CONFORMAL TANKS		3,475	22,600 ±900	21,900 ±900	23,300 ±900	23,650 ±900
INT FUEL PLUS EXT WING TANKS AND CONFORMAL TANKS		4,695	30,500 ±1050	29,600 ±1050	31,450 ±1050	31,950 ±1050
INT FUEL PLUS EXT ℄ TANK AND CONFORMAL TANKS		4,085	26,550 ±950	25,750 ±950	27,350 ±950	27,800 ±950
MAX FUEL LOAD-INT FUEL PLUS 3 EXT TANKS AND CONFORMAL TANKS		5,305	34,500 ±1150	33,400 ±1150	35,550 ±1150	36,100 ±1150



NOTES

- THE FUEL QUANTITIES, IN POUNDS, ARE ROUNDED OFF TO READABLE VALUES OF COUNTER PORTION OF THE FUEL QUANTITY INDICATOR; THEREFORE, THE ACTUAL GALLONS TIME 6.5, 6.3, 6.7 OR 6.8 WILL NOT NECESSARILY AGREE WITH THE POUNDS COLUMN.
- FUEL WEIGHTS ARE BASED ON JP-5 AT 6.8, JP-8 AT 6.7 AND JP-4 AT 6.5 AND 6.3 POUNDS PER GALLON (DIFFERENCES ARE DUE TO MANUFACTURERS ALLOWABLE TOLERANCES) AND 65 DEGREES FAHRENHEIT.

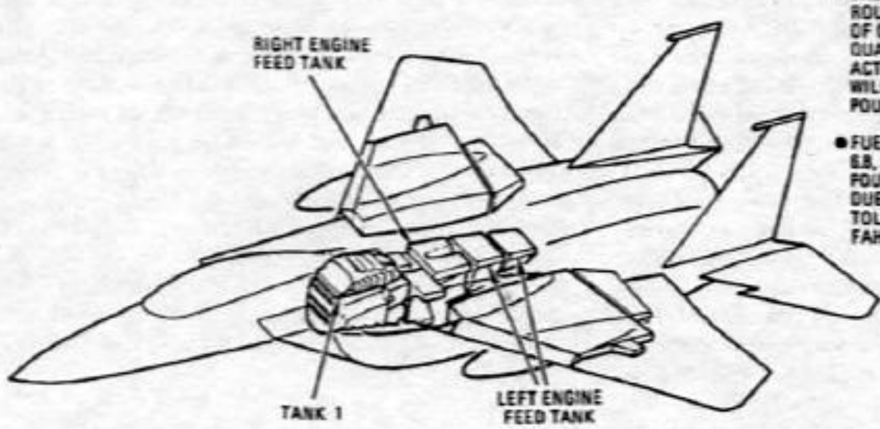


Figure 1-6

Fuel Quantity Selector Knob

FEED	The fuel remaining in the respective engine feed tanks will be displayed.
INT WING	The fuel remaining in the respective internal wing tanks will be displayed.
TANK 1	The fuel remaining in tank 1 will be displayed in the LEFT counter (RIGHT will indicate zero).
EXT WING	The fuel remaining in the respective external wing tanks will be displayed.
EXT CTR	The fuel remaining in the external centerline tank will be displayed in the LEFT counter (RIGHT will indicate zero).
CONF TANK	The fuel remaining in the respective conformal tank will be displayed.
BIT	A spring-loaded position that will drive the internal (pointer) and total (counter) indicators to 6,000 pounds, and the LEFT and RIGHT (counters) to 600 pounds indicating the fuel quantity indicator is operating normally.

FUEL LOW Caution

A FUEL LOW caution, on the MPD/MPCD display, warns the aircrew of a low fuel level in one or both engine feed tanks. The FUEL LOW caution is completely independent of the fuel quantity indicating system and is controlled by a sensor in each feed tank.

The sensor in the right feed tank is located at the 960 pound level and the sensor in the left feed tank is located at the 540 pound level. If either sensor is exposed (regardless of the combined indicated fuel quantity) the FUEL LOW caution will come on. The caution normally comes on at 1,500 plus/minus 200 pounds total internal fuel remaining. The FUEL LOW caution may come on with more than 1,500 pounds of fuel remaining if fuel transfer falls behind engine fuel consumption because of transfer system failure or sustained high speed afterburner usage.

The FUEL LOW caution activates automatic transfer of fuel from the CFT's and external tanks regardless of cockpit fuel switch positions. Transfer will stop as soon as feed tanks refill to the sensor levels and will reactivate when the fuel level again drops below the sensors.

FUEL LOW Voice Warning

The FUEL LOW voice warning is activated in conjunction with the FUEL LOW caution. When a low fuel condition exists, the voice warning states: "WARNING, FUEL LOW" pauses, then repeats the warning.

BINGO FUEL Caution

A BINGO fuel caution on MPD/MPCD comes on at a preset value, controlled by the aircrew. An adjustable index (bug) on the face of the indicator may be set to any internal fuel quantity by turning the bingo knob. If the bingo index is set above 600 pounds, the BINGO caution will come on when the BIT check is made. The bingo caution circuit may be used to automatically terminate fuel dumping.

BINGO FUEL Voice Warning

The bingo fuel voice warning is activated in conjunction with the bingo fuel caution. When a bingo fuel condition exists, the voice warning states: "BINGO FUEL" pauses, then repeats the warning.

FUEL DUMP SYSTEM

All fuel except engine feed tank fuel may be dumped by placing the dump switch DUMP. The dump switch is located on the fuel control panel. With the landing gear handle DOWN, external fuel cannot be dumped. Internal and/or CFT fuel is not dependent on the landing gear handle position. The fuel dump switch is spring-loaded to the lever-locked NORM position, and is electrically held in the DUMP position (with BINGO caution off).

When DUMP is selected, a motor-operated dump valve in the right internal wing tank opens. With the dump valve open, the transfer pumps in tank 1 and each internal wing tank force fuel out the right wing dump mast. Conformal fuel tanks and/or external fuel tanks transfer into tank 1 and the wing tanks and is then dumped.

Dumping will continue until STOP TRANS is selected or in the case of the external tanks, the landing gear handle is moved to DN. If the tank 1 and internal transfer pumps fail, external fuel passes through a check valve and is dumped. Dumping will continue until:

a. Norm is selected on the dump switch.
b. The BINGO caution comes on, at which time the dump switch automatically returns to NORM terminating fuel dumping.

c. Only feed tank fuel remains. This can occur if the BINGO bug is set below approximately 2,700 pounds.

The approximate fuel dumping rates are: right internal wing tank 390 PPM, left internal wing tank 260 PPM, and tank 1 of 260 PPM, for a total of 910 PPM dump rate. The uneven dump rates of the internal wing tanks produce a fuel imbalance (left wing heavy) of approximately 130 pounds per minute up to a maximum of approximately 1,100 pounds of wing fuel asymmetry. Wing fuel asymmetry will remain until all the fuel in the internal wing tanks is depleted.

EXTERNAL TANK JETTISON

The external fuel tanks may be jettisoned individually or simultaneously. See Stores Jettison Systems in this section.

AIR REFUELING SYSTEM

The air refueling system has a fixed receptacle, a slipway control switch, a hydraulically operated slipway door, two slipway lights, a receptacle flood light, a signal amplifier, a READY light, an air refueling release button, an air refueling pressure switch, and an emergency slipway door actuating system.

NOTE

- Air refueling with the MilViz F-15E is modeled, and incorporates an AI KC-135 that may be called up by the virtual pilot by bringing up the FSX toolbar while in flight, clicking on Add-ons, then MilViz Version 0.4.2161, and then Request Tanker.
- Two modes of refueling are selectable: Pro-Tanker Mode or Normal Tanker Mode. Normal Tanker Mode is automatically engaged upon request of the tanker. If the virtual pilot wants a more realistically demanding requirement, he may select Pro-Tanker Mode
- Pro-Tanker Mode requires physical boom latch to refuel
- Normal Tanker Mode merely requires that the MilViz F-15E be kept within these expanded parameters.
    - Within 200 feet of tanker altitude
    - Within 45 degrees right or left of tanker's rear
    - Within 0.4nm aft of tanker
- Signal "ready" by engaging the FSX command "Cowl flaps (close incrementally)" and if inside the Normal Tanker Mode parameters, or physically latched to the boom in Pro-Tanker

Mode, fuel flow will begin.

- Successful fuel onload is signaled by a repeating tone played while fuel transfer is ongoing. The tone will end when full fuel state is reached or if aircraft is allowed to maneuver outside required parameters.

For CG control, a float switch in tank 1 prevents external tank refueling until tank 1 fuel quantity is above approximately 1,560 pounds. The CFT's start filling immediately (regardless of tank 1 fuel quantity) with the CG being maintained by the sequence in which the CFT compartments are filled.

CAUTION

During refueling of external tanks or CFT's, a sudden fuel valve closure could occur, which may shatter the pylon standpipe, causing fuel to flow overboard. If fuel valves manufactured by Dolphin/Autovalve (Part Number 60486-1) are installed in the CFT or external fuel tank pylons, restrict the rate of flow for refueling (after internal fuel is full) to less than 150 gpm (gallons per minute). Valves manufactured by JC Carter are not restricted.

Slipway Switch

The three position slipway switch is located on the fuel control panel.

CLOSE — Closes the slipway door, turns on tank 1 and CFT transfer pump(s), reestablishes external fuel tank pressurization, and fuel sequencing.

OPEN — Shuts off tank 1 transfer pump, CFT transfer pumps (if operating), opens the slipway door, and, providing the slipway door has opened:

a. Depressurizes the external fuel tanks if FUEL LOW light not on.
b. Turns on the receptacle lights.
c. Turns on the READY light indicating the system is ready for boom engagement.

ORIDE — Accomplishes the same function as in OPEN above plus also the following:

a. Allows boom locking, but the tanker disengage feature (both automatic and manual) is lost.
b. The receiver must initiate all disconnects.
c. Bypasses tank 1 float switch and external tanks may be refueled, regardless of fuel tank 1.

NOTE

- With the slipway switch in OPEN or ORIDE and the slipway door open, the external tanks are depressurized and descent rate should not exceed 10,000 feet per minute.
- To prevent an undesirable CG condition when using ORIDE position, STOP REFUEL should be selected for the external tanks and CFT until tank 1 fuel quantity is above 1,560 pounds.
- FUEL LOW caution activation will not turn on the tank 1 transfer pump if the slipway switch is in OPEN or ORIDE.

Fuel Control Switches

The three fuel control switches, on the fuel control panel, provide an option of refueling the external/conformal tanks. If the switches are in NORM, the external/conformal tanks will fill during refueling. If any or all switches are in STOP REFUEL, then corresponding external/conformal tank(s) will not fill during refueling.

Air Refuel Pressure Switch

The air refuel pressure switch prevents the aircraft fuel system from becoming over-pressurized during refueling by unlatching the receptacle from the air refueling boom if fuel pressure exceeds approximately 80psi.

Air Refueling Release Button

The auto acquisition button is used as an air refueling release button. When the button is depressed, the receptacle unlatches from the boom.

Emergency Air Refueling Switch

In the MilViz F-15E, the Emergency Air Refueling Switch has been disabled. The slipway door will open normally in all cases.

GROUND REFUELING

All internal, CFT, and external fuel tanks are pressure fueled through a single point receptacle. However, the external tanks may be fueled through individual filler points. No external power is required for single point refueling.

NOTE

Ground refueling operations are accomplished for the MilViz F-15E through use of the AFSM to designate fuel loads as well as to load external fuel tanks on the available pylons. Due to limitations with FSX's designation and naming of fuel tanks, the standard FSX fuel menu has been disabled for the MilViz F-15E. If the standard FSX fuel menu is used, the fuel quantity can be changed, but upon exit from the FSX menu, the modified values will be ignored and the settings made in the AFSM will continue to be used. If ground refueling is desired, then the AFSM should be brought up with the aircraft on the ground and fuel and external tank settings modified as desired.

CFT Manual Precheck Valve

The manual precheck valve is located on the forward end of each CFT. This is not modeled on the MilViz F-15E given that actual ground fueling personnel actions are not modeled. Fuel is loaded on the ground through use of the AFSM menu.

ELECTRICAL POWER SUPPLY SYSTEM

The electrical power supply system consists of two main AC generators, three transformer-rectifiers, an emergency AC/DC generator, and a power distribution (bus) system. External electrical power can be applied to the bus system on the ground, and the JFS generator provides electrical power to part of the bus system during an engine start without external power. Refer to foldout section for electrical system simplified schematic.

AC ELECTRICAL POWER

Two AC generators are the primary source of electrical power. The two generators are connected for split bus nonsynchronized operation. This means that with both generators operating each generator supplies power independently to certain aircraft buses. If one generator fails, it drops off the line. At the same time, power from the remaining generator is provided to the buses of the failed (or turned off) generator.

Current limiters are provided to prevent a fault in one generator system from shutting down both generators. Either generator is capable of supplying power to the entire system. Each generator is activated automatically when its control switch is in the ON position, and the generator is connected to its buses when voltage and frequency are within prescribed limits (approximately 56% engine RPM). A protection system within the generator control unit protects against damage due to undervoltage, overvoltage, over and under frequency, feeder faults, and generator locked rotor.

If a fault or malfunction occurs, the generator control unit removes the affected generator from its buses. Except for an under frequency condition, the control switch of the affected generator must be cycled to bring the generator back on the line after the fault or out-of-tolerance condition clears. If the generator drops off the line due to under frequency and the prescribed frequency is restored, the generator will come back on the line automatically.

A generator may be removed from its buses at any time by placing the generator control switch to OFF. Indicator lights, labeled L GEN and R GEN, are on both caution light panels. These lights come on whenever their respective generator drops off the line with power available on the essential 115 VAC bus to illuminate the lights.

Generator Control Switches

Two generator control switches, one for each generator, are on the engine control panel. They are two-position toggle switches with positions of OFF and ON. The switches are lever-lock type and must be raised up before they are moved to a new position.

DC ELECTRICAL POWER

Three transformer-rectifiers (TR) are provided. The outputs of the left and right transformer-rectifiers are connected in parallel. However, protection is provided so that a short on the bus of one TR will not affect the other TR. Also, if either the right or left TF fails, the other TR will provide the entire DC system. A third TR is provided, the essential TR, which operates independently of the other two. No cockpit warning of single TR failure is provided.

EMERGENCY GENERATOR

A utility hydraulic motor-driven emergency AC/DC generator is provided. The emergency electrical system is separate from the primary electrical system. If either or both main generators are inoperative or both the left and right transform-rectifier fail, or some combination of faults occur, or if either or both main fuel boost pumps fail, the emergency generator is activated. If only one generator is inoperative or either or both main fuel boost pumps fail, the emergency generator powers the emergency/essential buses only (emergency fuel boost pump, arresting hook, emergency air refueling door open and AFCS/CAS).

If both generators are inoperative or both right and left transformer-rectifiers fail, the emergency generator supplies the essential AC/DC buses, the emergency/essential buses, and the ground power switch number one 28 volt DC bus.

With the aircraft on the ground and the emergency generator switch in AUTO during engine start without external power, the emergency generator automatically shuts off 30 seconds after first main generator comes on the line. The purpose of shutting down the emergency generator is to limit operation on the ground. The 30 second delay is to allow time to check the emergency generator/emergency boost pump system.

With the emergency generator switch in AUTO on the ground, both the EMER BST ON and BST SYS MAL lights come on in situations (single engine taxi, first engine start, etc.) where a main generator is off the line. The lights will go out when the second main generator comes on the line.

Emergency Generator Control Switch

The emergency generator control switch, on the engine control panel, is a three-position toggle switch with positions of AUTO, MAN, and ISOLATE. The switch is electrically held in the ISOLATE position.

AUTO	Provides automatic activation of the emergency generator if either or both main generators are inoperative, both left and right transformer-rectifiers fail, or either or both main fuel boost pumps fail. Also provides automatic shutdown of the emergency generator 30 seconds after the first main generator comes on the line after a ground start.
MAN	Provides manual activation of the emergency generator.
ISOLATE	Restricts the emergency generator to powering the emergency fuel boost pump and the arresting hook, and provides power from the emergency/essential 28 volt DC bus to the emergency air refueling switch to open the slipway door. It also provides power to the ground power switch number one 28 volt DC bus for

operation of the engine monitor indicator. Power and intercom are removed from the rear cockpit. In the event of a complete electrical failure, an attempt to restore the emergency generator may be made by cycling the switch to ISOLATE and back to MAN.

EMER BST ON/SYSTEM MALFUNCTION Caution

The EMER BST ON and BST SYS MAL cautions provide indication of the status of both the emergency fuel boost pump system and the emergency generator system. A single caution, or combination of cautions, indicates the following:

EMER BST ON	BST SYS MAL	STATUS
ON	OFF	Emergency fuel boost pump pressure normal and pump powered by emergency generator.
OFF	ON	Emergency fuel boost pump failed.
ON	ON	Emergency fuel boost pump pressure normal but powered by abnormal electrical source.

JFS GENERATOR

The JFS generator provides power to JFS ignition and control and, with the JFS READY light on, provides power to the intercom, front utility light, and AMAD fire warning. These items are powered by the JFS generator until JFS shutdown. If the JFS start switch is used for shutdown, the AMAD fire warning remains powered for a short time during JFS rundown.

EXTERNAL ELECTRICAL POWER

The MilViz F-15E does not require external power for any phase of operation and therefore the features associated with management of external power sources are not modeled in this jet.

External Power Control Switch

The external power control switch is modeled on the panel, but the switches themselves and the normal actions associated with those selections are not modeled in the MilViz F-15E. Therefore, their normal functions will not be discussed in this POH.

CIRCUIT BREAKERS

Circuit breakers for the AFCS, pitot heat, speed brake, flaps, landing gear, and nosewheel steering are provided on the lower center instrument panel in the front cockpit. Two circuit breaker panels are in the rear cockpit below the right and left consoles. All other circuit breakers are inaccessible to the flight crew.

HYDRAULIC POWER SUPPLY SYSTEM

Hydraulic power is supplied by three separate systems with each system divided into two or more circuits. Reservoir level sensing (RLS) is employed in all three systems for the purpose of isolating a leak. When a leak develops in a circuit a valve senses the reservoir level and shuts off the affected circuit. Through this method the maximum number of circuits remain operable. Refer to Hydraulic Flow Diagram in Section 3, and the hydraulic systems foldout for a description of what each system powers.

PC SYSTEMS

PC1 pump and PC2 pump operate at a pressure of 3,000 psi. Each PC system is divided into a circuit A and a circuit B.

UTILITY SYSTEM

The utility system has a left pump which operates at a pressure of 3,000 psi and a right pump which operates at a pressure of 2,775 psi. The utility system is divided into a circuit A, circuit B, and a non-RLS circuit.

RESERVOIR LEVEL SENSING (RLS)

If a leak occurs in any circuit, the reservoir level of that system (PC1, PC2, or utility) drops and circuit A is shut off. If the leak is in circuit B, the reservoir level continues to drop causing circuit A to be restored and circuit B is shut off. In the case of the utility system with a non-RLS circuit leak, circuit A is shut off then restored as circuit B is shut off. However, if flight is continued, a complete utility failure will eventually occur as indicated by zero pressure on the utility hydraulic gauge.

HYDRAULIC PRESSURE INDICATORS

Three hydraulic pressure gauges on the upper right corner of the instrument panel display PC1, PC2, and utility hydraulic system pressures.

HYDRAULIC SYSTEMS CAUTION LIGHTS

An amber HYD light on the caution light panel and the MASTER CAUTION light come on when any hydraulic system caution exists. The appropriate caution display: PC1 A, PC1 B, PC2 A, PC2 B, UTL A, and UTL B will be displayed on the MPD/MPCD when their respective RLS valve actuates to shut off that circuit. The L PUMP or R PUMP caution is also displayed on the MPD/MPCD when the respective utility hydraulic pump output pressure is low. An indication of a PC pump failure or low pressure is displayed on the MPD/MPCD. Resetting the MASTER CAUTION light will not extinguish the HYD light or the associated caution on the MPD/MPCD.

LANDING GEAR SYSTEM

The gear is electrically controlled and hydraulically operated. While weight is on the gear, the gear cannot be retracted. When the main and nose gear are extended, the forward door(s) will be closed.

LANDING GEAR CONTROL HANDLE

The landing gear is controlled by a wheel shaped handle located on the lower left side of the main instrument panel, and has two positions.

DOWN (DN)	Extends landing gear.
UP	Retracts landing gear.

Landing Gear Warning/UNSAFE Lights and Warning Tone

A red warning light in the front cockpit landing gear control handle and the rear cockpit UNSAFE light on the left lower main instrument panel comes on when any landing gear is not locked in the selected position. A low pitch (250 Hz) warning tone will be activated ten seconds after the landing gear control handle is placed down and will remain activated until all gear are down and will remain activated until all gear are down and locked.

The red warning lights will also illuminate due to an unlocked gear door when the landing gear control handle is up. These lights are independent of the three green landing gear position lights. The lights will illuminate and the warning tone will sound whenever the following conditions exist simultaneously:

- Aircraft altitude is below 10,000 feet
- Airspeed is below 200 KIAS
- Rate of descent greater than 250 FPM
- Gear handle is not down

In addition, the lights will illuminate and a warning tone will sound when the Air Data Computer (ADC) becomes inoperative, regardless of altitude, airspeed, or rate of descent. The warning tone may be silenced by depressing the warning tone silence button adjacent to the landing gear control handle. If the landing gear is up and locked and then the landing gear control circuit power fails (e.g., circuit breaker popped), the warning lights will illuminate. However, the warning tone will not come on.

Landing Gear Position Lights

There are three green landing gear position lights marked NOSE, LEFT, and RIGHT located on the left lower main instrument panel in each cockpit. Each light will illuminate when its respective gear is down and locked.

EMERGENCY LANDING GEAR HANDLE

An EMERG LG handle is located on the left main instrument panel in both cockpits. Emergency gear extension is accomplished by pulling either the front or rear cockpit EMERG LG handle full travel and ensuring the handle is locked in the extend (full travel) position. This bypasses normal hydraulic and electrical controls and hydraulically (JFS accumulator) releases the doors and landing gear. The landing gear then free falls to the down and locked position. The landing gear doors will remain open.

The emergency landing gear handle in the forward cockpit can be reset by rotating the handle 45 degrees clockwise and pushing forward. The handle in the rear cockpit must be pulled completely out and locked and once pulled and locked, cannot be reset from the rear seat.

NOSE GEAR STEERING SYSTEM

Nose gear steering is a full time mechanically controlled (front and rear cockpit rudder pedals) hydraulically powered (UTL A pressure) system that features a normal (15 degree maximum left or right) range. The steering system on the MilViz F-15E automatically engages whenever the nose gear is extended, and provides normal steering authority range.

WARNING

Due to the absence of modeling of the front control stick gear steering button, the increased maneuvering range that is present on the real world F-15E is not modeled on the MilViz F-15E.

Additionally, the real world strut compression engagement of the nose steering wheel is also not modeled. Use of the rudder pedals anytime the nose gear is extended will cause nose gear steering inputs. Therefore, special care must be taken to neutralize the rudder prior to the nose gear contacting the runway surface to avoid risk of ground looping the aircraft.

Emergency Steering

Emergency steering is not modeled in the MilViz T-38A

BRAKE SYSTEM

The main landing gear wheels are equipped with hydraulic powered brakes operated by toe action of the rudder pedals (or by use of the standard FSX brake keyboard commands). In FSX, braking action is present during all phases of flight and regardless of engine or power status.

Anti-Skid System

The MilViz F-15E is modeled for anti-skid braking. An ANTI-SKID caution and the MASTER CAUTION light will come on whenever the landing gear is down and a system failure is detected. A touchdown protection circuit (with anti-skid on) prevents hydraulic pressure from being applied to the brakes until both main wheels spin up. The brake pulser provides main tire skid control in the event that anti-skid braking is unavailable. Skid control effectiveness deteriorates below 30 knots. Therefore, heavy braking below 30 knots may result in locked wheels, potentially causing erratic steering ultimately leading to ground looping of the aircraft.

The pulser may be selected manually by use of the three position anti-skid switch. When the pulser system is activated, applied brake pressure is repeatedly interrupted to the wheel brakes. The settings of the anti-skid braking system and explanations are:

NORM	The anti-skid is on when the gear is down. In the MilViz F-15E, anti-skid is defaulted to on and can only be disabled via use of the FSX standard control menu key.
PULSER	Turns off normal anti-skid protection. For the MilViz F-15E, PULSER and NORM employ the same braking action.

OFF — The OFF position may be selected, but in the MilViz F-15E has been disabled, guaranteeing anti-skid braking operation.

Emergency Brake System

Emergency brake system pressure is supplied by the JFS accumulator and actuated by pulling the emergency brake/steering handle in either cockpit. In the MilViz F-15E, this option is always available regardless of the status of hydraulic systems.

Holding Brake (Parking Brake)

The holding brake is electrically controlled by a two position toggle switch located in the front cockpit on the lower main instrument panel.

ON — Holding brake is on regardless of status of hydraulic system.

OFF — Holding brake is off. In the MilViz F-15E, the holding brake will be disengaged with a momentary application and release of rudder toe braking action.

ARRESTING HOOK SYSTEM

A retractable arresting hook is in the underside of the aft fuselage. It is electrically controlled, extended by gravity and a hydraulic dashpot, and retracted by utility hydraulic pressure. Note: the MilViz F-15E retracts and lowers the arresting hook via the normal FSX commands or the cockpit switch, and does not require hydraulic pressure to facilitate full retraction.

Arresting Hook Switch

The arresting hook control switches are two position switches located on the front and rear cockpit left sub panels.

UP — Hook is retracted.

DOWN — Hook is extended.

ARRESTING HOOK Caution

Any time the arresting hook is not up and locked the MASTER CAUTION and HOOK caution lights illuminate.

FLAP SYSTEM

Each wing has a two position trailing edge flap. The flaps are electrically controlled and hydraulically operated. When the flaps are down, they are protected from structural damage by a blow up airspeed switch. The switch is set to automatically retract the flaps at approximately 250 knots. At approximately 240 knots, the flaps will automatically return to the down position, providing the flap control switch is in the down position.

Flap Control Switch

The flap control switch, located on the throttle quadrant on the real world F-15E, is not modeled on the MilViz F-15E. To operate the flaps, the default FSX commands may be used on the keyboard or assigned to a controller of choice.

UP	Retracts the flaps.
DOWN (DN)	Extends the flaps.

Flap Position Lights

The flap position lights are on the left sub panel. The YELLOW light indicates the flaps are in transit. A GREEN light indicates the flaps are down.

SPEED BRAKE SYSTEM

A speed brake is located on the upper surface of the center fuselage just aft of the canopy. It is electrically controlled and hydraulically operated. The speed brake in the MilViz F-15E is a two position brake: extended or retracted. The MilViz F-15E indexes the deployment or retraction of the speed brake based upon angle-of-attack so as to prevent continued deployment past a critical angle-of-attack. Therefore, above 25 units of AOA, the speed brake will automatically retract, and if the brake is commanded deployed, will automatically re-deploy it below 25 units of AOA. Operation of the MilViz F-15E speed brake is performed via the default FSX command.

WARNING

Deployment of the MilViz F-15E speed brake at or near critical angle of attack may cause immediate stall if the brake cannot retract before stall, possibly leading to catastrophic loss of the aircraft.

FLIGHT CONTROL SYSTEM

The MilViz F-15E employs the standard FSX commands for control of roll, pitch, and yaw. These maneuvers are accomplished via standard aileron, stabilator, and rudder controls. The F-15E uses a twin vertical stabilizer with twin integrated rudders. Pitch control is provided with two stabilators which are capable of symmetric or differential movement. The MilViz F-15E does not require hydraulic forces to maneuver the primary flight control systems and so they will function regardless of engine, hydraulic system, or power status.

Control Stick

While the MilViz F-15E models a moving control stick in both the forward and aft cockpits, the sticks are not modeled with their real world control switches. Control of the functions reserved to the control sticks in the real world F-15E are instead activated through use of standard FSX controls as well as customized weapons and radar controls that are specified in separate tutorial videos and manuals included with this release. Functionality of actual control sticks will depend upon whatever third-party procured control sticks the customer uses and programs for support.

Rudder Pedals

The rudder pedals operate conventionally and are adjustable. The rudder pedals are also used for the brakes and nose gear steering. Again, functionality of actual rudder pedals will depend upon whatever third-party procured rudder pedals the customer uses and programs for support.

Rudder Pedal Adjust Knob

The rudder pedal adjust knob is not modeled in the MilViz F-15E as the use of third-party physical controllers negate any virtual role such adjustments would provide.

T/O Trim Button and Light

The T/O trim button and light, on the CAS control panel, are not modeled on the MilViz F-15E.

Pitch, Yaw, and Roll Trim

In the MilViz F-15E, trim in each of the three axis (pitch, yaw, and roll) is achieved using the standard FSX commands, and are fully independent of engine, power, or hydraulic conditions.

Trim via physical controllers may be facilitated through customize programming of available switches on whatever third-party using the default FSX controller menu.

AOA TONE

The gear-down AOA tone is a high pitch beeping tone which starts at approximately 30 units of AOA. The beep rate increases as AOA increases. The tone may be eliminated by decreasing AOA.

HIGH ANGLE OF ATTACK WARNING

A high angle of attack warning is provided. This gear-up AOA tone is a medium pitch tone which starts at approximately 28 units AOA, depending on aircraft configuration. The landing gear handle must be up and the external stores configuration must be set correctly in the PACS for the AOA warning to function correctly.

The tone comes on at 28 units AOA. At 30 units AOA a beep rate is heard, and at 33 units AOA a steady tone will be heard. The AOA must decrease by 1 unit before the warning level transitions to the next lower state. The high AOA warnings pertain to all external stores configurations unless configured, with only air-to-air stores.

In addition, if the aircraft is loaded exclusively with SUU-20B/A dispensers on stations 2 and/or 8, the above limits are increased by 5 units AOA and consequently the warning tones will be triggered at 33, 35, and 38 AOA respectively.

NOTE

This high angle of attack warning tone uses the same tones as used by the OWS aural warnings.

DEPARTURE WARNING

With the landing gear up, a medium pitch beeping tone sounds when the yaw rate reaches 30 degrees per second. As the yaw rate increases the beep rate increases. The tone reaches a maximum beep rate at 60 degrees per second yaw rate. The tone sounds with the T/O trim button depressed and the T/O trim light on. The T/O trim beep rate correlates to approximately 45 degrees per second yaw rate.

AUTOMATIC FLIGHT CONTROL SYSTEM (AFCS)

The AFCS provides roll, pitch, and yaw control augmentation, autopilot modes in roll and pitch axes. In the MilViz F-15E AFCS interface with the terrain following is not modeled.

CONTROL AUGMENTATION SYSTEM (CAS)

Superimposed on the hydromechanical flight control system is a three channel, three axis control augmentation system (CAS). The CAS responds to electrical signals generated by forces applied to the control stick and to rudder pedal position. These signals modify the control surface deflections commanded by the hydromechanical flight control system to provide the desired flying qualities.

The CAS also provides increased damping on all three axes. Since CAS inputs are applied directly to the actuator and the inputs are due to force and require no control stick or rudder motion, with the CAS on, limited aircraft control is retained with the loss of any or all mechanical linkages.

The three channel design turns any axis off when a second like failure occurs. The CAS affects stabilator and rudder position only. The ailerons are not controlled by the CAS. A moderate yaw transient may occur and is normal when yaw CAS is disengaged, reengaged, or the landing gear is lowered.

CAS Caution Display

Three CAS caution displays (CAS YAW, CAS ROLL, and CAS PITCH) may illuminate on the MPD/MPCD any time their respective axis is disengaged by a failure in the CAS system or the switch is off. These cautions also light the master caution and the FLT CONTR caution on the caution panel. Any time the pitch or yaw CAS disengages, the roll CAS also disengages. A moderate yaw transient may occur and is normal when yaw CAS is disengaged or engaged.

If the roll CAS is functioning normally, it can be re-engaged following the loss of pitch CAS. Roll CAS cannot be engaged without an operating yaw CAS. A LAT STK LMT caution indicates that roll commands must be limited to half lateral stick inputs.

NOTE

CAS YAW and LAT STICK LIMIT cautions may be displayed after a single engine shutdown. This is normal aircraft operation and a YAW CAS reset should be attempted.

CAS Switches

The following three positions are applicable to the roll, pitch, and yaw CAS switches located on the CAS control panel.

ON	Allows normal operation after engagement.
RESET	Engages disconnected axis (provided fault no longer exists). The switch is spring loaded from RESET to ON.
OFF	Disengages applicable axis.

NOTE

On the MilViz F-15E, the CAS must be in the ON position before any autopilot mode of operation will be engaged.

BIT Button

A BIT button is located on the CAS panel. Pressing and holding the BIT button permits initiation of the AFCS BIT when the AFCS pushbutton on the MPD is pressed, the aircraft has weight on wheels, and the holding brake is ON. To initiate an AFCS BIT, the operator must press and release the pushbutton on the MPD/MPCD and verify AFCS IN TEST is displayed on the MPD/MPCD. Then release the CONSENT switch to allow BIT to run.

AUTOPILOT FUNCTIONS

The autopilot in the pitch axis provides attitude control, barometric altitude hold, radar altimeter hold or radar altitude select, and in the roll axis provides attitude hold, heading hold, TACAN steering, navigation steering, or ground track steering.

Upfront Control (UFC)

The UFC is the primary autopilot mode selection and engagement controller. The basic autopilot mode is selected and engaged using the UFC but before any autopilot mode can be engaged using the UFC, all three CAS axes, pitch, roll, and yaw, must be on.

The UFC menus involved in autopilot engagement and display of system and mode status are menu 1 and the autopilot submenu. See figure 1-7. Menu 1 provides current autopilot status information such as the engagement mode, and whether it has been coupled with the existing steering mode. The autopilot submenu provides the means of coupling the current aircraft steer mode and either the baro or radar altitude hold mode. When the autopilot is engaged in the autopilot status (same as Menu 1) is displayed centered on the top line. If the autopilot is not engaged by pressing the A/P button on the UFC, "A/P" is displayed centered on this line.

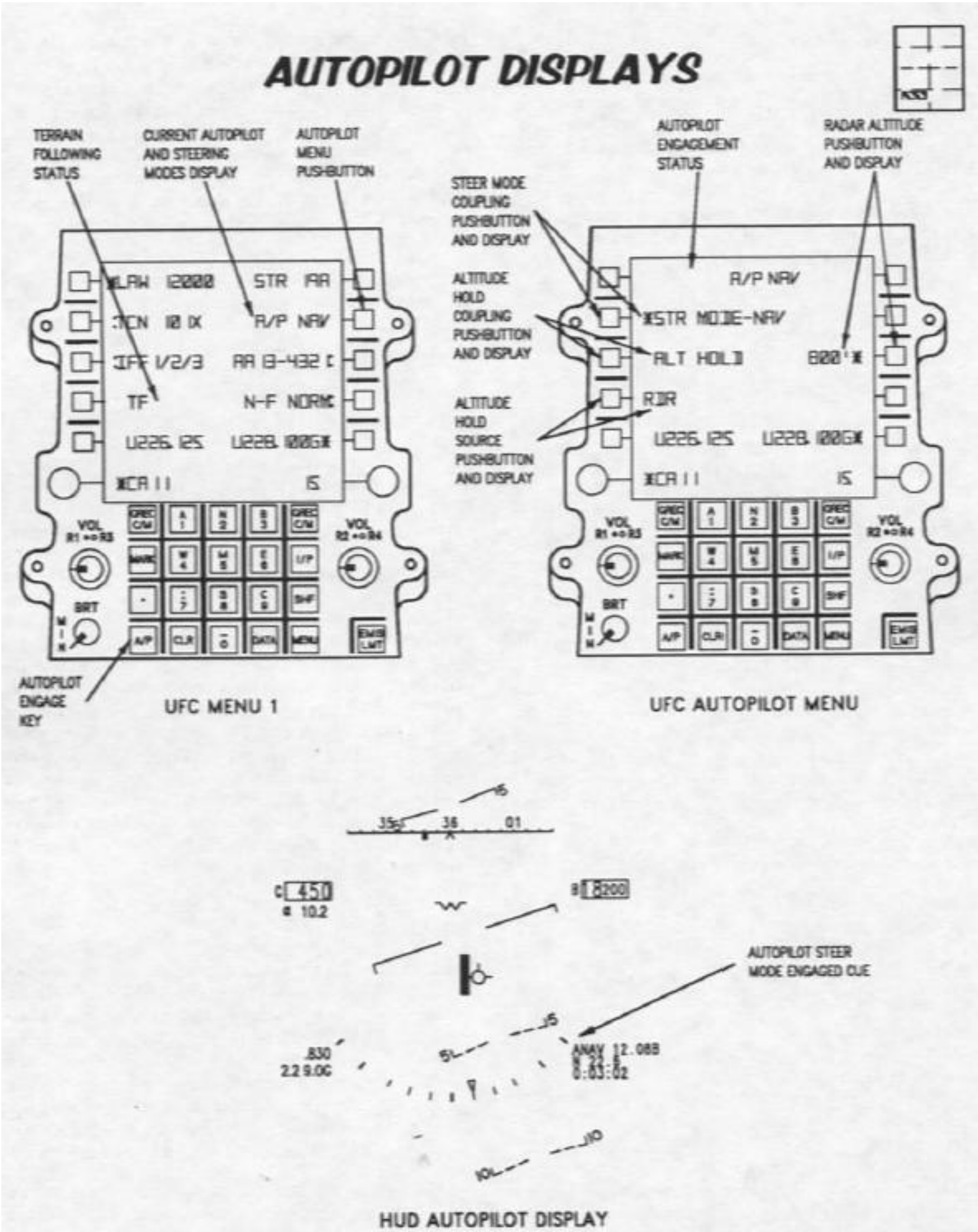


Figure 1-7

Autopilot Preselection

Autopilot modes of operation may be preselected on the autopilot submenu prior to coupling of the basic autopilot. Any option with an asterisk (steer mode and altitude hold) will be coupled when the UFC keyboard A/P button is pressed.

NOTE

Operating modes are remembered from the previous sortie. Before coupling the autopilot, review the autopilot submenu for Preselection.

Autopilot Engagement – Basic A/P Mode

The basic autopilot is engaged by pressing the A/P key on the UFC keyboard. The autopilot automatically engages pitch attitude hold if pitch is within 0 degrees plus/minus 45 degrees, and engages heading hold if the bank angle is 0 degrees plus/minus 7 degrees. If the bank angle is greater that plus/minus 7 degrees and less that 60 degrees roll, attitude hold is engaged until the bank angle is decreased to plus/minus 7 degrees and then automatically reverts to heading hold.

When the autopilot key is pressed, the UFC autopilot submenu replaces the current display to facilitate steer mode and/or altitude hold engagement selections. If attitude hold is engaged it appears on menu 1 in the current autopilot mode display as "A/P ATT." If heading hold is engaged it is displayed as "A/P HDG."

Autopilot Disengagement

The autopilot modes are disengaged by engaging the normal FSX keyboard or controller-assigned autopilot disengagement command, deselecting the mode via the UFC, or engaging a higher priority mode of autopilot operation via the UFC.

Autopilot Coupled With Steer Modes

The autopilot can be coupled with any one of three steer modes, navigation (NAV), ground track (GT), or TACAN (TCN). Steer modes are selected from the EHSI display format (figure 1-29). The UFC autopilot sub-menu, line 2, will show the steer mode currently selected on the HSI and is used to couple the autopilot to the displayed steer mode. If ILST or ILSN is selected on the HSI, the coupling to the steer mode is inhibited since the autopilot must be coupled prior to selection of the ILS modes on the HSI to fly an ILS approach. With the autopilot coupled, ILST and ILSN are removed from the HSI display.

NOTE

- If either ILS mode is selected on the HSI when the autopilot is coupled, the appropriate steer mode (TCN or NAV) is automatically selected and displayed on both the HSI and the UFC autopilot submenu. For example, if ILSN was selected, the NAV steer mode is automatically selected on the HSI (boxed) when autopilot is coupled.
- The TACAN steer mode no longer disengages automatically when flying through the zone of confusion (ZOC). In the ZOC, TACAN steering will parallel the desired course. Once out of the ZOC, TACAN steering will intercept and track the desired course.

Assuming that the basic A/P is already engaged, coupling of the selected steer mode is done from the autopilot submenu. Pressing the pushbutton next to the steer mode legend on the UFC displays an asterisk symbol next to the steer mode legend, couples the autopilot to the steer mode displayed, and displays an A/P symbol on the EHSI format.

If NAV steer mode has been coupled, the autopilot status is displayed on menu 1 as "A/P NAV," indicating that the autopilot is in the NAV steering mode. The two remaining steer modes, TACAN and ground track, are selected and coupled with the autopilot in the same manner.

In addition, the TACAN steer mode provides two display formats: PLAN view and course deviation indicator (CDI). When coupled to a steer mode, and "A" is displayed on the HUD to the left of the steer mode (figure 1-7).

Altitude Hold

Altitude hold is selected and engaged from the autopilot submenu where it is displayed as "ALT HOLD." One of two altitude hold modes are available, either radar (RDR) or barometric (BARO). To change the altitude source from radar to baro, press the pushbutton next to the displayed source. Assuming basic autopilot mode is engaged, the mode itself is selected by pressing the pushbutton next to the ALT HOLD. An asterisk symbol appears next to the ALT HOLD legend when selected.

BARO – With the BARO altitude source displayed on the autopilot submenu display, press the pushbutton next to the ALT HOLD legend to select the mode. ALT HOLD maintains baro altitude at selection. When selected an asterisk symbol appears next to the mode. The mode can be engaged if the vertical velocity is less than 2,000 feet per minute and disengages at 2,000 feet per minute or greater. The current altitude is held but not displayed on the A/P submenu in baro altitude hold.

WARNING

At low airspeeds (a function of gross weight and pressure altitude) when either the RDR or BARO altitude hold mode is being used, pitch authority becomes saturated and altitude hold will not be reliable. The system will not automatically trip off until the aircraft exceeds 2,000 FPM vertical velocity.

Radar – With radar (RDR) selected as the altitude source, two options are selectable, radar altitude select and radar altitude hold. The primary difference between the two is that a specific altitude is selected via the keyboard for radar altitude select whereas radar altitude hold maintains the altitude at selection. Each is described in the following:

a. Radar altitude select. First enter the desired holding radar altitude using the UFC keyboard. The selected altitude can be any value between 1,000 and 50,000 feet in increments of 10 feet. Once displayed on the scratchpad and confirmed as the desired altitude, the selection is transferred to the UFC display, opposite the ALT HOLD legend, by pressing the pushbutton next to the previously selected altitude value displayed in the PB8 legend.
b. Radar altitude hold. This mode is selected to maintain the existing aircraft radar altitude. The engagement limit is defined as a radar altitude of 400 to 50,000 feet. Selection is accomplished by first noting that the radar altitude select value on PB8 displayed has no asterisk, then press the pushbutton next to ALT HOLD.

WARNING

The MilViz F-15E does not model any "look ahead" capability in either radar altitude select or radar altitude hold modes of autopilot operation. Therefore, care must be taken to remain situationally aware of area of rapidly rising terrain to avoid catastrophic loss of the aircraft.

The autopilot status on MENU 1 with altitude hold or altitude select engaged and NAV steering selected (on the EHSI) and asterisk (on autopilot submenu) is displayed as "A/P NAV/ALT."

Control Stick Steering

In the MilViz F-15E, control stick steering will not override the engaged autopilot. For manual control stick inputs to affect aircraft pitch, roll, or yaw, autopilot must be first disengaged via the FSX autopilot disengagement command or via the UFC commands.

Autopilot Caution Displays

Caution displays relating to the autopilot system are indicated by illumination of the MASTER CAUTION LIGHT, the flight control caution light, and the specific caution displayed on the appropriate MPD/MPCD in each cockpit. Cautions are triggered as a result of crew action or autopilot system initiation.

There are two ways the autopilot related cautions can be activated by crew action. First is disengagement of the autopilot using the normal FSX autopilot disengage command. The second is an unsuccessful autopilot engagement attempt.

- Use of the FSX command to disengage the autopilot will cause the MASTER CAUTION, FLT CONTR (flight control) caution light, and MPD/MPCD autopilot (AUTO PLT) caution to illuminate. To extinguish the caution lights, press the MASTER CAUTION light in the cockpit to reset the caution system.
- If the crew attempts to engage an autopilot mode and the attempt is unsuccessful, the MASTER CAUTION, FLT CONTR caution light and the MPD/MPCD autopilot cautions are illuminated. Unsuccessful coupling also refers to the unsuccessful selection of a steer or altitude hold mode causing the same three caution cues to illuminate. In either case all three visual indications will remain on indefinitely until reset by the cockpit MASTER CAUTION reset function.

Any autopilot disengagement not initiated by the crew produces a minimum of three caution indications: MASTER CAUTION, flight control caution, and the MPD/MPCD AUTO PLT caution. In most cases, other related cautions will accompany this type of disengagement and will also be displayed.

The caution and warning system has been mechanized to provide caution indications to the crew of multiple autopilot related problems. The first autopilot related problem causes the MASTER CAUTION, flight control caution, and the MPD/MPCD AUTO PLT caution to come on. After MASTER CAUTION is reset, the crew is alerted to subsequent autopilot problems by the same system. The autopilot MPD/MPCD caution message is also repositioned to the top of the caution list.

CAS FUNCTIONAL FAILURE

CAS functional status is information available to the crew via the AFCS DETAIL BIT display. The data provided is intended as supplementary information as to the current operating mode of the flight control computer. The data may or may not be associated with an AFCS caution, but new information displayed will be accompanied by an AV BIT light. To see the functional failures displayed, first call up the BIT menu. Second, press the DETAIL pushbutton. Third, press the AFCS pushbutton on the detailed BIT display. The definition and associated options are as listed below:

PCAS First Fail

One of the three channels of flight control computer has detected a failure of an element (sensor, servo, switch, etc.) in the pitch axis of its channel. Although pitch CAS is in full normal operation, if a second channel detects a failure of the same element the pitch and roll axes will be shut down with a resulting degradation of pitch and roll handling qualities. Some of the first failures will automatically reset if the computer later determines normal operation. However, other failures are latched out until the PITCH RESET is cycled on the CAS control panel. Autopilot remains functional.

CASI Servoloop

The CAS interconnect servo provides the harmonization between pitch CAS and the pitch mechanical controls. If a second like failure occurs in this interconnect, pitch and roll CAS will shut down with associated CAS PITCH and CAS ROLL cautions in addition to the CASI SERVOLOOP status. Attempts should first be made to reset roll CAS with the ROLL RESET switch, then PITCH RESET switch on the CAS control panel. If pitch CAS is not resettable and the CASI SERVOLOOP status remains displayed, pitch CAS can be regained by positioning the pitch ratio switch to EMERGENCY prior to selecting pitch CAS reset.

NOTE

The combination of pitch CAS disengaged and Pitch Ration switch in emergency degrades handling qualities and should be accomplished at a safe altitude, below 500 KCAS and 1.0 Mach level flight conditions. A small trim change may occur if pitch CAS is reset and subsequently disengaged.

RCAS First Fail

One of the three channels of the flight control computer has detected a failure of an element (sensor, servo, switch, etc.) in the roll axis of its channel. Although roll CAS is in full operation, if a second channel detects a failure of the same element the roll axes will shut down resulting in degraded roll characteristics. Some of the first failures will automatically reset if the computer later determines normal operation. However, other failures are latched out until the ROLL RESET is cycled on the CAS control panel.

Roll Limit

A first failure has been detected in the AFCS schedule of roll authority versus airspeed. A second failure of the AFCS air data sensor will result in incorrect scheduling and an associated LT STK LMT caution. At high airspeeds, above 550 KCAS or 1.0 Mach, lateral stick inputs should be limited to one half of full authority.

AOA Fail

This status is displayed in association with a LAT STK LMT caution indicating the AFCS cannot determine the angle of attack. Roll CAS gain is set to zero which may result in degraded roll characteristics. Operations above 600 KCAS are permissible with lateral stick inputs limited to one-half full authority. Do not exceed one half lateral stick authority.

UCAS First Fail

One of the three channels of the flight control computer has detected a failure of an element (sensor, servo, switch, etc.) in the yaw axis of its channel. Although yaw CAS is in full operation, if a second channel detects a failure of the same element the roll and yaw axes will disengage resulting in lateral/direction stability degradation. Some of the first failures will automatically reset. However, other failures will be latched out until the YAW RESET is cycled on the CAS control panel.

Spin Recovery Failure

The AFCS provides spin recovery aid by disengaging CAS and selecting full mechanical roll authority if excessive yaw rate is detected. SPIN RECOVERY FAILURE in conjunction with a CAS YAW caution indicates yaw rate cannot be determined by the flight control computer and the spin recovery aid mode is inoperative. SPIN RECOVERY FAILURE status without an associated CAS YAW caution indicates full mechanical roll authority may be incorrectly selected. High AOA handling qualities and spin protection may be degraded. Avoid acrobatic maneuvers.

CAS ARI Off

The flight control system contains two harmonized ARI's. The mechanical ARI is scheduled as a function of stick position and the CAS ARI is scheduled as a function of roll rate and AOA. The mechanical ARI disengages at Mach 1.0 and the CAS ARI disengages at Mach 1.5. With the loss of the ability to determine Mach, roll rate, or AOA as a result of failures, the flight control computer disengages CAS ARI and displays CAS ARI OFF status. Although mechanical ARI is not affected by this, some additional aircrew coordination may be required during maneuvers above 30 units AOA.

RCP Stick Sensor

If the rear cockpit stick force sensor fails, pitch and/or roll CAS will disengage setting the CAS PITCH and/or CAS ROLL cautions with an associated RCP STICK status. CAS will be resettable. However, the rear cockpit stick force commands to the flight control computer will be inoperative. Stick inputs by the WSO will result in sluggish performance and reduction of loads (3.5g's maximum) capability. Only mild maneuvers should be attempted by the backseater.

CAS Rudder Pedal

If the rudder pedal position sensor fails, yaw CAS will disengage setting the CAS YAW caution with an associated CAS RUDDER PEDAL status. Yaw CAS will reset. However, the rudder pedal position sensor will be inoperative. Lateral directional stability will be normal for coordinated flight, but uncoordinated commands will tend to be washed out and should be avoided.

One Rudder CAS

If a rudder servo fails, the servo is disengaged and the CAS gain to the other servo is doubled. Yaw CAS will continue to work normally but total rudder power is reduced. Rolls must be limited to one half stick. No flight above the following limits:

Limits – 525 KCAS when > 1.6 Mach
-- With LANTIRN Pods

- 1.2 Mach < 18,000 ft
- 600 KCAS, 18-34,000 ft
- 1.6 Mach above 34,000 ft

Non-hydraulic BIT

NON-HYD is displayed on the DETAIL BIT page as a result of AFCS initiated BIT detecting an incompatible state of the aircraft hydraulic pressure switches or the PRCA thermal switch.

Some BIT tests requiring hydraulics will have been bypassed and therefore a full system test has not been accomplished. This status will remain displayed until a full system BIT can be initiated. Check the MPD/MPCD for cautions associated with the hydraulic systems. If all hydraulic systems are normal, proceed with the functional checkout of the Flight Control system.

BIT Code

Displayed as a result of any detected malfunction within the AFCS or associated flight control interface (for example BIT CODE 999A). BIT codes will cycle through all stored values and continuously repeat this process. In flight, BIT codes not associated with other functional failure information will not activate the AV BIT light. However, any stored code will activate the AV BIT light one minute after landing. BIT codes are intended as an aid to maintenance.

NOTE

Initiated BIT will clear all stored BIT codes. Pressing and holding the Emergency Disconnect Switch (EDS) and then pressing and holding the BIT consent switch also clears the stored BIT codes. To aid in aircraft maintenance, the AFCS BIT codes should be recorded before being cleared.

OVERLOAD WARNING SYSTEM (OWS)

An overload warning system (OWS) is provided. For the OWS to program properly, the external stores configuration must be correctly set in the PACS. A 900 Hz tone is heard in the headset to give warning that the maximum allowable G is being approached. The tone is first heard at 85% maximum allowable G or 1 G below the maximum allowable, whichever is lower, and is interrupted at a rate of 4 Hz to produce a beeping sound. At 92% the tone is interrupted at a rate of 10 Hz, until 100% the voice warning "OVER G, OVER G" is heard. The "OVER G, OVER G" continues until the percentage of overload falls below 100%. If the overload condition is relieved in the middle of an "OVER G" transmission, the transmission will be completed before the voice warning is discontinued. Inflight, OWS operation may be verified by display of both current G and maximum allowable G on the HUD.

The OWS computes fuel changes at a maximum of forty (40) pounds per second. Whenever the OWS computed fuel is greater than the aircraft configuration can hold (e.g. tank jettison), the OWS will be inoperative until computations catch up with actual fuel quantity.

Component Malfunctions

Failure of systems which supply data to OWS can cause the OWS to malfunction. Since these systems are also of prime importance for flight, a failure would be apparent to the aircrew (for example, CAS drop off, ADC BIT, fuel quantity malfunction, current G's unreasonable). If the aircrew detects a malfunction in one of these systems, the OWS should be considered inoperative and the flight manual non-OWS G limits should be observed, even though the HUD G window may still indicate the OWS is operating.

Certain failures can result in a continuous "over-G" voice warning. Logic was therefore incorporated to shut down the OWS after 30 seconds of accumulated voice warnings. Thus the aircrew should be aware that if the voice warning comes on for 30 seconds and then stops, it is not because the system has corrected itself. Checking the HUD in this situation will verify OWS shutdown, and the non-OWS G limits must be observed. The aircraft can verify that the OWS is operational by observing the following:

- Allowable G's are displayed on the HUD when airborne and current G's are of a reasonable value;
- The ARMT format on MPD/MPCD displays the actual configuration;
- The systems supplying information to the OWS are up (no ADC BIT failure, reasonable fuel quantity indications).

MPD/MPCD Display

When the aircraft is G loaded to 85% or more of the design limit, the overload conditions are stored in the CC memory and can be recalled as an information matrix on the MPD/MPCD. The overload conditions include normal acceleration in the G's (ACC), the percent overload (OVL), and overload severity codes for selected components.

Figure 1-8 shows a typical OWS matrix. The matrix is displayed on the MPD/MPCD by selecting OWS from the menu display. The abbreviations used on the display are:

ACC	Normal acceleration load factor. This is a two or three digit number with a decimal before the last digit understood (e.g., 92 is read as 9.2 G's).

OVL — Percentage of overload expressed as a whole percentage. The percentage severity code as follows.

%OVL	SEVERITY CODE LEVEL
0% -- 100%	0
101% -- 110%	1
111% -- 120%	2
121% -- 130%	3
131% -- 140%	4
141% and above	5

FUS	Fuselage
WNG	Wing
LTL	Left tail boom
RTL	Right tail boom
PYL	Pylon
CFT	Conformal fuel tanks
MIT	Mass items
CLR	Clear function for weight-on-wheels and to clear the OWS matrix from CC memory.
RCD	Record function for the video tape recording set (VTRS).

The first line of the display shows the worst (highest) overload condition recorded during the flight. The second line is the latest overload condition encountered. Subsequent lines display overload percentages and severity codes for the listed components. This information is used to determine the required maintenance action. An overload value of exactly 100 will cause a 0 to be displayed, but a value of 100 plus .01 will cause a 1 to be displayed. All applicable inspections are based on severity codes and not percent overload, which is displayed for information only.

Stored entries are automatically removed from the CC during INS align if no entry exceeds 100%. Overloads over 100% latch indicator 72 on the avionics status panel (ASP) and can be cleared by selecting CLEAR from the OWS display on the MPD/MPCD and having maintenance personnel reset the ASP in the nose wheel well. The procedure to clear the matrix is contained in section 2 of this POH.

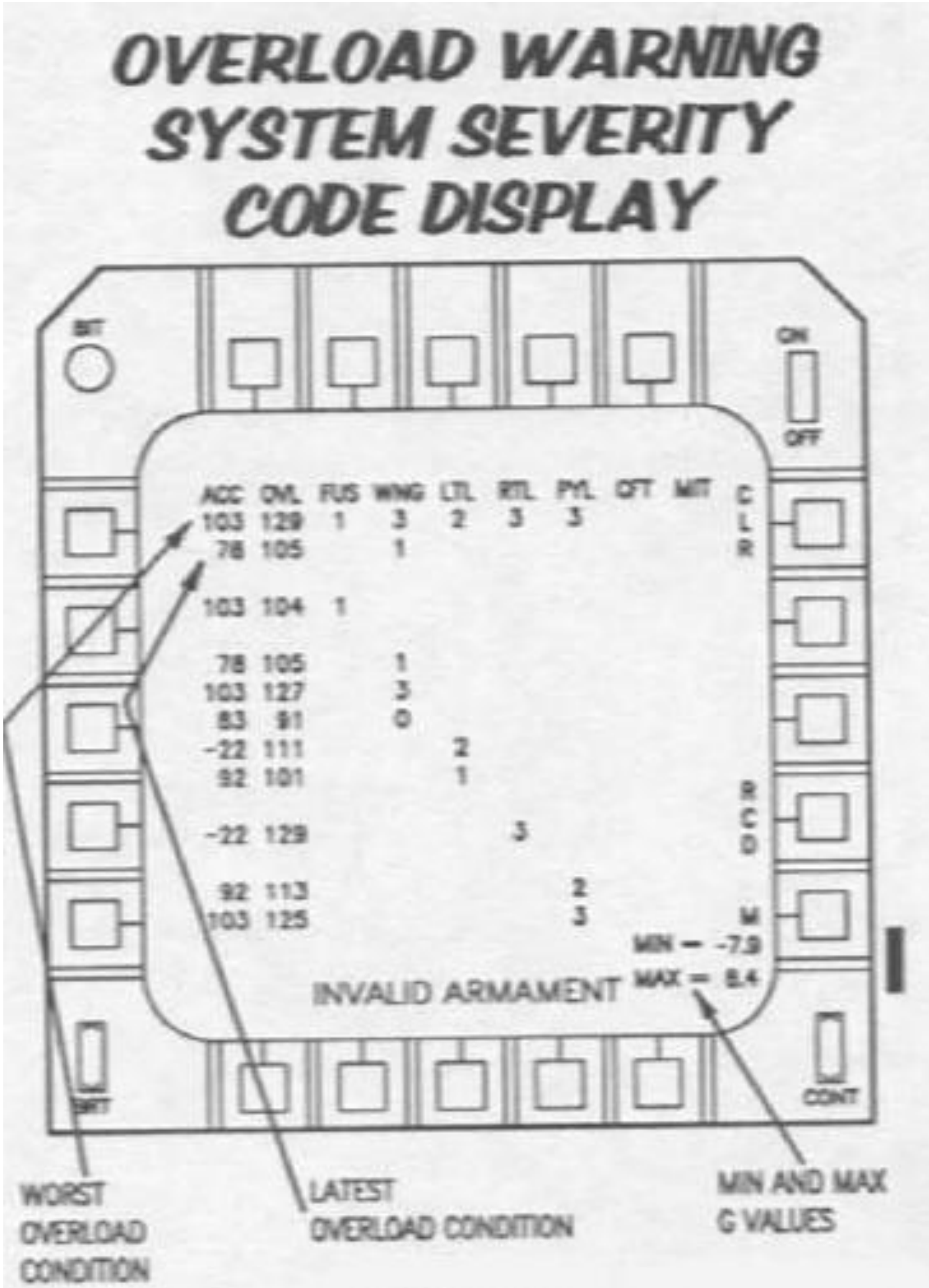

OVERLOAD WARNING SYSTEM SEVERITY CODE DISPLAY
BIT
ON
OFF
ACC OVL FUS WNG LTL RTL PYL CFT MIT
103 129 1 3 2 3 3
78 105 1
103 104 1
78 105 1
103 127 3
83 91 0
-22 111 2
92 101 1
-22 129 3
92 113 2
103 125 3
C L R
R C D
M
MIN = -7.9
MAX = 8.4
INVALID ARMAMENT
BRT
CONT
WORST OVERLOAD CONDITION
LATEST OVERLOAD CONDITION
MIN AND MAX G VALUES

Figure 1-8

WARNING/CAUTION/ADVISORY LIGHTS

The red warning lights provide indications of system malfunctions that require immediate crew attention. Except for the gear handle and gear UNSAFE lights, the warning lights are prominently located at or near the top of the instrument panel in both cockpits. The left and right BURN THRU lights are only located in the front cockpit. The caution lights also provide indications of system malfunction which requires less than immediate attention. There are two kinds of caution indications, the amber caution lights located on the caution lights panel in the front cockpit and on the warning/caution/advisory lights panel in the rear cockpit, and cautions which are displayed on the MPD's and MPCD's in both cockpits.

Only two cautions, the EMER BST ON and the BST SYS MAL, appear as both yellow caution lights and MPD/MPCD cautions. The FLYUP ARM yellow caution light appears only in the rear cockpit. MPD/MPCD cautions are initially displayed on the right MPD in the front cockpit and the right MPCD in the rear cockpit. Depending on the number of cautions displayed, they are present in three columns written left to right as they occur. The most recent caution will appear at the top of the right column. See figure 1-9.

CAUTION LIGHTS

There are three yellow caution lights on the caution lights panel in the front cockpit and warning/caution/advisory light panel in the rear cockpit which are classified as major category caution lights. These lights, ENGINE, FLT CONTR, and HYD, provide a prompt that MPD/MPCD cautions from that particular category are being displayed. The MASTER CAUTION light comes on with any of the major category caution lights. The corresponding MPD/MPCD caution will remain on until the problem is corrected. The systems associated with each major category light caution are as follows:

<u>ENGINE</u>	
ATDP	
FUEL HOT	INLET ICE
L BST PUMP	R BST PUMP
L INLET	R INLET
L BLEED AIR	R BLEED AIR
L ENG CONTR	R ENG CONTR
L OIL PRESS	R OIL PRESS
<u>FLT CONT</u>	
AUTO PLT	CAS PITCH
RUDR LMTR	PITCH RATIO
CAS YAW	ROLL RATIO
CAS ROLL	LAT STK LMT

HYD

L PUMP	R PUMP
PC1A	PC1B
UTL A	ULT B
PC2A	PC2B

With double generator failure and the emergency generator operating, cautions will be displayed only on the MPCD in the front cockpit. With a CC failure only, cautions are always displayed on any CRT that has the radar display format.

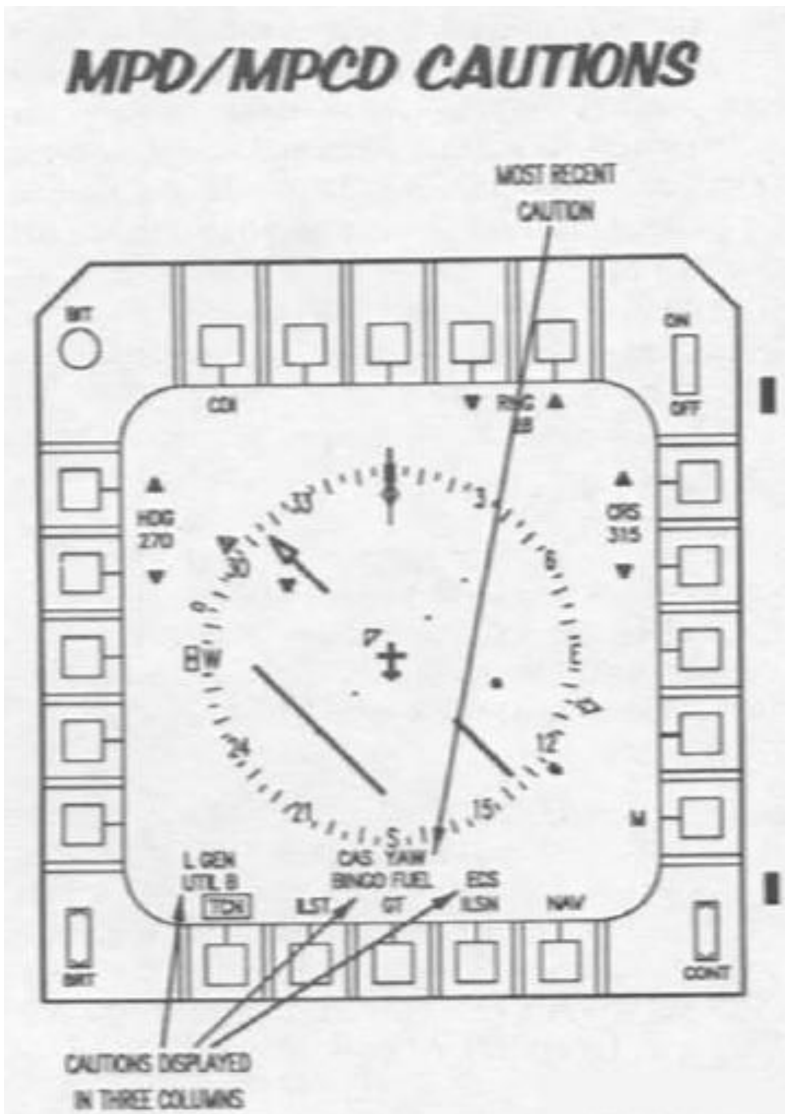


Figure 1-9

ADVISORY LIGHTS

The advisory lights, which are either green or white, indicate safe and normal conditions and impart information for routine purposes. Individual advisory lights are located throughout the cockpit and are described with their applicable equipment. A list of warning/caution/advisory lights, with causes of their coming on and correction action to be taken is described in Section 3 of this POH. Intensity control of the lights is described in lighting, this section, MASTER CAUTION LIGHTS.

MASTER CAUTION LIGHTS

The MASTER CAUTION lights, on the upper instrument panel in both cockpits, come on simultaneously when any MPD/MPCD caution comes on. They also come on with all yellow caution lights except the following: PROGRAM, MINIMUM, CHAFF, FLARE, LOCK/SHOOT, AV BIT, LASER ARMED, EMIS LMT, and FLY UP ARM. The MASTER CAUTION lights go out when the front cockpit MASTER CAUTION is pressed but, except for the AUTO PLT caution, the caution remains on until the malfunction is corrected.

Although the MASTER CAUTION lights do not come on with the AV BIT caution, pressing either cockpit MASTER CAUTION light turns off the AV BIT. Note: the rear cockpit MASTER CAUTION light cannot be used to re-set the master caution lights circuit or turn off the MASTER CAUTION light.

AUDIO WARNING SYSTEM

The audio warning system is made up of both audio tones and voice warnings. The weapons lock on tone, TEWS caution and launch tones, ILS audio, and TACAN audio are volume controlled by the RCIP for the cockpit and the ICSCP for the rear cockpit. The IFF mode 4 tone is generated by the IFF transponder in response to a valid mode 4 interrogation.

The OWS tone is generated by the MPDP when the aircraft approaches design limit structural overload. When overload is exceeded, the tone is replaced with a voice warning. The unsafe landing warning tone is generated as a function of landing gear position, aircraft altitude, airspeed, and rate of descent. The AOA stall warning tone is generated when the angle of attack exceeds 28.4 units.

The AFCS enables the departure warning tone when the yaw rate exceeds 30 degrees per second. The beep rate of the tone increases as the yaw rate increases, and the maximum beep rate is reached at a yaw rate of 60 degrees per second. The voice warning system volume cannot be adjusted. The silence button on the ICSCP/RICP is used to silence any voice or tone warning for up to one minute.

The voice warning system activates the following warnings if conditions exist which cause the associated warning lights to come on:

- "AB BURN THRU LEFT"
- "AB BURN THRU RIGHT"
- "BINGO FUEL"
- "LOW FUEL"
- "LOW ALTITUDE"
- "OBSTACLE AHEAD"
- "OVER-G"
- "WARNING, AMAD FIRE"
- "WARNING, FUEL LOW"
- "WARNING, ENGINE FIRE LEFT"
- "WARNING, ENGINE FIRE RIGHT"
- "WARNING, OVERTEMP LEFT"
- "WARNING, OVERTEMP RIGHT"
- "WARNING, TRANSFER PUMP"

Voice warning for OVER-G continues until the condition causing the voice warning system to activate is corrected. All other voice warnings repeat twice and do not repeat again unless the condition causing the warning is corrected and subsequently reoccurs.

Voice warning for the AMAD fire detection system and the FTIT indicators become effective with JTS operation during first engine start. Voice warning for the engine fire detection system and fuel low level detection system becomes effective with application of external power, or with the emergency generator coming on the line during engine start.

BUILT-IN TEST (BIT) SYSTEM

The built-in test (BIT) system provides the crewmembers with displays of avionic system status. Most information is derived from BIT mechanizations in the avionics sets and from non-avionic BIT's implemented in computer software for other aircraft systems.

Three methods are used: continuous, periodic, and initiated. The continuous method constantly monitors particular signals for presence, value or logic. The periodic method automatically intersperses test signals and replies amongst operating signals in such a manner that they do not interfere with normal equipment operation. The initiated method must be initiated by the crewmember and causes an interruption of normal operation of the designated system for the duration of the test.

Equipment Status Displays

Equipment status displays (BIT, caution, and advisory) provide the aircrew with continuous status of the avionic equipment. The AV BIT caution lights are a cue to check equipment BIT status.

Failure to pass any BIT test causes the appropriate equipment indicator(s) on the avionics status panel in the nose wheel well to latch, the front and rear cockpit AV BIT caution lights to come on, and if appropriate a system caution is displayed. Pressing the front cockpit MASTER CAUTION light turns off the AV BIT caution lights. BIT failures will be displayed by pressing the BIT button on the MENU display.

BIT DISPLAY

A MENU selectable BIT display (figure 1-10) contains the status of all BIT tested systems and is selected by pressing PB20 (BIT) on the main menu. The systems which may be BIT tested are displayed around the outer edge of the BIT display. To select a particular system for BIT, press the PB next to the desired system or combination of systems. The center of the BIT display is divided into two "windows." The upper "in-test" window displays the systems in which an inhibited BIT is being performed. The lower "equipment failure" window displays the system(s) that are turned off, not installed, or have failed BIT.

Initiated BIT

In addition to displaying the system BIT status the BIT display is used to command an initiated BIT. Those systems identified by the options on the display periphery have initiated BIT capability (figure 1-10). The basic BIT format is altered slightly depending on whether the aircraft is on the ground or airborne.

AFCS, DSPL, ADC, EXCS, and INS are displayed only when on the ground. AIU, RALT, and LANT are removed when conduction flight operations requiring their active function. The BIT is initiated from either cockpit by pressing the button adjacent to the desired option. When a BIT is initiated the other options are removed and the STOP option is displayed. Pressing STOP button will terminated the BIT in process. If STOP is pressed while an LRU is performing BIT and LRU remains locked in BIT for 5 seconds or longer, ESCAPE will replace the STOP legend.

If ESCAPE is pressed, the BIT routines in the CC are reset so BIT can proceed on other systems. ESCAPE should only be used as a last resort to abort the initiated BIT after STOP has failed. System lockup may occur when ESCAPE is pressed.

BIT may be initiated one at a time or in certain combinations. In the case of AFCS and PACS, additional switchology is required. Selection of AUTO BIT causes a simultaneous BIT of a majority of the avionic equipment. Refer to AUTO BIT.

NOTE

During ground operation, the DSPL legend on the BIT menu will not be displayed when either of the below conditions exist:

- A top level armament display has been selected on any MPD/MPCD.
- A nuclear display is selected which does not have the MENU legend displayed next to PB 11.

The above condition will exist if either of these two conditions list in the note above were previously selected on any MPD/MPCD even though that MPD/MPCD is turned off. If a DSPL BIT is required on the ground and DSPL legend is not displayed, turn on all MPD/MPCD and deselect any top level armament or nuclear displays.

AUTO BIT

If the AUTO button is pressed, BIT are initiated in time sequence for systems turned on. Prerequisites for ground AUTO BIT are: the PACS, HUD, and other peripherals must be turned on and the radar timed in (if included). The sequence is initiated by pressing the pushbutton adjacent to AUTO and will take 3.5 to 4 minutes to run if radar is included or 1 minute if radar is OFF.

The systems are displayed in the "in-test" window as they perform BIT and are removed when complete. The minimum time any equipment will be displayed is two seconds. If a failure is detected, the system is removed from the "in-test" window and is then displayed in the "failure" widow.

When an LRU with an asterisk is displayed as a no-go, DETAIL information may be available. If STOP is selected, all systems tests will be terminated, except the radar, ICSCP, and radar altimeter, which will continue to run. The following systems are tested during AUTO BIT:

AAI	IBS
ADC	ICS
ADF	IFF
AIM	M/4
AIU 1A	MPDP
AIU 1B	RALT
AIU 2	RDR

CMD	RMR
COMM	RWR
EMD	TCN
EWW	FWD UFC
EXCS	AFT UFC

The EXCS, ADC, and MPDP are not tested during AUTO BIT when airborne. The radar altimeter is not tested during AUTO BIT when airborne and used as an active component during any phase of flight.

FUNCTIONAL FAILURES

Functional status information is provided on the DETAIL BIT display for the AFCS, TGT Pod, and navigation FLIR. This information is supplementary and may trigger the MASTER CAUTION light. When AFCS, TGT FLIR, or NAV FLIR are displayed on any BIT format, check the DETAIL page for functional failure information. Refer to Section 3 of this POH for the meaning of AFCS functional failures.

AFCS PREFLIGHT INITIATED BIT

For the AFCS, the BIT button on the CAS panel in the front cockpit must be pressed and held when BIT is initiated from the BIT display. This prevents inadvertent initiation of BIT display. This prevents inadvertent initiation of BIT on the AFCS for reasons of flight safety. AFCS BIT is terminated by pressing the STOP button on the BIT display. If AFCS BIT is interrupted, the message INCOMPLETE is displayed in the lower display window. Reinitiate AFCS BIT to clear the INCOMPLETE legend. Running a successful AFCS BIT will clear the INCOMPETE. If the INS is powered, holding brake must be ON to perform AFCS initiated BIT.

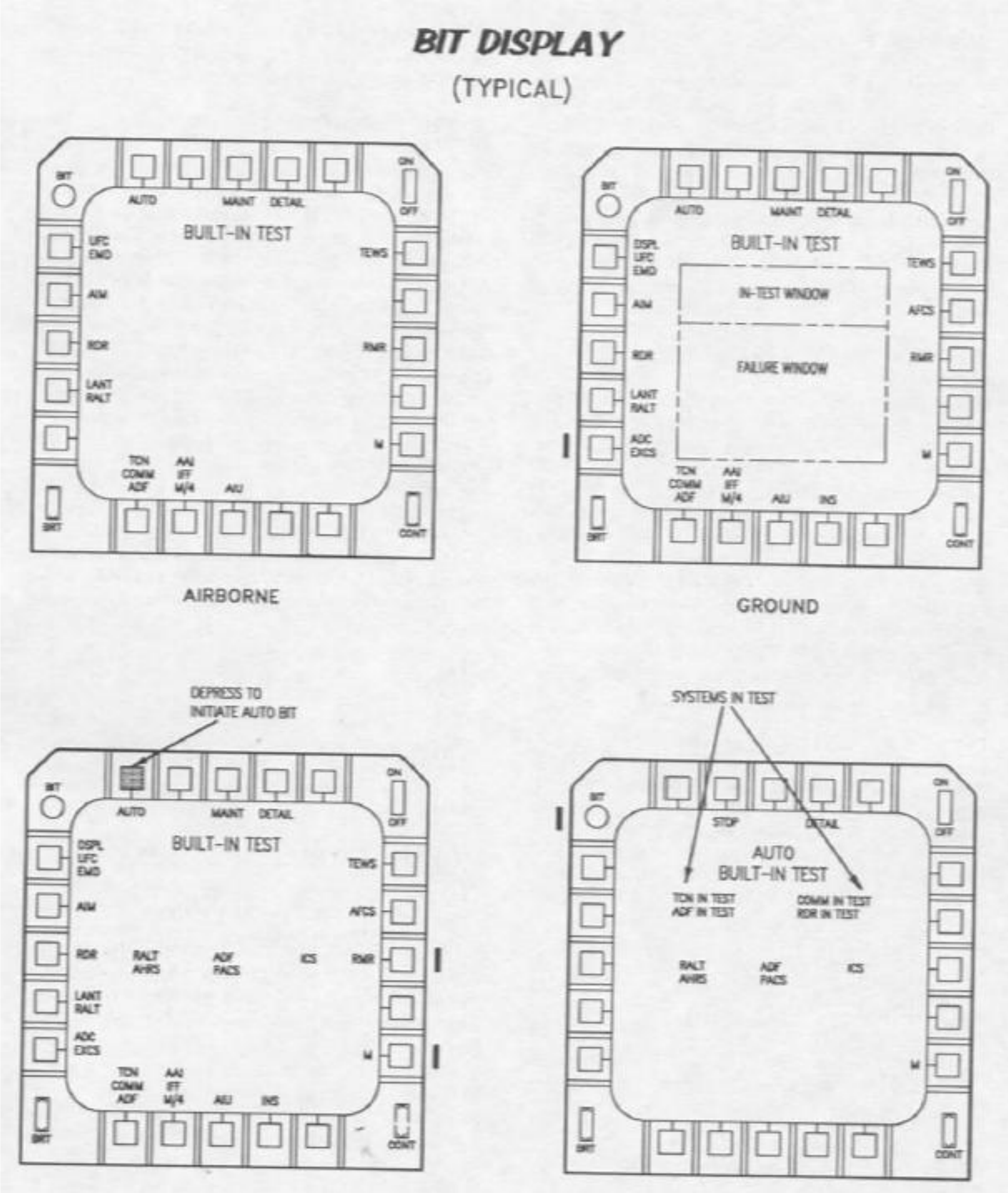

BIT DISPLAY
(TYPICAL)
BUILT-IN TEST
AIRBORNE
GROUND
IN-TEST WINDOW
FAILURE WINDOW
DEPRESS TO
INITIATE AUTO BIT
SYSTEMS IN TEST
AUTO
BUILT-IN TEST
TCN IN TEST
ADF IN TEST
COMM IN TEST
RDR IN TEST

Figure 1-10

CENTRAL COMPUTER (CC)

The central computer (CC) is a high speed, stored program, general purpose digital computer that performs mission oriented computation from data received from control panels and subsystems aboard the aircraft. The computations include A/A and A/G steering and weapon delivery, navigation, flight director, and control and display management. The CC provides the aircrew with steering and weapon delivery cues, target data, avionic system status, weapons configuration, and flight data in the air-to-air attack, air-to-ground attack, visual identification (VI), and navigation (NAV) modes of operation.

The CC computations are controlled by the operational flight program stored in the CC memory. Failure detection of the peripheral systems and CC internal operation is done by continual monitoring. Backup system substitution is also accomplished in the central computer. If the computer detects a power loss or failure there is a drastic change in the display formats.

In the front cockpit, the left MPD displays the radar A/A format (with A/G format selectable), the MPCD displays ADI, the right MPD displays TEWS, and the HUD shows a backup format. In the rear cockpit, the left MPCD displays ADI, the left MPD has a radar display, the right MPD displays, TEWS, and the right MPCD displays TSD.

CENTRAL COMPUTER INTERFACE

The central computer is interfaced with the radar, Programmable Armament Control System (PACS), AFCS, Air Data Computer (ADC), Attitude Heading Reference System (AHRS), Multipurpose Display System, Head Up Display (HUD), Signal Data Recorder (SDR), Radar Warning Receiver (FWR), Inertial Navigation Unit (INU), the Engine Diagnostic Unit (EDU), and the Avionics Status Panel. The CC reset is performed by pressing the CC reset button on the front cockpit sensor control panel. The CC reset should be initiated only if a CC problem is suspected.

MISSION NAVIGATOR (MN)

NOTE

If the CC is replaced, an INS precision velocity update (PVU) is required to correct for pointing errors.

The CC maintains a MN routine separate from the INS. The MN integrates PVU corrected velocities for use in weapons delivery modes. It also provides relative target ranges in platform coordinates and allows position updates independent of the INS.

MULTIPLEX BUS (MUX BUS)

Coded messages are transmitted between the CC and remote terminals in both directions on the multiplex bus. The coded messages are in serial digital format. The CC (or MPDP in backup mode) establishes communications on the avionics 1553 mux bus by scheduling all messages. Messages are blocks of data that contain the total information to be transferred. The blocks of data in a message are called words. There are three types of words: command, status, and data. The CC (or MPDP in backup mode) gives commands, inspects status, and receives and sends data.

AVIONICS INTERFACE UNITS (AIU)

The avionics interface unit set consists of two avionics interface units, AIU number 1 and AIU number 2. The AIU set controls, processes, and routes interfacing signals between multiple aircraft systems. The table below lists the units and data that are lost if an AIU fails.

The AIU set communicates with the CC by way of the avionics 1553 mux bus. During backup mode, when the CC has failed, the AIU set will communicate with the multipurpose display processor (MPDP). Data which is transferred between the AIU set and the CC is listed below:

1. BIT data – aircraft systems and AIU set.
2. Up-front display and control data.
3. Aircraft systems discrete, mode, control, and status data.
4. Cautions, warnings, and advisories.
5. UHF and IFF initialization.
6. Memory inspect data.

System/Items Degraded/Function Lost Due To AIU Catastrophic Failure

Failed AIU	Item Degraded	Data Lost
AIU1(A)	UHF no. 1 radio	No Operation
AIU1(A)	All MPD/MPCD displayed cautions (except LOW ALT and LASER)	No longer displayed
AIU1(A)	TACAN	No operation
AIU1(A)	IFF/RICP (IFF functions)	No operation
AIU1(A)	ADF	No operation
AIU1(A)	UHF2 Cipher	No operation
AIU1(A)	KY-58	Function lost
AIU1(A)	EWWS	BIT function lost
AIU1(A)	PACS (missile caged and missile reject)	No operation
AIU1(B)	Left hand controller	All switch functions lost except for CMD dispenser switch
AIU1(B)	Fuel flow on MPD/MPCD	No data transfer (erroneous fuel flow data displayed)
AIU1(B)	ILS	No operation
AIU1(A) & (B)	Avionics BIT and ASP	No operation
AIU1(A) & (B)	Asymmetric thrust departure function	Function lost
AIU2	UHF 2 radio	No operation
AIU2	Right hand controller	Functions lost
AIU2	AAI	Function lost

Figure 1-11.1

System/Items Degraded/Function Lost Due To AIU Catastrophic Failure

Failed AIU	Item Degraded	Data Lost
AIU2	KIR	Function lost
AIU2	HF COMM (Not used)	No operation
AIU2	FWD/ REAR sensor control panel	No system control
AIU2	LANTIRN (NAV and Targeting)	All operation lost
AIU1(A) and AIU2	Radar altimeter (CARA)	No data transfer (Erroneous data display)
AIU1(A) and AIU2	Emission limit	No operation
AIU1(A) and AIU2	EMD (BIT data AIU1(A), BIT discretes - AIU2, serial data)	No operation
AIU1(A) and AIU2	ICSCP	No COMM transmit capability
AIU1(A) and AIU2	Control stick grip	All switch functions lost except weapon release and trigger
AIU1(A) and AIU2	UFC panel (both)	No operation
AIU1(A) or AIU2	TF function (Requires CARA data from both AIU1(A) and AIU2)	No operation
AIU1(A) and AIU2	LOW ALT warning	Indication lost
AIU1(B) and AIU2	FWD throttle	All switch functions lost
AIU1(B) and AIU2	FWD sensor control panel	No system control
AIU1(B) and AIU2	Master modes	No operation
AIU1(B) and AIU2	LASER ARMED warning	Indication lost

Figure 1-11.2

DATA TRANSFER MODULE SET (DTMS)

The Data Transfer Module Set (DTMS) is not modeled on the MilViz F-15E because the purpose of the DTMS in the real F-15E is to facilitate electronic flight plans and weapons computations at a centralize planning facility and transfer for quick upload to the aircraft's systems. FSX does not facilitate any such option.

CONTROL STICK AND THROTTLE QUADRANT

The control sticks and throttles on the real world F-15E are specifically modeled for complex multiple HOTAS commands. Given that it is impractical to model precisely these features on the virtual control sticks and throttles in the virtual front and rear cockpits, these options are not present in the MilViz F-15E. However, default FSX commands as well as custom keyboard commands may be programmed using both the default FSX controller interface menu or third–party applications to allow the customer to program various available third-party controllers to fully replicate the HOTAS function. Customers who do this are therefore free to customize the commands to their personal desires. For these reasons, the illustrations and explanations of the control stick on the real world F-15E is omitted from this POH.

UPFRONT CONTROLS (UFC)

The upfront controls in the front and rear cockpit are the major interface units for control of avionics subsystems. The UFC consists of 10 function buttons, six 20-character rose of display, four radio volume controls, two rotary brightness control knob, and an EMIS LMT pushbutton (figure 1-12). The UFC Built-in test (BIT) and continuous BIT. Basic self test, initiated BIT and continuous BIT. Basic self test is run each time the unit comes out of the OFF mode. Initiated BIT is run in response to the BIT initiate discrete input.

The third level of BIT is continuous as performed in normal operation. This method depends on the aircrew observation because of the large number of switches and display segments. Each level of BIT is desensitized such that a single glitch will not cause a no-go indication. The UFC provides control of the following systems:

a. Intertial Navigation System (INS) – data entry and display
b. TACAN – frequency input and tuning
c. Autopilot – attitude hold, altitude hold, radar preset altitude, and steer modes.
d. IFF/SIF
e. AAI
f. UHF radios – including ADF and KY-58.
g. ILS
h. NAV FLIR

Either of the two UFC's controls all systems and each is driven by its own processor (an AIU) with paths to the other AIU. This provides a redundancy when a UFC or processor failure occurs.

The UFC panel alphanumeric pushbutton keys as well as the other pushbuttons are read by the CC. Numbers 0-9 or letters A, N, B, W, M, E, S, C, -(dash), decimal point, and colon are available.

0-9 Key	Enters number
SHF (shift) Key	Enables upper case functions on next key pressed.
A/P Key	Selects autopilot format and couples autopilot.
MARK Key	Mark and selects marked point for display.
MENU Key	Selects menu format 1st Push – MENU 1 2nd Push – MENU 2 3rd Push – MENU 1
DATA Key	Selects data display format 1st Push – DATA 1 2nd Push – DATA 2 3rd Push – DATA 1
CLR (clear) Key	Three functions on successive pushes 1st Push – Removes last character entered. 2nd Push – Clears all scratchpads 3rd Push – Clears display except radio data. Press one of the top 8 pushbuttons to recall the top 4 lines. All keyboard entries are active but data entry may be made for radios only. The scratchpad is enabled for display. If any of the top eight pushbuttons are pressed with data in the scratchpad the entry is invalid and the scratchpad flashes. If data is displayed, the CLR key blanks the scratchpad only. 4th Push – Clears all 6 rows of display. When all 6 rows are blanked, the scratchpad is not displayed and no data entry is permitted. MARK A/P, DATA, MENU, I/P and EMIS LMIT are the only active keyboard keys.
I/P Key	Initiates IFF identification of Position (I/P)
Decimal Point Key (.)	Enters decimal point

GREC C/M Key	Left or Right key enables/disables guard receiver or changes between preset channel and manual frequency on appropriate radio.
VOL R1, R2, R3, R4	Volume control for selected radio
EMIS LMT Key	Limits electronic emissions from the aircraft for passive operations. The EMIS LMT light comes on when first selected. When pushbutton is pressed again the emission limit is deselected and most emitters return to their previous state of operation. However, TACAN T/R must be reselected and all IFF modes must be reselected or phasing re-enabled on the UFC.
BRT	Controls brightness of LCD displays

The UFC multifunction buttons are used as the options indicated, except button 5 and 6 which are dedicated to radios/submenu displays. Buttons are numbered 1 thru 10 beginning at the top left. PB1 thru PB5 are top to bottom on the left. PB6 thru PB10 are top to bottom on the right.

NOTE

When making an entry requiring a decimal point, the decimal point must be entered, except for manual UHF frequencies.

Since a large number of system functions have been integrated into the UFC, several menus or display formats were developed. These displays are called data displays, menus, and submenus. There are 2 data displays, 2 menus, and 19 submenus. Regardless of the data or submenu displayed, the radio communication information is always retained. The two data displays (DATA 1 and DATA 2), menus (MENU 1, MENU 2) and the submenus pertaining to communications and radio navigation are described in the following paragraphs.

Data 1 Display

The following descriptions reference the information displayed on Figure 1-12. This displays current aircraft information. It is selected by pressing the DATA pushbutton on the UFC keyboard (Figure 1-12). On this format, pressing PB1 shows LOS bearing and range to current steerpoint and ETE/ETA. The selection will initially power up to display steerpoint bearing and range. The PB may be pressed and released to toggle through the three selections. PB2, PB3, and PB4 display calibrated, true, and ground speeds respectively. Additionally, PB3 and PB4 control the display of true airspeed and groundspeed on the HUD and EADI formats (an asterisk is displayed on the UFC when the display is enabled). PB7 displays either winds (from IS if in air data mode) or the CC clocktime (must be set each sortie by aircrew).

The display will initially power-up to display time at PB7. Radar (CARA) and baro-corrected altitudes are displayed by PB8 and PB9 respectively. In addition, PB8 controls the display of radar (CARA) altitude on the HUD and EADI formats (as asterisk is displayed on the UFC when display is enabled). PB10 shows the current steerpoint. Steering can be changed by typing the new point in the scratchpad and entering it by pressing PB10. Pressing PB10 with a blank scratchpad calls up the point data submenu.

Data 2 Display

Again, the following descriptions reference the information presented on Figure 1-12. Pressing the DATA pushbutton a second time displays the data 2 display (Figure 1-12). This display contains NAV data functions which provide the capability to determine what the remaining fuel will be at a selected sequence (steer or target) point, time enroute, and so forth. On the data 2 display, the sequence points are indicated by SP followed by the point number identifier. Only steer and target points may be identified as sequence points (SP) on the data 2 display. Target 23, route alpha is the current line of sight point selected. As a result, the 15,000 pounds readout represents the amount of fuel remaining when the aircraft reaches the SP if the aircraft travels at the current aircraft ground speed displayed, 395K, from the aircraft present position direct to SP24A. Also shown is the calculated ETA to reach SP24A. Pressing the pushbutton next to the ETA will provide the ETE. If range and bearing to SP24A is desired, pressing the pushbutton next to the fuel remaining (15,000 pounds) will display the information.

Within the same format a second sequence point, SP25A, is displayed automatically with the data relating to it because it is the next point after the line-of-sight point with a time-on-target (TOT) assigned to it. The 12,000 pounds readout is estimated fuel remaining when the aircraft gets to SP25A. Pressing the pushbutton next to either time-of-arrival (TOA), fuel (12,000 lbs), or command ground (CG) speed will cause TOT to be displayed as shown on figure 1-11. This selection also displays the words FUEL REM in place of the fuel remaining, and CG speed to make the TOT display next to CG. If no TOT has been stored for this point, OFF will appear next to TOT and CG. When CG is selected (asterisk) it will be displayed on the HUD just below AOA.

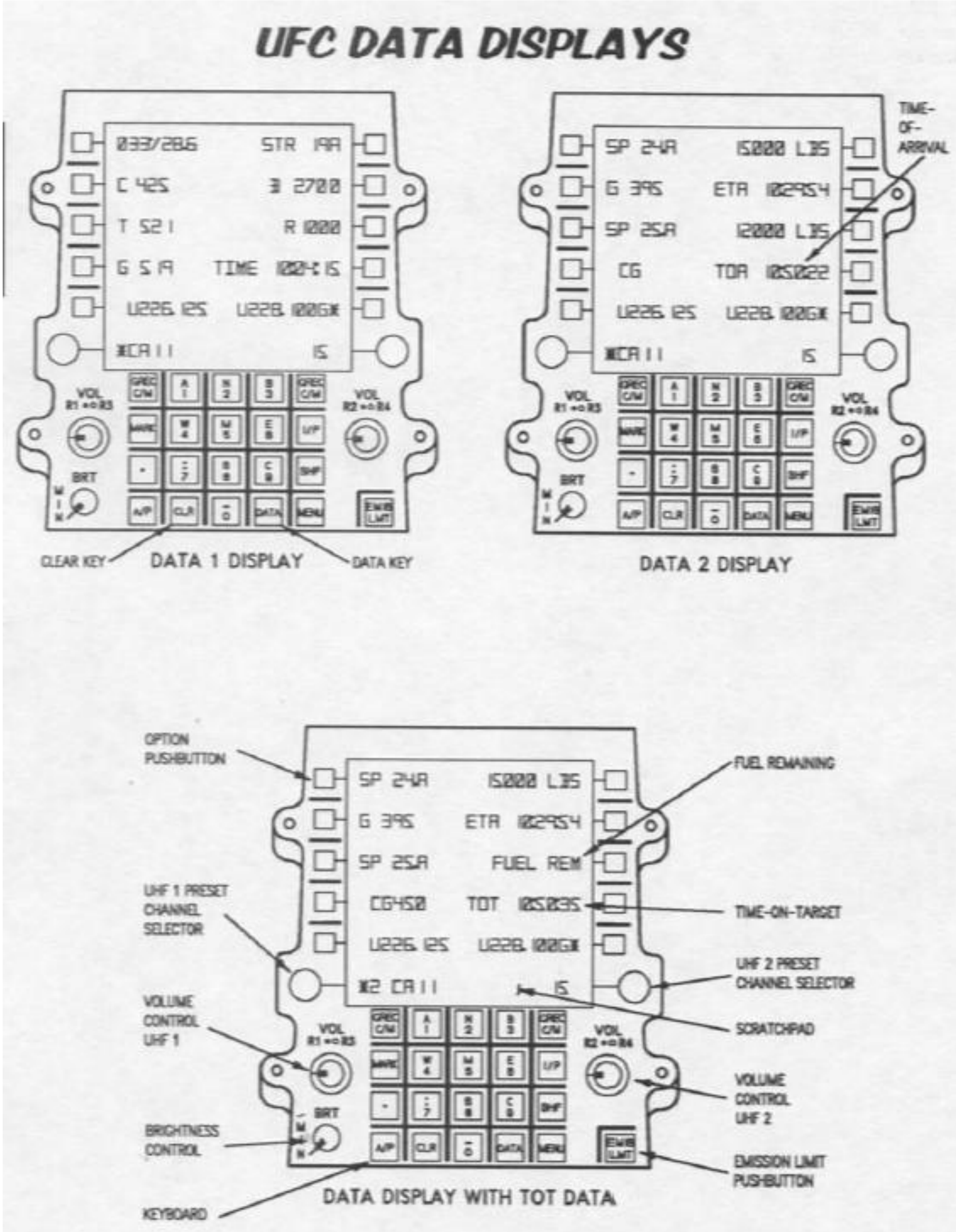

UFC DATA DISPLAYS
033/28.6
STR 19A
C 42S
3 2700
T 52 1
R 1000
G 5 A
TIME 1024:15
U226.125
U228.1006X
CA 1 1
15
CLEAR KEY
DATA 1 DISPLAY
DATA KEY
TIME-OF-ARRIVAL
SP 24A
15000 L35
G 39S
ETA 102954
SP 25A
12000 L35
CG
TOA 105022
DATA 2 DISPLAY
OPTION PUSHBUTTON
FUEL REMAINING
FUEL REM
CG450
TOT 105035
TIME-ON-TARGET
UHF 1 PRESET CHANNEL SELECTOR
UHF 2 PRESET CHANNEL SELECTOR
SCRATCHPAD
VOLUME CONTROL UHF 1
VOLUME CONTROL UHF 2
BRIGHTNESS CONTROL
EMISSION LIMIT PUSHBUTTON
KEYBOARD
DATA DISPLAY WITH TOT DATA

Figure 1-12

Menu 1 Display

The following descriptions use the information referenced on Figure 1-13. Pressing the MENU pushbutton on the keyboard (Figure 1-13) calls up the MENU 1 format. The information displayed and controlled from MENU 1 is described in the following paragraphs.

LAW	The LAW (12000' AGL) with the asterisk displayed indicates the system has been enabled with the adjacent pushbutton and the low altitude voice warning and light will be activated if the aircraft first climbs above and then descends below the altitude (AGL) displayed. The LAW altitude is changed by keyboard entry into the scratchpad and pressing the pushbutton next to LAW (based on CARA).
TACAN	The current TACAN channel selected and operating is channel 101 mode X. The colon indicates power is on. TACAN channels are changed by keyboard entry of the new channel number into the scratchpad and pressing the pushbutton next to TCN. Turning the TACAN ON/OFF, changing between mode X or Y, and changing operating operating modes (A/A, TR/ or REC) is done from the TACAN submenu. Pressing with a clean scratchpad displays the TACAN submenu. Refer to TACAN system for detailed TACAN operations.
AAI 3-4321	Indicates the current air-to-air interrogation (AAI) mode and code (3-4321). Pressing with a blank scratchpad displays the AAI submenu. AAI modes and codes can be changed from this format using the procedure described under IFF, this section.
N-F NORM	Indicates the current NORM mode/power status of the LATIRN navigation FLIR. Pressing with a blank scratchpad displays the NAV FLIR submenu.
A/P NAV	Indicates autopilot is engaged and current steer mode if any. In this case NAV steer mode. Pressing with a blank scratchpad displays the autopilot submenu.

IFF 1/2/3	This IFF format indicates that 1/2/3 modes 1, 2, and 3 have been selected for operation. If only mode 3 had been selected, the 1 and 2 would not be displayed. If it is necessary to change mode 3's code, for example, first, press 3 to identify the mode to be changed and second, press SHF (shift) to select the upper case functions of the keyboard, then third, select DASH (-), then fourth select the digital code, and then fifth, enter the new code by pressing the pushbutton next to IFF. The entered mode and code is displayed for 5 seconds and is then replaced by only the enabled modes without codes. A colon indicates power is on. Modes are selected/deselected from the IFF submenu. IFF phasing selection and programming are also done from the IFF submenu.
STR 19A	Indicates that current steer (STR) point is number 19 route alpha (A). Steering to a new point is selected by typing the desired point in the scratchpad and pressing in the scratchpad and pressing this pushbutton. Pressing this pushbutton with a blank scratchpad displays the point-data submenu.

Menu 2 Display

Menu 2 display (Figure 1-13) is selected by a second pressing of the menu pushbutton. The information displayed is described in the following paragraphs.

JVC	JTIDS voice code (JVC)
JMC	JTIDS mission code (JMC). For entry of JITDS data.
A/G DLVRY	Pressing this pushbutton displays the Air-to-Ground Delivery sub-menu.
: ILS 108.70	Indicates current instrument landing system (ILS) localizer frequency selected, with the colon indicating it is being powered.
PP-MN	Pressing the pushbutton displays the PP keeping submenu (INS, MN, TCN, or A/D). Current selection is mission navigator.

KY-58 — Pressing this pushbutton displays a KY-58 submenu.

UPDT SEL — Pressing this pushbutton displays an update select submenu.

BOTH TX — Pressing the pushbutton displays an asterisk which permits transmission on both radio transmitters, either on the same or different frequencies, provided neither radio is in a secure mode.

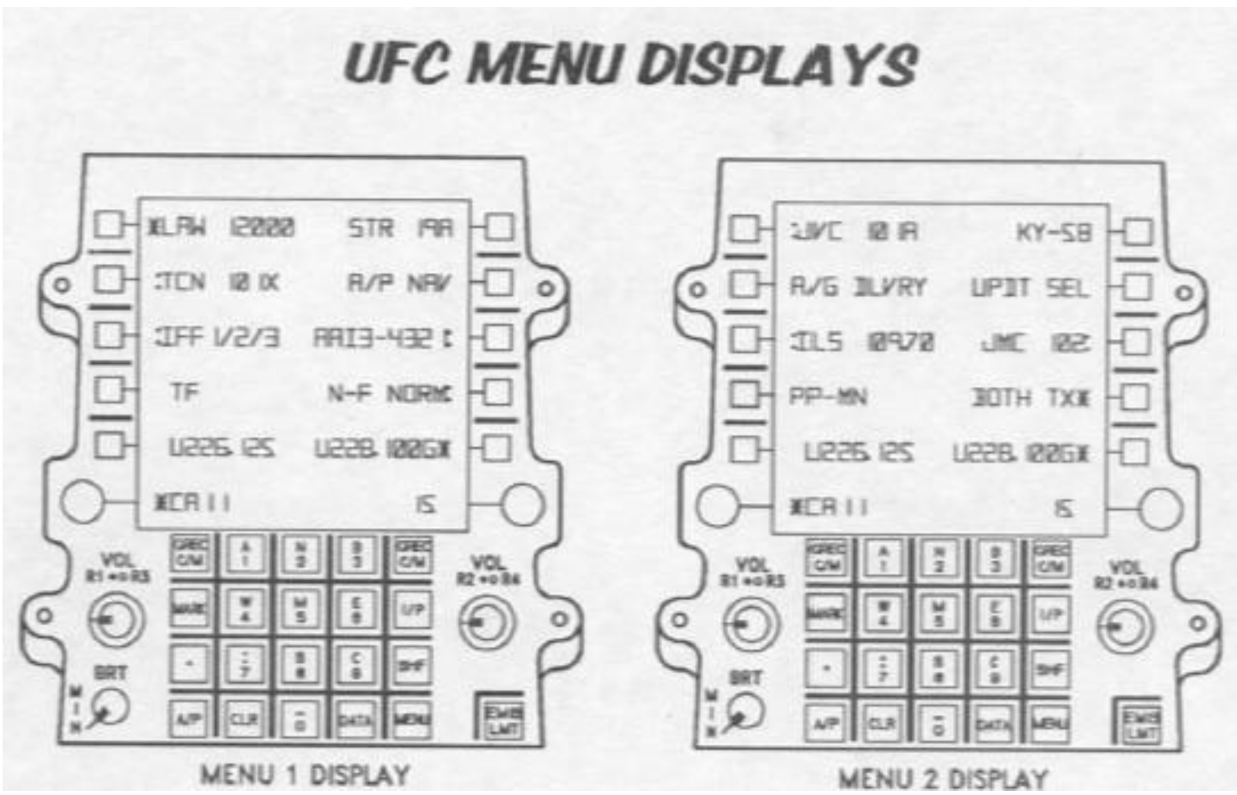


Figure 1-13

Submenus

Menu 1 and menu 2 provide access to submenus (figures 1-14 and 1-15) which contain selection of specific system functions. Figure 1-14 is for normal modes. Figure 1-15 is for modes available when the CC in inoperative. There are submenus for TACAN, TACAN programming, IFF, IFF programming, UHF 1, UHF 2, navigation FLIR, navigation FLIR boresight (from NAV FLIR), AAI, autopilot, point data latitude and longitude. UTM, UTM programming, point data range and bearing, direction and range offsets, present position keeping source, HUD titling, A/G delivery, update, and KY-58.

Submenus can be selected when the scratchpad is blank by pressing the pushbutton next to the system of interest. For example, to select the IFF submenu, press the pushbutton next to IFF on the menu 1 display. Once displayed, system changes can be selected and made using keyboard entry. To return to either a menu or data display, press either the MENU or DATA pushbutton.

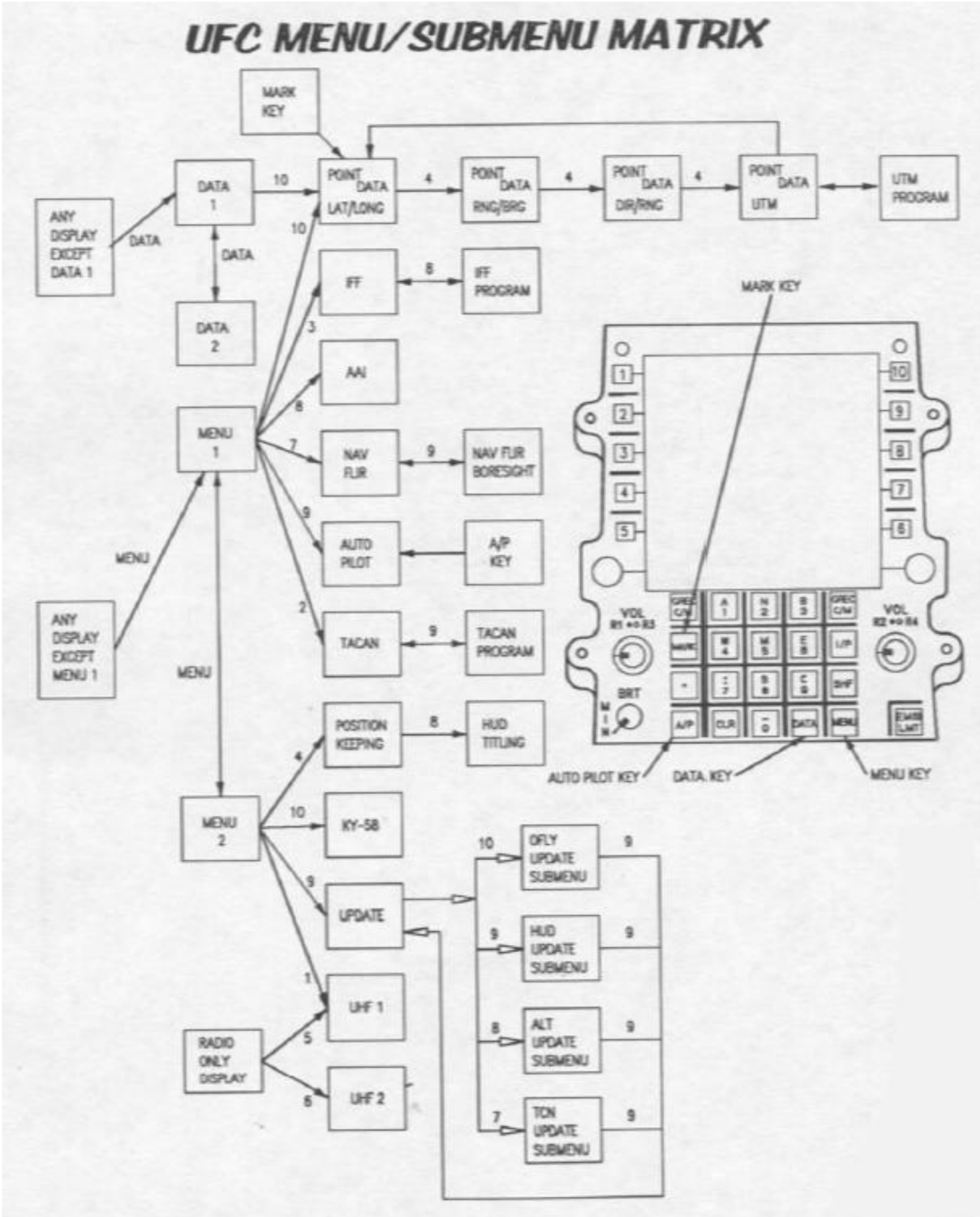
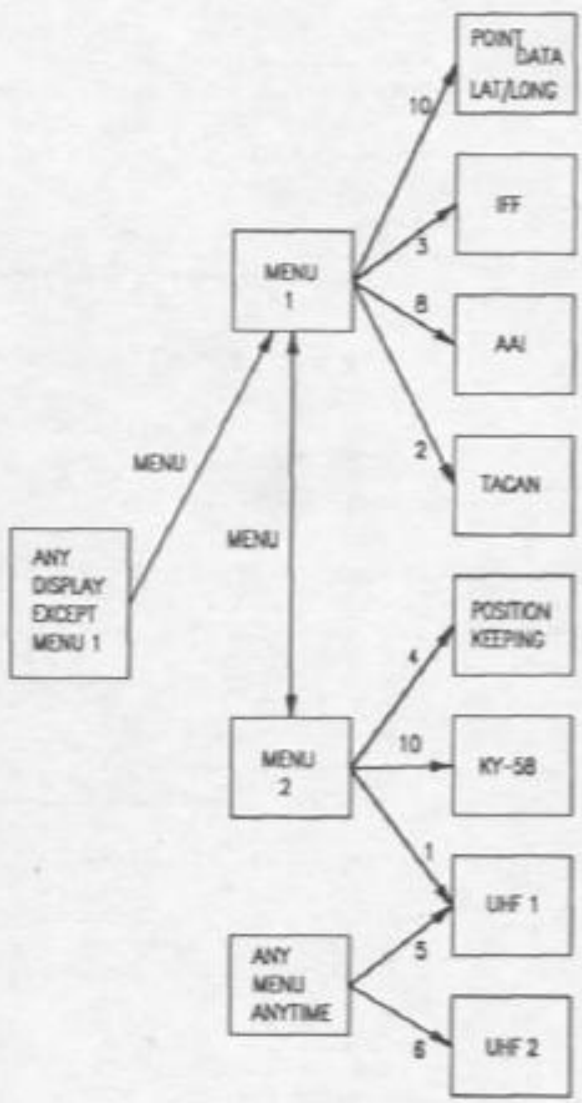

UFC MENU/SUBMENU MATRIX
MARK KEY
ANY DISPLAY EXCEPT DATA 1
DATA
DATA 1
DATA 2
POINT DATA LAT/LONG
POINT DATA RNG/BRG
POINT DATA DIR/RNG
POINT DATA UTM
UTM PROGRAM
IFF
IFF PROGRAM
AAI
MENU 1
NAV FLIR
NAV FLIR BORESIGHT
AUTO PILOT
A/P KEY
TACAN
TACAN PROGRAM
ANY DISPLAY EXCEPT MENU 1
MENU
POSITION KEEPING
HUD TITLING
MENU 2
KY-58
UPDATE
OFLY UPDATE SUBMENU
HUD UPDATE SUBMENU
ALT UPDATE SUBMENU
TCN UPDATE SUBMENU
UHF 1
UHF 2
RADIO ONLY DISPLAY
MARK KEY
VOL R1 ↔ R3
VOL R2 ↔ R4
BRT
AUTO PILOT KEY
DATA KEY
MENU KEY

Figure 1-14

UFC MENU/SUBMENU MATRIX (Continued)

(CC INOP)



NOTES:

1. Numbers on the function lines represent multifunction switch actuations necessary to proceed to next menu/submenu.

Figure 1-15

HEAD-UP DISPLAY (HUD)

The HUD control panel, figure 1-16, is located on the main console. The holographic combiner displays projected raster (video) and stroke (symbols) imagery in a total field of view which measures 21 degrees in elevation and 28 degrees in azimuth. The HUD displays navigation, FLIR video, flight control, and weapons delivery information.

HUD CONTROLS

Symbol Brightness (SYM BRT) Control

The SYM BRT control is a rotary knob. Clockwise rotation applies power to the HUD. This control adjusts brightness of the HUD stroke symbology only. Raster video imagery is not affected. A detented OFF position removes power from the HUD.

Symbol (SYM) Declutter Switch

The SYM switch is a three-position toggle switch which removes and restores symbol information from the combiner display. REJ 1 and REJ 2 provide identical Declutter functions. Selecting REJ 1 or REJ 2 for all master modes removes the Heading scale, Command Heading, Pitch Ladder, and Bank scale. The NORM position restores all information.

DAY/AUTO/NIGHT Switch

The DAY, AUTO, or NIGHT switch is a three-position toggle switch which provides the pilot with a means to select appropriate raster and stroke imagery brightness levels for daytime or nighttime missions. The DAY position allows for the full range of the stroke symbology and raster video. The AUTO position provides automatic brightness adjustment of stroke symbology only based on ambient brightness data.

NOTE

The AUTO position does not provide adequate illumination at night.

The NIGHT position limits the brightness range of the stroke symbology and raster video to be compatible with night operations.

BIT Indicator

In normal operation, the BIT indicator is black. The BIT indicator is white when the HUD has failed. The BIT indicator resets when HUD power is cycled off and back on, or after a successful initiated BIT. If the fault condition still exists after either of the above, the BIT indicator will set white after approximately 60 seconds. When power is removed from the HUD, the BIT indicator holds at its last setting.

Test Button

When the momentary action pushbutton, located above the BIT indicator, is pressed and held, an internally generated 18 x 28 FOV raster test pattern is displayed.

Video Brightness (VID BRT) Control

This rotary control fine adjusts the intensity of both the raster-generated video imagery and the stroke-generated symbology. This control, usually left at the 12 o'clock position, is used to make the darkest shade of gray truly black.

Video Contrast (VID CONT) Control

The CONT control is a rotary knob switch which adjust the contrast level (shades of gray) of the raster generated video. Stroke generated symbology is not affected. When the CONT knob is ON, NAV FLIR imagery is processed for display on the HUD. A detented OFF position removes raster generated video from the HUD and restores NAV data in stroke.

Master Mode Switches

Four master mode switches are available: NAV, A/A, A/G, and INST. When any of these switches are pressed, the light comes on the indicate that particular mode is selected. Only one master mode can be selected at a time.

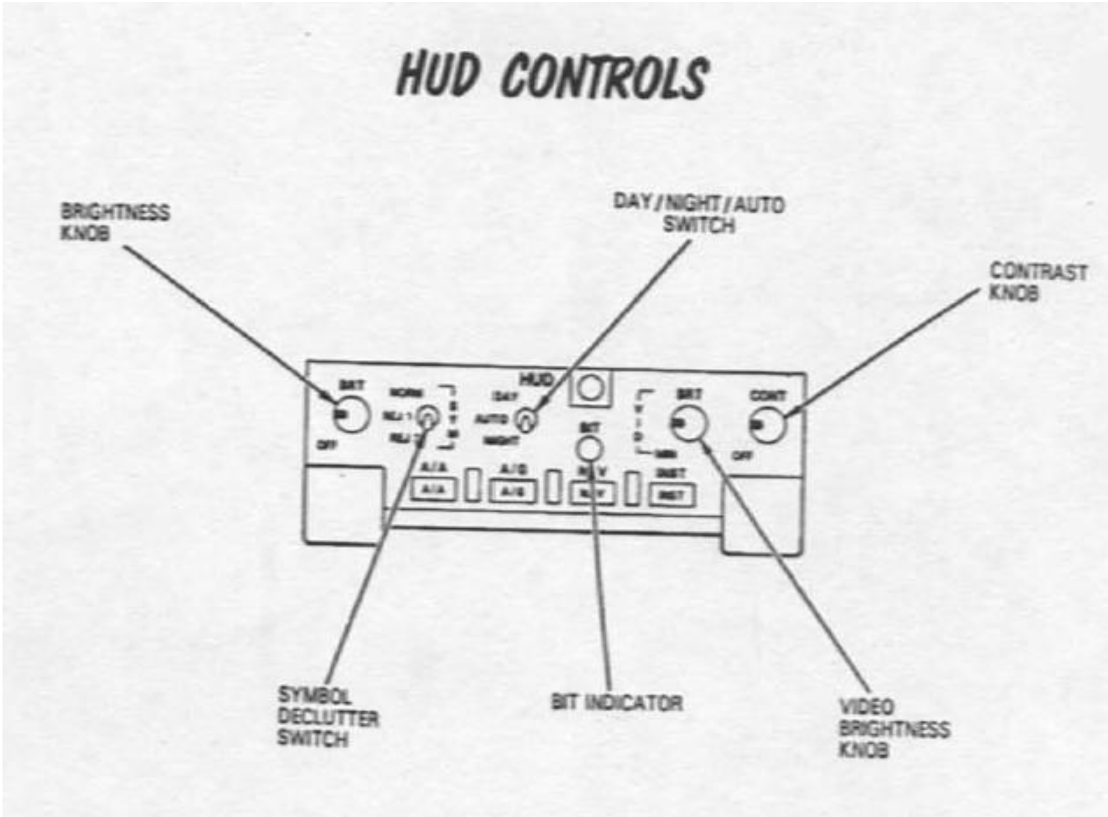


Figure 1-16

SYSTEM POWER UP

Once aircraft electrical power is applied, the HUD is turned on via the SYM BRT control and the raster via the VID CONT control.

HUD SYMBOLS

In this description, the following operational categories of HUD symbology are considered. Refer to figure 1-17.

a. HUD nav, flight, and weapon delivery symbols that are common to most master modes (except A/G) and positioned depending on the weapon mode and sensor device selected.
b. HUD window displays, alphanumeric data with fixed locations.

Calibrated airspeed and barometric altitude data are displayed in digital format to remove graphics clutter and provides a direct readout of the data. Additionally, the crew can select true airspeed (T) or groundspeed (G) data and select radar (R) altitude for display. These selections are obtained through the UFC data 1 display.

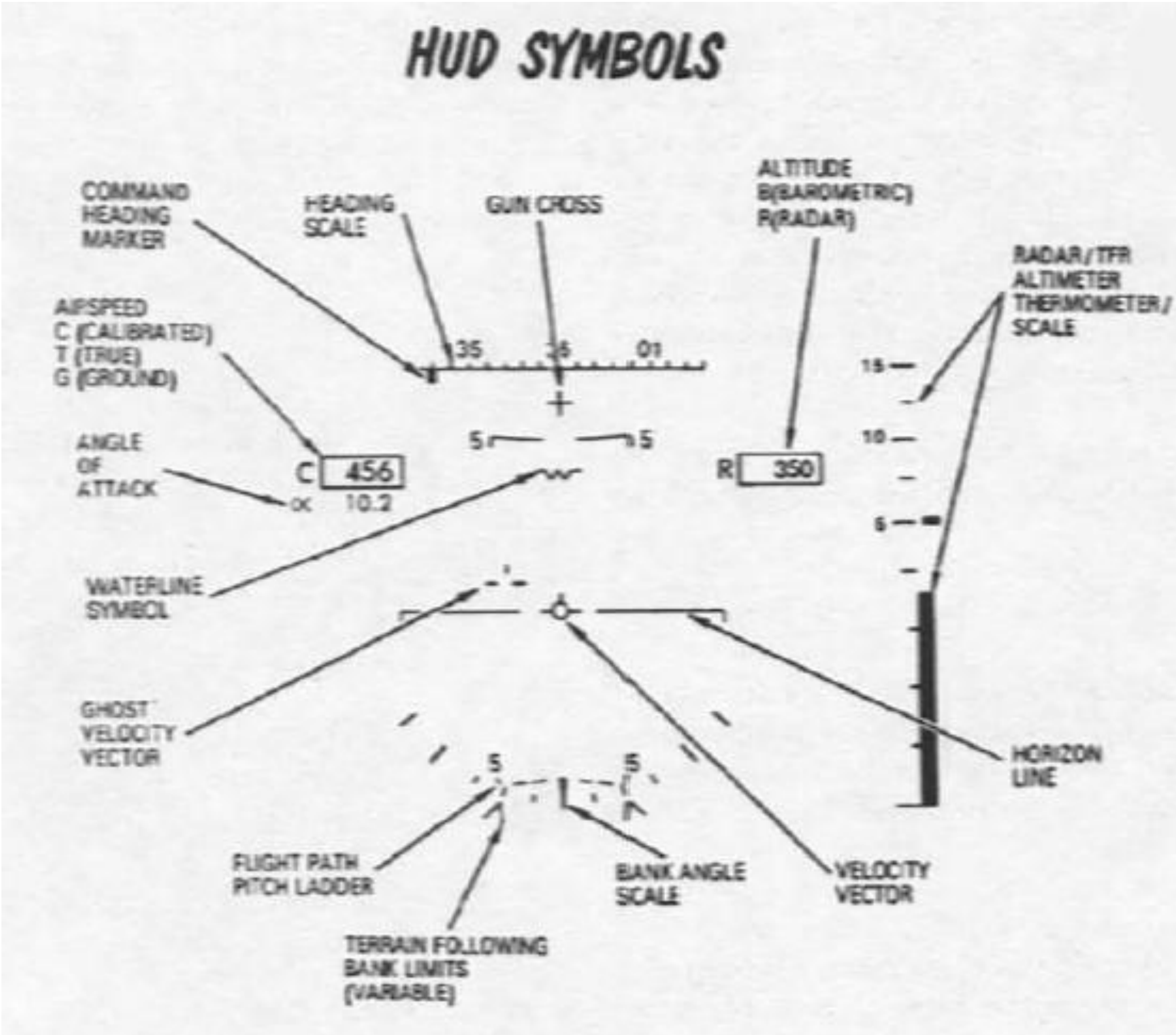


Figure 1-17

Velocity Vector

The velocity vector displays the instantaneous aircraft flight path with respect to the earth. It is a small airplane symbol. The wings of the symbol always remain parallel to the wings of the aircraft. The vertical relationship between the waterline symbol (when displayed) and the velocity vector indicates true AOA. Velocity vector azimuth displacement from HUD centerline indicates that drift (or a crab angle) is present. The vector symbol is limited to 8.5 degrees radius of motion centered on the HUD. The velocity vector flashes if the data to the CC is degraded or the velocity vector is caged or limited.

Command Velocity

As analog command vector wiper is displayed left of HUD window 1. The symbol rotates up and down from a horizontal position to indicate the difference between current aircraft speed and command velocity. The symbol rotation is limited from -80 to +80 degrees, where one degree represents 1 knot of velocity. A positive angle signifies more velocity (forward throttle). The command velocity is based on groundspeed or true airspeed if selected on the UFC. Otherwise, command velocity is based on calibrated airspeed. If the command velocity source is invalid, this symbol is not displayed.

Ghost Velocity Vector

When the velocity vector is caged, a ghost velocity vector is displayed at the true velocity vector position. The symbol is presented during snap look and look into turn (NAV FLIR) operations. The pitch ladder and steering information are referenced to the caged position. The ghost velocity vector flashes when within 1.5 degrees of the edge of the HUD.

Flight Path Pitch Ladder

The vertical flight path angle of the aircraft is indicated by the position of the flight path pitch ladder relative to the position of the velocity vector. The aircraft pitch attitude is indicated by the position of the aircraft waterline reference with respect to the pitch ladder about the stabilized wings of the velocity vector. The horizon line and the flight patch pitch angle lines are displayed for each five degrees between plus/minus 85 degrees.

Positive pitch lines are solid and negative pitch lines are dashed. The tabs at the end of each segment point toward the horizon. Each line has a number which maintains its orientation relative to the pitch ladder. The pitch lines themselves are angled (point) toward the horizon at an angle one-half the angle of pitch that the line represents. For example, the 40 degree positive pitch line angles 20 degrees toward the horizon. The 90 degree dive point is indicated by a circle with an X enclosed. The 90 degree climb point is indicated by a circle.

The flight patch pitch ladder is normally displayed in a position referenced to the velocity vector to provide flight path information. When the velocity vector becomes HUD-limited, the flight ladder does not transition back to the aircraft waterline symbol. The pitch ladder will always be referenced to the valid velocity vector while maintaining the artificial horizon line on the actual horizon. If the velocity vector is not displayed, the pitch ladder is referenced to the aircraft waterline in azimuth and displays best available pitch referenced to the horizon. This transition may take up to two seconds.

The horizon bar is longer than the other lines in the pitch scale and has tabs at each end that point toward the ground.

Heading Scale

The heading scale moves horizontally against a fixed caret index indicating aircraft magnetic heading from 0 degrees through 360 degrees. The two digit display is expressed in degrees x 10, e.g. 10 degrees is displayed 01 and 250 degrees as 25.

The command heading marker (when displayed) moves against the scale and if the marker is limited, a digital readout of command heading is displayed at the end of the scale.

Bank Angle Scale

In operations with NAV or A/G master mode selected, a bank angle scale with tic marks 0, 10, 20, 30, 45, and 60 degrees are displayed at the bottom of the HUD. The 0 and 45 degree tic marks are double width. The 30 and 60 tic marks are double length.

Waterline Symbol

An aircraft waterline position is indicated on the HUD by the display of a flying W symbol. The pitch ladder provides aircraft pitch attitude information when it is compared with the waterline symbol. If the velocity vector is not displayed, the pitch ladder slides to its waterline-referenced position in azimuth.

Gun Cross

The gun cross is fixed 2 degrees above waterline in the azimuth center of the HUD and appears when the master arm switch is in ARM. The symbol indicates the projectile conversion point (without AOA or ballistic drop corrections) at the 2,250-foot gun harmonization range. The symbol is also the position of the gun reticle pipper at zero mils depression (zero sight line). The gun cross is removed from the display by selected the master arm switch to SAFE position.

Reticle

The primary A/G reticle consists of a 50-mil circle, a 2-mil pipper (aim dot), and a range bar (analog bar) when radar A/G range is available. The reticle is displayed in all A/G attack modes when the CC and HUD are operable. The reticle is positioned in azimuth to one of several points, depending on the delivery mode selected.

a. To the velocity vector (Auto mode).
b. To the computed weapon impact point (CDIP mode).

c. To the HUD depression angle set by the pilot (Direct and Manual modes via the UFC).
d. To weapon boresight (when an EO guided weapon is selected).

Reticle Range Bar

When the CC receives valid laser and/or radar range data, the reticle range bar is displayed around the inside perimeter of the 50-mil reticle circle. The display priority is laser range and then radar range. The range bar, which rotates clockwise with increasing range, displays slant range from 0 to 23,000 feet. The range bar is limited to less than two revolutions around the perimeter of the reticle and contains an index to indicate the magnitude of the range displayed. The first revolution displays slant range from 0 to 12,000 feet and the second revolution displays slant range from 12,000 to 23,000 feet.

Break X

In the A/G master mode, a break X is displayed when the aircraft dive angle is greater than 3 degrees and the projected pullout altitude is below a specified level. The projected pullout altitude is based on a 4.0-G pull attained in 2 seconds. The pullout is based on the best available altitude. If radar altitude is available, the BREAK X is displayed if recovery is expected to occur below 200 feet. If baro altitude is used, the programmed altitude of the nearest sequence point is used to computer 400 feet ground clearance.

NOTE

In CDIP gun with pitch angles between -3 degrees and -20 degrees, zero feet is used as minimum ground clearance altitude.

HUD WINDOWS

Figure 1-18 shows the location of the various windows. Window 8, 9, and 12 are not fixed. They move dynamically as required. Windows 8 and 9 follow the location of the velocity vector. Window 12 follows the position of the range caret in the HUD radar range scale. When more than one item is commanded for display, the item highest in the list is displayed.

HUD Window 1

Aircraft calibrated airspeed is displayed. If the speed is invalid, OFF is displayed.

HUD Window 2

Aircraft AOA to the nearest tenth of a unit is displayed below the aircraft calibrated airspeed readout at all times.

HUD Window 2A

Aircraft true airspeed or groundspeed is displayed, preceded by T or G as selected on the Up-Front Control (UFC). If the selected airspeed source is invalid, the letter identifier and OFF are displayed.

HUD Window 3

This window displays the terrain following left turn obstacle (OBST) caution. The right turn caution is displayed in opposing window 15.

HUD Window 4

This window displays "IN CMD" legend when pilot has command of the HUD.

HUD Window 5

Emergency Cue

The emergency cue (legend "E") is displayed when the radar is in emergency mode.

Gun Rounds

The gun rounds display is a function of the number of rounds set on the weapon load display minus any rounds fired.

Missile Count

The type of missile loaded on the aircraft is identified by the PACS. With MRM selected, the display consists of M (MRM selected), the count of the MRM's available for launch (STBY or RDY), and the type in priority for launch (A for AIM-120A, F or M for the AIM-7).

With SRM selected, the display is S (SRM selected), the total count of SRM's available for launch (in a STBY or RDY status) and the type in priority for launch: J for AIM-9P/P-1, P for AIM-9P-2/P-3, and L or M for those missiles respectively.

The off missile cue is displayed if the attack develops to a point where another on-board missile is in the envelope for a shot at the target. Refer to HUD AIM-7, AIM-9, and AIM-120A Symbols this section.

HUD Window 6

Aircraft Mach number is displayed in all modes when the landing gear is up.

HUD Window 7

Target Mach

The target Mach number is displayed only in the visual ident (VI) mode.

Current G/Allowable G

The HUD displays both current and maximum allowable G. Allowable G is displayed for existing flight conditions, aircraft configuration, gross weight, and changes automatically as these factors change. Current G is displayed on the left and maximum allowable G on the right. The G data is not displayed with the landing gear down unless the CC is inoperative. In CC NOGO, only current G is displayed.

Overload Warning System (OWS) Inoperative

The OWOFF cue is displayed when the OWS system fails, or when airborne with an invalid armament condition.

Invalid Armament (INVARM) Cue

This cue is displayed only with Weight on Wheels (WOW) when the PACS senses an unidentifiable store on the aircraft, or if the aircrew programs a store mode that is not in the PACS inventory.

In such a case, OWS processing is disabled. If in flight, an invalid armament cue causes the OWOFF cue to be displayed.

HUD Window 8

Because the MilVis F-15E does not model the terrain-following (TF) system, HUD Window 8 is not modeled, and all references to Window 8 in Figure 1-18 should be disregarded.

HUD Window 9

Several cautions and information cues concerning the Nav FLIR (NF) systems can be displayed.

HUD Window 10

The selected radar range scale is displayed when the radar is in the track mode.

HUD Window 11

One-half the selected range scale (displayed in window 10) is displayed in window 11.

HUD Window 12

The opening or closing range rate (Vc) in knots between the aircraft and A/A target is displayed when the radar is in track.

HUD Window 12A

If the command heading bug is limited (outside the displayed 30 degree scale), a digital readout of the command heading is displayed at the appropriate side of the scale.

HUD Window 13

The aircraft barometric altitude is displayed. The thousands and ten thousands digits are larger than the hundreds, tens, and units digits, except below 1000 feet, when all digits are the large size.

If the barometric altitude is invalid, OFF is displayed.

HUD Window 14

ADC vertical velocity in feet per minute to the nearest 100 feet per minute is displayed in the NAV/INST master modes when the gear is down. Descents are indicated by negative signs preceding the numerical readout.

If the vertical velocity data is invalid, VV OFF is displayed.

When in A/G or A/A master mode, or in NAV/INST master mode with the gear handle up, SNIFF, TSNIFF, or FLOOD is displayed when radar is in SNIFF mode or training SNIFF or FLOOD mode respectively. An R displayed at the far right of window 14 indicates mode rejects are being sent to the radar.

HUD Window 14A

The aircraft radar altitude is displayed preceded by the letter "R" (if selected on the UFC, if not selected this window will be blanked). If the radar altitude is not valid, OFF preceded by "R" is displayed.

HUD Window 15

As this window is dedicated to TF operations, its functions are not modeled on the MilViz F-15E.

HUD Window 16

INS alignment cues are displayed as required. Refer to applicable paragraphs in this section. Also displays primary designated target (PDT) altitude.

HUD Window 17

Radar Jam Codes

The jam codes, when displayed, override all other window 17 displays.

Track Memory (MEM)

This feature is not modeled in the MilViz F-15E

No Zone

This feature is not modeled in the MilViz F-15E

Bad Track (BAD TRK)

This cue is displayed when the radar track quality is judged to be poor based on an inconsistent number of target updates (hits). Since the cue is not range dependent, it is designed to give an earlier indication of a degrading track than the MEM cue.

NAV Steer Displays

These cues are applicable to A/G target selection and to the NAV/INST master mode. Refer to applicable paragraphs in this section.

HUD Window 18

Range Displays

Window 18 always displays range data. A prefix letter identifies the display as R (radar), T (TACAN), N (Nav), or G (A/G) designated range. Ranges are displayed with a resolution of 0.1 NM to a maximum of 999.9 NM. The maximum radar range displayed is 160 NM.

HUD Window 19

MRM Time To Go (Tgo)

The MRM prelaunch Tgo cue is steady and appears in radar track when target range is between Rmax 1 and Rmin. The value is the predicted MRM Time of Flight and is continuously updated as range and angle conditions change. The postlaunch Tgo, a function of target position and velocity data, provides an accurate display of the required illumination period. The indications are as follows:

Target does not maneuver.	Flashing Tgo counts down in real time.
Target maneuvers, staying in range.	Flashing Tgo countdown adjusted for target maneuvers.
Lost missile, target has maneuvered to or beyond missile limit.	LOST is displayed for 15 seconds.
Flood Launch	Flashing Tgo counts down in real time.

Nav/TACAN Time To Go (Tgo)

In the NAV/INST master mode, the Tgo displays pertain to the NAV/TCN range displays shown in Window 18.

A/G Attack Mode (Tgo)

The A/G Tgo values pertain to the A/G range data of window 18, and the A/G weapon delivery modes displayed in window 20.

HUD Window 20

ILS Cues

Various cues are displayed for the Instrument Landing System (ILS) in the NAV/INST master modes. Refer to applicable paragraphs in this section.

CSET cue

In NAV/INST master modes, the "CSET xxx" will flash for 10 seconds when entering TCN, ILST, or ILSN steer modes. The flashing of the cue is independent of the previously selected mode. Also, the cue will not flash or appear on the NAV/INST HUD when the course select value is changed on the HSI.

Uncage (UNC)

UNC is displayed when the NGS button is pressed an odd number of times to permit SRM seeker uncage (IR lockon). An even number of button depressions removes UNC from the HUD, breaks IR lockon, and returns the SRM seeker to the missile boresight or to the (AIM-9L/M) radar antenna Line of Sight (LOS).

Target Aspect Angle

Target aspect angle is displayed for the designated A/A target.

A/G Delivery Mode

A cue denoting the selected A/G weapon delivery mode is displayed for each delibery mode. In addition, a cue denoting the sensor currently in use to calculate the height above target (HAT) is displayed.

HUD Window 21

This window displays TRNG cue when PACS is in a training mode.

HUD MRM MODE

See Weapons manual (separate publication) for detailed information on this HUD mode.

HUD GUN MODE

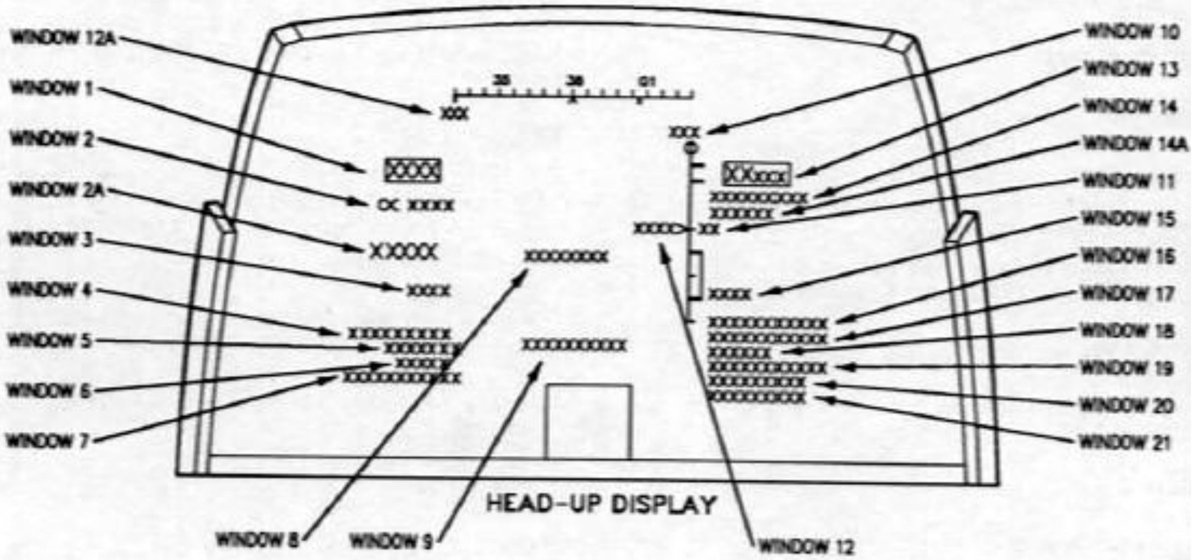
See Weapons manual (separate publication) for detailed information on this HUD mode.

HUD BACK-UP MODE

When the CC has failed and the MPDP has taken control of the mux bus and the displays, the HUD is in back-up mode. In back-up mode the HUD display format always appears in the gear-up position even if the gear is down. INS provides pitch and bank data and radar provides altitude data. The HUD format will only be displayed on the HUD (no repeater displays).

HUD FORMAT

WINDOWS – ALL MASTER MODES



LEGEND

(1) TRUE AIR OR GROUND SPEED IS SELECTED ON THE UP-FRONT CONTROL X = G OR T DEPENDING ON SELECTED SPEED.

(2) DISPLAYED IN ALL MASTER MODES/GEAR UP OR DOWN.

(3) XXX CAN BE ANY OF THE EIGHT MISSILE CUES.

(4) NOT DISPLAYED WITH GEAR DOWN.

(5) ONLY WITH WEIGHT-ON-WHEELS AND INVALID WEAPONS ID IN PACS.

(6) NOT DISPLAYED WITH GEAR DOWN UNLESS IN CC NO-GO. IN CC NO-GO, ONLY CURRENT G IS DISPLAYED,

(7) VALID INS OR AFCS ON 88-1667 AND UP, GEAR UP WITH OWS OFF.

(8) DISPLAYED IF RADAR NOT IN VI TRACK AND ONE OF THE BELOW CONDITIONS EXIST
- A. CAU, INS AND AFCS NOT VALID; INVALID ARMAMENT; WEIGHT-OFF-WHEELS.
- B. VALID ARMAMENT; OWS INVALID; WEIGHT-ON-WHEELS.
- C. VALID ARMAMENT; WEIGHT-OFF-WHEELS; LDG GEAR HANDLE UP; OWS INVALID AND CAU, INS AND AFCS NOT VALID.

(9) DISPLAYED WHEN COMMAND HEADING CUE IS OUTSIDE OF HEADING SCALE LIMITS.

(10) RADAR ALTITUDE DISPLAY IS SELECTED ON UP-FRONT CONTROL.

(11) VERTICAL VELOCITY DISPLAYED IN NAV/INST MASTER MODE WITH GEAR DOWN ONLY WITH PRIORITY OVER RADAR CUES.

(12) THE FOLLOWING COMBINATIONS ARE POSSIBLE:
NAV DEGD.
IFA, IFA X.X, IFA OK, SH NO TAXI, SH HOLD, SH XX.X, SH OK, GC NO TAXI, GC PP REQ, GC HOLD, GC XX.X, GC OK.
OK=ALIGNMENT FINISHED, PP REQ=A PRESENT POSITION ENTRY IS REQUIRED. NO TAXI=AIRCRAFT SHOULD NOT BE TAXIED, HOLD = ALIGNMENT IS ON HOLD. XX.X=ALIGNMENT QUALITY.

(13) DESTINATION CODE: BASE 1 THRU 99.01C: MARK 1 THRU 10

(14) A/G MASTER MODE WITH NO TARGET DESIGNATED, XXX=NAV OCTCN (DEFAULT), NAV MASTER MODE: XXX=NAV, TCN OR GT.

(15) FOR AIM-7WH, ZZZ=HOH OR DCY: FOR ANY MRM, ZZZ=SML, MED OR LRG DEPENDS ON TARGET TYPE SELECTION ON ARMT FORMAT. OFF MISSILE CUE HAS PRIORITY OVER TARGET TYPE CUE.

(16) AIRSPEED MAY FLASH.

(17) R CAN BE DISPLAYED W/SNIFF OR TSNIFF

(18) DISPLAY TRNG IN HUD WINDOW 21 IN ALL MASTER MODES WHEN PACS IS IN TRAINING MODE.

(19) HEIGHTH ABOVE TARGET (HAT) SENSOR CURRENTLY IN USE FOR A/G DELIVERY. "X" INDICATES EXTRAPOLATING RANGE.

Figure 1-18.1

HUD FORMATS *(Continued)*

SYMBOLS – ALL MASTER MODES

		MASTER MODES – A/A				MASTER MODES – NAV/INST					MASTER MODES – A/G							ALL MODES			
		MRM	SRM	GUN	VIS-IDENT	NAV	TACAN	ILS-NAV	ILS-TCN	GND TRK	CDIP	CDIP/GUN	AUTO	AUTO LADD	GUIDED	DIRECT	MANUAL	CC NO-GO	SYM REJ 1	SYM REJ 2	SEE NOTES
1 2 3 4 5 6 7 8 9 10 11	WINDOW 1																				
1 0 4 5	CALIBRATED AIRSPEED	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
0 F F	SPEED INVALID	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
1 2 3 4 5 6 7 8 9 10 11	WINDOW 2																				
∝ 2 0 . 1	ANGLE-OF-ATTACK	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				2
1 2 3 4 5 6 7 8 9 10 11	WINDOW 2A																				
G 1 0 4 5	GROUND SPEED	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				1
T 1 0 4 5	TRUE AIRSPEED	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
X 0 F F	SPEED INVALID	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
1 2 3 4 5 6 7 8 9 10 11	WINDOW 3																				
O B S T	WARNING (TF LEFT TURN)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
1 2 3 4 5 6 7 8 9 10 11	WINDOW 4																				
I N C M D	IN COMMAND					X	X	X	X	X											
1 2 3 4 5 6 7 8 9 10 11	WINDOW 5																				
E	RADAR EMERENCY MODE CUE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
7 0 0	ROUNDS REMAINING			X	X							X									
M 4 A	AIM-120A (AIM-120 COUNT)	X			X																
M 4 F	AIM-7F (AIM-7 COUNT)	X			X																
M 4 M	AIM-7M (AIM-7 COUNT)	X			X																
M 4 H	AIM-7MH (AIM-7 COUNT)	X			X																
S 4 J	AIM-9J (AIM-9 COUNT)		X		X																
S 4 P	AIM-9P (AIM-9 COUNT)		X		X																
S 4 L	AIM-9L (AIM-9 COUNT)		X		X																
S 4 M	AIM-9M (AIM-9 COUNT)		X		X																
X X X	OFF-MISSILE CUE	X	X	X	X																3
Z Z Z	TARGET TYPE CUE	X																			15
1 2 3 4 5 6 7 8 9 10 11	WINDOW 6																				
0 . 9 0 0	MACH	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				4
1 2 3 4 5 6 7 8 9 10 11	WINDOW 7																				
I N V A R M	INVALID WEAPON	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				5
T M 1 . 5	TARGET MACH				X																
- 4 . 5 9 . 0 G	CURRENT G, MAX ALLOWABLE G	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			6
- 4 . 5 G 0 W O F F	OWS OFF	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X				7
0 W O F F	OWS OFF	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				8

Figure 1-18.2

HUD FORMATS *(Continued)*

SYMBOLS – ALL MASTER MODES

		MASTER MODES																ALL MODES			
		A/A				NAV/INST					A/G										
		MRM	SRM	GUN	VIS-IDENT	NAV	TACAN	ILS-NAV	ILS-TCN	GND TRK	CDIP	CDIP/GUN	AUTO	AUTO LADD	GUIDED	DIRECT	MANUAL	CC NO-GO	SYM REJ 1	SYM REJ 2	SEE NOTES
1 2 3 4 5 6 7 8 9 10 11	WINDOW 8																				
FLY UP TF FAIL OBSTACLE G LIMIT TF LOW	TF WARNINGS ↓	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X	X X X X X			
1 2 3 4 5 6 7 8 9 10 11	WINDOW 9																				
ROLL TURN RATE TURN ACCEL DIV ANGLE UNARMED INS LIMIT AIRSPEED NO TERRAIN ECCM N-F BRST N-F LOS	TF CAUTIONS AND N-F INFO DIVE ANGLE ↓	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X X X	X X X X X X X X X X			16
1 2 3 4 5 6 7 8 9 10 11	WINDOW 10																				
160	RADAR RANGE SCALE	X	X	X	X																
1 2 3 4 5 6 7 8 9 10 11	WINDOW 11																				
80	HALF RADAR RANGE SCALE	X	X	X	X																
1 2 3 4 5 6 7 8 9 10 11	WINDOW 12																				
1150	RANGE RATE, +-KTS	X	X	X	X																
1 2 3 4 5 6 7 8 9 10 11	WINDOW 12A																				
270	LIMITED COMMAND HEADING	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				9
1 2 3 4 5 6 7 8 9 10 11	WINDOW 13																				
46350 OFF	BARO ALTITUDE INVALID	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
1 2 3 4 5 6 7 8 9 10 11	WINDOW 14																				
VV 25400	VERTICAL VELOCITY					X	X	X	X	X								X			11
VV OFF	VERTICAL VELOCITY OFF					X	X	X	X	X								X			
SNIFF	RADAR SPECIAL MODE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
TSNIFF	RADAR SPECIAL MODE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
R	REJECT SENT TO RADAR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				17
FLOOD	RADAR SPECIAL MODE	X	X	X	X												X				
1 2 3 4 5 6 7 8 9 10 11	WINDOW 14A																				
R 15000 R OFF	RADAR-ALTITUDE INVALID	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X			10
1 2 3 4 5 6 7 8 9 10 11	WINDOW 15																				
OBST	WARNING (TF RIGHT TURN)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			

Figure 1-18.3

HUD FORMATS (Continued)

SYMBOLS – ALL MASTER MODES

Symbol	Description	MASTER MODES																ALL MODES			SEE NOTES
		A/A				NAV/INST					A/G										
		MRM	SRM	GUN	VIS-IDENT	NAV	TACAN	ILS-NAV	ILS-TCN	GND TRK	CDIP	CDIP/GUN	AUTO	AUTO LADD	GUIDED	DIRECT	MANUAL	OC NO-GO	SYM REJ 1	SYM REJ 2	
1 2 3 4 5 6 7 8 9 10 11	WINDOW 8																				
FLY UP	TF WARNINGS	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
TF FAIL	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
OBSTACLE	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
G LIMIT	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
TF LOW	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
1 2 3 4 5 6 7 8 9 10 11	WINDOW 9																				
ROLL	TF CAUTIONS AND	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			16
TURN RATE	N-F INFO	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
TURN ACCEL	DIVE ANGLE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
DIV ANGLE	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
UNARMED	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
INS LIMIT	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
AIRSPEED	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
NO TERRAIN	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
ECCM	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
N-F BRST	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
N-F LOS	↓	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
1 2 3 4 5 6 7 8 9 10 11	WINDOW 10																				
160	RADAR RANGE SCALE	X	X	X	X																
1 2 3 4 5 6 7 8 9 10 11	WINDOW 11																				
80	HALF RADAR RANGE SCALE	X	X	X	X																
1 2 3 4 5 6 7 8 9 10 11	WINDOW 12																				
1150	RANGE RATE, +-KTS	X	X	X	X																
1 2 3 4 5 6 7 8 9 10 11	WINDOW 12A																				
270	LIMITED COMMAND HEADING	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				9
1 2 3 4 5 6 7 8 9 10 11	WINDOW 13																				
46350	BARO ALTITUDE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
OFF	INVALID																				
1 2 3 4 5 6 7 8 9 10 11	WINDOW 14																				
VV 25400	VERTICAL VELOCITY					X	X	X	X	X								X			11
VV OFF	VERTICAL VELOCITY OFF					X	X	X	X	X								X			
SNIFF	RADAR SPECIAL MODE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
TSNIFF	RADAR SPECIAL MODE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				
R	REJECT SENT TO RADAR	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				17
FLOOD	RADAR SPECIAL MODE	X	X	X	X												X				
1 2 3 4 5 6 7 8 9 10 11	WINDOW 14A																				
R 15000	RADAR-ALTITUDE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			10
R OFF	INVALID	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
1 2 3 4 5 6 7 8 9 10 11	WINDOW 15																				
OBST	WARNING (TF RIGHT TURN)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			

Figure 1-18.4

HUD FORMATS *(Continued)*

SYMBOLS – ALL MASTER MODES

		MASTER MODES																ALL MODES			
		A/A				NAV/INST					A/G										
		MRM	SRM	GUN	VIS-IDENT	NAV	TACAN	ILS-NAV	ILS-TCN	GND TRK	CDIP	CDIP/GUN	AUTO	AUTO LADD	GUIDED	DIRECT	MANUAL	CC NO-GO	SYM REJ 1	SYM REJ 2	SEE NOTES
1 2 3 4 5 6 7 8 9 10 11	WINDOW 20																				
1 7 L	LEFT ASPECT ANGLE	X	X	X	X																
0 1 R	RIGHT ASPECT ANGLE	X	X	X	X																
T	TAIL ASPECT ANGLE	X	X	X	X																
H	HEAD ASPECT ANGLE	X	X	X	X																
C D I P	CDIP DELIVERY MODE										X										
G U N	CDIP GUN MODE											X									
A U T O	AUTO DELIVERY MODE												X								
L A D D	AUTO LADD DELIVERY MODE													X							
G U I D E D	GUIDED DELIVERY MODE														X						
D I R E C T	DIRECT DELIVERY MODE															X					
M A N U A L	MANUAL DELIVERY MODE																X				19
L A S	LASER HAT SENSOR										X	X	X	X	X	X	X				
L A S X	EXTRAPOLATE										X	X	X	X	X	X	X				
A G R	RADAR HAT SENSOR (A/G RANGING)										X	X	X	X	X	X	X				
A G R X	EXTRAPOLATE										X	X	X	X	X	X	X				
R A L T	CARA HAT SENSOR										X	X	X	X	X	X	X				
R A L T X	EXTRAPOLATE										X	X	X	X	X	X	X				
B A R O	SYSTEM ALTITUDE HAT SENSOR										X	X	X	X	X	X	X				
1 2 3 4 5 6 7 8 9 10 11	WINDOW 21																				18
T R N G	PACS TRAINING MODE	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			

Figure 1-18.5

MULTIPURPOSE DISPLAY PROCESSOR (MPDP)

The MPDP is a multiple processor symbol generator that simultaneously drives eight displays. The eight displays include four MPD, three MPCD, and the HUD. The MPDP generates and overlays symbology (graphic symbols and alphanumerics) onto the MPD and MPCD by raster and/or stroke methods. A separate display channel drives each display individually.

Display output data generated by the MPDP may consist of either stroke written symbology, monochrome and color rasters, or hybrid with monochromatic raster symbology.

The primary functions of the MPDP include:

1. Produce stroke symbology and background video information for displays on:
    a. Three MPCD
    b. Four MPD
    c. HUD
    d. Video tape recorder (VTR) Note: actual function not modeled in MilViz F-15E
2. Convert analog voltage signals from the overload warning system (OWS) into digital values for transmission to the central computer (CC).
3. Data communications for the data transfer module (DTM). Note: function not modeled in the MilViz F-15E.
4. Backup bus controller (CC no-go condition exists) for avionics 1553 mux bus.
5. Bus controller for JTIDS 1553 mux bus (not used).
6. BIT controller for HUD, MPCD, and MPD.
7. Primary display (HUD, MPD, and MPCD) controller when CC no-go exists.
8. Process discrete data from:
    a. Radar
    b. Radar warning receiver (RWR)
    c. Electronic warfare warning set (EWWS)
    d. Fuel quantity and acceleration data (for OWS function)
    e. LANTIRN NAV and targeting pods (video)
    f. Remote map reader (video)
    g. Weapon stations (video)
9. Sends discrete data to:
    a. BIT discretes to AIU number 1 and avionics status panel (ASP)
    b. Overload warning system (OWS)
    c. NAV targeting pod (weapon video)

The MPDP produces symbology for the HUD, MPD, and MPCD. It also does video processing for the MPD and MPCD. In initiates and controls data transfer with the HUD, MPD, and MPCD and communicates with the CC using the displays 1553 mux bus.

The central computer, in normal mode, is the primary display controller for the multipurpose display system. The MPDP general processor (GP) section becomes the primary display controller during backup mode (CC no-go exists).

The MPDP converts all displays to composite video for the VTR. This video can be any display format or a split screen format (a pair of display formats recorded side by side).

The MPDP provides control of the avionics 1553 mux bus when the CC is not operational. The MPDP receives a CC no-go from the CC and automatically takes command of the avionics 1553 mux bus. During this backup mode condition, the MPDP communicates with eight systems:

1. Intertial navigation set
2. Remote map reader
3. Radar system
4. Left and right engines
5. Flight control computer
6. Radar warning receiver system
7. LANTIRN system
8. Avionics interface unit set

The MPDP also provides normal communications with the MPD, MPCD, and HUD.

MULTI-PURPOSE DISPLAY/MULTI-PURPOSE COLOR DISPLAY (MPD/MPCD)

There are 4 multi-purpose displays (MPD) and 3 multi-purpose color displays (MPCD) in the aircraft. There are two MPD's in each cockpit, and 1 MPCD in the front cockpit and 2 MPCD's in the rear cockpit. The MPD's display system data, sensor video and weapons information in monochromatic formats. The MPD's have 20 peripheral pushbuttons by which the crew can control weapons systems, sensors, and data to be displayed. Legends are positioned adjacent to each pushbutton to advise the crew of the modes and option selectable for operation of the onboard radar, FLIR, navigation, and weapon systems.

The exact content of data in the display formats is software programmable. The MPCD's display monochromatic or multicolor presentation of sensor and weapon video overlaid with symbology, advisory readouts and navigation data. Color coding of display data aids in quick interpretation of complex formats such as HSI and ADI. Color presentation of navigational maps also contributes to easy and accurate assessment of the tactical situation.

The MPCD's also have 20 peripheral pushbuttons which provide control in the same manner as the MPD. Each MPD/MPCD has a power switch, a brightness switch, a contrast switch, and the BIT indicator. See figure 1-19 for overview. See tutorial videos (separate publication) for detailed operations.

Pushbuttons

There are 20 pushbuttons on each MPD/MPCD numbered 1 through 20 counterclockwise from the upper button on the left side of the display to the left button on the top of the display.

Power Switch

A two-position rocker switch provides electrical power to the MPD/MPCD's. When powering up the aircraft, the aircrew must turn on the MPD and MPCD's. However, if the aircrew experiences a brief power interrupt inflight, the MPD/MPCD displays will automatically come up without reselecting the power rocker switch.

Brightness Switch

A two-position, spring-loaded-to-center rocker switch provides a non-linear adjustment of stroke written symbol luminance or brightness. On the MPD the switch controls black level. On the MPCD this switch controls brightness and raster contrast. Backlighted arrow symbols on this rocker switch indicate an increase or decrease in CRT display brightness.

Contrast Switch

A two-position, spring-loaded-to-center rocker switch provides adjustment of raster contrast, also called shade of gray. On the MPD's the switch adjusts both raster contrast and stroke brightness.

BIT Indicator

A magnetically controlled BIT ball rolls over to indicate white when MPD/MPCD has failed. In normal operation, the BIT ball is seen as black. When power is removed from the MPD/MPCD, the BIT ball will hold at its last setting. The BIT ball will reset automatically when the failure is corrected.

POWER UP OPERATION

Once electrical power is available, the individual MPD/MPCD must be turned on with the power switch. The display format that was being presented at aircraft shutdown will be initialized on each MPD/MPCD as shown on the MPD in figure 1-19.

The letter M or M2 is displayed adjacent to the pushbutton in the lower right hand corner of each display unit. It is used to call up the menu 1 or menu 2 display. When power is turned on, the MPD/MPCD's will come up at a 50% default brightness level and will be fully active. Default brightness level is a function of the DAY/NIGHT switch setting on the interior lights control panel. Pressing the pushbutton adjacent to the M results in the menu display shown on the MPD in figure 1-19.

MENU DISPLAY

The menu displays can be selected by pressing the lower right hand pushbutton on any display. This pushbutton will always be labeled M or M2. From the menu display (figure 1-19) the individual system formats are selected by pressing the appropriate pushbutton adjacent to the system legend.

Any format can be presented on any display unit except the air-to-ground radar format which is not selectable (legend not displayed) on a color display unit. Pressing the lower right hand pushbutton will alternate between the two menu displays. The menu 1 display has 18 separate display selections to choose from and one that permits display selections to choose from and one that permits display programming. Use of the various displays are described in other parts of this manual where the affected system(s) is covered.

NOTE

A/G radar not available on MPCD. WPN 1 and WPN 2 only available when video weapon loaded.

The menu display options are as follows:

MENU 1

PROG M/M	Program (Master Mode)
NAV	NAV master mode
WPN 1	Weapon 1
WPN 2	Weapon 2

VTRS	Video Tape Recording System (not modeled)
M2	Menu 2 (selects menu 2 labels)
TGT IR	LANTIRN Targeting FLIR
TEWS	Tactical Electronic Warfare System
A/G RDR	Air-to-Ground Radar
A/A RDR	Air-to-Air Radar
HUD	Head Up Display
ENG	Engine Parameters
EVENT	Event
BIT	Built-In-Test
ADI	Attitude Director Indicator
ARMT	Armament
HSI	Horizontal Situation Display
TF	Terrain Following (not modeled)
TSD	Tactical Situation Display

MENU 2

PROG M/M	Program master mode
A/G	Air-to-Ground (Master mode)
M	Menu 1
OWS	Overload Warning System
DTM	Data Transfer Module (not modeled)

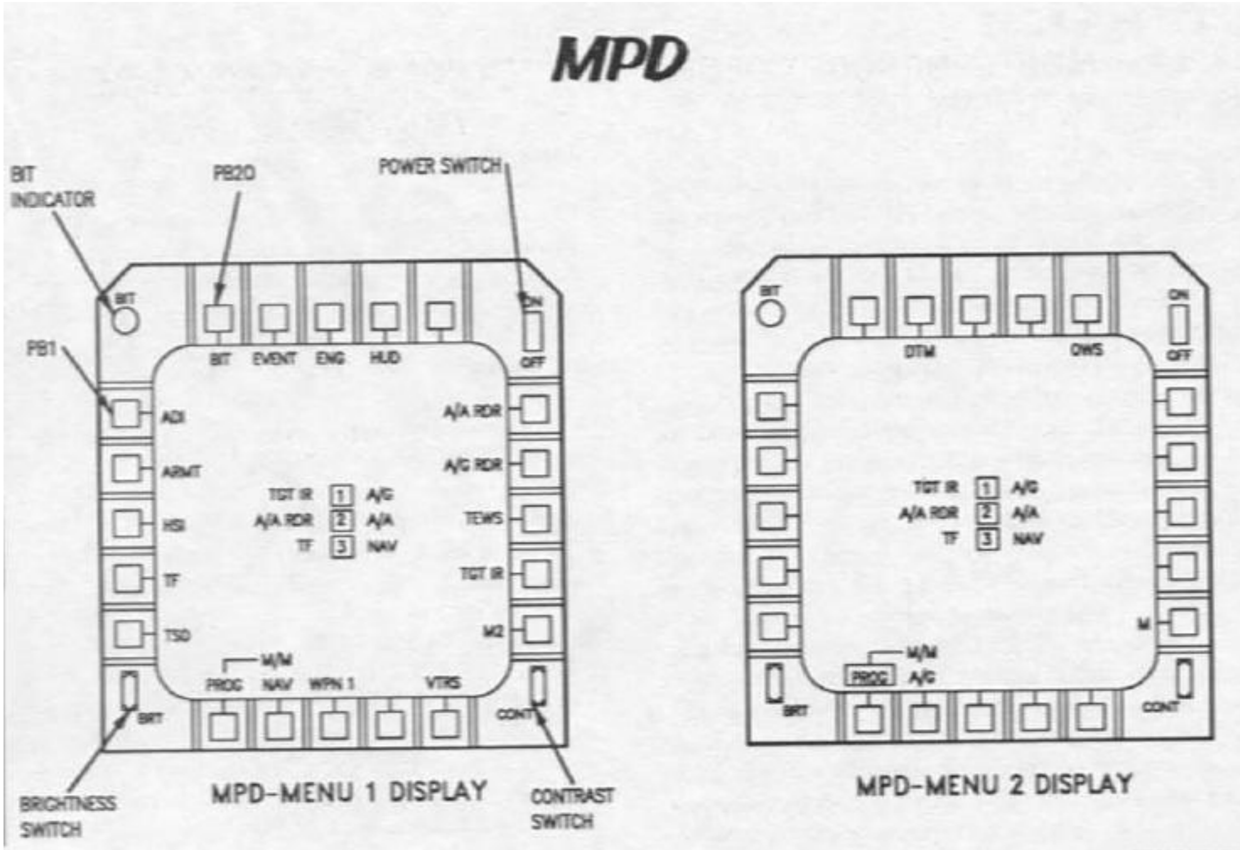


Figure 1-19

INSTRUMENTS

Refer to foldout section for front and rear cockpit instrument panel illustrations. For information about instruments that are an integral part of a weapons or radar system, refer to the weapons and radar manuals (separate publications). This section of the POH details function and appearance of primary and secondary flight instruments, with detailed focus on the standby instruments.

Additionally, detailed operation of the MPD/MPCD's and the UFC for interface with primary and secondary flight instruments as well as communications and navigation radios, are provided with video tutorials (separate publications).

VERTICAL VELOCITY INDICATOR (VVI)

The vertical velocity indicator (Figure 1-20) is driven by electrical signals from the air data computer. A window on the instrument will display an OFF flag if electrical power is lost or the display is not valid. The indicator is in both cockpits.

Figure 1-20

STANDBY ATTITUDE INDICATOR

The standby attitude indicator (Figure 1-21) is a self-contained electrically driven gyro-horizon type instrument. The OFF flag appears if there is a power loss to the indicator or the gyro is caged. The gyro is caged by pulling the knob. Do not turn the knob to lock the gyro in the caged position. The gyro cages to 0 degrees pitch and roll regardless of airplane attitude. The caged position is approximately 4 degrees nose up from the normal ground attitude and the gyro will process 4 degrees nose down after uncaging. Power should be applied to the instrument for at least 1 minute before caging. The indicator displays roll through 360 degrees. Pitch display is limited by mechanical steps at 90 degree climb and 78 dive. As the aircraft climbs or dives, the pitch attitude changes smoothly until the stop is reached when the gyro tumbles 180 degrees in roll. The indicator is in both cockpits.

Figure 1-21

STANDBY AIRSPEED INDICATOR

The standby airspeed indicator (Figure 1-22) operates directly from pitot-static pressures. It has a fixed scale of 60 to 850 knots and a rotation pointer. The indicator is in both cockpits.


Figure 1-22

STANDBY ALTIMETER

Figure 1-23

The standby altimeter (Figure 1-23) operates directly from a static pressure source. The altimeter is in both cockpits. The barometric pressure in inches of mercury is set on both altimeters. However, the baro altitude displayed on the HUD, ADI, and UFC is based on the cockpit altimeter baro setting only. On some aircraft the thousand digit moves progressively with the pointer rotation, rather than when the pointer transits the 9 to 0 range only.

STANDBY MAGNETIC COMPASS

A conventional aircraft magnetic compass (Figure 1-24) is mounted on the canopy arch in the front cockpit only.

Figure 1-24

ANGLE-OF-ATTACK (AOA) INDICATOR

Figure 1-25

The AOA indicator, in the front cockpit only, (Figure 1-25) is driven by electrical signals from the probe and displays indicated AOA in units from 0 t o45. A T-shaped index mark is set at approximate optimum landing approach AOA (20 to 22 units). A window on the face of the instrument displays an OFF flag if electrical power is lost, there is invalid data from the ADC or a failure within the indicator. A triangular index mark is positioned full scale and is inoperative.

SENSOR CONTROL PANEL

The MilViz F-15E uses the Sensor Control Panel (SCP) (Figure 1-26) to provide support for various functions.

RADAR

The Radar controls feature a four-position switch: OFF, STBY, ON, and EMERG. For the MilViz F-15E, to conduct aerial refueling operations, the switch must be placed in the STBY position. Active operation requires the switch placed in the ON position. In the MilViz F-15E, the EMERG switch provides the same functionality as the ON position. TF radar function is NOT modeled in the MilViz F-15E.

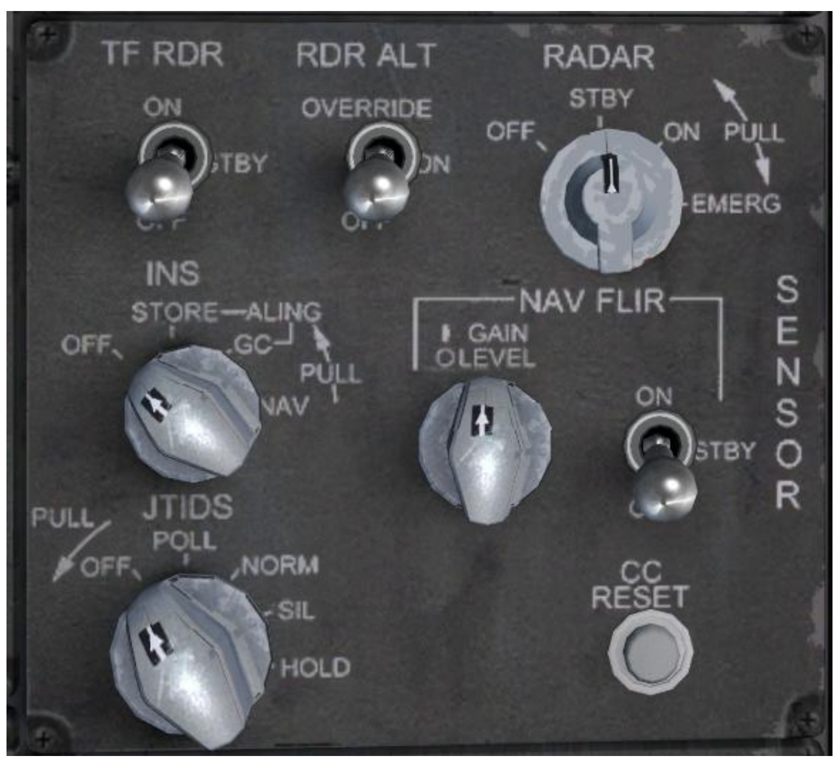


Figure 1-26

NAV FLIR

The NAV FLIR switch features a two-position lever switch: OFF and ON. It also features a three-position GAIN LEVEL knob switch to control the intensity of the FLIR display on the HUD. Placing the switch in the ON position will superimpose a FLIR picture on the HUD that is provided if the Aircraft Fuel and Stores Menu (Shift-4) is used to load a night-vision capable pod (LATIRN or SNIPER). The GAIN LEVEL knob can be rotated to select dim, medium, or bright intensity settings on the HUD.

RADAR ALTIMETER

The radar altimeter indicates clearance over land and water from 0 to 50,000 feet. Radar altitude is utilized by the AFCS, LANTIRN navigation pod, and the CC for low altitude warning (LAW). Radar altitude is displayed on the HUD, EADI, and UFC. A radar altitude scale (thermometer) is also displayed on the HUD and EADI during low level operations. The radar altimeter is controlled by the radar altimeter switch on the Sensor Control Panel (SCP) Figure 1-27).

Figure 1-27

Radar Altimeter Switch

The RDR ALT switch (Figure 1-27) is on the sensor panel on the left console in the front cockpit, and has three positions:

OFF	Radar altimeter is deactivated. If LAW is enabled, the LAW warnings are activated.
ON	Radar altimeter is activated.
OVERRIDE	Radar altimeter is deactivated. If LAW is enabled, the LAW warnings are activated. Note: The primary purpose of RDR ALT OVERRIDE mode is to facilitate manual fly up commands during TF operations. Given TF operations are not modeled on the MilViz F-15E, this feature simply replicates the function of the OFF mode.

HUD Display

With the radar altimeter turned on, radar altitude is displayed in window 14A of the HUD provided radar altitude is selected on the UFC data 1 format. The display includes radar altitude rounded to the nearest ten feet. An "R" appears to the left of the readout indicating the altitude is radar. Should the altitude source become invalid, OFF is displayed in place of radar altitude. During CC failure, radar altitude is displayed on the HUD and EADI since barometric altitude is not available. In addition, when a night vision pod (LATIRN or SNIPER) is equipped, the HUD will display a superimposed FLIR image boresighted ahead of the aircraft and fix focused to infinity.

Low Altitude Warning

When LAW is enabled on the UFC menu 1, audio and visual warnings are activated when the aircraft descends below the selected LAW altitude on menu 1. The warnings are removed when the aircraft climbs 20 feet above the selected LAW altitude, the LAW function is disabled on the UFC menu 1, or the LAW altitude is changed to below the present radar altitude. If LAW is enabled and the radar altimeter fails, the LAW warnings are activated. If LAW is enabled, radar altimeter fails, the LAW warnings are activated. If LAW is enabled, radar altitude is than 5,000 feet, aircraft attitude is less than 50 degrees of roll and less than 20 degrees of pitch, and the radar altimeter breaks track, the LAW warnings will be activated. The warnings are removed for these cases when either the fail condition corrects itself or the LAW function is disabled on the UFC menu 1.

Low Altitude Voice Warning

The "LOW ALTITUDE" voice warning repeats twice when the aircraft descends below the selected LAW altitude and resets when the LAW condition is removed. This voice warning is a function of LAW only.

Low Altitude Warning Light

A red low altitude warning light, labeled LOW ALT, is located on the upper instrument panel in both cockpits. The LOW ALT light comes on when a LAW condition is encountered and remains on until the LAW condition is removed.

Up-Front Control

The UFC is used to set the LAW altitude, to enable the LAW function, and the select radar (CARA) altitude for display on the HUD and ADI. Baro altitude is always displayed boxed in the upper right corner of the HUD and ADI and also at PB 9 on UFC Data 1. The present LAW altitude, in feet, is displayed at PB 1 on the UFC menu 1. To set a different LAW altitude, the desired altitude value is entered in the UFC scratchpad using the UFC keyboard. After verifying the correct altitude in the scratchpad, the upper left pushbutton adjacent to the LAW readout is pressed to change the LAW altitude to what is displayed in the scratchpad.

The LAW function is enabled if an asterisk appears on the upper left adjacent to the LAW readout. Alternatively pressing the upper left pushbutton with the scratchpad blank enables and disables the LAW readout.

Selecting "B" (asterisk) on UFC Data 1 displays radar (CARA) altitude on the HUD and ADI in addition to baro altitude. When selected, an "R" with the CARA readout will be displayed below the baro altitude on the HUD and ADI.

ATTITUDE DIRECTOR INDICATOR (ADI)

The ADI (figure 1-28) can be displayed on any MPD/MPCD and consists of the items indicated. The attitude sphere displays pitch and bank. The pitch markings on the sphere are in graduations of 5 degrees, the bank markings begin at 10 degree increments up to 30 degrees, and then single indicators at 45 and 60 degrees of bank angle.

Signals are received from the INS or AHRS system. The primary attitude source is the INS. The pitch and bank steering bars are driven by signals from the CC. The bank steering bar provides command steering information to intercept TACAN radials and navigation computer destinations. The ADI displays vertical velocity under the altitude window if gear is down. It is displayed as descending (-) or ascending (+).

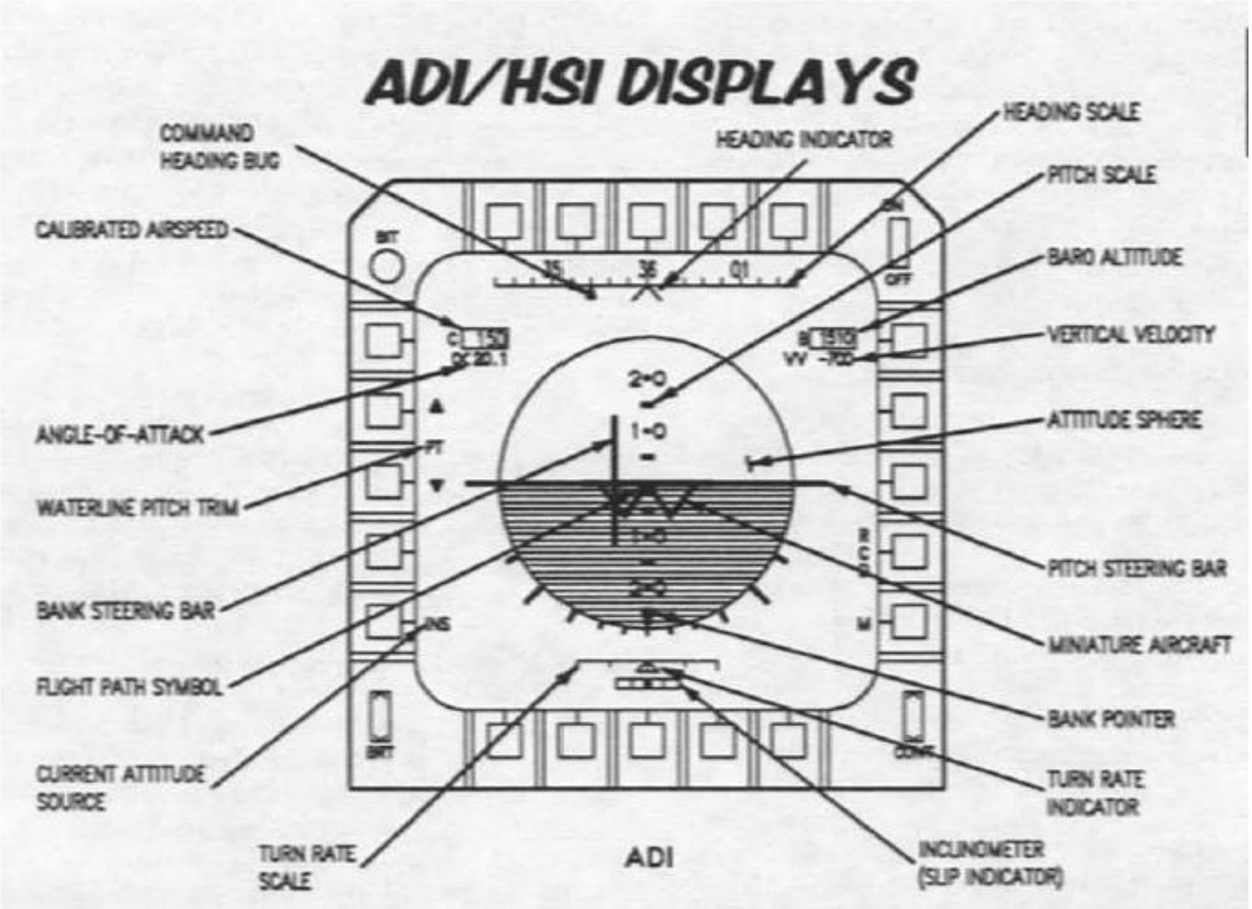


Figure 1-28

Angle of attack is displayed under the airspeed window when the landing gear is down. Command velocity (CV) is displayed if valid and the landing gear is up. When active, the CV is displayed under the airspeed window. The units of CV are KCAS unless TAS or GS are selected on UFC Data 1. For example, if PB 4 (on UFC data 1) is selected (asterisks shown) then CV is in units of GS. The CV reference point is displayed next to the CV. It is displayed as a function of entering data into the upfront control for time-over-target purposes.

When ILST or ILSN steer modes are selected on the HSI, ILS data is also displayed on the ADI (Figure 1-28).

ADI Invalid Displays

The major indication of attitude display problems is an "X" written across the attitude sphere. The word OFF written on the attitude source indicates the INS/AHRS is invalid. If the turn rate and/or inclinometer information is invalid, the word OFF is written adjacent to the data. If the heading source is invalid OFF is written in the middle of the heading scale. If airspeed information is invalid then OFF is displayed in the airspeed window. If vertical velocity is invalid, then OFF is written adjacent to it. If the selected source of altitude information is invalid OFF is written in the altitude window.

HORIZONTAL SITUATION INDICATOR (HSI)

The HSI (Figure 1-29) can be displayed on any MPD/MPCD when selected from the MPD/MPCD main menu. When the MPCD is used, the data is color coded as follows:

1. TACAN data is green
2. INS data is blue
3. Heading data is orange
4. All other information is white

The HSI provides a horizontal or plan view of the aircraft with respect to the navigation situation. The aircraft symbol in the center of the HSI is the airplane superimposed on the compass rose. The compass card rotates so that the aircraft heading is always under the top of the lubber line. Command heading and course selection function, plus the steering modes of TCN (PLAN or CDI), GT, ILST, ILSN, and NAV are provided by using the display pushbutton.

A selection for disabling/enabling automatic destination sequencing is available on the HSI format. The legend "AUTO SEQ" is displayed below PB 18 and is boxed when auto-sequencing is enabled. The selection is automatically enabled when power to the CC is cycled and the aircraft is on the ground. Data associated with ILS operation is also displayed, but only when ILSN/ILST is selected. Additional symbols which are displayed on the HSI are:

RANGE SCALE	There are five range scales (10, 20, 40, 80, and 160 nautical miles). The range represents the distance from the aircraft symbol to the perimeter of the compass rose. The navigation steer point and/or selected TACAN station is presented so that their position with respect to current heading can be seen and easily interpreted.
TACAN AND ILS NAV DATA	Two data blocks provide bearing, distance, and estimated time enroute (ETE) information about the selected point selected. The display also includes the TACAN channel mode X or Y, or sequence point number.

HEADING MARKER	The marker is moved around by command heading selections made by the operator in all modes except NAV and GT. In NAV the marker is positioned to the command heading to fly to maintain a constant ground track.
BEARING POINTERS	Two bearing pointers are displayed, one for INS nav bearing and one for TACAN station bearing. The two pointers are shaped and color coded when displayed on the color CRT.
ADF BEARING	A small lollypop symbol indicates the bearing of the transmitted signal. No symbol indicates ADF function is not selected. Selection of ADF is made on the UFC.

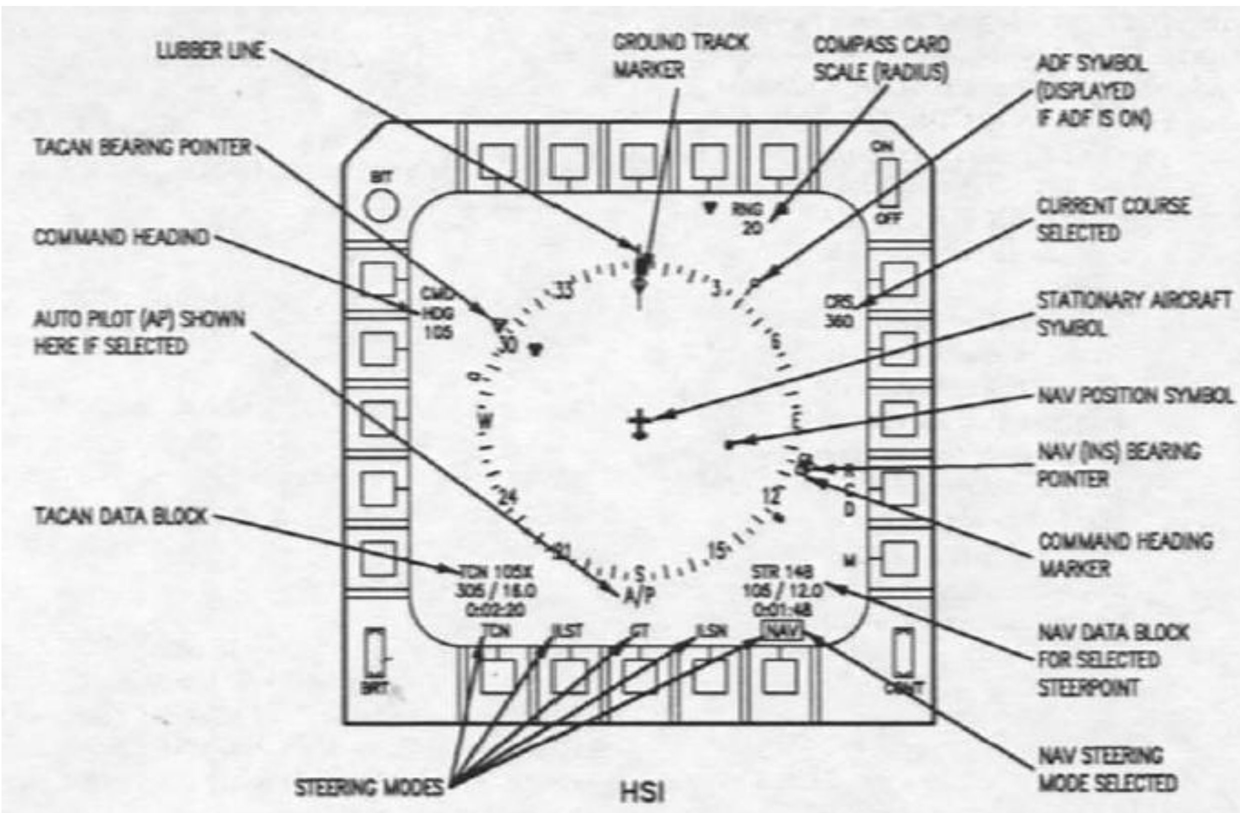


Figure 1-29

NAVIGATION/STEERING MODES

There are five steering modes listed at the bottom of the HSI display. They are TCN, ILST, GT, ILSN, and NAV, and are selected by pressing the desired mode pushbutton. The mode selected becomes boxed.

If the autopilot has been coupled, the two ILS steer modes are removed from the display and autopilot (A/P) is written on the display. A coupled ILS is not selectable.

TACAN Steering Mode

The display format with TCN selected is shown in Figures 1-30 and 1-31. There are two display options available with TCN selected: course deviation indicator (CDI) or PLAN. The current selection is shown at PB 20 and pressing PB 20 will alternate between the two options.

With CDI selected, a white set course pointer and course deviation indicator are drawn on the display. The set course pointer is drawn through the center of the aircraft symbol according to the course value shown between PB 14 and PB 15. The TO/FROM indicator is drawn adjacent to the aircraft symbol, and the course deviation indicator is drawn on the course deviation scale with full deflection being 10 degrees of displacement.

With PLAN selected, a green set course arrow is drawn through the center of the TACAN station symbol according to the course value shown between PB 14 and PB 15. There is no TO/FROM indicator and no course deviation indicator. If the selected range scale is too small to show the TACAN position, the TACAN position symbol and the set course arrow are removed. All other features of the HSI display format are the same for either CDI or PLAN.

The course set pushbuttons (PB 14 decrement, PB 15 increment) are used to select the desired inbound or outbound radial to fly. The course can also be set by entering the value in the UFC scratchpad and transferring it to the HSI by pressing either PB 14 or PB 15. Since the TACAN channels and modes are selected with the UFC, additional information is provided on the HSI display format to indicate TACAN status. When the TACAN system is off, OFF is written in large red letters in the TACAN data block and above the TCN steer mode cue, and all TACAN indications such as the station position symbol, set course arrow, set course pointer, CDI, bearing pointer, and TO/FROM indicator are removed.

STEERING DISPLAY

(TACAN MODE)
GEAR DOWN

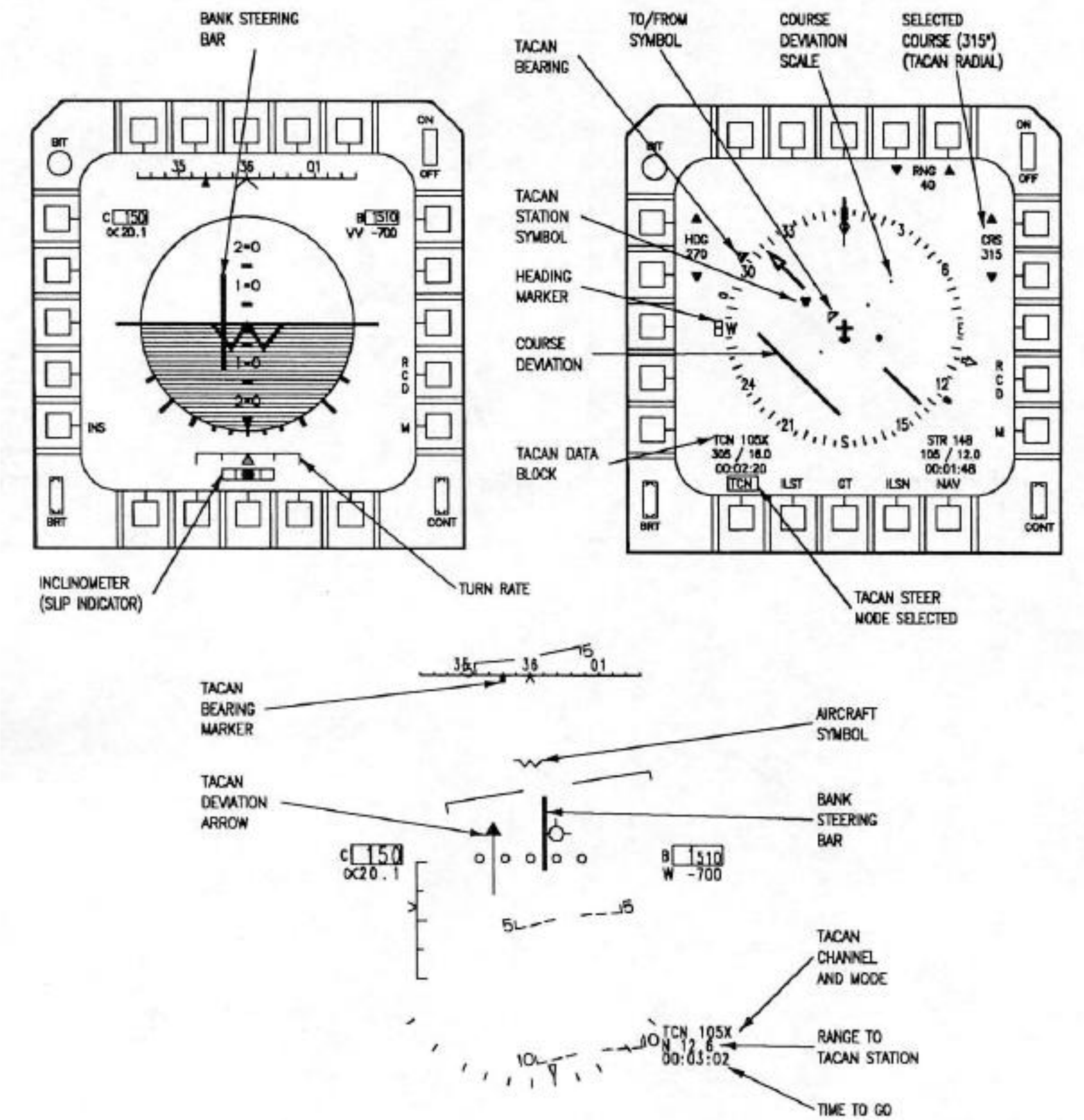


Figure 1-30

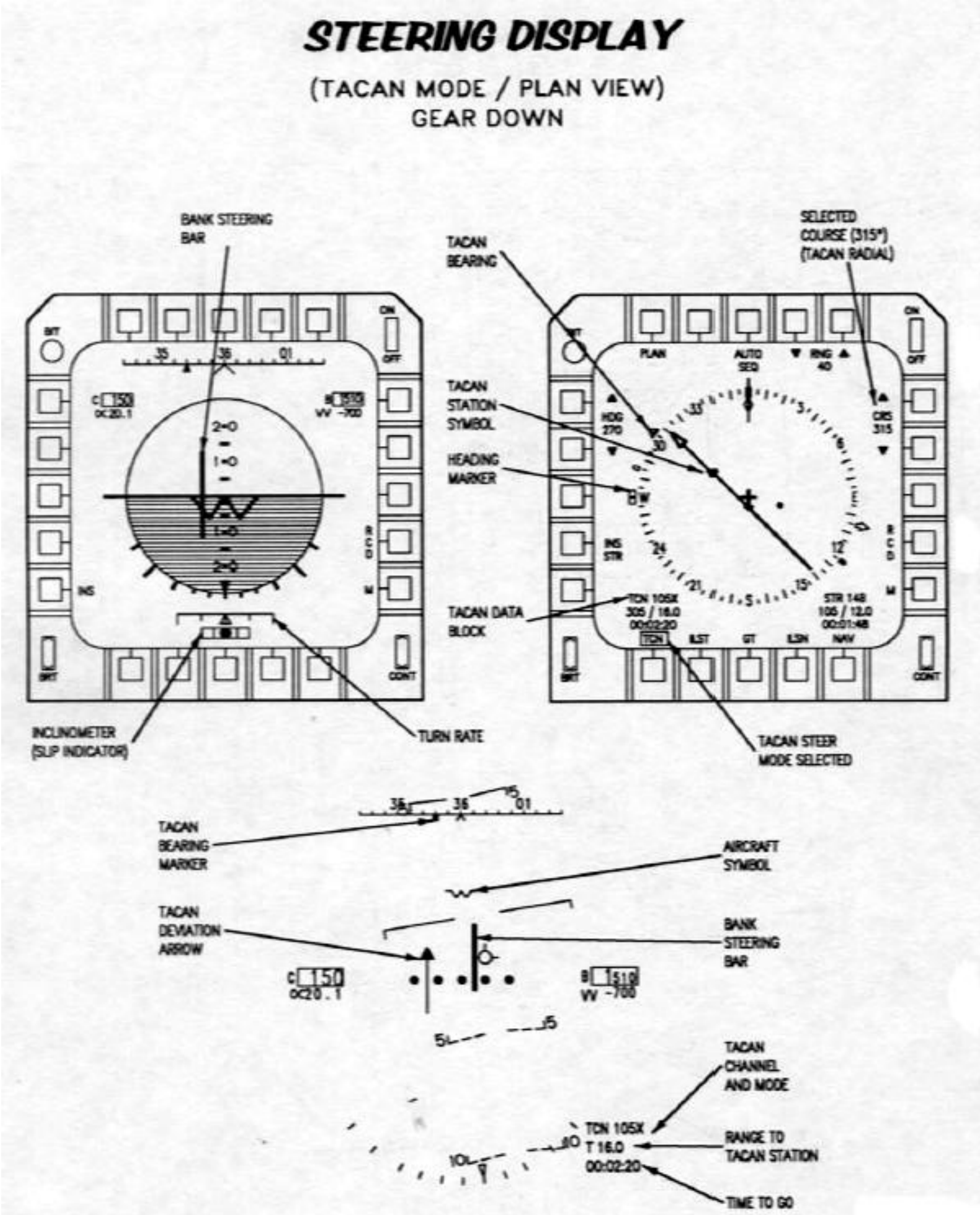

STEERING DISPLAY
(TACAN MODE / PLAN VIEW)
GEAR DOWN
BANK STEERING BAR
TACAN BEARING
SELECTED COURSE (315°) (TACAN RADIAL)
TACAN STATION SYMBOL
HEADING MARKER
TACAN DATA BLOCK
INCLINOMETER (SLIP INDICATOR)
TURN RATE
TACAN STEER MODE SELECTED
TACAN BEARING MARKER
AIRCRAFT SYMBOL
TACAN DEVIATION ARROW
BANK STEERING BAR
TACAN CHANNEL AND MODE
RANGE TO TACAN STATION
TIME TO GO
TCN 105X
T 16.0
00:02:20

Figure 1-31

ILST/ILSN Steering Modes

Selecting ILST or ILSN mode displays the format shown in Figures 1-32 and 1-33. The CDI displays localizer deviation and the TACAN TO/FROM indicator is removed. The course point indicates the selected inbound course to the localizer. The course set pushbutton (or UFC scratchpad) can be used to change the inbound course. The heading set pushbutton or UFC scratchpad can be used to move the heading marker.

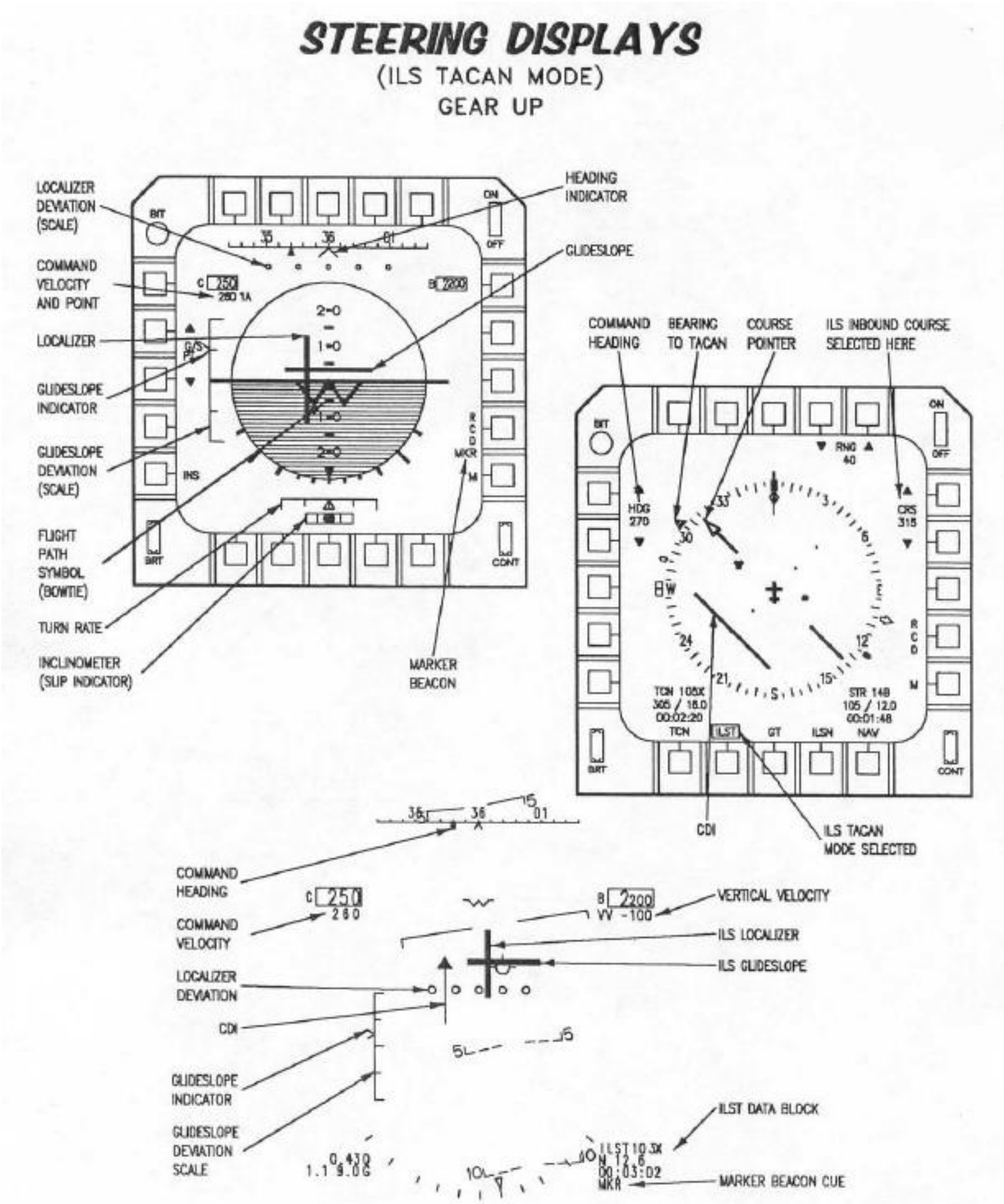


Figure 1-32

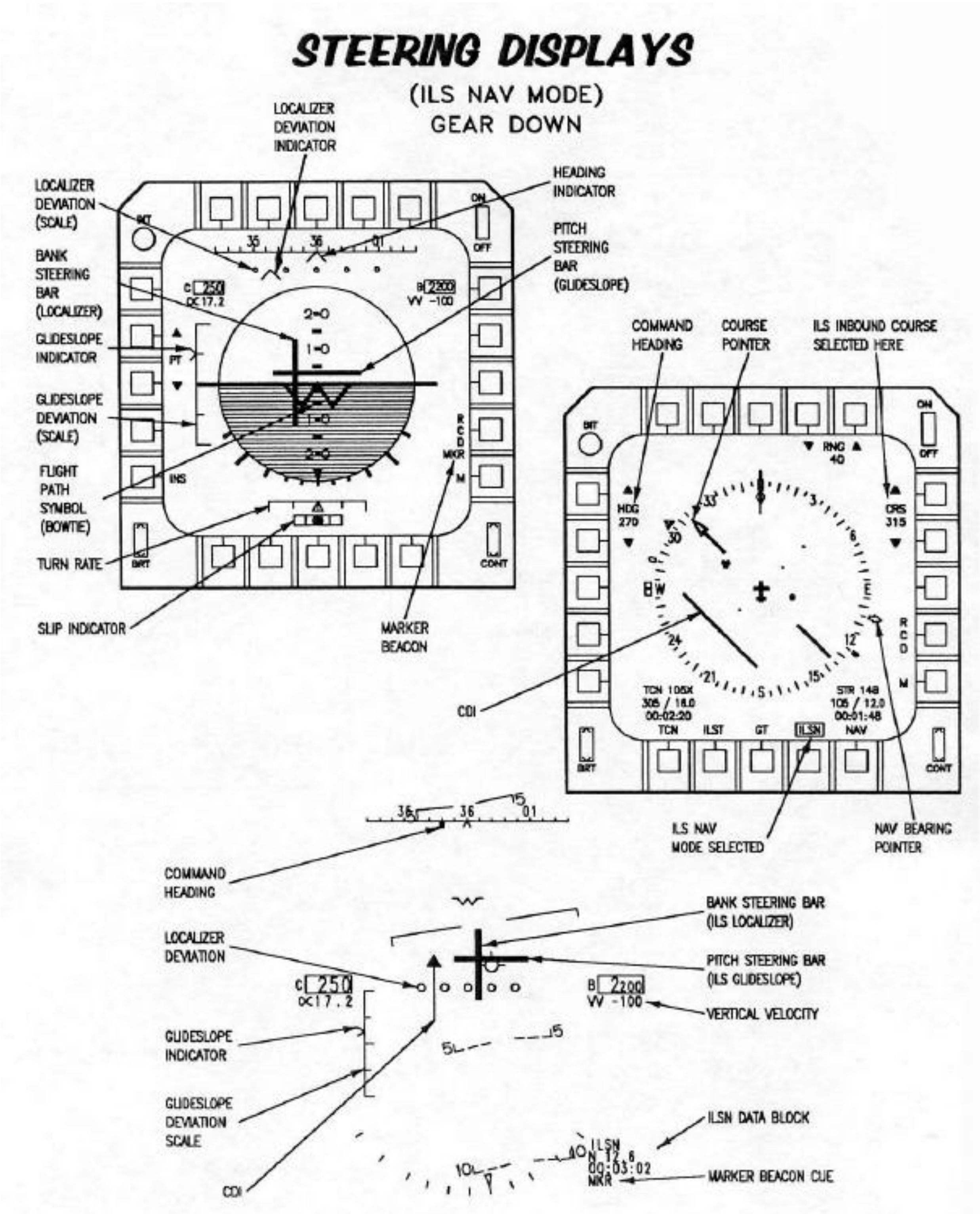

STEERING DISPLAYS
(ILS NAV MODE)
GEAR DOWN
LOCALIZER DEVIATION INDICATOR
LOCALIZER DEVIATION (SCALE)
BANK STEERING BAR (LOCALIZER)
GLIDESLOPE INDICATOR
GLIDESLOPE DEVIATION (SCALE)
FLIGHT PATH SYMBOL (BOWTIE)
TURN RATE
SLIP INDICATOR
HEADING INDICATOR
PITCH STEERING BAR (GLIDESLOPE)
MARKER BEACON
COMMAND HEADING
COURSE POINTER
ILS INBOUND COURSE SELECTED HERE
CDI
ILS NAV MODE SELECTED
NAV BEARING POINTER
COMMAND HEADING
LOCALIZER DEVIATION
GLIDESLOPE INDICATOR
GLIDESLOPE DEVIATION SCALE
CDI
BANK STEERING BAR (ILS LOCALIZER)
PITCH STEERING BAR (ILS GLIDESLOPE)
VERTICAL VELOCITY
ILSN DATA BLOCK
MARKER BEACON CUE

Figure 1-33

GROUND TRACK Steering Mode

Selecting GT mode presents the HSI format shown on Figure 1-34. The desired ground track is selected using the course set pushbutton or UFC scratchpad. The course pointer and CDI (course deviation indicator) will not be displayed.

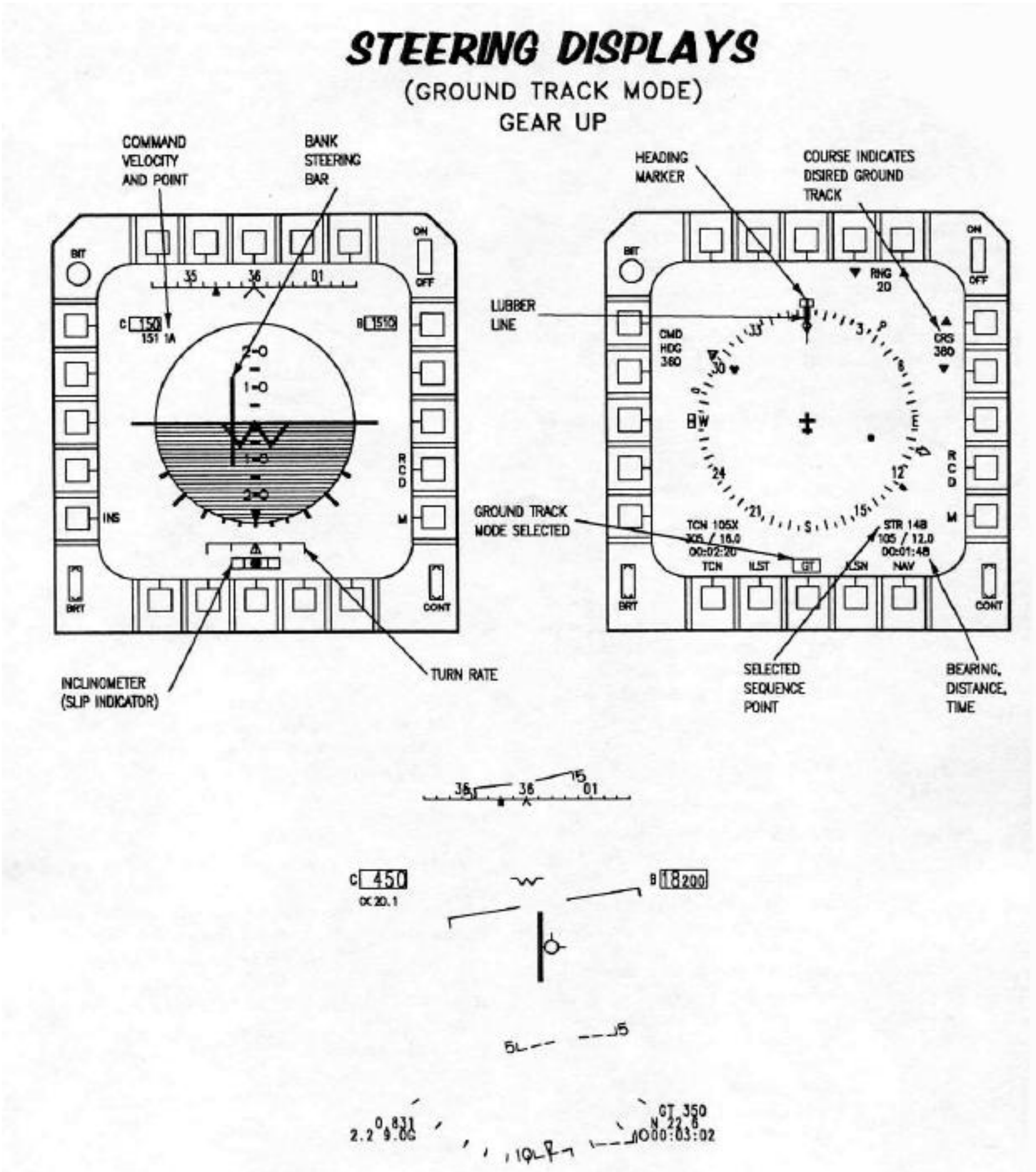


Figure 1-34

NAVIGATION Steering Mode

Selecting NAV mode displays the bearing and heading to fly to get the steer point selected. As shown on Figure 1-35, the heading marker moves to indicate the heading to fly. Command heading is also printed in the command heading window on the left side of the display. Course window displays ground track. Bearing, distance, and time-to-arrive are displayed in the lower right hand data block.

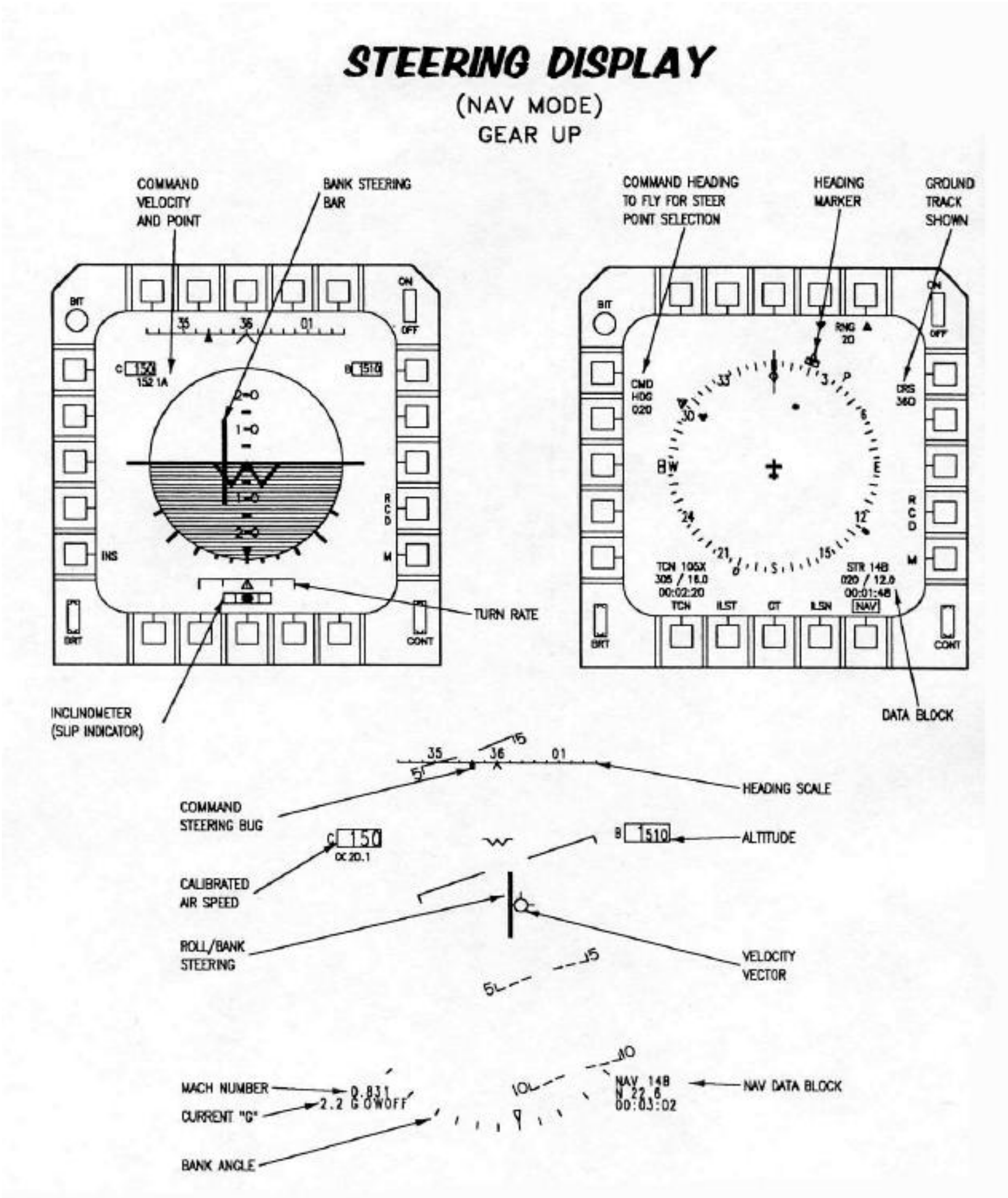


Figure 1-35

NAVIGATION HEAD-UP DISPLAYS (HUD)

For each navigation steering mode selected via the EHSI or UFC, the HUD display will adjust to replicate the same navigational steering inputs and displays. Figures 1-30 through 1-35 listed immediately above show the direct relationships between these various settings and displays.

UFC NAVIGATION DISPLAYS

Navigation displays consisting of sequence point coordinates, elevation, range and bearing, offset data, and INS update data are contained on several submenus on the UFC, and are accessible from the menu and data displays on the UFC. These submenus are used to verify data loaded into the aircraft via the keyboard of the UFC. This information also provides steering and timing data for route navigation and target attack, or to change data for navigation and target attack. Weapons and radar specific instructions are contained in the weapons and radar manuals (separate publication).

In order to enter or change a specific item on the UFC, the appropriate submenu must be accessed. Procedures for entering or changing data are located in Section 2 of this POH.

SEQUENCE POINTS

Sequence points are a set of geographical points which can be overflown or used for sensor cuing during a mission. All points are stored at latitude/longitude and converted for display as lat/long.

These points are divided into the following categories.

LIST	Points which are used to generate steer, aim, target, and target offset points. The system can store a total of 99 list points.
STEER	Points which comprise the basic route to be flown. Combined steer and target points cannot exceed 100 (all routes, A, B, and C). Displayed as the point number and route letter (17A).
AIM	Always associated with a steer point, up to seven aim points per steer point. Displayed as the steer point number plus a decimal, tenth, and route letter (17.1A). The system can store up to 100 combined aim and offset points in all three routes.

TARGET	Displayed as a point number followed by a decimal and route letter (18.B). Combined target and steer points cannot exceed 100. Target data also displayed in direction/range north and east of offset or range/bearing from offset point.
OFFSET	Always associated with a target point, displayed as the target number, decimal, hundredths, and route letter (18.01B). The system can store up to seven offsets per target, maximum of 100 combined offset and aim points in all three routes. Point data is also displayed in direction expressed as range north and east of target, or as range expressed as a bearing and distance from target.
MARK	Mark points are entered by an overfly mark, radar mark, or an automatic overfly mark at weapon release. Data displayed includes time of day. They are displayed as the mark sequence number preceded by M (M2) up to 10 such mark points.
BASE	The base point is normally the unit home station, is displayed as B and should agree with the PP coordinates during INS alignment.

NOTE

When changing sequence point numbers, the route letter does not need to be entered if the new point is in the same route (A, B, or C) as the old point.

Data 1 Display

The data 1 display (Figure 1-36) contains current aircraft information. From this display, either the pilot or WSO can change:

Item	Options
Aircraft Altitude	Radar or Barometric
Wind Direction & Speed	Can be changed if PP source is ADC or if when the INS failed
Airspeed	True, Calibrated, or Ground speed
Steer Point	Select the current steer point

Point Data Submenus

The point data latitude/longitude submenu is accessed by pressing the button adjacent to the current steer point number (Figure 1-36). For each point, the sequence point type, lat/long, elevation, minimum enroute altitude (MEA), and time-on-target (TOT) may be changed.

The RNG/BRG submenu is available from the lat/long submenu only if there are offsets stored for a target or target offset point. Press RNG/BRG to enter the range/bearing submenu. On this display, the following items may be changed"

Item	Options
Current Range to Point	Expressed in nautical miles and tenth of miles
Magnetic Bearing to Point	Expressed in degrees magnetic
ETA to Point	Not available for aim, mark, or offset points
Point Elevation	Expressed in feet

Pressing the button next to DIR/RNG on the range/bearing submenu selects the direction/range submenu. The DIR/RNG submenu is available only if there are offsets stored for a target or target offset point. Direction N, S, E, or W and range in feet to the point shown may be changed. To return to the Data 1 display at any time from the submenu, press the data button once.

UTM (MGRS) coordinates are not supported on the MilViz F-15E. Coordinates may only be entered using the lat/long method. In addition, the coordinate format spheroid options (Bessel, WGS84, etc…) cannot be changed in FSX.

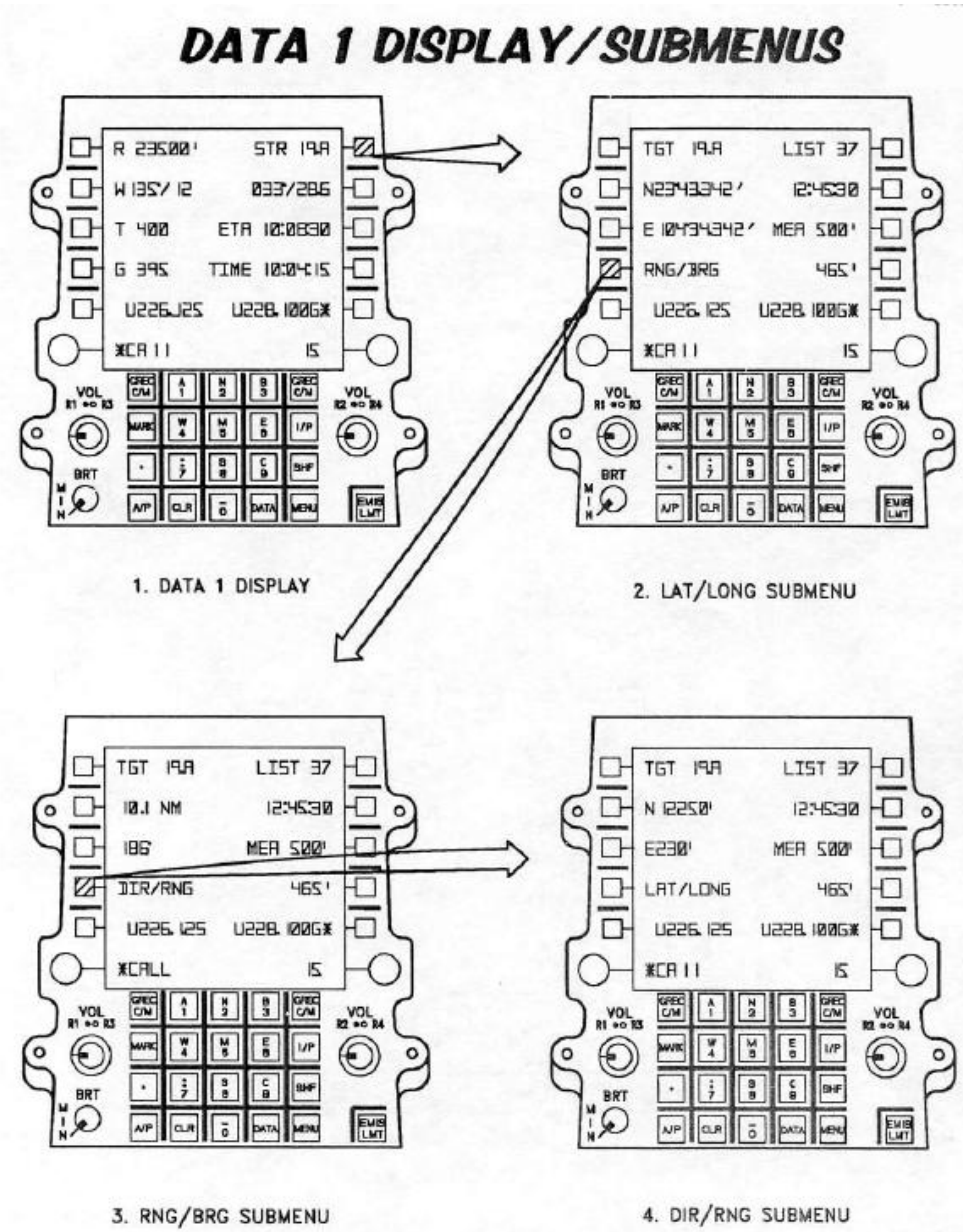

DATA 1 DISPLAY/SUBMENUS
R 23500'
STR 19A
W 135/ 12
033/286
T 400
ETA 10:08:30
G 395
TIME 10:04:15
U226.125
U228.100G*
*CA11
15
TGT 19A
LIST 37
N2343342'
12:45:30
E 10434342'
MEA 500'
RNG/BRG
465'
10.1 NM
186'
DIR/RNG
*CALL
N 1225'
E230'
LAT/LONG
1. DATA 1 DISPLAY
2. LAT/LONG SUBMENU
3. RNG/BRG SUBMENU
4. DIR/RNG SUBMENU

Figure 1-36.1

DATA 1 DISPLAY/SUBMENUS (CONTINUED)

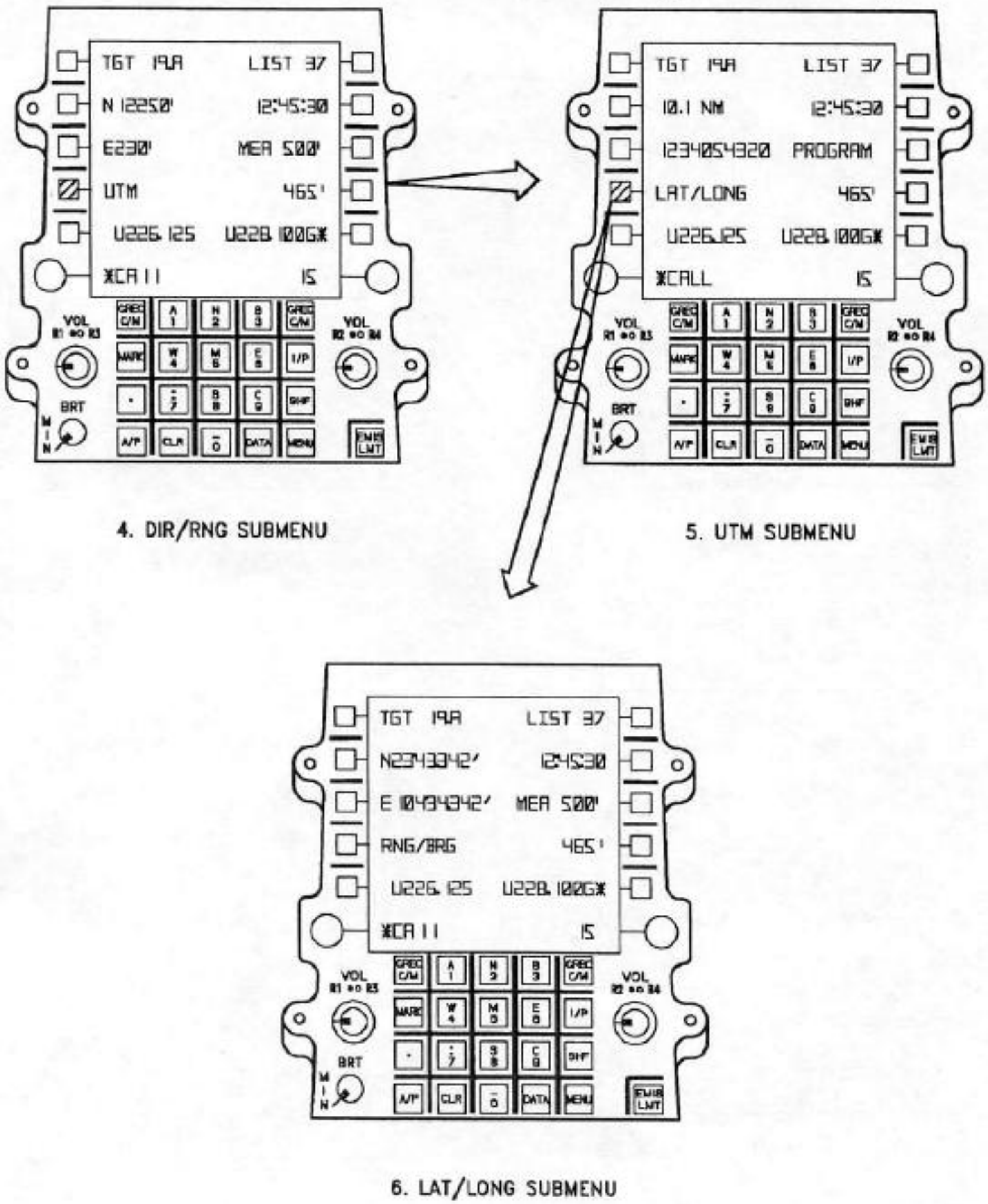


Figure 1-36.2

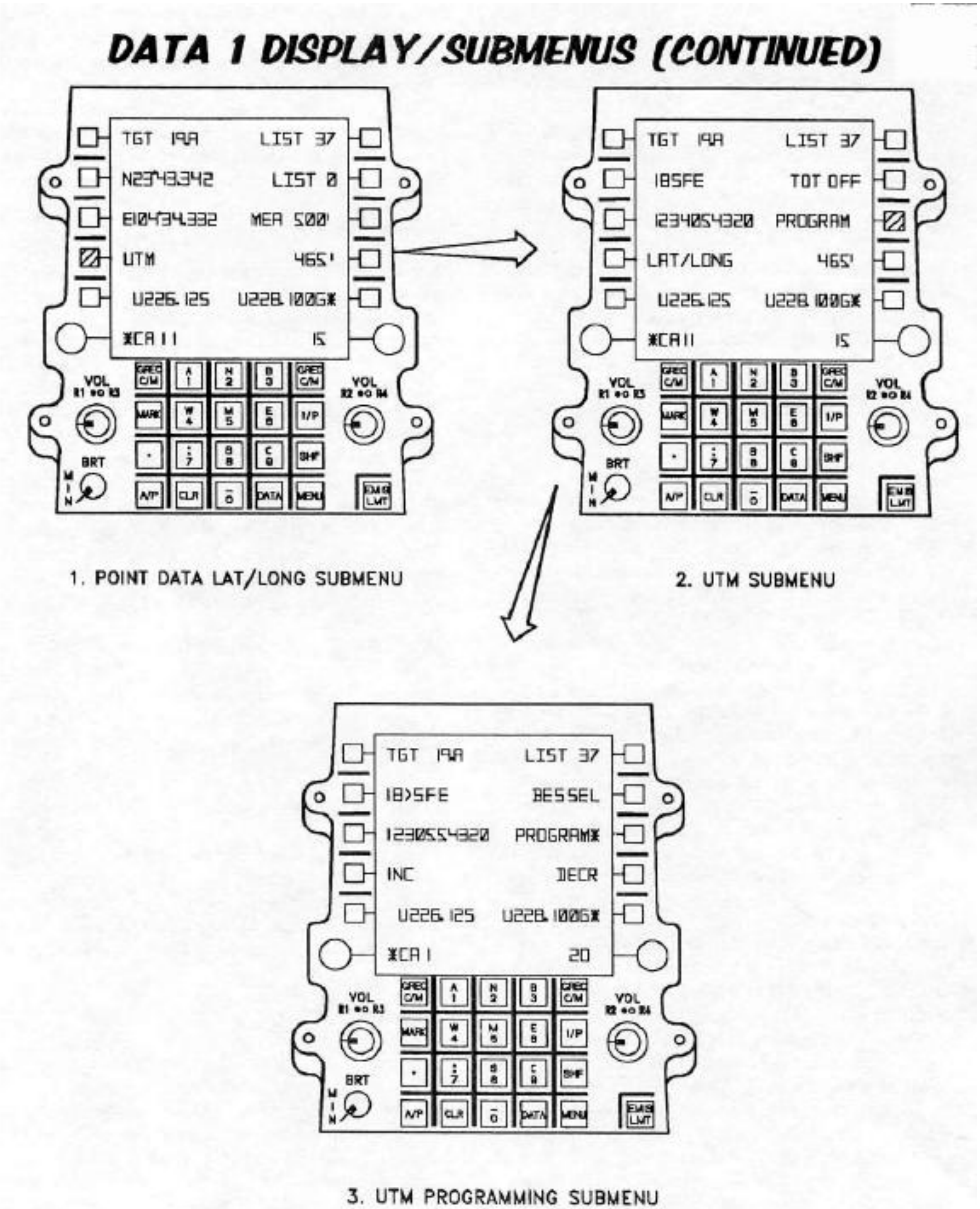

DATA 1 DISPLAY/SUBMENUS (CONTINUED)
TGT 19A
LIST 37
LIST 0
MEA 500'
UTM
465'
U226.125
U228.100G*
*CA 11
15
LAT/LONG
PROGRAM
TOT OFF
INC
DECR
BESSEL
*CA 1
20
VOL
BRT
MARK
CLR
DATA
MENU
SHF
I/P
A/P
EMIS LMT
1. POINT DATA LAT/LONG SUBMENU
2. UTM SUBMENU
3. UTM PROGRAMMING SUBMENU

Figure 1-36.3

DATA 2 DISPLAY

The data 2 display (Figure 1-37) provides time, groundspeed, and fuel information pertaining to two selected points in the navigation route sequence (the origin and destination waypoints for the current steering pathway).

Pressing the button next to ETA cycles to ETE and back to ETA as the button is pressed. The label "12000 LBS" shows the fuel remaining at the waypoint (SP 25.A) if the leg is flown at the command ground speed (CG) direct to the line of sight pathway drawn from the previous waypoint (SP 24.A). TOA is the arrival time to the destination waypoint (SP 25.A) assuming the CG is maintained. Pressing either CG, fuel, or TOA changes the display as shown in Figure 1-37. If there is not TOT stored for the destination waypoint (SP 25.A) then OFF is displayed next to CG and TOT. A TOT may be entered on this display. The line-of-sight sequence point (origin point SP 24.A) and the look ahead sequence point (destination SP 25.A) can be incremented by pressing the adjacent button or changed using the scratchpad.

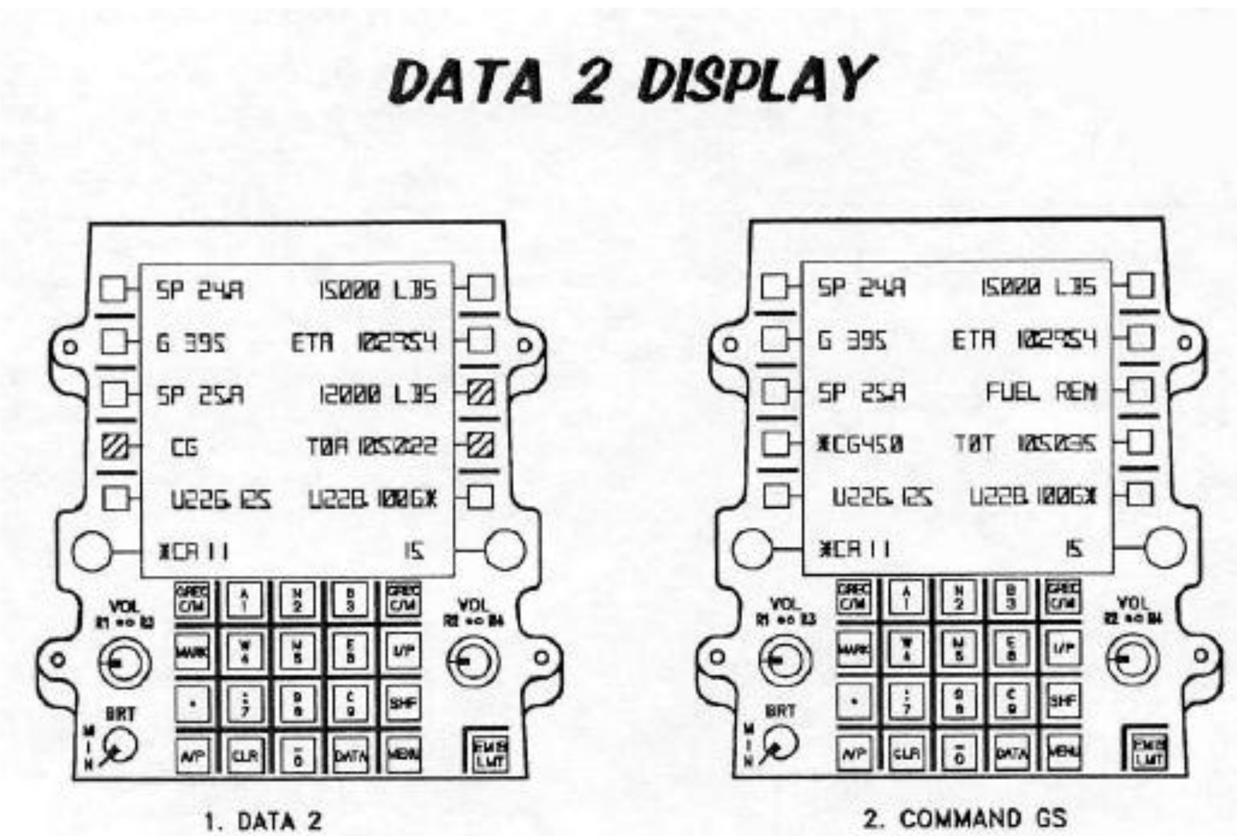


Figure 1-37

MENU 1 DISPLAY

The menu 1 display (Figure 1-38) is a basic avionic system status display. However, if can be used to change steer points, to access the point data submenu, to access the TACAN, FLIR, AAI, IFF, and A/P submenus, or change the LAW altitude for radar altitude hold mode operations.

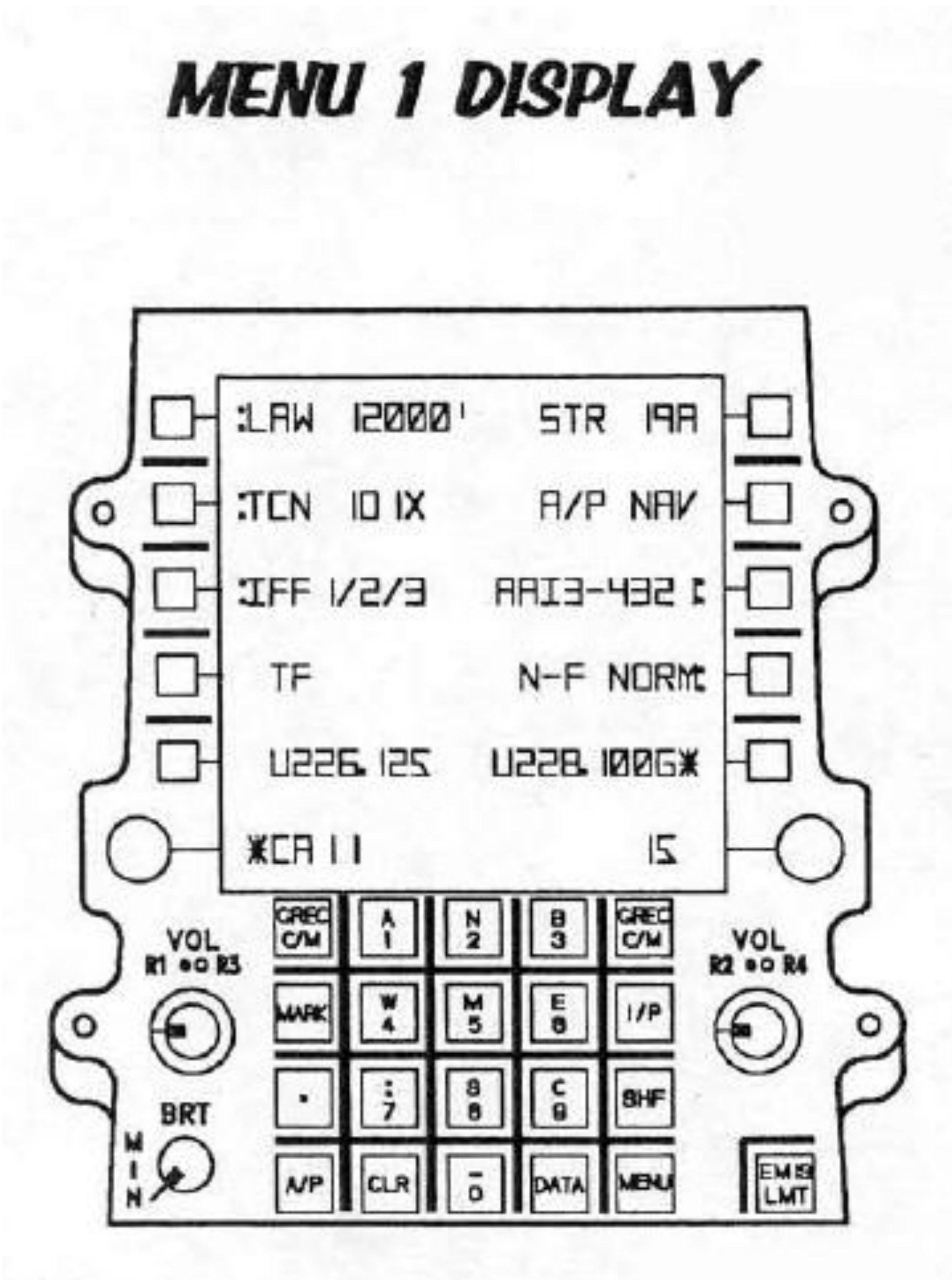


Figure 1-38

MENU 2 DISPLAY

The menu 2 display (Figure 1-39) contains control features for the ILS as well as access to the DIRECT/MANUAL bombing mode HUD reticle setting, present position source submenu, update submenu, present position source submenu, update submenu, and the HUD titling submenu.

HUD Reticle Mil Setting

The HUD reticle is depressible only in direct or manual mode. Depression angle in mils is set by entering the desired setting in the scratchpad and pressing the HUD RET button.

Present Position Source Submenu

To select the PP source submenu, press the button next to PP-INS. The display appears as shown in Figure 1-39. Either the pilot or WSO may select the desired PP source and change the aircraft present position latitude and longitude.

Entering a new latitude and longitude to the INS should not be done without the INS, CC, and UFC turned-on and evaluation on the INS stored PP at turn-on. When a new PP is entered the new values should be accurate to 600 feet (0.1 are minute). Present position entered during INS alignment should be the actual location of the aircraft. PP corrections made after the aircraft has moved should be done by update after transition to NAV mode. The cockpit UFC will automatically initialize to the PP source submenu when going from INS OFF to GC align, if the cockpit UFC is not on a submenu.

Update Submenu

Pressing the button adjacent to UPDATE selects the update submenu as shown in Figure 1-39 display 3. This display allows the aircrew to update the INS position using data from the HUD, TACAN, or by direct overfly freeze of a point. Prior to any attempted update, verify that the point to be updated is displayed next to UPDATE. If not, enter the point via the scratchpad. The point entered will become the current steer point.

To perform a HUD update, the desired update point must be identified using the HUD designation procedures after pressing HUD on the UFC. Once the point is designated, the CC calculates range errors between the stored latitude/longitude of the update point and the HUD designated location of the point. The errors are displayed in N/S and E/W feet on the display. (INV, for invalid, is displayed if a present position source is not available.) To accept the displayed errors, press ENTER and the INS position is updated. If the update is not desired, the aircrew may perform another update or exit the update submenu.

To perform a TACAN update the aircrew must first select the desired TACAN channel and X or Y system on the UFC. Then, press the button next to the TACAN channel. The CC calculates the directional range errors between the stored latitude/longitude of the TACAN station and the range/bearing of the station to the current aircraft position. (INV is displayed if a PP source is not available or the TACAN coordinates have not been stored.) The aircrew may then ENTER the update, perform another update, or exit the update submenu.

An overfly freeze update is accomplished by flying directly over the displayed steer point and pressing the OFLY FRZ button. The CC calculates the directional range errors between the stored coordinates and the aircraft present position and displays the N/S and E/W errors in feet. The aircraft may ENTER the update, perform another update, or exit the update submenu.

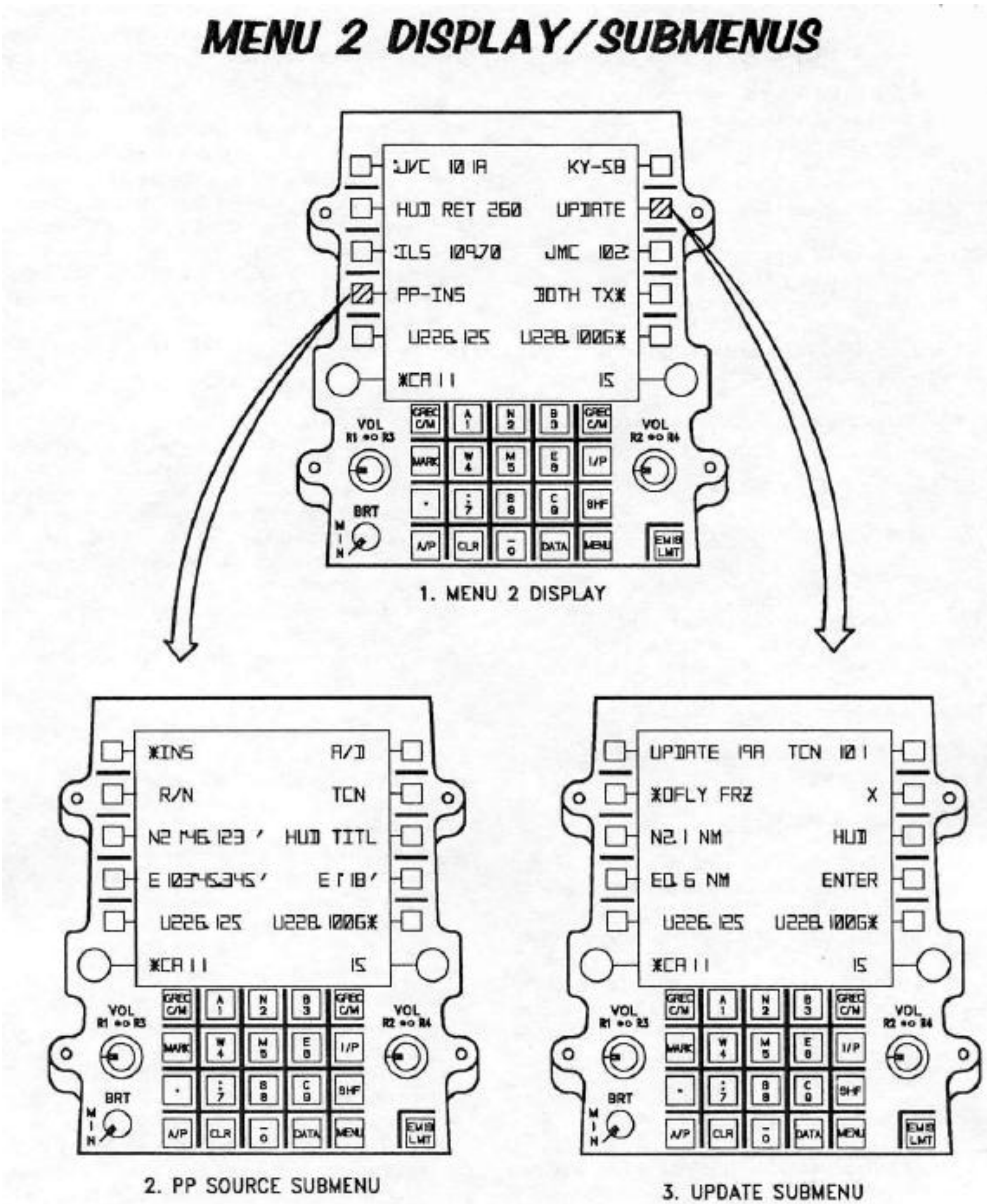

MENU 2 DISPLAY/SUBMENUS
KY-58
UPDATE
HUD RET 260
ILS
PP-INS
U226.125
CA 11
15
VOL
BRT
MARK
I/P
SHF
A/P
CLR
DATA
MENU
EMIS LMT
1. MENU 2 DISPLAY
INS
A/D
R/N
TCN
HUD TITL
2. PP SOURCE SUBMENU
UPDATE
TCN
OFLY FRZ
X
HUD
ENTER
3. UPDATE SUBMENU

Figure 1-39

VHF COMMUNICATIONS SYSTEM

The VHF communications system is controlled via the UFC and the intercommunications set control panel located on the left console in the rear cockpit. The system consists of two units (VHF 1 and VHF 2).

NOTE

FSX does not support UHF communications. Therefore, the UHF radios present in the real world F-15E have been replaced with VHF radios in the MilViz F-15E. In addition, provisions for secure voice radio communications are also not supported in FSX; therefore, these features are likewise not modeled in the MilViz F-15E. While the diagrams for UFC control are used in this POH, the customer must understand that in lieu of the UHF frequency references shown, VHF frequencies are actually used in the MilViz F-15E.

In additional, simultaneous monitoring of guard (VHF 121.5) while an alternate radio frequency is tuned is not supported in FSX and therefore is not available in the MilViz F-15E.

Radio control via the UFC system is illustrated in Figure 1-40.

VHF Antenna Selector Switch

The VHF antenna selector switch has three positions: UPPER, LOWER, and AUTO. Placing the switch to UPPER selects the upper antenna for VHF 1 radio and putting the switch to LOWER selects the lower antenna for VHF 1. Placing the switch to AUTO causes the VHF 1 radio to automatically select the antenna with the best signal. The VHF 2 radio always transmits and receives on the lower antenna.

Operation of VHF Radios

When aircraft power is activated the radios selections on VHF 1 and VHF 2 radios from the previous flight are displayed on the UFC. The asterisk symbol displayed next to the preset channel number or the manual frequency indicates the radio is turned on. To confirm the operational status of VHF 1, press the pushbutton next to VHF 1 digital readout on the UFC. When selected and pushed, the submenu for VHF 1 control will appear as shown in Figure 1-40.

Additional details on operation of VHF radios via the UFC can be learned by using the tutorial videos (separate publication).

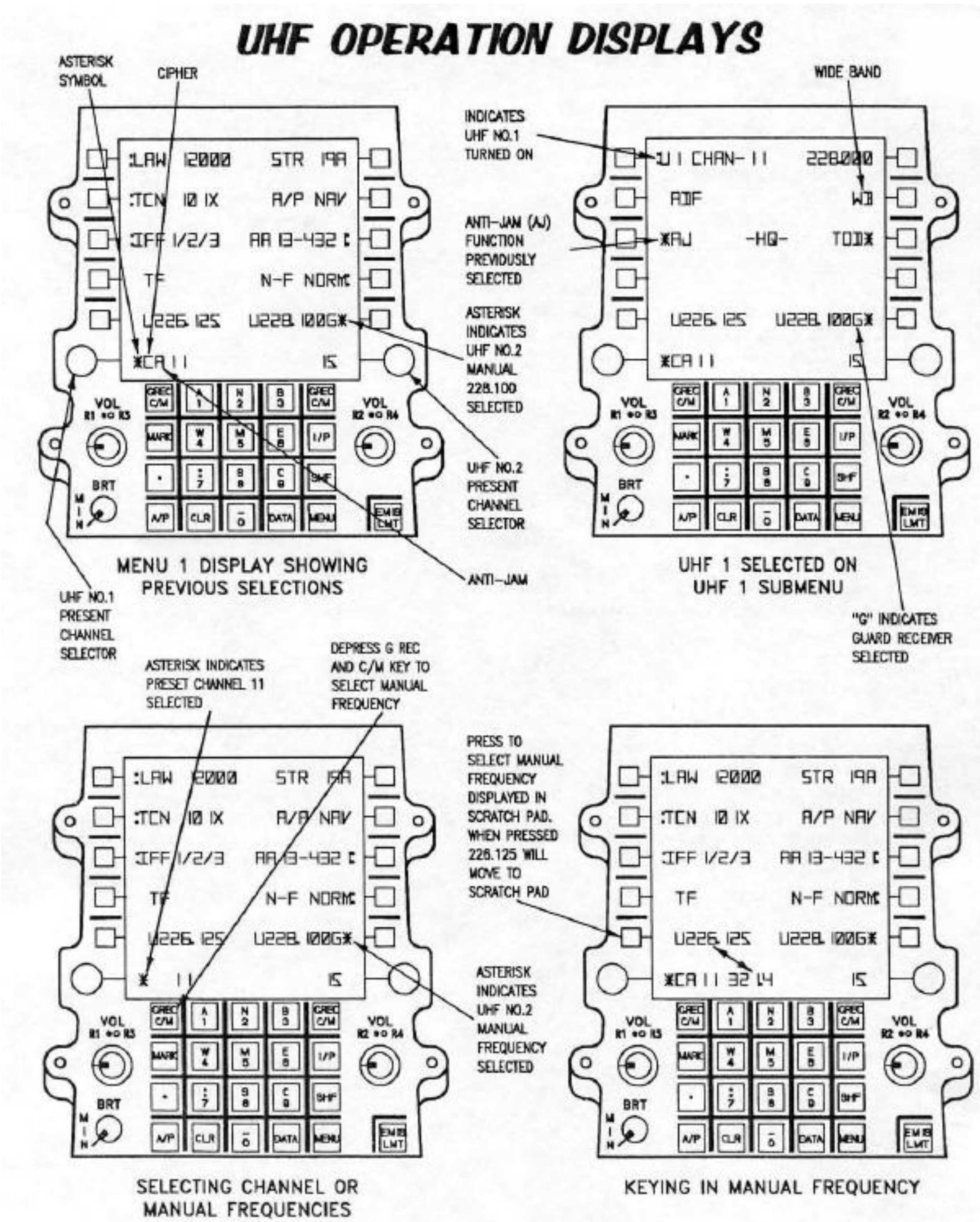

UHF OPERATION DISPLAYS
ASTERISK SYMBOL
CIPHER
WIDE BAND
INDICATES UHF NO.1 TURNED ON
ANTI-JAM (AJ) FUNCTION PREVIOUSLY SELECTED
ASTERISK INDICATES UHF NO.2 MANUAL 228.100 SELECTED
UHF NO.2 PRESENT CHANNEL SELECTOR
ANTI-JAM
UHF NO.1 PRESENT CHANNEL SELECTOR
MENU 1 DISPLAY SHOWING PREVIOUS SELECTIONS
UHF 1 SELECTED ON UHF 1 SUBMENU
"G" INDICATES GUARD RECEIVER SELECTED
ASTERISK INDICATES PRESET CHANNEL 11 SELECTED
DEPRESS G REC AND C/M KEY TO SELECT MANUAL FREQUENCY
PRESS TO SELECT MANUAL FREQUENCY DISPLAYED IN SCRATCH PAD. WHEN PRESSED 226.125 WILL MOVE TO SCRATCH PAD
ASTERISK INDICATES UHF NO.2 MANUAL FREQUENCY SELECTED
SELECTING CHANNEL OR MANUAL FREQUENCIES
KEYING IN MANUAL FREQUENCY

Figure 1-40.1

UHF SUBMENUS

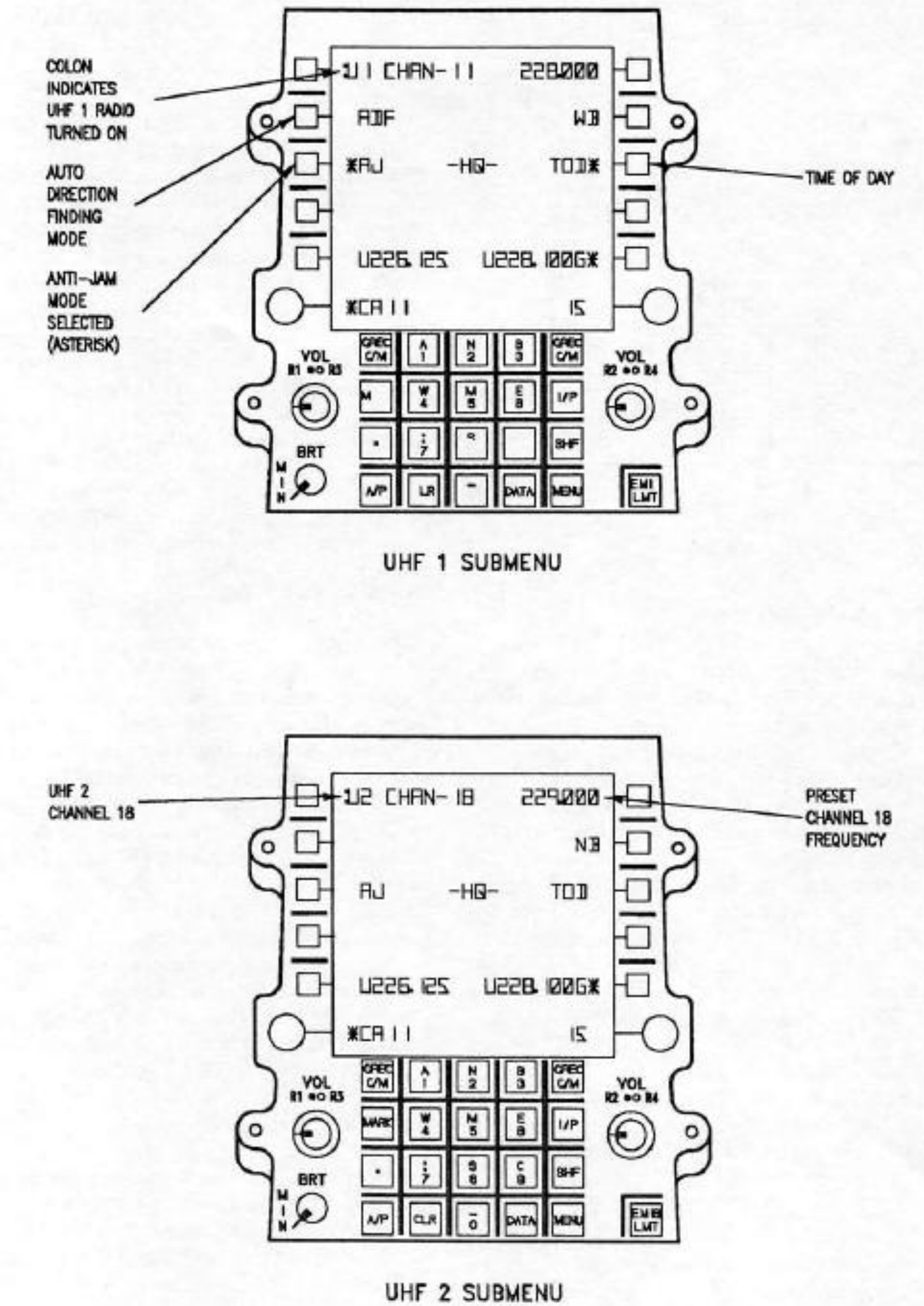


Figure 1-40.2

INTERCOM SYSTEM

The intercom system (ICS) is not modeled on the MilViz F-15E given that in the virtual operations within FSX, there is no facility for voice communications over a self-contained radio system. While the controls are modeled, they are inoperative.

IDENTIFICATION SYSTEM

IFF TRANSPONDER SET

The IFF (identification friend of foe) transponder set provides automatic identifications of the airplane in which it is installed when challenged by surface or airborne interrogator sets, and provides momentary identification of position (I/P) upon request. The modes provided are mode 1, mode 2, mode 3/A, mode 4, and mode C. Modes 1, 2, and 3/A are selective identification feature (SIF) modes. Mode 4 is used for highest confidence identification (cypto), and mode C is used for altitude reporting.

The codes for modes 1 and 3/A can be set in the cockpit. Mode 2 is set using the control box in door 3R. Mode 4 is keyed in door 3R by maintenance personnel for the real world jet, and therefore that action is not available in the MilViz F-15E.

NOTE

FSX does not support any transponder mode other than Mode 3/C. Therefore, none of the detailed operation of Mode 1, 2, and 4 will be covered in this POH.

Operation of the IFF system in the MilViz F-15E is via the UFC and the ICCS console located on the left console of the front cockpit. Details of the UFC menus are shown in Figure 1-41 as well as illustrated in the tutorial video (separate publication). Selection settings on the ICCS console are slewable, but are not activated in the MilViz F-15E. Selection of the IFF submenu on the UFC is achieved by pressing the pushbutton adjacent the "IFF" label.

IDENTIFICATION OF POSITION (IDENT)

Pressing the I/P pushbutton on the UFC enables the IFF system to transmit a momentary squawk ident feature in response to ATC request. This "flash" of information is engaged for 15 to 30 seconds after the initial pushbutton release.

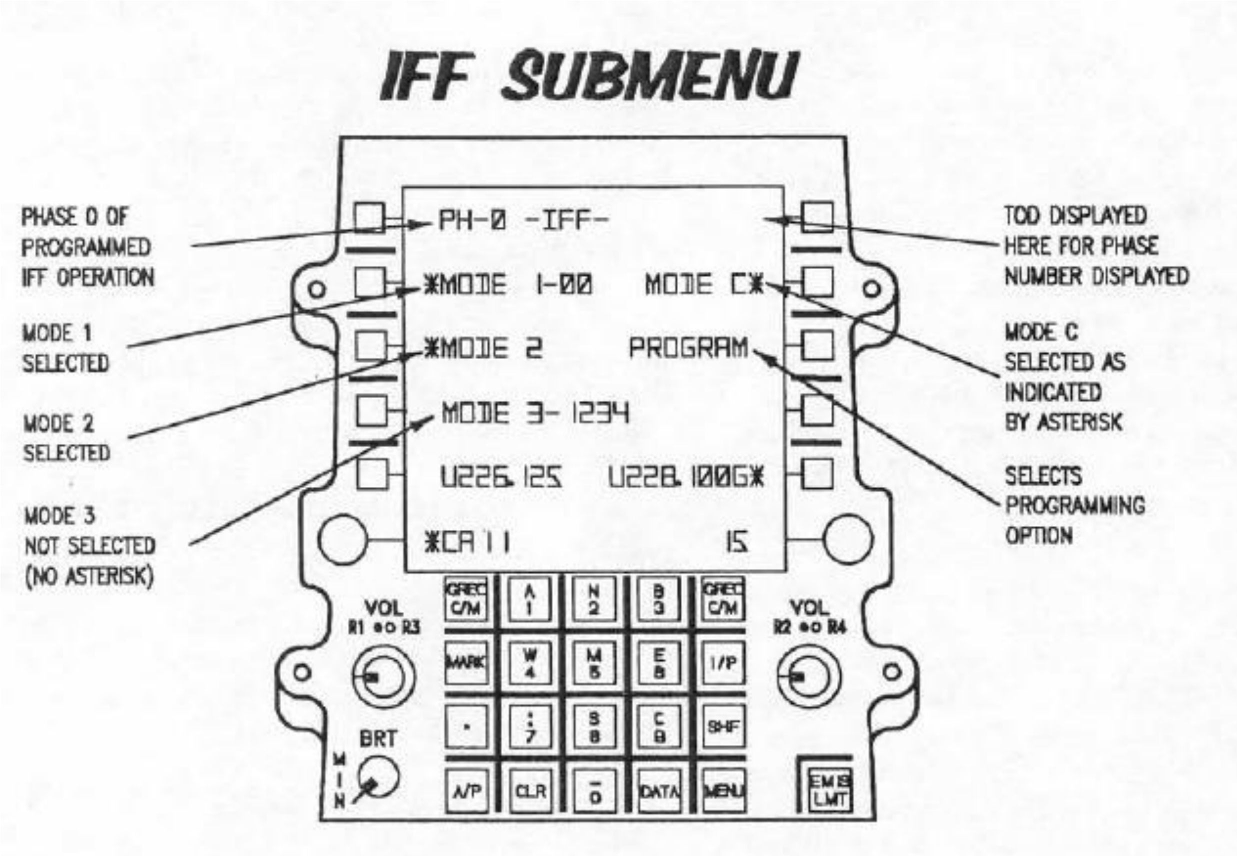


Figure 1-41

INERTIAL NAVIGATION SYSTEM (INS)

The INS is a self-contained, fully automatic ring laser gyro (RLG) system which supplies primary attitude and positional information through the Central Computer (CC). This information is used to support a myriad of normal and tactical missions for the F-15E. While the MilViz F-15E does facilitate realistic options for INS alignment, FSX does not fully replicate the real world factors that dictate operation of an RLG INS. Nevertheless, functionality is replicated in the sense that an initial aircraft position may be entered via the UFC to start an INS alignment. Additionally, the accurate method of enhanced alignment is also facilitated (see Ring Laser Gyro section).

Ring Laser Gyro

The Ring Lases Gyro (RLG) is a key element of the INS. It is a rate-integrating gyro which does not use a spinning mass like a conventional gyroscope. The RLG detects and measures angular rotation by measuring the effective frequency difference between two contrarotating (one clockwise, one counterclockwise) laser beams in a ceramic block. As the two laser beams travel simultaneously around the cavity, mirrors reflect each beam around the enclosed path.

When the gyro is at rest (aircraft not moving) the two beans have the same frequency because the optical path is the same in both directions. However, when the gyro is subjected to acceleration in any of the three dimensions, that angular velocity causes measurable variations in the frequencies of the two beams. These variations in resonant frequency are then measurable to determine the velocities of the gyro, and by extension the aircraft.

INERTIAL NAVIGATION DIGITAL COMPUTER

The inertial computer contains all circuits necessary for gyro and accelerometer signal processing and for computing North/South, East/West, and vertical velocities and accelerations. X, Y, and Z velocities and accelerations, body rates, body angle, and linear accelerations are converted into pitch, roll, magnetic heading and true heading. Additionally, the primary purpose of the computer is to convert the raw resonance frequency variations from the two RLG paths to digital information used to measure and report the values used to compute aircraft pitch, roll, and yaw values for autopilot stabilization, as well as positional information for navigational and targeting systems.

INS MODE KNOB

The INS mode knob is located on the sensor control panel (SCP, Figure 1-42) and controls the following functions:

OFF	Removes power from the INS.
STORE	Selects the stored heading (SH) alignment mode and uses gyro-compass alignment parameters which were stored at the time of the last system shut-off for rapid INS alignment. PP source submenu is called up on the pilot's UFC when SH is selected. The aircraft must not have been moved since the last shutdown. SH alignment is complete approximately 40 seconds after turn-on and should achieve approximately GC alignment accuracy. The accuracy is directly affected by the INS accuracy of the previous flight and error rate at the time of the last system shutdown. Alignment complete is indicated by SH OK in the HUD window 16 and on the air-to-ground (A/G) radar precision velocity update (PVU) display. If STORE is selected and the INS has determined that stored heading alignment is not available (GC

had not been performed or groundspeed of previous flight was greater than 3 knots at shutdown) the INS will automatically switch to GC align mode.

GC Selects the gyrocompass (GC) mode which is the most accurate mode of INS alignment. PP source submenu is called up on pilot's UFC when GC selected. Full GC alignment requires approximately 4 minutes. Alignment complete is indicated by GC OK in HUD window 16 and on the PVU display.

NAV This is the primary navigation mode. The INS solves the navigation problem by sensing aircraft accelerations, applying appropriate corrections and determining aircraft velocity and position.
Steering to destination is computed in the CC based on inertially derived present position. The knob must be pulled up before it can be rotated out of NAV.

If the mode switch is positioned directly from OFF to NAV, the INS will perform a GC alignment and after align complete is reached the INS will automatically transition to the NAV mode.

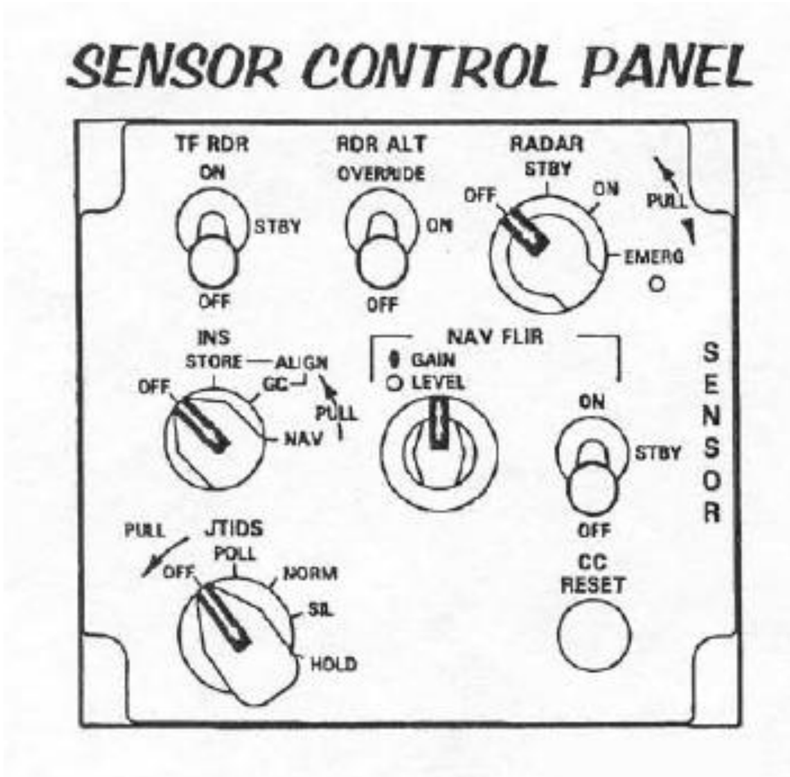


Figure 1-42

GYROCOMPASS AND STORED HEADING ALIGNMENT AND NAV

There are several displays on the HUD and PVU display during INS alignment that indicate system align status. The display will reflect the INS operation. The may differ from the switch selection on the sensor control panel (Figure 1-42). The displayed values are shown in Figure 1-43.

GC PP REQ SH PP REQ	Present position update required. Displayed for GC or SH alignment if last shutdown position differs from the INS stored base location by more than 2 NM. When displayed the pilot or WSO must insert new PP on UFC PP source submenu. INS alignment is continuing using the stored base location while PP REQ is displayed.

NOTE

The PP can be entered more than once during an alignment cycle, the PP should reference the aircraft base location. Once the aircraft leaves the base location, changes should be done by update in the NAV mode. If a new PP is entered during a GC alignment, the INS may restart a full GC alignment (restart the 4-minute sequence) at the time the PP is entered depending on the time in the alignment cycle that the entry is made. If a new PP is entered during a SH alignment or align HOLD, the INS will automatically switch to GC alignment mode and restart the alignment.

GC NO TAXI SH NO TAXI	NO TAXI is displayed for approximately 60 seconds after GC or STORE is selected until INS attitude is valid (figure 1-43). During this time the aircraft should not be moved. Movement during this time will require the INS to be turned off (2 seconds minimum), back on, and then restart alignment.

NOTE

NAV may be selected at any time after NO TAXI is removed, but degraded accuracy should be expected if NAV is selected before GC or SH OK is displayed.

GC XX.X SH XX.X IFA XX.X	INS alignment quality is indicated by a numerical countdown from 15.9 in GC, SH or IFA. This display indicates the accuracy of the alignment. It does not indicate the expected accuracy at the end of flight. A full GC should result in an indication of approximately 1.0. A complete SH should result in an indication of SH OK. SH quality is directly affected by previous accuracy.
GC HOLD	Displayed if INS senses motion while GC of SH alignment is in progress. This indicates that the INS is retaining the existing alignment

quality until the aircraft motion stops and the holding brake is engaged or until the aircraft takes off. If the holding brake is engaged and the INS detects no motion, the system will resume a GC alignment and GC XX.X will be displayed as above.

NOTE

- If new PP is entered when INS is in a HOLD mode the INS will switch to GC alignment and restart the alignment.
- If the aircraft takes off with GC HOLD displayed, he GC HOLD is removed with nose gear up and the INS automatically enters the NAV mode. Degraded accuracy should be expected.
- If the aircraft is stopped but the holding brake is not engaged, the INS will not re-enter the GC mode. Degraded accuracy should be expected.

GC OK SH OK IFA OK	Indicates which align mode was done and that the INS alignment is complete. Displayed until NAV selected or takeoff.

The GC indicates the INS is in the gyrocompass align mode. The SH indicates the INS is in the stored heading align mode. The IFA indicates the INS is in the inflight align mode. IFA mode requires position and/or velocity updates. IFA also requires initialization of data by the CC at the start of IFA selection. OK, PP REQ, NO TAXI, HOLD, and XX.X (align quality) are displayed in one HUD window based on the following priorities order: 1 – OK, 2 – PP REQ, 3 – NO TAXI, 4 – HOLD, 5 – XX.X. During alignment when the INS mode knob is positioned to GC or SH, the present position submenu is automatically called up on the pilot's UFC.

The present position stored in the INS and being used for alignment will be displayed. If the PP is correct, no action is required. If the PP is not correct the pilot should enter the correct PP. The new entered PP should be accurate to 600 feet (0.1 arc minute). Depending on the time in the GC alignment that the new PP is entered, the alignment may start over. If a new PP is entered from SH, the INS will automatically switch to the GC alignment mode.

NAV DEGD	Displayed on the HUD and indicates that the INS is in a degraded NAV mode caused by

transition to NAV via the mode switch, early exit of IFA, or INS automatic transition without alignment being completed. Aided alignment (position and velocity updates) can be performed during NAV to improve NAV accuracy.

NOTE

If an IFA is being performed the IFA and associated display will replace NAV DEGD if displayed.

INS UPDATES

Updates to the INS should be done during IFA alignment or done to improve the accuracy of the INS when it has drifted off when NAV DEGD is indicated. Updates should be done only with source data that is correct and more accurate than the INS. Updating the INS with bad data will induce more error and the INS may not be able to recover.

When the INS updates are performed, the INS uses a Kalman filter using inputs from the CC. The INS compares the data received such as the source of update, error, the variance of the error, and the correlation of the error. The INS determines if the error is reasonable in reference to recent INS operation and previous updates. Based on CC inputs, the INS will accept a smaller or larger portion of an update based on the quality of the update and the update source.

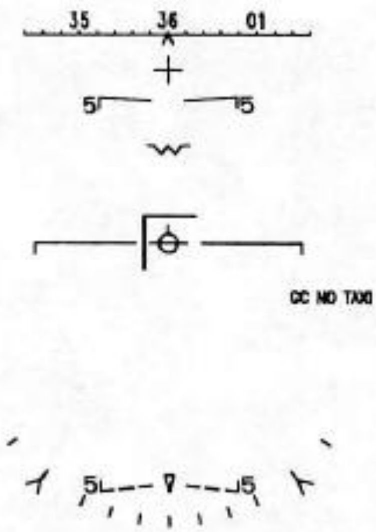
ATTITUDE HEADING REFERENCE SET (AHRS)

The attitude heading reference set supplies aircraft magnetic heading to various avionic systems. The AHRS is also the standby system which provides attitude (roll and pitch) information if the INS system fails. AHRS attitude is displayed when AHRS is selected on the ADI.

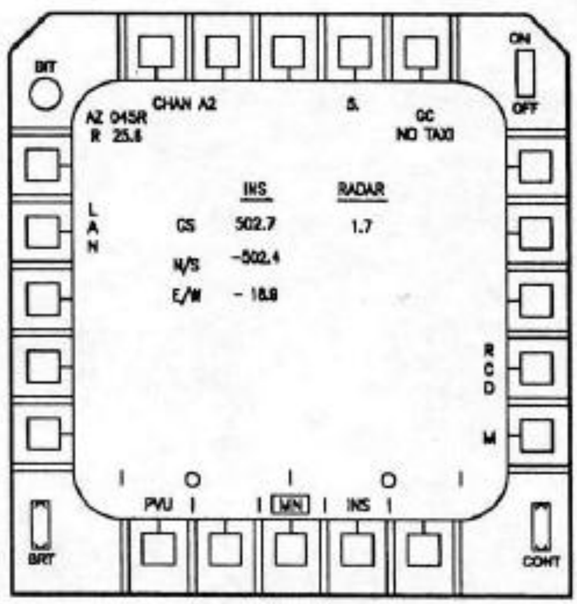
AHRS INTERFACE

The INS provides roll and pitch data to the radar set. The AHRS is informed by the INS of the INS attitude validity. If INS attitude is invalid, the AHRS sends attitude information to the radar set. The AHRS provides the CC with magnetic heading at all times and informs the computer when the AHRS is in the slaved mode of operation. The AHRS supplies magnetic heading to the HSI to position the compass card when AHRS is selected.

GYROCOMPASS ALIGNMENT DISPLAYS



HUD DISPLAY



A/G PVU RADAR DISPLAY

Figure 1-43

COMPASS CONTROL PANEL

The compass control panel, on the right console, provides the necessary controls to operate the gyro-magnetic compass system. These controls are the sync indicator meter, push-to-sync knob, fast erect pushbutton, hemisphere switch, latitude control knob, and the mode selector knob.

Sync Indicator Meter

The sync indicator meter indicates the direction (plus or minus) between the AHRS directional gyro and the magnetic azimuth detector, in the slaved mode.

Push to Sync Knob

The push to sync knob is a combination push to sync and push to turn (set heading) knob. When the knob is pressed and the mode selector knob is in SLAVED, the AHRS provides fast synchronization of the gyro stabilized magnetic heading output to the magnetic azimuth detector. When the mode selector knob is in DG and AHRS is selected on the ADI, pressing and rotating the push to sync knob will slew the AHRS heading output through 360 degrees of rotation (on the compass card) while the heading in the HUD remains steady.

Fast Erect Pushbutton

Depressing the fast erect pushbutton causes the AHRS pitch and roll erection loops to revert to the fast erection rate. If the aircraft is in unaccelerated flight and there is an obvious disagreement between the attitude indicator and the visual verified attitude of the aircraft, go to straight-and-level unaccelerated flight and momentarily press the fast erect pushbutton to re-erect the gyro for correct attitude sensing. During the fast erect condition, the AHRS will indicate invalid BIT outputs, and level and unaccelerated flight must be maintained until a correct attitude is obtained.

Hemisphere Switch

The hemisphere switch selects the northern (N) or southern (S) hemispheres for operation of AHRS.

Latitude Control Knob

The latitude control knob manually inserts present position latitude, in DG and slaved mode, so that the AHRS can determine the correction needed for gyro drift due to the earth's rotation.

Mode Selector Knob

The mode selector knob is a three-position rotary knob with positions of COMP, DG, and SLAVED. The SLAVED mode is normally used. In the SLAVED mode, directional gyro sensed heading is continuously corrected to the heading sensed by the magnetic azimuth detector and the result is transmitted to other aircraft systems. The COMP mode is usually selected only when there is a gyro malfunction.

In the COMP mode, the reading sensed by the magnetic azimuth detector is transmitted to other aircraft systems. The DG mode is used in latitudes higher than 70 degrees, or when the earth magnetic field is appreciably distorted. In the DG mode, the directional gyro heading is transmitted to other aircraft systems. When the DG mode is initially selected, the aircraft magnetic heading must be set into the system with the PUSH TO SYNC knob. The system then uses the reference for subsequent heading indications.

In the SLAVED and DG modes, apparent drift compensation is inserted with the hemisphere (N-S) switch and the latitude settings correspond with the actual latitude.

COMP	Heading sensed from the magnetic azimuth detector.
DG	Heading sensed from the directional gyro.
SLAVED	Heading sensed from the directional gyro continuously corrected by the magnetic azimuth detector.

TACAN (TACTICAL AIR NAVIGATION) SYSTEM

The TACAN system functions to give precise air-to-ground bearing and distance information at ranges up to approximately 300 miles (depending on aircraft altitude) from an associated ground or shipboard transmitting station. It determines the identity of the transmitting station and indicates the dependability of the transmitted signal. TACAN information except in A/A mode is presented on the HSI, the ADI, and the HUD. In A/A mode, both distance and bearing are received if cooperating aircraft (such as refueling tanker aircraft) have bearing transmission capability.

When operating in conjunction with aircraft having air-to-air capability, the A/A mode provides line of sight distance between two aircraft operating their TACAN sets 63 channels apart. Up to five aircraft can determine line of sight distance from a sixth lead aircraft in the A/A mode, provided their TACAN sets are set 63 channels apart from the lead aircraft's setting. The limit of operation is four times the distance between the lead aircraft and the nearest aircraft to the lead. The lead aircraft will indicate distance from one of the other five, but it cannot readily determine which one. Before operating in the A/A mode, the frequencies used by each aircraft must be coordinated.

TACAN CONTROLS

The controls for TACAN operation are on the intercom communications set control panel, the remote intercommunications control panel, and the UFC. The TACAN volume control on the ICSCP/RICP adjusts the volume level on the TACAN station identification audio tone. Operation of the TACAN system is done using the upfront control (UFC). See Figure 1-44.

TACAN Submenu

The TACAN submenu on the UFC is selected and displayed from menu 1. When displayed, all the TACAN functions are presented as shown in Figure 1-44. For example, TACAN channel 101 is shown as the current channel selected and the system is being powered as indicated by the colon symbol adjacent to TCN. The asterisk symbol indicates the system currently has the transmit/receive (T-R) mode selected.

To change the TACAN channel number, type the new number on the keyboard and check it in the scratchpad, then enter it by pressing the pushbutton next to TCN display. To select a TACAN mode (A/A, T-R, REC), press the pushbutton next to the respective display. An asterisk appears next to the selected mode. The change the channel mode from Y to X or X to Y, press the pushbutton next to the X or Y currently being displayed. Return to menu 1 by pressing the MENU key on the keyboard. As noted in the figure, TACAN has a program sub-menu that permits indexing of 12 TACAN stations for navigation updating and present position keeping purposes.

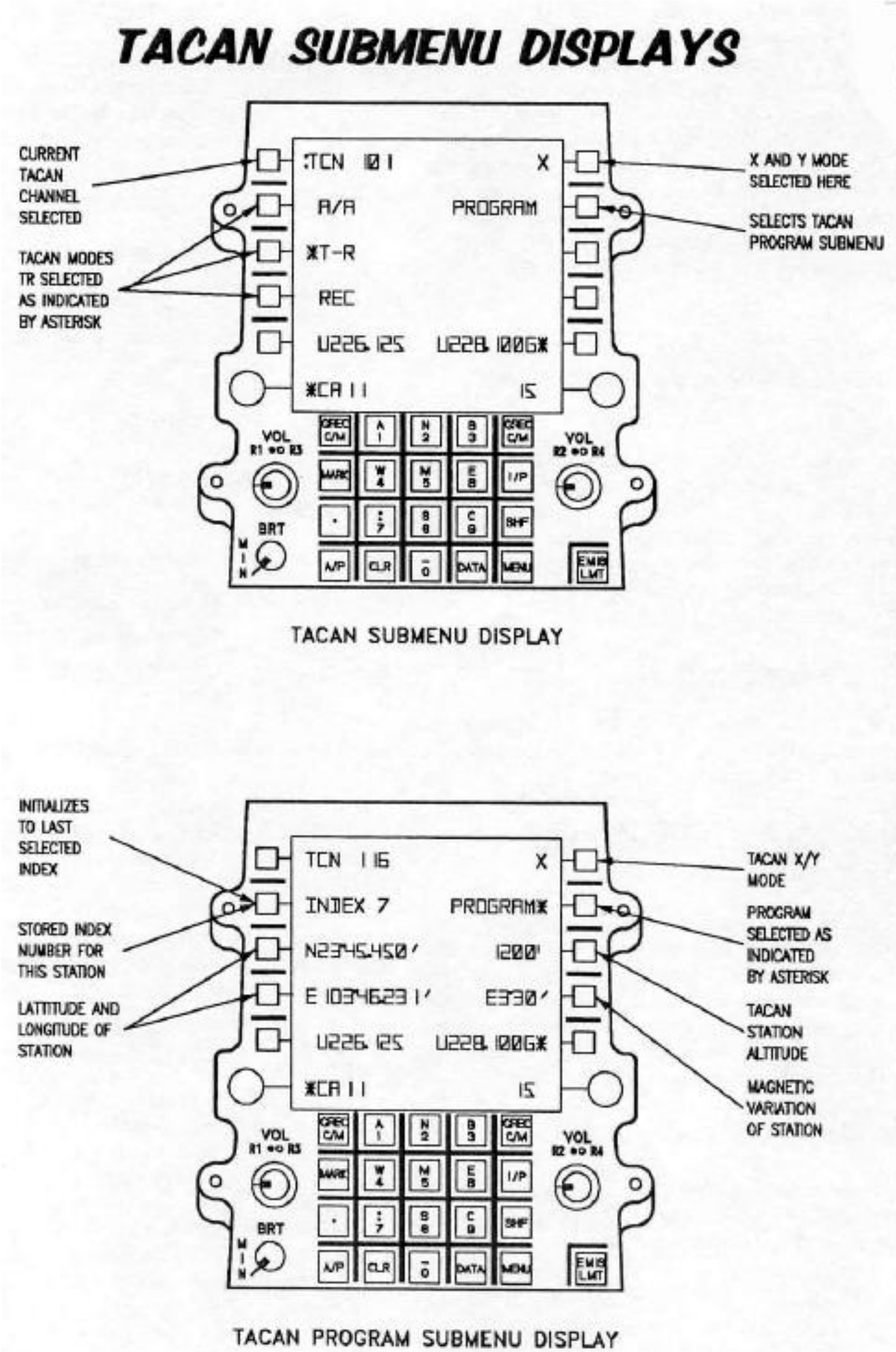

TACAN SUBMENU DISPLAYS
CURRENT TACAN CHANNEL SELECTED
TACAN MODES TR SELECTED AS INDICATED BY ASTERISK
X AND Y MODE SELECTED HERE
SELECTS TACAN PROGRAM SUBMENU
TCN 101
X
A/A
PROGRAM
*T-R
REC
U226.125
U228.100G*
*CA11
15
TACAN SUBMENU DISPLAY
INITIALIZES TO LAST SELECTED INDEX
STORED INDEX NUMBER FOR THIS STATION
LATTITUDE AND LONGITUDE OF STATION
TACAN X/Y MODE
PROGRAM SELECTED AS INDICATED BY ASTERISK
TACAN STATION ALTITUDE
MAGNETIC VARIATION OF STATION
TCN 116
X
INDEX 7
PROGRAM*
N2345.450'
1200'
E 1034623 1'
E330'
U226.125
U228.100G*
*CA11
15
TACAN PROGRAM SUBMENU DISPLAY

Figure 1-44

TACAN Channel Programming

The UFC provides for storing 12 TACAN stations for navigation update purposes, using latitude, longitude, altitude, and magnetic variation. This submenu, as shown in Figure 1-44, is selected by pressing the pushbutton adjacent to PROGRAM on the TACAN submenu. In most cases these stations will be programmed into the data transfer module. To select a different TACAN channel number for the displayed index number, enter the channel number on the keyboard and enter it by pressing the pushbutton next to the TCN display.

To select a different index number (stored number for the station), increment the number by one by pressing the pushbutton next to the INDEX display. This provides the new index number and associated data in memory for display on the UFC. To change the latitude of the TACAN station, first press the SHF (shift) key on the keyboard and then N or S followed by the latitude value, including any leading zeroes. Then enter the latitude by pressing the latitude pushbutton (below the INDEX pushbutton). A new longitude is entered the same way except the SHF key must be pressed follow by the W or E key and then the value with any leading zeroes.

NOTE

When programming channel and index numbers, index number should be changed before the channel numbers. Failure to use this sequence could result in an incorrect channel number being entered into an index number.

To change the magnetic variation (MV), press the SHF key then the E or W key. Type in the M/V value including leading zeroes. Enter new M/V by pressing the pushbutton second from the bottom on the right side of the UFC.

To change the altitude of the TACAN station, type the altitude value on the keyboard and enter by pressing the pushbutton just above the M/V pushbutton. This new altitude is stored in memory for the TACAN station. To change the channel mode from Y to X (or vice-versa), press the pushbutton next to the X or Y current being displayed to cycle to the other value.

NOTE

FSX does not model TACAN channels. However, the MilViz F-15E retained the TACAN logic because all VOR frequencies have matching TACAN channels. Figure 1-45 can be used to reference the matching TACAN channel for any VOR frequency. Entering the matching channel will provide all functionality. The frequencies highlighted in yellow are accurate matching pairs, but are not used by VOR systems.

VOR	TACAN	VOR	TACAN	VOR	TACAN	VOR	TACAN
134.40	1X	134.45	1Y	134.50	2X	134.55	2Y
134.60	3X	134.65	3Y	134.70	4X	134.75	4Y
134.80	5X	134.85	5Y	134.90	6X	134.95	6Y
135.00	7X	135.05	7Y	135.10	8X	135.15	8Y
135.20	9X	135.25	9Y	135.30	10X	135.35	10Y
135.40	11X	135.45	11Y	135.50	12X	135.55	12Y
135.60	13X	135.65	13Y	135.70	14X	135.75	14Y
135.80	15X	135.85	15Y	135.90	16X	135.95	16Y
108.00	17X	108.05	17Y	108.10	18X	108.15	18Y
108.20	19X	108.25	19Y	108.30	20X	108.35	20Y
108.40	21X	108.45	21Y	108.50	22X	108.55	22Y
108.60	23X	108.65	23Y	108.70	24X	108.75	24Y
108.80	25X	108.85	25Y	108.90	26X	108.95	26Y
109.00	27X	109.05	27Y	109.10	28X	109.15	28Y
109.20	29X	109.25	29Y	109.30	30X	109.35	30Y
109.40	31X	109.45	31Y	109.50	32X	109.55	32Y
109.60	33X	109.65	33Y	109.70	34X	109.75	34Y
109.80	35X	109.85	35Y	109.90	36X	109.95	36Y
110.00	37X	110.05	37Y	110.10	38X	110.15	38Y
110.20	39X	110.25	39Y	110.30	40X	110.35	40Y
110.40	41X	110.45	41Y	110.50	42X	110.55	42Y
110.60	43X	110.65	43Y	110.70	44X	110.75	44Y
110.80	45X	110.85	45Y	110.90	46X	110.95	46Y
111.00	47X	111.05	47Y	111.10	48X	111.15	48Y
111.20	49X	111.25	49Y	111.30	50X	111.35	50Y
111.40	51X	111.45	51Y	111.50	52X	111.55	52Y
111.60	53X	111.65	53Y	111.70	54X	111.75	54Y
111.80	55X	111.85	55Y	111.90	56X	111.95	56Y
112.00	57X	112.05	57Y	112.10	58X	112.15	58Y
112.20	59X	112.25	59Y	133.30	60X	133.35	60Y
133.40	61X	133.45	61Y	133.50	62X	133.55	62Y
133.60	63X	133.65	63Y	133.70	64X	133.75	64Y
133.80	65X	133.85	65Y	133.90	66X	133.95	66Y
134.00	67X	134.05	67Y	134.10	68X	134.15	68Y
134.20	69X	134.25	69Y	112.30	70X	112.35	70Y
112.40	71X	112.45	71Y	112.50	72X	112.55	72Y
112.60	73X	112.65	73Y	112.70	74X	112.75	74Y
112.80	75X	112.85	75Y	112.90	76X	112.95	76Y
113.00	77X	113.05	77Y	113.10	78X	113.15	78Y
113.20	79X	113.25	79Y	113.30	80X	113.35	80Y

VOR	TACAN	VOR	TACAN	VOR	TACAN	VOR	TACAN
113.40	81X	113.45	81Y	113.50	82X	113.55	82Y
113.60	83X	113.65	83Y	113.70	84X	113.75	84Y
113.80	85X	113.85	85Y	113.90	86X	113.95	86Y
114.00	87X	114.05	87Y	114.10	88X	114.15	88Y
114.20	89X	114.25	89Y	114.30	90X	114.35	90Y
114.40	91X	114.45	91Y	114.50	92X	114.55	92Y
114.60	93X	114.65	93Y	114.70	94X	114.75	94Y
114.80	95X	114.85	95Y	114.90	96X	114.95	96Y
115.00	97X	115.05	97Y	115.10	98X	115.15	98Y
115.20	99X	115.25	99Y	115.30	100X	115.35	100Y
115.40	101X	115.45	101Y	115.50	102X	115.55	102Y
115.60	103X	115.65	103Y	115.70	104X	115.75	104Y
115.80	105X	115.85	105Y	115.90	106X	115.95	106Y
116.00	107X	116.05	107Y	116.10	108X	116.15	108Y
116.20	109X	116.25	109Y	116.30	110X	116.35	110Y
116.40	111X	116.45	111Y	116.50	112X	116.55	112Y
116.60	113X	116.65	113Y	116.70	114X	116.75	114Y
116.80	115X	116.85	115Y	116.90	116X	116.95	116Y
117.00	117X	117.05	117Y	117.10	118X	117.15	118Y
117.20	119X	117.25	119Y	117.30	120X	117.35	120Y
117.40	121X	117.45	121Y	117.50	122X	117.55	122Y
117.60	123X	117.65	123Y	117.70	124X	117.75	124Y
117.80	125X	117.85	125Y	117.90	126X	117.95	126Y

Figure 1-45

INSTRUMENT LANDING SYSTEM (ILS)

The instrument landing system (ILS) provides the capability for the aircraft to execute precision or non-precision instrument approach procedures (IAP's). The localizer function provides lateral guidance information to position the aircraft on the runway centerline. The localizer frequency range is 108.10 to 111.95 MHz. The localizer frequency is entered and selected on the menu 2 display on the UFC. The localizer identification tone can be heard by enabling the localizer station audio located on the Intercom Control Panel.

The glideslope function provides vertical guidance information to position the aircraft on the glideslope angle during the final approach leg of the IAP. Glideslope steering symbols are displayed on the HUD and ADI. When the ILSN or ILST steering mode is selected from the HSI, ILSN or ILST appears on the HUD. See Figures 1-32 and 1-33.

When the aircraft captures the glideslope center, the pitch steering bar appears on the HUD to join with the bank steering bar. The pitch steering bar also appears on the ADI. A MKR also flashes on the HUD and ADI when the aircraft flies in the transmission cone of any marker beacon. ILS guidance information is displayed on the HUD and ADI (Figures 1-32 and 1-33).

ILS Volume Control Knob

The ILS volume control knob on the Intercom Control Panel adjusts the volume level of the localizer and station identifier audio.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

Exterior lights are controlled from either the exterior lights control panel or the miscellaneous control panel, both on the left console in the front cockpit.

Position Lights

The position lights include a green light on the forward edge of the right wingtip, a red light on the forward edge of the left wingtip, and a white light just below the tip of the left vertical tail fin. The position lights are controlled by a knob on the exterior lights control panel labeled POSITION. With the anti-collision lights on, the position lights automatically go to steady full brilliance, regardless of the position of the position lights knob. The settings are:

OFF	Lights are off.
1-5	Guide numbers for varying brightness from off to full bright.
BRT	Lights are at full brightness.
FLASH	The lights will flash at full brightness.

Anti-Collision Lights

There are three red anti-collision lights. One is on the leading edge of each wing just outboard of the air intake and the third is just below the tip of the right vertical tail fin. The anti-collision lights are controlled by a single toggle switch on the exterior lights control panel labeled ANTI-COLLISION. The switch positions are OFF and ON.

Formation Lights

Six green electroluminescent formation lights are provided. Two lights are on the wingtips behind the position lights, two lights are on the side of the forward fuselage just forward of the cockpit, and two lights are on the aft fuselage just aft of the wing trailing edge. The formation lights are controlled by a single knob on the exterior lights control panel labeled FORMATION.

OFF	Lights are off.
1-5	Guide numbers for varying brightness from off to full bright.
BRT	Lights are at full brightness.

Vertical Tail Flood Lights

Two vertical tail flood lights are installed on the right and left aft fuselage to illuminate the vertical tails during night join-ups and formation flying. They are controlled by a single switch on the exterior lights control panel.

OFF	Lights are off.
DIM	Lights are on in a dimmed condition.
BRT	Lights are at full brightness.

Landing and Taxi Lights

The landing and taxi lights are on the nose gear strut. They are controlled by a toggle switch on the miscellaneous control panel. The lights are off, regardless of switch position, when the landing gear handle is in the up position.

OFF	Lights are off.
LDG LIGHT	In the landing gear handle is down, the landing lights are turned on.
TAXI	If the landing gear handle is down, the taxi light is turned on.

INTERIOR LIGHTING

Except for the utility floodlights, and UFC display lighting, all the controls for interior lights are on the interior lights control panel on the right console in each cockpit.

Upfront Control Display Lighting

The UFC Liquid Crystal Display (LCD) consists of six display rows. A brightness control (BRT) provides a full range of adjustment for night utilization. Backlighting is not required because the LCD is a reflective type display.

A simple and quick method of clearing the LCD is as follows:

To Blank	**Press**

Scratchpad	CLR key twice
Top 4 Rows	CLR key with blank scratchpad
All 6 Rows	CLR key twice
To Recall	**Press**
Bottom 2 Rows	Either of bottom two display pushbuttons
Top 4 Rows (when bottom 2 rows are displayed)	Any of the top eight display pushbuttons with a blank scratchpad
All 6 Rows	Any of the top eight pushbuttons

Instrument Lighting

Integral lighting is provided for all instruments and panels on the front cockpit instrument panel including the MPD’s, MPCD, UFC, circuit breaker panels, and the HUD. Integral lighting is also provided to the radio call, emergency hook and emergency vent panels. Instrument lighting is provided to the front cockpit, standby compass whenever the STBY COMP switch is ON. Rear cockpit integral instrument lighting is provided for all instruments and panels on the rear instrument panel including the MPD’s and MPCD’s. Integral lighting is also provided to the UFC, the command selector valve panel, the emergency hook panel, and the radio call panel. The lights are controlled by the instrument panel lights knob in either cockpit, labeled INST PNL, which provides variable lighting between positions OFF and BRT.

Console Lighting

The console lights are controlled by the CONSOLE knob in either cockpit which provide variable lighting between positions OFF and BRT.

Storm/Flood Lighting

Four storm/flood lights are provided in the front cockpit and two in the rear cockpit for secondary lighting. The front cockpit has a light above each console and two above the main instrument panel. The rear cockpit has one light above each console. The lights in each cockpit are controlled by the storm/flood lights knob labeled STORM FLOOD, which provides variable lighting between OFF and BRT. In either cockpit, if the warning/caution/advisory lights are in the dimmed condition, moving the storm/flood lights knob to full BRT causes the warning/caution/advisory lights to revert to full intensity, regardless of the position of the WARNING CAUTION control knob.

Utility Flood Lights

A portable utility flood light is provided in each cockpit and is normally stowed on a bracket above the right console. An alligator clip attached to the light may be used to fasten the light to various locations in the cockpit at the crewmember's discretion. The utility light in the front cockpit is the only cockpit light designed to illuminate the cockpit which operates from JFS generator power.

Standby Compass Light

Lighting for the front cockpit standby compass is controlled by the STBY COMP switch and the INST PNL knob. With the STBY COMP switch ON, variable lighting is provided between positions OFF and BRT of the INST PNL knob. In the rear cockpit, although a STBY COMP switch is provided, there is no standby compass installed.

Chart Lights

A chart light is provided in the front cockpit on the canopy bow and in the rear cockpit above the right console. The lights, which illuminate maps and other documents on the crewmember's kneeboard, are mounted by adjustable positioning joints. The lights are controlled by the CHART LT knob in either cockpit, which provides variable lighting between positions OFF and BRT.

Display Lighting Switch

A DISPLAY switch is provided in each cockpit which controls the maximum illumination level for the MPD/MPCD displays. The positions are DAY and NIGHT.

Warning/Caution Lights Control Knob

A control is provided in each cockpit on the interior lights control panel to switch the warning/caution/advisory lights from bright intensity to the low intensity range, and then to vary the brightness within the low intensity range. The control is labeled WARNING CAUTION. The control only works provided the flight instrument lights knob is not in OFF, the storm/flood lights knob is not in full BRT, and the warning/caution lights control knob has been momentarily placed to the RESET position.

Once in the low intensity range, the warning/caution/advisory lights can be brought back to bright intensity by turning the storm/flood lights knob to full BRT, or removing and re-applying power to the aircraft. The master caution light is also placed to RESET, but intensity cannot be varied.

Lights Test Switch

A lights test switch, labeled LT TEST, is a two-position switch to test the warning/caution/advisory lights. The positions are OFF and ON with the switch spring loaded to remain in the OFF position once released.

OXYGEN SYSTEM

MOLECULAR SIEVE OXYGEN GENERATING SYSTEM (MSOGS)

The MilViz F-15E features an onboard MSOGS system that converts outside atmosphere into 100% oxygen and filters it. This provides a nearly unlimited supply of emergency and normal oxygen supply for the aircraft. The aircraft also features a Backup Oxygen System (BOS) that relies upon a pressurized liquid oxygen container to provide alternative oxygen supply when the MSOGS fails.

NORMAL OXYGEN SUPPLY

The normal system pressure is 70 psi with a usable pressure range of 55 to 90 psi. When the system is not operating (pilot not using system oxygen) the allowable pressure range is 55 to 120 psi. The pressure should remain within these limits until the converter is depleted.

Oxygen Low Caution

The OXY LOW caution is displayed when oxygen quantity is below 4 liters. The caution also comes on with the oxygen quantity test button in either cockpit pressed when the oxygen quantity gauge pointer drops below 4 liters.

EMERGENCY OXYGEN SUPPLY

A 10-minute supply of oxygen is furnished by a gaseous oxygen storage bottle on the left rear of each ejection seat. The supply is activated automatically on ejection, or is activated manually by pulling the emergency oxygen green ring just forward of the bottle on the left seat arm rest.

NOTE

The emergency oxygen supply system is not modeled on the MilViz F-15E because personal safety equipment is not applicable to FSX virtual flight operations.

OXYGEN REGULATOR

The oxygen regulator, on the front and rear cockpit right consoles, automatically controls the pressure and flow rate of normal oxygen based on demand and cockpit altitude.

Supply Lever

A two-position lever on the right corner of each regulator panel, controls the flow of oxygen from the regulator.

ON	The proper mix of cockpit air and oxygen is supplied to the mask.
OFF	Breathing is not possible with the mask on.

Diluter Lever

A two-position diluter lever, in the center of each regulator, controls the mixture of air and oxygen.

100%	Pure oxygen is delivered.
NORMAL	The scheduled mixture of air and oxygen is delivered.

Emergency Lever

A three-position emergency lever is on the lower left corner of each regulator panel.

EMERGENCY	Continuous positive pressure oxygen is delivered to the mask.
NORMAL	Normal oxygen is provided.
TEST MASK	Positive oxygen pressure is supplied.

Oxygen Flow Indicator

The oxygen flow indicator on each regulator panel alternately shows white for flow and black for no-flow with each breath under normal conditions. Continuous black indicates no air/oxygen is being furnished and continuous white indicates a leak in the system.

Oxygen Pressure Gauge

The oxygen pressure gauge on each regulator panel indicates oxygen delivery to the regulator. The normal indication is approximately 70 psi.

OXYGEN QUANTITY GAUGE

The oxygen quantity gauge is on the front and rear cockpit ECS panel.

OXYGEN QUANTITY GAUGE TEST BUTTON

The oxygen quantity gauge test button, on the front and rear cockpit ECS panel, tests the operation of the gauge and the OXY LOW caution. Depressing the test button causes the gauge needle to rotate from the present quantity indication to 0. As the needle passes below 4 liters the OXY LOW caution should come on. Upon release of the test button, the gauge needle should rotate from 0 to an indication of the present quantity. The OXY LOW caution should go out as the needle passes above 4 liters.

ENVIRONMENTAL CONTROL SYSTEM

The environmental control system (ECS) provides conditioned air and pressurization for the cockpit, avionics, windshield anti-fog and anti-ice, anti-G suits, canopy seal, and fuel pressurization. The ECS uses engine bleed air from both engines for normal operation. With the air source knob OFF, or the cockpit temperature switch OFF, cooling for the avionics automatically switches to ram air. Ram air cooling is automatically supplied to the avionics whenever compressor inlet duct pressure drops. See foldout section for the ECS schematic.

ECS vents and louvers are located on the center instrument panel and along the canopy rails in both cockpits.

AIR SOURCE KNOB

The air source knob, on the air conditioning control panel on the right console, selects the engine bleed air source for the ECS system.

BOTH	Supplies bleed air from both engines.
L ENG	Shuts off bleed air from the right engine.
R ENG	Shuts off bleed air from the left engine.
OFF	Shuts off bleed air from both engines.

CAUTION

Selection of OFF on the air source knob or cabin temperature control switch will switch avionics from normal cooling to ram air cooling. Overheat damage to the avionics may occur. Monitor the ECS caution on the MPD/MPCD.

AIR FLOW SELECTOR SWITCH

The air flow selector switch allows three cockpit flow selections.

MAX	Maximum air flow
NORM	Normal air flow
MIN	Minimum air flow

Flow selection is at the discretion of the pilot. The change in flow from MIN to MAX is not always perceptible to the pilot.

BLEED AIR CAUTIONS

The L and/or R BLEED AIR MPD/MPCD caution comes on when a bleed air leak is detected between the engine and the primary heat exchanger.

COCKPIT PRESSURIZATION

Control of the pressure schedule by the cockpit pressure regulator is automatic. Refer to figure 1-46 for the cockpit pressure schedule.

COCKPIT PRESSURE ALTIMETER

The pressure altitude of the cockpit is indicated on a 0-50,000 foot pressure altimeter on the right main instrument panel.

COCKPIT TEMPERATURE CONTROL

Cockpit temperature is controlled by the cabin temperature control knob and switch on the air conditioning control panel.

AUTO	Cockpit temperature is automatically maintained at the temperature selected on the control knob.
MANUAL	Cockpit temperature may be manually changed with the control knob but is not automatically maintained.
OFF	a. Turns off ECS air to the cockpit, avionics, and windshield anti-fog. b. Avionics cooling automatically switches to ram air. c. The canopy seal, fuel pressurization, radar waveguide, anti-G, and windshield anti-ice continue to operate.

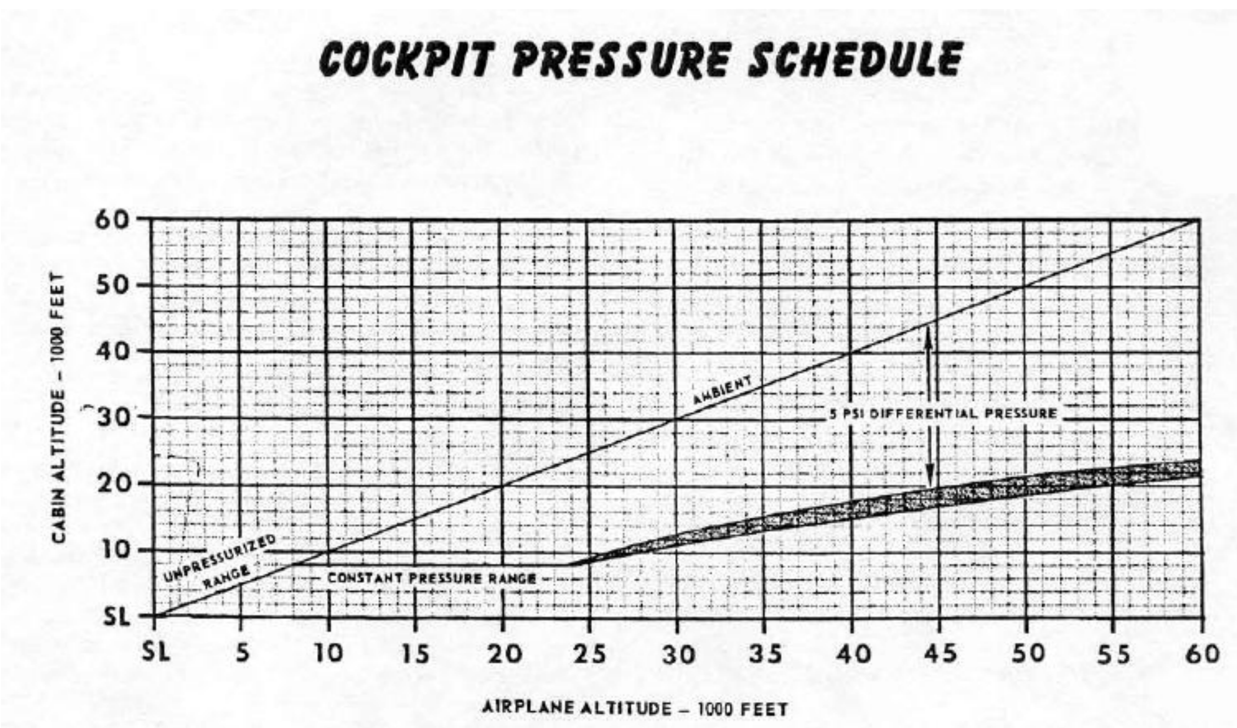


Figure 1-46

AVIONICS PRESSURIZATION AND TEMPERATURE

The pressurization and temperature control of the avionics system is automatic.

ECS CAUTION

The ECS caution warns of overtemperature or low air flow of the avionics cooling air. With the ECS operating normally, the ECS caution may come on during low speed flight, particularly at high power settings, or during idle descents. When the ECS caution comes on during single engine operation on the ground, selected avionics equipment will automatically be turned off.

DISPLAY FLOW LOW CAUTION

The DISPLAY FLOW LOW caution warns of inadequate cooling air flow to the cockpit displays. Caution lights are located in both the forward and aft cockpits. In the forward cockpit, the DSPL FLO LO light is located on the right subpanel. In the aft cockpit, the DISPLAY FLOW LOW light can be found above the right MPD.

A differential pressure switch monitors the difference between cabin pressure and display cooling line pressure. If the differential pressure drops below a required value, the cockpit display cooling flow is assumed low and the caution will illuminate. The caution light will remain on until adequate differential pressure is restored.

EMERGENCY VENT CONTROL

The emergency vent handle on the right main instrument sub panel, when turned 45 degree CCW, electrically dumps cabin pressure. Extension of the handle shuts off ECS air to the cockpit, diverts all ECS cooling air to the avionics and allows ram air to enter the cockpit.

The amount of cockpit ram air flow is controlled by how far the handle is extended. At full travel the handle is locked. If the handle is pushed in and rotated clockwise (CW), normal ECS operation is restored.

WINDSHIELD ANTI-FOG

Windshield anti-fog air is supplied when cockpit air conditioning is operating. The anti-fog air temperature may be regulated by the pilot with the anti-fog switch. If the emergency vent handle is turned 45 degrees CCW and pulled, windshield anti-fog hot air is automatically selected.

Anti-Fog Switch

The anti-fog switch allows the pilot to select a range of temperatures for anti-fog air. The switch is electrically held in the HOT or COLD position and automatically resets to NORMAL when electrical power is lost.

NORMAL	Anti-fog air is supplied at normal temperature.
HOT	Anti-fog air is hotter than normal.
COLD	Anti-fog air temperature is controlled by the cockpit temperature control knob and may be varied colder than normal to hotter than normal.

The position of this switch is at the pilot's discretion for his own comfort. If the switch is in the COLD position and a condition where windshield fogging is anticipated, select HOT.

ANTI-G SYSTEM

The anti-G system is automatically and delivers cooled bleed air to the anti-G suit. The airflow into the suits is proportional to the G force experienced. A manual inflation button in the valve allows each pilot to inflate his suit for checking the system. The system incorporates an automatic pressure relief valve.

ANTI-ICING SYSTEMS

ENGINE ANTI-ICE SWITCH

The engine anti-ice system is comprised of the inlet ice detector and the engine anti-ice valve. The engine anti-ice valve and the inlet ice detector are functionally unrelated. The detector only senses engine inlet ice buildup and turns on the INLET ICE caution. The engine heat switch, on the front cockpit ECS panel, controls the engine anti-ice airflow to the engine nose cone and stationary inlet guide vanes and electrically heats the inlet pressure probe. The DEEC will automatically shut off the engines anti-ice when the altitude is above 30,000 feet or the engine inlet temperature is above 15 degrees C (60F) regardless of switch position.

ON	Activates the engine anti-ice system.
OFF	Deactivates the engine anti-ice system.
TEST	Checks detector operation, and turns on the INLET ICE caution.

INLET ICE CAUTION

The INLET ICE caution indicates and icing condition in the left engine inlet duct. The INLET ICE caution remains on as long as the icing condition exists and will not be extinguished by activating the engine anti-ice system.

INLET ICE CAUTION

The INLET ICE caution indicates an icing condition in the left engine inlet duct. The INLET ICE caution remains on as long as the icing condition exists and will not be extinguished by activating the engine anti-ice system.

WINDSHIELD ANTI-ICE SWITCH

The windshield anti-ice switch on the ECS panel control hot airflow from the primary heat exchanger to the windshield exterior and anti-ice nozzle.

CAUTION

Use of the windshield anti-ice system under non-icing conditions may damage the windshield.

ON	Activates the windshield anti-ice system.
OFF	Deactivates the windshield anti-ice system.

WINDSHIELD HOT CAUTION LIGHT

The WINDSHLD HOT caution light comes on when windshield anti-ice air temperature is excessive. It does not detect the temperature of the windshield and may not warn of impending windshield damage.

STORES JETTISON SYSTEM

Emergency jettison is provided by the emergency jettison button. Selective jettison is provided by the select jettison knob/button in conjunction with the MPD/MPCD. When the landing gear handle is down, the selective jettison controls are de-energized. The gear handle safety interlock can be bypassed by the armament safety switch.

Regardless of master arm switch position, when either the emergency jettison or select jettison (in COMBAT, A/A, or A/G position only) button is pressed, all arming solenoids are automatically de-energized before jettison and all stores are jettisoned unarmed.

Emergency Jettison Button

The emergency jettison button is located on the center of the front instrument panel to the left of the MPCD. This button, when pressed, will simultaneously jettison all pylons with cartridges installed and all AIM-7 missiles. Although the button is spring-loaded to the normal position, a means is provided to determine that the button is not stuck in the jettison position. In the normal position only the color black on the inside lip of the button guard can be seen above the button. If the button is stuck in the jettison position, yellow color can be seen in the switch guard below the black color.

CAUTION

Emergency jettison button is hot when electrical power is on the aircraft.

Select Jettison Knob/Button

When pressed, the select jettison button (Figure 1-47) jettisons stores depending on the rotational position of the knob. Those settings and explanations are:

OFF	Removes power from the selective jettison button.
COMBAT	Selective jettison button first press initiates combat jettison program 1 (all external tanks except CFT's). Second press initiates combat jettison program 2 (all A/G type weapons).
A/A	Selects air-to-air selective jettison.
A/G	Selects air-to-ground selective jettison.
ALTN REL	Used for nuclear weapons release (not modeled in the MilViz F-15E).
MAN RET	Not modeled in the MilViz F-15E.
MAN FF	Not modeled in the MilViz F-15E.

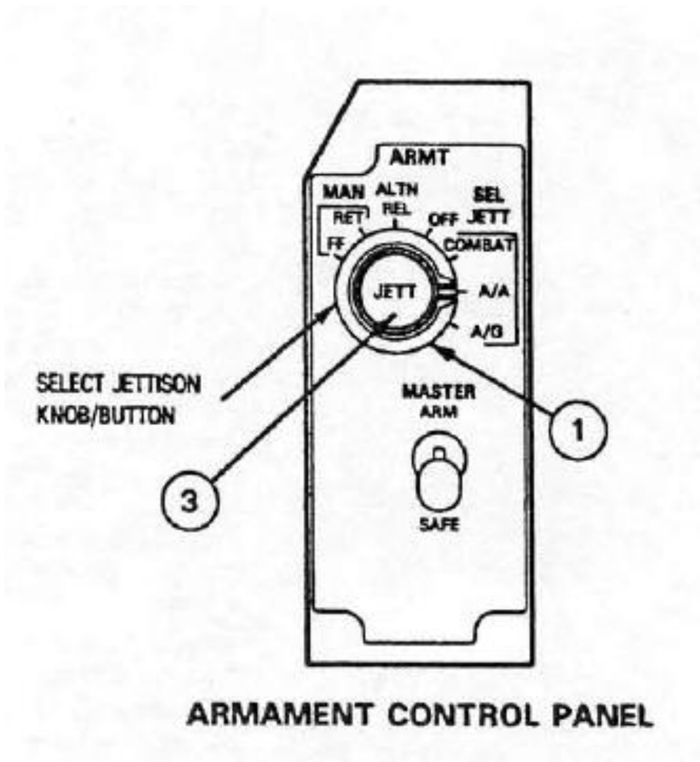


Figure 1-47

Programming Combat Jettison

Programmable ordinance jettisoning is not modeled in the MilViz F-15E. Furthermore, its associated integration with the MPD/MPCD is not modeled. Stores jettison is limited to the use of the select jettison knob/button.

Armament Safety Switch

The armament safety switch, on the left console outboard of the anti-G valve, allows the gear handle safety interlock to be bypassed for armament circuit checkout. The switch is a two-position with these options:

SAFE	Normal circuitry is used.
OVERRIDE	The switch is solenoid held until electrical power is removed, the landing gear handle is placed UP, or the switch is manually placed to SAFE.

BOARDING STEPS

The boarding steps are modeled on the MilViz F-15E to cycle in harmony with the raising and lowering of the canopy. When the canopy is raised, the boarding steps are extended and when the canopy is lowered, the boarding steps are retracted.

CANOPY SYSTEM

The cockpit area is enclosed by a clamshell type canopy. The main components of the canopy system are a hydraulic actuator which provides manual and powered operation of the canopy by use of the default FSX main exit cycling command or by performing a left click operation on the canopy control handle (Figure 1-48). The canopy control handle will cycle between the closed, hold, and open positions with each click and facilitate the lowering and opening of the canopy with each click.

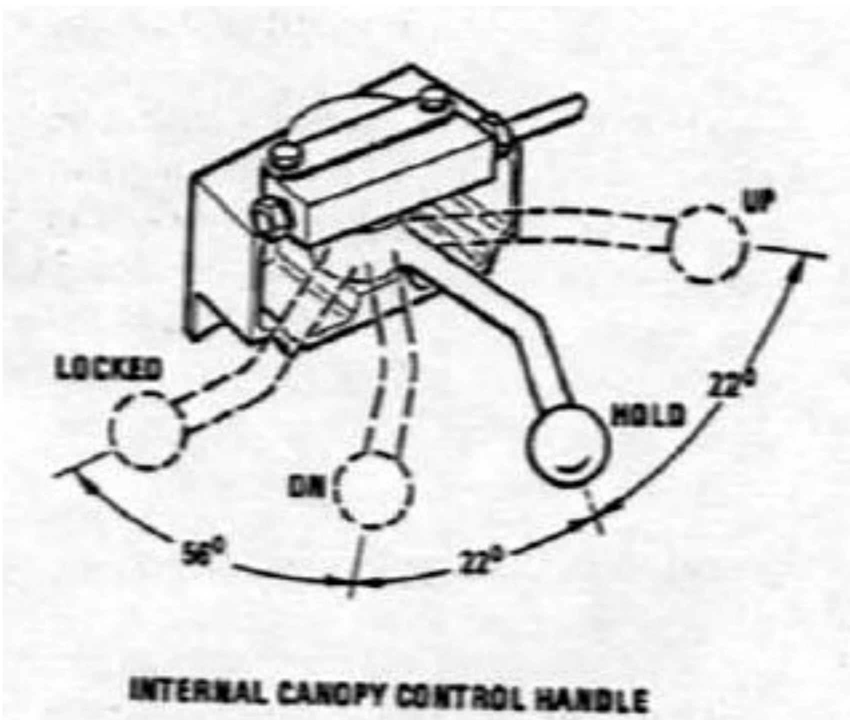
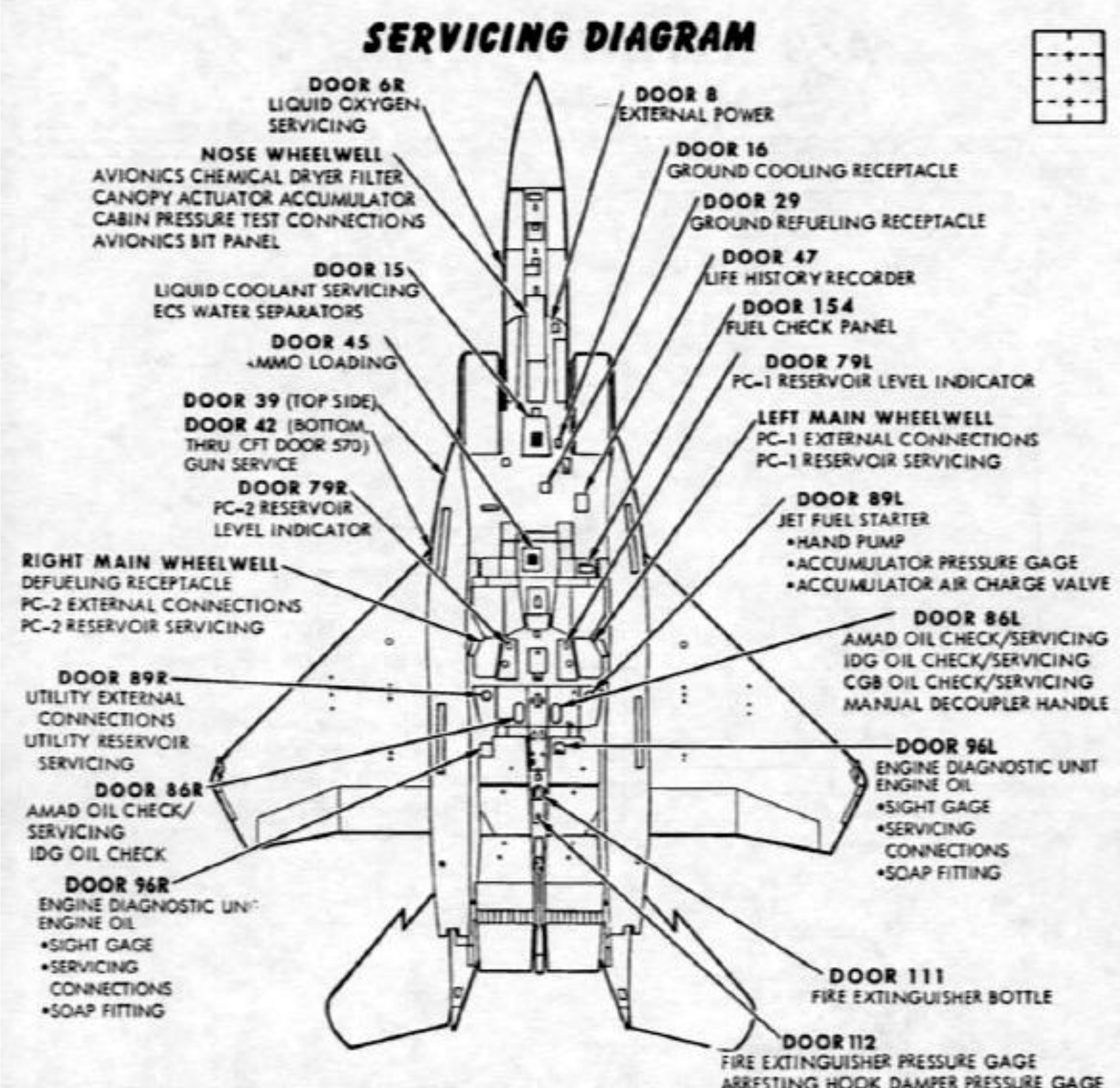


Figure 1-48

SERVICING DIAGRAM

Refer to Figure 1-49 for details on aircraft servicing requirements.



SPECIFICATIONS		USAF	NATO
FUEL	PRIMARY	MIL-T-5624, JP-4	F-40
	ALTERNATE (REFER TO SECTION VI)	MIL-T-5624, JP-5 MIL-T-83133, JP-8	F-43 F-44 F-34 F-35
EXTERNAL ELECTRICAL POWER	115 ± 15 VAC, 400 ± 30 Hz	A/M 32A-60A ONLY	
HYDRAULIC FLUID		MIL-H-5606 MIL-H-83282	H-515 H-537
OXYGEN	LIQUID	MIL-O-27210	

SPECIFICATIONS		USAF	NATO
OIL	TURBINE ENGINE CENTRAL GEAR BOX INTEGRATED DRIVE GENERATOR AMAD	MIL-L-7808 (NO ALTERNATE)	O-148
NITROGEN	GASEOUS	BB-N-411 GRADE A, TYPE I OR II	
OIL	M61A1 GUN	MIL-L-46000	
EXTINGUISHING AGENT	FIRE EXTINGUISHER BOTTLE	HALON-1301	

Figure 1-49

SECTION 2
NORMAL PROCEDURES
TABLE OF CONTENTS

PREPARATION FOR FLIGHT

TAKEOFF AND LANDING DATA CARD

If the takeoff distance exceeds on-half the available runway, the takeoff and landing data card in the Aircrew's Checklist should be completed.

WEIGHT AND BALANCE

For maximum gross weight limitations, refer to section 5, Operating Limitations this POH. For weight and balance information, refer to the Aircraft Fuel & Stores Menu (AFSM) called up via Shift-4 from the keyboard.

PREFLIGHT CHECK

1. Set fuel and stores using the AFSM.
2. Takeoff and landing data – COMPUTE (P)

EXTERIOR INSPECTION

1. Check general condition. Check aircraft exterior for abnormalities. Check all sensors (AOA, pitot/static, inlet ice, total temperature). Check all control surfaces for functionality and connection and all intakes for foreign objects.

FRONT COCKPIT INTERIOR CHECK

A thorough cockpit interior preflight shall be accomplished before each flight. The design features of the aircraft greatly simplify this task. Switch positions designated AS DESIRED allow pilot preference in switch/control positioning. AS REQUIRED indicates those switches that will differ with mission requirements. If no specific requirement exists, those avionics switches designed AS DESIRED or AS REQUIRED should be OFF for start.

CAUTION

Do not place any item on the glare shield, as scratching the windshield is probable.

1. Left Console Equipment – CHECK/SET

a. Ground power panel – ALL SWITCHES AUTO
b. Armament safety switch – SAFE
c. Emergency air refueling switch guard – DOWN
d. Communications controls – AS DESIRED
    1) Volume knobs – AS DESIRED
    2) UHF antenna switch – AUTO
    3) Tone switch – AS DESIRED
    4) IFF master switch – AS REQUIRED
e. EWWS enable switch – OFF, GUARD DOWN
f. IFF antenna switch – BOTH
g. Sensor control panel – OFF
h. Exterior lights panel – AS REQUIRED
i. Flyup enable switch – OFF, GUARD DOWN
j. NCTR enable switch – AS REQUIRED
k. V-MAX switch – COVER CLOSED AND SAFETY WIRED
l. Flap switch – UP
m. Throttles – OFF (left click finger lifts in front of each throttle to set)
n. Fuel control panel – SET
    1) Fuel dump switch – NORM
    2) Wing switch – AS REQUIRED
    3) Center switch – AS REQUIRED
    4) Conformal tank switch – STOP TRANS
    5) Slipway switch – CLOSE
    6) Conformal tank emergency transfer switch – NORM
    7) External transfer switch WING/CTR
o. Nuclear consent switch – COVER CLOSED
p. CAS switches – ON
q. TF COUPLE switch – OFF
r. Miscellaneous control panel – SET
    1) Anti-skid switch – NORM
    2) Inlet ramp switches – AUTO
    3) Roll ratio switch – AUTO
    4) Landing/taxi light switch – OFF
s. Canopy jettison handle – FORWARD (left click to cycle to forward position)
t. Emergency landing gear handle – IN
u. Arresting hook switch – UP

2. Instrument Panel – CHECK/SET
    a. Landing gear handle – DOWN

   b. Pitch ratio switch – AUTO
   c. Master arm switch – SAFE
   d. Select jettison knob – OFF, BUTTON NOT PRESSED
   e. Fire lights – NOT PRESSED
   f. Fire test/extinguisher switch – OFF
   g. HUD control panel – AS REQUIRED
   h. Emergency jettison button – NOT PRESSED
   i. Circuit breakers – IN
   j. JFS handle – IN
   k. Holding brake switch – OFF
3. Right Console Equipment – CHECK/SET
   a. Emergency vent handle – IN AND VERTICAL
   b. Oxygen system – CHECK AND SET
      1) Oxygen supply lever – FULLY ON
      2) Emergency lever – NORMAL
      3) Indicator – CHECK
      4) Diluter lever – 100%
      5) Emergency lever – EMERGENCY
      6) Oxygen flow – CHECK
      7) Emergency lever – NORM
      8) Diluter lever – NORM
   c. Anti-ice switches – SET
   d. Engine control panel – SET
      1) Generator switches – ON
      2) Emergency generator switch – AUTO
      3) ENG CONTR switches – ON
      4) JFS starter switch – ON
      5) Engine master switches – ON
      6) EXT PWR switch – AS REQUIRED
   e. Air conditioning control panel – SET
      1) Temperature control switch – AUTO
      2) Air source knob – NORM
      3) Air flow selector switch – BOTH
   f. Interior lights controls – AS DESIRED
   g. Compass control panel – AS REQUIRED
      1) Latitude – SET
      2) Hemisphere – SET

STARTING ENGINES

Normal engine start procedure does not use external power. (Note: external power for the MilViz F-15E is not modeled). With the JFS running, power is available to operate the AMAD fire warning system, the intercom system between the aircrew and ground personnel, and the cockpit utility light. Engine RPM and FTIT indications on the EMD are inoperative until the emergency generator comes on the line at 15-17% RPM during engine start. The rest of the engine instruments are inoperative until a main generator comes on the line at 56-58% RPM during the first engine start.

The ENGINE category light will come on and remain on until the second engine starts and no engine faults exist. It will come on again momentarily, between 15-29% RPM, indicating that the IDEEC is automatically performing a self test. If engine is started with the ENG CONTR switch in OFF, the ENGINE category stays on throughout the start cycle, indicating the engine is in SEC mode. During engine starts, the engine anti-ice switch will be placed in the ON position for all starts, to provide additional starting stall margin. Test cell data has shown a hot start may occur on warm engine restarts if the engine is started without anti-ice flow. The engine anti-ice switch should be set as required for ambient conditions.

Because a JFS accumulator was discharged to start the JFS, the JFS LOW caution light will come on when power is available to display the caution. It will go out when accumulators are recharged by a running engine.

When the fingerlift is raised, the JFS will engage and accelerate the engine. JFS engagement is indicated by an audible decrease in JFS whine when the JFS clutch engages. JFS whine decrease is followed immediately by an increase to a higher pitch than before engagement. Engine rotation is apparent within approximately 5 seconds. If electrical power is not available, rotation can be felt and heard. If electrical power is available, rotation can be felt and heard. If electrical power is available, RPM increase can be seen on the EMD. The JFS will continue to smoothly accelerate engine rotation without hesitation until light-off occurs or steady-state windmill (23-30%) is reached . A normal start is indicated by RPM acceleration occurring before initial FTIT movement.

Monitor engine indications on the EMD and compare against the operating limitations listed in Section 5 of this POH. After first engine start, the JFS automatically decouples from that engine and is ready for the second engine start. After second engine start, the JFS shuts down automatically.

The following procedure is applicable to either engine. The right engine is normally started first to permit checking utility hydraulic pressure with only the right pump operating.

JFS START

1. Engine master switches – CHECK ON
2. JFS switch – CHECK ON
3. JFS handle – PULL AND RELEASE

NOTE

If JFS does not start, starter switch should be set OFF. Wait 30 seconds after cycling switch to OFF before trying second start so JFS can decelerate, and start sequence relay de-energize. Failure to wait 30 seconds may result in a JFS no start.

4. Starter READY light – ON (within 10 sec, 15 sec if temp below -18C/0F)
5. Fire extinguisher switch – TEST (observe the AMAD fire warning light on with voice)
6. Ensure that Parking Brake is ON

ENGINE START

QUICK START:

1) Flip cover on Nuclear Consent
2) Flip switch on Nuclear Consent
3) Wait (do NOTHING) till both engines are at 68%
4) Should the left engine fail to start, please press and hold Ctrl E until it does so

CAUTION

To prevent possible failure of the CGB shear section and to prevent the DEEC from going into the secondary mode, do not cycle the ENG CONTROL switches until 1 minute after engine start.

NOTE

Ensure engine anti-ice switch is ON prior to engine start.

1. Finger lift RIGHT ENGINE THROTTLE – RAISE AND RELEASE (left click FUEL CUTOFF to put throttle into IDLE)
2. EMD RPM display – OBSERVE INDICATING
3. Fire extinguisher switch – TEST (check all fire light and voice warnings)
4. Throttle – IDLE (18% RPM)
5. Engine instruments – CHECK
6. Repeat for LEFT ENGINE
7. Switch ALL Generator switches to ON

CAUTION

Abort the start if no oil pressure occurs within one minute.

8. JFS deceleration – CONFIRM
9. Warnings and caution lights – TEST (check AB BURN THRU warning light)
10. VHF #2 – ON
11. EMER BST ON caution – OBSERVE ON

NOTE

If automatic avionics shutdown occurs due to low ECS cooling airflow only VHF #2 will be available. All major caution lights will be inoperable. In addition, the right engine ramp may move to the full up position. Start other engine as soon as possible to obtain sufficient ECS airflow. If two engine operation is not possible, single engine operation at 71-73% RPM will provide sufficient ECS airflow.

12. Total fuel quantity – CHECK
13. Hydraulic caution light – CHECK

NOTE

At idle RPM the left engine fuel flows displayed on the EMD and MPD]MPCD may oscillate between 200 and 1,600 PPH, may momentarily drop to zero, and may differ between EMD and MPD/MPCD displays. The fuel flow displays should all stabilize when the left engine RPM is increased above idle.

14. Engine instruments – CHECK
15. JFS – CONFIRM OFF; JFS SWITCH ON
16. ECS – CHECK (ensure ECS caution off and airflow present)
17. Inlet ramp switches – CHECK AUTO (observe ramps down)
18. Engine anti-ice switch – AS REQUIRED

WARNING

If access to door 10L or 10R is required by maintenance personnel, both engines must be shut down to prevent possible inlet ramp activation with could cause ramp/door collision with resulting personnel injury.

BEFORE TAXIING (FRONT COCKPIT)

1. Canopy – CLOSE IF DESIRED (wait 10 sec before locking)
2. MPDs/MPCDs – ON
3. HUD – ON
4. Brakes – CHECK
5. Holding Brake – ON
6. Sensor control panel – SET
    a. NAV FLIR power switch – STBY
    b. Radar power switch – STBY
    c. Radar altimeter power switch – ON
    d. INS – ALIGN
7. Flight Controls – CHECK (CAS OFF)
    a. AFCS BIT – NOT IN TEST

   b. CAS PITCH, CAS ROLL, CAS YAW – OFF
   c. Anti-skid – CHECK NORM
   d. Stick full aft and left – OBSERVE CONTROLS
   e. Stick full left and forward – OBSERVE CONTROLS
   f. Stick full right and forward – OBSERVE CONTROLS
   g. Stick full right and aft – OBSERVE CONTROLS

8. Trim – CHECK AND SET
   a. Trim pitch, roll, and yaw off neutral
   b. T/O TRIM button – PUSH (to set normal takeoff trim)
   c. T/O trim light – ON
   d. T/O trim button – RELEASE
9. AFCS preflight BIT – INITIATE
10. Engine control switches – CHECK
11. Avionics – AS REQUIRED (AAI, IFF, ILS/TACAN)
12. Slipway door – CHECK (if AAR is planned)
13. Oxygen – CHECK
    a. Emergency lever – NORMAL
    b. Pressure – 10 to 60 psi
    c. Indicator – CHECK
    d. Connection – CHECK
    e. Emergency Oxygen – CHECKED AND SET NORMAL
14. Fuel quantity gauge – CHECK
15. Bleed air – CHECK
16. Radar STBY BIT – INITATE
    a. GND indication – CONFIRM
    b. Previous matrix – CHECK
17. Radar power switch – ON
18. Auto BIT – INTIATE
19. Radar Track Test and Operate BIT – INITIATE
20. Flaps – DOWN
21. Speed brake – CYCLE
22. JFS LOW caution – OUT
23. INS mode knob – NAV (when aligned)
24. MPD – BIT CHECK
25. AAI BIT – INITIATE
26. Avionics/BIT – CHECK BIT FOR CODES
27. Cautions/Warnings – CHECK OFF
28. Standby attitude indicator – CAGED THEN UNCAGED

29. Altimeter – SET AND CHECK (should be within 75 feet of known field elevation)
30. Radar – SET STBY
31. MPDs/MPCDs – SET AS DESIRED
32. UFC – SET AS DESIRED

REAR COCKPIT INTERIOR CHECK

A thorough cockpit interior preflight shall be accomplished before each flight. Switch positions in response to AS DESIRED and/or AS REQUIRED actions are the same as for the front cockpit.

1. Left Console Equipment – CHECK/SET
    a. Intercom set control panel -- SET
        1) Volume knobs – AS DESIRED
        2) Tone switch – OFF
    b. EW control panel – SET AS REQUIRED
    c. Sensor control panel – SET
    d. Nuclear consent switch – SAFE (cover closed)
2. Instrument Panel Equipment – CHECK/SET
    a. Emergency landing gear handle – IN
    b. Arresting hook switch – UP
    c. Emergency brake/steer handle – IN
3. Right Console Equipment – CHECK/SET
    a. Command selector valve – NORM (vertical)
    b. Oxygen system – CHECK AND SET
        1) Oxygen supply lever – FULLY ON
        2) Emergency lever – NORMAL
        3) Indicator – CHECK
        4) Connections – CHECK
        5) Emergency oxygen – CHECKED AND NORMAL
    c. TEWS control panel – SET
        1) ICS switch – OFF
        2) RWR switch – OFF
        3) EWWS switch – OFF
    d. Countermeasure dispenser control panel – SET
        1) Mode switch – OFF
        2) Flare switch – OFF
    e. Circuit breakers – IN
    f. Interior lights controls – AS DESIRED

BEFORE TAXIING (REAR COCKPIT)

1. Warning and caution lights – TEST
2. MPD's/MPCDs – ON
3. INS – CONFIRM ALIGN
4. Avionics – AS REQUIRED (AAI, ILS, VHF, TACAN, TEWS, CMD)
5. Sensor control panel – SET
   a. TGT FLIR – STBY
   b. LASER switch – SAFE
6. Avionics systems – CHECK and SET
7. Radar – STBY
8. PACS – SET AS REQUIRED
9. Oxygen – CHECK
10. Standby attitude indicator – CAGE THEN UNCAGE
11. Altimeter – SET AND CHECK

NOTE

If the altimeter is not within tolerances, the aircraft may be flown provided that the altimeter checks within plus/minus 75 feet of field elevation. The plus/minus 75 feet of field elevation is an operational restriction and does not necessarily reflect instrument tolerance.

TAXIING

As the throttles are moved out of idle, confirm that the holding brake is released. As aircraft starts to roll, apply brakes to check operation. When clear, actuate nose gear steering in both directions to ensure proper operation. During taxi, check all flight instruments. At high gross weights, make all turns at minimum practicable speed and maximum practicable radius. At low gross weight, taxi speed requires continual attention due to excess thrust at IDLE.

CAUTION

Nose gear damage can result during turns at high gross weight when using asymmetric thrust and/or asymmetric braking. At heavy gross weights, avoid abrupt nose gear steering inputs. Make turns at minimum practical speed and maximum practical radius, and avoid operations on rough and uneven taxiways or runways. Failure to do so may result in tire damage.

1. Holding brake – OFF
2. Brakes – CHECK
3. Nose gear steering – CHECK
4. Flight instruments – CHECK

If taxiing is required before INS alignment is complete and the aircraft is stationary again before takeoff, place the holding brake ON to continue the alignment.

CAUTION

To prevent a skid and possible tire failure, the aircraft must be completely stopped before placing the holding brake ON.

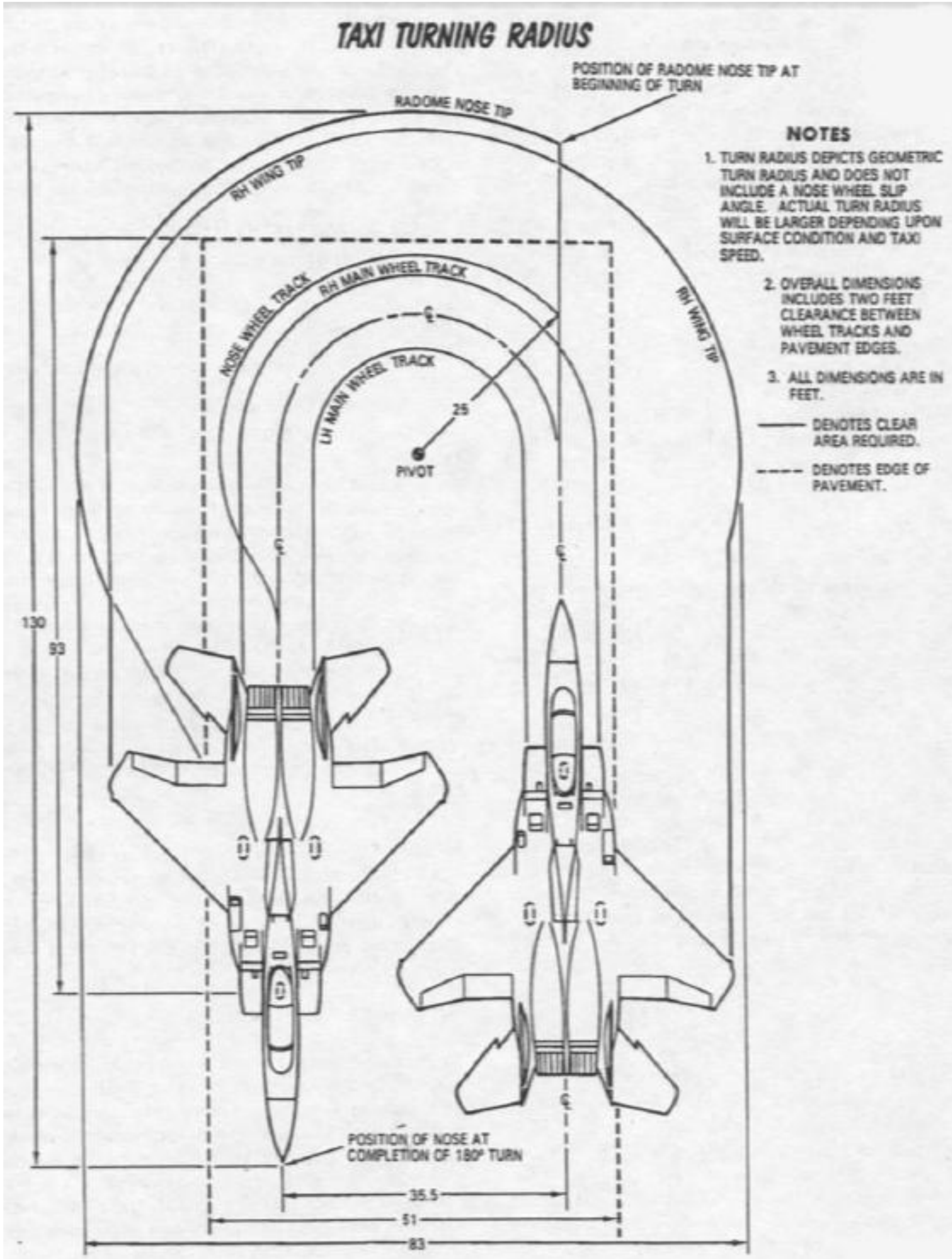

TAXI TURNING RADIUS
POSITION OF RADOME NOSE TIP AT BEGINNING OF TURN
RADOME NOSE TIP
RH WING TIP
NOSE WHEEL TRACK
RH MAIN WHEEL TRACK
LH MAIN WHEEL TRACK
25
PIVOT
NOTES
1. TURN RADIUS DEPICTS GEOMETRIC TURN RADIUS AND DOES NOT INCLUDE A NOSE WHEEL SLIP ANGLE. ACTUAL TURN RADIUS WILL BE LARGER DEPENDING UPON SURFACE CONDITION AND TAXI SPEED.
2. OVERALL DIMENSIONS INCLUDES TWO FEET CLEARANCE BETWEEN WHEEL TRACKS AND PAVEMENT EDGES.
3. ALL DIMENSIONS ARE IN FEET.
DENOTES CLEAR AREA REQUIRED.
DENOTES EDGE OF PAVEMENT.
130
93
POSITION OF NOSE AT COMPLETION OF 180° TURN
35.5
51
83

Figure 2-1

BEFORE TAKEOFF

1. Command select valve – AS BRIEFED (WSO)
2. Flight controls – CHECK FREE (P, WSO)
3. Flaps – CHECK DOWN (P, WSO)
4. T/O Trim – CHECK (P)
5. Canopy – CLOSE, WAIT 10 SEC, THEN LOCK (P, WSO)

CAUTION

Ensure canopy has completed movement and wait 10 seconds before moving handle to LOCKED position. If there is a heavy load when attempting to place the handle in LOCKED, recycle the handle to DN and again perform locking procedure. Ensure canopy unlock light is on with handle in DN and goes out with handle in LOCKED. Ensure handle is full forward.

6. IFF – ON (P, WSO)
7. Radar – ON (P or WSO)
8. TGT Pod – STBY (WSO)
9. Pitot heat/anti-ice – ON, AS REQUIRED (P or WSO)
10. Warnings, cautions, BIT lights, and circuit breakers – CHECK (P, WSO)
11. Holding brake – OFF (P)

TAKEOFF

Advance engines to 80% (some aircraft creep may occur) and check instruments. When ready for takeoff, release brakes and advance throttles to MIL or MAX as desired. Monitor engine instruments for proper operation, assuring that nozzles remain below 80% at MIL.

WITH CFT

Move the stick to approximately one-half aft stick at the rotation speed specified in figure A3-10 and rotate to 10 to 12 degree pitch attitude. Applying aft stick at a lower speed may result in nose wheel bounding. With CFT's, the aircraft has increased pitch response. Excessive aft stick can lead to high pitch rate. Retract gear and flaps when airborne.

TAKEOFF WITHOUT CFT (The MilViz F-15E is not modeled without CFT's)

For normal takeoffs, move the stick to approximately one-half aft stick at about 130 KCAS and rotate to approximately 10 degree pitch attitude. For maximum performance takeoffs (minimum ground roll), move the stick full aft at a speed below the nose wheel lift-off speed in figure A3-11 and rotate to 12 degrees pitch attitude. Nose wheel lift-off speed and takeoff speed is increased for heavy gross weights and/or forward center of gravity. Additional aft stick will compensate for these effects, but rotation rates could be unacceptably high, leading to over-rotation. Retract gear and flaps when airborne.

AFTERBURNER OPERATION

During normal afterburner operation, observe exhaust nozzles open progressively with each afterburner segment. Thrust and fuel flow increase proportionately. As throttles are advanced from minimum to maximum afterburner, the increase in thrust is fairly smooth and continuous.

CLIMB TECHNIQUES

MIL Power – For drag index of 40 or less, climb at 350 KCAS to 0.88 Mach, then maintain Mach to cruise altitude. For indexes between 40 and 100, use 330 KCAS/0.83 Mach. Greater than 100, use 310 KCAS/0.74 Mach.

MAX Power – For drag index of 60 or less, climb at 350 KCAS to 0.95 Mach. If Mach increases above 0.95 at 40 degrees pitch attitude, hold 40 degree pitch and allow the Mach to increase. (Mach will rise only slightly before returning to 0.95.) For drag index greater than 60, climb at 350 KCAS to 0.92 Mach, then maintain 0.92 Mach.

INFLIGHT

Continually monitor aircraft systems operation throughout the flight. Periodically check attitude of primary ADI versus standby ADI. Frequently check engine instruments (EMD), cabin pressure, oxygen system, fuel quantity, and fuel transfers.

Optimum cruise and maximum endurance should be found in the performance data section of this POH. Alternatively, reasonably accurate cruise settings can be obtained by setting 12 units of AOA for optimum cruise and 14.5 units of AOA for maximum endurance.

FUEL MONITORING

With three external fuel tanks installed, fuel transfer should be checked by selecting stop transfer on external wing tanks and observing fuel transfer from the centerline tank. When centerline transfer is confirmed, the external wing tank switch should be returned to normal. To prevent fuel pump damage or failure, the CFT transfer switch must be placed in the STOP TRANS position when all CFT fuel has been transferred.

After all external fuel tanks (wing, centerline, and CFT) are empty and the internal wing tanks start feeding, a check should be made to ensure that a differential of 750 pounds is not being exceeded between tank 1 and each internal wing tank. The transfer rate should be periodically monitored until tank 1 and the internal wing tanks are empty.

During low altitude/high speed flight, fuel consumption can be as high as 150,000 PPH (2,500 pounds per minute) and may exceed fuel transfer capability. This will cause premature reduction of feed tank fuel level. Maneuvering and acceleration can cause fuel gauge errors resulting in a fuel state over 1,000 pounds less than gauge indication. To avoid dangerously low fuel states as a result of these factors, maintain situation awareness, make more frequent fuel checks, and closely monitor feed tank fuel quantity.

With external tanks installed, an asymmetric external fuel imbalance may occur. Compare the internal fuel pointer with the total counter for indications of trapped external fuel. During sustained cruise power an external wing tank may not transfer fuel until after the other external wing tank is empty. The aircraft may be safely flown below 30 units AOA with an asymmetric load as great as one full external wing fuel tank.

INSTRUMENT FLIGHT PROCEDURES

GENERAL

The HUD is the primary indicator for instrument flight.

RECOMMENDED AIRSPEEDS

The holding, penetration, and downwind airspeed for instrument approach may vary from those recommended. At normal approach gross weight, acceleration and high residual thrust characteristics of turbfan engines, combined with low aerodynamic drag, make precise speed control difficult. The recommended technique during instrument approach is to select a power setting which allows the aircraft to stabilize at the approximate recommended airspeed.

Holding

The recommended holding airspeed is 250 KCAS.

Penetration

Normally, after power is set (approximately 72% RPM), lower nose to approximately 10 degrees and allow airspeed to increase slowly to 300 KCAS. The speed brake can be used in a higher decent rate is required. Approaching final approach fix, slow to 200 to 250 KCAS and lower gear and flaps.

INSTRUMENT APPROACHES

In the pattern, select a power setting that will maintain 200 to 250 KCAS. Approaching final, lower gear and flaps, and slow the aircraft. Maintain on-speed AOA indication while on final approach. The speed brake can be used to control decent and airspeed. On GCA final, the velocity vector can be used to indicate glideslope by laying the vector overtop the desired pitch ladder reference matching the planned glidepath.

For example, if a 2.5 degree glidepath is used, holding the velocity vector on top of the 2.5 degree down pitch ladder indication on the HUD provides a good basis from which corrections, if required, can be made.

On an ILS approach, use of the bank steering bar in the ILS mode is not recommended until approximately aligned with the final approach heading. Bank steering information on the HUD and ADI automatically switches from 30 degrees maximum bank angle to the final approach mode of 15 degrees maximum bank angle when the glideslope is intercepted. If the glideslope is intercepted with considerable difference between aircraft heading and final approach course, a 15 degree bank angle may not be sufficient to align the aircraft on final approach.

When an ILS mode is selected, CSET flashes on the HUD for 5 seconds to remind the pilot to set the final approach course. Interception of the center of the glideslope and automatic shift to approach made is indicated by the appearance of glideslope indications on the HUD and ADI. Glideslope and localizer information is displayed on the ADI.

WARNING

HUD ILS command guidance is mechanized for a 3 degree glideslope. If other than a 3 degree glideslope is being flown, the generated glideslope commands will place the aircraft approximately one half dot off the glidepath. Therefore, during any ILS approach, crosscheck generated steering commands with raw glideslope data by direct reference to the glideslope deviation indicator.

Use the best available range information. ILST normally provides the most accurate range information if the TACAN station is suitably located. ILSN mode provides range to the coordinates entered for the STEER TO destination.

On final approach, steer the velocity vector to the flight director cross (intersection of the pitch steering bar and course steering bar). Velocity vector position on the pitch scale may be used to reduce the effect of an overly sensitive flight director cross (out of HUD limit for display). A flashing (caged) velocity vector may be used but it will not indicate the actual azimuth of the flight path.

MISSED APPROACH/GO AROUND

Advance power as required and retract speed brake. Retract gear and flaps when climb is established. Confirmation of climb should be based on at least two independent indications (VVI and visual, or VVI and altimeter). If local obstructions are critical, achieve Vx climbspeed. If obstructions are not critical, achieve Vy until clearance from all published obstructions is assured.

DESCENT CHECK/BEFORE LANDING

Descents from high altitude may cause windshield fogging. The hot position should be selected before descent if fogging is anticipated.

1. Master arm switch – SAFE (P)
2. CMD mode switch – OFF (P)
3. Altimeters – SET AND CHECK (P, WSO)
4. TGT FLIR switch – STBY/OFF
5. Landing light – ON
6. Holding brake – OFF

WARNING

Landing with holding brake on (engaged) will cause loss of control when struts compress and throttle is placed in IDLE.

LANDING TECHNIQUE

The aircraft can accommodate several different landing techniques. However, the procedures described below are recommended.

NORMAL LANDING

Approaching the break, set power to maintain altitude and airspeed (330 KCAS minimum). The speed brake may be used as required. On downwind, below 250 KCAS, lower gear and flaps.

During base turn, reduce speed to arrive on final at on-speed AOA (20-22 units). If faster than on-speed, the aircraft will float for considerable distance. If slower than on-speed, minor buffet may be noticed and effects of turbulence may be increased.

At the flare point, smoothly retard the throttles to IDLE and reduce rate of decent. Ground effect will cushion the aircraft, and touchdown may be difficult to recognize. Raising the nose too high in the flare will cause ballooning, and possibly a hard landing and tail/engine ground contact. For high gross weights, fly on-speed AOA, but delay reducing power until well into the flare (refer to Section 6 of this POH). After touchdown, maintain directional control with rudder and raise the nose to approximately 13 degrees pitch attitude to achieve aerodynamic braking. With CFT's the aircraft has increased pitch response. Aerobraking is highly effective at airspeeds above 90 KCAS and significantly reduce the possibility of hot brakes, excessive tire wear, and blown tires. Therefore, aerobraking should be accomplished first until below at least 90 KCAS is achieved, followed by normal braking once the nose gear is firmly on the ground.

CAUTION

Limit pitch attitude to 15 degrees to avoid dragging the tail.
The aircraft symbol (W on the HUD) will flash at 13 degrees.

At 80-90 KCAS fly the nose to the runway and apply brakes as required (at high gross weight, or forward CG, the nose will begin to fall at proportionally higher airspeeds, refer to Section 6 of this POH). Due to high idle thrust, the aircraft may not decelerate after the nose wheel is on the ground unless braking is used.

WARNING

With low gross weight (less than 2,000 lbs of fuel), use caution in turns and avoid excessive speed. Weight-off-wheels switch may break contact and cause loss of brakes.

CROSSWIND LANDING

Landing is not recommended if the 90 degree crosswind component exceeds 30 knots. Fly a normal pattern adjusted to avoid excessively steep or shallow base turns. On final, establish a wings-level crab to counteract drift and maintain the flight path straight down the runway. It may be necessary to adjust power or delay throttle reduction in the flare to avoid abrupt sink rates or counteract the effects of turbulence. In gusty or turbulent conditions, use normal on-speed AOA. However, AOA deviations are more critical.

Hold the crab through touchdown. After touchdown, maintain the ground track with rudder. Use aileron into the wind to maintain a wings-level attitude. After touchdown, if the crosswind component exceeds 25 knots, do not increase pitch attitude to greater than 10 degrees. If directional control becomes difficult, lower the nose and brake in a three-point attitude. See Wind Components Chart, figure A1-11.

NOTE

When landing with an asymmetric load, it is desirable to place the heavy wing into the wind.

MINIMUM RUN LANDING

When stopping distance is critical, fly final at 23 units AOA, and use a flatter approach angle (1.5 to 2 degrees). Precise control of the touchdown point can be achieved using the velocity vector. If runway is dry and gross weight is 45,000 pounds or less, lower nose after touchdown and commence maximum anti-skid braking. Maximum anti-skid braking is achieved by applying maximum pedal pressure. If gross weight is greater than 45,000 pounds, use aerobraking technique. See Section 7 for slippery runway techniques.

NO FLAP LANDING

No flap landings require no special technique. Approach speed is slightly faster at on-speed AOA and the aircraft is more sensitive to pitch. Allow for higher pitch attitude and slower deceleration on final.

AFTER LANDING

1. Command Selector valve – NORMAL (P)
2. Speed brake – IN (P)
3. Flaps – UP (P)
4. IFF modes – DESELECT (P, WSO)
5. Mode 4 crypto switch – HOLD MOMETARILY AND RETURN TO NORM (P or WSO)
6. Radar power knob – STBY (P or WSO)
7. Trim – T/O (P)
8. Landing/taxi lights – OFF (P)
9. Anti-ice switches – OFF (P, WSO)
10. Mode 4 selector switch – OUT (P or WSO)
11. INS – UPDATE (if position known) (P or WSO)

SINGLE-ENGINE TAXI

1. Avionics – OFF (AAI, ILS, TACAN, SENSORS, HUD, TEWS, RADAR) – (P, WSO)
2. MPD's/MPCD's – OFF (P, WSO) (The right display in each cockpit should be left on to monitor cautions).
3. VHF #2 – VERIFY ON (P, WSO)
4. Either throttle – OFF (P)
5. Corresponding engine master switch – OFF (P) (Placing the engine master switch OFF resets the automatic avionics shutdown system).

NOTE

Automatic avionics shutdown may occur due to low ECS cooling airflow at idle RPM. Single engine RPM at 71 – 73% should provide sufficient airflow.

HOT REFUELING

Stop short of the refueling area for tanks/stores safety checks. If suspected hot brakes or other unsafe conditions exist, do not enter refueling area. Consider all available methods of escape should a fire or other emergency occur. Taxiing clear, ground egress, and static ejection are some of the options available. Follow ground crew directions into the refueling area, and establish communications with the ground crew or crash-fire-rescue net (normally ground or tower control). If you suspect a malfunction stop refueling. Do not transmit on VHF except in an emergency. After refueling complete and when cleared by ground crew, taxi clear of the area. Do not use high power in congested areas.

Before Refueling –

1. After landing checklist – COMPLETE (P, WSO)
2. Holding brake – ON (P)
3. Avionics – OFF (AAI, ILS, TACAN, MPD's/MPCD's, SENSORS, HUD, TEWS, RADAR) (P, WSO)
4. Anti-collision lights – OFF (P)
5. Slipway switch – OPEN (P)

NOTE

Either engine may be shut down for hot refueling. In actual combat conditions, both engine may be left running.

6. Either throttle – OFF (P)
7. Inoperative engine master switch – OFF (P)
8. VHF # 2 – VERIFY ON (P, WSO)

NOTE

Automatic avionics shutdown may occur during refueling due to low ECS cooling airflow. The most notable indication will be blanking of the right displays. Single engine RPM at 71 – 73% should provide sufficient airflow for avionics cooling. Make sure VHF # 2 continues to operate if auto shutdown occurs. The inoperative engine ramp may extend full up with automatic avionics shutdown.

9. Canopy – CLOSED (P, WSO) (Hot refueling with the canopy closed provides maximum protection in the event of fire and minimizes chances of toxic fumes entering cockpit).
10. Fuel quantity – NOTE (P, WSO)
11. RPM – SET AT 71-73% (P)

During Refueling –

12. Keep hands visible to refueling supervisor. Be prepared to shut down engine and evacuate aircraft or taxi clear of area as directed by ground crew if an emergency occurs.

After Refueling –

13. Fuel quantity indicator – CHECK AND NOTE TOTAL QUANTITY (P, WSO)
14. Slipway switch – CLOSED (P)
15. External lights – AS REQUIRED (P)
16. Avionics – AS REQUIRED (P, WSO)

ENGINE SHUTDOWN

1. Slipway switch – OPEN (P) (if required)
2. OWS matrix – CHECK (P)
3. INS – UPDATE (P or WSO) (perform and accept overfly update to known PP can be done any time after landing).
4. LATIRN pods – OFF (P, WSO)
5. INS – OFF (P or WSO) (obtain mission data)
6. Avionics – OFF (AAI, ILS, TACAN, SENSORS, HUD, TEWS, RADAR) (P, WSO) (Turn avionics OFF, including systems controlled on the UFC, before shutting down engines to prevent false BIT warnings on the status panel).
7. Throttles – OFF (P) (pull to IDLE then left click to place in OFF position).

NOTE

Wait 15 seconds after INS shutoff to allow VTR to unthread. Before the emergency generator drops off the line, ensure that the R GEN OUT and L GEN OUT caution lights and the landing gear indicator lights comes on. Illumination of these lights indicate that the generator failure circuit is functioning and the emergency generator is supplying both AC and DC essential power.

OWS MATRIX DISPLAY

To display the OWS matrix –

1. From MENU 2, OWS menu – SELECT (P or WSO)

To clear the OWS matrix –

2. CLEAR pushbutton – PRESS (CLEAR boxed) (P or WSO) (Ensure maintenance personnel toggle OWS reset switch on the ASP and reset ASP 72).

WARNING

To prevent injury, do not clear maintenance personnel to enter the nose wheel well unless one engine is shut down.

3. Matrix cleared – CHECK (CLEAR unboxed and ASP 72 black).

UFC PROCEDURES

DATA FORMATS

Numerous different types of data may be entered on the UFC for navigation. In most cases, data is entered by first selecting the appropriate menu display, data display, or submenu. Typing the data into the scratchpad and pressing the UFC button adjacent to the data to be changed will enter the updated value.

SEQUENCE POINTS

Sequence point types include steer, target, aim, offset, mark, and base style points. Detailed descriptions of these styles is covered in Section 1 of this POH. Details on manipulations of the menus and keystrokes to facilitate the various options should be learned by use of the tutorial videos provided in the MilViz F-15E release package (separate publication).

SECTION 3
EMERGENCY PROCEDURES
TABLE OF CONTENTS

EMERGENCY PROCEDURES

This section covers the operation of the aircraft during emergency or abnormal conditions. It includes a discussion of problem indications and corrective actions, as well as procedural steps when applicable. Adherence to these guidelines will insure maximum safety for the aircrew and aircraft. The situations covered are representative of the most probably malfunctions. However, multiple emergencies, weather or other factors, may require modification of the recommended procedures. Accomplish only those steps required to correct or manage the problem. When dealing with emergency or abnormal conditions, it is essential that you determine the most correct course of action using sound judgment, common sense, and a full understanding of the applicable systems. When practical, advise other concerned agencies (i.e., flight lead, tower, etc.) of the problem and intended course of action. The following rules are basic to all emergency or abnormal conditions. You should thoroughly understand and apply them.

1. MAINTAIN AIRCRAFT CONTROL
2. ANALYZE THE SITUATION AND TAKE THE PROPER ACTION
3. LAND AS SOON AS PRACTICABLE

During any inflight emergency, when structural damage or any other failure is known or suspected that may adversely affect aircraft handling characteristics, perform a Controllability Check.

Retain the canopy during all emergencies that could result in crash or fire such as crash landing, aborted takeoff, or arresting gear engagement. The protection the canopy affords you during such emergencies far outweighs the isolated risk of entrapment due to canopy malfunction or overturn. During ground egress, consider normal canopy opening procedures first to preclude the possibility of a static seat ejection.

The emergency/abnormal procedures are organized in this Section 3 in an expanded format. Multiple tiers of logical questions are often provided to walk the pilot through the various alternative actions based upon given conditions. For these multi-tiered procedures, checklist steps are numbered in the logical flow that the steps should be executed, and this sequence is shown by numerical order. Each of these conditions are designated by formal case bold font conditional headings with a trailing dash (i.e. "**If engine is on – "**). For example, if steps 1-3 are listed, followed by two different bold highlighted conditions, each starting with step 4, then it means the conditions branch out in two alternate paths after step 3 is performed. On the other hand, if steps 1-3 appear followed by two different bold highlighted conditions, and the first section starts at step 4 and the second by step 5, then both sections must be performed in sequence.

STARTING

AMAD FIRE DURING START

AMAD fire may be recognized by illumination of the AMAD fire light, voice warning "Warning, AMAD Fire," or by ground crew notification. Extinguisher actuation will discharge the fire extinguisher into the AMAD compartment and automatically shut down the JFS. If this action does not suffice, ground fire extinguishers may be required. If fire light is on (steady light):

1. AMAD light – PUSH
2. Fire extinguisher – DISCHARGE
3. Throttles – OFF

JFS READY LIGHT DOES NOT COME ON

If the JFS ready light does not come on within 10 seconds, and –

a. The JFS sounds normal.
b. The AMAD fire light tests normally, then the JFS light is inoperative, and the start may be continued (the JFS READY light is required to monitor inflight JFS air start).

If the above cues are not present or JFS did not start on the first accumulator:

a. JFS switch – CYCLE
b. Have ground crew check JFS system.

If no abnormality is found and 30 seconds have elapsed, another JFS start may be attempted.

JFS FAILS TO ENGAGE OR ABNORMAL ENGAGEMENT/DISENGAGEMENT

Failure to engage is indication by no decrease in JFS whine after the fingerlift is raised. This may be caused by the throttle not being full off, dirty switch contacts, master switch not on, an electrical malfunction, or low CGB servicing. If the normal starting sequence has been interrupted (one engine shut down for some reason), it may be necessary to cycle the engine master switch to reset the control circuits. Once the JFS has engaged (JFS whine decreased), any abnormal sound or other indication requires immediate JFS shutdown. These can include no JFS whine increase, no engine rotation, RPM hangup, or JFS disengagement. If the JFS fails to decelerate after either engine start, shut down the JFS and both engines. This may indicate AMAD lubrication pump failure.

If JFS fails to engage –

1. Throttle – ENSURE FULL OFF
2. Engine master switch – CYCLE
3. Fingerlift – RAISE AND RELEASE

If still no engagement –

4. Engine master switch – OFF
5. Do not attempt another start

If engagement/disengagement is abnormal –

1. Throttle – OFF
2. Engine master switch – OFF
3. JFS switch – OFF
4. Do not attempt another start

EMERGENCY GENERATOR NOT ON LINE ON START

On internal power starts, the emergency generator should come on line within 30 seconds after raising fingerlift for first engine start. This is indicated by an increasing RPM indication on the engine monitor display. The emergency generator does not power the emergency boost pump during the first engine start. Therefore, the EMER BST ON caution will not illuminate until the first main generator comes on line. The emergency generator should remain on the line for 30 seconds after the first main generator is on line. There is a remote possibility of the emergency generator dropping off line prematurely. If this occurs before a main generator come on line, the RPM and FTIT indications go blank. Regard a BST SYS MAL caution less than 30 seconds after the first main generator comes on line as an indication that the emergency generator has dropped off line prematurely.

If emergency generator not on line 30 seconds after raising fingerlift –

1. Emergency generator switch – CYCLE THRU ISOLATE

If emergency generator still does not come on line –

2. Engine master switches – OFF
3. JFS – OFF
4. Abort

If emergency generator prematurely drops off line –

1. Throttle – OFF
2. Engine master switch(es) – OFF (Have maintenance investigate malfunction).

ABNORMAL ENGINE START

ENGINE FAILS TO START

If no indication of light – off 20 seconds after throttle advanced to IDLE –

1. Throttle – OFF

If another start attempt desired –

2. Engine master switch – OFF
3. Throttle – IDLE

If another start attempt is not desired –

2. Engine master switch – OFF
3. JFS – OFF
4. Complete engine shutdown procedure

ENGINE FAILS TO ACCELERATE NORMALLY

If both RPM and FTIT appear to stop increasing during the start sequence –

1. Throttle – OFF
2. Engine master switch – OFF
3. JFS switch – OFF
4. Complete engine shutdown procedure

AUTO-ACCELERATION ABOVE IDLE

If auto-acceleration occurs, place the throttle to OFF, press the ENG FIRE PUSH light, and place the engine master switch to OFF.

HOT START

If one of the following conditions occur during engine start, the starting FTIT limit of 680 C may be exceeded:

- RPM acceleration simultaneous with or after initial FTIT movement.
- FTIT above 500 C with RPM before 40%.
- FTIT rises rapidly through 580 C.
- RPM stops increasing then decreases while FTIT is stable or increases.

If starting FTIT is exceeded, allowing the engine to windmill after shutdown will assist cooling.

1. Throttle – OFF

If FTIT starting limit not exceeded –

2. Engine – WINDMILL (10 seconds after FTIT indicates 200 C) (The JFS can be engaged when RPM is below 30%).
3. Air source knob – SELECT ENGINE TO BE STARTED
4. Throttle IDLE
5. Air source knob – BOTH (idle RPM)

If FTIT exceeded starting limit –

2. Engine – WINDMILL (if practical)
3. Engine master switch – OFF
4. JFS switch – OFF
5. Complete engine shutdown procedure

ENGINE FIRE DURING START

1. Fire warning light – PUSH

If warning light remains on –

2. Throttle – OFF
3. Fire extinguisher – DISCHARGE
4. JFS switch – OFF

GROUND OPERATION

ECS MALFUNCTIONS

DUAL ENGINE OPERATION (ECS CAUTION ON)

An ECS caution during engine ground operation is an abnormal condition. Make sure that the cockpit temperature control switch is in the AUTO position and that the air source knob is at BOTH. If the caution remains on, the ECS is not operating properly and avionics may suffer heat damage. Shutting down either engine will provide automatic avionics shutdown to protect the avionics equipment from overheating. In the event the automatic avionics shutdown does not occur, turning off all avionics except VHF will protect this equipment.

1. Temperature Control Switch – AUTO
2. Air Source Knob – BOTH

If the ECS caution remains on after 2 minutes –

3. Either throttle – OFF

Automatic avionics shutdown will occur at this time –

4. Abort Mission

If automatic avionics shutdown does not occur –

5. Avionics (except VHF) – OFF
6. Remaining engine – SHUTDOWN (as soon as practical)

SINGLE ENGINE OPERATION (AUTOMATIC AVIONICS SHUTDOWN)

During single engine operation inadequate avionics cooling airflow is possible. When inadequate cooling is detected, an immediate automatic avionics shutdown occurs. The only indication of this condition will be blank displays.

Automatic avionics shutdown disables the following avionics:

- HUD
- RMR
- MPDP
- RADAR

- ADC
- JTIDS (when available)
- EWWS
- AIU #1
- AFCS Flight Control Computer
- ILS
- CC
- IBS
- PACS
- RWR Low Band Receiver/Processor
- RWR Power Supply
- AHRS
- Left and Right Air Inlet Controller
- VTRS
- VHF #1
- MDPs
- MPCDs

The MASTER CAUTION light and major category light are shutdown as a result of the automatic avionics shutdown of AIU #1.

Advancing the throttle to increase single engine RPM to 73% should provide adequate airflow to avionics and normal avionics operation will resume in two minutes. If normal operation does not resume, it may be necessary to start the second engine.

1. Single engine RPM – INCREASE (to 73%)

If avionics remain shut down after two minutes –

2. Abort mission

DISPLAY FLOW LOW CAUTION

During dual engine operation, a Display Flow Low caution is an abnormal condition and indicates low cooling air flow to the cockpit displays. Turning off all non-essential displays will help protect them from heat damage.

During single engine operations, a slight increase in RPM above idle (to 73%) may be required to extinguish the light with ECS operating normally.

1. Non-essential displays – OFF

2. Abort Mission

INS PROBLEMS

EXCESSIVE GROUNDSPEED/POSITION ERROR

If groundspeed and present position/update errors are excessive prior to take-off, another alignment may be attempted. Generally, groundspeed error of 6 knots or more, and/or positional error of 2 miles or more, are considered excessive for normal operations. Lesser errors may be considered excessive for certain missions. The INS should be off for at least 5 seconds prior to another alignment. Allow the INS to remain in the GC mode as long as possible. If possible, monitor the ground speed and present position for at least one minute to assess accuracy.

BRAKE OVERHEAT

Brake overheat occurs whenever the kinetic energy absorbed by either the right or left wheel brake exceeds 23 million foot pounds. Depending on the severity of the stop, brake energies in excess of this limit can result in tire deflation and fire. Tire deflation due to wheel thermal fuse plug activation generally occurs within 20 minutes of initial brake application. Fires are usually fueled by wheel and brake contaminates and easily extinguished. However, if extreme overheat occurs (brake energies in excess of 48 million foot pounds), hydraulic fluid fires are a possibility due to the deterioration of seals within the brake assembly.

Brake overheat should be considered. When brakes are dragging during taxi, or when successive stops from airspeeds in excess of normal taxi speeds are made within one hour of each other. Refer to Section 5 of this POH for brake energy determination. If brake overheat is suspected:

1. Notify tower that brake overheat exists.
2. Taxi aircraft to closest safe location (use brakes only as needed to stop or turn).
3. Turn aircraft into the wind.
4. Wheels – CHOCKED
5. Brakes – RELEASE
6. Shutdown engines after firefighting equipment arrives.

WARNING

Fuel draining overboard after engine shutdown can contact a hot wheel and cause a fire. Engine shutdown before arrival of firefighting equipment should be avoided when hot brakes exist.

7. If necessary to egress aircraft, move away from aircraft along nose line.

WARNING

When hot brakes exist, stay clear of an area extending at least 300 feet in a 45 degree cone around the axle on both sides of the wheel until brakes have cooled or until thermal release plugs have deflated the tires.

LOSS OF BRAKES

Loss of normal brakes may be caused by a defective anti-skid system, faulty brakes, improper strut servicing (causing loss of WOW signal) or UTL A hydraulic pressure loss. Malfunction of the anti-skid system may not illuminate the anti-skid light, but failures may be recognized by no apparent braking action.

In any case, it is important to remember when assessing the status of brakes, that very little deceleration will be sensed by the pilot at speeds above 100 knots regardless of whether the anti-skid system has failed. Therefore, aerodynamic braking should be accomplished first during the landing roll, followed by braking action as necessary. If loss of brakes is determined, turn the anti-skid switch to PULSER at high speed or OFF at taxi speed.

If braking is not restored, pulling the emergency brake/steering handle provides an alternate power source for brakes or steering and bypasses the anti-skid/pulser system. Sufficient accumulator pressure is available to safely stop the aircraft. Repeated brake applications deplete the system faster than a smooth steady application.

If UTL B is operating, the JFS accumulator will remain charged. If the JFS LOW caution is on, the emergency brake system is not reliable for taxi since accumulator pressure can no longer be monitored. Do not pull the emergency brake/steering handle in flight as the nosewheel will follow rudder commands, and touchdown protection is lost.

If UTL A is available, normal operation can be restored by pushing in the emergency brake/steering handle. When brake failure occurs during landing roll, consider lowering the tail hook before attempting to restore braking. While taxiing, if stopping distance is critical, use the emergency brake/steering handle first.

If loss of brakes occurs –

1. Brakes – RELEASE
2. Anti-skid switch – OFF OR PULSER (as required)
3. Brakes – REAPPLY (Place the anti-skid switch to OFF at taxi speed).

If braking is not restored –

4. Brakes – RELEASE (Completely remove both feet from brake pedals).
5. Emergency brake/steering handle – PULL (Pulling the emergency brake above 70 KCAS increases the possibility of blown tires).
6. Brakes – REAPPLY (To avoid blowing tires, light brake pedal pressure should be applied initially to develop a feel for effective braking).

LOSS OF DIRECTIONAL CONTROL

Directional control problems with the nose gear on the ground may be caused by a blown tire, nose gear shimmy, defective nose gear steering, defective anti-skid, overextended strut, or a faulty brake. For a known blown tire or brake loss refer to the appropriate emergency procedure. If the cause of the directional control problem cannot be determined, time spend in fault isolation may worsen the situation. In this case, a single procedure (pulling the emergency brake/steering handle) is recommended. Use of this procedure provides an alternate source for powered braking/steering, and disables the anti-skid and pulser systems, thereby accommodating all the various failure modes which may have caused the directional control problem.

1. Brakes – RELEASE
2. Emergency brake/steering handle – PULL (Because anti-skid has been removed, be prepared for a possible wheel lockup and a subsequent blown tire or tires).

If departing a prepared surface –

3. Throttles – OFF (conditions permitting).

CABIN PRESSURIZATION MALFUNCTION

Cabin pressurization malfunctions may be detected by discomfort in the ears and can be verified by the cabin pressure altimeter. On the ground, if the cabin pressure altimeter does not agree with the actual field elevation, perform the following before opening the canopy:

1. Emergency vent handle – TURN

CAUTION

If the cockpit pressure altitude is lower than actual field elevation, the canopy may separate from the aircraft if the canopy is opened before cockpit pressure is dumped.

TAKEOFF

ABORT

The decision to abort or continue takeoff depends on many factors, most of which relate to a specific takeoff situation. Considerations should include, but are not limited to, the following:

- Runway factors: Runway remaining, surface condition (wet, dry, etc.), type and/or number of arresting gear available, obstructions alongside or at the departure end, wind direction and velocity, weather and visibility.
- Aircraft factors: Weight, stores aboard, nature of the emergency, velocity at decision point, and importance of getting airborne.
- Stopping factors: Maximum braking (see Minimum Run Landing, Section 2), speed brake, hook, jettisoning stores, engine shutdown.

Consider aborting after airborne where sufficient runway is available. Normally, with the short takeoff distances of the aircraft, abort is not a problem, but early decision will provide the most favorable circumstances.

1. Throttles – IDLE
2. Brakes – APPLY (If aborting with a blown tire or if a main tire blows during abort, place the anti-skid switch to PULSER and use braking on the good tire).
3. Hook – AS REQUIRED

If hot brakes are suspected –

4. Use Brake Overheat procedure.

EXTERNAL STORES JETTISON

Two means exist to jettison external stores: the emergency jettison button on the center of the front instrument panel, or the select jettison knob/button on the armament control panel in the front cockpit.

WARNING

- The emergency jettison button jettisons pylons on stations 2, 5, and 8 plus also all CFT stores (air-to-air and air-to-ground). When airborne, the possibility

exists of wing station stores colliding with CFT mounted stores and subsequent collision with the aircraft. Ground jettisoning may result in the stores striking the ground before pylon aft pivots release. Under these conditions, the wing mounted pylon stores will probably rotate horizontally, and will strike the landing gear if the rotation is in that direction. The centerline pylon will almost certainly strike the landing gear.
- Air-to-ground stores on CFT stations must be jettisoned before air-to-ground stores on wing stations to ensure safe separation.

CAUTION

If centerline or inboard release is required with the landing gear down, damage may occur to the aircraft.

Do not use emergency jettison on the ground, or with AIM-7 missiles onboard, except as a last resort or in extreme emergency. For complete selective jettison procedures, refer to stores jettison systems, Section 1 of this POH.

ENGINE FAILURE ON TAKEOFF

Depending on the type of failure and aircraft condition, MIL power may be sufficient to sustain flight. The aircraft accelerates better at a reduced AOA. If afterburner is required, use only that necessary to maintain safe flight.

If the decision is made to continue takeoff, input one-half aft stick at the rotation speed for continued takeoff found in figure A3-10 (with CFTs) or figure A3-11 (without CFTs), and rotate to a 10 degree pitch attitude. Delaying rotation in this way results in increased single engine rate of climb at takeoff. With CFTs, figures A3-12 through A3-16 should also be checked to determine if adequate single engine rate of climb is available at this takeoff speed. If available runway permits, the takeoff speed may be increased somewhat by delaying rotation until either runway limitations or tire limit speeds dictate rotation. This will result in correspondingly increased ground roll distance.

If takeoff is continued –

1. Throttle(s) – AS REQUIRED

2. Climb to a safe altitude and investigate

ASYMETRIC THRUST DEPARTURE PREVENTION SYSTEM (ATDPS) FAILURE

When the ATDP caution is ON, loss of augmentor or transfers to secondary mode on one engine can result in a sudden loss of thrust on both engines. Refer to Engine Control Malfunction.

AFTERBURNER FAILURE

The engine has an automatic afterburner recycle capability using the light-off detector. If the afterburner does not light satisfactorily or a blowout occurs, the DEEC will automatically resequence the afterburner ignition systems a maximum of three times in approximately 12 seconds providing the throttle remains above MIL. If the afterburner does not light during these attempts, the throttles must be retarded to MIL or below before further attempting to light the afterburner.

If the ENG CONTR caution is on, afterburner operation may be prevented or may be limited to only the first and second segment. If the DEEC has transferred to secondary mode, afterburner operation is prevented and approximately 80 to 85% of MIL thrust is available. Cycling the engine control switch may return the engines to normal operation. The engine control switch may be cycled ON-OFF-ON at MIL or below. If the ENG CONTR caution goes off, the engine will operate normally. However, if there is a malfunction in the afterburner control, the ENG CONTR caution may come on again when afterburner is re-selected. Refer to Engine Control Malfunction, page 3-13 of his section.

ENGINE FIRE ON TAKEOFF

If you decide to abort –

1. Fire warning light – PUSH

If warning light remains on –

2. Throttle – OFF
3. Fire extinguisher – DISCHARGE

If you decide to continue –

1. Climb to safe altitude and follow Engine Fire Inflight procedures

PITCH RATIO FAILURE

If takeoff is made with the CAS ON, it is unlikely that pitch ratio failure will cause any control difficulty, and takeoff may be continued. The PITCH RATIO caution may be the only noticeable indication of failure. However, if the failure occurs with CAS OFF, longitudinal stick forces may be considerably higher than normal, and the late nosewheel liftoff will likely result. In this case, aborting the takeoff is preferred if conditions permit. If takeoff is continued with CAS OFF, maneuver conservatively since the ARI is inoperative.

TIRE FAILURE DURING TAKEOFF

Tire failure is very difficult to recognize and may not be noticed in the cockpit. If a failure is suspected, or confirmed, the following procedures should be used:

If takeoff is discontinued –

1. Abort
2. Anti-skid – PULSER

If takeoff is continued –

1. Gear – DO NOT RETRACT
2. Follow Blown Tires procedure

LANDING GEAR FAILS TO RETRACT

If the warning light in the landing gear handle stays on after the handle is placed up, or it comes on in flight, the gear or the gear doors are not correctly sequenced. Reduce airspeed below 250 KCAS, check landing gear circuit breakers in, and lower the gear. If the gear comes down normally, attempt a second retraction. If the light is still illuminated, lower the gear, reduce weight, and land.

INFLIGHT

OUT-OF-CONTROL RECOVERY

The aircraft is out of control when it does not properly respond to aircrew flight control inputs. An example of this is attempting to perform a slow speed, nose high reversal in one direction and the aircraft will not roll in that direction. An out-of-control situation will progress to a departure if the situation is not corrected by smoothly neutralizing controls to reduce AOA or yaw rate.

A departure is characterized by an uncommanded flight path change such as a nose slice, roll away from a lateral input, or excessive yaw rates. The departure warning tone may sound indicating high yaw rate and is the best indication of an impending spin. If a continuous warning tone is heard and the controls are not neutral, it is imperative that the controls be neutralized immediately in a smooth manner. This action should recover the aircraft from all departures.

Abrupt neutralization of longitudinal controls while out-of-control or in a departure, where high yaw rates are present, may aggravate the situation and induce a spin. Releasing all rudder and stick pressure (hands off) once the controls are at or near neutral will result in neutral controls if trimmed near 1G.

If the controls are not neutralized at the first indication of departure, or when the departure warning tone begins, a spin may develop. Spins are typified by a high yaw rate accompanied by a high rate departure warning tone. The turn needle will be steady and full deflected in the direction of the spin. For recovery from a positive G spin, maintain neutral longitudinal stick and apply full lateral stick with the yaw the same direction as the turn needle. Rudder is not needed, but if used, must be against the yaw, opposite the direction of the turn needle. Neutralize all controls when the aircraft recovers from the spin and allow large residual motion to subside. Spin recovery is indicated by departure warning tone stopping, sustained nose low attitude, increasing airspeed, and AOA decreasing from greater than 45 units.

An auto-roll is a rudder roll caused by rudder deflections with neutral cockpit controls. The aircraft may slowly self-recover. However, for a rapid recovery from a positive-G auto-roll, apply full rudder against the roll. Do not use ailerons to stop the roll as this input may induce a spin. In unsure of the roll direction, use the ADI to determine roll direction. Do not use the turn needle as it oscillates during rolls. The departure warning tone may not sound.

Neutral controls will recover the aircraft from all negative G conditions including spins and auto-rolls. However, rudder with the roll will produce a faster recovery from a negative G auto-roll.

Do not move the throttles unless in afterburner. If in afterburner, reduce power to MIL.

1. Controls – SMOOTHLY NEUTRALIZE AND RELEASE

If aircraft is not recovering, an auto-roll is possible –

2. Rudder – OPPOSITE ROLL

WARNING

Aileron against the roll can induce a spin.

If aircraft is still not recovering, an upright spin is most probable –

3. Longitudinal stick – CENTERED
4. Lateral stick – FULL IN DIRECTION OF YAW (turn needle)
5. Aircraft recovers (tone ceases) – CONTROLS NEUTRAL

WARNING

If the departure warning tone malfunctions (i.e., yaw rate gyro failure) and stops prior to 30 degrees per second, neutralizing controls may result in yaw acceleration and a redeveloped spin. Use other indications of spin recovery in conjunction with the departure warning tone.

If recovery is not apparent by 10,000 feet AGL –

6. Eject

EJECTION

Ejection sequences are not supported in FSX and therefore at not modeled in the MilViz F-15E. All emergency and abnormal checklist procedures that reference ejecting should be referenced as the equivalent of ending the flight through the normal FSX methods.

ENGINE STALL/STAGNATION

Engine stalls are the result of a disruption of airflow across one or more fan/compressor blades. Although many conditions affect compressor airflow (i.e., aircraft maneuvering, ice, DEEC, afterburner backpressure, etc.) most will not exceed the design stall margin of the engine. The IDEEC includes logic to detect and automatically recover most engine stalls without pilot action.

The fan bypass duct provides a convenient passage from pressure disturbances created in the afterburner section to travel directly forward to the fan/compressor. If the engine nozzle does not position properly when operating the afterburner, pressure pulses can be transmitted forward to the fan/compressor causing the blade to exceed the stall limit. Hence, most stalls will be associated with use of the afterburner. High altitude/slow flight and maneuvering all increase the sensitivity to stall because they increase airflow disturbances to the face of the engine. Cycling the control mode switch (PRI to SEC or SEC to PRI), particularly during throttle transients or high altitude/idle power operation, may cause stalls.

If the fan/compressor stall does not self-clear, the disturbed airflow will propagate through the compressor, resulting in engine stagnation. Unstable burning then occurs in the combustion chamber causing higher than normal temperatures and RPM decreasing to sub-idle (less than 60%). To clear this condition, the engine must be shutdown and restarted.

Stalls normally produce and audible pop, bang, or thud, but may occur without audible warning. Engine instruments may not indicate anything unusual, but RPM rollback, increased FTIT, and nozzle opening may be noted for more severe stalls at MIL and above.

Generally, the stall will be self-clearing. However, quickly retarding the throttle to MIL (IDLE if non-afterburner stall) will aid recovery. If a stagnation develops, it will be characterized by rising FTIT and decreasing RPM with no change in throttle position. FTIT may exceeed 1,070 C or stabilize at some lower level. FTIT above 1,070 C will result in engine damage.

To prevent catastrophic engine damage, immediate corrective action should be taken. It is possible that a stagnated engine may also display a fire plume trailing the aircraft if the throttle is not placed to OFF. This plume may persist until the throttle is placed to OFF and the stagnation cleared.

A GEN OUT caution and EMER BST ON caution may be the first indication of engine stagnation. With a single engine stagnation and no other anomaly, the GEN OUT caution and EMER BST ON should be the only cautions on before engine shutdown. If altitude permits, immediately lower the nose to maintain 350 KCAS.

Post stagnation engine operation is keyed to FTIT. If 1107 C was not exceeded, normal engine operating limits apply. If 1,000 C was exceeded, the engine may be started to provide redundant hydraulic and electric power, but should be left at IDLE unless additional thrust is required to ensure safe recovery. After a stagnation has cleared, engine parameters at MIL will initially be lower until the DEEC can return.

SINGLE ENGINE STALL/STAGNATION

1. Throttle – CHOP TO IDLE (MIL if in AB) (If afterburner stall does not clear at MIL, chop the throttle to IDLE).

If RPM is less than 60% with no response to throttle movement, or if FTIT continues to rise –

2. Throttle – OFF
3. Perform restart

If engine overtemp warning activated (1107 C) –

4. Throttle – SET AT 80% RMP OR LESS (if practical)

SINGLE ENGINE OPERATION

If the engine will not start, best cruise may be approximated by a climb at 250 KCAS until rate of climb stops. Accelerate to 0.7 Mach in MIL. Cruise climb as fuel weight decreases.

DOUBLE ENGINE STALL/STAGNATION/FAILURE

Three conditions can cause double engine flameout: all boost pumps inoperative, empty feed tanks, or mechanical failure of both engines. If both main boost pumps and the emergency boost pumps are not operating, restart is possible only within a severely restricted flight envelope. If altitude permits, immediately lower the nose to maintain 350 KCAS. Check RPM and FTIT to determine whether the engines are flamed out or stagnated. If the flameouts were caused by temporary fuel starvation, they may restart. If the engines are stagnated, they must be shut down and restarted.

Shut down the right engine first unless the engine overtemp warning is activated. If this occurs, shut down the engine with the lower FTIT.

During a double engine out situation, regardless of airspeed, altitude or cause, attempt a spool down restart. However, the primary task is to maintain enough hydraulic power for aircraft control while getting at least one engine producing normal power. A single engine at about 18% RPM, or both engines at 12% RPM, will provide enough hydraulic power for flight control and emergency generator operation. An airspeed of 350 KCAS will normally maintain 12% RPM or greater.

At low speed, a momentary steep dive may be required to rapidly attain 350 KCAS. However, a shallow dive (10 degrees or less) will maintain 350 KCAS and 12% RPM. Once steady state RPM is established, excessive airspeed/dive angle reduces time available for restart.

If sufficient RPM is not maintained to fully power the emergency generator system, the emergency generator output may degrade to powering only the ISOLATE functions. In this case, RPM and FTIT will still be available. If this occurs, increase airspeed to increase engine RPM and cycle the emergency generator switch to ISOLATE and back to MAN to restore full emergency power. The JFS, when engaged, will provide sufficient hydraulic power for flight control and emergency generator operation, permitting a minimum rate of descent glide at 210 KCAS.

During a double engine stagnation, allow one engine to remain in stagnation while commencing a restart on the other engine. Prolonged overtemperature increases damage and reduces the probability of successful restart of that engine. Therefore, shut down the second engine and commence a restart as soon as a restart is indicated on the first engine.

Eject before losing flight control. Imminent loss of control is indicated by loss of the emergency generator and/or control transients as the first PC system drops to 0.

DOUBLE ENGINE STALL/STAGNATION

1. Both throttles – CHOP TO IDLE (MIL if in AB) (If afterburner stall does not clear at MIL, chop throttle(s) to IDLE).

If RPM on both engines is less than 60% with no response to throttle movement, or FTIT on both engines continues to rise –

2. Throttle (right engine) – OFF WHILE ESTABLISHING 350 KCAS (If FTIT exceeds 1,107 C, shut down engine with lower FTIT).
3. Perform Restart procedure (If optimum restart parameters are not met by the time RPM decreases through 30%, place the throttle to midrange regardless of FTIT, airspeed, or altitude).
4. At RPM increase on engine being restarted or if restart unsuccessful, shut down other engine
5. Other engine – RESTART

RESTART

Ignition and fuel are continuously supplied when the throttles are at IDLE or above. If an engine does flameout and the auto start does not occur, it is unlikely that a start can be accomplished as cycling the throttles through OFF does not recycle either ignition circuits or fuel flow. Therefore, restarts are generally required only because an engine has been shut down for some reason. Restarts may be made with RPM as low as 12% (fuel flow and/or ignition may not be available below approximately 12%). However, for optimum restart capability, place the throttle in midrange when the following conditions are met:

- RPM between 30% and 50%.
- FTIT below 800 C.

Normally the fastest restart is accomplished by placing the throttle to midrange as RPM unwinds rather than waiting for RPM to stabilize, or by attempting a JFS assisted restart. Advancing the throttle at a minimum 30% when RPM is decreasing should allow time for a relight before RPM drops to 12% RPM. There is a high probability of hot starts, hung starts, or no lights below 275 KCAS, as well as increased chances for these problems at altitudes at or above 30,000 feet. If airspeed is insufficient and RPM drops below 12%, airspeeds up to 450 KCAS may be required to regain 12% RPM.

CAUTION

If the engine RPM is allowed to drop to 0%, it may thermally seize. If this occurs, the engine will not rotate even with high airspeeds or engagement of the JFS. If a restart is planned, maintain engine RPM above 0%.

During restart, there will be no response to throttle movement above IDLE and the IDEEC will inhibit pilot inputs until a stabilized flight idle has been established.

Stabilizing or increasing RPM is normally the first indication of light-off during restart. The fuel manifold drain port on the pressurization and dump valve is capped, resulting in normal light-off time of 5 seconds or less after advancing throttle to mid-range. However, RPM and FTIT turn around are slow, making light-off subtle and difficult to detect. This condition should not be confused with a hung start. For PRI restarts below 30,000 feet MSL, if light-off is not indicated in 20 seconds, place the throttle in OFF and attempt a restart in SEC.

IDEEC overtemperature protection logic attempts to limit FTIT during start to 870 C, which may result in decreasing, hung, or slowly increasing RPM. If a hung start occurs below 30,000 feet

MSL (stabilized FTIT 870 C or less, RPM hung, and definitely stabilized below 60% RPM), increase airspeed to a maximum of 400 KCAS/0.9 Mach. If the hung start persists, attempt a restart in SEC.

Above 30,000 feet MSL, the restart should be initiated by moving the throttle to midrange at 50% RPM regardless of FTIT or airspeed to increase the probability of light-off. If unable to move the throttle to midrange at 50%, do so at as high an RPM as possible and always by 30%. Obtain 400 KCAS/0.9 Mach by diving or using the good engine to minimize RPM spool down rate, and quickly decrease altitude to less than 30,000 feet MSL. If light-off indications are not noted within 20 seconds after advancing the throttle, or if FTIT exceeds 870 C (hot start), move the throttle to OFF and reinitiate a PRI restart. If a hung start occurs (RPM stable with FTIT stable at 870 C or less), keep the throttle at midrange until below 30,000 feet MSL, then reinitiate a PRI restart.

If the control system senses a condition which could prevent safe operation in the primary mode, an automatic transfer to SEC mode will occur and a SEC start may result regardless of the ENG CONTR switch position. The start procedure for either a primary or secondary start is the same. However, a higher airspeed is required for SEC start.

Windmill restarts at 25,000 feet MSL and above with alternate fuels may result in no lights. If light-off indications are not noted within 20 seconds, move the throttle to OFF, descend and hold airspeed to maintain 12% RPM, and reinitiate the restart when below 25,000 feet MSL.

During a SEC start, 60 to 70 seconds are required for light-off and acceleration to midrange from the time the throttle is advanced from OFF. If a SEC spool down restart is initiated below 20,000 feet with RPM in the 40 to 50% range, as much as 30 seconds may be required to see positive RPM response. Do not confuse this slow response with a no-light. Higher altitude or lower RPM (30-40%) SEC spool down restarts will show normal positive RPM indications within 20 seconds. Restarts initiated at higher RPM in general will typically accelerate slowly in the 40-50% RPM range.

JFS ASSISTED RESTART

JFS airstart capability has been incorporated for assistance in engine restarting. This capability is intended for use when encountering engine stall or stagnations after all other restart options have been attempted or rejected as being impractical. The probability of a successful JFS airstart and engine engagement will be enhanced if the aircraft is within the envelope depicted in Figure 3-1. Additionally, the centerline pylon should be jettisoned if at all possible. If the centerline pylon will not jettison, it may be necessary to descend to lower altitudes to achieve a JFS airstart.

In all cases, proper considerations to the safe ejection envelope should be made prior to attempting the JFS airstart procedure. During restart attempts, ensure that at least one engine is rotating (even in stagnation) at or above 18% RPM to provide sufficient hydraulic power for the emergency generator and flight controls.

WARNING

When doing a JFS assisted restart, the engine display format on the MPD/MPCD may freeze if power is lost to the IDEEC. The EMD will continue to correctly display engine parameters and should be used in this case.

If a JFS assisted restart is desired:

1. Throttle – OFF
2. Centerline pylon – JETTISON (if required) (If both engines are below minimum RPM for generators (approximately 56%) or both main generators are inoperative, the centerline pylon can only be jettisoned by pressing the emergency jettison button.
3. JFS switch – CHECK ON

After at least one engine is below 40% RPM –

4. JFS handle – PULL AND RELEASE (Use single accumulator for inflight JFS starts. If both accumulators are discharged simultaneously the JFS may accelerate too rapidly and fail to start.

WARNING

If the JFS does not start, the starter switch should be placed to OFF. Wait 30 seconds after cycling the switch to allow the start sequence relay to disengage and the JFS to decelerate before trying a second start. Failure to wait 30 seconds may result in a JFS no start.

5. JFS ready light – CHECK ON (within 10 seconds)

After engine is below 30% RPM –

CAUTION

To preclude a possible CGB shear section failure, do NOT move the engine control switch until the engine achieves idle.

6. Finger lift – RAISE AND RELEASE (Attempts to engage the JFS above 30% RPM may shear the CGB shaft. Once the JFS is engaged, sufficient hydraulic pressure to the flight controls should be available to permit a controlled minimum rate of descent glide – approximately 210 KCAS).
7. Throttle – MID RANGE (after engine reaches steady state motoring speed of 26 to 29% RPM)

CAUTION

When shutting down an engine with the JFS running, releasing the finger lift before reaching the cutoff position to prevent immediate JFS reengagement and possible CGB shear section failure.

8. Other engine – START (if applicable)
9. JFS – CONFIRM OFF

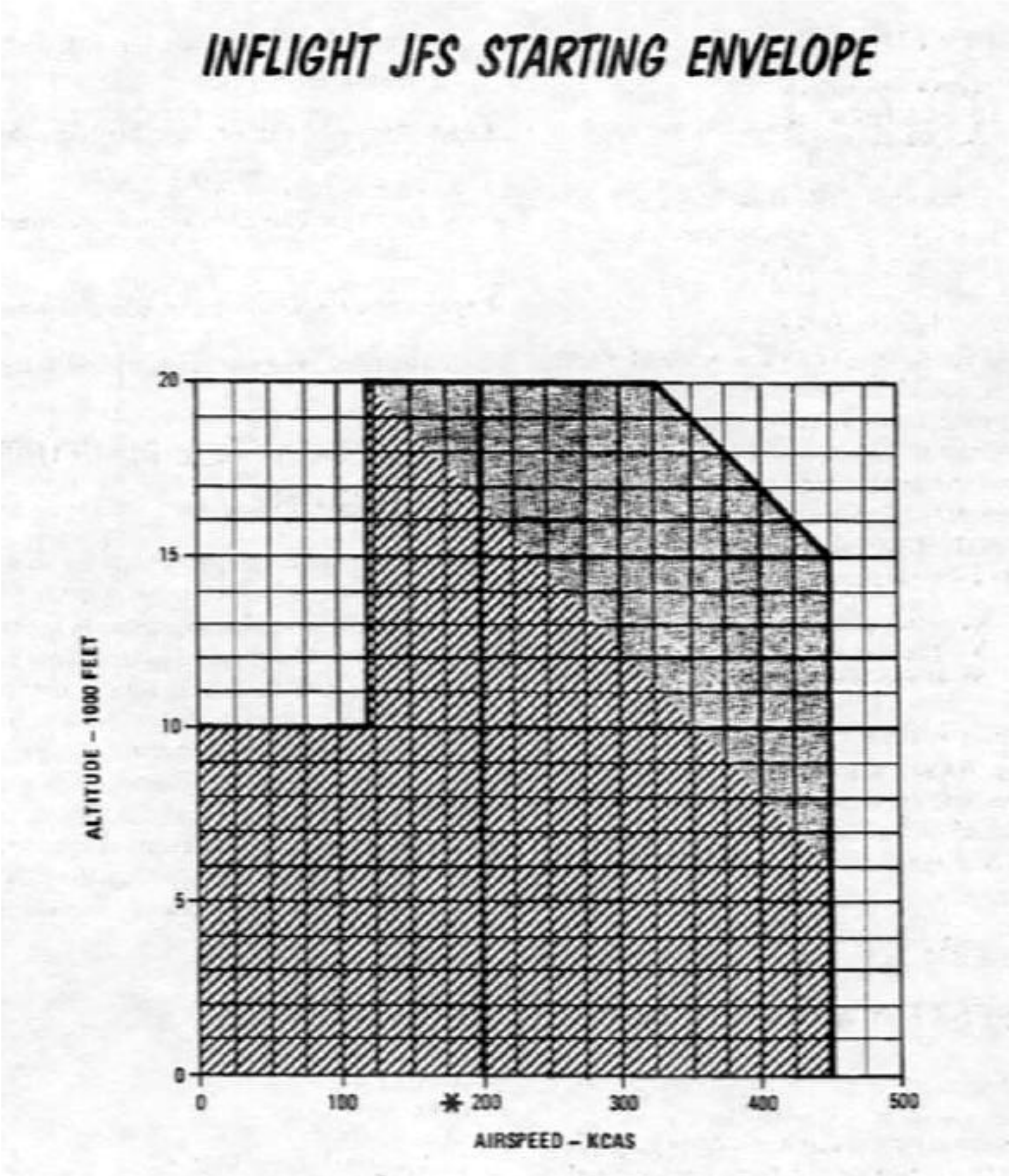


Figure 3-1

AIR INLET SYSTEM MALFUNCTION

INLET LIGHT ON

An illuminated caution light indicates either an AIC failure, ramp position error, or a diffuser ramp that did not lock or unlock at the appropriate Mach number. Airspeed should be reduced below Mach 1.0 and if above Mach 0.95 accelerations are limited to +4.0 G to -1.0 G.

1. Inlet ramp switch – EMERG
2. Throttle – MIL (if above Mach 1.0)
3. Limit aircraft loads to +4.0 G to -1.0 G

ROLL RATIO and RUDR LMTR CAUTION ON –

If the engine RPM does not decrease as the throttle is moved to idle, and ROLL RATIO (and possibly RUDR LMTR) caution is displayed, and AIC malfunction has probably occurred resulting in a false high Mach signal to the engine.

1. Determine if engine RPM responds to throttle movement

If RPM does not respond to throttle movement –

2. Engine control switch – OFF
3. Refer to Engine Control Malfunction procedures

If RPM does respond to throttle movement –

2. Refer to Engine Control Malfunction procedures

ENGINE CONTROL MALFUNCTION

The ENG CONTR caution will come on as a result of a failure of an electrical signal used for afterburner control, or if the IDEEC has transferred from the primary to the secondary mode due to the IDEEC failure detection. If the ENG CONTR caution and corresponding INLET caution are ON, a Mach number failure is most likely the cause. If the ENG CONTR caution is ON, and the corresponding nozzle position is greater than 5%, then the engine is probably in secondary mode. When the engine control is in secondary mode, the nozzle is closed, afterburner operations is prevented, only 70-80% RPM at MIL thrust is produced, and both ground idle and approach idle thrust are disabled. This will increase taxi speed. Cycling the ENG CONTR switch may return the engine to normal operation.

If supersonic –

1. Throttles – MIL
2. Slow to subsonic

If above 30,000 feet –

1. Throttle – MINIMIZE MOVEMENT
2. Descend below 30,000 feet

If subsonic and below 30,000 feet –

1. Throttle – 80% to 85% RPM
2. ENG CONTR switch – CYCLE ON – OFF – ON

NOTE

Cycling the ENG CONTR switch from OFF to ON above 30,000 feet may cause an engine stall.

If engine operation abnormal or ENGINE category light and ENG CONTR caution message still on –

3. ENG CONTR switch – OFF
4. Land as soon as practical (Gear down idle thrust will be greater than normal)

After landing –

5. Shutdown the engine to reduce taxi speed (if required)

NOZZLE FAILURE

The cockpit nozzle indication is nozzle control unit commands, not actual nozzle position. It is possible for the nozzle to fail open or closed and still have normal cockpit indications. Engine stall when selecting afterburner may be an indication of a nozzle failed closed. A loss of thrust and lower than normal FTIT at MIL may be an indication of a nozzle failed open. If nozzle malfunction is indicated, leave the ENG CONTR switch ON. Do not use MIL or afterburner unless required to maintain flight. Gear down idle thrust will be greater than normal with the nozzle full closed.

ENGINE FIRE INFLIGHT

If a fire light comes on, or a voice warning "Warning, Engine Fire, Left (or Right)" is heard, or indications of an engine/aft fuselage fire are observed, perform this procedure. A fire in the afterburner section or in the vicinity of the nozzle will not cause a FIRE light to come on, the L BURN THRU or R BURN THRU light will come and the "AB Burn Thru, Left (Right)" voice warning will be heard. If an afterburner/nozzle burn through occurs, reducing the throttle to IDLE should extinguish the fire within 30 seconds. If the initial throttle reduction causes the light to go out or fire indications to cease and the fire detection system tests good, restrict thrust on the affected engine. If a fire light is accompanied by other indications of a fire (e.g., smoke, control difficulties, bleed air light, hydraulic or electrical anomalies), complete the procedure.

With indications of explosion or catastrophic failure, do not delay completing engine shutdown steps. This may terminate fuel to the fire before it becomes self sustaining. Once the light has been pushed and the fuel shut off, do not depress the light again unless engine restart is necessary. If the fire extinguisher is used successfully, do not consider restarting the engine unless absolutely necessary.

1. Throttle – IDLE

If warning light goes off or fire out –

2. Fire warning system – TEST
3. Monitor other fire indications closely

If warning light remains on or fire persists –

2. Fire warning light – PUSH
3. Throttle – OFF
4. Fire extinguisher – DISCHARGE

If fire persists –

5. Eject

AFTERBURNER BURN THRU

If a fire occurs in the afterburner section, the left or right afterburner burn through lights will come on and the voice warning will be heard.

1. Throttles – RETARD TO MIL OR BELOW

AMAD FIRE INFLIGHT

The most likely cause of an AMAD fire light in flight is the generators. If indications of a fire (AMAD Fire Light and "Warning, AMAD Fire" voice warning) exist, check electrical indications as well. Turning off a generator may remedy the situation.

1. Throttles -- REDUCE

If fire warning light goes out –

2. Fire warning system – TEST
3. Monitor other fire indications closely
4. Discontinue mission

If fire warning light remains on –

2. AMAD light – PUSH
3. Fire extinguisher – DISCHARGE

If fire warning light still remains on –

4. Emergency generator switch – MANUAL (The EMER BST ON caution light should come on and the BST SYS MAL caution light should remain off. If the BST SYS MAL caution is on when both generator switches are turned OFF, double engine flameout may occur due to lack of boost pump pressure).
5. Affected generator switch – OFF

If unable to determine which generator is affected –

6. Both generator switches – OFF (one at a time to isolate source)

If fire persists –

7. Eject

SMOKE, FUMES, OR FIRE IN COCKPIT

Consider all unidentified odors in the cockpit as toxic. Do not confuse condensation from the air conditioning system with smoke. The most probably source of visible smoke or fumes in the cockpit is from the engine or residual oil in the ECS ducts which can enter the cockpit through the ECS system via the center pedestal air outlet and/or cabin defog outlets. This smoke is blue grey in color, has a characteristic pungent odor, and may cause the eyes to sting. This odor may be noticed during engine run-up (if accomplished), during takeoff roll and, occasionally, during supersonic flight.

Another possible source of smoke or fumes is an electrical malfunction or overheat in equipment located in the cockpit. In the event of electrical short or overload condition, this equipment may generate electrical smoke (usually white or grey in color) but should not cause an open fire since cockpit equipment uses very little electrical current. Cockpit electrical wiring insulation may smolder and create smoke, but will not erupt into a seriously damaging fire. There are no fuel or hydraulic lines passing through or near the cockpit area, hence the possibility of cockpit fire from this source is remote. Both main generators may be turned off after emergency boost system operation is confirmed.

If smoke or fumes detected –

1. Oxygen regulator – 100% AND EMERGENCY (Placing the diluter lever to 100% and the emergency lever to EMERGENCY will provide pure oxygen under positive pressure. This will prevent smoke and fumes from entering the mask even if the mask leaks.

WARNING

The emergency oxygen supply (bailout bottle) does not supply sufficient oxygen flow for normal breathing unless the oxygen supply hose is disconnected from the CRU-60/P. This action would permit smoke and fumes to enter the mask.

If required –

2. Emergency vent handle – TURN AND PULL (below 25,000 feet)

If electrical smoke confirmed –

3. Non-essential electrical equipment – OFF
4. Land as soon as practical

If cockpit visibility restricted –

5. Canopy – JETTISON

WARNING

If the cockpit is the source of the smoke or fumes, canopy jettison may cause an eruption of flames around the pilot by greatly increasing oxygen to feed a smoldering fire.

NOTE

Neither the bailout bottle, nor the CRU-60/P, nor the ability to actually jettison the canopy are modeled in this MilViz F-15E.

If electrical fire/smoke persists –

6. Emergency generator switch – MAN (The EMER BST ON caution should come on and the BST SYS MAL caution should remain off).

WARNING

If the BST SYS MAL caution is on when both generator switches are turned OFF, double engine flameout may occur due to lack of boost pump pressure.

7. Both main generator switches – OFF

If electrical fire still persists –

8. Emergency generator switch – ISOLATE

NOTE

In ISOLATE mode, rear cockpit power and intercome are lost. WSO should be advised prior to initiating ISOLATE mode.

If fire is intolerable –

9. Eject

CANOPY UNLOCKED INFLIGHT/LOSS OF CANOPY

CANOPY UNLOCKED

The CANOPY UNLOCKED caution indicates that either the canopy locking mechanism has moved to the unlocked position or the canopy actuated initiator lanyard has become disconnected. The following procedures are recommended:

- Slow to below 250 KCAS.
- Emergency vent handle – TURN (below 25,000 feet).
- Canopy control handle – FULL FORWARD

CANOPY LOST

The MilViz F-15E does not model catastrophic loss of the canopy during inflight operations. Therefore, the real world considerations of wind buffet and damage or injury caused by slipstream in the open cockpit does not apply. In addition, inadvertent or deliberate activation of the canopy unlock or canopy open lever positions will not cause adverse reactions even as their use would be unrealistic.

EXTREME COCKPIT TEMPERATURE

If temperature control cannot be maintained in AUTO, switch to MANUAL and adjust temperature control. If this fails and temperature becomes excessive, pull the emergency vent handle. Observe caution at altitude and consider descent. If temperature is hot and altitude is low, consider a climb to cooler air and/or deceleration to slower speed.

BLEED AIR CAUTION

Bleed air malfunctions have the potential for developing into serious situations. Depending on the location of the hot air leak, various indications can result, causing pilot confusion and misinterpretation. Therefore, prompt action is required by the pilot.

If left or right bleed air caution comes on –

1. Air source knob – OPPOSITE SOURCE

If caution remains on –

2. Throttle – IDLE

If both cautions come on –

3. Air source knob – OFF (below 25,000 feet)

ECS CAUTION

An ECS caution indicates low airflow or overtemperature of the avionics cooling air. In either case, avionics damage due to heat is the primary concern. Very low or high engine RPM can degrade ECS operation. Therefore, maintain moderate airspeeds and RPM if the ECS caution is on. Shut down the radar first as it is very heat sensitive and reduces the cooling air available for other systems. Turn off non-essential avionics for their own protection. Avionics that cannot be turned off, (AHRS, transformer rectifiers, IFF, AIC, ADC, signal data recorder, etc.) will continue to be heat damaged.

Turning the emergency vent handle dumps cockpit pressurization. Pulling the handle diverts ECS cockpit air to the avionics and allows ram flow to enter the cockpit as a function of handle extension. Turning the cockpit temperature control switch OFF will switch avionics cooling to ram air. The ECS caution will continue to monitor avionics cooling air flow and temperature. Optimum ram air cooling is obtained at 400 KCAS and 15,000 feet.

ECS turbine bearing disintegration and failure generally causes a high pitched whine that increases in pitch as engine RPM rises (starting about 80%). It can be accompanied by vibration in the floor area, an ECS light, and/or smoke and fumes. The only way to shut the ECS turbine down is by placing the cabin temperature control switch or air source knob to OFF.

NOTE

When landing with an illuminated ECS light, an automatic avionics shutdown may occur upon touchdown or during landing rollout. If so, the HUD and cockpit displays will blank out and VHF 1 will be inoperative. Aerobrake using backup visual references.

If ECS caution illuminates –

1. Maintain 250 to 450 KCAS (75% to 85% RPM)

If caution remains on –

2. Non-essential avionics – OFF
3. Emergency vent handle – TURN AND PULL (below 25,000 feet)

If caution still remains on –

4. Cabin temperature control switch – OFF

ASYMMETRIC THRUST DEPARTURE PREVENTION (ATDP) SYSTEM CAUTION

When ATDP caution is ON, the aircraft is unprotected from asymmetric thrust induced yaw departures and may also be susceptible to dual secondary mode transfers. When operating in afterburner at high dynamic pressures, the yaw moment can be large enough to cause permanent structural aircraft damage or even aircraft loss.

The caution indicates either system operating mode is other than commanded or air data is invalid. With the caution present, the aircraft flight envelope is restricted based on airframe configuration.

WARNING

When configured without CFT, do not fly above 650 KCAS when Mach is greater than 1.3 and altitude is less than 35,000 feet. When configured with CFT, do not fly above 525 KCAS when Mach is greater than 1.35 and altitude is less than 35,000 feet, or fly above 600 KCAS when Mach is between 1.25 and 1.35 and altitude is less than 35,000 feet.

Refer to Engine Control Malfunctions.

OXYGEN CAUTION

A Molecular Sieve Oxygen Generating System (MSOGS) OXYGEN caution indicates a low Positive Pressure Oxygen (PPO_s) concentration, a low concentrator outlet pressure, or incorrect internal BIT response. The Backup Oxygen System (BOS) will be automatically engaged when the generator light comes on.

If OXYGEN caution comes on –

1. Oxygen pressure gauge – CHECK (greater than 50 PSI) (A pressure reading greater than the normal MSOGS operating range (up to 450 PSI) indicates the system has automatically selected the BOS as the source of breathing gas).

If BOS is not available or when BOS pressure falls below 50 PSI –

2. Descend below 10,000 feet MSL.

DISPLAY FLOW LOW CAUTION

A DISPLAY FLOW LOW caution indicates low cooling air flow to the cockpit displays. The cockpit displays include the UFCs, HUD, RMR, MPDs, and MPCDs. The primary concern in this case is damage to the displays due to overheat. Turning Internal Countermeasures Set off will increase cooling supply pressure to the cockpit displays. Non-essential displays should be turned off for their own protection. The RMR and MPCDs are the most heat sensitive displays and have no overheat protection which will cycle the units off and on during periods of extreme overheat.

The HUD is the most reliable display and has limited overheat protection circuitry which will turn itself off until turned on again by the pilot. If cabin airflow is normal, it can be assumed that some cooling airflow is available to the displays. As a minimum, the HUD, UFCs, and the aft cockpit R/H MPD should remain on. This will provide the pilot with flight information and allow the WSO to monitor fault indications. Also, turning the emergency vent handle below 25,000 feet will lower cabin pressure, and therefore increase display cooling flow.

SINGLE ENGINE OPERATION

During single engine low or high RPM operation, ECS performance will be degraded and a DISPLAY FLOW LOW caution may come on with the ECS operating normally. Display cooling is marginal but is adequate for short term operations. Optimum cooling is achieved by operating at 80 to 82% RPM below 40,000 feet.

If DISPLAY FLOW LOW caution illuminates –

1. Internal Countermeasures Set – OFF (as soon as practical)

If caution remains on –

2. Non-essential displays – OFF
3. Emergency vent handle – TURN (below 25,000 feet)

If in single engine operation –

4. Maintain 80-82% RPM below 40,000 feet

OIL SYSTEM MALFUNCTION

Engine oil system malfunctions include over or under pressure, and excessive fluctuations. If the oil pressure stays below 8 PSI but above 0 PSI and appreciable time at altitude is expected, consider engine shutdown. If oil pressure stays at 0 PSI or above 100 PSI and the other engine is operating normally, the engine should be shut down without delay to limit damage. If the engine is left running and vibration or other indications of possible engine seizure occur, shut down the engine and make a single-engine landing.

If oil pressure is out of normal range –

1. Throttle – IDLE

If oil pressure below 8 PSI or pegged at 100 PSI –

1. Throttle – OFF (conditions permitting)

EMER BST ON AND/OR BST SYS MAL CAUTION

The EMER BST ON and BST SYS MAL cautions provide indication of the status of both the emergency fuel boost pump system and the emergency generator system. A single caution, or combination of cautions, requires the following aircrew actions:

EMER BST ON	BST SYS MAL	AIRCREW ACTION
ON	OFF	Refer to generator failure or boost pump failure as applicable.
OFF	ON	Follow applicable boost pump failure procedure.
ON	ON	Do not turn main generators OFF or place emergency switch to ISOLATE as this may fail the emergency boost pump.

FUEL BOOST PUMPS INOPERATIVE

There are various combinations of indications to warn of a single or multiple fuel boost pump failure. A single boost pump failure is indicated by a L or R BST PUMP caution on, or a BST SYS MAL caution on, or even a BST SYS MAL caution light on without an associated illumination of the EMER BST ON caution light. Emergency procedures are different depending upon whether one or both of the cautions are displayed.

SINGLE OR DOUBLE (ANY TWO) FUEL BOOST PUMP FAILURE(S)

With only one boost pump operating, prudence dictates that the aircraft be operated at the lowest practical altitude below 30,000 feet and at a higher (but not afterburner) power setting.

1. Land as soon as practical

BOTH MAIN FUEL BOOST PUMPS AND EMERGENCY BOOST PUMP INOPERATIVE (TOTAL BOOST PUMP FAILURE)

1. Descend to minimum practical altitude using maximum practical power on at least one engine (not afterburner)

NOTE

If the situation permits, maintain high power settings for at least 3 minutes to cool the fuel, and descend with both throttles at military power. As the descent becomes more restricted by weather, airspeed, etc., maintain one throttle at MIL while retarding the other as necessary toward IDLE. If the retarded engine operates at IDLE and additional power reduction is required, you can then retard the advanced throttle as required. Use of the speed brake should be considered.

2. Reduce electrical load to the minimum practical
3. Maintain split throttles until established in traffic pattern

NOTE

Maintain one engine at as high a power setting as possible until the throttle must be retarded to permit landing.

FUEL TRANSFER SYSTEM MALFUNCTION

The primary indication of a fuel transfer system malfunction is the fuel gauge. Other indications include premature FUEL LOW caution, BINGO caution, wing low tendency and appropriate voice warnings.

INTERNAL TANK(S) FAIL TO TRANSFER

If tank 1 transfer pump has failed, a differential greater than 750 pounds between tank 1 and the internal wing tanks will be observed. If this occurs, the fuel in tank 1 should be considered trapped, and as the wing tanks empty the aircraft CG will shift forward.

If feed tank fuel quantity begins to drop with fuel remaining in either of the internal wing tanks, a wing transfer fuel pump failure is likely. If any or all of the transfer pumps fail, the fuel in the affected tanks will gravity transfer to the feed tanks when tanks with operating transfer pumps are empty and the fuel level in the feed tanks drop below the level of fuel in the affected tank(s). Gravity transfer can be confirmed by observing the simultaneous decrease of fuel levels in the affected tank(s) and associated increase in fuel level in the feed tanks. Gravity transfer may not occur until after the FUEL LOW caution warning illuminates and very low feed tank fuel level is reached (300 to 400 pounds in each tank). Gravity transfer will not completely refill the feed tanks, and may not keep up with feed tank usage.

WARNING

Fuel flow rates above 3,500 pounds per hour per engine will exceed the gravity feed transfer rate and if not corrected will result in fuel starvation to the engines.

If transfer pump failure is suspected –

1. Throttles – RETARD (less than 3,500 PPH per engine)

For tank 1 transfer failure –

2. Slipway switch – CHECK CLOSED

NOTE

Open slipway will prevent fuel feed from tank 1.

If slipway switch closed –

3. Stay below 30 units AOA
4. Maintain approximately 250 KCAS for cruise and plan for a minimum fuel descent
5. Land as soon as practical

EXTERNAL TANK FAILS TO TRANSFER

With external wing tanks installed, if the external fuel tanks fail to transfer completely or if STOP TRANS is selected due to an emergency and any external tank, including the centerline, is partially full, the aircraft may exceed the aft CG limit as internal fuel decreases due to fuel moving aft in the external tanks. Cycling the external tank switch or slipway door may restore transfer. If the landing gear is cycled under these conditions, it may fail to retract due to weight-on-wheels (WOW) switch malfunction. Ensure fuel on board will allow flight to a suitable landing base with the gear down if transfer is not restored. If not, it may be necessary to jettison the tanks to restore CG within acceptable control ranges.

If external tank transfer failure is suspected –

1. External transfer switch – WING/CTR
2. External tank fuel control switches – CYCLE
3. Landing gear circuit breaker – IN
4. Slipway switch – CYCLE
5. Throttle(s) – MIL

If external tank still fails to transfer or STOP TRANS is selected –

6. Maintain minimum 250 KCAS
7. Use minimum pitch angle for maneuvering
8. Jettison external tanks (if required)

If partially full external tanks are retained –

9. Maintain 18 units AOA on final

CFT FAILS TO TRANSFER

CFT fuel transfer failure is indicated by voice warning, "WARNING, TRANSFER PUMP" and by the FUEL PUMP caution light illuminating. This condition can be verified by referencing the fuel quantity indicator and noting reductions in feed tank fuel levels with lack of reductions in CFT fuel levels.

If CFT transfer pumps on one side of the aircraft, it may be necessary to discontinue all CFT fuel transfer to preserve safe aircraft CG. If both main generators fail, all CFT transfer pumps automatically shut off.

If fuel is not critical, do not transfer CFT fuel. However, if fuel condition is critical, then CFT fuel can be transferred using the CFT emergency transfer switch. The landing gear handle must be up to prevent fuel from transferring to the other CFT vice the intended feed tanks. Wait until internal fuel decreases to 1,000 pounds then select L or R. When internal tanks are full, place the switch to NORM. Wait until internal fuel again decreases to 1,000 pounds before repeating the same emergency fuel transfer procedure. Repeat this procedure until the CFT's are empty or until the fuel condition is no longer critical.

If both generators fail and fuel critical –

1. Landing gear handle – UP

After internal fuel decreases to 1,000 pounds or less –

2. Conformal tank emergency transfer switch – L or R (select desired CFT side to transfer from)

When internal tanks full –

3. Conformal tank emergency transfer switch – NORM
4. Repeat steps 1 through 3 for opposite CFT

EMERGENCY FUEL TRANSFER/DUMP (EXTERNAL TANKS), GEAR DOWN

Fuel in external tanks cannot be transferred and/or dumped unless the landing gear handle is up or the fuel low level system is activated. If it is necessary to transfer or dump fuel with the gear down, the following procedures will permit external fuel transfer/dump without raising the landing gear.

1. Emergency landing gear handle – PULL
2. Landing gear handle – UP
3. Fuel gauge – MONITOR
4. Fuel dump switch – DUMP (if required)
5. Landing gear handle – DOWN (when dumping complete)

If UTL A pressure zero –

6. Emergency landing gear handle – RESET

UNCOMMANDED FUEL VENTING

Fuel flowing uncommanded from the dump mast(s) in flight is, in all probability, due to abnormal venting caused by fuel transfer system and/or fuel pressurization/vent system failures. The probability of spontaneous dump system failure is extremely rare.

CAUTION

If fuel dump is selected during abnormal venting, the internal fuel tanks could over-pressurize and rupture.

If uncommanded fuel venting is observed –

1. Fuel dump switch – NORM
2. External tank/conformal tank fuel control switches – STOP TRANSFER

WARNING

If any external tank is partially full, the aircraft may exceed the aft CG limit at light internal fuel weights due to fuel moving aft in the external tanks. In this case, it may be necessary to jettison the external tanks.

3. Slipway switch – OPEN
4. Air source knob – OFF (below 25,000 feet) (Except a possible ECS light once the air source knob is turned off).

If fuel venting continues and flight to an emergency landing site is not within range of feed tank fuel quantity –

5. Emergency generator switch – MAN (The EMER BST ON caution should come on and the BST SYS MAL caution should remain off).
6. Main generator switches – OFF (If the BST SYS MAL caution is on when both generator switches are turned OFF, double engine flameout may occur due to lack of boost pump pressure).
7. Fuel gauge – MONITOR FEED TANK (Feed tanks may be refilled by turning on a main generator thus activating transfer pumps, or by allowing fuel to gravity feed from internal wing tanks).

When feed tank fuel is sufficient for flight to an emergency landing site –

8. Main generator switches – ON

INFLIGHT FUEL LEAK

Prompt action is required to isolate the source of the leak to minimize fuel loss and fire hazard. If the leak can be associated with one engine bay, feed tank, or side of the aircraft, then the fire warning light for the engine on that side should be pressed to close the airframe fuel shutoff valve. Placing the throttle OFF will not isolate leaks upstream of the engine fuel control. If the leak is upstream of the airframe fuel shutoff valve, fuel loss may be reduced by stopping all fuel transfer and shutting off the fuel boost pumps.

The transfer and boost pumps can be shut off by turning both main generators OFF. This will reduce but will probably not stop the leak. Monitor feed tank fuel quantity and turn the main generators OFF. This will reduce but will probably not stop the leak. Monitor feed tank fuel quantity and turn the main generators ON as required to prevent feed tank depletion. Failure of some fuel system components can cause loss of all fuel in a few minutes. Consider increasing airspeed (without afterburner) to maximize range by using fuel which would otherwise be lost.

WARNING

Use of afterburner during any known fuel leak condition may ignite the leaking fuel.

NOTE

Checking the fuel flow gauges may help to determine associated engine bay.

If leak can be associated with one engine bay –

1. Fire warning light – PRESS
2. Throttle – OFF

If source of leak cannot be determined –

1. Either fire warning light – PRESS
2. Throttle – OFF

If leak continues –

3. Fire warning light – RESET
4. Engine – RESTART
5. Other engine fire warning light – PUSH
6. Other engine throttle – OFF

If leak continues and flight to emergency landing site not assured –

7. External tank/conformal tank fuel control switches – STOP TRANSFER
8. Fire warning light – RESET
9. Engine – RESTART
10. Emergency generator switch – MAN (EMER BST ON caution on and BST SYS MAL caution off).
11. Both main generator switches – OFF
12. Fuel gauges – MONITOR FEED TANKS
13. Main generator switches – ON AS REQUIRED FOR FUEL TRANSFER AND FOR LANDING
14. External tank switches – ON AS REQUIRED

After landing –

15. Shutdown engines using fire warning lights, engine master switches, and throttles

GENERATOR FAILURE

A generator failure is indicated by an L GEN OUT or an R GEN OUT caution light. The emergency generator will come on and power the emergency boost pump and the EMER BST ON caution will come on. If the BST SYS MAL caution comes on, the emergency generator has probably failed. Normal flight electrical loads (except TEWS pods) can be handled by one generator. Check hydraulic warning lights and gauges for indications of AMAD failure. Check engine instruments for indication of stall/stagnation or flameout.

Upon indication of generator failure –

1. Generator switch – CYCLE

If generator still failed –

2. Generator switch – OFF

DOUBLE GENERATOR FAILURE

If both generators fail, the emergency generator will automatically power the essential buses providing the emergency generator is not in ISOLATE. The HYDRAULIC caution and the landing gear warning light will come on and the landing gear warning tone will sound. Operation of the landing gear warning light/tone is due to the loss of the ADC. The gear should operate normally. Hydraulic system operation can be verified only by proper operation of hydraulically powered systems.

Refer to Emergency Power Distribution Chart (Figure 3-5) for equipment that will be operative/inoperative when the emergency generator in on line. If either generator can be reset, the electrical system will revert to normal operation.

The following indicators/instruments will fail immediately and, except for the fuel flow, oil pressure, and exhaust nozzle indications (which all go blank), will tend to remain at the last valid reading:

- Vertical velocity indicator
- AOA indicator
- Exhaust nozzle position indications
- Oil pressure indications
- Fuel flow indications
- Oxygen quantity indicator
- PC1 hydraulic pressure indicator
- PC2 hydraulic pressure indicator
- Utility hydraulic pressure indicator

The only display powered by the emergency generator is the front MPCD which will display ADI format and cautions. Dual generator failure may also degrade quality of power to surviving displays, making them unreliable. Therefore, reference to the standby ADI and other standby instruments becomes essential.

NOTE

All standby instruments remain operational and reliable during dual generator failure.

Upon indication of dual generator failure –

1. EMER BSO ON caution – CHECK ON (If the EMER BST ON caution is not on, cycle the emergency generator switch to ISOLATE and back to MAN).

NOTE

In ISOLATE mode, rear cockpit power and intercom are lost. WSO should be notified prior to initializing ISOLATE mode.

2. Main generator switches – CYCLE

3. Implement "Both Main Fuel Boost Pumps and Emergency Boost Pump Inoperative" procedures

WARNING

With both main generators inoperative the nozzles will stay fully closed with the landing gear down and idle thrust will be substantially higher than normal.

NOTE

Feed tank fuel cannot be monitored. Flameout due to fuel starvation may occur with prolonged use of high power settings. With total electrical failure, the standby attitude indicator will display an OFF flag but is reliable for 9 minutes after loss of electrical power.

AMAD FAILURE

AMAD failure is indicated by the simultaneous loss of the PC system, the utility pump, and the generator on the same side. If this occurs:

1. Throttle – IDLE
2. Refer to Electrical and Hydraulic Failures

If double AMAD failure occurs –

1. Eject (If double AMAD failure occurs, total hydraulic and electrical power are lost and aircraft control is impossible).

RUNAWAY TRIM

Sufficient control is available to land the aircraft from a runaway trim in any direction. Unless other flight control malfunctions are evident, leave pitch and roll ratio switches in AUTO. If a runaway trim condition cannot be controlled with the normal trim controls, use of the takeoff trim button may be effective in returning the trim to a near neutral position. Pulling the AFCS ESS AC circuit breaker removes power from the trim actuators while leaving the rest of the flight control system operational (upper AFCS ESS AC circuit breaker is for pitch trim, and the lower AFCS ESS AC circuit breaker is for both roll and yaw trim).

FLIGHT CONTROL SYSTEM MALFUNCTION

The CAS is a highly reliable three channel system that continuously self-checks its operation. If the system senses two channels, of the same CAS axis failure, it will drop itself off line. Nevertheless, if flight control failure is noted, immediately perform the following step:

1. Eject

ADC FAILURE

Operation of the Air Data Computer (ADC) is entirely automatic, and no control over the system is available to the pilot. Primary indications of ADC failure are freezing or failure of the vertical velocity indication, warning light in the landing gear handle, and when airborne, landing gear warning tone. The ADC provides inputs to most flight instruments as well as to the inlet controller to each engine intake.

Reference to standby instruments is the only effective pilot action. Flight should be continued to the first available emergency airport.

INS FAILURE

If the INS fails, the ATTITUDE caution is displayed. If the ISN is the selected data source, OFF is displayed next to INS and an X is displayed on the ADI attitude ball. Master caution and the AV BIT caution will also come on. Select the attitude source that is still valid and monitor the standby attitude indicator.

Flight without the INS can still be made using either visual pilotage or by dead reckoning methods as well as by use of TACAN navigation systems.

In the event of INS failure inflight, the pilot or WSO may elect to perform an inflight alignment (IFA) by inputting a known position and heading, and having the pilot remain on a constant heading, unaccelerated vector during the duration of the alignment period. Navigational errors of 8 knots may be experienced after a successful IFA.

CENTRAL COMPUTER FAILURE

Central computer failure is not modeled in FSX and therefore is not modeled in the MilViz F-15E.

AVIONICS INTERFACE UNIT FAILURE

Avionics interface unit failure is not modeled in the MilViz F-15E. While FSX menu do facilitate failure of avionics master as well as individual instruments, the manner in which the AIU failure is not modeled.

MULTIPURPOSE DISPLAY PROCESSOR (MPDP) FAILURE

The MPDP is powered by four power supplies. These supplies are labeled A through D. Each of these four power supplies control dedicated displays and modes, and therefore a failure of any of the four supplies will cause performance and display degradations. The systems lost through supply failures are:

Power Supply A Failure

- FWD MPCD
- Right Aft MPD
- Displays off 1553 Bus A
- GP I/O (backup mode capability)
- 1553 avionics bus
- SGP Bus A
- JTIDS 1553
- Radar

Power Supply B Failure

- Aft right MPCD
- Fwd right MPD
- EWWS, OWS, RWR
- Displays off 1553 Bus B
- SGP Bus B

Power Supply C Failure

- Aft left MPCD
- HUD backup mode
- Displays off 1553 Bus B
- Radar
- Fwd left MPD

Power Supply D Failure

- Displays off 1553 Bus A
- VTR
- Aft left MPD
- HUD (primary)
- TEST PATTERN (on initiated BIT)

NOTE

In the event of a power supply C or D failure, removing power from the CC will result in six display backup mode of operation.

If a total MPDP failure occurs, all systems which require an MPD/MPCD or HUD to be displayed (i.e. radar, INS, PACS) are lost. The EMDs and the standby instruments are still functional.

NOTE

If several front and rear cockpit displays go blank or display STANDBY, a recycle of power to MPDP should return the system to normal operation.

LANDING

CONTROLLABILITY CHECK

If handling characteristics for recovery are suspect, perform a controllability check. If recovery is possible, plan to fly the final approach at the AOA determined in the controllability check, and delay reducing power until well into the flare.

1. Attain a safe altitude
2. Reduce gross weight to minimum practicable
3. Establish landing configuration (Use of flaps is not recommended if structural damage to the wing is suspected).
4. Slow aircraft to no less than on-speed AOA (20-22 units)

If recovery is possible –

5. Maintain landing configuration and fly straight-in approach no slower than AOA determined in step 4
6. Delay reducing power until well into the flare

If recovery is not possible –

5. Eject (Eject over ideal location for optimal chance of successful recovery).

SINGLE-ENGINE OPERATION

Single-engine operation provides adequate power for flight. Since loss of electric and hydraulic redundancy is the major concern, make every attempt, consistent with safety and prudence, to have the ailing engine running, even at idle. Otherwise, normal procedures should be followed, making appropriate allowance for reduced thrust. Reduce gross weight as practicable. Plan ahead to avoid situations requiring high thrust levels. A windmilling engine can cause repeated flight control transients, reduced control sensitivity, momentary split flaps, and CAS disengagements as the hydraulic switchover valves operate. After PC pressure has decreased to near zero, these anomalies will cease.

Approaches to landing should be made on a straight-in final with a normal glidepath and ideally flown under visual conditions.

WARNING

Failure of the surviving engine while on final approach is a very critical issue and unless already established in the flare, should lead to immediate ejection. Ejection at very low altitude and with an established sink rate can cause increased risk of injury during the ejection sequence.

FLAP MALFUNCTIONS

If a split-flap situation occurs and the flaps cannot be retracted, fly a wider than normal pattern using normal AOA and airspeeds. Sufficient control will be available either CAS-ON or CAS-OFF under most configurations. A controllability check should be performed. With CAS-ON, only a slight rolling tendency will be noticed. With CAS-OFF, the tendency for roll is more pronounced but still not severe.

BLOWN TIRES

Selecting PULSER prevents continuous loss of brake pressure due to skid sensing on the blown tire and allows braking on the good tire. If both main tires are blown, be prepared to counter any skid with timely nose gear steering inputs in the direction of the skid.

Spontaneous tire failure is not modeled in FSX.

ANTI-SKID MALFUNCTION

Anti-skid braking failure is not modeled on the MilViz F-15E.

HYDRAULIC FAILURE

Refer to hydraulic flow diagram (Figure 3-2) and BIT panel for systems affected.

A failure of a single hydraulic system is not considered a critical item because of the fully dual redundancy of the aircraft's hydraulic system. UTL A supports the operation of the landing gear. Therefore, failure of UTL A does require aircrew action to lower the landing gear by alternate method.

UTL A FAILURE

A UTL A failure is the only single hydraulic failure which requires aircrew action:

1. Landing gear – EXTEND (Use Landing Gear Emergency Extension procedures).
2. Emergency brake/steer handle – PULL AFTER NOSEWHEEL IS ON THE GROUND (Pulling the emergency brake handle above 70 KCAS increases the possibility of blown tires).

UTL A AND PC2 A FAILURE

A UTL A and PC2 A failure reduces aircraft control appreciably. The pitch ratio and roll ratio CAUTIONS will be visible.

When UTL A and PC2 A Cautions are present –

1. Slow to subsonic speed
2. Conduct controllability check
3. Landing gear – EXTEND (Use Landing Gear Emergency Extension procedures).
4. Emergency brake/steer handle – PULL AFTER NOSEWHEEL IS ON THE GROUND (Pulling the emergency brake handle above 70 KCAS increases the possibility of blown tires).

TOTAL UTILITY SYSTEM FAILURE

A UTL B caution light and a decreasing utility system hydraulic pressure will be the primary early indication of a total system failure. When UTL A subsequently fails, pitch ratio may fluctuate when the CSBPC switches to back-up hydraulic power (PC2 A).

If this fluctuation produces undesirable flight effects, place the pitch ratio switch to emergency. A PC1 B or PC2 B caution followed by a UTL A caution also indicates possible total utility system failure. In either case, if there is a possibility of a total utility hydraulic system failure, considerations should be given to lowering the landing gear normally before UTL A fails completely. Engines should be shut down as soon as possible after landing consistent with runway distance remaining to avoid cavitation damage to the utility hydraulic pumps.

Upon indications of total utility system failure –

1. Land as soon as possible
2. Landing gear – EXTEND (If necessary, use Landing Gear Emergency Extension procedures).
3. Emergency brake/steer handle – PULL AFTER NOSEWHEEL IS ON THE GROUND (Pulling the emergency brake handle above 70 KCAS increases the possibility of blown tires).

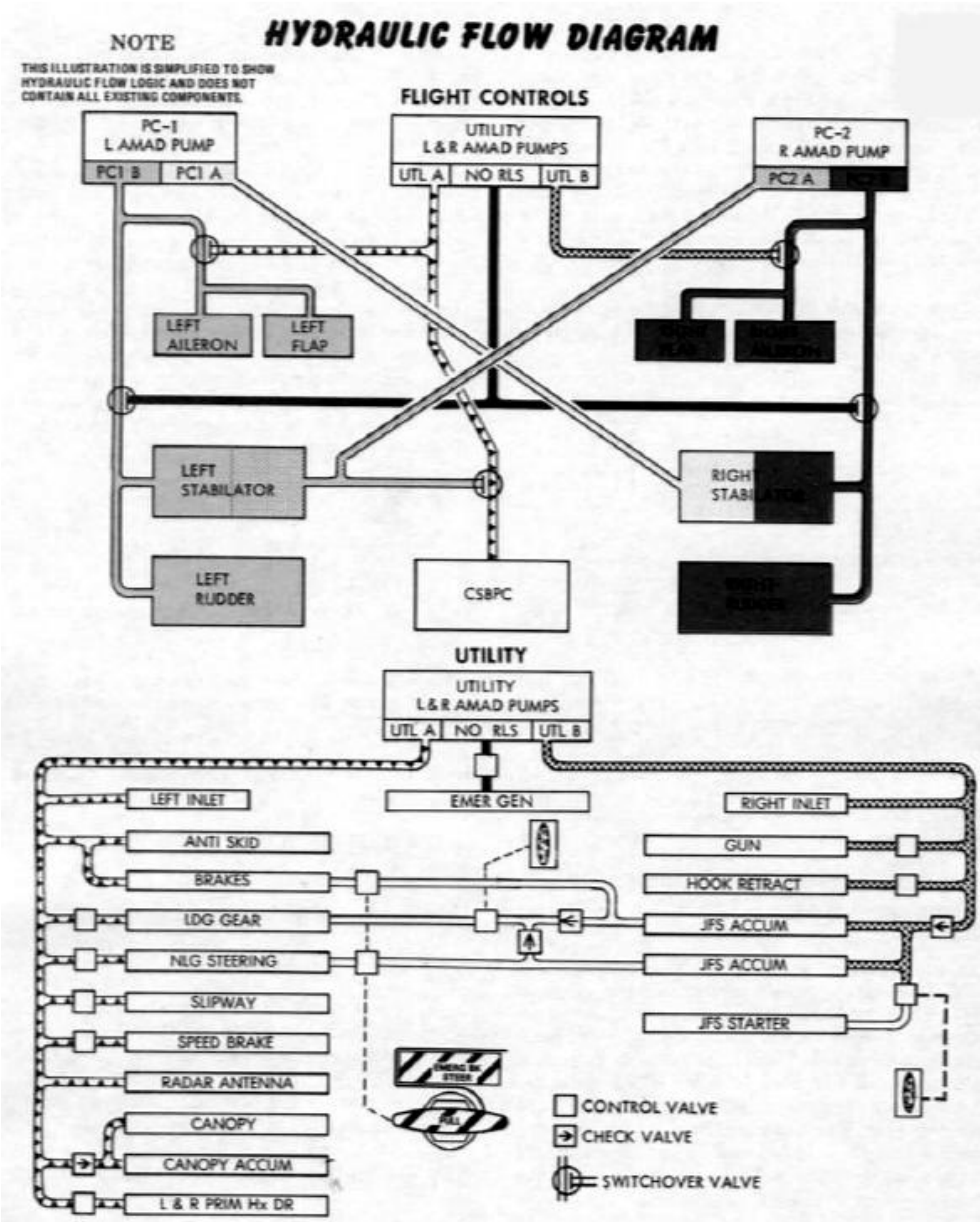

HYDRAULIC FLOW DIAGRAM
NOTE
THIS ILLUSTRATION IS SIMPLIFIED TO SHOW HYDRAULIC FLOW LOGIC AND DOES NOT CONTAIN ALL EXISTING COMPONENTS.
FLIGHT CONTROLS
PC-1
L AMAD PUMP
PC1 B
PC1 A
UTILITY
L & R AMAD PUMPS
UTL A
NO RLS
UTL B
PC-2
R AMAD PUMP
PC2 A
LEFT AILERON
LEFT FLAP
LEFT STABILATOR
LEFT RUDDER
CSBPC
UTILITY
UTILITY
L & R AMAD PUMPS
UTL A
NO RLS
UTL B
EMER GEN
LEFT INLET
ANTI SKID
BRAKES
LDG GEAR
NLG STEERING
SLIPWAY
SPEED BRAKE
RADAR ANTENNA
CANOPY
CANOPY ACCUM
L & R PRIM Hx DR
RIGHT INLET
GUN
HOOK RETRACT
JFS ACCUM
JFS ACCUM
JFS STARTER
CONTROL VALVE
CHECK VALVE
SWITCHOVER VALVE

Figure 3-2

LANDING GEAR UNSAFE

If one or both main gear indicate unsafe, but all gear are visually confirmed to have extended and appear to be locked, leave the gear handle down and perform a normal approach and landing with minimum touchdown force and minimum braking action. Runway length should be factored in to account for additional float and increased stopping distances. Use of nosewheel steering should be minimized and applied in a smooth manner.

If all three gear extend without any of the three gear down indicator lights on, and a gear down condition is visually confirmed (either by tower controller or wingman), then a circuit breaker is likely popped.

If unable to visually confirm the landing gear down condition, or if visual confirmation is made that one or more gear has failed to extend, refer to Landing Gear Emergency Extension procedures.

If landing gear failure is indicated –

1. Obtain visual confirmation of gear status (if practical)

If gear visually confirmed down –

2. Anti-skid – OFF/PULSER

If one or both main gear indicate unsafe –

3. If conditions warrant, conduct a normal approach with softest possible touchdown and minimum braking and nosewheel steering inputs (if one main gear is unsafe, land on the good gear and keep full aileron input to keep the failed gear off the ground as long as possible).

If nose gear indicates unsafe –

3. Make normal landing (use maximum aft stick force as necessary to keep nose gear off the ground as long as possible, or to keep nose radome off the ground as long as possible).

If gear not visually confirmed down –

2. Use Landing Gear Emergency Extension procedure

LANDING GEAR EMERGENCY EXTENSION

Failure of the gear to extend may be caused by loss of UTL A hydraulic pressure, mechanical or electrical failure of a system component, or physical jamming of the gear. Pulling the emergency landing gear handle (far enough out to lock) bypasses the normal electrical and hydraulic controls and port JFS accumulator pressure to open the gear doors and unlock the landing gear. The landing gear, aided by air loads, then free falls to down and locked. Providing no component or UTL A failure exists, resetting the emergency landing gear handle with the normal handle DOWN will restore pressure to the extend side of the gear actuator, close the landing gear doors, and allow JFS accumulator to recharge.

If failure to extend is due to a mechanical jam, repeated cycling with the normal system may be the only method to dislodge the object causing the jam. If normal hydraulic and electrical power are available and completion of the following steps does not successfully extend the gear, restore normal system operation by pushing the emergency landing gear handle in and ensuring the circuit breaker is in. Attempt to extend the landing gear normally several times. Pause 10 seconds between each attempt and pull positive G during the extension cycle. If this fails, refer to Landing With Abnormal Gear Configuration.

1. Airspeed – BELOW 250 KCAS
2. Landing gear handle – DOWN
3. Emergency landing gear handle – PULL UNTIL LOCKED (Yawing the aircraft and slowing to below 200 KCAS may aid in obtaining gear down indications).

With UTL A pressure zero –

4. Emergency landing gear handle – RESET

If any gear fails to extend –

5. Landing gear control circuit breaker – PULL, WAIT AT LEAST 30 SECONDS
6. EMERGENCY LANDING GEAR HANDLE – PULL

If gear extend –

7. Landing gear control circuit breaker – RESET

If gear still fails to extend or cannot be visually confirmed down –

8. Refer to Landing Gear Emergency – Landing, Figure 3-4

If any gear retracts –

5. Emergency landing gear handle – PULL (DO NOT RESET)

LANDING WITH ABNORMAL GEAR CONFIGURATION

There are essentially three types of abnormal gear indications for landing:

- All gear retracted (or not locked down)
- Nose gear retracted (or not locked down)
- One or both main gear retracted (or not locked down)

All three conditions call for a normal approach glidepath on normal approach speeds. The only differences are various techniques employed during the flare, touchdown, and initial landing rollout. In all such landings, crash-fire rescue (CFR) should be notified and standing by at the runway environment to provide immediate response. Runway of optimal length should also be selected.

LANDING WITH ALL GEAR RETRACTED OR NOT LOCKED DOWN

When all three landing gear are jammed in the retracted position, or are not indicating extended and locked, all the gear should be assumed unreliable. Effort should be made to make a normal stabilized approach on speed until crossing runway threshold. At the point of flare, slightly more power should be maintained so as to ensure a soft touchdown with minimal descent velocity. Rudder should be used to maintain runway centerline orientation. Below 70 KCAS, rudder effectiveness will reduce and the pilot will lose ability to ensure runway centerline alignment.

A runway environment with a minimum of side obstructions should be used. Additionally, if possible, select a runway with sufficient distance remaining to skid to a stop.

If optimal runway conditions are not possible, consider ejecting over the airport environment with the aircraft pointed away from populated areas.

LANDING WITH NOSE GEAR RETRACTED OR NOT LOCKED DOWN

Landing with both main gear fully extended and locked but nose gear retracted or not locked down is not considered a critical emergency. Use of normal approach, flare, and touchdown technique should allow the pilot to use the rudder after touchdown to maintain runway centerline. Strong consideration should be given to select a runway oriented as close as possible into the wind, but should not come at the expense of inadequate runway distance to facilitate the longer than expected stopping distance.

After touchdown, the pilot should use all available elevator authority to keep the nose gear off the ground, or if the nose gear is jammed in the retracted position, to keep the nose radome off the ground as long as possible. Contact of either should only be made at the minimum airspeed possible. However, the pilot should ensure enough elevator authority is retained to facilitate a soft touchdown of the nose gear of radome.

After the nose gear or radome touches the ground, rudder should be avoided if the nose gear is partially extended as any nose wheel movements could cause ground looping. If the nose gear is confirmed to be fully retracted, then rudder can be used after nose radome contact on the ground to help avoid ground looping, but control inputs must be smooth and steady so as to avoid inducing a ground loop.

LANDING WITH ONE OR MORE MAIN GEAR RETRACTED OR NOT LOCKED DOWN

The most critical situation is landing with the nose gear extended, with one of the two main gear extended but the second either jammed in the retract configuration, or partially extended but not locked. Visual inspections should be made to try to determine whether the main gear with faulty indication is likely suffering a false indication. If the main gear is merely a false indication, then a normal landing may be performed, but special caution observed to anticipate a gear collapse at any time during the landing gear rollout.

If the suspect main gear is confirmed visually to be jammed, then runway selection becomes a critical component of successful landing. If a runway of sufficient length is available that is oriented directly into the wind, it should be selected. Crosswind landings should be avoided if possible, but runway length should be prioritized over crosswind considerations.

If a crosswind landing is necessary, the approach should be made so as to have the good main gear on the upwind side of the aircraft. This will allow the pilot to ensure that gear makes first contact with the ground. Regardless, the pilot must make every effort to bank the aircraft as necessary to ensure only the good main gear contacts the runway, and aileron and rudder should be used to keep the bad gear off the runway as long as possible while using rudder to keep the nose pointed down the runway centerline.

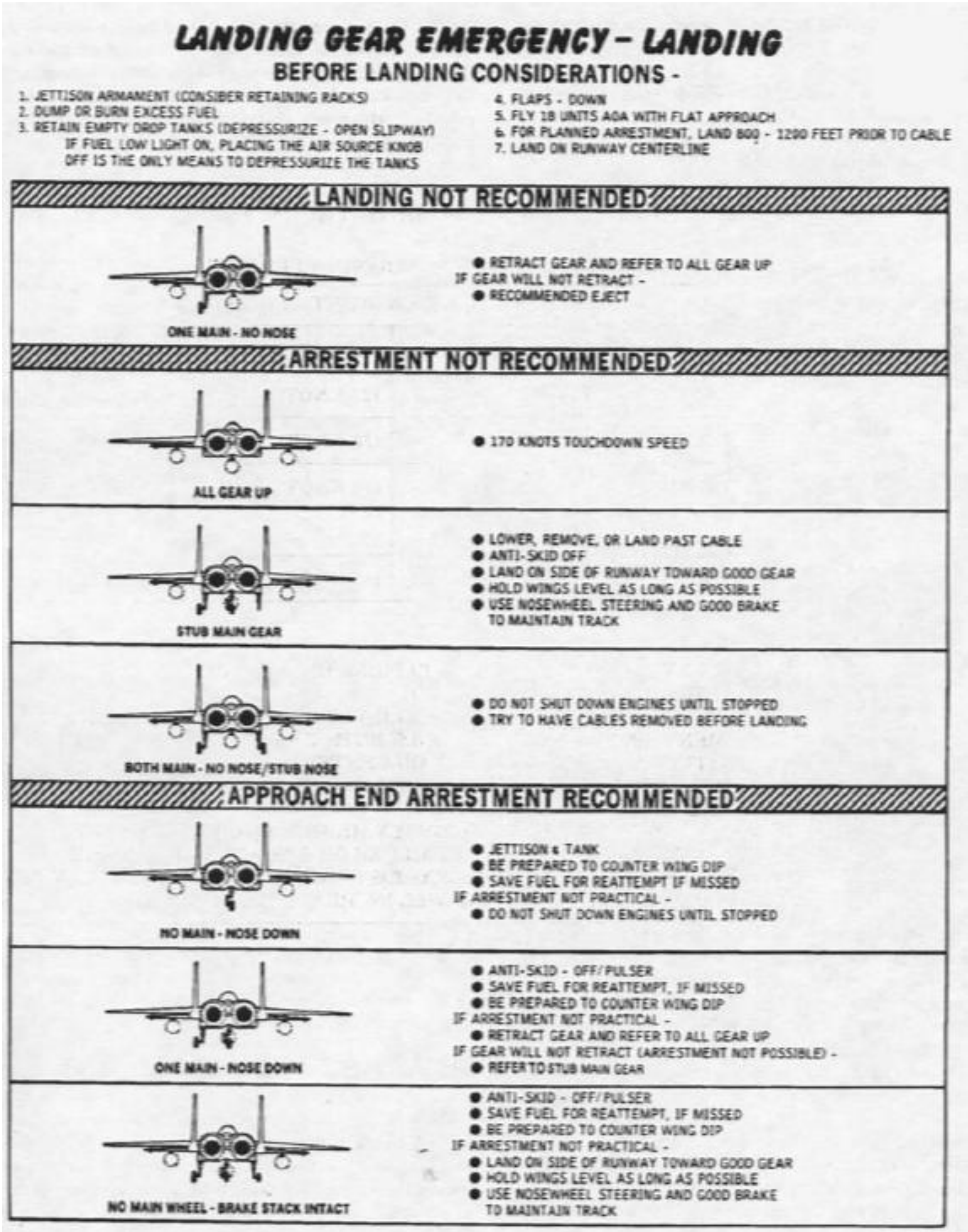
The pilot should also retain enough aileron authority to softly fly the bad gear side down to the runway while also having rudder authority to attempt to counter the expected yaw toward the side of the aircraft with the bad landing gear. The pilot and WSO should anticipate a ground loop as well as the aircraft veering off the side of the runway. CFR should therefore be immediately available and lined up on the side of the runway facing the good main gear side of the aircraft. CFR should also follow the aircraft as it rolls/slides down the runway.

NOTE

If single main landing gear failure is noted, it should be considered preferable to retract all landing gear and implementing the Landing With All Gear Retracted procedures.

Also, given the FSX does not model a working arrester or barrier landing system on land-based runways, the procedures associated with planned arrester landing are not discussed for the MilViz F-15E.

Additional procedures and techniques are covered in Figure 3-4.



LANDING GEAR EMERGENCY – LANDING

BEFORE LANDING CONSIDERATIONS -

1. JETTISON ARMAMENT (CONSIDER RETAINING RACKS)
2. DUMP OR BURN EXCESS FUEL
3. RETAIN EMPTY DROP TANKS (DEPRESSURIZE - OPEN SLIPWAY)
   IF FUEL LOW LIGHT ON, PLACING THE AIR SOURCE KNOB OFF IS THE ONLY MEANS TO DEPRESSURIZE THE TANKS
4. FLAPS - DOWN
5. FLY 18 UNITS AOA WITH FLAT APPROACH
6. FOR PLANNED ARRESTMENT, LAND 800 - 1200 FEET PRIOR TO CABLE
7. LAND ON RUNWAY CENTERLINE

LANDING NOT RECOMMENDED

ONE MAIN - NO NOSE
- RETRACT GEAR AND REFER TO ALL GEAR UP

IF GEAR WILL NOT RETRACT -
- RECOMMENDED EJECT

ARRESTMENT NOT RECOMMENDED

ALL GEAR UP
- 170 KNOTS TOUCHDOWN SPEED

STUB MAIN GEAR
- LOWER, REMOVE, OR LAND PAST CABLE
- ANTI-SKID OFF
- LAND ON SIDE OF RUNWAY TOWARD GOOD GEAR
- HOLD WINGS LEVEL AS LONG AS POSSIBLE
- USE NOSEWHEEL STEERING AND GOOD BRAKE TO MAINTAIN TRACK

BOTH MAIN - NO NOSE/STUB NOSE
- DO NOT SHUT DOWN ENGINES UNTIL STOPPED
- TRY TO HAVE CABLES REMOVED BEFORE LANDING

APPROACH END ARRESTMENT RECOMMENDED

NO MAIN - NOSE DOWN
- JETTISON ¢ TANK
- BE PREPARED TO COUNTER WING DIP
- SAVE FUEL FOR REATTEMPT IF MISSED

IF ARRESTMENT NOT PRACTICAL -
- DO NOT SHUT DOWN ENGINES UNTIL STOPPED

ONE MAIN - NOSE DOWN
- ANTI-SKID - OFF/PULSER
- SAVE FUEL FOR REATTEMPT, IF MISSED
- BE PREPARED TO COUNTER WING DIP

IF ARRESTMENT NOT PRACTICAL -
- RETRACT GEAR AND REFER TO ALL GEAR UP

IF GEAR WILL NOT RETRACT (ARRESTMENT NOT POSSIBLE) -
- REFER TO STUB MAIN GEAR

NO MAIN WHEEL - BRAKE STACK INTACT
- ANTI-SKID - OFF/PULSER
- SAVE FUEL FOR REATTEMPT, IF MISSED
- BE PREPARED TO COUNTER WING DIP

IF ARRESTMENT NOT PRACTICAL -
- LAND ON SIDE OF RUNWAY TOWARD GOOD GEAR
- HOLD WINGS LEVEL AS LONG AS POSSIBLE
- USE NOSEWHEEL STEERING AND GOOD BRAKE TO MAINTAIN TRACK

Figure 3-3

EMERGENCY POWER DISTRIBUTION

EMERGENCY GENERATOR OPERATING
SWITCH IN AUTO OR MAN

L GEN OUT **R GEN OUT**

INOPERATIVE EQUIPMENT

ENGINE-
- AB BURN THRU DETECTION
- CFT AFT TRANSFER PUMPS
- ENGINE ANTI-ICE
- ENGINE OIL PRESSURE INDICATIONS
- FUEL FLOW INDICATORS
- FUEL TRANSFER PUMPS
- ICE DETECTOR
- L&R BOOST PUMPS
- L&R DUCT TEMP PROBE HEATERS
- L&R ENG INLET CONTROLLERS
- L&R TOTAL TEMP PROBE HEATERS
- NOZZLE POSITION INDICATIONS
- F-15E 90-233 AND UP, ASYMMETRIC THRUST DEPARTURE PREVENTION SYSTEM

FLIGHT INSTRUMENTS-
- ANGLE OF ATTACK INDICATOR
- VERTICAL VELOCITY INDICATORS

NAVIGATION EQUIPMENT-
- ADF
- ATTITUDE HEADING REFERENCE SYSTEM
- IFF INTERROGATOR
- ILS
- KY-58
- STANDBY COMPASS LIGHT
- TACAN
- UHF R/T NO.2

OTHER-
- AIR DATA COMPUTER
- AIU NO.2
- ANTI-COLLISION LIGHTS
- CENTRAL COMPUTER
- CONSOLE LIGHTS
- FORMATION LIGHTS
- HUD
- INSTRUMENT LIGHTS
- IRE (IFF REPLY EVALUATOR)
- JETTISON (USING A/G SELECT AND SELECT JETTISON CONTROLS)
- KIR (INTERROGATOR COMPUTER)
- KIT (TRANSPONDER COMPUTER)
- LANTIRN POD
- LANDING & TAXI LIGHTS
- MPCD (REAR)
- MPD'S (ALL)
- OVERLOAD WARNING
- OXYGEN GAGE
- PC-1 HYD PRESS INDICATOR
- PC-2 HYD PRESS INDICATOR
- PITCH RATIO INDICATOR
- POSITION LIGHTS
- RADAR
- RADAR ALTIMETER
- RMR
- SEAT ADJUST
- TEW (RWR, EWWS, ICS)
- TIS
- UTILITY HYD PRESS IND
- UTILITY FLOOD LIGHT (REAR CKPT)
- VERTICAL TAIL LIGHTS
- VTRS
- WPN NORM RELEASE/LAUNCH
- WINDSHIELD ANTI-ICE SYSTEM

Figure 3-4 Page 1

EMERGENCY POWER DISTRIBUTION

EMERGENCY GENERATOR OPERATING

SWITCH IN AUTO OR MAN

L GEN OUT   R GEN OUT

OPERATIVE EQUIPMENT

ENGINE-

- AMAD FIRE DETECTION SYS
- AMAD FIRE EXTINGUISHER SYS
- BLEED AIR LEAK DETECTOR
- EMER FUEL BOOST PUMP
- [1] ENG AND A/B IGNITION
- ENG FIRE EXTINGUISHER SYSTEM
- ENG FIRE DETECTION SYSTEM
- ENG RPM INDICATION
- FTIT INDICATION
- FUEL DUMP (EXT TANKS ONLY)
- FUEL LOW AND BINGO LIGHTS
- [1] FUEL PRESS AND VENT
- FUEL QUANTITY INDICATORS
- L & R ENG FUEL SHUTOFF VALVES
- SELECTED CFT CENTER TRANSFER PUMP

FLIGHT INSTRUMENTS

- [1] STANDBY AIRSPEED
- [1] STANDBY ALTIMETER
- STANDBY ATTITUDE INDICATOR

NAVIGATION EQUIPMENT-

- INTERCOM
- [2] IFF TRANSPONDER
- INS
- UHF R/T NO.1

OTHER-

- AERIAL REFUELING
- AERIAL REFUELING FLOOD LIGHTS
- AFCS/CAS
- AIU NO.1
- AN/ALE-45 CMD
- ANTENNA SELECT
- ANTI-SKID
- ARRESTING HOOK
- CHART LIGHTS
- EMERGENCY JETTISON POWER (EMERG JETT BUTTON)
- ENVIRONMENTAL CONTROL SYSTEM
- FLAPS
- ICSCP/RICP
- LANDING GEAR
- LANDING GEAR POSITION INDICATORS
- MASTER CAUTION RESET
- MPCD-FRONT (EADI FORMAT ONLY)
- MPDP
- NOSEWHEEL STEERING
- PITCH RATIO
- PULSER BRAKE SYSTEM
- SPEEDBRAKE
- STORM/FLOOD LIGHTS
- TRIM (AIL/RUD/STAB)
- UP-FRONT CONTROLS
- UTILITY FLOOD LIGHT (FRONT CKPT)
- VOICE WARNING SYSTEM
- WARNING/CAUTION/ADVISORY LIGHTS
- WARNING/CAUTION/ADVISORY LIGHTS TEST

Figure 3-4 Page 2

EMERGENCY POWER DISTRIBUTION

EMERGENCY GENERATOR OPERATING

SWITCH IN ISOLATE

OPERATIVE EQUIPMENT

- AERIAL REFUELING (DEGRADED OPERATION)
- ARRESTING HOOK
- EMER BST ON CAUTION LIGHT
- EMER FUEL BOOST PUMP
- [1] EMERGENCY NOSEWHEEL STEERING
- [1] ENG AND A/B IGNITION
- ENG RPM AND FTIT INDICATIONS
- [1] FUEL PRESS AND VENT
- [1] STANDBY AIRSPEED
- [1] STANDBY ALTIMETER

NOTE

[1] ALTHOUGH OPERATIVE, ITEMS ARE NOT POWERED BY THE EMERGENCY GENERATOR

[2] WHEN ANY MODES ARE SELECTED, THE IFF TRANSPONDER WILL SQUAWK EMERGENCY (ONLY WITH WEIGHT OFF WHEELS)

Figure 3-4 Page 3

Warning/Caution/Advisories

DISPLAY	CAUSE	CORRECTIVE ACTION/REMARKS
RED WARNING LIGHTS		
AI	Air intercept threat	Information
AMAD FIRE	Fire condition	Refer to emergency procedure (Front cockpit only)*
L BURN THRU R BURN THRU	Abrupt temperature change in AB section	Retard throttles out of AB range (Front cockpit only)
CANOPY UNLOCKED	Canopy unlocked or canopy actuated initiator lanyard disconnected	GROUND: Relock canopy or connect lanyard AIR: Airspeed - 200 KNOTS Cockpit pressure - DUMP Canopy - LOCK
FIRE	Excessive temperature in indicated area	Refer to emergency procedures
Landing Gear Handle	Gear up and aircraft in landing regime, gear not in selected position, no control power, or ADC failed	Climb or Refer to emergency procedures*
LOW ALT (LOW ALTITUDE)	Aircraft has descended below 75% of set clearance plane value or AFCS system determines or predicts you will reach less than 75% of ground clearance if action not taken	Climb to proper altitude and check system for problems
LOW ALT	Aircraft has descended below LAW altitude selected in UFC menu 1	Climb above LAW altitude
OBST	Obstacle in flight path requiring more than 2g to clear	Climb or turn
SAM	Missile threat	Information
TF FAIL	Terrain following failed	Do not rely on terrain following indications
UNSAFE	Gear up and aircraft in landing regime, gear not in selected position, no control power, or ADC failed	Information (Rear cockpit only)
* ADDITIONAL INFORMATION AVAILABLE IN THIS SECTION		

Figure 3-5 Page 1

Warning/Caution/Advisories (CONT)

DISPLAY	CAUSE	CORRECTIVE ACTION/REMARKS
YELLOW CAUTION LIGHTS (CAUTION LIGHT PANEL)		
AV BIT	Avionics BIT failure	Check BIT display on MPD/MPCD If FLT CONTR caution also on - Refer to LAT STK LMT caution*
BST SYS MAL	Emergency boost pump logic malfunction	Refer to emergency procedure*
CHAFF	Flashing: Dispensing chaff Steady: Chaff dispenser empty	Information
DISPL FLO LO	Inadequate cooling air flow to cockpit displays	Refer to emergency procedure*
EMER BST ON	Emergency boost pump supplying pressure	Check BST SYS MAL caution out/off
ENGINE	Engine systems failure	Check MPD/MPCD cautions
FLARE	Flashing: Dispensing flares Steady: Flare dispenser empty	Information
FLYUP ARM	Flyup enable switch ON	Information (Rear cockpit only)
FLT CONTR	Flight control system failure	Check MPD/MPCD cautions
FUEL LOW	Left feed tank below 540 pounds and/or Right feed tank below 960 pounds	Use minimum power - Check all tanks
L GEN R GEN	Left/right generator failure	Refer to emergency procedure*
HYD	Hydraulic systems failure	Check MPD/MPCD cautions
MINIMUM	Dispensable stores at predetermined level	Information
NUCLEAR	Nuclear armament malfunction	Check armament display
1 OXYGEN	Oxygen concentration is below acceptable limits	Refer to Emergency Procedues

NOTES

*ADDITIONAL INFORMATION AVAILABLE IN THIS SECTION

1 F-15E 90-0233 AND UP; ALSO F-15E 86-0183 THRU 90-232 AFTER TO 1F-15E-561

Figure 3-5 Page 2

Warning/Caution/Advisories (CONT)

DISPLAY	CAUSE	CORRECTIVE ACTION/REMARKS
YELLOW CAUTION LIGHTS (MISCELLANEOUS)		
EMIS LMT	EMIS LMT switch ON	Information
FLAPS	Flaps in transit	Information
LASER ARMED	Target pod laser armed	Information (Front cockpit only)
LOCK/SHOOT	Steady: Radar locked on Flashing: Shoot cue	Information (Canopy bow)
MASTER CAUTION	One or more cautions displayed	Check caution lights and MPD/MPCD
HUD WARNINGS (TF)		
FLYUP	Flyup initiated	Recover aircraft to safe altitude and determine cause of flyup
G-LIMIT	Flyup command greater than 2.1g	Climb to 0g command. Recover at safe altitude. Determine cause of failure.
OBSTACLE	Obstacle requiring more than 2.0g is in aircraft flight path	Climb or turn away from obstacle
TF FAIL	Terrain following failed	Recover aircraft to safe altitude. Determine cause of failure.
TF LOW	Below 75% of selected terrain clearance or predicted to descend below 75% of selected clearance	Climb and recover aircraft to safe altitude. Determine cause of descending below set clearance.
HUD CAUTIONS (TF)		
ROLL	Roll angle exceeding 45° in TF mode	Decrease roll angle below 45°
TURN RATE	TF mode turn rate exceeded	Reduce turn rate
TURN ACCEL	TF mode turn acceleration limit exceeded	Reduce turn acceleration
DIVE	Dive angle $\geq$ 15°	Reduce dive angle to $<$ 15°
UNARMED	Malfunctions preclude auto flyup	Determine cause of flyup fault
INS LIMIT	Drift, pitch or vector angle exceeded	Reduce exceeded limit
AIRSPEED	Airspeed too slow to accomplish flyup maneuver or exceeding TF radar limit	Adjust speed accordingly
NO TERRAIN	TF radar cannot determine terrain altitude	Information. Continue following TF commands.

Figure 3-5 Page 3

Warning/Caution/Advisories (CONT)

DISPLAY	CAUSE	CORRECTIVE ACTION/REMARKS
	HUD CAUTIONS (cont)	
ECCM	Jamming interfering with TF radar	Select TF Radar ECCM mode if appropriate
N-F LOS	NAV FLIR LOS out of tolerance	Use NAV FLIR only with extreme caution
N-F BRST	NAV FLIR in boresight mode	Forward TDC may be used to slew NAV FLIR video
	MPD/MPCD CAUTIONS	
ANTI-SKID	Anti-skid inoperative or OFF	Refer to emergency procedure*
ATTITUDE	Unreliable attitude source	Check standby attitude indicator* Select operable mode
AUTO PLT	Auto pilot malfunction and /or mode disengagement	Information
BINGO FUEL	Fuel at preset amount	Information
CAUTION	Caution lights are no longer functional	Information, cautions are not being displayed
L BLEED AIR R BLEED AIR	Left/right bleed air leak or overtemperature	Refer to emergency procedure*
BST SYS MAL	Emergency boost pump logic malfunction	Refer to emergency procedure*
L BST PUMP R BST PUMP	Left/right boost pump failure	Refer to emergency procedure*
CAS PITCH	Control augmentation system inoperative or disengaged in mode shown	CAS pitch - RESET
CAS ROLL		CAS roll - RESET
CAS YAW		CAS yaw - RESET/CAS roll - RESET
ECS	Environmental control system flow low or high temperature	Refer to emergency procedure*
L ENG CONTR R ENG CONTR	Left/right DEEC failed, Mach number failure, engine overspeed, AB inhibited, or switch OFF	Refer to emergency procedure*
EMER BST ON	Emergency boost pump supplying pressure	Check BST SYS MAL caution off/out
FIRE SENSOR	Failed fire/temperatue sensor	Information

* ADDITIONAL INFORMATION AVAILABLE IN THIS SECTION

Figure 3-5 Page 4

Warning/Caution/Advisories (CONT)

DISPLAY	CAUSE	CORRECTIVE ACTION/REMARKS
MPD/MPCD CAUTIONS (CONT)		
FUEL HOT	Engine fuel temperature	Throttles - ADVANCE AS FEASIBLE Ground: If light does not go out within five minutes - ABORT
HOOK	Hook unlocked	Slow and cycle hook
IFF MODE 4	Mode 4 OUT/zeroized or not responding	Check mode 4 not in OUT Check proper A or B code
INLET ICE	Ice buildup in left engine inlet	Anti-ice engine heat switch - ON
L INLET	Left/right engine inlet control failure	Refer to emergency procedure *
R INLET		
JFS LOW	JFS accumulator pressure low	JFS start/emergency gear/brakes/steering may be inoperative*
LAT STK LMT	AFCS failure	Do not exceed 1/2 lateral stick Refer to LAT STK LMT caution*
NAV POD HOT	Navigation pod overtemperature	Turn OFF NAV FLIR and TF RDR
L OIL PRESS	Left/right oil pressure low	Check oil pressure
R OIL PRESS		
OXY LOW	4 liters oxygen remaining	Below 1/2 liter - Descend below 10,000 feet MSL
PC1 A	Designated RLS valve has actuated to shut off subsystem	Refer to Hydraulic Flow Diagram for systems affected*
PC1 B		
PC2 A		
PC2 B		
PITCH RATIO	CSBPC failure, pitch ratio failure or EMERG selected	Pitch ratio switch - EMERG*
L PUMP	Left/right utility pump pressure low	Information
R PUMP		
ROLL RATIO	Roll ratio incorrect or EMERG selected	Roll ratio switch - EMERG*

*ADDITIONAL INFORMATION AVAILABLE IN THIS SECTION

Figure 3-5 Page 5

Warning/Caution/Advisories (CONT)

DISPLAY	CAUSE	CORRECTIVE ACTION/REMARKS
MPD/MPCD CAUTIONS (CONT)		
RUDR LMTR	Rudder limiter not scheduling properly	No high speed large rudder input Verify rudder available before landing
TGT POD HOT	Target pod overtemperature	Turn OFF Pod
TOT TEMP HI	Critical inlet temperature (3 minute limit)	Reduce airspeed
UTL A	Designated RLS valve has actuated to shut off system	Refer to Hydraulic Flow Diagram for systems affected* If UTL A and PC 2 failure - Refer to emergency procedure*
UTL B		
WNDSHLD HOT	Anti-ice air hot	Windshield anti-ice switch - OFF
XFER PUMP	Wing or CFT fuel transfer pump inoperative	Monitor wing and CFT fuel transfer*
GREEN ADVISORY LIGHTS		
AUTO TF	Auto terrain following selected	Information (Rear cockpit only)
FLAP	Flaps are down	Information
LEFT	Left main gear down and locked	Information
MASTER ARM	Master arm switch in ARM	Information (Rear cockpit only)
NOSE	Nose gear down and locked	Information
PROGRAM	Countermeasure dispenser in semi-auto mode and stored dispense program awaiting action	Information
RIGHT	Right main gear down and locked	Information
RCD	Recorder function commanded and record enabled	Information
READY (JFS)	JFS ready for engine engagement	Information
READY (AR)	Air refueling system ready	Information
T/O TRIM	Trim is takeoff position	Information
*ADDITIONAL INFORMATION AVAILABLE IN THIS SECTION		

Figure 3-5 Page 6

Warning/Caution/Advisories (CONT)

DISPLAY	CAUSE	CORRECTIVE ACTION/REMARKS
MPD/MPCD CAUTIONS (CONT)		
FUEL HOT	Engine fuel temperature	Throttles - ADVANCE AS FEASIBLE Ground: If light does not go out within five minutes - ABORT
HOOK	Hook unlocked	Slow and cycle hook
IFF MODE 4	Mode 4 OUT/zeroized or not responding	Check mode 4 not in OUT Check proper A or B code
INLET ICE	Ice buildup in left engine inlet	Anti-ice engine heat switch - ON
L INLET R INLET	Left/right engine inlet control failure	Refer to emergency procedure *
JFS LOW	JFS accumulator pressure low	JFS start/emergency gear/brakes/steering may be inoperative*
LAT STK LMT	AFCS failure	Do not exceed 1/2 lateral stick Refer to LAT STK LMT caution*
NAV POD HOT	Navigation pod overtemperature	Turn OFF NAV FLIR and TF RDR
L OIL PRESS R OIL PRESS	Left/right oil pressure low	Check oil pressure
OXY LOW	4 liters oxygen remaining	Below 1/2 liter - Descend below 10,000 feet MSL
PC1 A PC1 B PC2 A PC2 B	Designated RLS valve has actuated to shut off subsystem	Refer to Hydraulic Flow Diagram for systems affected*
PITCH RATIO	CSBPC failure, pitch ratio failure or EMERG selected	Pitch ratio switch - EMERG*
L PUMP R PUMP	Left/right utility pump pressure low	Information
ROLL RATIO	Roll ratio incorrect or EMERG selected	Roll ratio switch - EMERG*

*ADDITIONAL INFORMATION AVAILABLE IN THIS SECTION

Figure 3-5 Page 7

AFCS FUNCTIONAL STATUS SUMMARY

FUNCTIONAL STATUS	INDICATIONS	CREW ACTIONS	COMMENTS
PCAS FIRST FAIL	AV BIT LIGHT ON	●RESET AV BIT ●CALL UP BIT PAGE ●SELECT PCAS RESET TO POSSIBLY CLEAR FIRST FAIL	FLIGHT CONTROL SYSTEM REMAINS FUNCTIONAL. IF IN TF, IT REMAINS FUNCTIONAL.
PCAS DISENGAGE	MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON CAS PITCH CAUTION MESSAGE ON CRT CAS ROLL CAUTION MESSAGE ON CRT PITCH HANDLING QUALITIES DEGRADED NO AUTO PILOT MODES FLYUP COMMANDED IF IN ARMED MANUAL OR ATF NO AUTOMATIC ROLL TO WINGS LEVEL	●RESET MASTER CAUTION ●ATTEMPT RESET OF ... —CAS ROLL —CAS PITCH IF RESET FAILS: —STAY BELOW 600 KCAS ●CALL UP BIT PAGE AND CHECK IF CASI-SERVOLOOP HAS FAILED —IF PCAS NO RESET, SELECT PITCH RATIO EMERG AND REFER TO CASI SERVOLOOP STATUS. ●RECOVER FROM FLYUP AND ASSESS PROBLEM	
RCAS FIRST FAIL	AV BIT LIGHT ON	●RESET AV BIT ●CALL UP BIT PAGE AND DETERMINE PROBLEM ●SELECT RCAS RESET TO POSSIBLY CLEAR FIRST FAIL	FLIGHT CONTROL SYSTEM REMAINS FULLY FUNCTIONAL.
RCAS DISENGAGE	MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON CAS ROLL CAUTION MESSAGE ON CRT AUTO PLT caution if autopilot previously engaged POSSIBLE DEGRADED ROLL RESPONSE NO AUTOPILOT MODES (EXCEPT ATF)	●RESET MASTER CAUTION ●ATTEMPT RESET OF RCAS IF RESET FAILS —STAY BELOW 600 KCAS	DEGRADED ROLL DAMPING AND ROLL RESPONSE. NO ROLL AUTOPILOT, NO ROLL RATE LIMITING, ONLY 1/2 DIFFERENTIAL STABILATOR AVAILABLE.

Figure 3-6 Page 1

AFCS FUNCTIONAL STATUS SUMMARY (CONT)

FUNCTIONAL STATUS	INDICATIONS	CREW ACTIONS	COMMENTS
YCAS FIRST FAIL	AV BIT LIGHT ON	●RESET AV BIT ●CALL UP BIT PAGE ●SELECT YAW CAS RESET TO POSSIBLY CLEAR FIRST FAIL	FLIGHT CONTROL SYSTEM REMAINS FUNCTIONAL.
YCAS DISENGAGE	MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON CAS YAW AND ROLL MESSAGE ON CRT LATERAL/DIRECTIONAL STABILITY DEGRADED NO AUTO PILOT MODES (EXCEPT ATF)	●RESET MASTER CAUTION ●ATTEMPT RESET OF... —CAS YAW —CAS ROLL IF RESET FAILS —STAY BELOW 600 KCAS/ 1.7M (1.5M WITH CFTS AND LANTIRN) AND LAND AS SOON AS PRACTICAL	
SPIN RECOVERY	FIRST FAIL AV BIT LIGHT ON	●RESET AV BIT ●CALL UP BIT PAGE ●LIMIT LATERAL STICK INPUTS TO 1/2	IF SPIN RECOVERY IS LISTED BUT NOT CAS YAW, OR FULL MECHANICAL ROLL AUTHORITY INCORRECTLY SELECTED. SPIN RECOVERY AID MAY NOT BE AVAILABLE. HIGH ANGLE-OF-ATTACK HANDLING QUALITIES MAY BE DEGRADED. IF RESET FAILS AND BOTH SPIN RECOVERY AND CAS YAW ARE DISPLAYED, FULL MECHANICAL AUTHORITY IS NOT SELECTED IN SPIN.
SPIN RECOVERY WITH YAW CAS DISENGAGE	MASTER CAUTION ON CAS YAW CAUTION MESSAGE ON CRT	●RESET MASTER CAUTION ●ATTEMPT RESET OF CAS YAW ●CALL UP BIT PAGE ●IF IN A SPIN, PUT GEAR DOWN TO GET FULL AUTHORITY ●REDUCE MANEUVERS TO "YCAS DISENGAGE" LIMITS. ●LIMIT LATERAL STICK INPUTS TO 1/2 EXCEPT FOR SPIN RECOVERY.	
CAS ARI-(2ND FAIL)	AV BIT LIGHT ON	●RESET AV BIT ●CALL UP BIT PAGE ●REQUIRES COORDINATED FLIGHT CONTROL INPUTS .	POSSIBLE TO HAVE RELATED FAIL INDICATIONS, I.E., ● AOA FAIL ● ROLL LIMIT

Figure 3-6 Page 2

AFCS FUNCTIONAL STATUS SUMMARY (CONT)

FUNCTIONAL STATUS	INDICATIONS	CREW ACTIONS	COMMENTS
ROLL LIMIT	AV BIT LIGHT ON	●RESET AV BIT ●CALL UP BIT PAGE ●IF >550 KCAS/1.0M, LIMIT TO 1/2 STICK INPUTS	LATERAL ROLL AUTHORITY MAY BE INCORRECT. PITCH RATIO MAY BE INCORRECT.
ROLL LIMIT WITH LATERAL STICK LIMIT CAUTION	MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON LATERAL STICK LIMIT MESSAGE ON CRT	●RESET MASTER CAUTION ●LIMIT LATERAL STICK INPUTS TO 1/2	
AOA FAIL	MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON LATERAL STICK LIMIT MESSAGE ON CRT SPEEDBRAKE RETRACTS (IF EXTENDED)	●RESET MASTER CAUTION ●LIMIT LATERAL STICK INPUTS TO 1/2	
CASI SERVOLOOP	AV BIT LIGHT ON MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON CAS PITCH CAUTION MESSAGE ON CRT CAS ROLL CAUTION MESSAGE ON CRT	●RESET MASTER CAUTION ●ATTEMPT RESET OF... —ROLL CAS —PITCH CAS ●IF PITCH CAS NO RESET, CALL UP BIT PAGE ●IF CASI SERVOLOOP DISPLAYED, SELECT PITCH RATIO EMERG ●SELECT PITCH RATIO EMERG WHEN STRAIGHT AND LEVEL BELOW 500 KCAS/1.0 M. EXPECT G TRANSIENT FROM -1/2 TO +1.0G/SEC ●THEN, ATTEMPT RESET OF PITCH CAS	CASI SERVOLOOP FAIL WILL SHOW UP WITH PITCH CAS FAIL, ROLL CAS FAIL.
R/C/P STICK	AV BIT LIGHT ON MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON CAS PITCH CAUTION MESSAGE ON CRT CAS ROLL CAUTION MESSAGE ON CRT-	●RESET MASTER CAUTION ●RESET ROLL AND PITCH CAS ●CALL UP BIT PAGE AND DETERMINE FAILURE ●TURN CAS OFF TO IMPROVE RESPONSE, IF ONLY AFT STICK INPUTS ARE REQUIRED.	RCP STICK FORCE SENSOR HAS FAILED. RCP STICK INPUTS RESULTS IN REDUCED PERFORMANCE AND REDUCES RCP G CAPABILITY TO 3.5G MAXIMUM.

Figure 3-5 Page 3

AFCS FUNCTIONAL STATUS SUMMARY (CONT)

FUNCTIONAL STATUS	INDICATIONS	CREW ACTIONS	COMMENTS
CAS RUDDER PEDAL	AV BIT LIGHT ON MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON CAS YAW CAUTION MESSAGE ON CRT	●RESET MASTER CAUTION ●ATTEMPT RESET OF YAW AND ROLL CAS ●CALL UP BIT PAGE AND DETERMINE FAILURE	RUDDER PEDAL POSITION SENSOR HAS FAILED. LARGER PEDAL INPUTS REQUIRED TO OVERCOME CAS FOR EQUIVALENT RESPONSE. NORMAL MECHANICAL PLUS DAMPENING IS AVAILABLE.
ONE RUDDER CAS	AV BIT LIGHT ON MASTER CAUTION ON FLIGHT CONTROL CATEGORY LIGHT ON LATERAL STICK LIMIT MESSAGE ON CRT	●RESET MASTER CAUTION ●CALL UP BIT PAGE AND DETERMINE FAILURE ●LIMIT LATERAL STICK INPUTS TO 1/2 ●ATTEMPT YAW AND ROLL CAS RESET ●OBSERVE THE FOLLOWING LIMITS: - 525 KCAS WHEN > 1.6M. - WITH LANTIRN PODS. ●1.2 M < 18,000 FT ●600 KCAS, 18-34,000 FT. ●1.6M ABOVE 34,000 FT	RUDDER SERVO HAS FAILED. CAS GAIN IS DOUBLED TO REMAINING RUDDER. TOTAL RUDDER POWER REDUCED.

Figure 3-5 Page 4

SECTION 4
CREW DUTIES
TABLE OF CONTENTS

GENERAL AIRCREW RESPONSIBILITIES

The safe operation of the aircraft is the responsibility of both aircrew members. The flight manual and checklist is based on a definite division of responsibilities between cockpits. Each aircrew member should have a thorough working knowledge of Aircraft Systems, Normal/Emergency Procedures, Operating Limitations, and Aircraft Flight Characteristics.

CREWMEMBER IN COMMAND OF AIRCRAFT

The primary responsibility of the crewmember in command of the aircraft is to ensure mission accomplishment within acceptable safety limits. Specific responsibilities are:

- Conduct adequate integral aircrew briefings to ensure definite division of responsibility during flight.
- Accomplish Normal/Emergency Procedures as outlined in this manual.
- Operation of the aircraft within published operating and structural design limitations.
- Ensure use of abbreviated checklist of all flights.

CREWMEMBER IN CONTROL OF AIRCRAFT

The crewmember actually in control of the aircraft is responsible for flying the aircraft and operating auxiliary equipment under his control in accordance with this manual and the additional publications provided in the MilViz F-15E release package. This includes detailed study of the tutorial systems videos. Those procedures requiring immediate response will be accomplished as required. However, aircrew member not in control of the aircraft will be required to read the procedure from the checklist when time and circumstances permit. The crewmember in control of the aircraft will call for checklist items when required during flight profile.

CREWMEMBER NOT IN CONTROL OF AIRCRAFT

The crewmember not in control of the aircraft shares overall responsibility for the safe accomplishment of the mission. In addition, he is responsible for operating auxiliary equipment under his control in accordance with this manual and the additional publications provided in the MilViz F-15E release package. This includes detailed study of the tutorial systems videos. Specifically, his responsibilities are:

- Perform navigational duties as required.
- Assist other aircrew member in monitoring flight progress.
- Assist other aircrew member in monitoring aircraft systems and detecting system malfunctions.
- Initiate required inflight checklist items when not called for by crewmember in control of aircraft.
- Monitor instruments during all climbs and descents and advise the other crewmember of any deviations from established flight parameters.
- Clear the flight area whenever possible.

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SECTION 5
OPERATING LIMITATIONS
TABLE OF CONTENTS

GENERAL

All aircraft/system limitations that must be observed during normal operation are covered herein. Some limitations that are characteristic only of a special phase of operation (emergency procedures, flight through turbulent air, etc.) are not covered here. These special phase limits are contained within the discussion of the operation itself.

NOTE

All references to airspeed are in calibrated (KCAS).

CREW REQUIREMENTS

The minimum crew for safe flight in the F-15E aircraft is one.

INSTRUMENT MARKINGS

Instrument markings are shown in figure 5-1.

ENGINE LIMITATIONS

Refer to figure 5-2.

PRIMARY FUEL

The primary fuel is JP-8. F-40 is the NATO equivalent fuel. However, NATO F-40 may not contain corrosion inhibitor at some locations. Operation without corrosion inhibitor should be restricted to 10 consecutive hours.

ALTERNATE FUEL

The aircraft may be operated on NATO F-34, NATO F-35, JP-4, NATO F-43, NATO F-44, or commercial JET A, JET A-1, or JET B. The jet was originally designed for JP-4 which was withdrawn from US military services in the early 1980's. Except for freeze point, possible icing inhibitor, and possible corrosion inhibitor differences, JET B and JP-4 are equivalent and the same operating limitations apply.

NOTE

> Alternate fuels are much more prone to leak than is JP-8. Guidelines provided in T.O. 1-1-3 should be used to evaluate leaks when the occur.

Operating and throttle handling limitations for approved alternate fuels are the same as for primary fuels except that ground starts with temperature below -20C (-4F) with alternate fuel may produce more smoke and require a longer time for engine light-off. Ground starts should not be attempted with fuel temperatures below -40C (-40F). When using alternate fuels, hot starts may occur during spool down airstarts at airspeeds less than 350 KCAS for altitudes above 30,000 feet. Alternate fuel airstarts may require longer engine light-off times.

Alternate fuels may be intermixed in any proportion with primary fuels during ground or air refueling operations. No changes in operating limitations are indicated, nor is retrimming required. Most alternate fuels are heavier, so refer to Fuel Quantities in section 1 of this POH.

Due to alternate fuel freeze points, fuel in external tanks may not transfer after sustained operation (5 minutes or longer) below 200 KCAS above 25,000 feet, or below 250 KCAS above 45,000 feet.

NATO F-34 and NATO F-44 may not contain corrosion inhibitor, and NATO F-35, NATO F-43, JET A-1, and JET B may not contain icing or corrosion inhibitors. Restrict operation without icing inhibitor to one flight. Restrict operation without corrosion inhibitor to 10 consecutive hours.

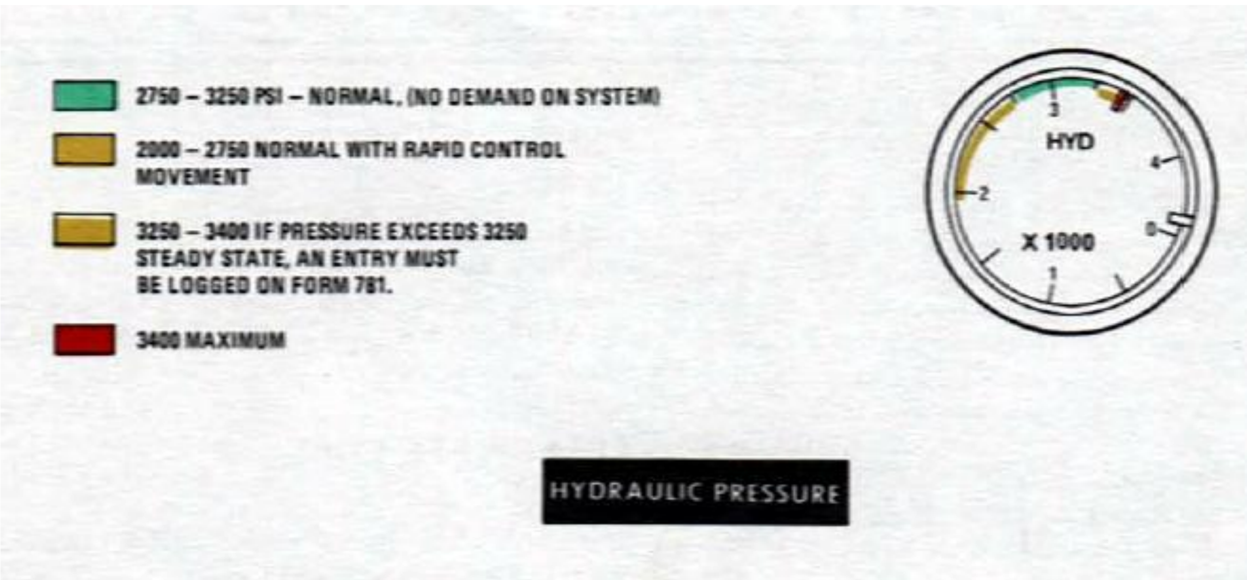


Figure 5-1

ENGINE LIMITATIONS

GROUND

CONDITION	FTIT°C	RPM%	OIL PSI	REMARKS
START	680	-	-	NOTE 5
IDLE	-	-	15-80	NOTE 5
MILITARY/AB	960	94	30-80	NOTES 2, 5, 6, 8 AND 10
TRANSIENT	970	94	30-80	NOTES 2, 5, 8 AND 10
FLUCTUATION	±10	±1	±10	NOTES 2, 3, 4 AND 6

FLIGHT

CONDITION	FTIT°C	RPM%	OIL PSI	REMARKS
AIRSTART	800	-	-	
IDLE	-	-	15-80	
MILITARY/AB	970	96	30-80	NOTES 1, 2 AND 7
TRANSIENT	990	96	30-80	NOTES 2, AND 11
FLUCTUATION	±10	±1	±10	NOTES 2, 3, 4 AND 6

NOTES

1. Use of VMAX switch is prohibited
2. FTIT and RPM limitations include fluctuations
3. In phase fluctuation of more than one instrument, or short term cyclic fluctuations accompanied by thrust surges, indicate engine control problems
4. Nozzle fluctuations are limited to ±2% at military power and above. Fluctuations are not permitted below military power.
5. Any oil pressure from 0 to 100 (pegged) PSI is acceptable during start and initial operation for a period not exceeding 1 minute after reaching idle.
6. Oil pressure fluctuations of ±10PSI are acceptable if the average is within limits
7. At less than 0g, oil pressure may drop as low as 0PSI
8. For engine operation at military or above, oil pressure must increase 15PSI minimum above idle oil pressure
9. Engine nozzle position is limited to 30% open or less at military power
10. Maximum temperature limited to 30 seconds
11. Maximum temperature limited to 10 seconds.

Figure 5-2

AIRSPEED LIMITATIONS

Maximum airspeeds are shown in figure 5-3. Additional limitations may be imposed by external stores. Limiting airspeed for operation of various aircraft systems are shown in figure 5-4.

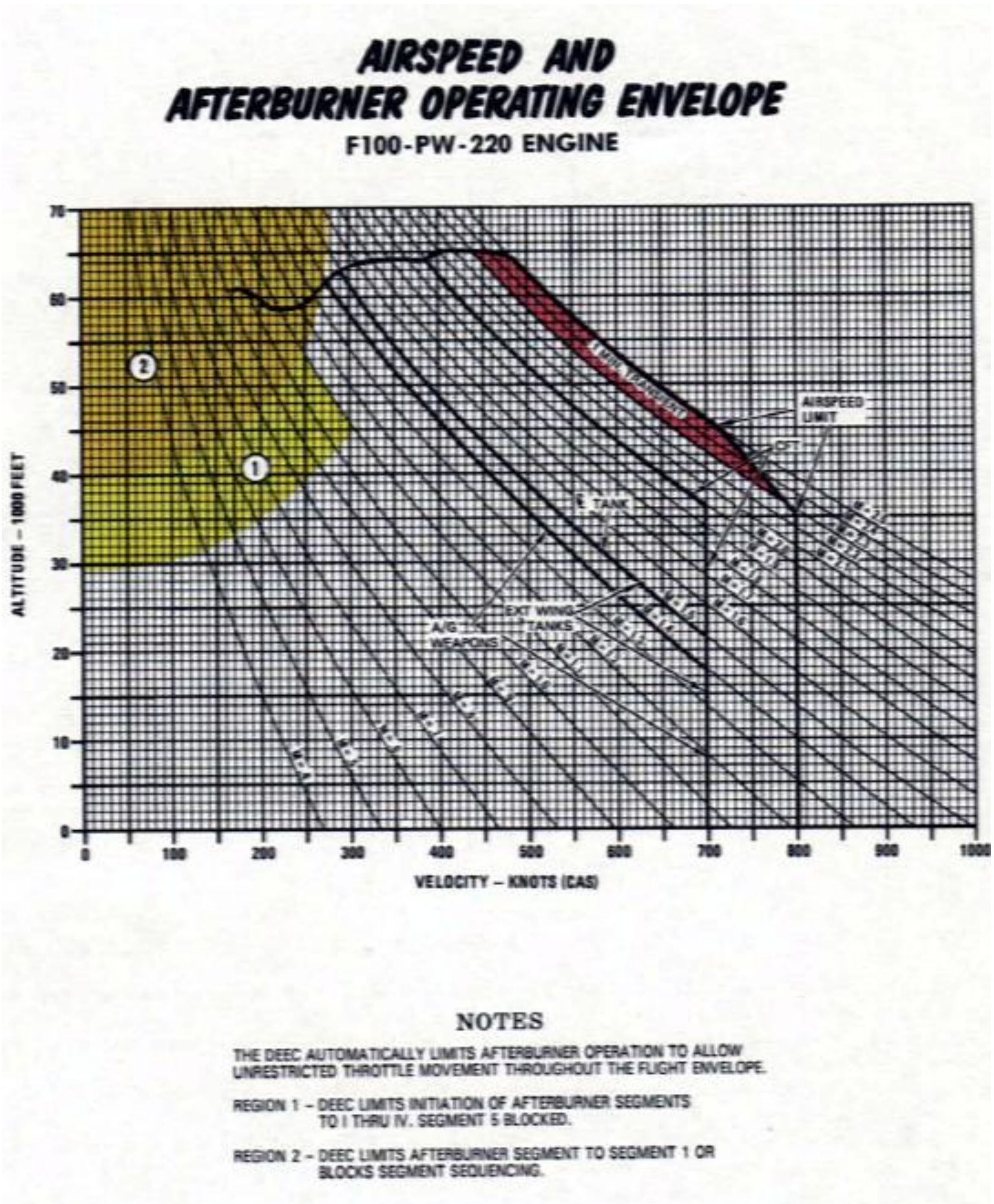


Figure 5-3

SYSTEM RESTRICTIONS

JFS LIMITATIONS

JFS limitations are shown on figure 5-4.

SYSTEMS LIMITATIONS

	AIRSPEED	LOAD FACTOR
LANDING GEAR EXTENSION/RETRACTION (Minimize Sideslip)	300 KCAS (CLEAN OR MISSILES ONLY, WITH OR WITHOUT CFT'S) 250 KCAS (ANY CONFIGURATION)	1.25g 2.0g
FLIGHT WITH GEAR EXTENDED	300 KCAS (CLEAN OR MISSILES ONLY, WITH OR WITHOUT CFT'S) 250 KCAS (ANY CONFIGURATION)	1.25g 2.0g
FLAPS DOWN	250 KNOTS	0.0 to +4.0g Load factor
CANOPY OPEN (INCLUDING WIND)	60 Knots	
INLETS EMERGENCY POSITION	Above 0.95 MACH	-1.0 to +4.0g

SYSTEMS

JET FUEL STARTER

Maximum 10 seconds (15 seconds if temperature below 0° F) between JFS start initiation and READY light.

Starter engagement time shall not exceed 90 seconds except, if a hot start occurs, the time may be extended to 150 seconds.

Minimum 10 seconds between first engine at idle speed and engagement for second engine start. If the engine engagement time exceeds 90 seconds, wait 20 seconds before again engaging or shutting down the JFS.

FLIGHT CONTROLS

To insure the flight control hydraulic fluid is sufficiently warm before takeoff, observe the listed warm up times for the corresponding temperature range.

Temperature	Time (minutes)
+4°C (+40°F) AND UP	No restriction
-4°C (+25°F) to +3°C (39°F)	5
-18°C (0°F) to -5°C (+24°F)	8
-32°C (-26°F) to -19°C (-9°F)	10
-46°C (-50°F) to -33°C (-27°F)	12

Figure 5-4

BRAKES

The brakes are limited in the amount of energy they can absorb and dissipate in the form of heat without damage. A measure of the amount of heat absorbed by the brakes is the kinetic energy expended, measured in millions of foot-pounds. The amount of heat added to the brakes for each braking effort during a landing rollout or taxiing is cumulative and is a function of the speed of the aircraft and its gross weight at the time the brakes are applied. The heat generated in the brakes is transferred to the wheel and tire, and depending upon the severity of the stop, can cause the tire pressure to rise to dangerous levels. Thermal fuse plugs within the wheels are designed to prevent wheel explosion by relieving pressure from the tire when the wheels attain a particular temperature.

Brake energy zones for flaps and speed brake extended landings are provided in figure 5-5. Brake overheat occurs when the energy absorbed by an individual brake exceeds normal zone limits. In the caution zone, fuse plug release is possible. In the danger zone, fuse plug release is possible and wheel or brake damage may occur. Brake fires are also possible. In the extreme danger zone, brake energies exceed all tested conditions and wheel or brake damage is certain. The brake energy limit chart should be used whenever a takeoff is aborted, for flaps-up landings, or when the pilot suspects that the combination of gross weight, IAS, and the number of stops and decelerations will result in brake energies in the caution or danger zones.

HOLDING BRAKE

To avoid brake damage, the holding brake should not be set when cumulative per brake energy exceeds 16.6 million foot pounds.

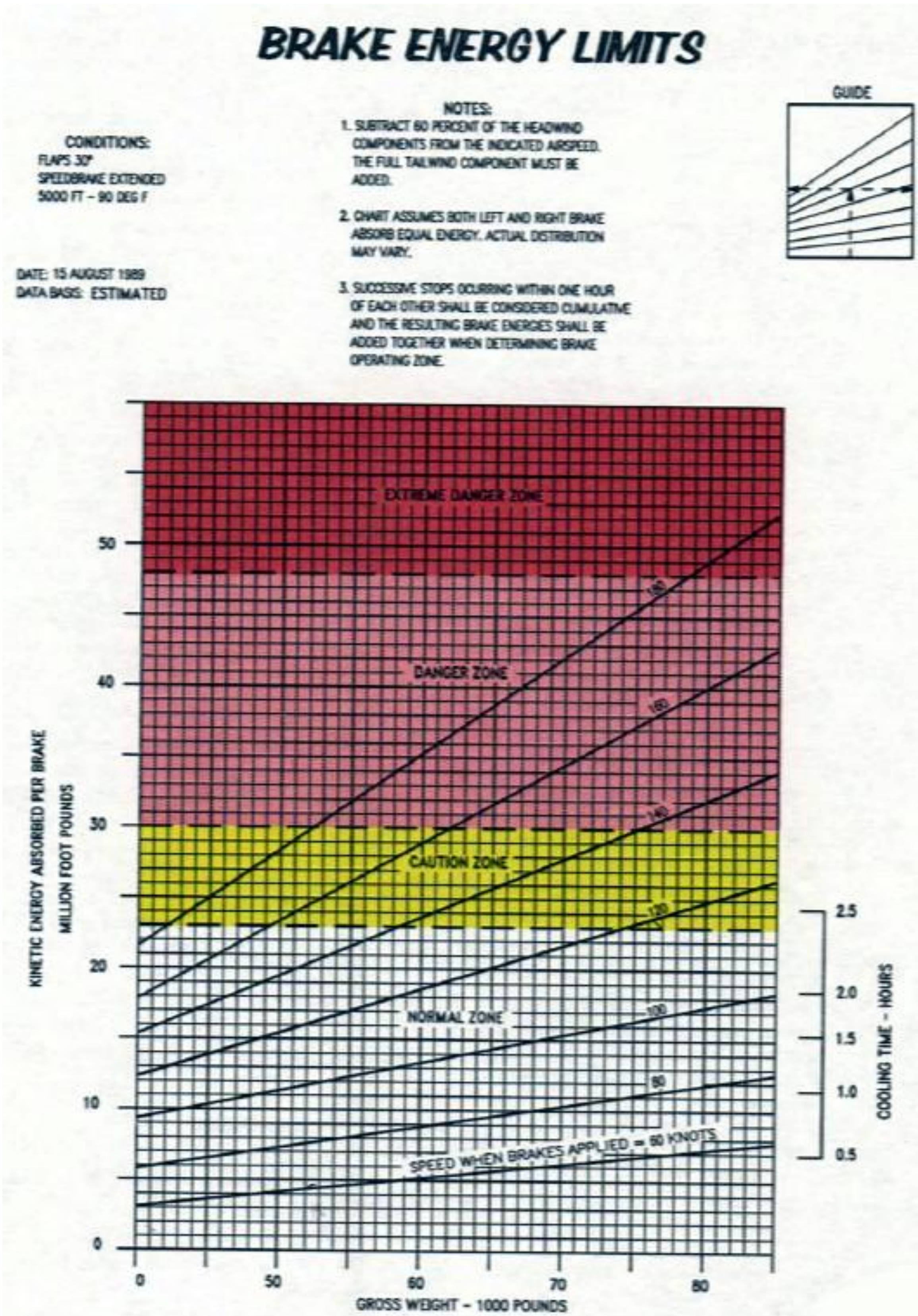

BRAKE ENERGY LIMITS
CONDITIONS:
FLAPS 30°
SPEEDBRAKE EXTENDED
5000 FT – 90 DEG F
DATE: 15 AUGUST 1989
DATA BASIS: ESTIMATED
NOTES:
1. SUBTRACT 60 PERCENT OF THE HEADWIND COMPONENTS FROM THE INDICATED AIRSPEED. THE FULL TAILWIND COMPONENT MUST BE ADDED.
2. CHART ASSUMES BOTH LEFT AND RIGHT BRAKE ABSORB EQUAL ENERGY. ACTUAL DISTRIBUTION MAY VARY.
3. SUCCESSIVE STOPS OCCURRING WITHIN ONE HOUR OF EACH OTHER SHALL BE CONSIDERED CUMULATIVE AND THE RESULTING BRAKE ENERGIES SHALL BE ADDED TOGETHER WHEN DETERMINING BRAKE OPERATING ZONE.
GUIDE
EXTREME DANGER ZONE
DANGER ZONE
CAUTION ZONE
NORMAL ZONE
SPEED WHEN BRAKES APPLIED = 60 KNOTS
80
100
120
140
160
180
KINETIC ENERGY ABSORBED PER BRAKE
MILLION FOOT POUNDS
0
10
20
30
40
50
COOLING TIME - HOURS
0.5
1.0
1.5
2.0
2.5
GROSS WEIGHT - 1000 POUNDS
0
50
60
70
80

Figure 5-5

EXTERNAL FUEL TRANSFER

An adverse CG condition may develop if STOP/TRANSFER is selected while fuel remains in the external tanks. This condition develops as internal fuel continues to feed while fuel moves in the external tanks. With pitch CAS off, external fuel transfer should not be stopped except in an emergency.

NEGATIVE G FLIGHT

Negative G flight is limited to 10 seconds at all power settings.

PROHIBITED MANEUVERS

The following maneuvers are prohibited.

GENERAL

a. Spins
b. Zero G flight, except transient
c. AOA over 30 units with any of the following:
    1) Fuel asymmetry (wing and CFT) over 600 pounds.
    2) Fuel asymmetry over 200 pounds when the asymmetric missile load is 3 or more.
    3) Air-to-ground stores, whether carried on the CFT, or on the wing stations, wing mounted tanks or cargo pods. An exception is the LANTIRN pods, which are limited to 35 units AOA.
    4) Gear down.
    5) LANTIRN pods.
    6) Inoperative tank 1 fuel transfer pump.
d. With CFTs, no flight above 600 KCAS when Mach number is greater than 1.8.
e. With CFTs, above 600 KCAS when the Mach number is greater than 1.3, limit roll inputs to one-half lateral stick with slow stick inputs, maximum of 90 degrees bank angle change, and +3G maximum.

ROLLS

a. Full lateral stick inputs in less than 1 second with LANTIRN pods.
b. Full lateral stick rolls in excess of 360 degrees.
c. Full lateral stick rolls in excess of 180 degrees initiated at less than +1.0 G or greater than +3.0 G.
d. Rolls in excess of 360 under any of the following conditions:
    1) Airspeed above 550 KCAS or Mach 1.4, whichever is less.
    2) Any CAS axis disengaged.
e. Rolls in excess of 180 degrees initiated at other than +1.0 G above 500 KCAS or Mach 1.4, whichever is less.

NOTE

For all aircraft configurations not specifically prohibited herein, with full CAS, mild to moderate rolls below 550 KCAS or Mach 1.4, whichever is less, are not limited by bank angle change or initial G provided that the OWS limit is not exceeded (voice warning activated). Without an operative OWS, the unsymmetrical acceleration limits shown in figure 5-7 should not be exceeded. Longitudinal control coordination may be required to prevent G excursions outside these limits during the roll.

f. Rolls in excess of 90 degree with gear down.
g. Rolls at more than 20 units AOA, below Mach 1.0 with PITCH RATIO or ROLL RATIO light ON.
h. Rolls with roll CAS on, above 475 KCAS below 12,000 feet, with abrupt lateral stick deflection. Such rolls shall be performed with smooth lateral stick deflections. Close formation flight in this speed or altitude region is not recommended.
i. Rolls in excess of 90 degrees with more than one-half lateral stick displacement at Mach number greater than 1.8 at altitudes above 40,000 feet.

WITHOUT OPERATIVE OWS

a. With wing-mounted tanks, cargo ods, or air-to-ground stores:
    1) Rolls over 360 degrees.
    2) Rolls over 180 degrees started at other than +1.0 G.
    3) Rolls at less than 0.0 G above 600 KCAS.
b. More than one-half lateral stick with full or partially full CFTs, full or partially full wing-mounted tanks, cargo pods, or air-to-ground stores or, above Mach 1.0, with empty wing-mounted tanks.

CAS OFF

a. Operation above 600 KCAS with any CAS axis OFF or inoperative.

LANTIRN/SNIPER POD RESTRICTIONS

The LANTIRN Pod has been supplemented with the recent addition to the upgraded SNIPER targeting and navigation pod. All LANTIRN restriction charts provide equal restrictions for operations using the SNIPER pods.

- Minimum set clearance for radar altitude autopilot hold in mountainous terrain while n IMC is 500 feet.

NOTE

Mountainous terrain is defined as a vertical change that exceeds 900 feet per nautical mile, which equates to a 15% slope. This restriction only applies along the anticipated aircraft flight path. Terrain that exceeds a change of 13,000 per nautical mile will cause CARA dropout and a flyup.

- Manual terrain following is authorized provided that the aircraft is kept within system limits for any required fly up maneuvers. Increased vigilance at heavy gross weights (above 68,000 pounds) is required, especially if pitch CAS fails as pilot induced oscillations are likely.

GROSS WEIGHT LIMITATIONS

The maximum allowable gross weight for flight or ground operations and landings is 81,000 pounds. The maximum allowable landing sink rate versus gross weight is shown in figure 5-6.

CAUTION

At heavy gross weight, avoid abrupt nose gear steering inputs and make turns at minimum practical speed and maximum practical radius. Avoid operations on rough and uneven taxiways or runways. Failure to do so may result in tire damage.

CENTER OF GRAVITY LIMITATIONS

During ground operations below 76,000 pounds gross weight, the forward CG limit is 22% MAC (gear down). Add 0.5% MAC for each 2,000 pounds above 76,000 pounds gross weight.

Longitudinal center of gravity may be adversely affected by failure of internal transfer tanks to feed properly. With a malfunctioning tank 1 transfer system and the wing tanks feeding normally, the aircraft CG will shift forward until the wing tanks run dry and tank 1 starts to gravity feed. This forward CG condition will increase aircraft departure susceptibility.

Without CFTs, the aircraft CG limit (gear up) is as follows:

a. With wing pylons – 29.0% MAC
b. Without wing pylons – 29.9% MAC

With CFTs, the aft CG limit (gear up) is as follows:

a. With air-to-air missiles or no stores on CFTs – 29.3% MAC
b. With air-to-air missiles or no stores on CFTs and with LANTIRN pods – 28.8% MAC
c. With air-to-ground stores on CFTs – 27.8% MAC
d. With air-to-ground stores on CFTs and with LANTIRN pods – 27.3% MAC

ACCELERATION LIMITATIONS

With the Overload Warning System (OWS) operating, the maximum allowable acceleration is continuously displayed on the HUD. The OWS tones indicate proximity to the maximum allowable G (85% and 90% of design limit load) and the OWS voice warning indicates that the maximum allowable G is exceeded. See figure 5-7.

With the OWS inoperative, the maximum acceleration allowed for flight in smooth or moderately turbulent air are shown in Figure 5-7. Separate plots are provided for symmetrical maneuvers (maneuvers without any roll rate) and unsymmetrical maneuvers (maneuvers with an accompanying roll rate such as rolling pullouts, etc).

Maximum acceleration may be reduced by limitations applicable to a specific store as shown on the External Stores Limitation chart.

EXTERNAL STORES LIMITATIONS

LANTIRN production Navigation pod carriage limits are shown in figure 5-8.

For airspeed, and Mach number limits, BAL refers to the limits shown in Figure 5-3 for the specific aircraft configuration. For acceleration limits with OWS, BAL refers to the limit shown on the HUD and indicated by the voice warning. External store limits other than BAL are not programmed in the OWS. Where only a positive G limit is shown, the negative G limit is the OWS limit. For acceleration limits without OWS, BAL refers to the acceleration limits shown in Figure 5-7 for the specific aircraft configuration.

Only the external stores configuration shown in the External Stores Limitation chart (Figure 5-9) may be loaded and carried. Additional stores will be added to the chart upon completion of flight testing of stores configurations.

CAUTION

- Flares should not be carried in the left outboard fuselage CMD station or in the outer row on the left inboard fuselage CMD station when the LANTIRN Targeting pod is installed.

NOTE

- Conformal fuel tanks must be installed when the LANTIRN pods are carried.
- Firing of the 20 MM gun is authorized. Inspect the AN/ALQ-135 ICS Control Oscillator boxes (in the gun bay) for external damage after each 10,000 rounds are fired.

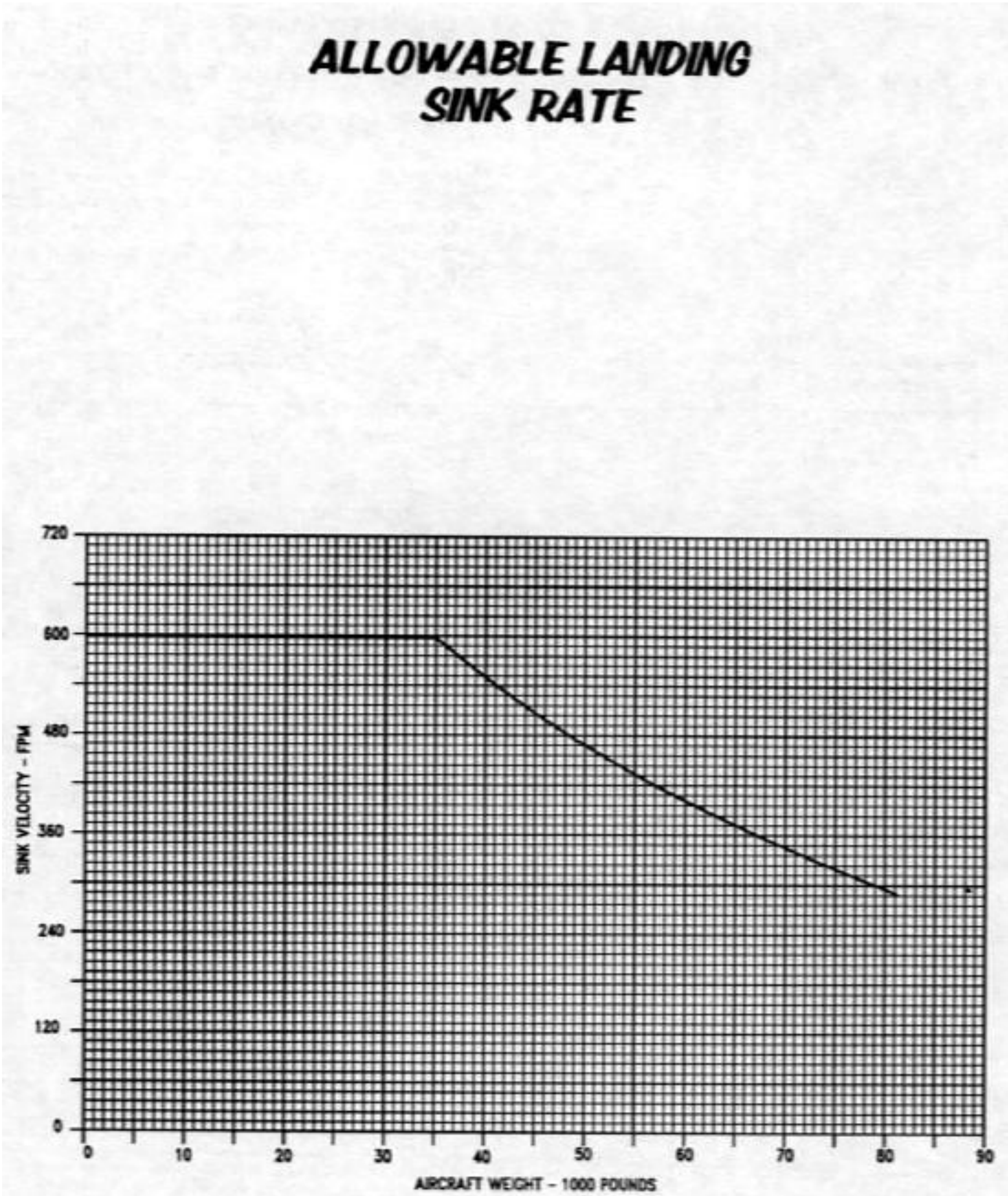

ALLOWABLE LANDING SINK RATE
720
600
480
360
240
120
0
SINK VELOCITY - FPM
0
10
20
30
40
50
60
70
80
90
AIRCRAFT WEIGHT - 1000 POUNDS

Figure 5-6

ACCELERATION LIMITATIONS OVERLOAD WARNING SYSTEM INOPERATIVE SYMMETRICAL MANEUVERING

NOTES

1. Negative Load Factor varies linearly from −3Gs at 750 KCAS to −1G at 800 KCAS
2. Airspeed limits with CFTs and/or A/G Stores is 700 KCAS; with Tanks is 660 KCAS.
3. See External Store Limitations For Additional Acceleration Limits

CONFIGURATION	AIM-9	AIM-7	Wing Tanks or Wing A/G Stores/Pods	CFT	CFT AIM-7	CFT A/G Stores
A (1)	with or without	with or without	with M < 1.0 or without	without		
B	with or without	with or without	with M > 1.0	without		
C	with or without		with < 600 KCAS or without	with	with or without	
D	with or without		with > 600 KCAS	with	with or without	
E	with or without		with < 600 KCAS or without	with		with
F	with or without		with > 600 KCAS	with		with

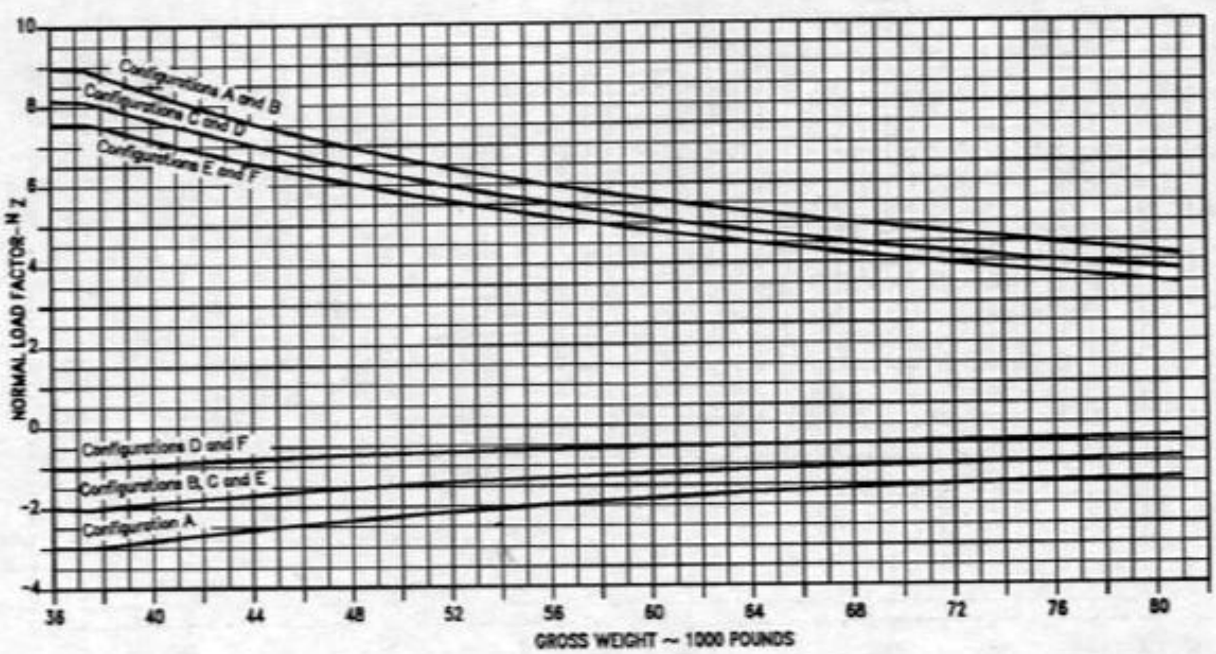


Figure 5-7 Page 1

ACCELERATION LIMITATIONS OVERLOAD WARNING SYSTEM INOPERATIVE ASYMMETRICAL MANEUVERING

NOTE

1. Full stick with tanks Empty; 1/2 stick with tank fuel or Air-To-Ground stores.
2. Configuration has 1/2 stick capability.
3. Configuration has FULL stick capability; with wing tanks, 1/2 stick M > 1.0.
4. See External Store Limitations For Additional Acceleration Limits.

CONFIGURATION	AIM-9	AIM-7	Wing Tanks or Wing A/G Stores/Pods	CFT	CFT AIM-7	CFT A/G Stores
A 1	with or without	with or without	with M < 1.0 or without	without		
B 2	with or without	with or without	with M > 1.0	without		
C 2	with or without		with < 600 KCAS or without	with	with or without	
D 2	with or without		with > 600 KCAS	with	with or without	
E 3	with or without		with Empty < 600 KCAS or without	with Empty	with or without	
F 3	with or without		with Empty > 600 KCAS	with Empty	with or without	
G 2	with or without		with < 600 KCAS or without	with		with
H 2	with or without		with > 600 KCAS	with		with

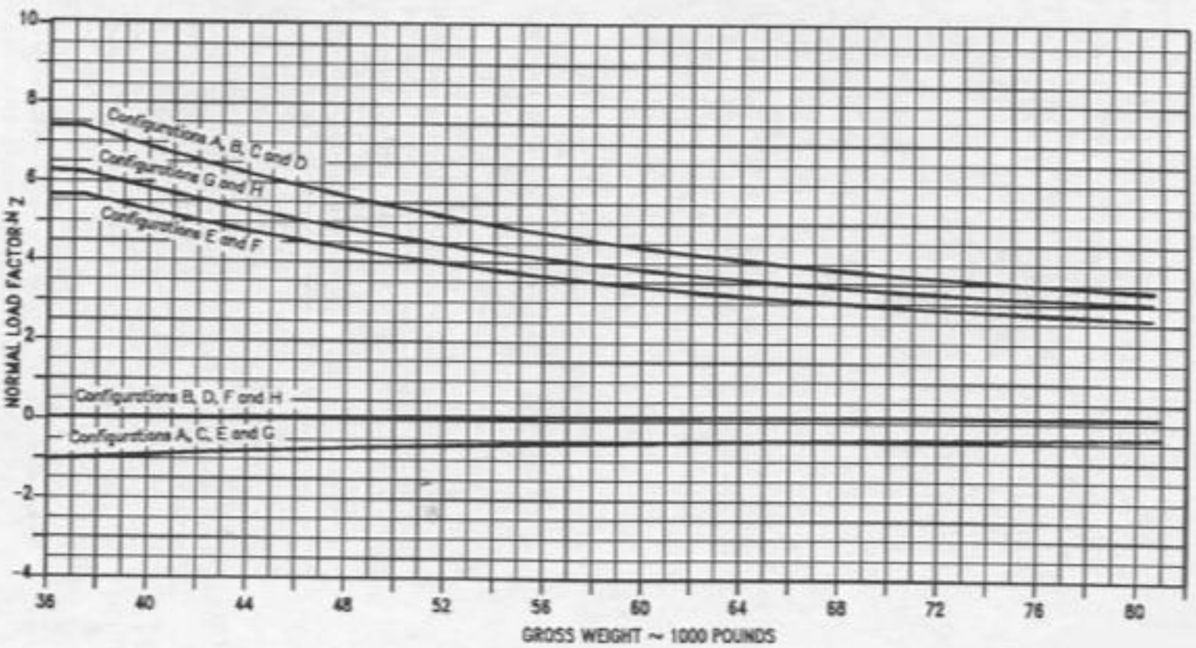


Figure 5-7 Page 2

LANTIRN POD CARRIAGE

TARGETING POD

NOTE

CFT'S MUST BE INSTALLED.

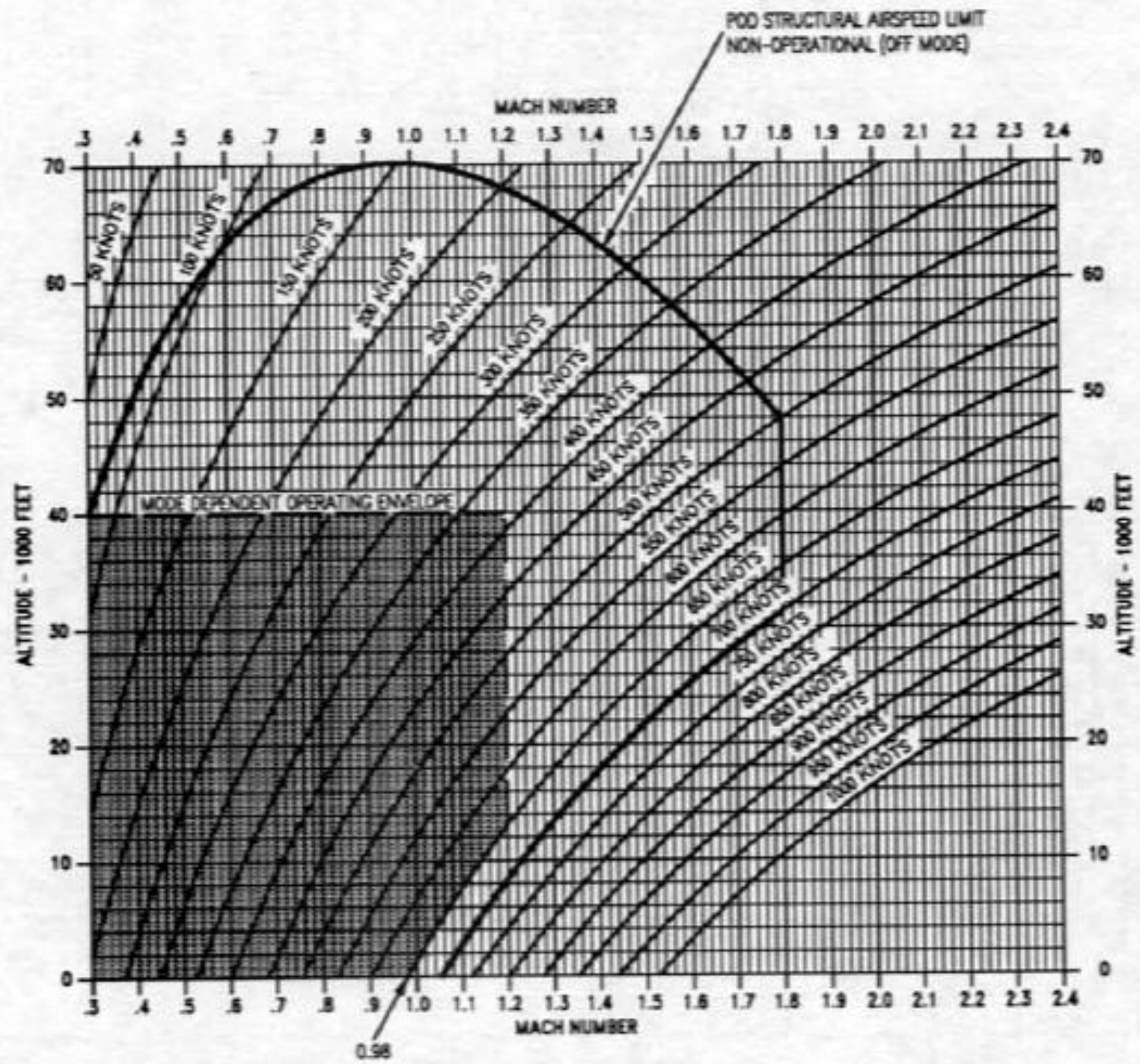


Figure 5-8 Page 1

LANTIRN POD CARRIAGE *(Continued)*

NAVIGATION POD

NOTE

CFT'S MUST BE INSTALLED.

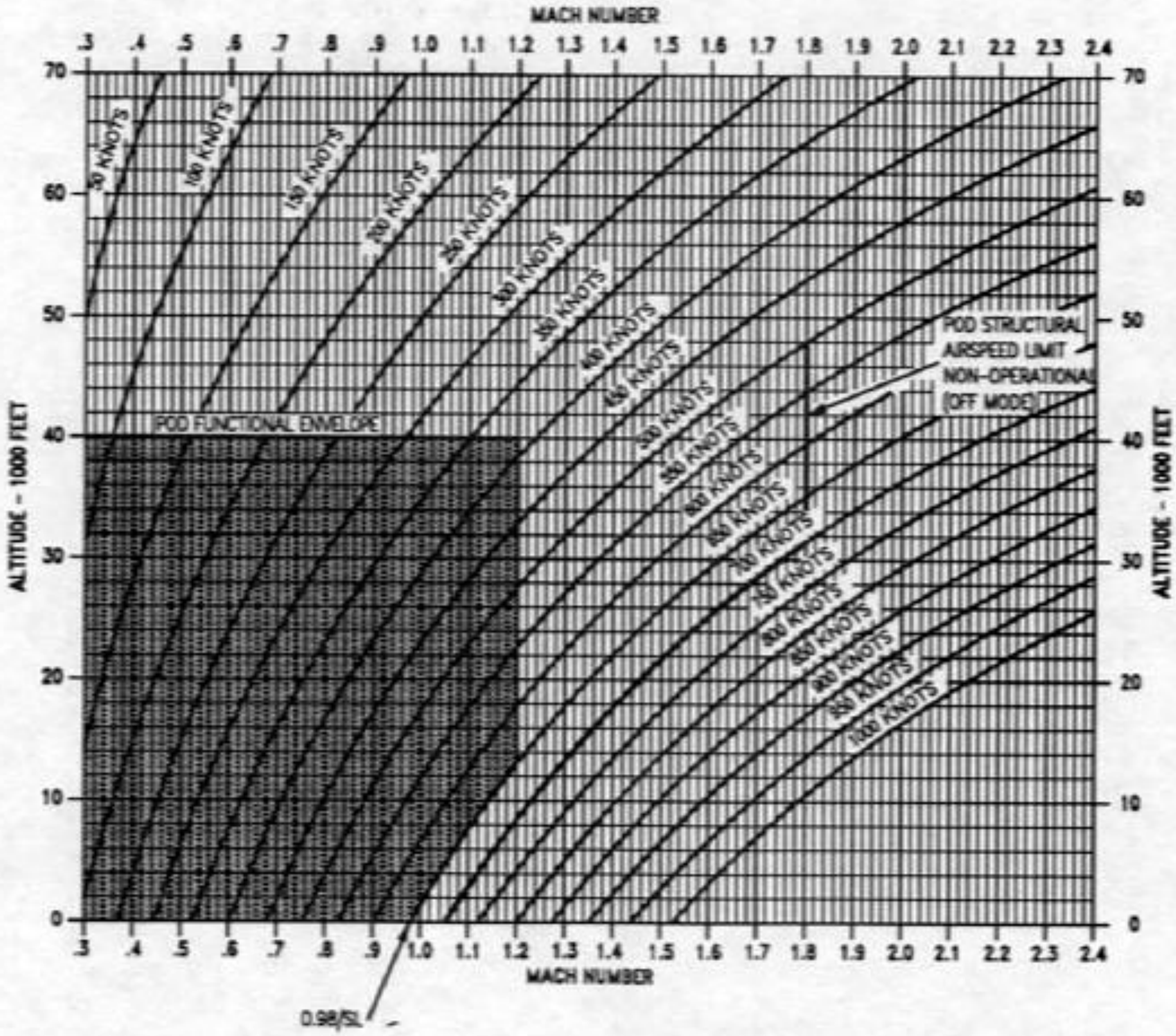


Figure 5-8 Page 2

LANTIRN POD CARRIAGE *(Continued)*

FLIGHT RESTRICTIONS WITH TWO LANTIRN PODS INSTALLED

NOTES

- CFT'S MUST BE INSTALLED.
- CLEAN OR MISSILES ONLY.

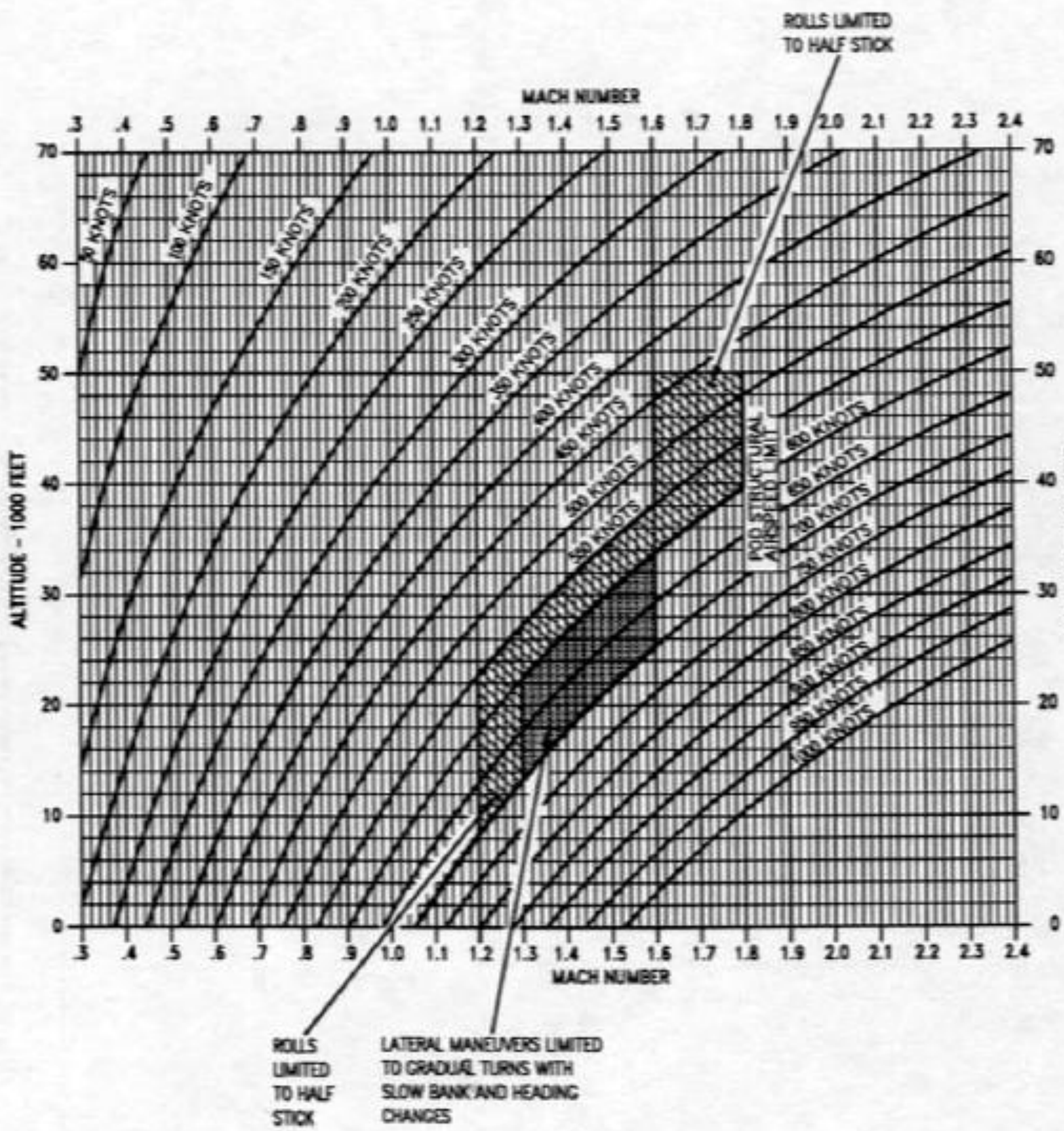


Figure 5-8 Page 3

LANTIRN POD CARRIAGE (Continued)

FLIGHT RESTRICTIONS WITH SINGLE LANTIRN POD INSTALLED

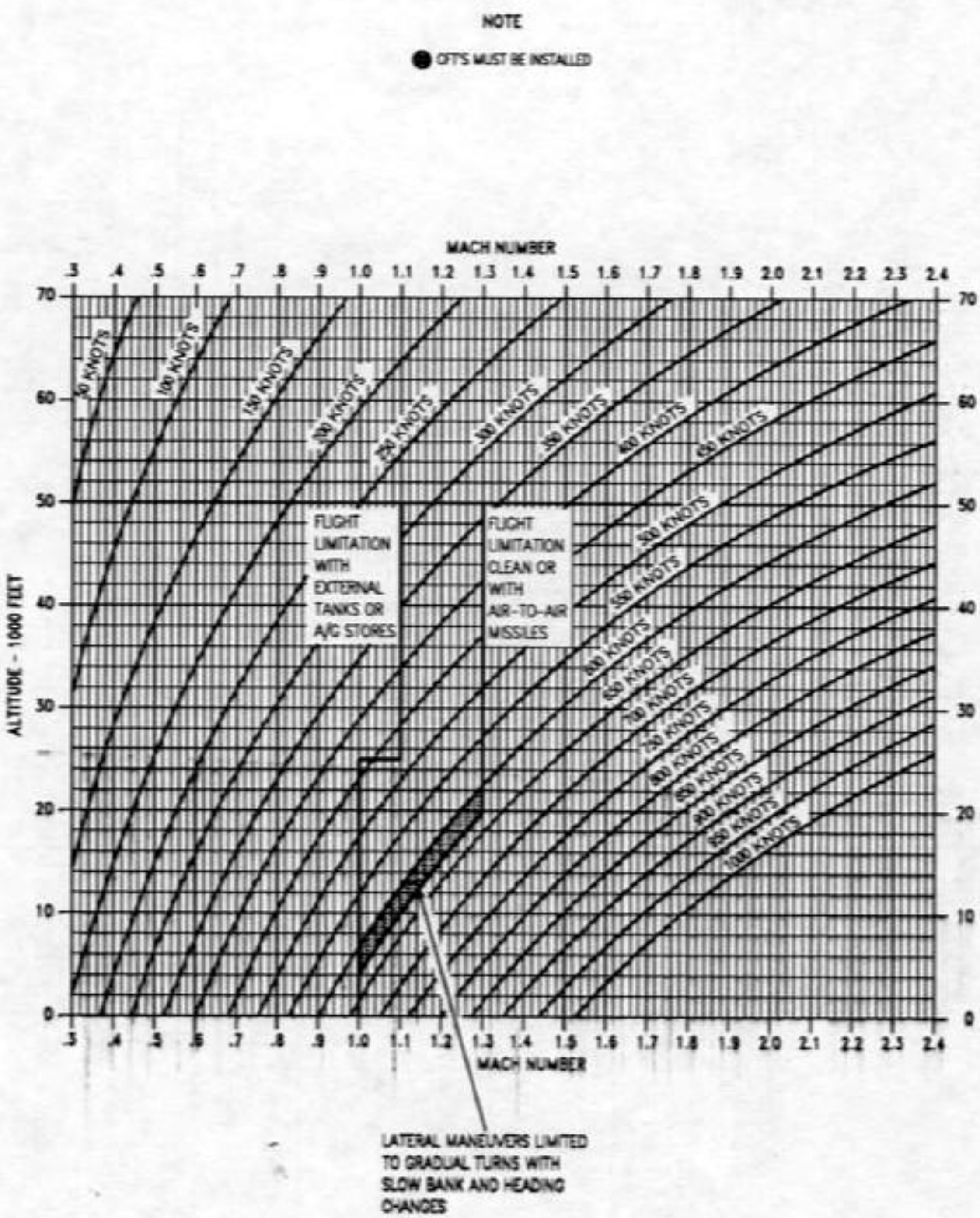


Figure 5-8 Page 4

EXTERNAL STORES LIMITATIONS

EXTERNAL STORES STATION IDENTIFICATION

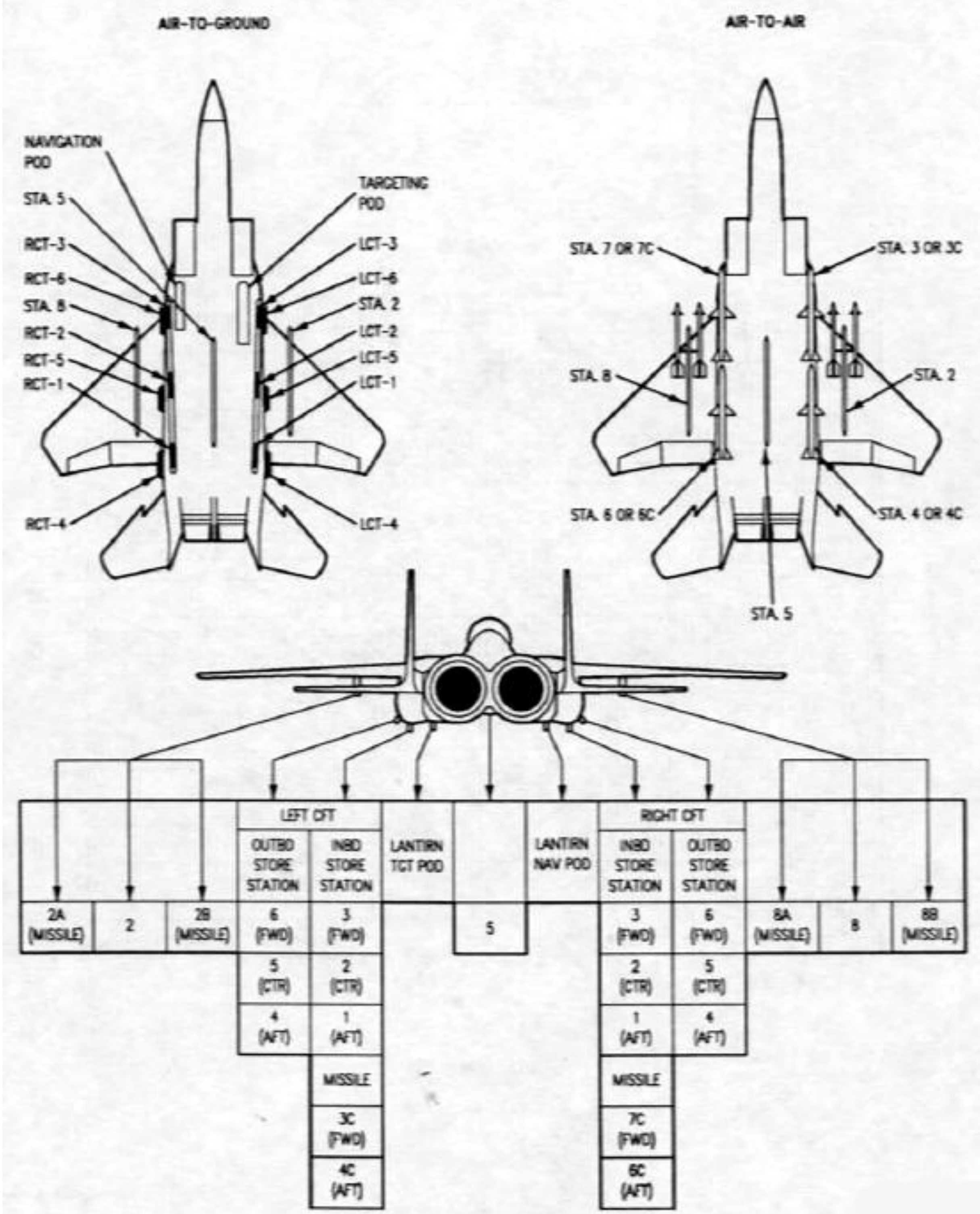
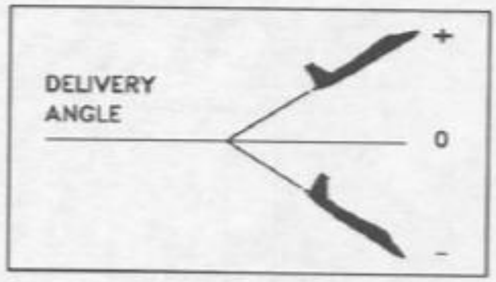


Figure 5-9 Page 1

EXTERNAL STORES LIMITATIONS



GENERAL

1. NORMAL F-15E RELEASE SEQUENCE:
   - LCT-1/RCT-1
   - STATION 5
   - LCT-3/RCT-3
   - LCT-4/RCT-4
   - LCT-6/RCT-6
   - LCT-5/RCT-5
   - LCT-2/RCT-2
   - STATION 2
   - STATION 8
2. A FUEL TANK IS OPTIONAL ON STATION 5 WITH ALL STORE CONFIGURATIONS UNLESS OTHERWISE NOTED.
3. MIXED LOADS OF AIR-TO-AIR MISSILES, AIS PODS, AND CATMS ARE OPTIONAL ON STATIONS 2A, 2B, 8A, 8B WITH ALL STORE CONFIGURATIONS UNLESS OTHERWISE NOTED.
4. CFT MOUNTED AIR-TO-AIR MISSILES ARE OPTIONAL WITH ALL STORE CONFIGURATIONS UNLESS OTHERWISE NOTED.
5. LANTIRN PODS ARE OPTIONAL WITH ALL STORE CONFIGURATIONS UNLESS OTHERWISE NOTED.
6. MOST RESTRICTIVE LIMITS APPLY WHEN CARRYING MIXED LOADS.
7. CAPTIVE, INERT AND TRAINING STORE CONFIGURATIONS ARE AUTHORIZED UNLESS OTHERWISE NOTED.
8. CFT AIR-TO-GROUND STORES MUST BE RELEASED BEFORE WING AIR-TO-GROUND STORES.
9. MIXED LOADS OF DIFFERENT A/G STORES (I.E., MK-82 AND MK-84), DIFFERENT STORE TYPES (I.E. MK-82 AIR AND MK-82SE) AND DIFFERENT STORE MODELS (I.E. A/B AND C/B) ARE NOT AUTHORIZED UNLESS DEPICTED AS A SEPARATE STORE CONFIGURATION. THIS RESTRICTION APPLIES TO ALL AIRCRAFT STATIONS.
10. DOWNLOADS PER NORMAL F-15E RELEASE SEQUENCE ARE AUTHORIZED. MIRROR IMAGES ON ALL ASYMMETRIC DOWNLOADS ARE AUTHORIZED UNLESS OTHERWISE NOTED.
11. CFT AIR-TO-AIR OR AIR-TO-GROUND STORES STATION LOADING IS SHOWN BY LISTING AUTHORIZED STATION NUMBER IN L/R CFT COLUMNS. REFER TO SHEET 1 FOR CFT STORES STATION IDENTIFICATION.
12. SMOOTH STICK INPUTS AND NO ROLLING MANEUVERS ALLOWED FOR CARRIAGE ABOVE 600KCAS/1.2 MACH WITH ASYMMETRIC CFT CONFIGURATIONS.
13. JETTISON LIMITS ARE APPLICABLE ONLY FOR SELECTIVE JETTISON IN THE CFT RELEASE SEQUENCE. SELECTIVE JETTISON MODES WITH RIPPLE INTERVALS LESS THAN THE STORE MINIMUM INTERVAL ARE NOT AUTHORIZED.
14. MINIMUM RELEASE INTERVAL APPLIES ONLY TO BOMBS RELEASED FROM THE SAME A/G STATION. WHEN PERFORMING RIPPLE SINGLE RELEASES FROM MULTIPLE STATIONS, DIVIDE THE RELEASE INTERVAL BY NUMBER OF STATIONS SELECTED.
15. SIDESLIPS ARE RESTRICTED TO 9 DEGREES SUBSONICALLY WITH NO RESTRICTIONS SUPERSONICALLY. (THIS EQUATES TO GREATER THAN ½ RUDDER PEDAL DEFLECTION).
16. WITH CFT MOUNTED AIR-TO-GROUND STORES, LIMIT ASYMMETRIC MANEUVERS ABOVE 25 UNITS AOA TO +3G.
17. DO NOT ROLL THE AIRCRAFT UNTIL AT LEAST ONE SECOND AFTER WEAPON RELEASE.

Figure 5-9 Page 2

SECTION 6
FLIGHT CHARACTERISTICS
TABLE OF CONTENTS

HANDLING QUALITIES

GENERAL

The hydro-mechanical and CAS systems operate together to produce handling qualities which do not vary significantly throughout the flight envelope. Section 1 describes in detail the various components of the flight control system. This section discusses some of the resultant handling qualities and describes how they change with various failures.

HANDLING CHARACTERISTICS

Pitch CAS ON, Pitch Ration AUTO

Pitch response to stick input does not vary appreciably with airspeed, altitude, engine power, or configuration change. There is an approximate 1 to 1.5 G increase in stick dig in tendency as the aircraft decelerates through Mach 1 at high G loading. In high altitude, high Mach number flight, stick forces increase. Stick forces also increase at high angle of attack (AOA) to produce a natural "nose heaviness" near stall. At gross weight above approximately 50,000 pounds there is a noticeable longitudinal "deadband" in the control stick (fore and aft movement of the stick produces no aircraft response). This deadband is only present when the stick is moved rapidly during fine tracking tasks such as formation flying or air-to-ground gunnery. The deadband is most apparent when the stick is slightly forward of the trimmed position (at approximately 0.8 G), and goes away at more positive or more negative G loadings. The deadband gets more pronounced as gross weight increases.

Because of the automatic trim feature, the stick force required to maintain a desired G does not change with airspeed or configuration change. The automatic trim does not trim off control forces. You select a desired stick force by use of the manual trim. For example, if you trim for hands-off, 1 G level flight, the aircraft will tend to remain in 1 G level flight, regardless of thrust, airspeed, or configuration changes. There is some delay in the automatic trim function. This is particularly noticeable when rolling out of a turn.

The nose will tend to rise, requiring some forward stick force, even if the aircraft was not trimmed in the turn. In this case, do not retrim immediately, since most of the nose-up tendency will disappear in a very short time.

Pitch CAS OFF, Pitch Ratio AUTO

The aircraft feels less solid in pitch (less pitch damping) and precise maneuvers, such as tracking and air refueling are more difficult. Slow to approximately 250 KCAS to improve handling qualities for air refueling. The automatic trim is less effective, causing larger trim transients during airspeed or configuration changes, or when rolling out of turns. Supersonic, above 600 KCAS, and transonic between 0.8 and 1.0 Mach, pitch control is very sensitive and pilot induced oscillations (PIO) may occur, particularly at higher gross weights and with external fuel tanks.

Close formation and air refueling may be difficult. If this occurs, release the stick and reduce speed. Maximum stabilator available is slightly less at all speeds, resulting in higher stick forces at high G and less available G at full aft stick. At higher altitude, this reduction can be as much as 2 G. Below 10,000 feet, the reduction in available G is negligible.

During takeoffs and landings, the nose feels heavier and some mild pitch oscillations may occur. Because of the reduced stabilator effectiveness, the nose cannot be raised as early during takeoff roll nor held up as long during landing.

Pitch CAS ON, Pitch Ratio EMERG

Very little degradation in handling qualities is noticeable. Maximum stabilator deflection is reduced at low speed. The greatest danger in this condition is the severely degraded handling qualities if pitch CAS drops off.

Pitch CAS OFF, Pitch Ratio EMERG

Stick forces are very high at low speed, and pitch control is very sensitive at high subsonic speed. Autotrim is not available. Available AOA and G are severely reduced at both subsonic and low speed. During landing, stick forces are very high, pitch response is slow, and flare is greatly reduced. Recommended AOA is approximately 21 units at touchdown speed. Control is adequate for landing, but avoid high sink rate at low slow speed. An approach at 18 units AOA or less provides sufficient flare capability for landing.

LATERAL-DIRECTIONAL CHARACTERISTICS

Yaw and Roll CAS ON, Roll Ratio AUTO

Roll response to stick input does not vary appreciably throughout the flight envelope. Full lateral stick produces a high roll rate through most of the flight envelope. Continuous full-stick rolls can result in aircraft pitch and yaw excursions, which can cause high structural loads and possible loss of control due to inertial coupling. This tendency is greatest with negative or high positive G loads and above 550 KCAS or Mach 1.4.

Lateral stick forces are light, and initial roll acceleration is high, particularly during low altitude, high speed subsonic flight. At these conditions, there is a tendency to overcontrol. The ARI, supplemented by CAS, permits all rolling maneuvers to be made with lateral stick only. No coordinating rudder is necessary, even at high AOA. When stick is near full aft, lateral stick causes large rudder deflection in the direction of lateral input. With forward stick (stick forward of trimmed position), the rudder deflection is opposite to lateral input.

With gear down, full aileron is available at any stick position and coordinating rudder is maintained. The aircraft can be rolled using rudder. However, maximum roll rate can be achieved using only lateral stick at all AOA. At higher AOA, either rudder alone, lateral stick alone, or both together may be used to achieve the desired roll response.

Yaw and Roll CAS ON, Roll Ratio EMERG

Roll response will be slightly degraded at most flight conditions. Mechanical ARI is inoperative which results in some adverse yaw when rolling at high AOA. Lateral-directional control during landing will be slightly degraded, particularly in the presence of crosswind.

Yaw or Roll CAS OFF, Roll Ratio AUTO

Dutch roll (roll-yaw motion) damping is greatly reduced, particularly at approach speed. Roll can produce uncommanded yaw, especially at termination. Precise tracking is difficult. Initial roll acceleration is reduced, but maximum roll rate can be greater than with the CAS ON. The tendency to overcontrol in roll at high speed is reduced. The ARI is less effective. During landing, the airplane tends to wallow and some rudder may be necessary for coordinated flight.

Yaw or Roll CAS OFF, Roll Ratio EMERG

Roll rate is reduced at all speeds. Roll response is very sluggish, and stick forces are high, particularly at low speed. There is no ARI. Approach and landing in crosswind, turbulence, or with asymmetric load is difficult.

External Stores

External stores (particularly the centerline tank only configuration) reduces aircraft stability. The centerline tank, by itself, reduces the lateral-directional stability while wing stores, with or without centerline tank loaded, reduce the longitudinal stability. With the CAS on, there is little noticeable effect, particularly below 30 units AOA. With the CAS off, there is a noticeable increase in pitch sensitivity with external stores loaded. Store inertia will affect roll response. More time is required to attain or stop a given roll rate, particularly at high AOA.

The CFTs increase the pitch sensitivity of the aircraft. The LANTIRN or SNIPER pods decrease the lateral directional stability of the aircraft.

CG Affects

The aircraft CG will be maintained within limits during release of CFT stores if the normal release sequence is followed. Stores that fail to release (hung stores) from the aft CFT stations (L/RC-1, 4) may cause the aircraft CG to move behind the aft limit, especially at low fuel states (less than 5,000 lbs). All flight with CG out of limits should be done cautiously with maneuvers limited to those required to recover the aircraft. The CAS may mask the adverse effects of having the CG behind the aft limits. Fling qualities will degrade significantly with a failed pitch CAS. Following a pitch CAS failure, consideration should be given to improving the longitudinal stability by jettisoning wing tanks or wing-mounted A/G stores if aircraft pitch response is too sensitive for adequate control.

HEAVY GROSS WEIGHT

The aircraft exhibits no adverse handling qualities at maximum gross weight.

WARNING

The control system masks the weight effects to the point where the pilot can put the aircraft in a high AOA, high sink rate condition with little warning.

Control system masking of weight effects is particularly apparent during traffic patterns and landings. For this reason, a wide pattern or straight-in approach is recommended. Fly final approach at on speed AOA, but delay reducing power until well into the flare to prevent an excessive sink rate. Expect the nose to drop at significantly higher airspeed during aerobraking.

NOTE

Heavyweight operations with three full external tanks, or external stores, are more susceptible to departure than operations with centerline tank only.

The CFT-equipped aircraft exhibits much the same flying qualities as the basic aircraft at comparable weights. The effects of the CFTs are minor over much of the flight envelope for most maneuvers. The most noticeable longitudinal effect is an increase in pitch response and maneuverability and pitch sensitivity over the basic aircraft at similar weights.

During takeoff, less aft stick is needed for rotation, especially with three external tanks. Aerial refueling and formation flying are largely unaffected by CFTs. During maneuvering flight, CFTs increase the maximum AOA capability of the aircraft by about 4 units. During landing approaches, aircraft with CFTs lack the normal aircraft buffet onset cues at 20 to 21 AOA units and have lower speed stability. It may be necessary to refer to the AOA indicators more often to prevent AOA overshoots during pattern and flare. With the pitch CAS off the aircraft exhibits satisfactory flying qualities for a backup mode. However, as with the basic aircraft, high gain tasks such as close formation or aerial refueling with three external tanks may be very difficult with a failed pitch CAS.

At subsonic Mach numbers the lateral-directional flying qualities of the aircraft are not significantly affects by CFTs. CFT-equipped aircraft retain the good departure resistance in directional stability due to the CFTs results in larger, less comfortable yaw excursions during rolling maneuvers.

The aircraft exhibits good handling qualities with partially-full to full CFTs. At these higher weights the aircraft response to control inputs may be initially slowed by the higher inertias, although the control system will often mask this effect. Longitudinally, the higher inertias will also be partially caused by the aerodynamic effects of the CFT installation. Aircraft flying qualities during aerial refueling and formation flying are good, although higher power settings will be required for these maneuvers than with the basic aircraft.

STALLS

1 G STALLS

Light buffet begins at approximately 15 units AOA, increases in intensity to 23 units, then remains fairly constant. External stores decreases buffet onset AOA and increase the buffet level. Required aft stick force increases with increasing AOA (CAS On or Off). Some wing rock and yaw oscillation occurs above 30 units AOA. This is accentuated in the centerline tank configuration.

With full aft stick, AOA stabilizes at 38 units or above with airspeed 100 KCAS or less (this varies with CG position, aft CG giving higher AOA). As AOA increases above 30 units, lateral stick becomes less effective in generating roll. The rudder is more effective than lateral stick for roll control approaching the stall. At stall (full aft stick) neither lateral stick nor rudder are very effective.

The vertical velocity (cockpit gauge) will probably be pegged going down. Recovery from a stall is immediate when the stick is moved forward. Lateral stick inputs should be removed before the stick is moved forward to recover from a stall or departures could be induced. Any sideslip present will induce a roll with forward stick motion.

ACCELERATED STALLS

Accelerated stall characteristics are heavy buffet with moderate yaw and roll oscillations averaging less than 10 degrees of sideslip and 20 degrees of bank. All buffet and yaw/roll activity diminishes rapidly with airspeed bleed-off. With external stores, buffet onset is earlier and buffet level is greater. Airspeed bleed-off tends to be more rapid.

NEGATIVE ANGLE-OF-ATTACK STALLS

In a level flight negative G stall, AOA is below zero units. The last few inches of forward stick travel does not increase. AOA, and moving the stick back from the forward stop does not produce any response during the first few inches of stick motion. Positive aft stick force may be required to eliminate negative G and recover to normal flight. Negligible lateral or directional activity occurs at stall with no buffet. External stores have little effect.

LANDING CONFIGURATION STALLS

With gear and flaps down, stall characteristics are much the same as in the 1 G stall. Buffet begins at about 23 units AOA. External stores decrease buffet onset AOA and increase buffet level. The roll and yaw motions, buffet, and indicated airspeed are similar to the 1 G stall. Any lateral control input above 35 units AOA can produce excessive adverse yaw (apparent flight control reversal), and a spin may rapidly develop.

FLIGHT WITH ASYMETRIC LOADS

The aircraft will tend to turn into the heavy wing during takeoff roll. Since lateral stick away from the heavy wing is required to keep the wings level, any aft stick movement produces yaw away from the heavy wing (because of ARI action). Therefore, avoid abrupt pitch changes.

Although aerodynamic asymmetry has some drag effect, the primary source of degraded departure warning and resistance is weight asymmetry. The centerline tank only configuration further aggravates the condition due to the reduction of the lateral-directional stability. High AOA's, high subsonic Mach numbers, and higher altitudes tend to amplify the characteristics created by the asymmetry. However, the aircraft may be safely flown with 30 units AOA or below with an asymmetric load as great as one full external wing tank. Lateral asymmetries have a pronounced effect on roll performance above 30 units AOA in that little capability remains to roll into the heavy wing. If the critical AOA for a given asymmetric loading is exceeded, the aircraft will roll in the direction opposite the heavy wing. At higher AOA's, this roll rate can be quite rapid.

In addition to increased departure susceptibility, lateral asymmetry also degrades the recovery characteristics. As the asymmetric increases, the recovery is delayed. Control can be regained by reducing AOA and increasing speed.

Landing may be made with asymmetric loading if turns are shallow and a flat approach is flown. Fly final approach at on speed AOA but delay reducing power until well into the flare. Avoid a large or abrupt flare. With a large asymmetric load, avoid crosswinds over 15 knots. When in doubt, perform a controllability check before landing.

WEIGHT LIMITS

Lateral weight asymmetry is measured by summing the moments about the lateral center of gravity. Each moment is a product of the distance from the lateral CG in feet and the weight of the differential fuel or store in pounds. For example, a 650 pound internal wing fuel imbalance equals 5,000 foot-pounds (7.7 feet X 650 pounds). The airplane is very departure resistant below 5,000 foot-pounds of asymmetry.

If you have two AIM-7's on one side and none on the other, you need only 200 pounds wing fuel difference to add up to 5,000 foot-pounds. Two AIM-7's and two AIM-9's on one side result in more than 7,000 foot-pounds asymmetry. The aircraft is resistant below 7,000 foot-pounds. Spin recovery has been demonstrated up to 10,000 foot-pounds of asymmetry. Figure 6-1 shows asymmetric contributions for various loads.

DEPARTURE/SPIN SUSCEPTIBILITY SUMMARY

Lateral Asymmetry (Foot-Pounds)	Departure (All Loadings)	Spin	
		Without centerline Tank	With centerline Tank Only
0 to 5,000	Resistant	Extremely resistant	Resistant
Greater than 5,000 (Less than 7,000)	Susceptible	Resistant	Resistant
7,000 to 10,000	Extremely Susceptible	Resistant	Susceptible

Notes:
- This table applies to altitudes above approximately 20,000 feet.
- Departure resistance is increased considerably at lower altitudes.
- At 37 to 44 units AOA and 0.45 to 0.76 Mach number, departure resistance is decreased over that stated. The table presents the overall departure susceptibility, considering the low probability of remaining within this limited region of instability.

Figure 6-1

LATERAL ASSYMETRY CONTRIBUTIONS

Weapon/Store	Store Station	Weight (Pounds)	Buttline (Inches)	Lateral Asymmetry (Foot-Pounds)
Gun		264	65.5	1440
Wing Pylon	2 or 8	371	115.3	3570
LAU-128/A	2B or 8A 2A or 2B	82	105.5 125.0	720 850
AIM-9L	2B or 8A 2A or 8B	195	99.6 130.9	1620 2130
AIM-7F	3 or 7 4 or 6 -4 CFT Stations	510	58.5 55.4 70.7	2490 2350 3000
ACMI Pod	2B or 8A 2A or 8B	160	99.6 131.5	1330 1760
LANTIRN Navigation Pod		520	46.4	2010
Internal Wing Fuel			89.7	7.5 x Fuel Imbalance
External Wing Fuel			94.5	7.9 x Fuel Imbalance
-4 CFT Fuel			67.3	5.6 x Fuel Imbalance

Figure 6-1

DEPARTURES

A departure from controlled flight is characterized by an uncommanded flight path change such as a nose slice, roll away from a lateral input, or excessive yaw rates, as in a spin whereas an out-of-control condition exists when the aircraft is not responding properly to pilot inputs. The initial presence of the yaw rate warning tone indicates a departed flight condition that, if not corrected immediately, may quickly transition to a spin. Record all departures and spins on AFTO Form 781. Include aircraft configuration, flight parameters, wing/CFT fuel, and any other significant information.

Departure should not be encountered below 30 units AOA at any altitude, airspeed, or loading. However, loss of directional stability and subsequent rolling departures may be encountered when attempting high sideslip maneuvers (cross controls) even with CAS ON. These departures are preceded by an apparent increase in the sideslip with a constant rudder pedal input. The aircraft is resistant to departure at lower altitudes. Above 30 units AOA, external stores or asymmetry increases the departure susceptibility.

The centerline tank only configuration further increases departure susceptibility which, if combined with lateral asymmetry, markedly increases the likelihood of departure. Due to the increased drag with three external tanks installed, significantly more altitude is required to attain flying speed during recovery from post stall gyrations than is required with only air-to-air missiles installed or clean. Jettison of stores is not recommended due to the possibility of stores-to-aircraft collision.

The aircraft has a small flight regime where it is directionally unstable, and has increased susceptibility to departure and spin. This can occur in any configuration with any weight asymmetry if the yaw, angle of attack, and airspeed combine in just the right amounts. While this area of instability is not hard and fast, it generally occurs between 40-44 units AOA when there is sideslip. The pilot must be cautious not to use abrupt stick or rudder inputs at high AOA with sideslip.

Smoothly neutralizing the controls at the first indication of departure (such as roll away from lateral input, nose slice, or excessive yaw rate (i.e. departure warning tone) will normally the aircraft to controlled flight quickly. Even though the aircraft exhibits high directional stability, large lateral asymmetries can cause the aircraft to quickly enter a spin if not promptly recovered from a departure.

NOTE

While the region of decreased departure resistance actually occurs between 40-44 units AOA, lag in the AOA system during maneuvering flight can result in cockpit gauge readings of 37-44 units AOA when actual AOA is 40-44 units.

SYMMETRIC LOADS

In the region of directional instability even a symmetrically loaded aircraft will usually exhibit one of more classic signs of an impending stall, such as win rock (it may only be one) or some yaw excursions. Departure may be characterized by a nose slice and a rolling departure. Departures with a centerline tank only configuration will be more abrupt and will exhibit higher yaw rates. Neutralizing the controls at departure, results in recovery, usually within one complete rotation in roll, with negligible altitude loss.

It is possible to enter an autoroll during the recovery from a rolling departure. While the aircraft remains spin resistant, high yaw rates may be experienced before the aircraft settles into a low energy 1 G stall. It should be noted, that with a centerline tank only configuration loaded, introducing and holding full lateral stick at or near longitudinal center during the departure roll may cause spin entry in as little as three seconds. Vertical stall, tailslide, 1G stall, or accelerated stall below 200 KCAS in the clean configuration show no tendency to spin if there is no lateral asymmetry.

CENTER OF GRAVITY

As longitudinal CG approaches the aircraft forward design limit of 22% MAC, aft stick maximum angle of attack will be reduced. The reduced performance may cause the aircraft to stagnate in the region of 40-44 units AOA. This stagnation may be of sufficient time for yawing moments and sideslip angles to increase to the point of overcoming aircraft directional stability, resulting in departure from controlled flight. Monitor for tank 1 transfer malfunctions which may result in forward CG.

ASYMMETRIC LOADS

Departure susceptibility (Figure 6-1) is most affected by lateral CG position (internal wing fuel and/or stores, tanks, or missiles imbalances). Adequate lateral control and departure resistance exists up to 30 units AOA, with up to one full external wing fuel tank and one empty (36,200 foot-pounds of asymmetry). As AOA is increased above 30 units AOA, more lateral stick is required to hold up the heavy wing. This results in increasing sideslip (nose away from the heavy wing) due to reduced directional stability, rudder deflection through the ARI, and the proverse yawing moment (yaw in the direction of lateral stick input) caused by the aileron/differential stabilator deflections. If AOA continues to increase, the rudder is no longer able to reduce the sideslip into the heavy wing. The aircraft will depart with a yaw and roll acceleration away from the heavy wing.

At 40 units AOA or above, the yaw and roll accelerations cannot be controlled by lateral stick. If full aft stick is maintained during or after a 1 G stall or abrupt pull-up, the aircraft will depart (with the yaw rate tone as the first warning) with a very pronounced roll away from the heavy wing and a descending spiral is likely. Therefore, controls should be smoothly neutralized immediately following the stall/departure.

When the aircraft approaches the flight regime of directional instability, lateral weight asymmetries greater than 5,000 foot-pounds tend to provide enough sideslip to make departure inevitable. Again, departure will be without warning. In summary, the aircraft is considered susceptible to departure with lateral asymmetries above 5,000 foot-pounds and extremely susceptible with greater than 7,000 foot-pounds.

Out-of-control/departed flight conditions with asymmetric loads will usually take longer to recover due to the higher yaw rates involved. With 7,000 to 10,000 foot-pounds of asymmetry, recovery may be significantly delayed, with several peaks in AOA and yaw rate and 1.5 to 2 rolls during the departure.

Abrupt entries into high AOA regions will result in a departure and loss of control without warning. During slow entry rate approaches to stall with asymmetric loads (especially greater than 5,000 foot-pounds), the ever increasing amount of lateral stick or rudder to control heading and bank angle should serve as ample warning that loss of control is imminent. Controls must be neutralized immediately at departure to effect recovery.

The most significant effect on recovery capability is the amount of time between departure and neutralization of the controls. Longitudinally centered lateral stick against rotation in roll will result in a spin. Even though the aircraft exhibits a high directional stability, larger lateral asymmetry can cause the aircraft to quickly enter a spin if not promptly recovered from a departure.

Asymmetric Thrust Departure Prevention System (ATDPS)

Asymmetric thrust at a high dynamic pressure leads to a departure characterized by rapid uncommanded sideslip, which can exceed aircraft structural design limits. Protection against asymmetric thrust departures is provided by the ADTPS.

SPIN CHARACTERISTICS

SYMMETRIC LOADS

A laterally symmetric aircraft in the cruise configuration (i.e., gear and flaps up and speed brake in) is extremely spin resistant with any combination of lateral-directional control inputs when aft stick is maintained. Full cross-controls at full aft stick over a wide range of speeds fails to achieve spins. The extreme spin resistance is a result of the basic high AOA stability and flight control system designs. Full lateral control applied opposite to the direction of roll during an autoroll will result in a spin if the lateral stick input is prolonged. Following departure in a laterally symmetric aircraft, full lateral control inputs with the stick near the neutral position may cause a spin in as little as 3 seconds. With the centerline tank only configuration, full lateral control deflections applied opposite to the rotation following a departure can result in spins in even less time.

ASYMMETRIC LOADS

With lateral asymmetries of 5,000 foot-pounds or less, except for centerline tank only loading, there is no significant increase in spin susceptibility. When aft stick is maintained with any combination of lateral control inputs, the aircraft will remain extremely spin resistant. However, with AOA above 30 units, spins are attainable in as little as three seconds with lateral control inputs (no rudder required) against the rotation at departure.

With the centerline tank only configuration, the aircraft is still spin resistant while maintaining aft stick at departure with up to 5,000 foot-pounds of asymmetry. With 5,000 foot-pounds asymmetry, the aircraft with the centerline tank only configuration is close to being considered spin susceptible when full lateral inputs are applied with the stick near neutral following a departure. Only 1 to 2 seconds may be required to develop a spin. Overall, the aircraft with 5,000 foot-pounds is due to the increasing rolling moment caused by the increased asymmetry. As asymmetry increases, the susceptibility to spin increases and neutralizing the controls must not be delayed.

SPIN MODES

Three different erect spin modes may be entered. The two most common are a highly oscillatory mode with medium yaw rates and a smooth flat spin with high yaw rates. The third mode, encountered very infrequently, is characterized by law yaw rates (approximately 60 degrees per second) and mild oscillations.

The highly oscillatory spin mode will exhibit average AOA in excess of cockpit gauge range (70-80 units), with average yaw rates of 60 to 90 degrees per second. Oscillations of plus/minus 32 units of AOA and plus/minus 20 degrees per second yaw rate are typical. Neutralizing the controls during a highly oscillatory spin usually will result in a recovery in as little as 1 to 1.5 turns with an altitude loss of approximately 2,500 to 4,000 feet.

However, with neutral controls, it may require as much as 3.5 turns and 7,000 feet to self-recover, or the spin could progress to a flat spin. Delaying recovery or inadvertently applying pro-spin controls my cause a flat spin. Applying aileron in the direction of the spin will recover the aircraft almost immediately and prevent flat spin entry in all cases. Application of aileron opposite the spin direction (i.e., pro-spin) will accelerate the yaw, and a flat spin can develop rapidly. Characteristics of the highly oscillatory spin are not significantly different for various symmetric loadings, altitudes, gross weights, CG's, or power settings.

The flap spin mode with symmetric loadings will exhibit average AOA in excess of cockpit gauge range (70-90 units), with average yaw rates of 75 degrees to 135 degrees per second. Periods of high (i.e., 3 to 4 G) negative "eyeballs out" longitudinal G forces are experienced. These spins are uncomfortable and disorienting due to high yaw rates and G forces. The flat is often very steady with no oscillations apparent to the pilot. In some cases, mild oscillation may be present. When a flat spin has developed, recovery is no longer possible with neutral controls.

Nearly full aileron/differential stabilator deflections in the spin direction are required for recovery. Rudder deflections in either direction have little effect on spin recovery. Recovery will not be immediately apparent and will require approximately two to four turns, with at least 3,000 to 6,000 feet of altitude loss (approximately 10 to 20 seconds) to stop the rotation. Full aileron deflection, which is required for satisfactory recovery, is made available by the spin recovery mode of the flight control system. This mode allows the pilot to use full aileron deflections regardless of fore and aft stick positions, 5 seconds after yaw rate exceeds 41,5 degrees per second.

Normal aileron control is restored when yaw rate is reduced to less than 30 degrees per second. Full aileron deflection is available with the stick at longitudinal neutral regardless of yaw rate. Yaw rate reduction (i.e., recovery) is smooth and quite slow, and may not be apparent for some time. With application of aileron opposite the spin direction (i.e., pro-spin), the yaw rate will accelerate and "eyeballs out" G force may reach 4 to 5 G.

With the aileron again applied in the direction of the spin (anti-spin), recovery will be even slower due to increased yaw rate. For asymmetric loadings (i.e., 5,000 to 7,000 foot-pounds), turn to recover from the smooth spin will increase by 1 to 1.5 turns, with an additional altitude lost of 1,000 to 2,000 feet when compared to symmetric loadings.

In the low rate spin mode the aircraft AOA will be in excess of the cockpit gauge range (this condition also exists for higher rate modes), but the average value of 60 to 65 units is lower than that of the other erect spin modes. Oscillations of plus/minus 12 units in AOA are typical. Average yaw rate will be between 45 and 60 degrees per second, usually with oscillations of plus/minus 10 degree per second.

As a result, the departure tone beep rate may not be constant during this spin mode (figure 6-2). Delaying recovery controls or inadvertently applying pro-spin controls can cause the aircraft to progress into higher rate spin mode. Applying full lateral stick in the direction of the spin will normally recovery the aircraft quickly. Occasionally, the amplitude of the spin oscillations will reduce and the low-rate spin will become very smooth.

Should this occur, aircraft recovery will be slowed. If the aircraft is in the low rate spin mode, and is not recovering with full anti-spin controls (especially with yaw rate gyro failure) landing gear may be lowered. This results in a control system change which insures full anti-spin aileron deflection is available with full lateral stick regardless of longitudinal stick position. Flaps should not be extended during spins as they may increase the number of turns for recovery.

INVERTED SPINS

The inverted spin can be caused by full lateral stick or full rudder deflection at the full forward stick position (i.e., inverted stall). The spin direction is in the direction of rudder deflection. The inverted spin is generally stabilized at -55 to -60 units AOA, with 40 degrees to 45 degrees per second yaw rate. No buffet or roll/yaw oscillations exist. After neutralizing the controls, the aircraft will recover from the spin in approximately 1.5 turns, with 4,000 feet altitude loss.

ENGINE OPERATION DURING DEPATURE AND SPIN

Engine stagnation requiring shutdown and restart is possible in an out-of-control maneuver. Dual engine stagnation has occurred during extremely violent, forced departure. Engine stagnation has also occurred when very slow airspeed/high AOA has resulted in AB blowout and engine stall. No engine anomaly has occurred during stall, vertical stall or tailslide at MIL or IDLE throttle setting.

AUTOROLLS

An autoroll is sustained combination of rolling and yawing motion. The rolling and yawing motion is sustained by a residual rudder surface deflection and inertial coupling which may continue after controls are neutralized. An autoroll differs from a spin in that it is primarily a rolling maneuver with a small yaw rate and AOA of 20 to 25 units.

Typical autoroll entry conditions are: 200 to 300 KCAS, 20 to 30 units AOA, rolling with rudder alone and then easing the stick forward. It can be terminated by applying rudder against the roll. A negative G autoroll can be terminated by neutralizing the controls. The wing is not stalled during an autoroll.

POSITIVE G AUTOROLLS

During a positive G autoroll, roll and yaw will be in the same direction. The turn needle will fluctuate from side to side and cannot be used to determine direction. The roll direction should be obvious; however, if in doubt, use the ADI. The departure warning may or may not sound since the yaw rate will be slightly above or below 30 degrees per second, the point at which beeping begins (Figure 6-2).

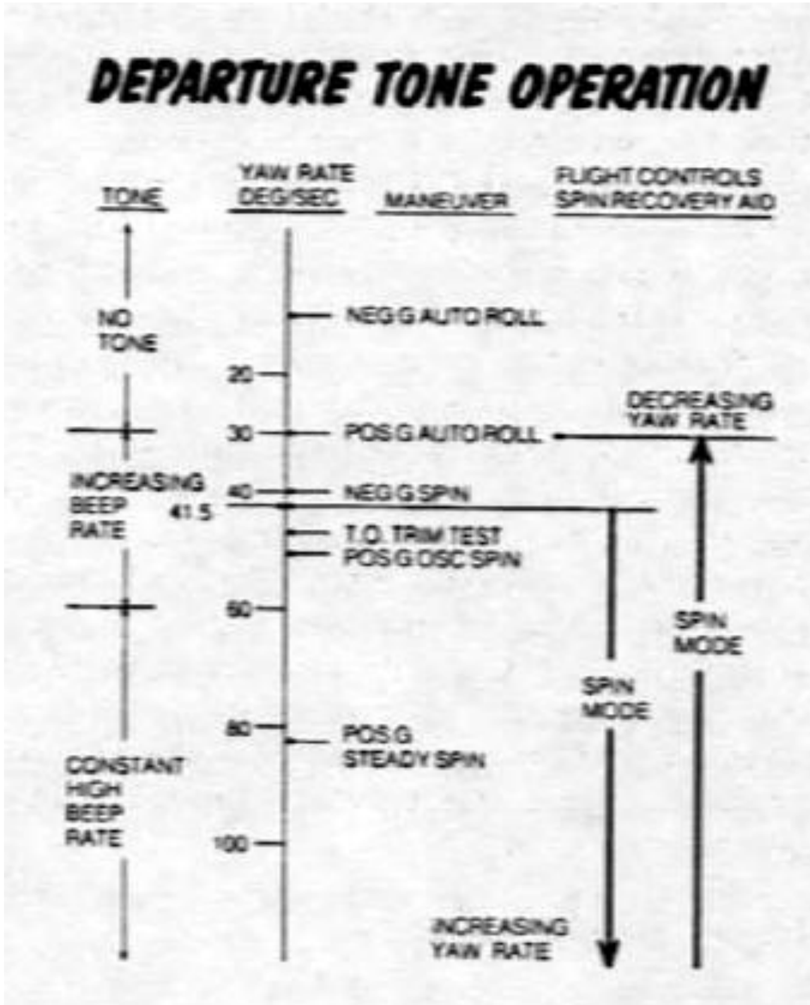


Figure 6-2

Neutralizing the controls and rudder application opposite the rolling motion will terminate the maneuver. The more rudder applied, the faster the recovery. When the roll stops, a negative G pitch over will occur. The severity of the negative G pitch over is a function of the rate of recovery and is worse if pitch CAS is off. An abrupt application of rudder may cause negative G pitch over of up to two negative G. To minimize negative G pitch over and aid in pilot orientation, slowly apply rudder to the deflection required to stop the roll. Aileron against the roll in an autoroll is a pro spin input which can induce a spin.

NEGATIVE G AUTOROLLS

During negative G autorolls, yaw and roll will be in opposite directions. Negative G autorolls are normally entered at negative G and sustained by maintaining forward stick. A negative G autoroll normally exhibits slow roll and yaw rates, and the departure warning tone will not sound. Neutralizing the controls is sufficient to terminate the maneuvers. Neutral controls and rudder application with the rolling motion will speed the recovery. If the stick was sufficiently forward to reduce the negative G during both the maneuver and recovery. Negative G autorolls can be extremely disorienting because of negative G's.

SLOW SPEED FLIGHT

The aircraft exhibits no unusual slow speed flight characteristics. For a symmetrically loaded aircraft (i.e., no weight asymmetry), the handling qualities remain acceptable up to the point where there is sufficient airflow over the controls and wings to provide control power or lift. In many cases at very slow speed, full aft stick and/or a pegged vertical velocity may be the only sign(s) of a low energy 1 G stalled condition.

For an asymmetrically loaded aircraft, maintain a minimum of 300 KCAS, except during low speed tactical maneuvers, maximum range descents, holding, instrument approaches, and landing. This minimum airspeed provides reasonable handling qualities and adequate maneuver margins for terrain and collision avoidance.

NEGATIVE G FLIGHT CHARACTERISTICS

Aircraft response to roll and yaw control inputs at negative load factors can be extremely disorienting. Abrupt rudder or cross controls can result in pilot inducted out-of-control situations.

During negative G maneuvers, pitch rates increase rapidly with decreasing load factor including negative G. Large aileron inputs cause the aircraft to roll out from under you with the disorienting and uncomfortable effect of being thrown up around the side mirror.

Rudder response varies with AOA and under negative G can produce adverse effects. At positive G, left rudder produces left wing down roll. However, as positive G reduces, rudder input produces more and more yaw induced sideslip and has less effect on generating roll. As angle of attack becomes negative (between 0 and -0.5 G) rudder input produces all sideslip and no roll. Large rudder inputs will result in extreme sideslip angle and the aircraft will be flying sideways, resulting in high cockpit lateral G's. At load factors more negative than about -0.5 G, rudder will cause a roll in the opposite direction and will be accompanied by high pitch rate and pitch angle changes.

This condition is extremely disorienting due to the combined effect of negative and lateral G and severe pitch and roll oscillations. Avoid abrupt manual rudder inputs at negative load factors. If this situation is encountered, neutralizing or releasing the controls will recover the aircraft.

The combined effect of aileron and manual rudder input at negative G can be even more dramatic. With forward stick, ailerons easily overcome any opposite direction rolling movement. If cross controls are applied, inertial coupling can produce extremely rapid and disorienting oscillatory rolls (in the direction of the aileron input) in excess of 200 degree per second. Cross control rolls should be avoided. If this situation is encountered, neutralizing or releasing the controls will recover the aircraft.

Asymmetry has little effect on recovery from negative AOA out-of-control rolls. Oscillations in all axes and roll rates are accentuated. However, neutral controls will recover the aircraft almost immediately.

LOW-ALTITUDE HIGH SPEED FLIGHT

The aircraft is susceptible to gusts during low-altitude, high-speed flight due to low wing loading/high lift wing characteristics. In areas of very heavy turbulence, such as found in mountainous desert terrain, flight above about 0.8 Mach may induce abrupt vertical motions. None of these disturbances significantly alter the aircraft flight path. Flight with external stores increases the wing loading and reduces the effect of gusts on the aircraft.

SECTION 7
ADVERSE WEATHER OPERATION
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TURBULENCE AND THUNDERSTORMS

Avoid areas of icing, turbulence, hail, or thunderstorms, when possible, due to increased danger of engine stagnation. If these areas cannot be avoided, turn on the engine anti-icing system before weather penetration. Monitor FTIT gauges continuously during weather penetration. Increasing FTIT is an indication of engine icing. The INLET ICE caution warns of icing conditions in the engine inlet. When possible, anticipate icing and turn on the anti-icing system to warm the engine inlet guide vanes.

PENETRATION

Thunderstorm penetration has not been flight tested. The aircraft structure is capable, subsonic, of withstanding the accelerations and gust loadings associated with the largest thunderstorms. The aircraft is stable and comparatively easy to control in severe turbulence if speed is not high. Severe damage may be caused by hail and lightning. Hail damage to the speed brake is increased significantly if the speed brake is extended.

PENETRATION AIRSPEED

Optimum thunderstorm penetration speed is 300 KCAS, or best cruise, whichever is lower. Optimum thunderstorm penetration speed is a compromise between pilot comfort, controllability, structural stress, and engine inlet air distortion. At high speed, aircraft discomfort and structural stress are greater. At slow speed, controllability is reduced and inlet airflow distortion due to turbulence may cause compressor stall and/or engine stagnation.

THUNDERSTORM PENETRATION

Place the windshield anti-ice switch ON at the first sign of ice or before entering known icing conditions. Establish recommended penetration speed. Perform or check the following:

1. Throttle – ADJUST TO MAINTAIN DESIRED PENETRATION SPEED
2. Pitot heat switch – ON
3. Engine anti-ice switch – ON
4. Windshield anti-ice switch – ON
5. Lower seat

If night penetration –

6. Storm flood switch – BRT

7. Instrument lights – BRT
8. Console lights – BRT
9. Anti-collision lights – OFF

IN THE STORM

Maintain a normal instrument scan with added emphasis on the attitude indicator (EADI) and power setting. Attempt to maintain attitude and accept altitude, AOA, and airspeed fluctuations. Ice or hail may damage the pitot tubes or AOA probe.

SNOW, ICE, RAIN, AND SLUSH

TAXIING

Painted areas on runways, taxiways, and ramps are significantly slipperier than non-painted areas. When painted areas are wet, braking may be negligible. Painted areas may serve as condensation surfaces and it is possible to have wet, frosty, or icy conditions on these areas when the overall weather is dry. With snow or ice, the approach end of the runway is usually slipperier than other areas due to melting and refreezing.

There is sufficient braking effectiveness to overcome residual thrust at the very slow taxi speed required on slippery surfaces. Use care to avoid imprudent taxi speed may cause skidding. Use of the groundspeed indicator to properly manage taxi speed is recommended. Avoid hard turns on snow or ice-covered taxiways. Expect the nose to overshoot the desired position and skid sideways when using the maneuvering nose wheel steering mode. If the nose wheel skids, straighten the nose wheel and again indicate the turn.

The windshield anti-ice switch may be used momentarily to clear ice or moisture from the windshield. Inlet lip and engine face icing can occur when the ambient temperature is between 10C (50F) and -20C (-4F) and the dew point is within 0 to 3C (5F) of ambient temperature. If a half inch or more ice build-up is observed on the leading edge of the inlet variable ramp, mission abort should be considered. Ice ingestion from the lip or engine face even with engine anti-ice ON, can cause engine FOD and slight loss of power. Inlet lip and engine face ice build-up during taxi can be minimized during icing conditions by observing the following: Before engine start, insure the ground surface directly below and just forward of the inlet face is clear of snow, slush, and water whenever the ambient temperature is below 10C (50F).

After engine start, turn on engine anti-ice if either visible moisture is present or the dew point is within 3C (5F) of ambient temperature with the ambient temperature between 10C (50F) and -20C (-4F). While taxiing, avoid stopping where inlets are above areas covered by snow, slush, or water. Prior to takeoff, minimize engine operation above IDLE power with ambient temperature between 2C (36F) and 10C (54F). In this temperature range and at IDLE power, water droplets in the airstream will remain above freezing. Above IDLE power, the temperature decreases through the inlet duct is such that water will freeze on impact causing ice formation. After landing, single engine taxi during icing conditions is recommended to prevent exposure of both engines, to possible ice FOD. If taxiing single-engine with power below 73%, expect automatic avionics shutdown. Do not turn the engine anti-ice switch OFF until engine shutdown.

TAKEOFF

Do not attempt takeoff with ice or snow on the aircraft.

INFLIGHT

There is always a possibility of engine and/or airframe icing in instrument conditions. Icing is most likely when takeoff is made into low clouds with temperature near freezing. Flight operations are normally above serious icing levels and the aircraft's high performance will usually enable you to move out of dangerous areas quickly. When icing is encountered, take immediate action to avoid further accumulation.

Flight through ice and/or rain requires no special technique. However, engine and windshield anti-ice systems do require attention. Turn on the engine anti-ice when icing is anticipated. Do not wait until the INLET ICE caution comes on since this indicates that ice has already formed in the inlets. The L and/or R INLET caution may come on in icing conditions below 1.33 Mach due to ice blockage of the duct static port.

When icing conditions no longer exist, turning the engine anti-ice off reduces FTIT and increases engine life. Momentarily application of windshield anti-ice may be used to clear precipitation from the windshield during the approach.

NOTE

Icing of the AOA probes may cause pitch and roll CAS to disengage. The speed brake may also retract due to erroneous AOA information.

LANDING

When stopping distance is critical, fly final approach as slow as possible up to 23 units of AOA. Precise control of airspeed and touchdown point is critical. Use of speed brake may assist in airspeed control and decreased landing roll. The velocity vector, airspeed, and AOA on the HUD can be used as aids. On a wet runway, anticipate hydroplaning. If the runway is slippery, raising the flaps will allow aerobraking to lower speeds, thereby reducing the braking required to slow taxi speed. Landing roll can also be reduced by shutting down one engine after touchdown when committed to stop.

During single-engine operations at idle, expect automatic avionics shutdown. Aerobrake until full aft stick is achieved. Hold full aft stick until the nose drops. With a crosswind, do not jeopardize directional control by attempting to aerodynamic brake to very low airspeeds. If conditions prevent a normal aerodynamic braking attitude, consider lowering the nose and commencing maximum anti-skid braking.

Maximum wheel braking is obtains with the brake pedals full depressed. Use as much pedal force as possible (not just enough to get anti-skid cycling) without jeopardizing your ability to maintain directional control. Failure to hold the pedals fully depressed may extend the landing roll.

HYDROPLANING

Operation on wet or flooded runways may produce three conditions under which tire traction may be reduced to an insignificant value.

DYNAMIC HYDROPLANING

As the tire velocity is increased, the hydrodynamic pressure acting on the leading portion of the tire footprint will increase to a value sufficient to support the vertical load acting on the tire. The speed at which this occurs is called total hydroplaning speed. Any increase in ground speed above this critical value lifts the tire completely off the runway, leaving the tire supported by the fluid alone. Since the fluid cushion is incapable of sustaining any appreciable shear forces, braking and side force coefficients drop to near zero. The total hydroplaning speed is equal to nine times the square root of tire pressure. Figure 7-1 indicates the hydroplaning speeds for typical tire pressure:

MLG TIRE PRESSURE (PSI)	TOTAL HYDRO-PLANING SPEED (KTS)	NLG TIRE PRESSURE (PSI)	TOTAL HYDRO-PLANING SPEED (KTS)
210	130	205	128
230	136	230	136
260	145	275	149
300	155		
325	162		
355	169		

Figure 7-1

VISCOUS HYDROPLANING

Viscous hydroplaning occurs due to the inability of the tire to penetrate the very thin film found under damp runway condition. This condition is aggravated when more viscous fluid such as oil, fuel, rubber deposits, and/or dust are present. The condition is improved on a coarse textured runway. Viscous hydroplaning occurs at medium to high speeds with rolling or skidding tires. The speed at which it occurs is not dependent on tire pressure.

REVERTED RUBBER HYDROPLANING

Reverted rubber hydroplaning occurs after a locked-wheel skid has started on a wet runway. Enough heat may be produced to turn the trapped water to steam. The steam will heat the rubber sufficiently to revert it to its natural state and will seal the tire grooves. The tire then rides on a cushion of steam which greatly reduces the friction coefficient and may continue to do so to very low speeds.

AFTER LANDING

Ensure windshield anti-ice switch is OFF. Single engine taxi is recommended on slippery surfaces. Expect automatic avionics shutdown during single engine taxi below 73% RPM. Use extra care when turning from runway to taxiway as transition from a relatively dry to a slippery surface can cause rotational skids. A rotational ski is insidious and will likely result in a ground loop if it starts. Slow nearly to a stop before attempting a turn under these conditions.

COLD WEATHER OPERATION

BEFORE ENTERING COCKPIT

The entire aircraft must be free of snow, ice, and frost. These are a major flight hazard and result in a loss of lift and increased stall speed. They must be removed before flight. Do not ship or scrape away ice as damage to aircraft may result.

1. Shock struts, pitot tube, fuel vents, and actuating cylinders – FREE OF ICE OR DIRT
2. Fuel drain chocks – FREE OF ICE
3. All exterior covers – REMOVED
4. JFS accumulators – 2900 PSI MINIMUM TO 4000 PSI

INTERIOR CHECK

In temperature below 0C (32F), difficulty may be experienced when connecting the oxygen mask hose to the T-connector. Apply a small amount of heat to the T-connector to alleviate this problem. If the oxygen mask is not fastened, keep it well clear of the face to prevent freezing of the valves.

STARTING JFS AND ENGINE

The MilViz F-15E JFS system is not affected by cold weather and will function normally. Additionally, the engines may also be started normally regardless of ambient temperature.

BEFORE TAXIING

Ambient temperature does not affect the performance of the flight controls on the MilViz F-15E. However, in all cases, multiple cycles of all flight controls should be carried out to ensure proper operation and controller calibration.

TAXIING

Avoid taxiing in deep or rutted snow since frozen brakes will likely result. Increase space between aircraft while taxiing at sub-freezing temperatures to insure safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice blown by the jet blast of the preceding aircraft. The high idle thrust can produce high taxi speeds. Control taxi speeds to avoid high-speed stops or turns on slipper taxiways.

TAKEOFF

Below -20C (-4F), MIL power RPM may be as low as 87% and FTIT may be as low as 810C.

AFTER LANDING

Single engine taxi is recommended for easier control of taxi speed. Expect automatic avionics shutdown at single-engine operation below 73% RPM. Idle thrust is high, and remains essentially constant as temperature decreases.

BEFORE LEAVING AIRCRAFT

Leave canopy open, weather permitting, to permit circulation. This decreases windshield and canopy frosting. Check that protective covers are installed. Engine intake duct covers should not be installed until two hours after engine shutdown to prevent condensation from puddling and freezing, preventing subsequent engine rotation.

HOT WEATHER/DESERT OPERATION

Do not operate the engine in a sand storm or dust storm, if avoidable. Fine particulate sand is especially damaging to engine compressor blades and may cause engine flameout in severe concentrations of suspended dust. Park aircraft crosswind and shut down engine to prevent sand or dirt from damaging engine.

APPENDIX A
PERFORMANCE DATA WITH F100-PW-229 ENGINE
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PART 1

INTRODUCTION, DRAG INDEX, AIRSPEED, ALTITUDE & WINDS

NOTE

- All performance data are based on JP-4 fuel and are also applicable for JP-8 fuel.
- Performance charts for the PW-229 engines are currently being developed. In cases where the referenced performance chart for the PW-229 engine is not yet available, the corresponding chart for the PW-220 engine has been substituted.

DRAG INDEX SYSTEM

Most of the charts use the drag index system to effectively present the many combinations of weight/drag effects on performance. The Airplane Loading chart (figure A1-1 Pages 1 through 4) contains the drag number and weight of each externally carried store. The weight and drag number for external store suspension equipment are listed separately. The drag index for a specific configuration may be found by multiplying the number of stores carried by its drag number, and adding the drag number of the applicable suspension equipment.

The total drag index may then be used to enter the planning data charts. The F-15E Gross Weights and CG Location (% MAC) chart (figure A1-1 Pages 1-4) contains the weight and %CG for certain "typical" load configurations. Charts applicable for all loads and configuration are labeled ALL DRAG INDEXES. Charts labeled INDIVIDUAL DRAG INDEXES contain data for a range of drag numbers. Supersonic data is not compatible to the drag index system. Therefore, each chart is labeled for a specific configuration.

STANDARD ATMOSPHERE TABLE

The standard atmosphere tables (figures A1-2 Pages 1 and 2) allow the pilot to compute standard atmosphere to use in performance charts used for various other computations, such as runway length, stopping distance, etc.

STALL SPEEDS CHARTS

The Stall Speeds charts (figures A1-3 to A1-6) present stall speeds for various combinations of gross weight, bank angle, power settings and altitudes. The data is based on having the gear and flaps down (figures A1-3 and A1-4) or gear and flaps up (figures A1-5 and A1-6).

USE

Enter the appropriate chart with the applicable gross weight and proceed horizontally to the right to intersect the applicable bank angle. From this intersection, descend vertically and intersect the applicable altitude curve. Then project horizontally left to read the stall speed.

AIRSPEED CONVERSION

The Airspeed Conversion charts, (figure A1-7 and A1-8) provide means of converting calibrated airspeed to true Mach number and true airspeed.

INDICATED AIRSPEED

Indicated airspeed (IAS) is the uncorrected airspeed read directly from the standby airspeed indicator and NOT the Air Data Computer resolved indications on the MPD/MPCD and HUD, which are calibrated airspeeds (CAS).

CALIBRATED AIRSPEED

Calibrated airspeed (CAS) is indicated airspeed corrected for static source error.

EQUIVALENT AIRSPEED

Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility. There is no provision made for reading equivalent airspeed.

TRUE AIRSPEED

True airspeed (TAS) is equivalent airspeed corrected for density altitude. Refer to the Airspeed Conversion charts (figure A1-7 and A1-8).

AIRSPEED POSITION ERROR CORRECTION CHART

Under normal conditions, the air data computer compensates for the static source position error. If an air data computer malfunction occurs, the primary airspeed/Mach indicator become inoperative and airspeed is read from the standby indicator. The indicated airspeed read on the standby indicator may be corrected to calibrated airspeed by utilizing the Airspeed Position Error Correction chart (figure A1-9).

USE

Enter the appropriate chart with the indicated airspeed read from the standby indicator. In the flaps down, gear down configuration at 10,000 feet and below, read the calibrated airspeed from the tabulated chart. In the flaps up, gear up configuration, enter the chart with the indicated airspeed and project vertically up to the appropriate altitude reflector curve. From this point, project horizontally left to read the calibrated airspeed.

ALTIMETER POSITION ERROR CORRECTION CHART

Under normal conditions, the ADC compensates for the static source position error. If an ADC malfunction occurs, the primary altitude indicator becomes inoperative and the altitude is read from the standby indicator. The indicated altitude read on this indicator may be corrected to calibrated altitude by utilizing the Altimeter Position Error Correction chart (figure A1-10).

USE

Enter the appropriate chart with indicated airspeed. In the flaps retracted, gear up configuration project horizontally right to the assigned altitude reflector. From this point, project vertically up to the reflector line. From this point, project vertically up to the reflector line. From this point, project horizontally left to read the delta H altitude correction. In the full flaps, gear down configuration project vertically up to the appropriate gross weight curve. From this point, project horizontally left to read the delta H altitude correction. In either case apply the delta H altitude correction to the altimeter and fly indicated altitude.

WIND COMPONENTS CHART

A standard Wind Components chart (figure A1-11) is included. It is used primarily for breaking a forecast wind down into crosswind and headwind components for takeoff computations. It may also be used whenever wind component information is desired. It is not to be used as a ground controllability chart.

USE

Determine the effective wind velocity by adding one-half the gust velocity (incremental wind factor) to the steady state velocity. Reduce the reported wind direction to a relative bearing by determining the wind direction and runway heading. Enter the chart with the relative bearing. Move along the relative bearing to intercept the effective wind speed arc. From this point, descend vertically down to read the crosswind component. From the intersection of bearing and wind speed, project horizontally left to read headwind component.

STATION LOADING

OPERATING WEIGHT (Basic airplane weight plus crew)

F-15E ....33,898 pounds

BASIC TAKEOFF WEIGHT (Operating weight plus full internal fuel and ammunition)

F-15E ....47,310 pounds

NOTE

FOR PRECISE AIRPLANE BASIC WEIGHT, REFER TO WEIGHT AND BALANCE DATA HANDBOOK, TO 1-1B-40, FOR THE PARTICULAR AIRPLANE

CONFIGURATION DRAG

ITEM	WEIGHT (POUNDS)	DRAG NUMBER
F-15E		0
Two -4 CFTs (F-15E Production Model)	E 4,286 F 13,747	20.1
LANTIRN Navigation Pod (AN/AAQ-13) and Adapter (ADU-576/A)	520	9.5
LANTIRN Targeting Pod (AN/AAQ-14) and Adapter (ADU-577/A)	621	7.4

ITEM	WEIGHT PER ITEM (POUNDS)	DRAG NUMBER WITHOUT CFT		DRAG NUMBER WITH CFT			
		CENTER-LINE STATION	OTHER STATIONS	CENTER-LINE STATION	WING STATIONS	CFT STATIONS WITHOUT BOMBS/ TANKS ON WING STATIONS	CFT STATIONS WITH BOMBS/ TANKS ON WING STATIONS
Air-to-Air Missiles							
AIM-7F, -7M	510	-	1.8	-	-	2.3	2.3
AIM-9L, 9M	195	-	2.1	-	2.1	-	-
AIM-9P/P-1	170	-	2.1	-	2.1	-	-
AIM-9P-2/P-3	180	-	2.1	-	2.1	-	-
AIM-120A	338	-	1.3	-	2.3	1.7	1.7
CATM-9L/M-1	195	-	2.1	-	2.1	-	-
Air-to-Ground Missiles							
AGM-65A, B	481	-	3.7	-	3.7	-	-
AGM-65D	485	-	3.7		3.7	-	-
AGM-65G	687	-	3.7	-	3.7	-	-
AGM-130A,B	2962	-	TBD	-	TBD	-	-

Figure A1-1 Page 1 of 4

STATION LOADING (CONT)

ITEM	WEIGHT PER ITEM (POUNDS)	DRAG NUMBER WITHOUT CFT		DRAG NUMBER WITH CFT			
		CENTER-LINE STATION	OTHER STATIONS	CENTER-LINE STATION	WING STATIONS	CFT STATIONS WITHOUT BOMBS/ TANKS ON WING STATIONS	CFT STATIONS WITH BOMBS/ TANKS ON WING STATIONS
Pylons, Launchers and Adapters							
SUU-73/A Center-line Pylon with BRU-47/A	316	3.3	-	3.3	-	-	-
SUU-59C/A Wing Pylon with BRU-47/A	371	-	3.3	-	3.3	-	-
LAU-128/A Launcher and AIM-9/AIM-120 Adapter (ADU-552/A)	111	-	1.1	-	1.1	-	-
LAU-88A/A Launcher (Triple Rail) and AGM-65 Adapter (ADU-578/A)	573	-	9.6	-	9.6	-	-
LAU-117/A Launcher (Single Rail) for AGM-65	135	-	1.4	-	1.4	-	-
LAU-114/A Launcher and AIM-9 Adapter (ADU-407/A)	79	-	1.2	-	1.2	-	-
General Purpose Weapons							
MK-82 LDGP	505	-	-	-	-	0.8	0.9
MK-82 SE	550	-	-	-	-	1.4	1.5
MK-82 AIR (With BSU-49 Fin)	540	-	-	-	-	1.1	1.2
MK-84 LDGP	1970	3.0	2.1	3.0	2.3	2.8	3.0
MK-84 AIR (With BSU-50 Fin)	2010	5.4	3.9	5.4	4.2	5.1	5.6

Figure A1-1 Page 2 of 4

STATION LOADING (CONT)

ITEM	WEIGHT PER ITEM (POUNDS)	DRAG NUMBER WITHOUT CFT		DRAG NUMBER WITH CFT			
		CENTER-LINE STATION	OTHER STATIONS	CENTER-LINE STATION	WING STATIONS	CFT STATIONS WITHOUT BOMBS/ TANKS ON WING STATIONS	CFT STATIONS WITH BOMBS/ TANKS ON WING STATIONS
Guided Weapons							
GBU-10A/B	2053	10.5	7.5	10.5	7.5	9.8	10.7
GBU-10C/B, D/B	2081	10.5	7.5	10.5	7.5	9.8	10.7
GBU-12B/B, C/B	610	-	-	-	-	3.9	4.3
GBU-15(V)-4/B	2502	-	5.6	-	5.6	-	-
GBU-24/B	2323	7.8	5.6	7.8	5.6	5.6	6.2
Dispensers/Rockets							
CBU-52B/B	785	-	-	-	-	4.6	5.0
CBU-58/B	810	-	-	-	-	4.6	5.0
CBU-71/B	810	-	-	-	-	4.6	5.0
CBU-87/B (TMD)	950	-	-	-	-	2.9	3.2
CBU-89/B (TMD)	706	-	-	-	-	2.9	3.2
MK-20 Rockeye	486	-	-	-	-	1.5	1.6
TMU-28/B Spray Tank	E 567 F 1935	-	4.9	-	4.9	-	-
Special Weapons							
B61	716	2.5	1.8	2.5	1.8	1.8	2.0
Miscellaneous Stores							
610 Gallon Fuel Tank	E 320 F 4285	12.2	5.5	12.2	6.0	-	-
610 Gallon Fuel Tank (With Bombs on Inboard CFT Station)	E 320 F 4285	-	-	12.2	8.2	-	-
610 Gallon Fuel Tank (With Bombs on Out-board CFT Station)	E 320 F 4285	-	-	12.2	12.3	-	-
SUU-20B/A Practice Dispenser (Empty)	276	5.0	3.6	5.0	3.9	3.9	3.9
MK-106 PB (Incl)	F 306	4.2	3.0	4.2	3.3	3.3	3.3
BDU-33 PB (Incl)	F 414	4.2	3.0	4.2	3.3	3.3	3.3
BDU-48 PB (Incl)	F 336	4.2	3.0	4.2	3.3	3.3	3.3

E - Empty F - Full PB - Practice Bomb

Figure A1-1 Page 3 of 4

STATION LOADING (CONT)

ITEM	WEIGHT PER ITEM (POUNDS)	DRAG NUMBER WITHOUT CFT		DRAG NUMBER WITH CFT			
		CENTER-LINE STATION	OTHER STATIONS	CENTER-LINE STATION	WING STATIONS	CFT STATIONS WITHOUT BOMBS/ TANKS ON WING STATIONS	CFT STATIONS WITH BOMBS/ TANKS ON WING STATIONS
BDU-38 (B61 Training Shape)	716	2.6	1.8	2.5	1.8	1.8	2.0
AN/AXQ-14 Data Link Pod (for GBU-15)	450	3.3	-	3.3	-	-	-
P-4A/AX AIS Pod	160	-	2.1	-	2.1	-	-
AN/ASQ-T17 AIS Pod	122	-	2.1	-	2.1	-	-
AN/ASQ-T20 AIS Pod	123	-	2.1	-	2.1	-	-
AN/ASQ-T21 AIS Pod	124	-	2.1	-	2.1	-	-
AN/ASQ-T25 AIS Pod	122	-	2.1	-	2.1	-	-
BLU-107 Durandal	494	-	-	-	-	1.2	1.4
MXU-648A/A-50 Cargo Pod	E 98 F 398	3.6	3.6	3.6	3.6	-	-
Ammunition (512 Live Rounds)	289	-	-	-	-	-	-
(Spent Cartridges)	136	-	-	-	-	-	-

E - Empty F- Full

Figure A1-1 Page 4 of 4

STANDARD ATMOSPHERE TABLE

STANDARD SEA LEVEL AIR:
T = 59°F (15°C)
P = 29.921 IN. OF HG

W = 0.076475 LB/CU FT = 0.0023769 SLUGS/CU FT
1 IN. OF HG = 70.732 LB/SQ FT = 0.4912 LB/SQ IN
a_0 = 116.5 FT/SEC = 661.5 KNOTS

U.S. STANDARD ATMOSPHERE, 1966

ALTITUDE FEET	DENSITY RATIO ρ/ρ_0	$1/\sqrt{\sigma}$	AIR TEMPERATURE		SPEED OF SOUND RATIO a/a_0	PRESSURE	
			DEG. F	DEG. C		IN. OF HG	RATIO $P/P_0 = \delta$
-2.000	1.0598	0.9714	66.132	18.962	1.0068	32.15	1.0745
-1.000	1.0296	0.9855	62.566	16.981	1.0034	31.02	1.0368
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	0.9482	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	-8.74	0.9579	19.03	0.6360
13.000	0.6713	1.2206	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	16.83	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	0.9827	13.75	0.4593
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

Figure A1-2 Page 1 of 2

STANDARD ATMOSPHERE TABLE

STANDARD SEA LEVEL AIR:
T = 59°F (15°C)
P = 29.921 IN. OF HG

W = 0.076475 LB/CU FT = 0.0023769 SLUGS/CU FT
1 IN. OF HG = 70.732 LB/SQ FT = 0.4912 LB/SQ IN
a_0 = 116.5 FT/SEC = 661.5 KNOTS

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

Figure A1-2 Page 2 of 2

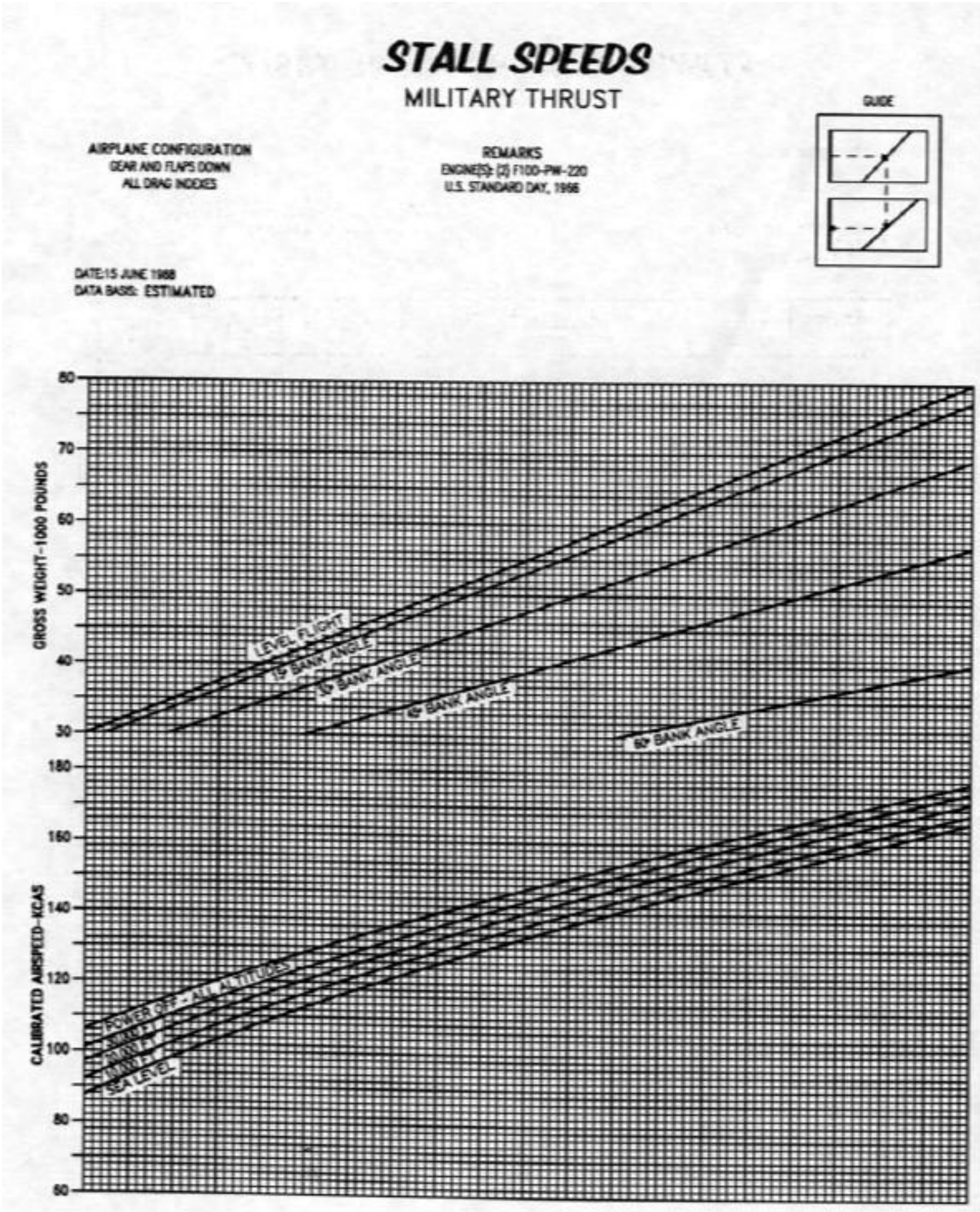

STALL SPEEDS
MILITARY THRUST
AIRPLANE CONFIGURATION
GEAR AND FLAPS DOWN
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GROSS WEIGHT-1000 POUNDS
CALIBRATED AIRSPEED-KCAS
LEVEL FLIGHT
15° BANK ANGLE
30° BANK ANGLE
45° BANK ANGLE
60° BANK ANGLE
POWER OFF - ALL ALTITUDES
SEA LEVEL

Figure A1-3

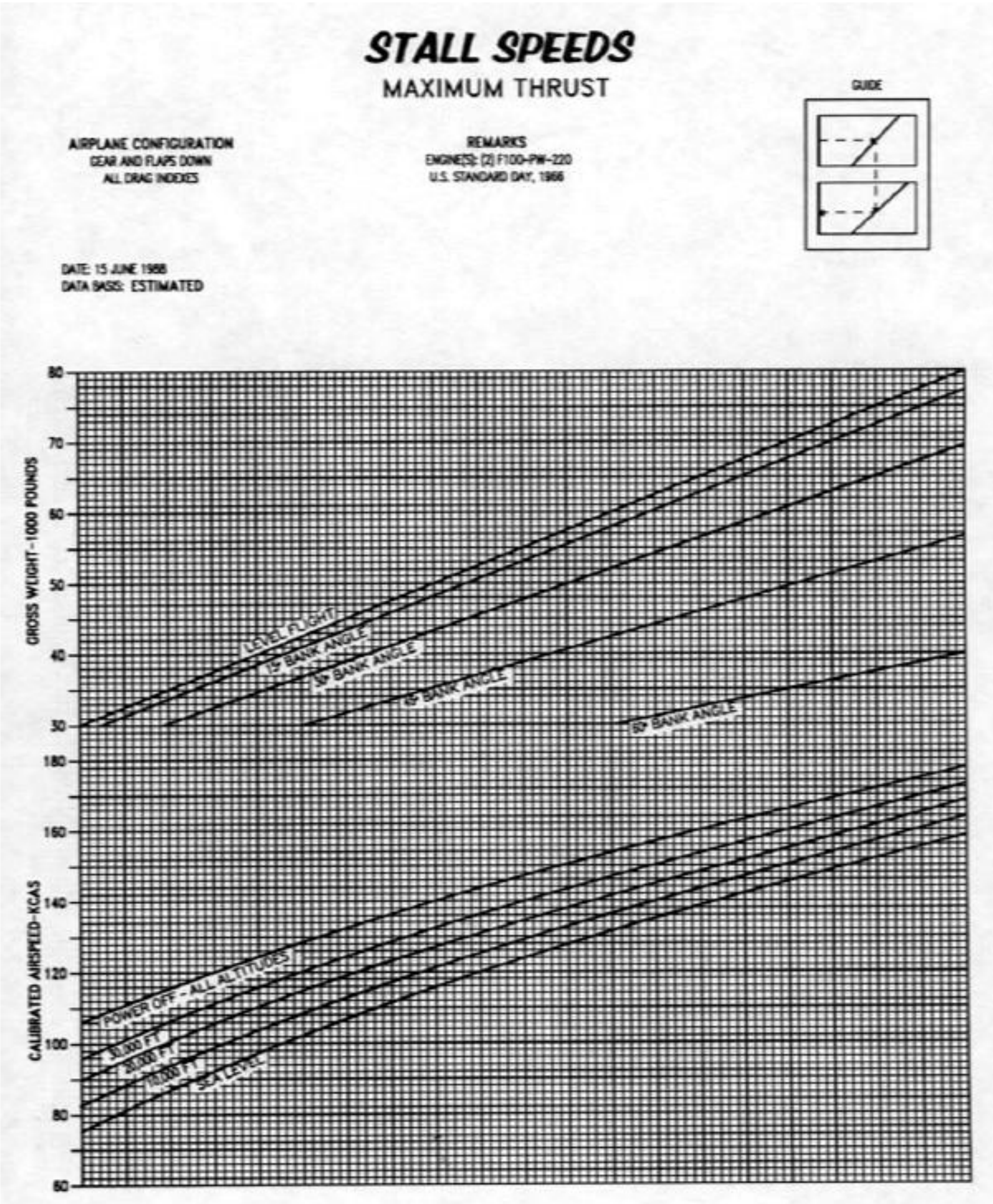

STALL SPEEDS
MAXIMUM THRUST
GUIDE
AIRPLANE CONFIGURATION
GEAR AND FLAPS DOWN
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GROSS WEIGHT-1000 POUNDS
LEVEL FLIGHT
15° BANK ANGLE
30° BANK ANGLE
45° BANK ANGLE
60° BANK ANGLE
CALIBRATED AIRSPEED-KCAS
POWER OFF - ALL ALTITUDES
30,000 FT
20,000 FT
10,000 FT
SEA LEVEL
80
70
60
50
40
30
180
160
140
120
100
80
60

Figure A1-4

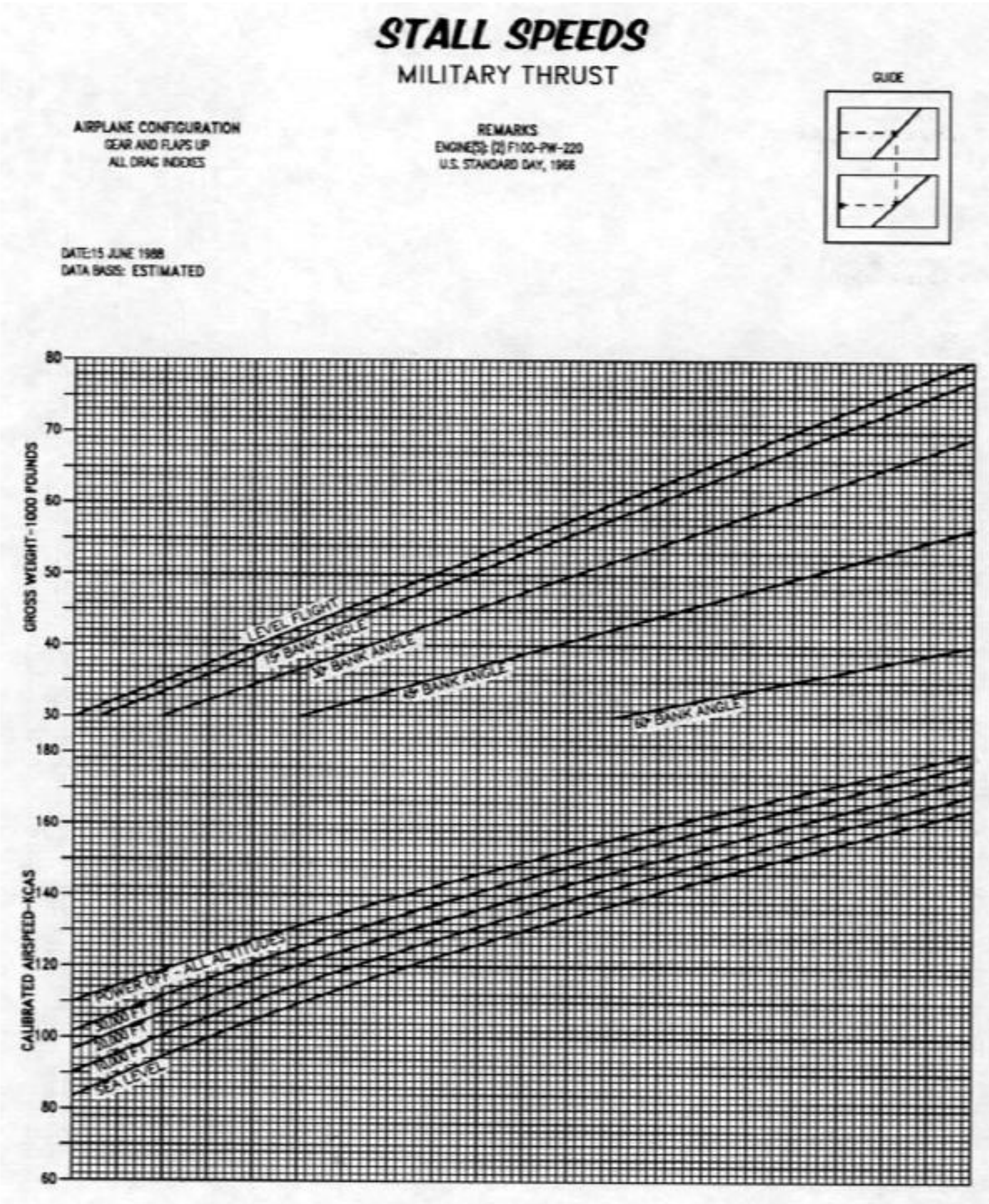

STALL SPEEDS
MILITARY THRUST
GUIDE
AIRPLANE CONFIGURATION
GEAR AND FLAPS UP
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GROSS WEIGHT - 1000 POUNDS
CALIBRATED AIRSPEED - KCAS
LEVEL FLIGHT
15° BANK ANGLE
30° BANK ANGLE
45° BANK ANGLE
60° BANK ANGLE
POWER OFF - ALL ALTITUDES
30,000 FT
20,000 FT
10,000 FT
SEA LEVEL
80
70
60
50
40
30
180
160
140
120
100
80
60

Figure A1-5

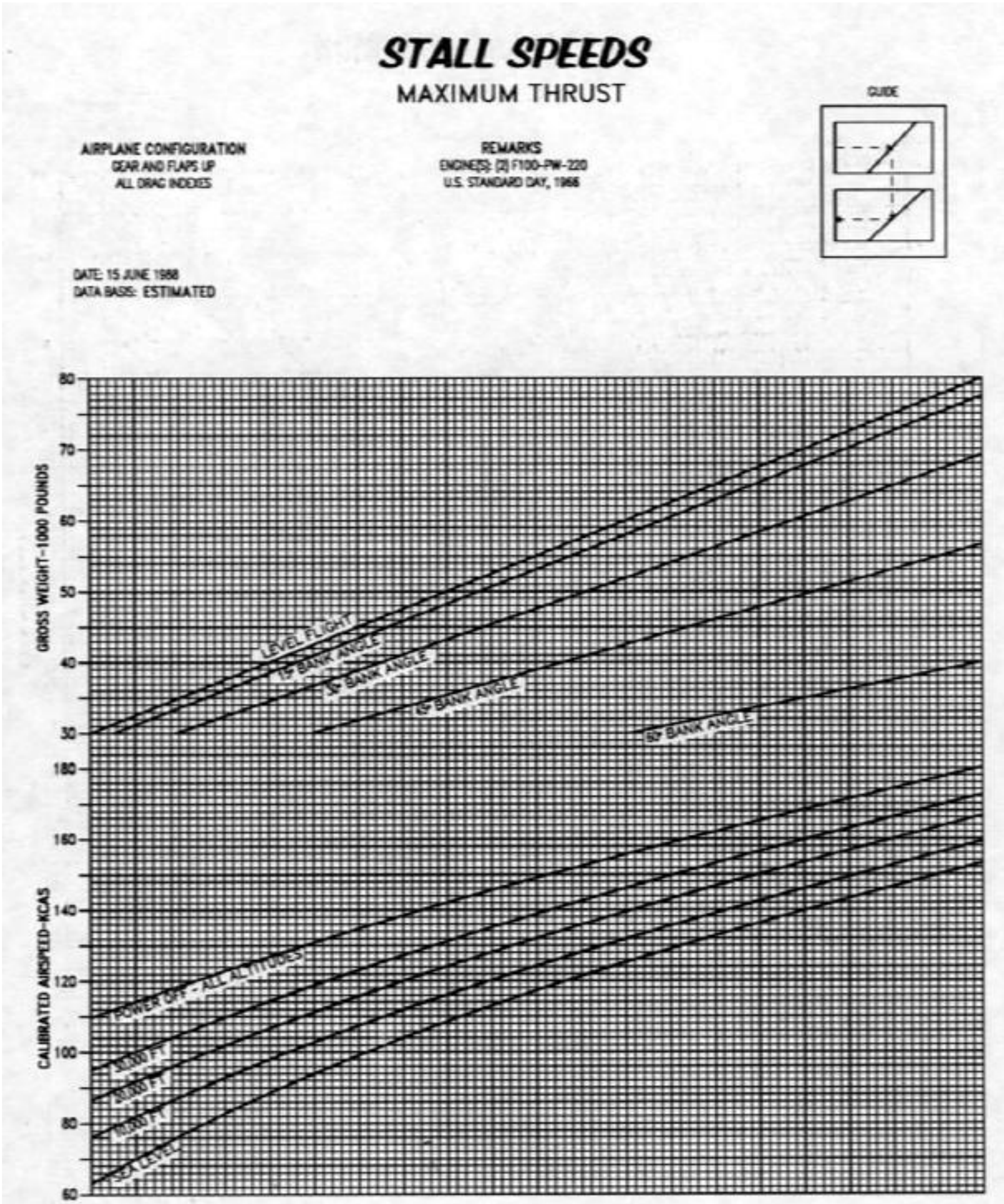
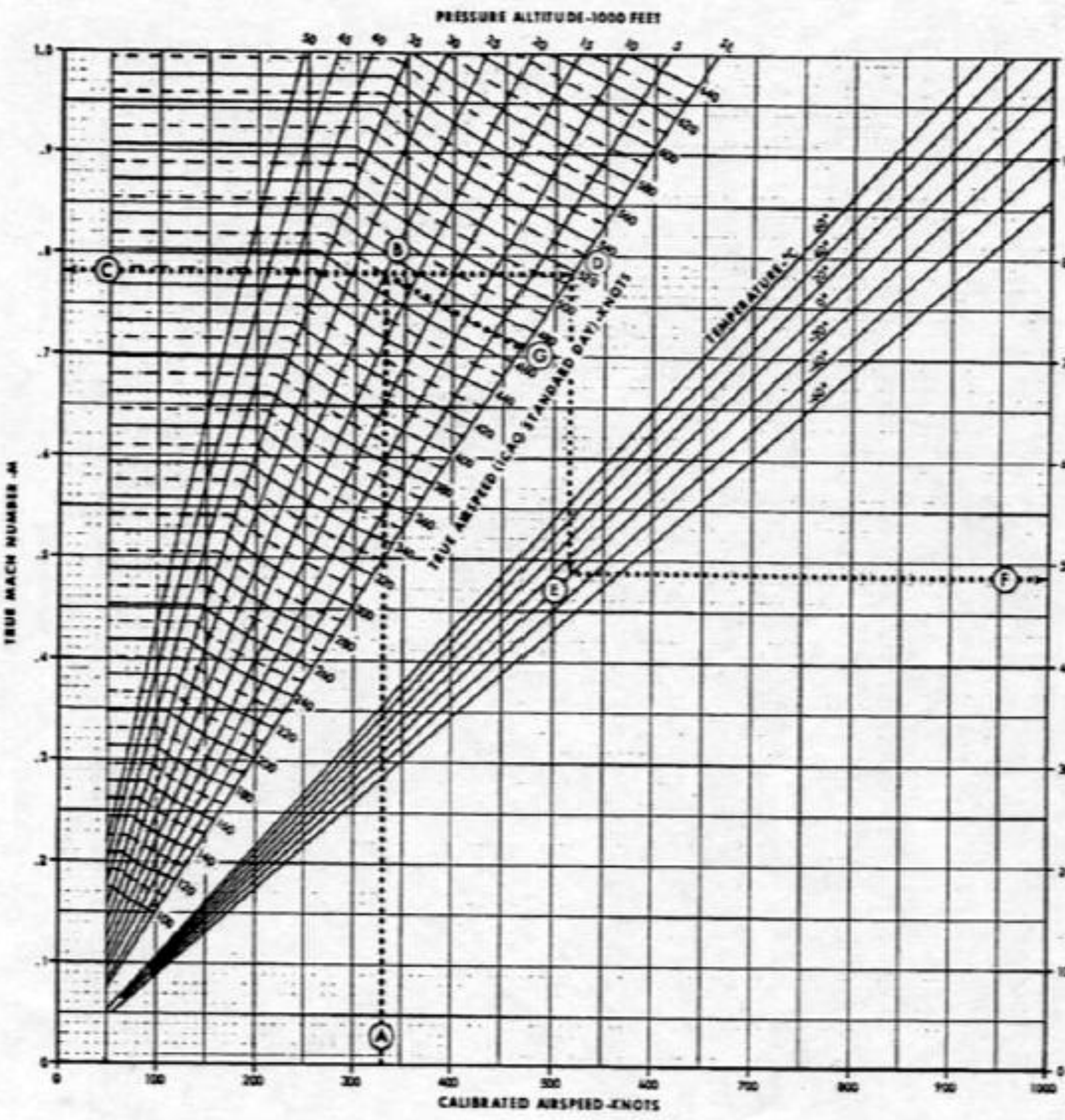

STALL SPEEDS
MAXIMUM THRUST
GUIDE
AIRPLANE CONFIGURATION
GEAR AND FLAPS UP
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GROSS WEIGHT-1000 POUNDS
CALIBRATED AIRSPEED-KCAS
LEVEL FLIGHT
15° BANK ANGLE
30° BANK ANGLE
45° BANK ANGLE
60° BANK ANGLE
POWER OFF - ALL ALTITUDES
30,000 FT
20,000 FT
10,000 FT
SEA LEVEL
80
70
60
50
40
30
180
160
140
120
100
80
60

Figure A1-6

AIRSPEED CONVERSION

LOW MACH



EXAMPLE

A = CAS = 330 KNOTS
B = ALTITITUDE = 25,300 FEET
C = MACH = .782
D = SEA LEVEL LINE
E = TEMPERATURE = −20°C
F = TAS = 486 KNOTS
G = TAS (STANDARD DAY) = 472 KNOTS

Figure A1-7

AIRSPEED CONVERSION

HIGH MACH

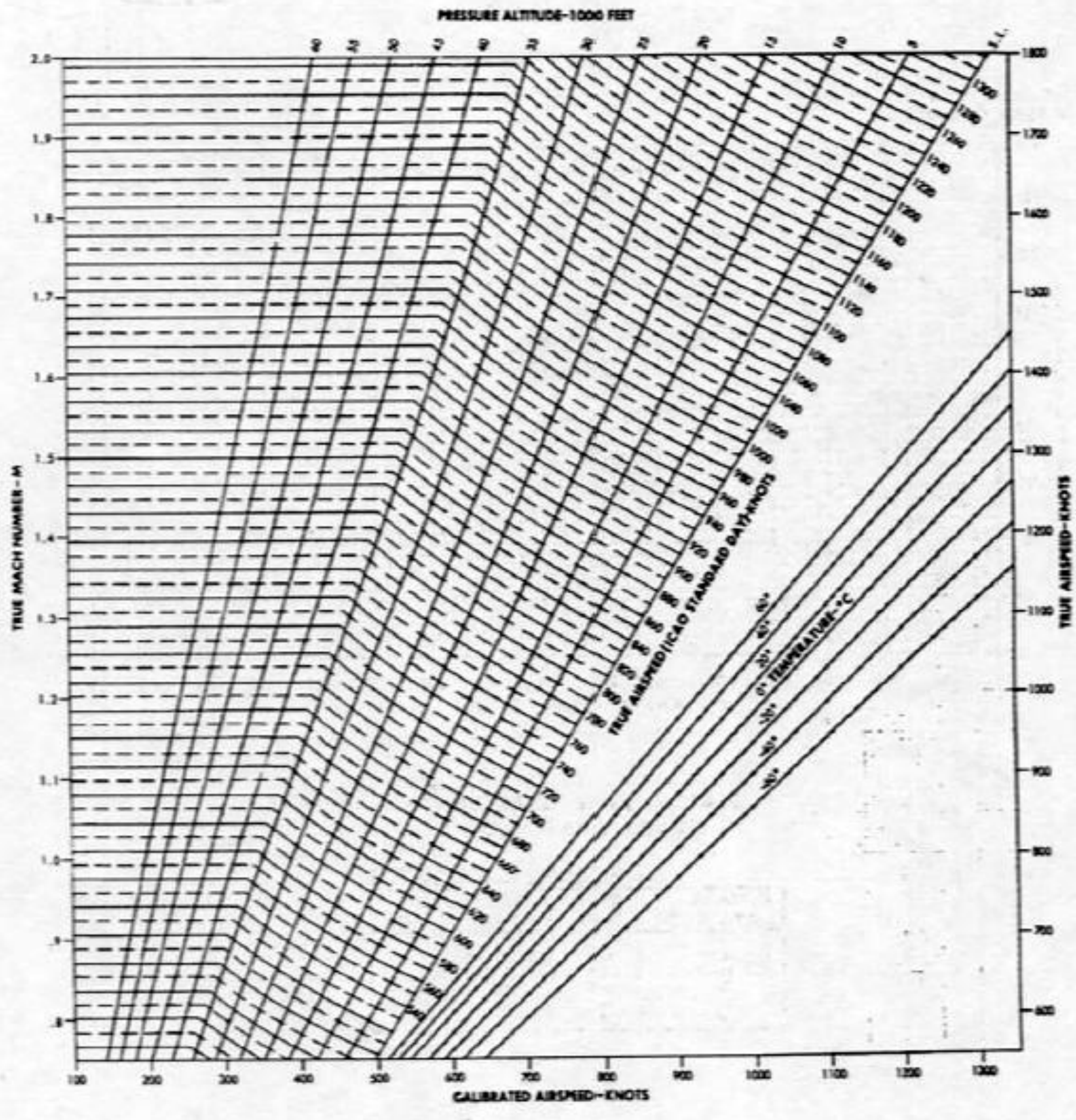


Figure A1-8

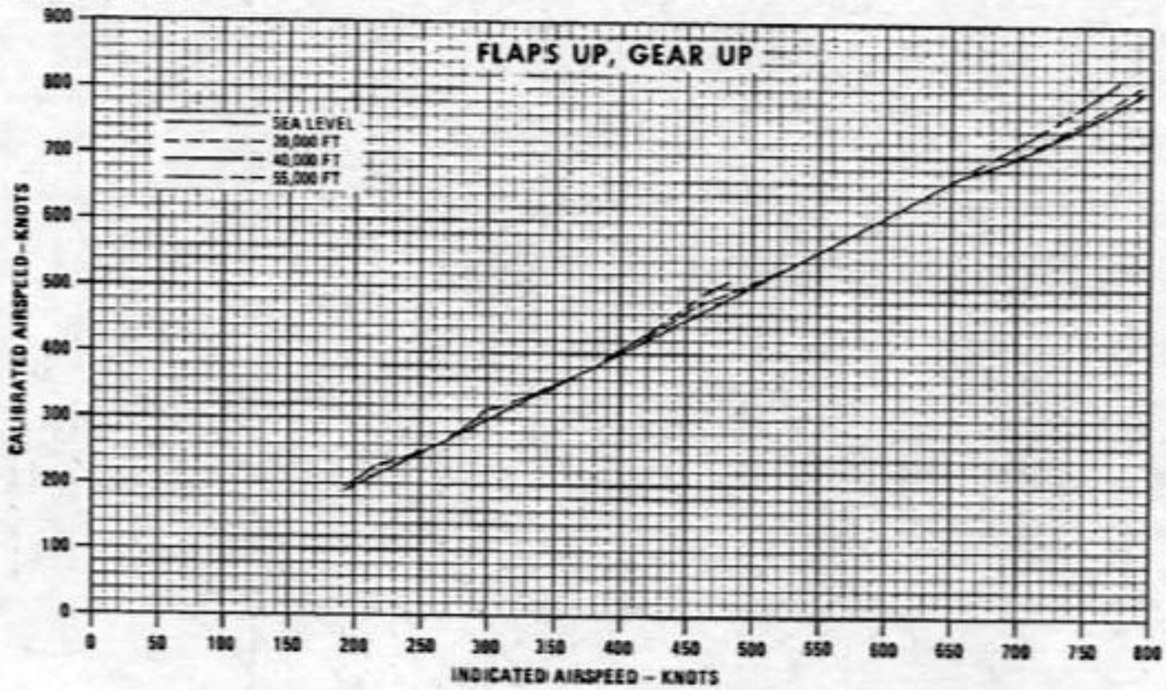
AIRSPEED POSITION ERROR CORRECTION

1G FLIGHT

AIRPLANE CONFIGURATION
FLAPS AND GEAR AS NOTED

REMARKS
ENGINE(S): (2) F100-PW 229
U.S. STANDARD DAY, 1966

DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED

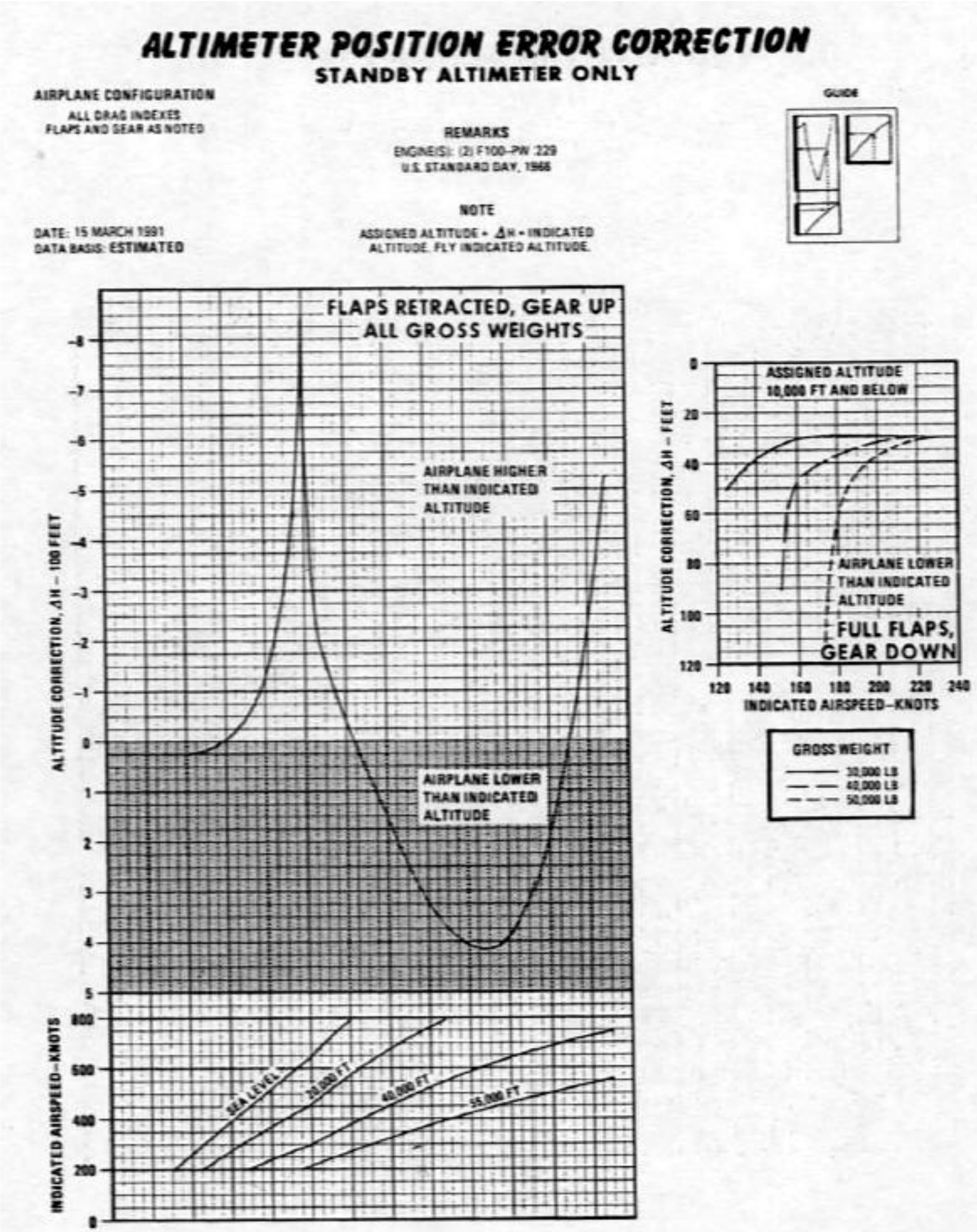


FLAPS DOWN, GEAR DOWN
10,000 FT AND BELOW

INDICATED AIRSPEED–KTS	CALIBRATED AIRSPEED-KTS GW 30,000	GW 40,000	GW 50,000
140	137	–	–
160	158	157	–
180	178.5	178	177
200	198.5	198.5	198
220	219	218.5	218.5
240	239	239	239

Figure A1-9

Version 1.1 – 9 July 2011



ALTIMETER POSITION ERROR CORRECTION
STANDBY ALTIMETER ONLY
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
FLAPS AND GEAR AS NOTED
REMARKS
ENGINE(S): (2) F100-PW-229
U.S. STANDARD DAY, 1966
NOTE
ASSIGNED ALTITUDE + ΔH = INDICATED ALTITUDE. FLY INDICATED ALTITUDE.
DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED
GUIDE
FLAPS RETRACTED, GEAR UP
ALL GROSS WEIGHTS
AIRPLANE HIGHER THAN INDICATED ALTITUDE
AIRPLANE LOWER THAN INDICATED ALTITUDE
ALTITUDE CORRECTION, ΔH – 100 FEET
INDICATED AIRSPEED–KNOTS
SEA LEVEL
20,000 FT
40,000 FT
55,000 FT
ASSIGNED ALTITUDE 10,000 FT AND BELOW
ALTITUDE CORRECTION, ΔH – FEET
AIRPLANE LOWER THAN INDICATED ALTITUDE
FULL FLAPS, GEAR DOWN
INDICATED AIRSPEED–KNOTS
GROSS WEIGHT
30,000 LB
40,000 LB
50,000 LB

Figure A1-10

WIND COMPONENTS

- DETERMINE THE EFFECTIVE WIND VELOCITY BY ADDING ONE-HALF THE GUST VELOCITY (INCREMENTAL WIND FACTOR) TO THE STEADY STATE VELOCITY: E.G. REPORTED WIND 050/30 G40, EFFECTIVE WIND IS 050/35.
- CROSSWIND LIMITS FOR RCR VALUES, 12-16 AND 16-23 MAY BE OBTAINED BY INTERPOLATING BETWEEN THE LIMITS SHOWN.

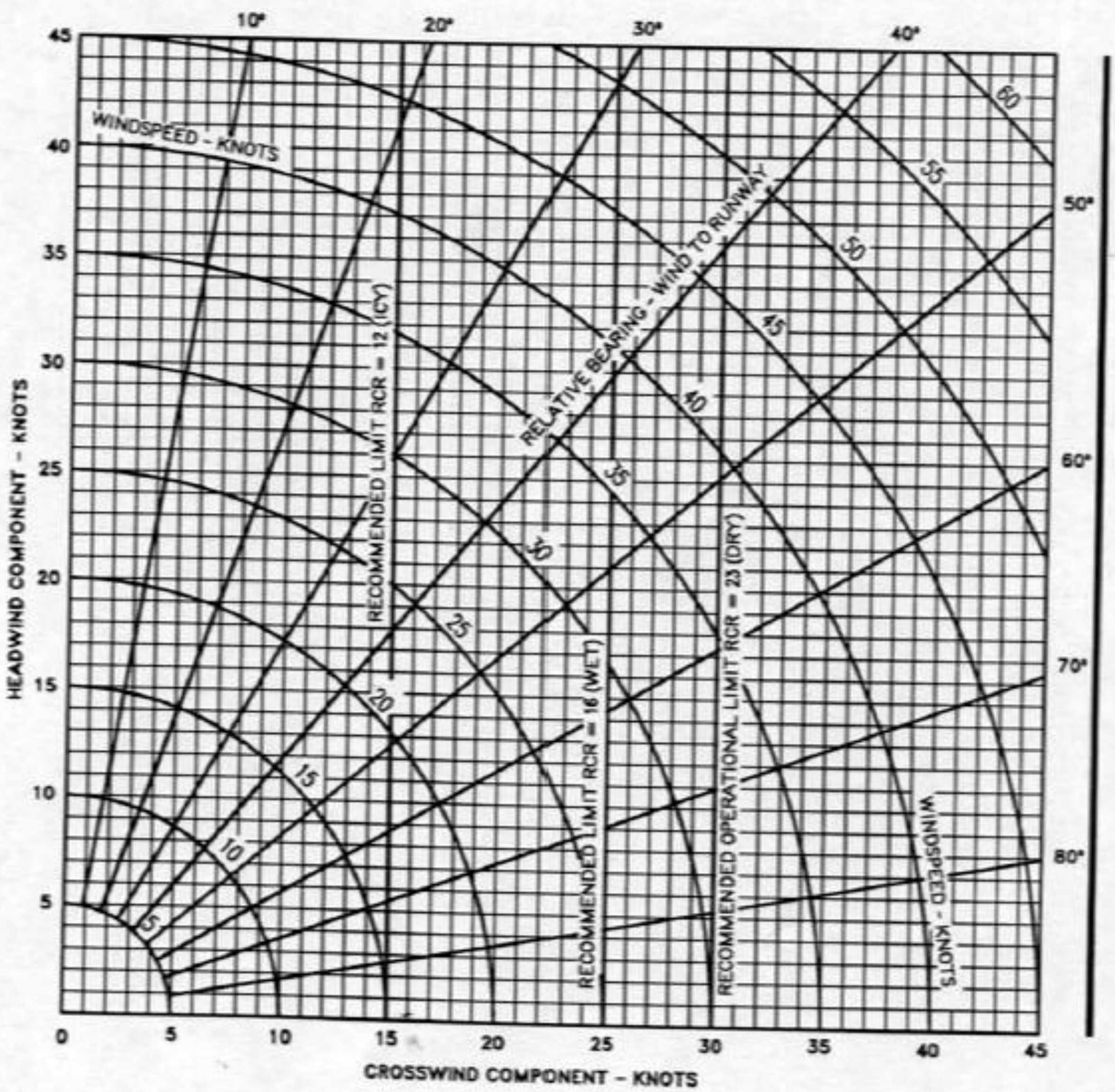


Figure A1-11

PART 2

TAKEOFF

DENSITY RATIO CHART

This chart (figure A2-1) provides a means of obtaining a single factor (density ratio) that may be used to represent a combination of temperature and pressure altitude. Density ratio must be determined before the Minimum Go Speed and Maximum Abort Speed charts can be utilized.

USE

Enter the chart with existing temperature and project vertically to intersect the applicable pressure altitude curve. From this point, project horizontally to the left scale to read density ratio.

MINIMUM GO SPEED CHART

These charts (figures A2-2 and A2-6) provide the means of determining the minimum speed at which the aircraft can experience an engine failure and still take off under existing conditions of temperature, pressure altitude, gross weight, and the runway length remaining. Separate plots are provided for maximum and military thrust conditions, and for aircraft with and without CFT's installed. The data is based on an engine failure occurring at the minimum go speed and allows for a 3-second decision period with one engine operating at its initial thrust setting. In the case of a military thrust takeoff, an additional 3-second period is allowed for advancing the operating engine throttle to maximum thrust.

WARNING

If an engine is lost above the maximum abort speed, but below the minimum go speed, the pilot can neither abort nor take off safely on the runway length remaining without immediately implementing such options as reducing gross weight through fuel dumping on the ground, or immediately lowering the arrestor hook and engage the departure end barrier or arresting cable (if installed). Refer to Engine Failure During Takeoff, Section 3 of this POH. It is normally safer to abort on the ground.

USE

Enter the applicable plot with the prevailing density ratio, and project horizontally to the available runway length grid line. Parallel the nearest guideline up or down to intersect the baseline. From this point, descend vertically to intersect the applicable takeoff gross weight curve, then horizontally to read minimum go speed. If this projected line lies entirely to the right of the gross weight curve, single engine failure can be tolerated at any speed between zero and the highest speed shown with the ground roll being within the available runway length.

If the above projected line lies entirely to left of the gross weight curve, single engine failure takeoff cannot be accomplished within the available runway length. With CFTs, the recommended rotation speeds are given in figure A2-10. Without CFTs, with an engine failure before nose rotation at high gross weights, the ground roll will be shortened if aft stick is relaxed until 10 to 15 knots below takeoff speed. This situation will be obvious to the pilot.

MAXIMUM ABORT SPEED CHART

NOTE

- The maximum abort speed chart does not include the capability of any arrestment gear which may be installed, and takes into account only aircraft stopping performance for the given field conditions.
- Lower weight aircraft are often shown to have lower maximum abort speeds than higher weight aircraft due to the greater acceleration of the lighter aircraft during the abort decisions period used in the calculation.

These charts (figures A2-3 and A2-7) provide a means of determining the maximum speed at which an abort may be started and the aircraft stopped within the remaining runway length. Separate plots are provided for maximum and military thrust, and for aircraft with and without CFTs installed. Allowances included in this data are based on a 3-second decision period (with both engines operating at the initial thrust setting) followed by a 2-second period to apply wheel brakes and a 5-second period to reach idle thrust (these two abort procedures are initiated simultaneously).

USE

Enter the applicable plot with the prevailing density ratio, and project horizontally to intersect the available runway length curve. From this point, descend further to intersect the computed takeoff gross weight, then horizontally to read the corresponding maximum abort speed.

TAKEOFF DISTANCE CHARTS

These charts (figures A2-4, A2-5, A2-8, and A2-9) are used to determine the no wind ground run distance, wind adjusted ground run, and the total distance required to clear a 50-foot obstacle. Separate charts are provided for maximum and military thrust, and for aircraft with and without CFTs installed. The without CFTs charts (figures A2-8 and A2-9) are based on CGs representative of each gross weight. With CFTs, the CGs used for each gross weight are noted on the chart. Takeoff distances will be reduced for aft CGs and increased for forward CGs.

The notes regarding CG effect on ground roll on the takeoff charts are based on conservative performance estimates based on data generated at typical weight, altitude, and temperature conditions.

USE

Enter the chart with existing temperature and project vertically to intersect the applicable pressure altitude curves. From that point, proceed horizontally to the right and intersect the takeoff weight line. Then descend vertically to read no wind ground run distance. Parallel the appropriate wind guidelines (headwind or tailwind) to intersect the takeoff wind velocity. From this point project vertically down to read the ground run adjusted for wind effects. To find the total distance required to clear a 50-foot obstacle, continue downward to the reflector line and project horizontally to the left scale.

NOSEWHEEL LIFTOFF SPEED/TAKEOFF SPEED CHART

These charts (figures A2-10 and A2-11) are used to determine nosewheel liftoff speed for various gross weights in either maximum or military thrust for aircraft with and without CFTs installed.

With CFTs installed, rotation speeds along with the corresponding nosewheel liftoff and takeoff speeds are presented for standard two-engine takeoffs as a function of CG and gross weight. At the indicated rotation speed one-half aft stick should be applied and the aircraft rotated to 12 degrees. Rotation speeds increase at forward CGs to prevent nosewheel bouncing. Rotation speeds are also presented for continued takeoffs after an engine failure during ground roll. For continued takeoffs one-half aft stick should be applied at the rotation speed, but the aircraft should only be rotated to 10 degrees for improved acceleration.

Without CFTs, the speeds are based on CGs representative of each gross weight. The chart provides data for either a normal or maximum performance takeoff. A normal takeoff is accomplished by applying one-half aft stick over a period of 1 second as the aircraft is accelerating through 120 KCAS, and then holding 10 degrees of pitch throughout the takeoff roll. A maximum performance takeoff is accomplished by applying full aft stick at a low speed and when the nose rotates, holding 12 degrees of pitch throughout the takeoff roll.

Aircraft rotation will be more rapid with the maximum performance takeoff technique. Rotation speeds are also presented for continued takeoffs after an engine failure during ground roll. For continued takeoffs one-half aft stick should be applied at the rotation speed, with a 10 degree pitch attitude held throughout the takeoff roll.

The difference in nosewheel lift-off speeds between military and maximum thrust are due to the thrust effects on pitching moment. The differences in takeoff speeds are due to the thrust support in lift and the time required to rotate the aircraft to takeoff attitude.

SINGLE ENGINE RATE OF CLIMB

These charts (figures A2-12 through A2-14) provide the means of determining single engine rate of climb for takeoff planning purposes for existing conditions of temperature, pressure altitude, gross weight, airspeed, and Drag Index. Separate plots are provided for gross weights from 60,000 pounds to 81,000 pounds. The data are for one engine operating at maximum AB thrust and the other engine windmilling. Out-of-ground effects zero data were used in construction of these charts. Gear and flaps are extended.

These charts can be used to determine if single engine rate of climb is adequate at the single engine takeoff speeds obtained from figure A2-10 for the continued takeoff technique. The change in rate of climb due to increasing or decreasing takeoff speed can also be determined.

USE

Enter the applicable chart with existing temperature and project vertically to intersect the applicable pressure altitude curve. From this point, project horizontally to the right and intersect the applicable with or without wing stores line. Then descend vertically to intersect the baseline velocity of 210 KCAS. Parallel the guidelines to intersect the takeoff velocity in question. From this point descend vertically to intersect the baseline Drag Index. Parallel the appropriate velocity guideline to intersect the takeoff Drag Index. Descend vertically again to read the single engine rate of climb.

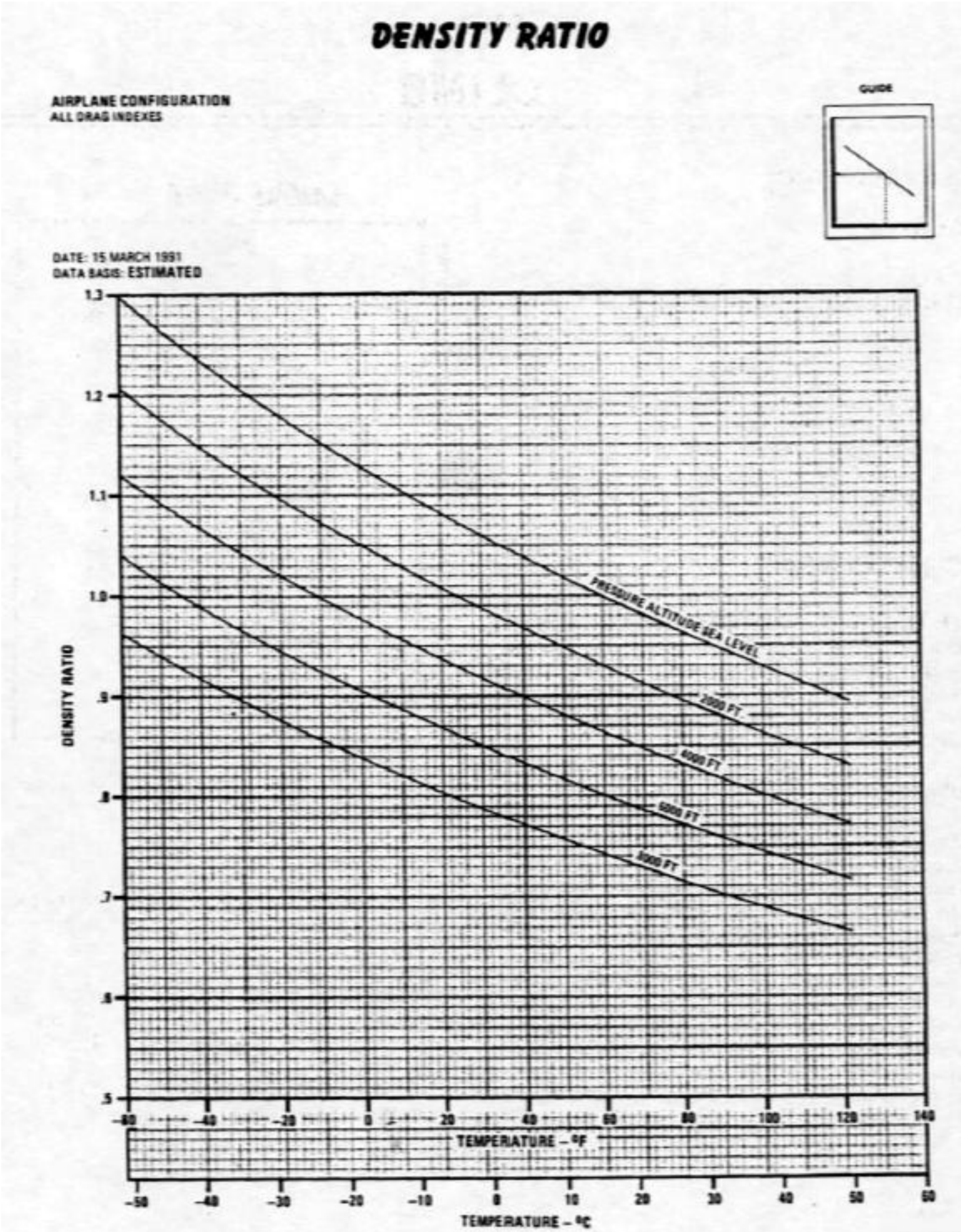

DENSITY RATIO
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
GUIDE
DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED
DENSITY RATIO
PRESSURE ALTITUDE SEA LEVEL
2000 FT
4000 FT
6000 FT
8000 FT
1.3
1.2
1.1
1.0
.9
.8
.7
.6
.5
-60 -40 -20 0 20 40 60 80 100 120 140
TEMPERATURE – °F
-50 -40 -30 -20 -10 0 10 20 30 40 50 60
TEMPERATURE – °C

Figure A2-1

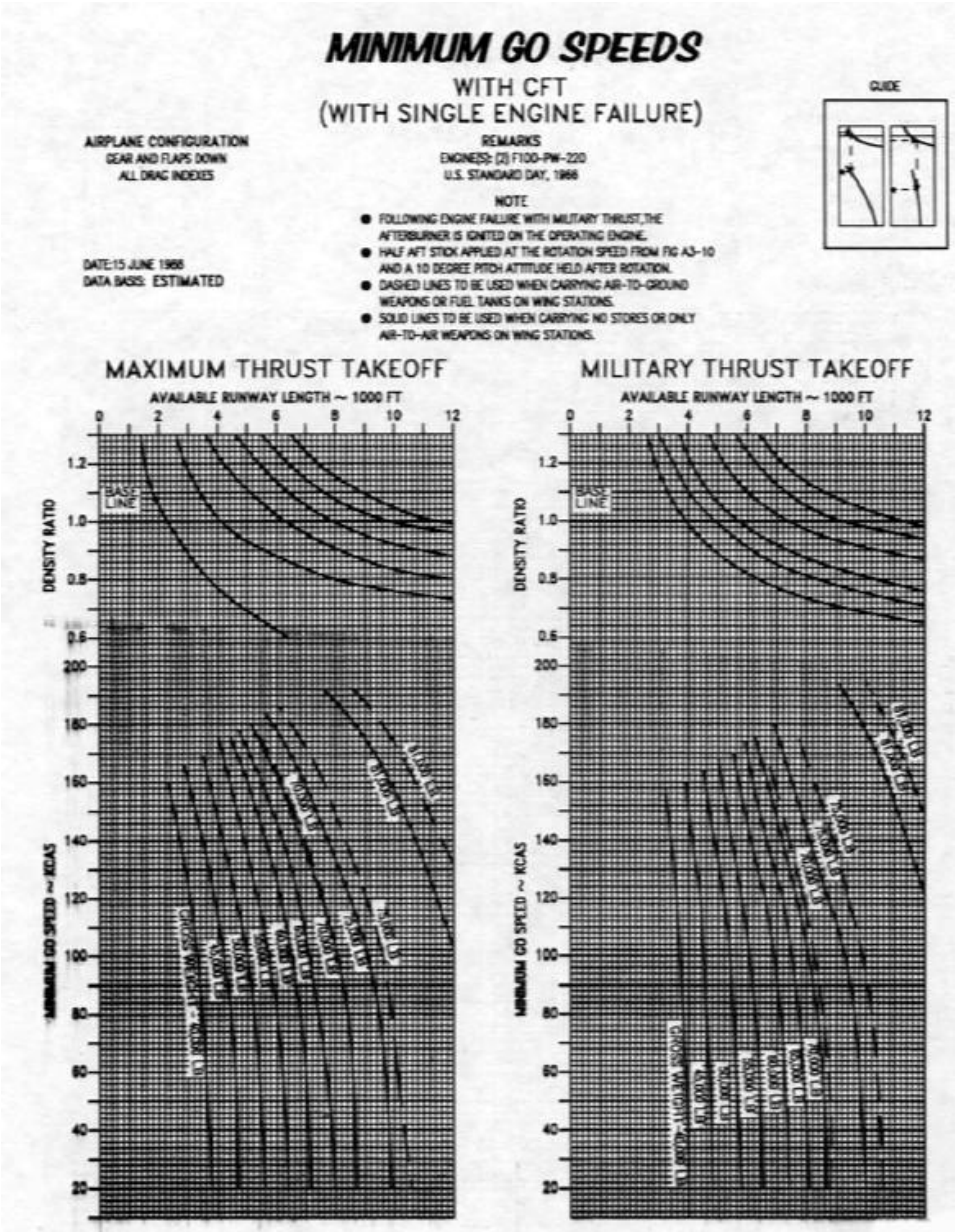


Figure A2-2

Version 1.1 – 9 July 2011

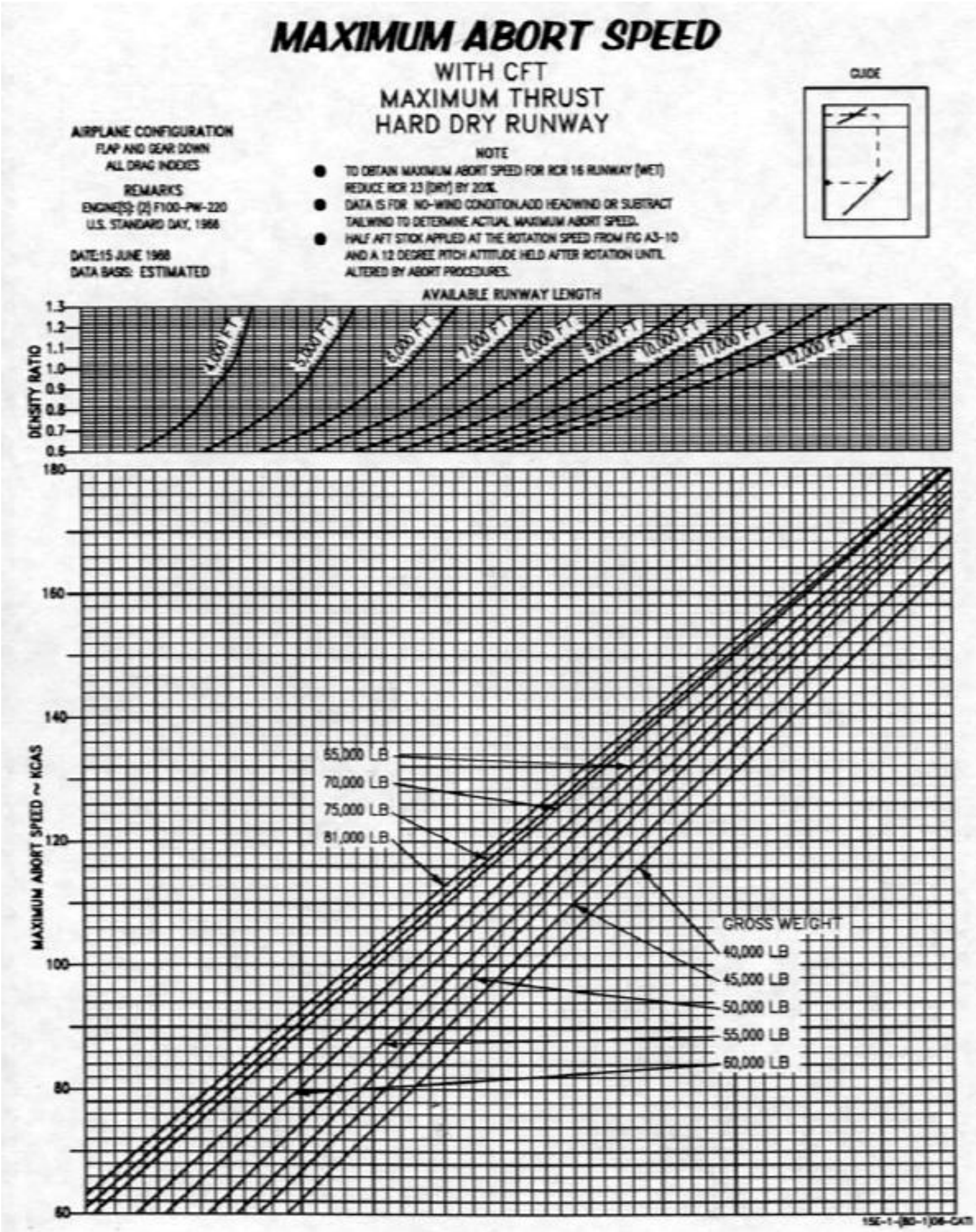


Figure A2-3 Page 1 of 2

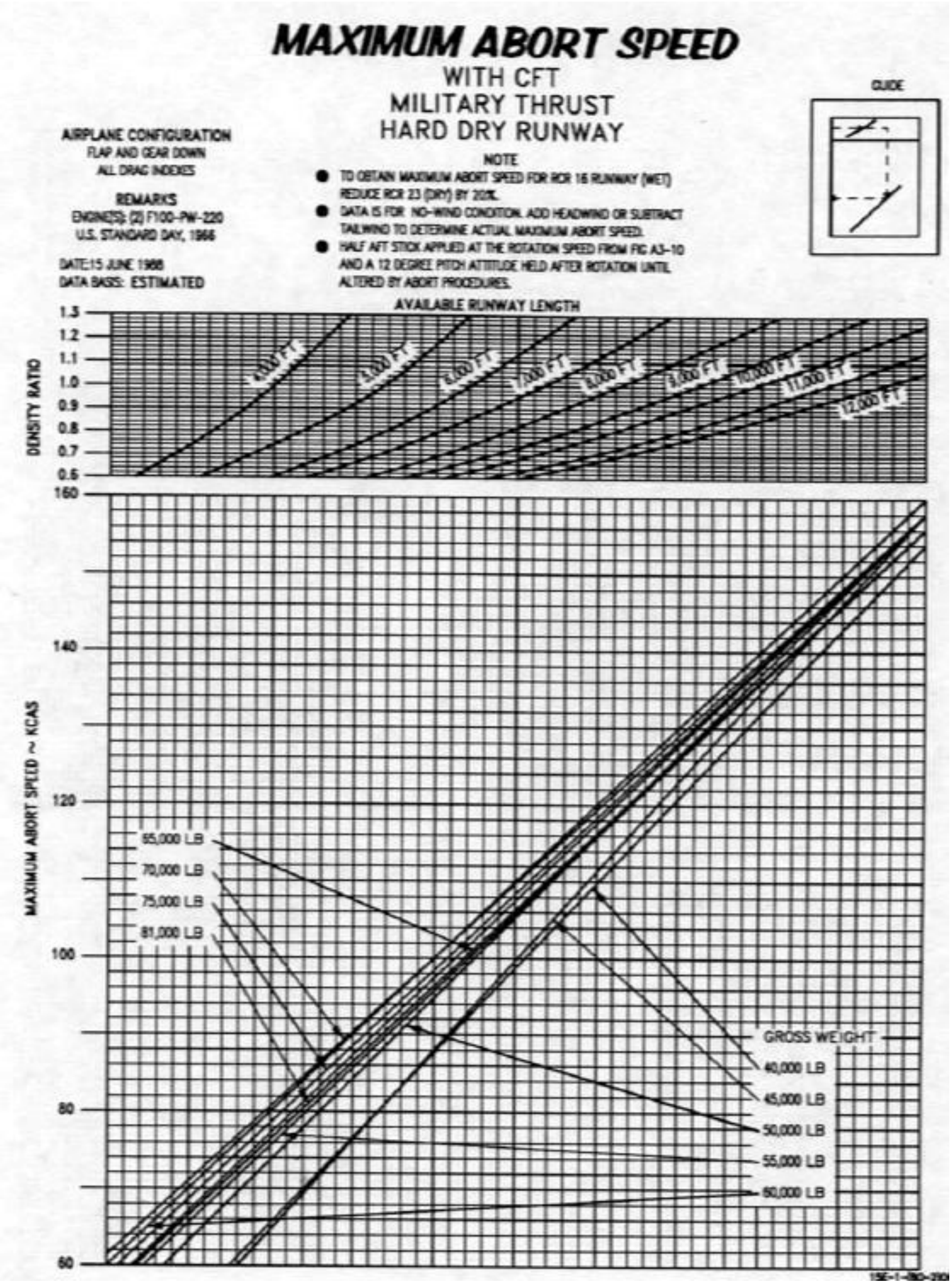


Figure A2-3 Page 2 of 2

TAKEOFF DISTANCE

WITH CFT
MAXIMUM THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
FLAPS AND GEAR DOWN
ALL DRAG INDEXES

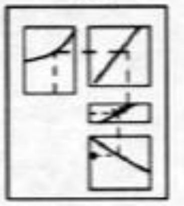
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE

- THIS DATA BASED ON HALF AFT STICK APPLIED AT THE ROTATION SPEED FROM FIG A3-10 AND A 12 DEGREE PITCH ATTITUDE HELD AFTER ROTATION.
- DASHED LINES TO BE USED WHEN CARRYING AIR-TO-GROUND WEAPONS OR FUEL TANKS ON THE WING STATIONS.
- SOLID LINES TO BE USED WHEN NO STORES OTHER THEN AIR-TO-AIR WEAPONS ARE INSTALLED ON THE WING STATIONS.
- FOR EVERY 1% CG SHIFT FORWARD OF THE REFERENCE CG, INCREASE THE ZERO WIND GROUND ROLL DISTANCE BY 5%. FOR EVERY 1% CG SHIFT AFT OF THE REFERENCE CG, DECREASE THE ZERO WIND GROUND ROLL DISTANCE BY 1%. THEN APPLY WIND EFFECTS AND DETERMINE DISTANCE TO 50 FT. USING NORMAL PROCEDURES.

GUIDE



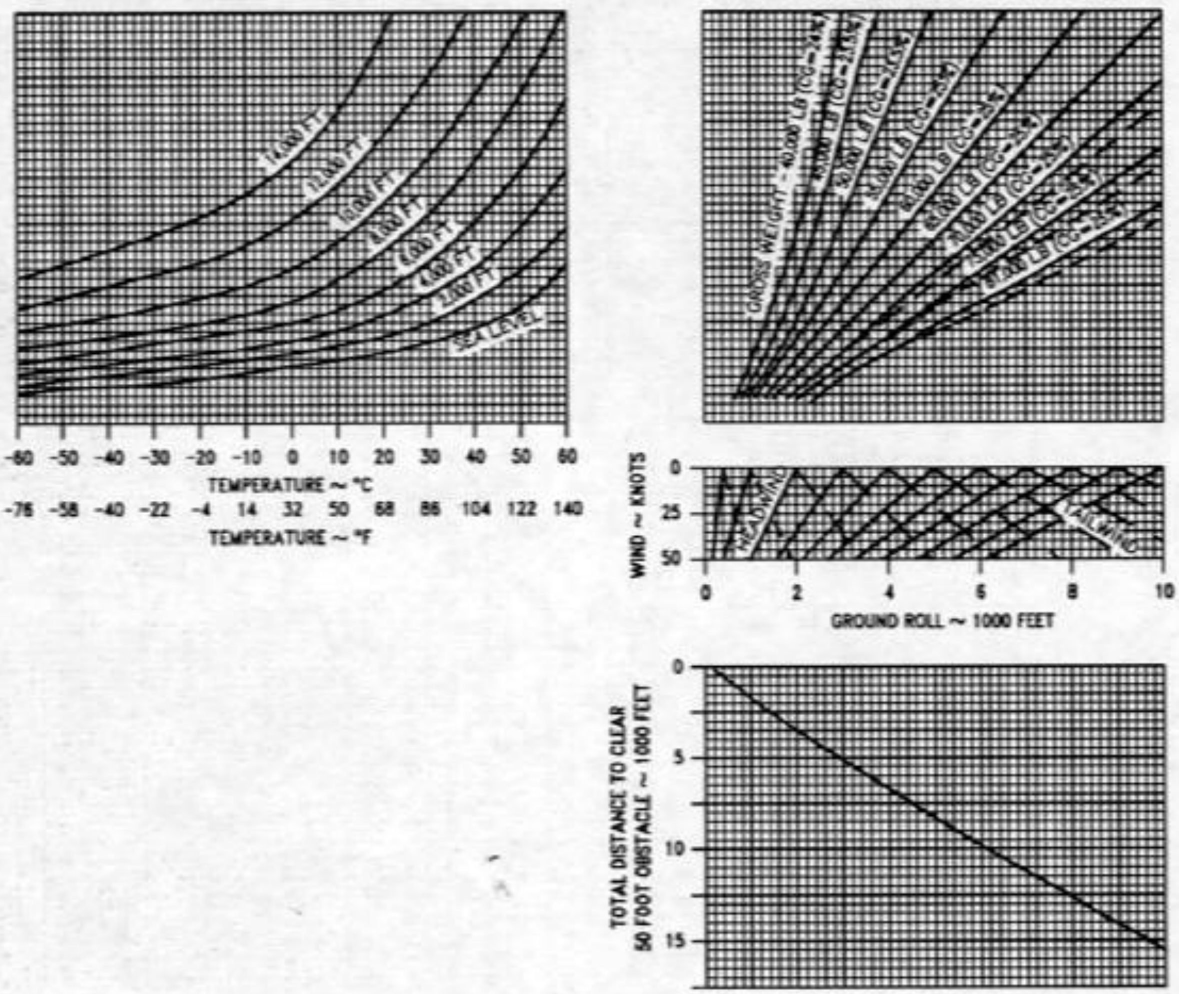


Figure A2-4

TAKEOFF DISTANCE
WITH CFT
MILITARY THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
FULL FLAPS,GEAR DOWN
ALL DRAG INDEXES

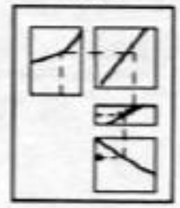
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

NOTE

- THIS DATA BASED ON HALF AFT STICK APPLIED AT THE ROTATION SPEED FROM FIG A3-10 AND A 12 DEGREE PITCH ATTITUDE HELD AFTER ROTATION.
- DASHED LINES TO BE USED WHEN CARRYING AIR-TO-GROUND WEAPONS OR FUEL TANKS ON THE WING STATIONS.
- SOLID LINES TO BE USED WHEN NO STORES OTHER THEN AIR-TO-AIR WEAPONS ARE INSTALLED ON THE WING STATIONS.
- FOR EVERY 1% CG SHIFT FORWARD OF THE REFERENCE CG, INCREASE THE ZERO WIND GROUND ROLL DISTANCE BY 3%. FOR EVERY 1% CG SHIFT AFT OF THE REFERENCE CG, DECREASE THE ZERO WIND GROUND ROLL DISTANCE BY 1%. THEN APPLY WIND EFFECTS AND DETERMINE DISTANCE TO 50 FT. USING NORMAL PROCEDURES.

GUIDE



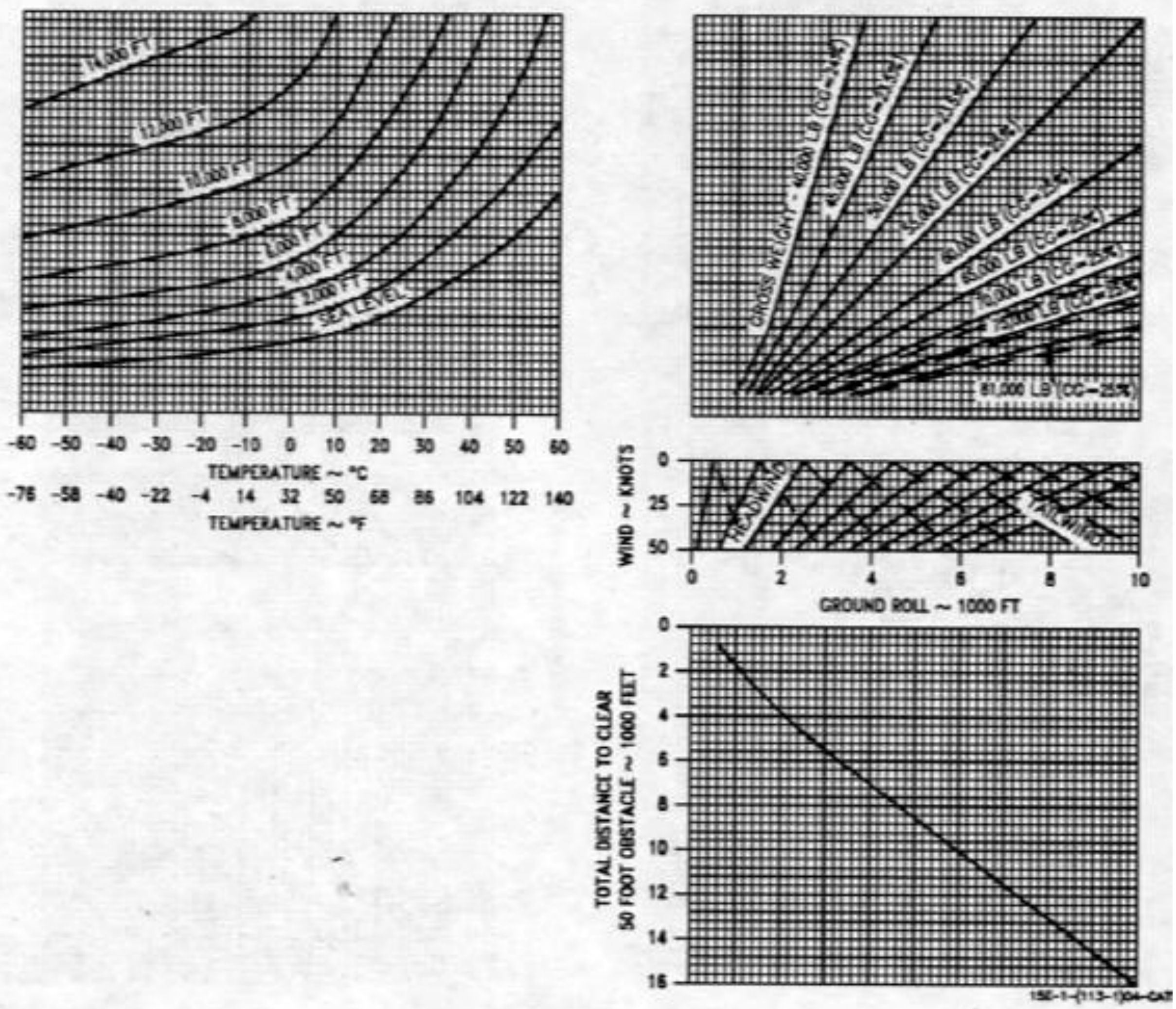


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Figure A2-5

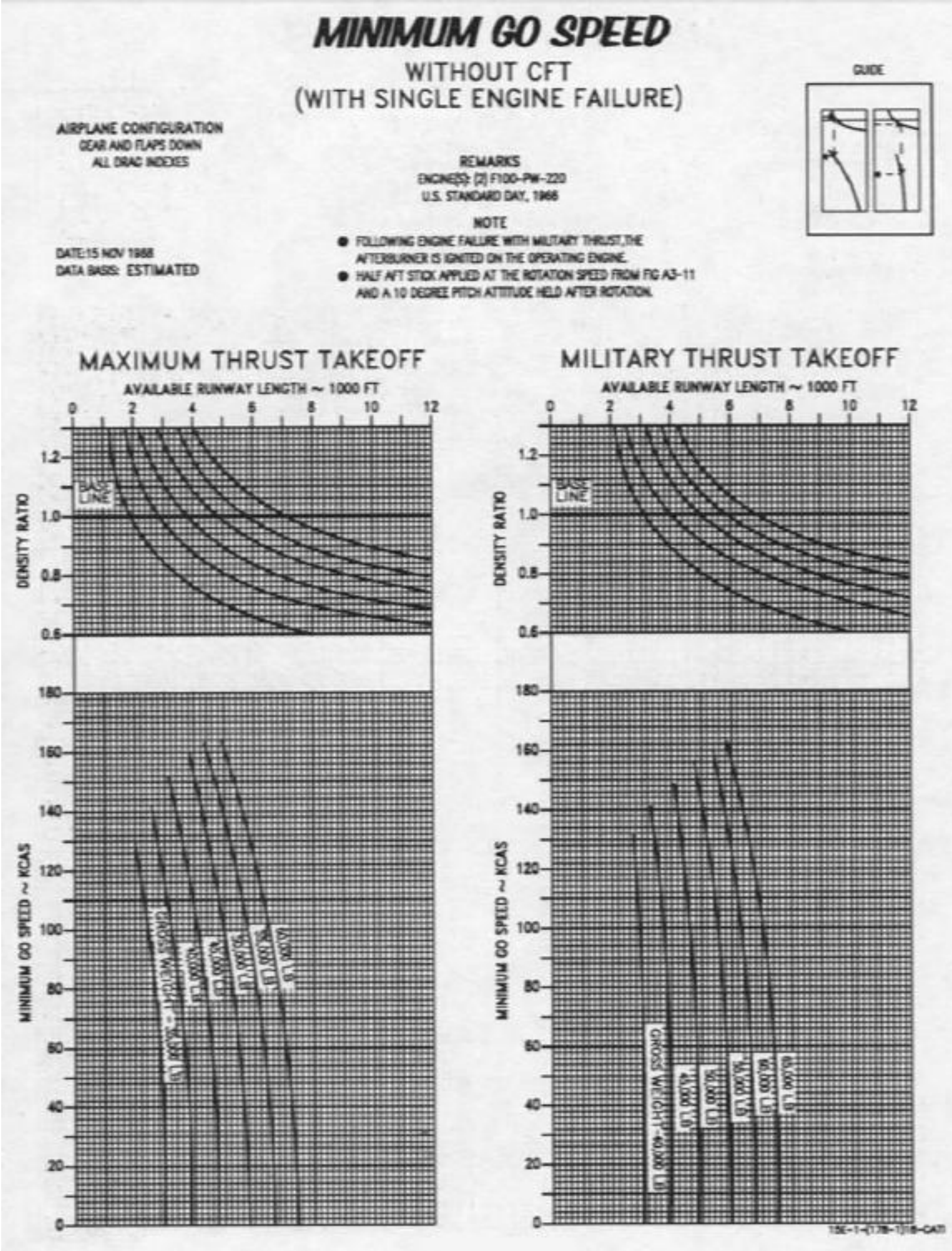

MINIMUM GO SPEED
WITHOUT CFT
(WITH SINGLE ENGINE FAILURE)
AIRPLANE CONFIGURATION
GEAR AND FLAPS DOWN
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
FOLLOWING ENGINE FAILURE WITH MILITARY THRUST, THE AFTERBURNER IS IGNITED ON THE OPERATING ENGINE.
HALF AFT STICK APPLIED AT THE ROTATION SPEED FROM FIG A3-11 AND A 10 DEGREE PITCH ATTITUDE HELD AFTER ROTATION.
GUIDE
DATE: 15 NOV 1988
DATA BASIS: ESTIMATED
MAXIMUM THRUST TAKEOFF
MILITARY THRUST TAKEOFF
AVAILABLE RUNWAY LENGTH ~ 1000 FT
DENSITY RATIO
BASE LINE
MINIMUM GO SPEED ~ KCAS
GROSS WEIGHT ~ 40,000 LB
45,000 LB
50,000 LB
56,000 LB
60,000 LB
63,000 LB

Figure A2-6

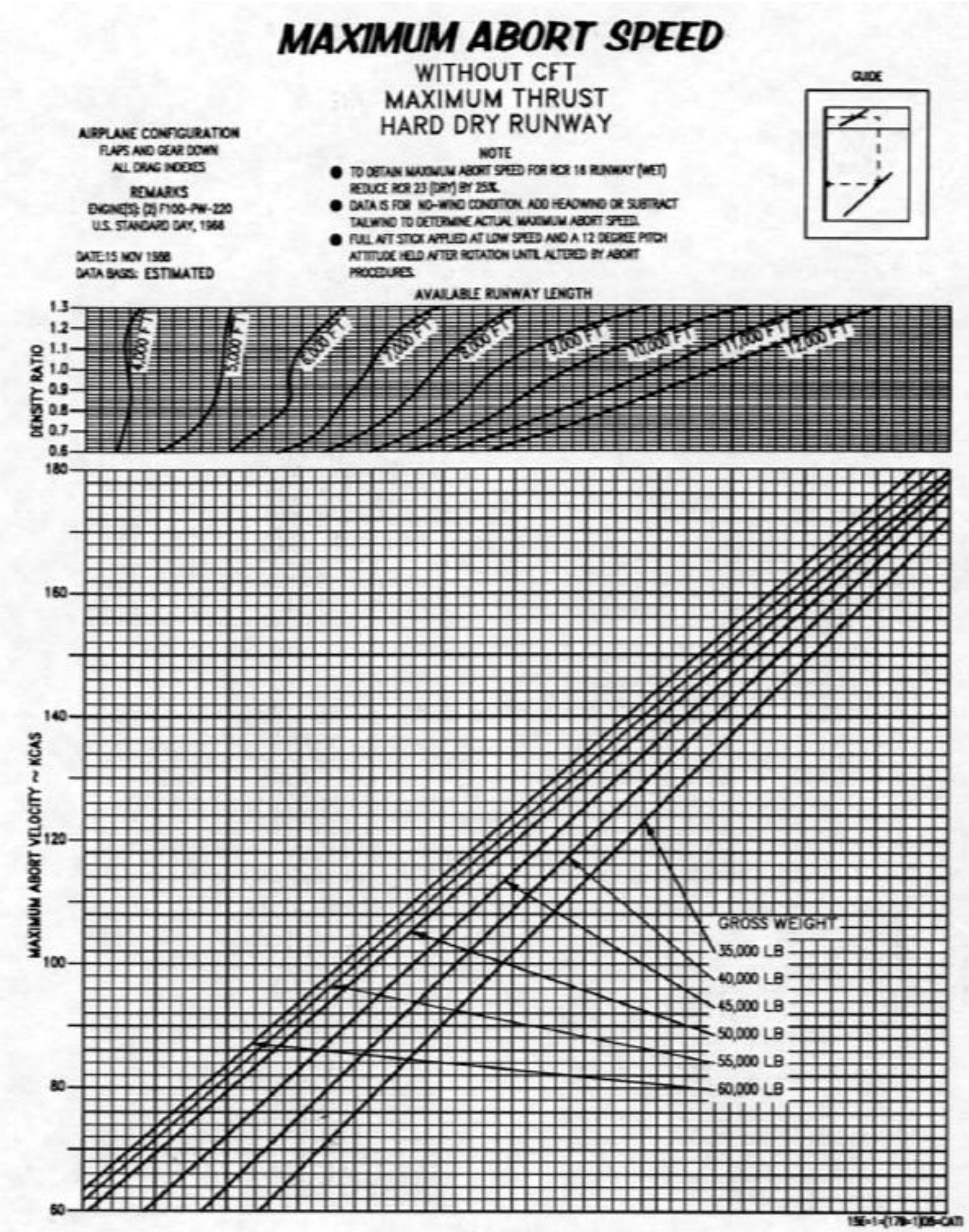


Figure A2-7 Page 1 of 2

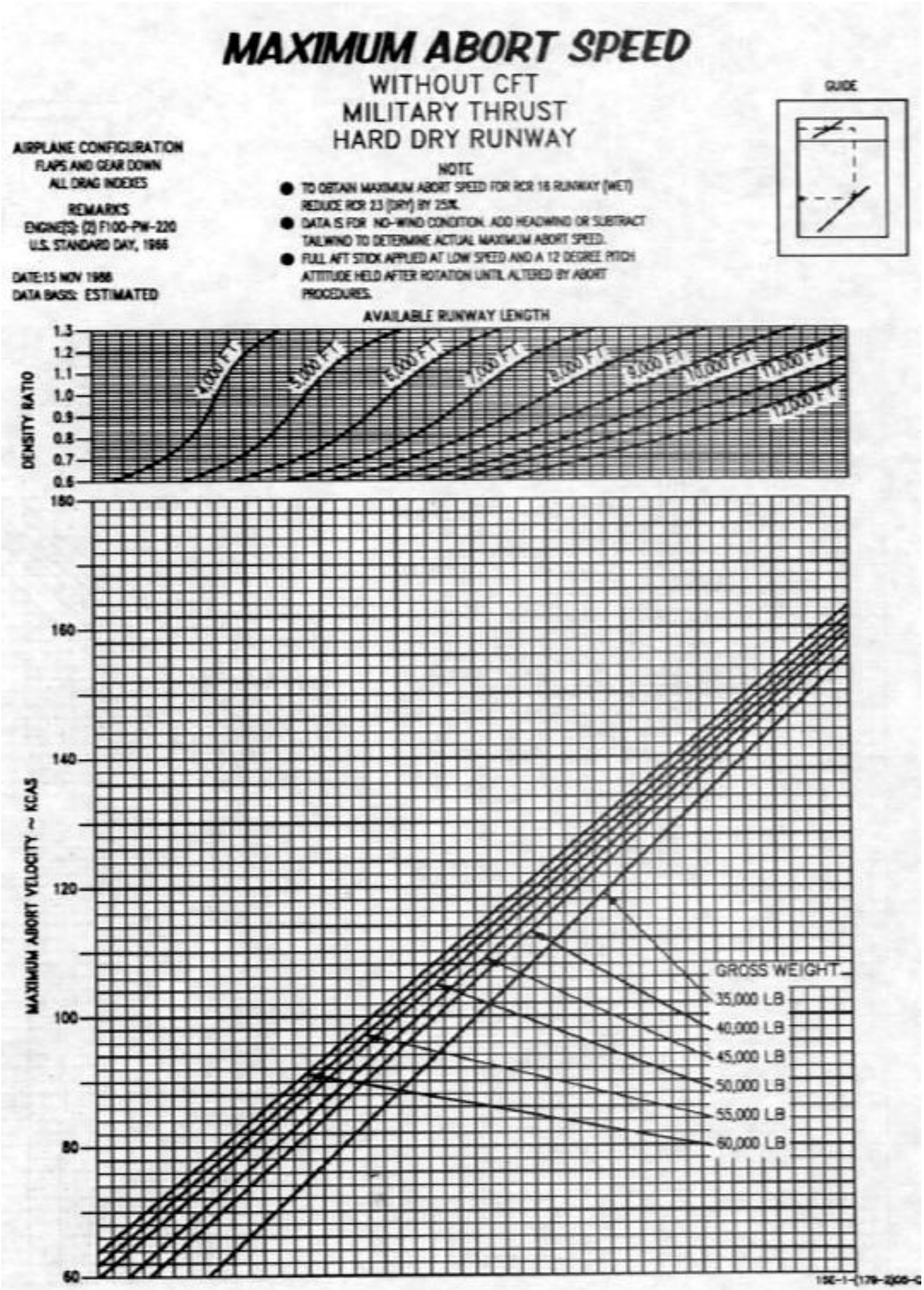


Figure A2-7 Page 2 of 2

TAKEOFF DISTANCE

WITHOUT CFT
MAXIMUM THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
FULL FLAPS, GEAR DOWN
ALL DRAG INDEXES

DATE: 1 AUGUST 1986
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
THESE DATA BASED ON MAXIMUM PERFORMANCE TAKEOFF PROCEDURES: FULL AFT STICK APPLIED AT LOW SPEED AND A 12 DEGREE ATTITUDE IS HELD AFTER ROTATION.

GUIDE

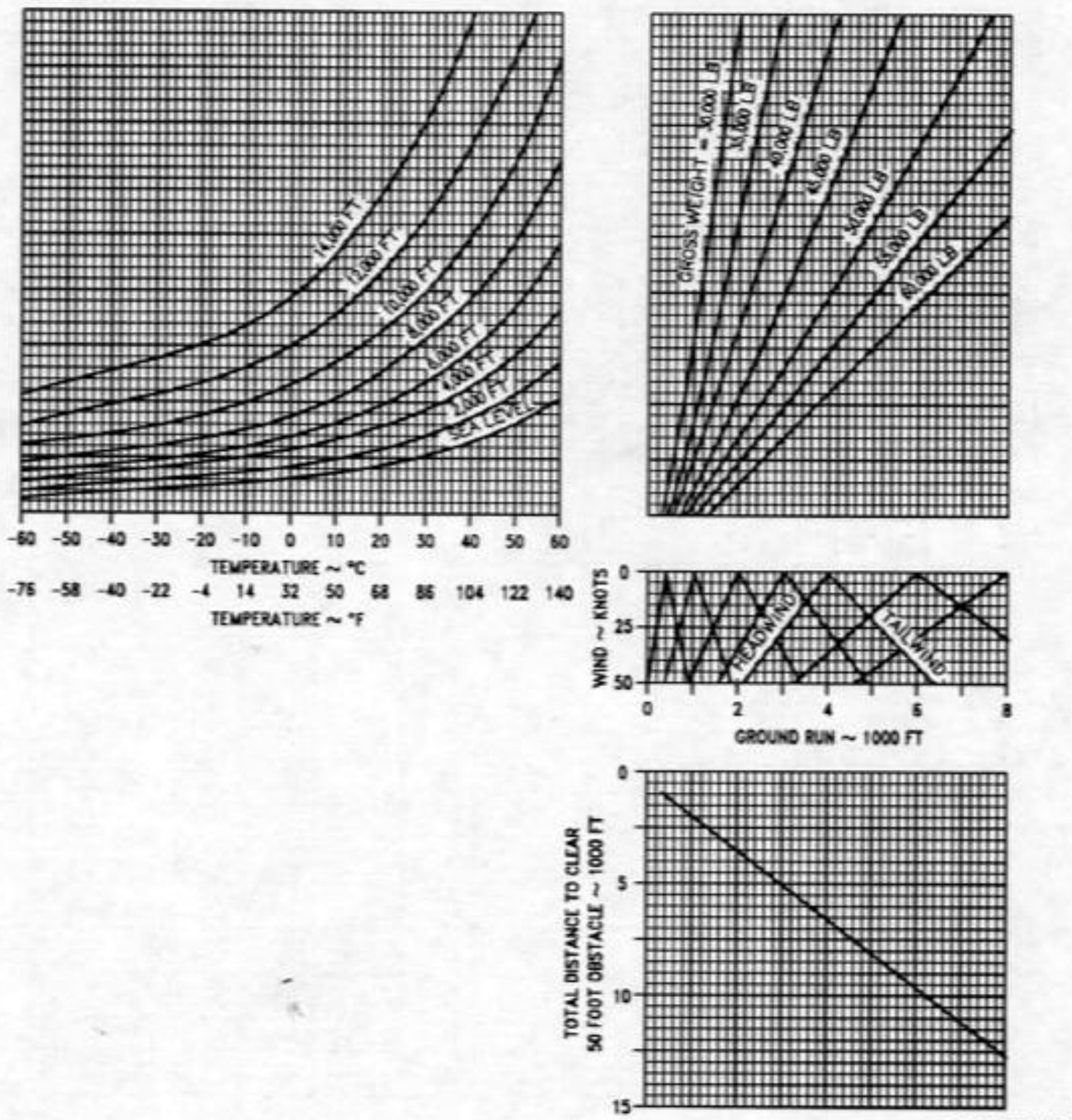
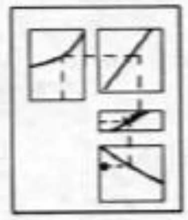


Figure A2-8

TAKEOFF DISTANCE

WITHOUT CFT
MILITARY THRUST
HARD DRY RUNWAY

GUIDE



AIRPLANE CONFIGURATION
FULL FLAPS, GEAR DOWN
ALL DRAG INDEXES

DATE: 1 AUGUST 1986
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
THESE DATA BASED ON MAXIMUM PERFORMANCE TAKEOFF PROCEDURES: FULL AFT STICK APPLIED AT LOW SPEED AND A 12 DEGREE ATTITUDE IS HELD AFTER ROTATION.

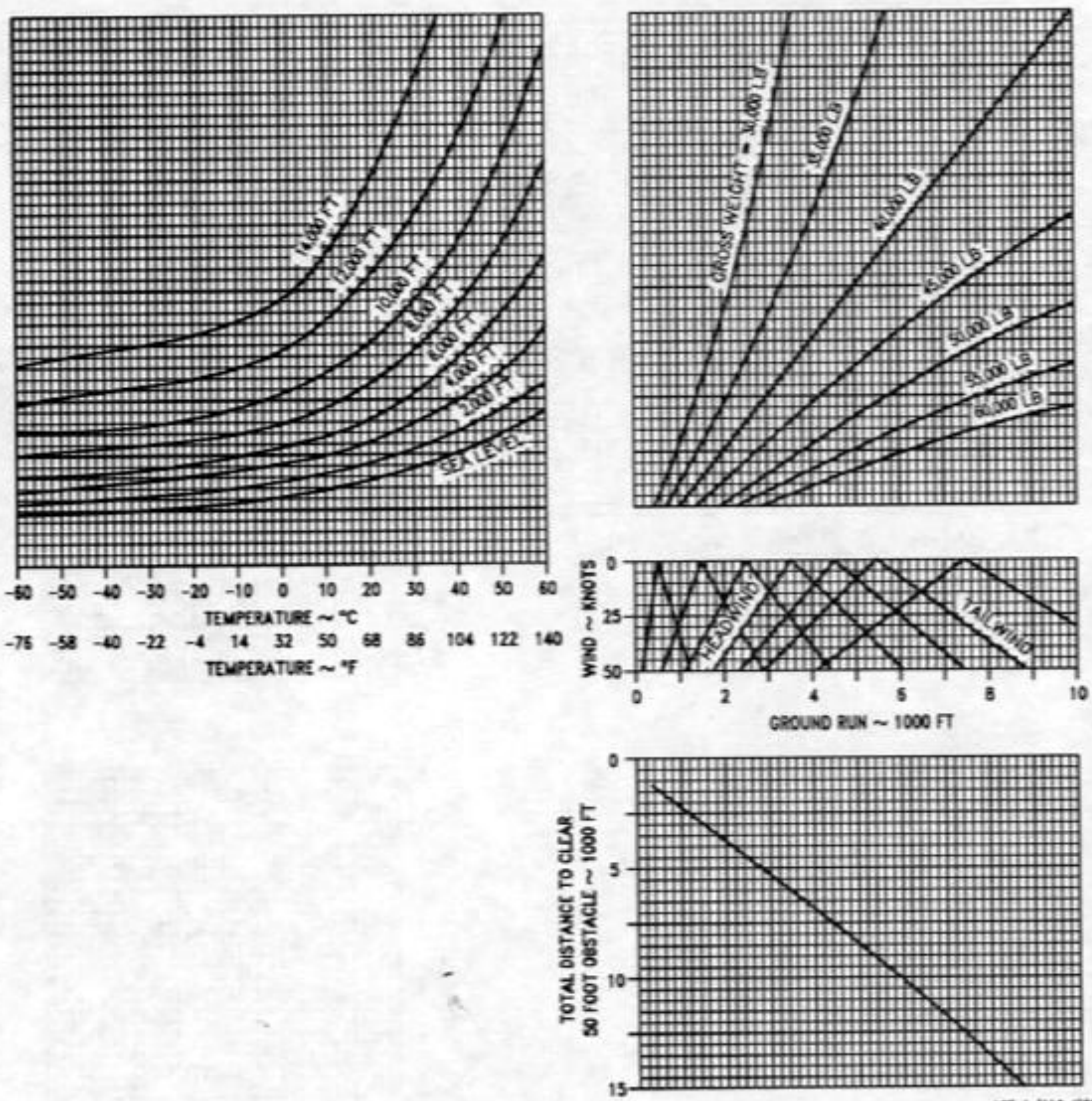


Figure A2-9

ROTATION SPEED/NOSEWHEEL LIFT-OFF SPEED/ TAKEOFF SPEED

WITH CFT

AIRPLANE CONFIGURATION
FULL FLAPS, GEAR DOWN
ALL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NORMAL TAKEOFF

ONE-HALF AFT STICK APPLIED OVER A PERIOD OF 1 SECOND STARTING AT THE ROTATION SPEED LISTED BELOW AND 12° ATTITUDE HELD AFTER ROTATION.

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

GROSS WEIGHT-LB	CG (-%)	ROTATION/NOSEWHEEL LIFT-OFF/TAKEOFF SPEEDS (KCAS)	
		MAXIMUM THRUST	MILITARY THRUST
40,000	28	—	—
	26	110 / 124 / 149	115 / 123 / 141
	24	110 / 128 / 152	115 / 125 / 143
	22	110 / 130 / 154	120 / 130 / 146
45,000	28	—	—
	26	115 / 130 / 154	120 / 127 / 144
	24	115 / 132 / 156	120 / 129 / 146
	23.5	115 / 133 / 156	120 / 129 / 146
	22	118 / 137 / 159	125 / 134 / 150
50,000	28	—	—
	26	120 / 134 / 158	125 / 132 / 148
	24	120 / 136 / 159	125 / 134 / 150
	23.5	120 / 137 / 160	125 / 134 / 150
	22	125 / 142 / 163	130 / 139 / 154
55,000	28	—	—
	26	125 / 138 / 161	130 / 137 / 155
	25	125 / 139 / 162	130 / 138 / 155
	24	125 / 141 / 163	135 / 142 / 156
	22	—	—
60,000	28	—	—
	26	130 / 143 / 165	135 / 141 / 163
	25	130 / 144 / 166	135 / 142 / 163
	24	133 / 148 / 169	140 / 147 / 163
	22	—	—
65,000	28	140 / 150 / 171	145 / 150 / 169
	26	140 / 152 / 172	145 / 151 / 170
	25	140 / 154 / 173	145 / 151 / 170
	24	145 / 159 / 177	150 / 156 / 170
	22	—	—
70,000	28	155 / 164 / 183	155 / 159 / 180
	26	155 / 166 / 184	155 / 160 / 181
	25	155 / 167 / 185	155 / 161 / 181
	24	160 / 172 / 190	160 / 166 / 182
	22	—	—
75,000	28	160 / 169 / 187	160 / 164 / 186
	26	160 / 171 / 189	160 / 165 / 188
	25	160 / 173 / 190	160 / 166 / 188
	24	165 / 177 / 194	165 / 171 / 189
	22	—	—
81,000	28	167 / 176 / 192	167 / 171 / 194
	26	167 / 177 / 194	167 / 171 / 195
	25	167 / 179 / 195	167 / 172 / 196
	24	172 / 184 / 199	172 / 177 / 197
	22	—	—

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Figure A2-10 Page 1 of 2

SINGLE ENGINE ROTATION SPEED/NOSEWHEEL LIFT-OFF SPEED/ TAKEOFF SPEED

WITH CFT

AIRPLANE CONFIGURATION
FULL FLAPS, GEAR DOWN
ALL DRAG INDEXES
ALL CG LOCATIONS

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
NOSEWHEEL BOUNCING MAY OCCUR DURING ONE-ENGINE-OUT TAKEOFF AT GROSS WEIGHTS OF 65,000 LBS AND LESS.

CONTINUED (SINGLE ENGINE) TAKEOFF

ONE-HALF AFT STICK APPLIED OVER A PERIOD OF 1 SECOND STARTING AT THE ROTATION SPEED LISTED BELOW AND 10° ATTITUDE HELD AFTER ROTATION.

GROSS WEIGHT-LB	ROTATION/NOSEWHEEL LIFT-OFF/TAKEOFF SPEEDS (KCAS)	
	MAXIMUM THRUST	
40,000	170 / 171 / 177	TO BE USED WHEN NO STORES OTHER THAN AIR-TO-AIR WEAPONS ARE INSTALLED ON THE WING STATIONS.
45,000	180 / 181 / 187	
50,000	185 / 186 / 192	
55,000	190 / 191 / 196	
60,000	190 / 191 / 196	
65,000	190 / 192 / 197	
70,000	190 / 192 / 197	
75,000	190 / 192 / 199	
81,000	190 / 192 / 207	
70,000	190 / 192 / 198	TO BE USED WHEN CARRYING AIR-TO-GROUND WEAPONS OR FUEL TANKS ON THE WING STATIONS.
75,000	190 / 193 / 204	
81,000	190 / 193 / 213	

Figure A2-10 Page 2 or 2

NOSEWHEEL LIFT-OFF SPEED/TAKEOFF SPEED

WITHOUT CFT

AIRPLANE CONFIGURATION
FULL FLAPS, GEAR DOWN
ALL DRAG INDEXES

REMARKS

ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

DATE: 1 AUGUST 1986
DATA BASIS: ESTIMATED

NORMAL TAKEOFF

ONE-HALF AFT STICK APPLIED OVER A PERIOD OF 1 SECOND STARTING AT 120 KNOTS AND 10° ATTITUDE HELD AFTER ROTATION

GROSS WEIGHT – LB	NOSEWHEEL LIFT-OFF/TAKEOFF SPEEDS (KCAS)	
	MAXIMUM THRUST	MILITARY THRUST
30,000	129/143	124/135
35,000	134/150	128/141
40,000	136/153	129/142
45,000	137/155	130/148
50,000	139/158	133/161
55,000	150/166	144/169
6[illegible],000	158/173	161/177

MAXIMUM PERFORMANCE TAKEOFF

FULL AFT STICK APPLIED AT LOW SPEED AND 12° ATTITUDE HELD AFTER ROTATION

GROSS WEIGHT – LB	NOSEWHEEL LIFT-OFF/TAKEOFF SPEEDS (KCAS)	
	MAXIMUM THRUST	MILITARY THRUST
30,000	83/110	94/108
35,000	91/121	102/119
40,000	102/131	110/129
45,000	115/142	119/139
50,000	127/151	129/148
55,000	138/159	140/157
60,000	143/166	148/165

Figure A2-11 Page 1 of 2

SINGLE ENGINE ROTATION SPEED/NOSEWHEEL LIFT-OFF SPEED/ TAKEOFF SPEED

AIRPLANE CONFIGURATION
FULL FLAPS, GEAR DOWN
ALL DRAG INDEXES
ALL CG LOCATIONS

WITHOUT CFT

REMARKS
ENGINES: (2) F100-PW-220
U.S. STANDARD DAY, 1966

DATE: 1 FEBRUARY 1989
DATA BASIS: ESTIMATED

CONTINUED (SINGLE ENGINE) TAKEOFF

ONE-HALF AFT STICK APPLIED OVER A PERIOD OF 1 SECOND STARTING AT THE ROTATION SPEED LISTED BELOW AND 10° ATTITUDE HELD AFTER ROTATION

GROSS WEIGHT – LB	ROTATION/NOSEWHEEL LIFT-OFF/TAKEOFF SPEEDS (KCAS)
	MAXIMUM THRUST
35000	160/163/169
40000	170/173/179
45000	180/183/188
50000	185/189/195
55000	190/194/199
60000	190/194/200

Figure A2-11 Page 2 of 2

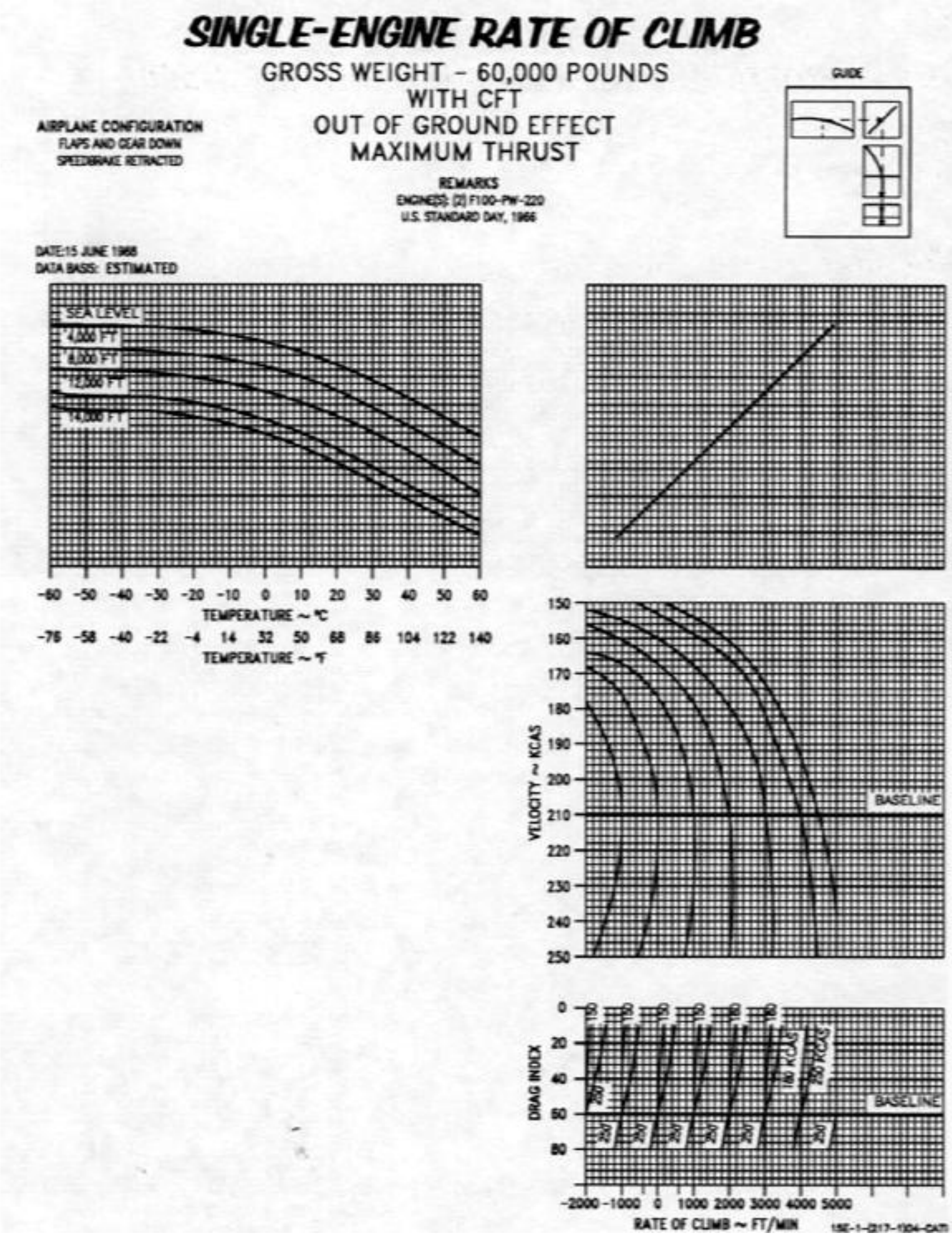

SINGLE-ENGINE RATE OF CLIMB
GROSS WEIGHT - 60,000 POUNDS
WITH CFT
OUT OF GROUND EFFECT
MAXIMUM THRUST
GUIDE
AIRPLANE CONFIGURATION
FLAPS AND GEAR DOWN
SPEEDBRAKE RETRACTED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
SEA LEVEL
4,000 FT
8,000 FT
12,000 FT
14,000 FT
-60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60
TEMPERATURE ~ °C
-76 -58 -40 -22 -4 14 32 50 68 86 104 122 140
TEMPERATURE ~ °F
VELOCITY ~ KCAS
150 160 170 180 190 200 210 220 230 240 250
BASELINE
DRAG INDEX
0 20 40 60 80
BASELINE
180 KCAS
250 KCAS
-2000 -1000 0 1000 2000 3000 4000 5000
RATE OF CLIMB ~ FT/MIN
15E-1-(217-1)04-CATI

Figure A2-12

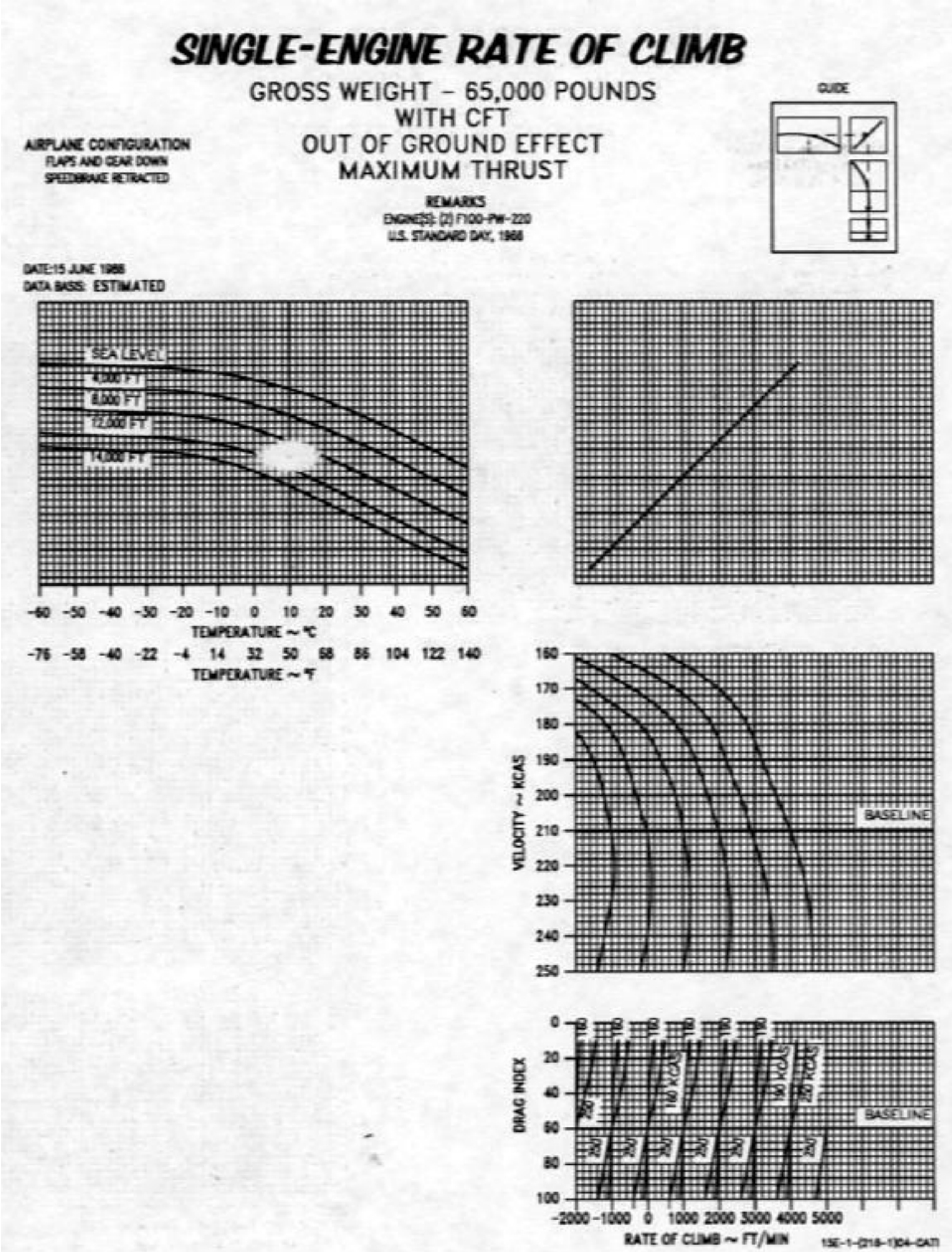

SINGLE-ENGINE RATE OF CLIMB
GROSS WEIGHT – 65,000 POUNDS
WITH CFT
OUT OF GROUND EFFECT
MAXIMUM THRUST
AIRPLANE CONFIGURATION
FLAPS AND GEAR DOWN
SPEEDBRAKE RETRACTED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
SEA LEVEL
4,000 FT
8,000 FT
12,000 FT
14,000 FT
TEMPERATURE ~ °C
TEMPERATURE ~ °F
VELOCITY ~ KCAS
BASELINE
DRAG INDEX
160 KCAS
250 KCAS
RATE OF CLIMB ~ FT/MIN

Figure A2-13

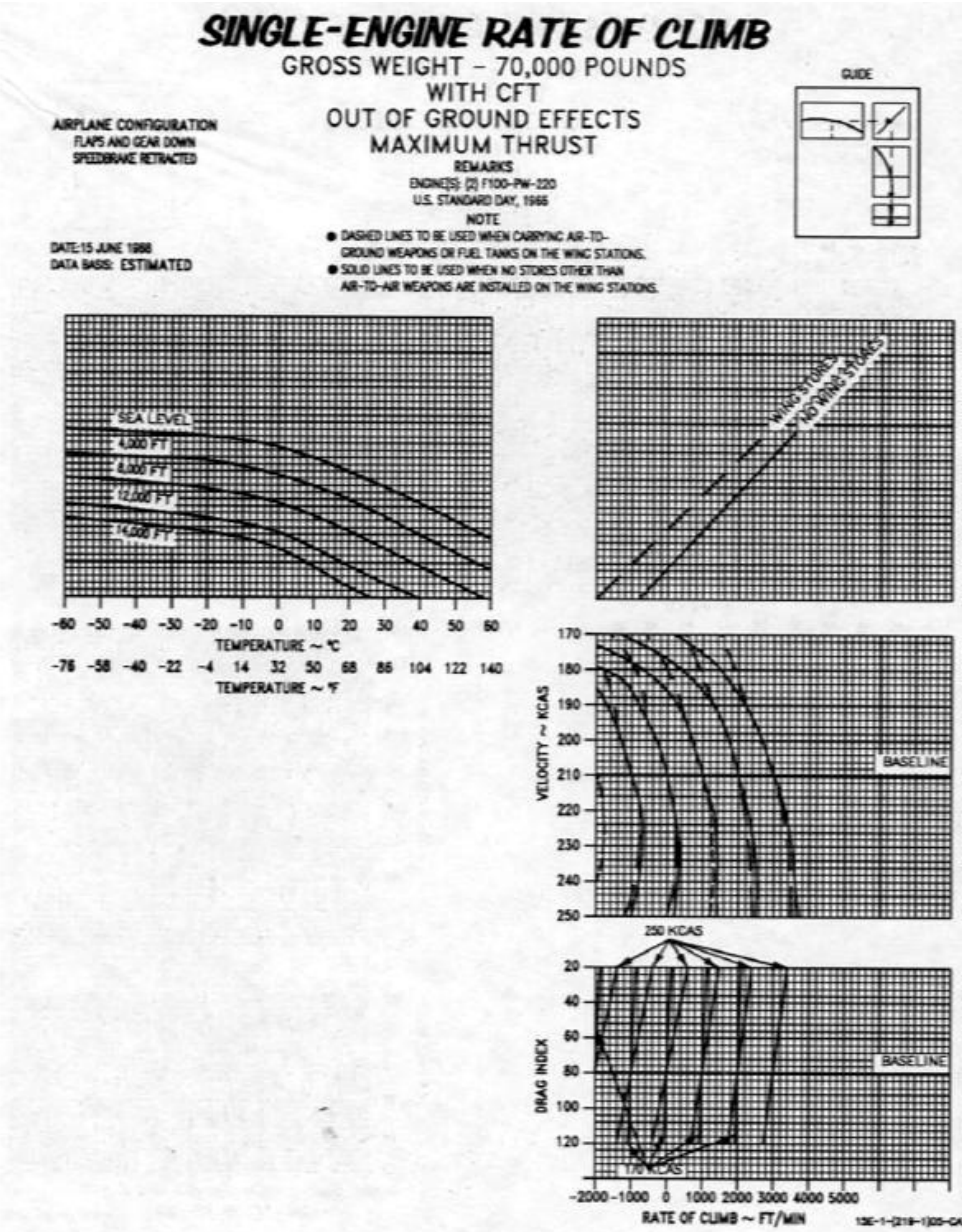

SINGLE-ENGINE RATE OF CLIMB
GROSS WEIGHT – 70,000 POUNDS
WITH CFT
OUT OF GROUND EFFECTS
MAXIMUM THRUST
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
● DASHED LINES TO BE USED WHEN CARRYING AIR-TO-GROUND WEAPONS OR FUEL TANKS ON THE WING STATIONS.
● SOLID LINES TO BE USED WHEN NO STORES OTHER THAN AIR-TO-AIR WEAPONS ARE INSTALLED ON THE WING STATIONS.
AIRPLANE CONFIGURATION
FLAPS AND GEAR DOWN
SPEEDBRAKE RETRACTED
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
SEA LEVEL
4,000 FT
8,000 FT
12,000 FT
14,000 FT
-60 -50 -40 -30 -20 -10 0 10 20 30 40 50 60
TEMPERATURE ~ °C
-76 -58 -40 -22 -4 14 32 50 68 86 104 122 140
TEMPERATURE ~ °F
WING STORES
NO WING STORES
VELOCITY ~ KCAS
170 180 190 200 210 220 230 240 250
BASELINE
250 KCAS
DRAG INDEX
20 40 60 80 100 120
BASELINE
170 KCAS
-2000 -1000 0 1000 2000 3000 4000 5000
RATE OF CLIMB ~ FT/MIN
13E-1-(218-1)05-CA

Figure A2-14

PART 3

CLIMB

CLIMB CHARTS

The Climb charts (figures A3-1 to A3-6) are used to determine time, fuel used, and distance covered while in the climb. Each chart is based on a military or maximum thrust climb for individual drag index configurations. The climb speed schedule and pre-climb data are noted on each chart.

USE

The method of presenting data on the time, fuel, and distance charts is identical, and the use of all three charts will be undertaken simultaneously here. Enter the charts with the initial climb gross weight and project horizontally right to intersect the assigned cruise altitude or the optimum cruise altitude for the computed drag index, then vertically down to intersect the applicable drag index curve. From this point project horizontally left to the temperature guidelines to read time, fuel, or distance. Time, fuel, or distance required to accelerate to climb speed must be added to the chart values.

COMBAT CEILING CHARTS

These charts (figures A3-7 and A3-8) present the military and maximum thrust subsonic combat ceiling for both single engine and normal two engine operation. The variable of gross weight and pressure altitude are taken into consideration for a range of drag indexes.

USE

Enter the applicable graph with estimated gross weight at end of climb. Project vertically up to intersect applicable configuration curve, then horizontally to the left to read combat ceiling.

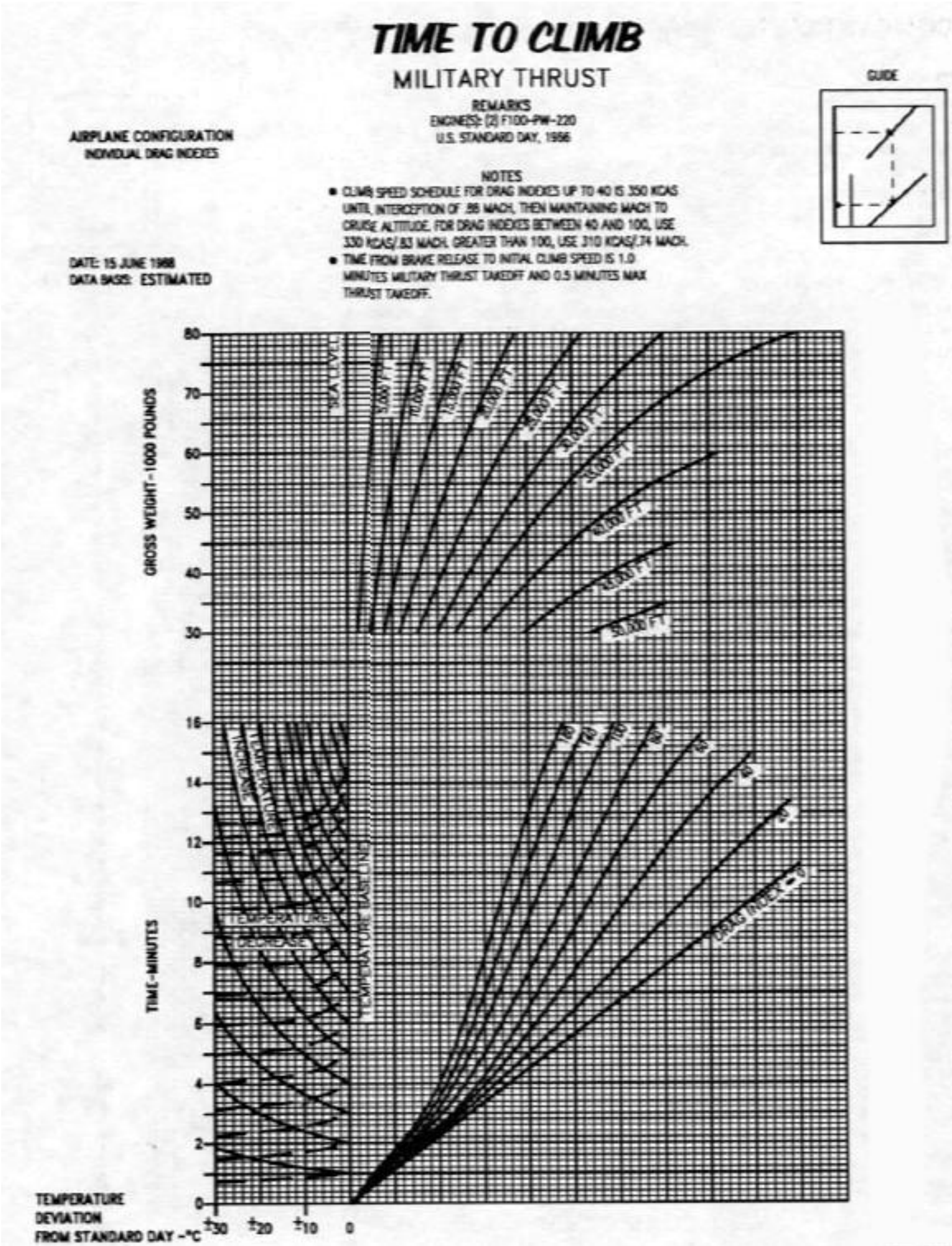

TIME TO CLIMB
MILITARY THRUST
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
NOTES
• CLIMB SPEED SCHEDULE FOR DRAG INDEXES UP TO 40 IS 350 KCAS UNTIL INTERCEPTION OF .88 MACH, THEN MAINTAINING MACH TO CRUISE ALTITUDE. FOR DRAG INDEXES BETWEEN 40 AND 100, USE 330 KCAS/.83 MACH. GREATER THAN 100, USE 310 KCAS/.74 MACH.
• TIME FROM BRAKE RELEASE TO INITIAL CLIMB SPEED IS 1.0 MINUTES MILITARY THRUST TAKEOFF AND 0.5 MINUTES MAX THRUST TAKEOFF.
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GROSS WEIGHT - 1000 POUNDS
SEA LEVEL
5,000 FT
10,000 FT
15,000 FT
20,000 FT
25,000 FT
30,000 FT
35,000 FT
40,000 FT
45,000 FT
50,000 FT
TEMPERATURE INCREASE
TEMPERATURE DECREASE
TEMPERATURE BASELINE
DRAG INDEX = 0
TIME-MINUTES
TEMPERATURE DEVIATION FROM STANDARD DAY - °C
±30
±20
±10
0

Figure A3-1

FUEL REQUIRED TO CLIMB

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTES
- CLIMB SPEED SCHEDULE FOR DRAG INDEXES UP TO 40 IS 350 KCAS UNTIL INTERCEPTION OF .88 MACH, THEN MAINTAINING MACH TO CRUISE ALTITUDE. FOR DRAG INDEXES BETWEEN 40 AND 100, USE 330 KCAS/.83 MACH. GREATER THAN 100, USE 310 KCAS/.74 MACH.
- PRETAKEOFF FUEL CONSUMPTION IS AS FOLLOWS: START– 32 LB/ENG; MIL RUNUP– 82 LB/ENG; TAXI 23 LB/MIN/ENG.
- FUEL REQUIRED FROM BRAKE RELEASE TO INITIAL CLIMB SPEED IS 300 POUNDS MILITARY THRUST AND 550 POUNDS MAXIMUM THRUST.

GUIDE

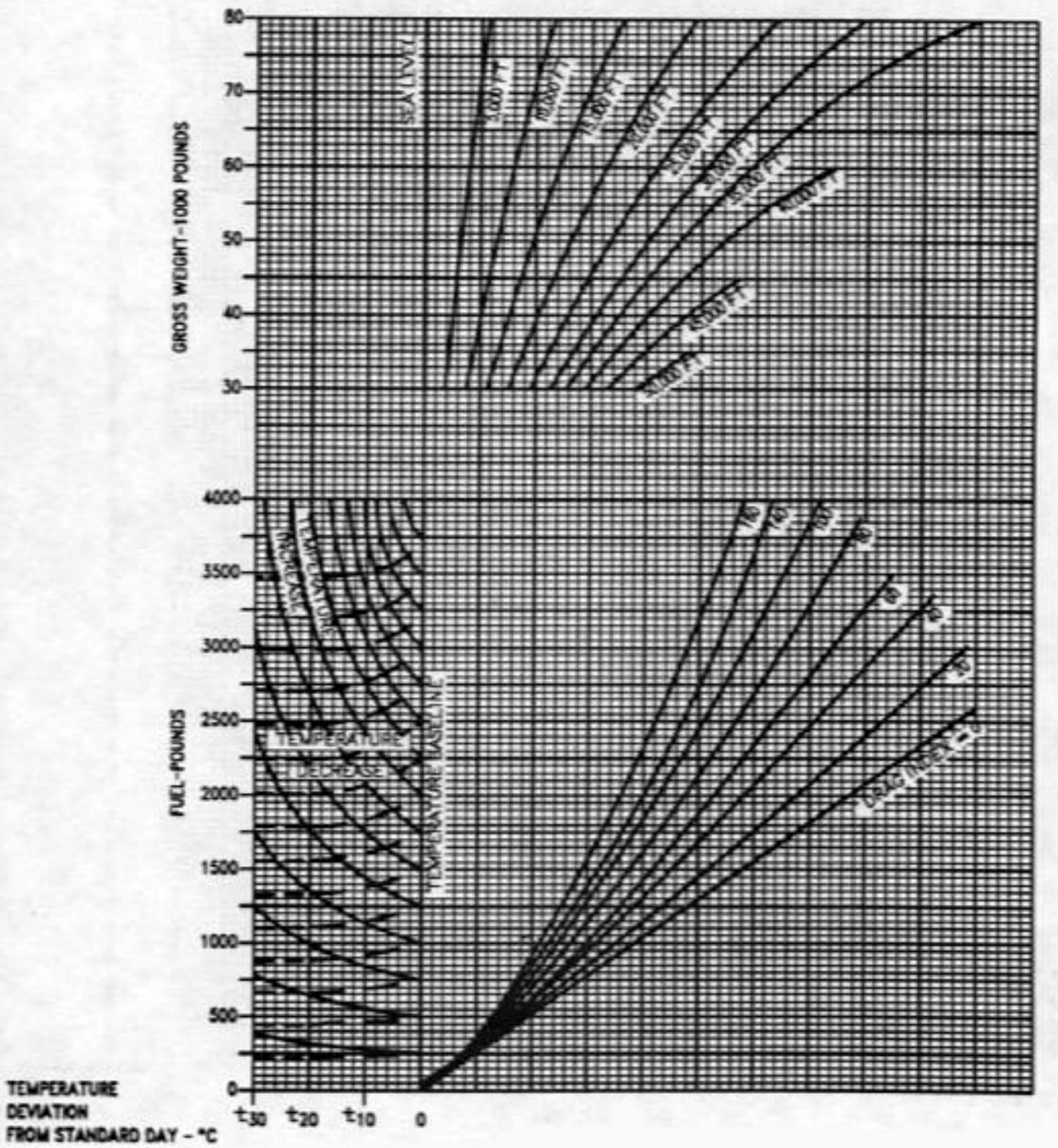


Figure A3-2

DISTANCE REQUIRED TO CLIMB

MILITARY THRUST

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTES
- CLIMB SPEED SCHEDULE FOR DRAG INDEXES UP TO 40 IS 350 KCAS UNTIL INTERCEPTION OF .88 MACH, THEN MAINTAINING MACH TO CRUISE ALTITUDE. FOR DRAG INDEXES BETWEEN 40 AND 100, USE 330 KCAS/.83 MACH. GREATER THAN 100, USE 310 KCAS/.74 MACH.
- DISTANCE FROM BRAKE RELEASE TO INITIAL CLIMB SPEED IS 2.0 NAUTICAL MILES MILITARY THRUST TAKEOFF AND 1.0 NAUTICAL MILES MAXIMUM THRUST TAKEOFF.

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

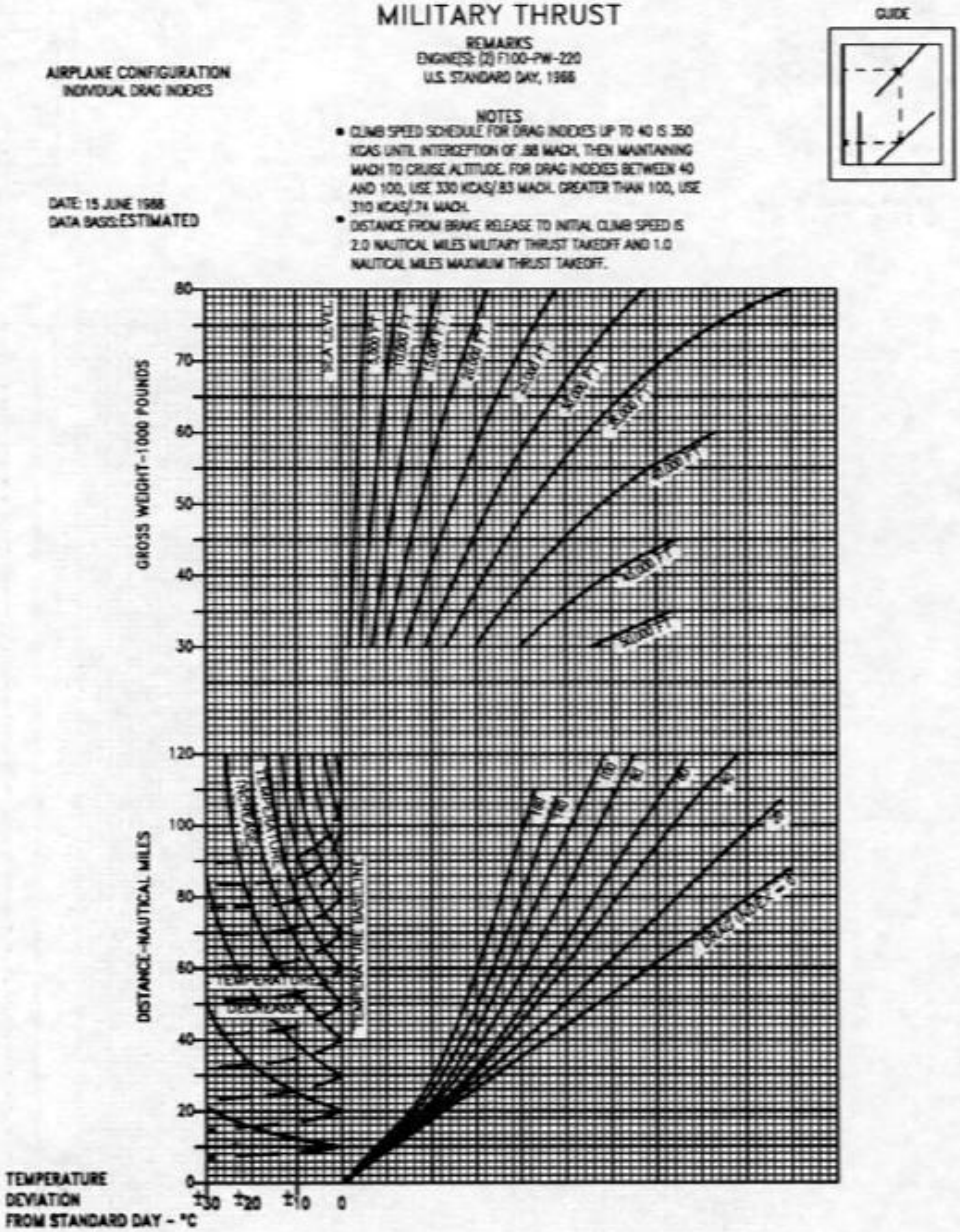


Figure A3-3

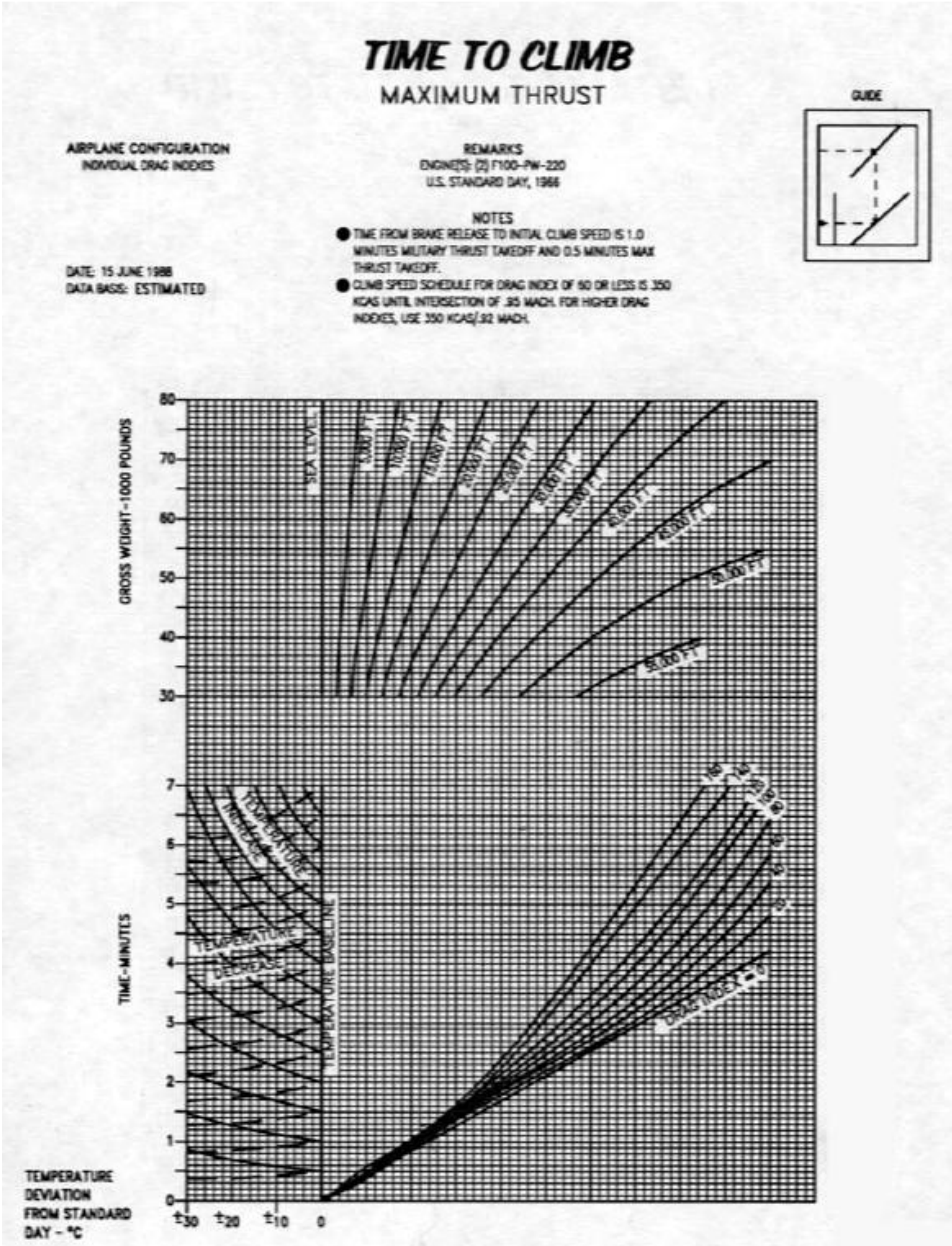

TIME TO CLIMB
MAXIMUM THRUST
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTES
TIME FROM BRAKE RELEASE TO INITIAL CLIMB SPEED IS 1.0 MINUTES MILITARY THRUST TAKEOFF AND 0.5 MINUTES MAX THRUST TAKEOFF.
CLIMB SPEED SCHEDULE FOR DRAG INDEX OF 60 OR LESS IS 350 KCAS UNTIL INTERSECTION OF .85 MACH. FOR HIGHER DRAG INDEXES, USE 350 KCAS/.92 MACH.
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
GROSS WEIGHT - 1000 POUNDS
SEA LEVEL
5,000 FT
10,000 FT
15,000 FT
20,000 FT
25,000 FT
30,000 FT
35,000 FT
40,000 FT
45,000 FT
50,000 FT
55,000 FT
TIME - MINUTES
TEMPERATURE INCREASE
TEMPERATURE DECREASE
TEMPERATURE BASE LINE
DRAG INDEX = 0
TEMPERATURE DEVIATION FROM STANDARD DAY - °C
±30 ±20 ±10 0

Figure A3-4

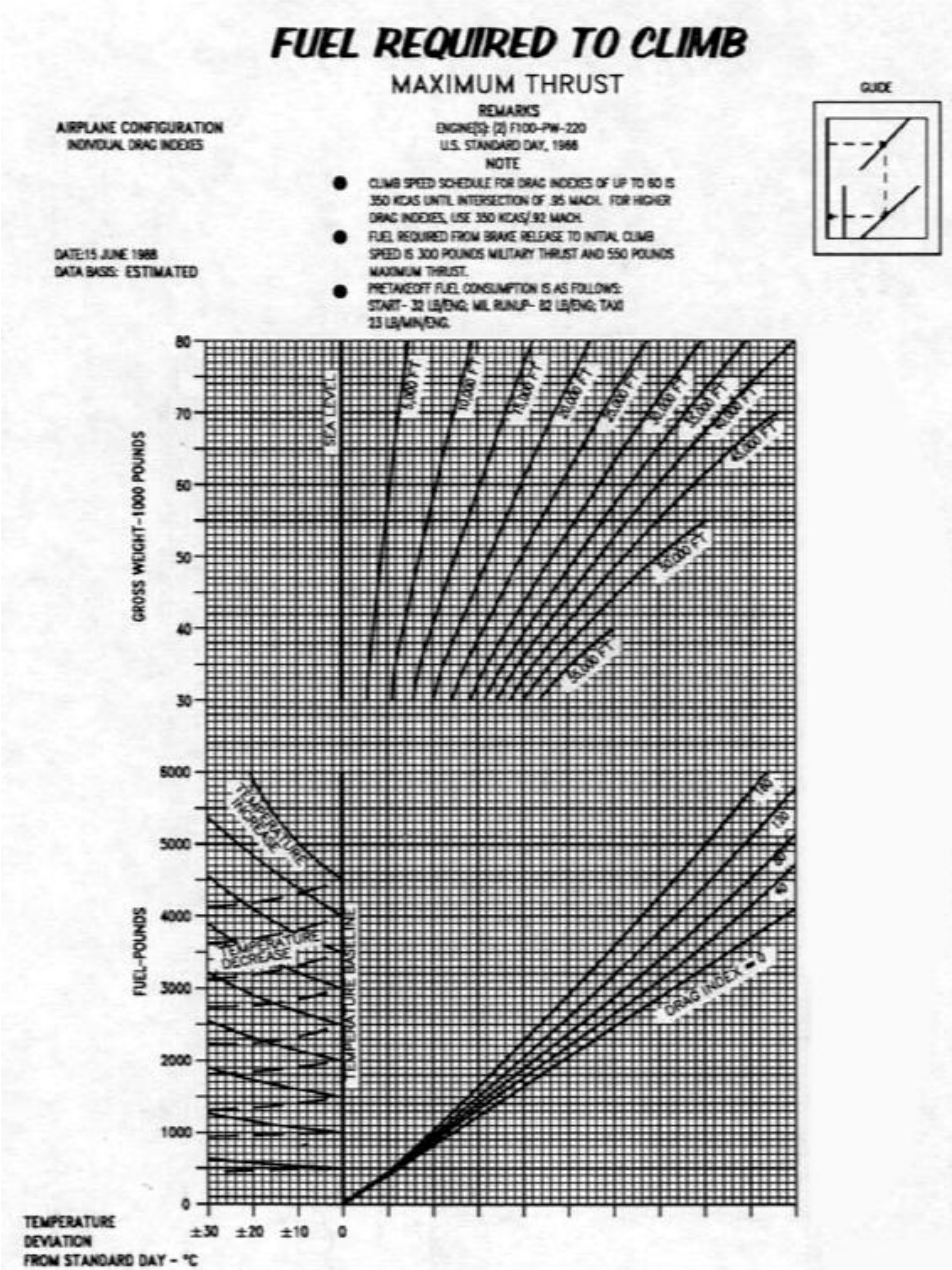

FUEL REQUIRED TO CLIMB
MAXIMUM THRUST
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
CLIMB SPEED SCHEDULE FOR DRAG INDEXES OF UP TO 60 IS 350 KCAS UNTIL INTERSECTION OF .85 MACH. FOR HIGHER DRAG INDEXES, USE 350 KCAS/.92 MACH.
FUEL REQUIRED FROM BRAKE RELEASE TO INITIAL CLIMB SPEED IS 300 POUNDS MILITARY THRUST AND 550 POUNDS MAXIMUM THRUST.
PRETAKEOFF FUEL CONSUMPTION IS AS FOLLOWS: START- 32 LB/ENG; MIL RUNUP- 82 LB/ENG; TAXI 23 LB/MIN/ENG.
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GROSS WEIGHT-1000 POUNDS
SEA LEVEL
50,000 FT
55,000 FT
TEMPERATURE INCREASE
TEMPERATURE DECREASE
TEMPERATURE BASELINE
DRAG INDEX = 0
FUEL-POUNDS
TEMPERATURE DEVIATION FROM STANDARD DAY - °C
±30 ±20 ±10 0

Figure A3-5

DISTANCE REQUIRED TO CLIMB

MAXIMUM THRUST

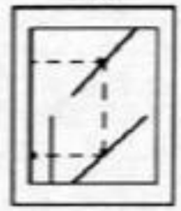
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTES
- DISTANCE FROM BRAKE RELEASE TO INITIAL CLIMB SPEED IS 2.0 NAUTICAL MILES MILITARY THRUST TAKEOFF AND 1.0 NAUTICAL MILES MAXIMUM THRUST TAKEOFF.
- CLIMB SPEED SCHEDULE FOR DRAG INDEX OF 60 OR LESS IS 350 KCAS UNTIL INTERSECTION OF .95 MACH. FOR HIGHER DRAG INDEXES, USE 350 KCAS/.92 MACH.

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

GUIDE



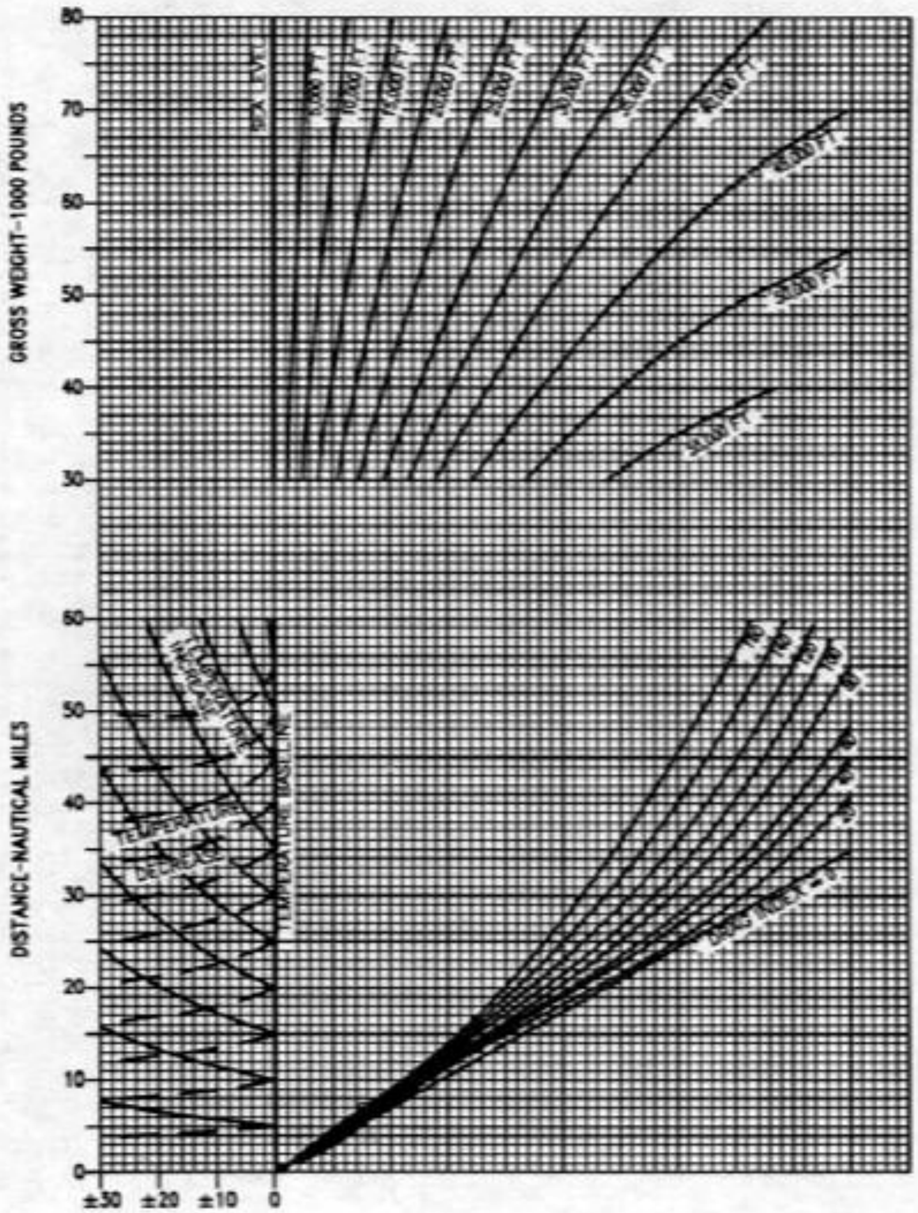


Figure A3-6

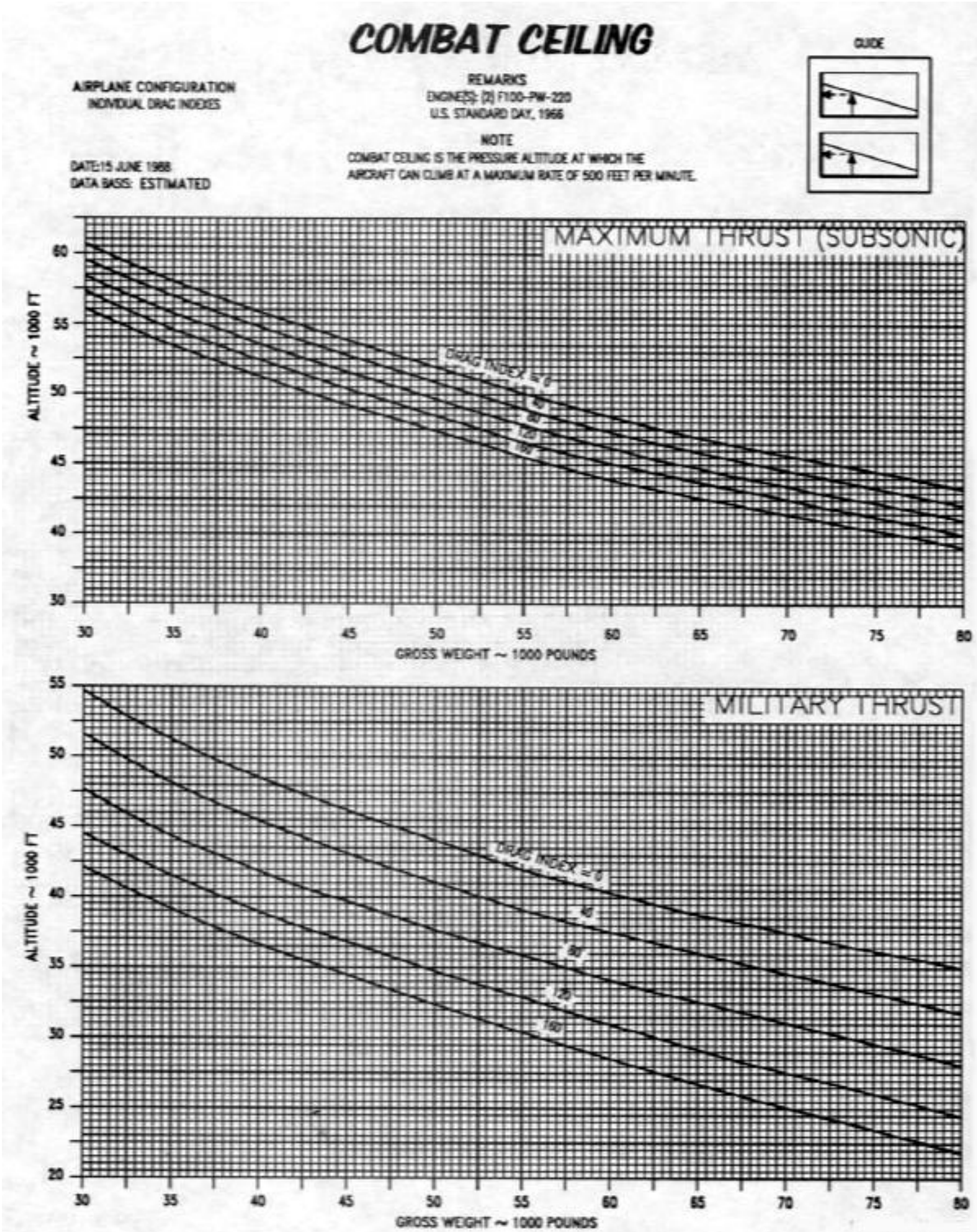

COMBAT CEILING
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
COMBAT CEILING IS THE PRESSURE ALTITUDE AT WHICH THE AIRCRAFT CAN CLIMB AT A MAXIMUM RATE OF 500 FEET PER MINUTE.
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
MAXIMUM THRUST (SUBSONIC)
ALTITUDE ~ 1000 FT
DRAG INDEX = 0
40
80
120
160
GROSS WEIGHT ~ 1000 POUNDS
MILITARY THRUST
ALTITUDE ~ 1000 FT
DRAG INDEX = 0
40
80
120
160
GROSS WEIGHT ~ 1000 POUNDS

Figure A3-7

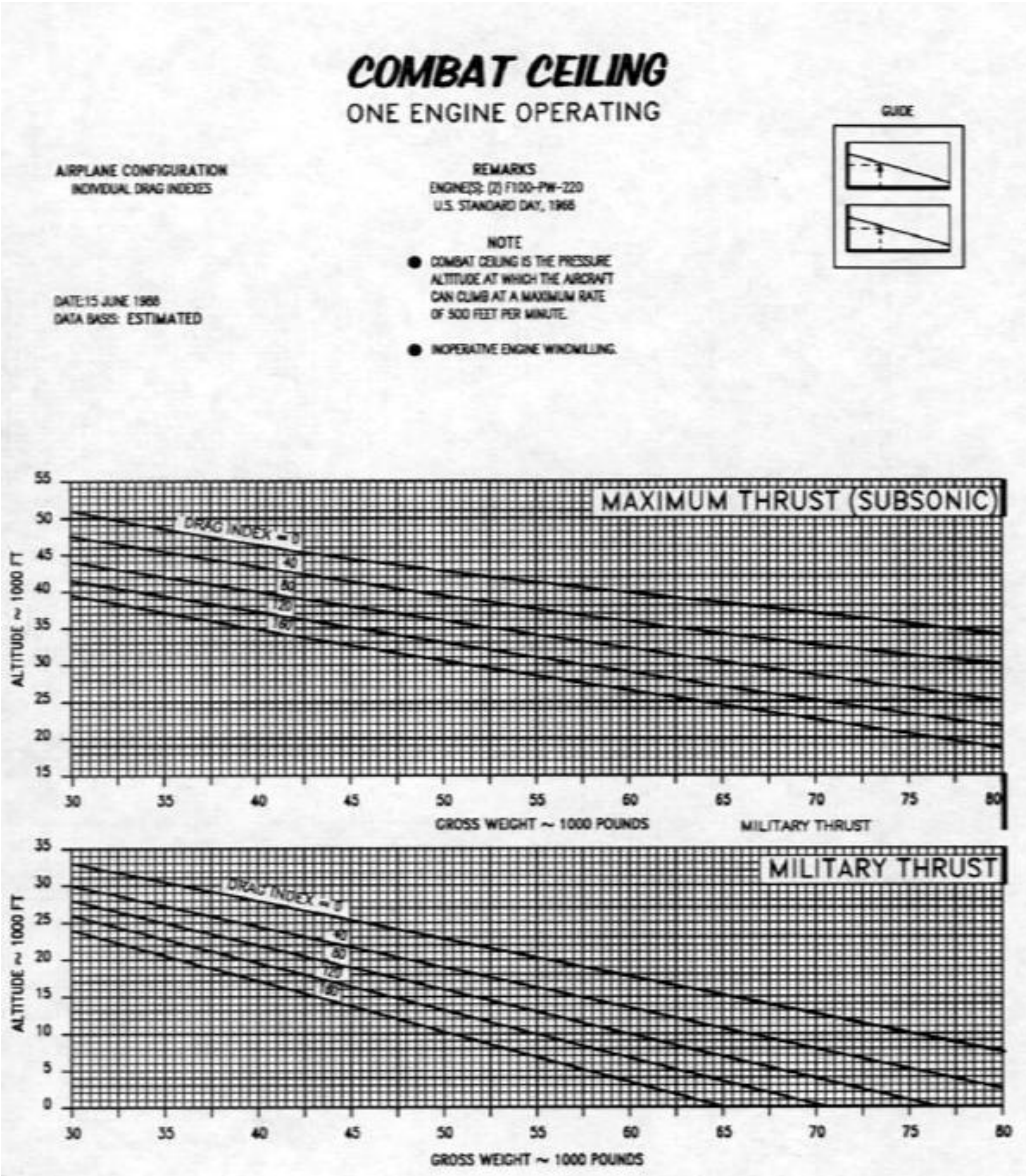

COMBAT CEILING
ONE ENGINE OPERATING
GUIDE
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
COMBAT CEILING IS THE PRESSURE ALTITUDE AT WHICH THE AIRCRAFT CAN CLIMB AT A MAXIMUM RATE OF 500 FEET PER MINUTE.
INOPERATIVE ENGINE WINDMILLING.
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
MAXIMUM THRUST (SUBSONIC)
DRAG INDEX = 0
40
80
120
160
ALTITUDE ~ 1000 FT
GROSS WEIGHT ~ 1000 POUNDS
MILITARY THRUST
ALTITUDE ~ 1000 FT
GROSS WEIGHT ~ 1000 POUNDS

Figure A3-8

PART 4

RANGE

OPTIMUM LONG RANGE CRUISE

These charts (figures A4-1 and A4-2) present cruise data for twin-engine and single-engine operation. These charts depict cruise altitude, specific range (nautical miles per pound) and cruise Mach number for various gross weight and drag indexes.

USE

Enter the chart with the applicable gross weight and project vertically up to intersect the appropriate drag index curves in each plot. From the intersection of the appropriate drag index curve, reflect horizontally left and read cruise Mach number, specific range in nautical miles per pound and cruise altitude.

CONSTANT ALTITUDE/LONG RANGE CRUISE

These charts (figures A4-3 to A4-12) present the necessary planning data to set up optimum cruise schedules for normal two-engine operation at a constant altitude. The charts depict specific range (nautical miles per pound of fuel) for various Mach numbers, gross weights and individual drag indexes at altitudes of seal level through 45,000 feet in increments of 5,000 feet. The recommended procedure is to use an average gross weight for a given leg of the mission.

One way to find the average gross weight is to divide the mission into weight segments. With this method, readjust the cruise schedule each time a given amount of fuel is used. Subtract one-half of the fuel weight allocated for the first leg from the initial cruise gross weight allotted for the first leg from the initial cruise gross weight. The remainder is the average gross weight for the leg. It is possible to obtain instantaneous data if desired.

USE

Enter the chart with the desired gross weight and project vertically upward to intersect the appropriate drag index curve, then horizontally to the left to determine the optimum cruise Mach number. From the optimum airspeed-gross weight intersection project vertically up to intersect the appropriate drag index curve, then horizontally left to determine the specific range. These charts are applicable for any temperature day.

CONSTANT ALTITUDE CRUISE CHARTS

This chart (figure A4-13) presents the necessary planning data to set up optimum cruise schedules for normal two-engine operation at a constant altitude at various flight-level temperatures.

USE

Enter the left side of the chart with the optimum cruise Mach number and project horizontally right to intersect the predicted flight-level temperature. Then, project vertically up to obtain the corresponding true airspeed. Project vertically down to intersect the interpolated specific range, then project horizontally left to obtain total fuel flow required in pounds per hour.

LOW ALTITUDE CRUISE TABLES

These tables (figures A4-14 to A4-23) present total fuel flow values for various combinations of cruise airspeed, and drag index at altitudes of Sea Level, 5,000, 10,000, 15,000, and 20,000 feet. Also included for each altitude are the total fuel flow values and resultant Vmax (maximum attainable TAS) for a MIL thrust setting. Separate tables are provided for gross weight of 35,000 to 80,000 pounds. Fuel flow values are tabulated for US Standard Day. However, correction factors are given for non-standard temperatures. The standard day temperature is listed with the altitude. If the actual temperature at a particular altitude differs from the standard day temperature, refer to the TEMP. EFFECTS column to determine the appropriate temperature correction factor.

USE

After selecting the applicable table for gross weight and altitude, determine the equivalent standard day true airspeed by dividing the desired true airspeed by the non-standard day temperature correction factor obtained from the appropriate TEMP. EFFECTS column. Enter the table with the equivalent standard day true airspeed and project horizontally to the applicable drag index column and read the total fuel flow at the desired true airspeed, multiply the total fuel flow for a standard day by the non-standard day temperature correction factor.

HIGH ALTITUDE CRUISE TABLES

These tables (figures A4-24 to A4-33) present total fuel flow values for various combinations of cruise airspeed and drag index at altitudes of 25,000 feet to 45,000 feet in 5,000 foot increments. Also included for each altitude are the total fuel flow values and resultant Vmax for a MIL thrust setting. Separate charts are provided for gross weights of 35,000 to 80,000 pounds. Fuel flow values are tabulated for US Standard Day. However, correction factors are given for non-standard temperatures. The standard day temperature is listed with the altitude differs from the standard day temperature, refer to the TEMP. EFFECTS column to determine the appropriate temperature correction factor.

USE

After selecting the applicable table for gross weight and altitude, determine the equivalent standard day true airspeed by dividing the desired true airspeed by the non-standard day temperature correction factor obtained from the appropriate TEMP EFFECTS column. Enter the table with the equivalent standard day true airspeed and project horizontally to the applicable drag index column and read total fuel flow for a standard day. To obtain the total fuel flow at the desired true airspeed, multiply the total fuel flow for a standard day by the non-standard day temperature correction factor.

CONSTANT ALTITUDE CRUISE-LANDING GEAR EXTENDED

This chart (figure A4-34) presents data to set up constant altitude cruise schedules when landing gear cannot be retracted. The chart contains specific range (nautical miles per pound of fuel) data for various combinations of gross weight, drag index, and altitude for a cruise speed of 250 KCAS.

USE

Enter the chart at the gross weight scale and project horizontally right to intersect with the applicable drag index. From this point, project downward to intersect with the desired cruise altitude and project horizontally left to read the specific range.

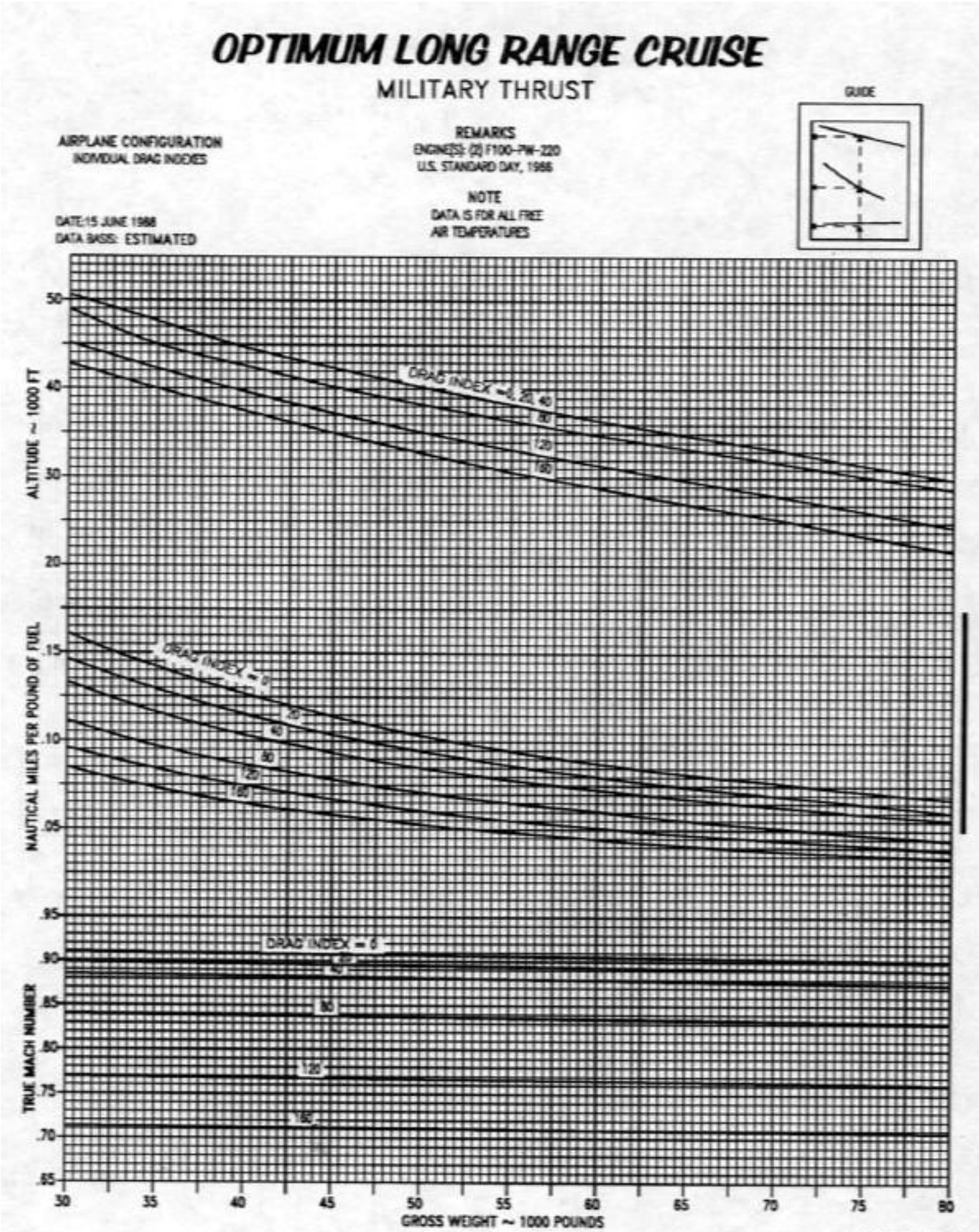

OPTIMUM LONG RANGE CRUISE
MILITARY THRUST
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
DATA IS FOR ALL FREE AIR TEMPERATURES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
ALTITUDE ~ 1000 FT
NAUTICAL MILES PER POUND OF FUEL
TRUE MACH NUMBER
GROSS WEIGHT ~ 1000 POUNDS
DRAG INDEX ~ 0, 20, 40
DRAG INDEX ~ 0
DRAG INDEX ~ 0

Figure A4-1

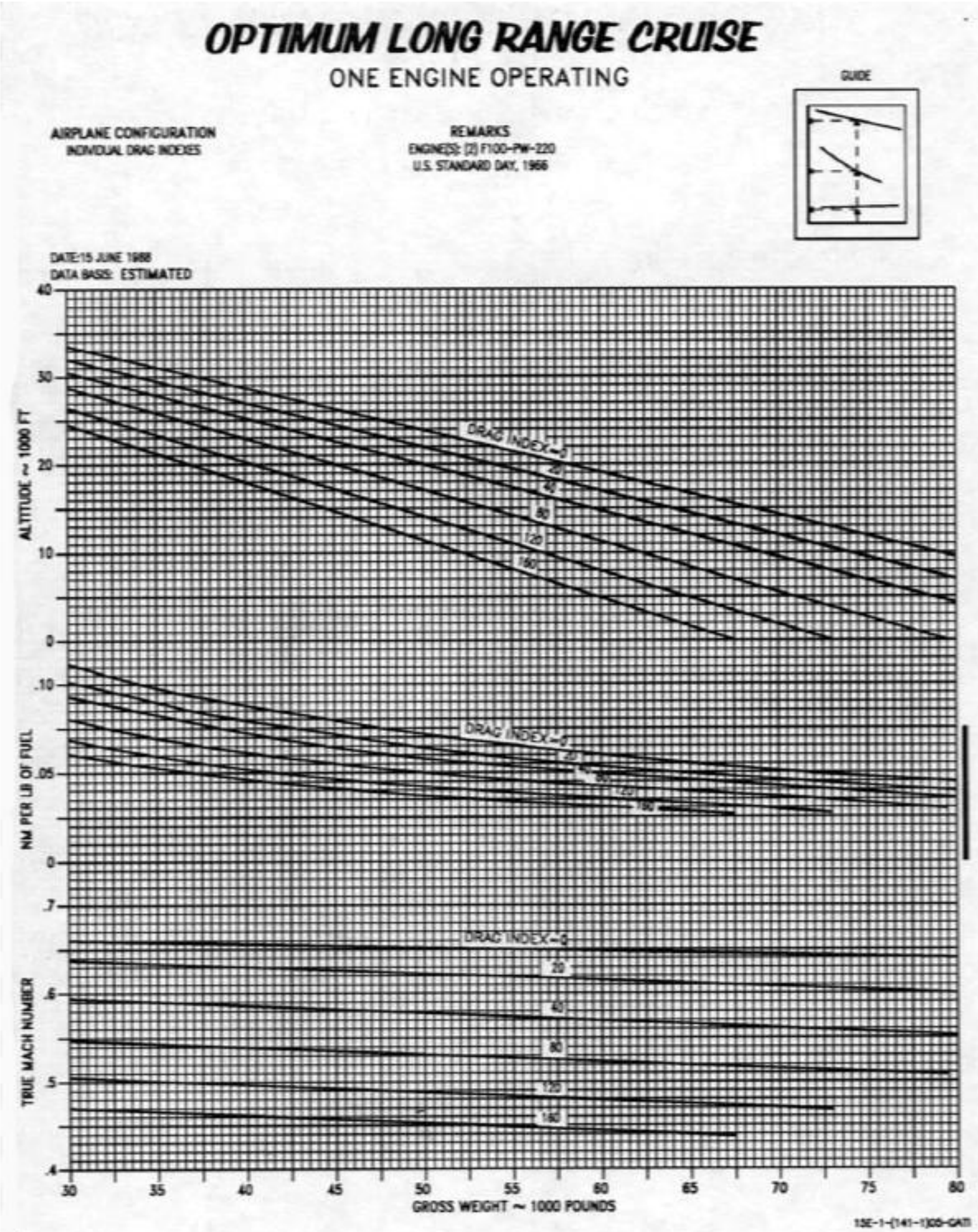

OPTIMUM LONG RANGE CRUISE
ONE ENGINE OPERATING
GUIDE
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
ALTITUDE ~ 1000 FT
NM PER LB OF FUEL
TRUE MACH NUMBER
DRAG INDEX=0
20
40
80
120
160
GROSS WEIGHT ~ 1000 POUNDS
15E-1-(141-1)05-CATI

Figure A4-2

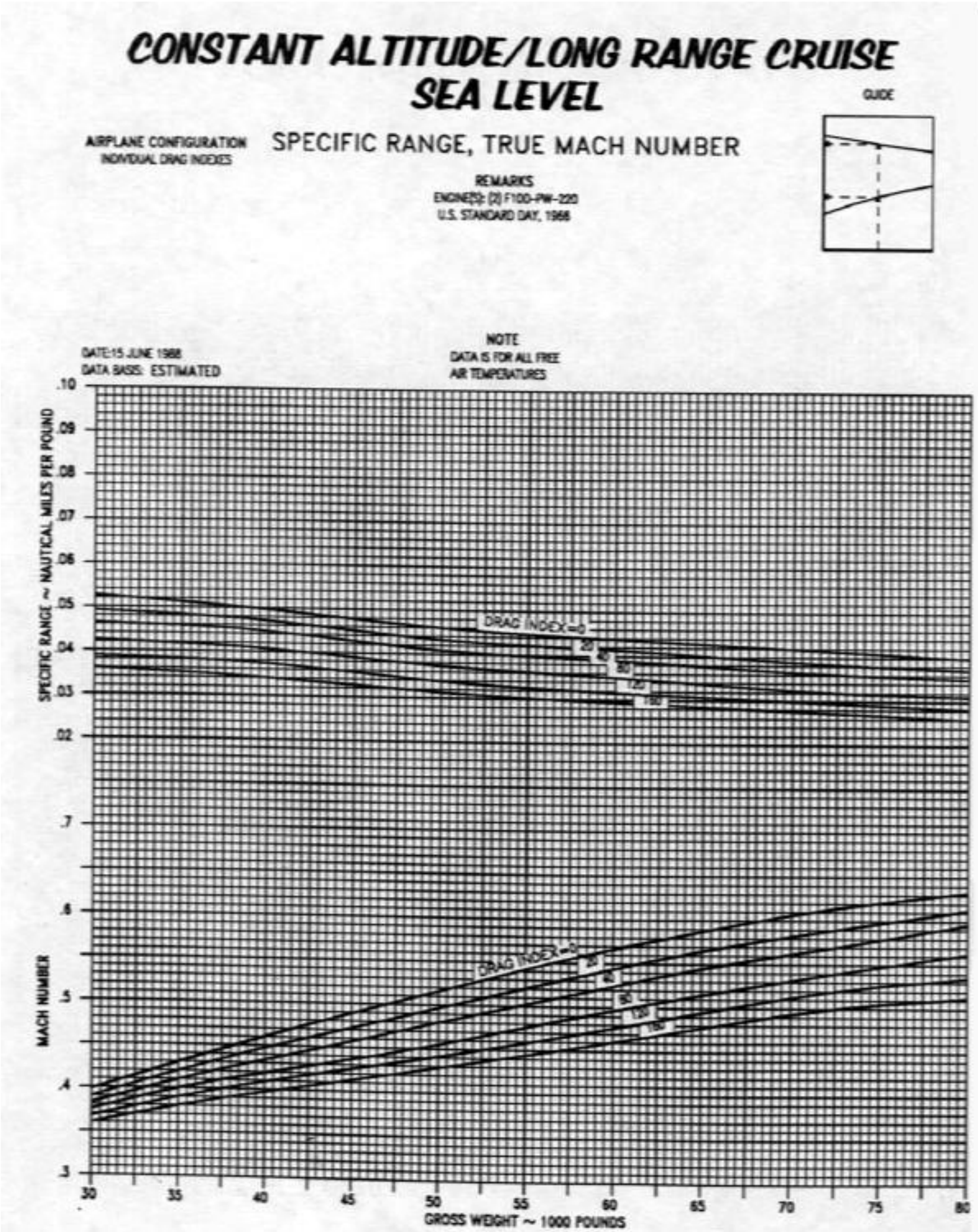

CONSTANT ALTITUDE/LONG RANGE CRUISE
SEA LEVEL
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
SPECIFIC RANGE, TRUE MACH NUMBER
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
NOTE
DATA IS FOR ALL FREE AIR TEMPERATURES
SPECIFIC RANGE ~ NAUTICAL MILES PER POUND
MACH NUMBER
DRAG INDEX = 0
GROSS WEIGHT ~ 1000 POUNDS

Figure A4-3

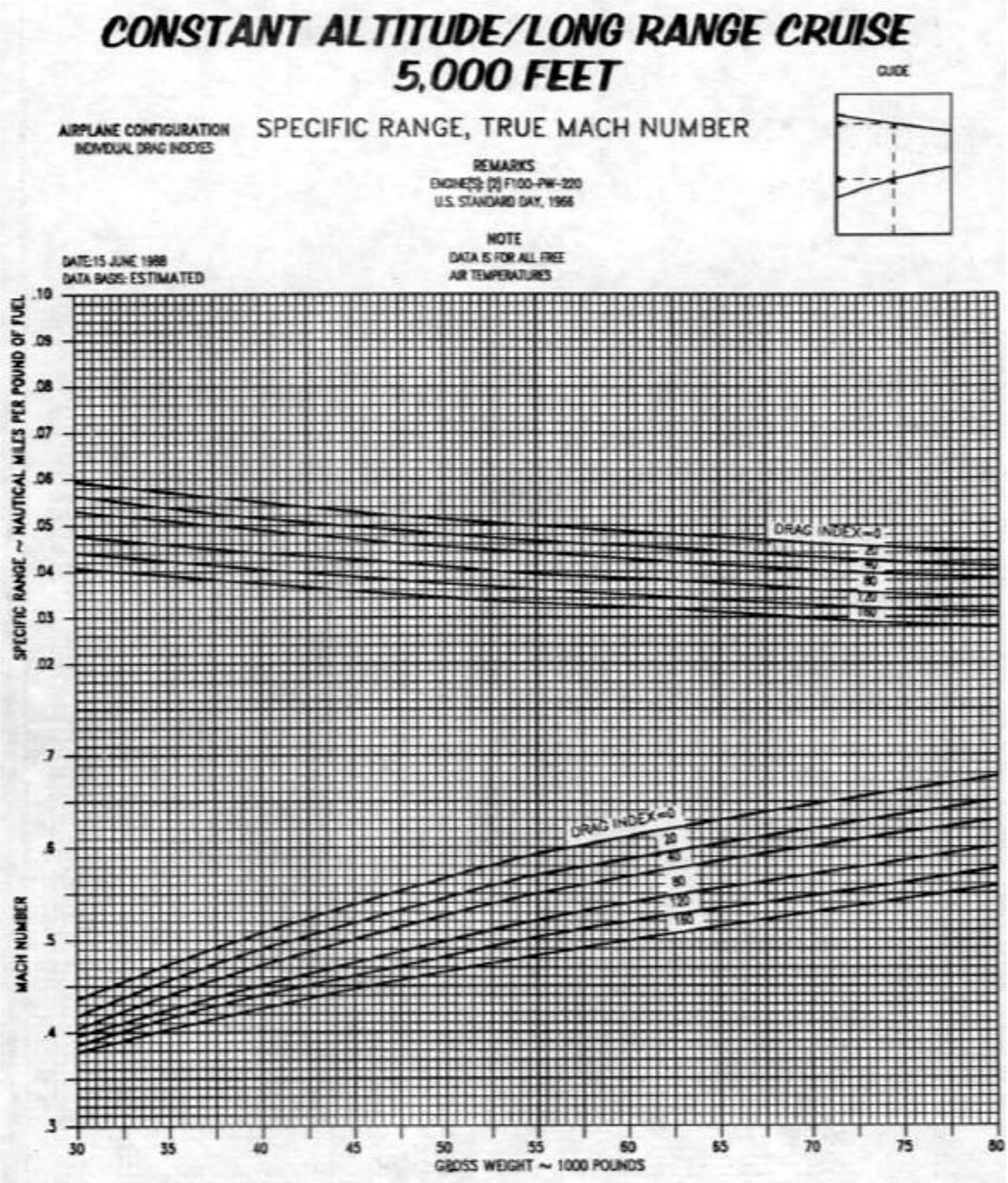

CONSTANT ALTITUDE/LONG RANGE CRUISE
5,000 FEET
SPECIFIC RANGE, TRUE MACH NUMBER
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
DATA IS FOR ALL FREE
AIR TEMPERATURES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
SPECIFIC RANGE ~ NAUTICAL MILES PER POUND OF FUEL
MACH NUMBER
DRAG INDEX = 0
GROSS WEIGHT ~ 1000 POUNDS

Figure A4-4

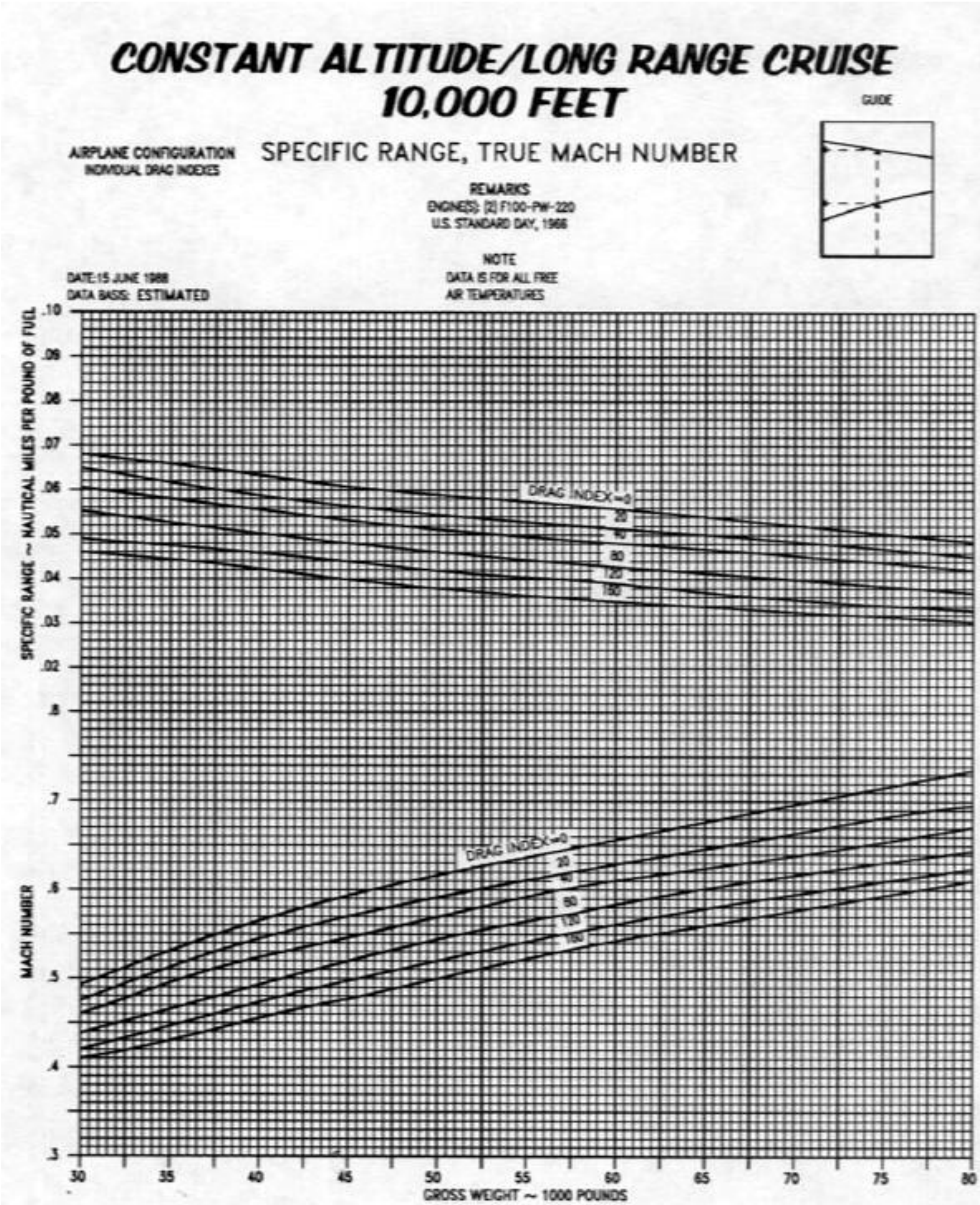

CONSTANT ALTITUDE/LONG RANGE CRUISE
10,000 FEET
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
SPECIFIC RANGE, TRUE MACH NUMBER
GUIDE
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
DATA IS FOR ALL FREE
AIR TEMPERATURES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
SPECIFIC RANGE ~ NAUTICAL MILES PER POUND OF FUEL
MACH NUMBER
DRAG INDEX ~ 0
20
40
80
120
160
GROSS WEIGHT ~ 1000 POUNDS
30
35
40
45
50
55
60
65
70
75
80
.10
.09
.08
.07
.06
.05
.04
.03
.02
.8
.7
.6
.5
.4
.3

Figure A4-5

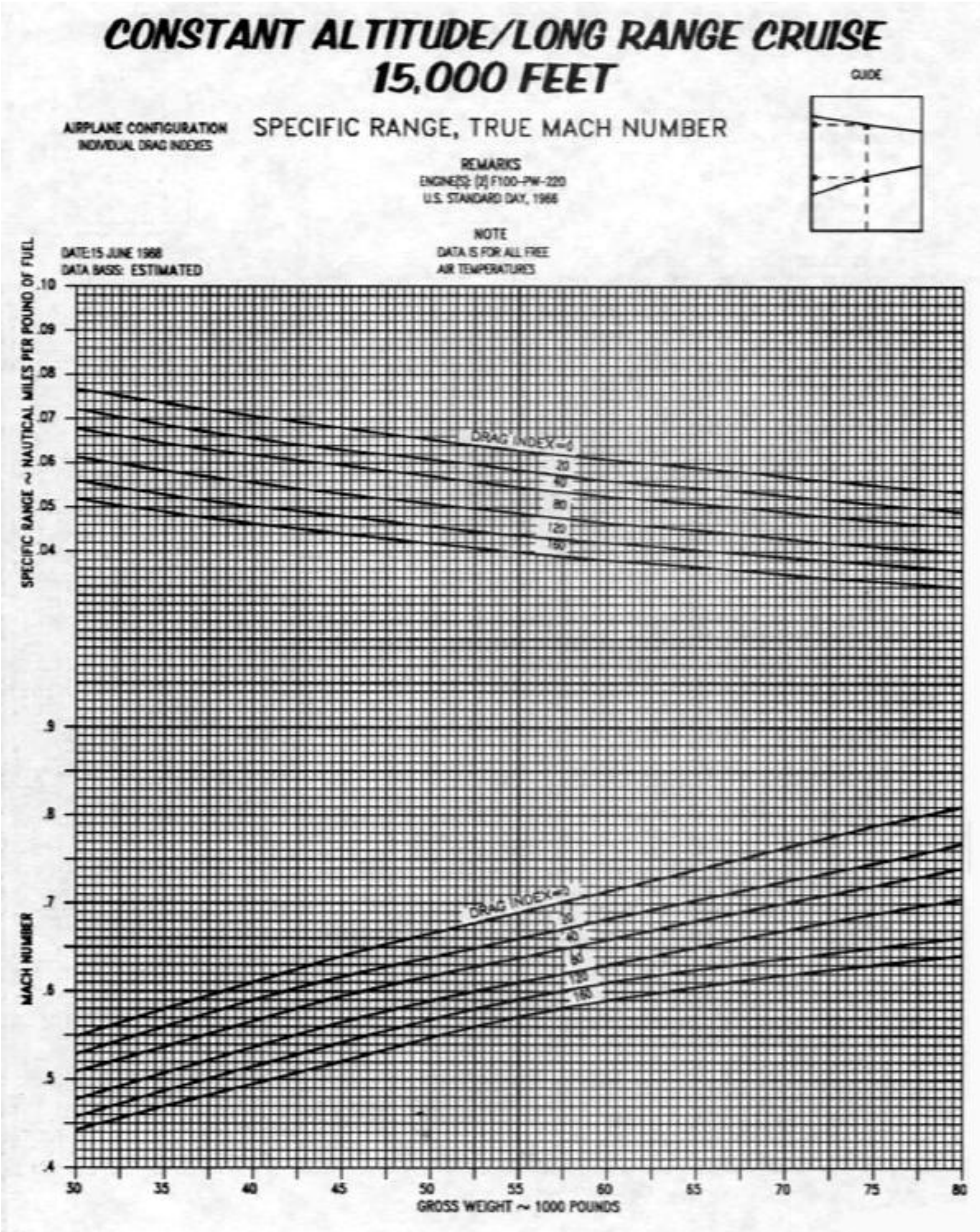

CONSTANT ALTITUDE/LONG RANGE CRUISE
15,000 FEET
SPECIFIC RANGE, TRUE MACH NUMBER
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
DATA IS FOR ALL FREE AIR TEMPERATURES
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
SPECIFIC RANGE ~ NAUTICAL MILES PER POUND OF FUEL
MACH NUMBER
DRAG INDEX=0
20
40
80
120
160
GROSS WEIGHT ~ 1000 POUNDS

Figure A4-6

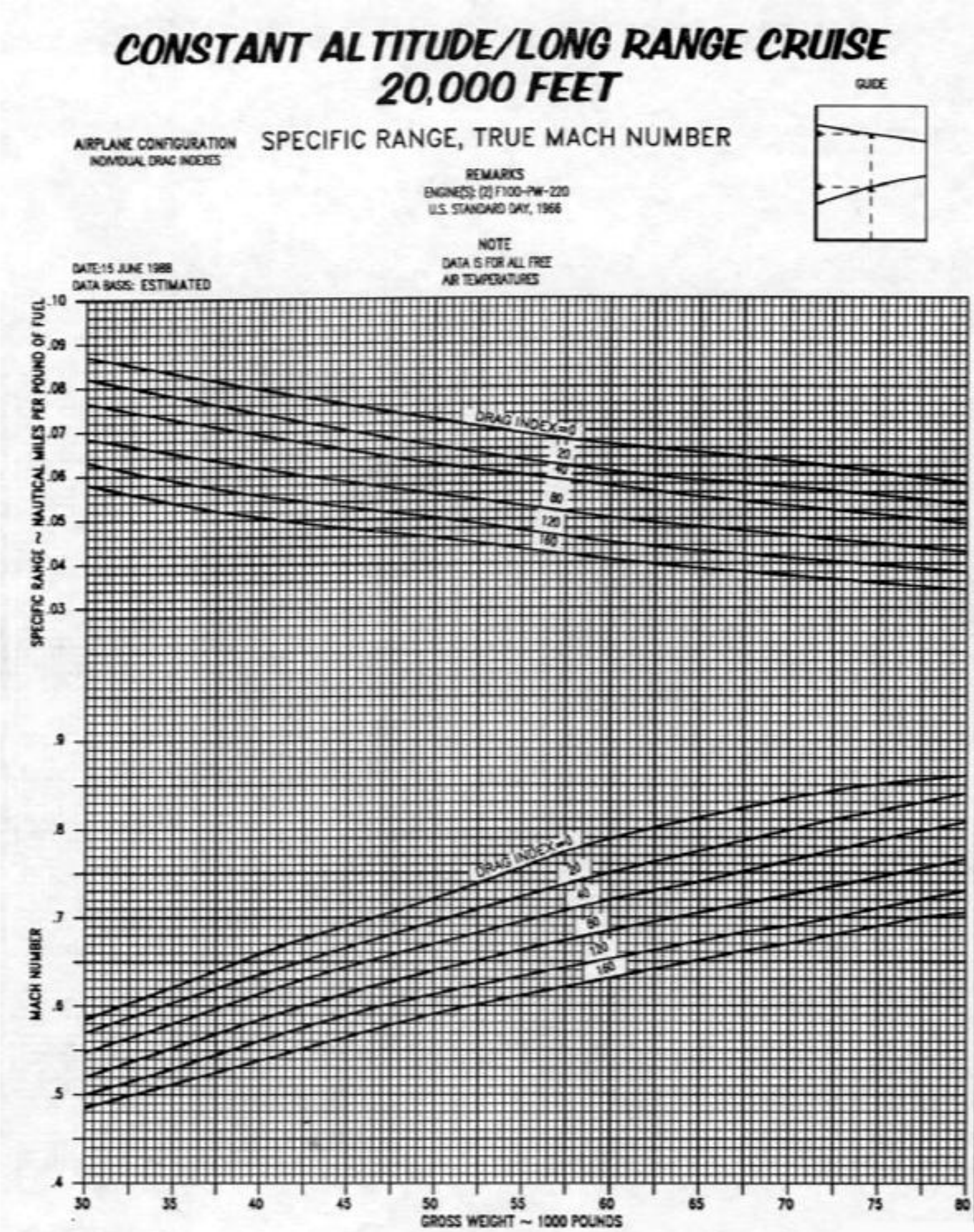

CONSTANT ALTITUDE/LONG RANGE CRUISE
20,000 FEET
SPECIFIC RANGE, TRUE MACH NUMBER
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
DATA IS FOR ALL FREE AIR TEMPERATURES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
SPECIFIC RANGE ~ NAUTICAL MILES PER POUND OF FUEL
MACH NUMBER
DRAG INDEX=0
20
40
80
120
160
GROSS WEIGHT ~ 1000 POUNDS
30
35
40
45
50
55
60
65
70
75
80

Figure A4-7

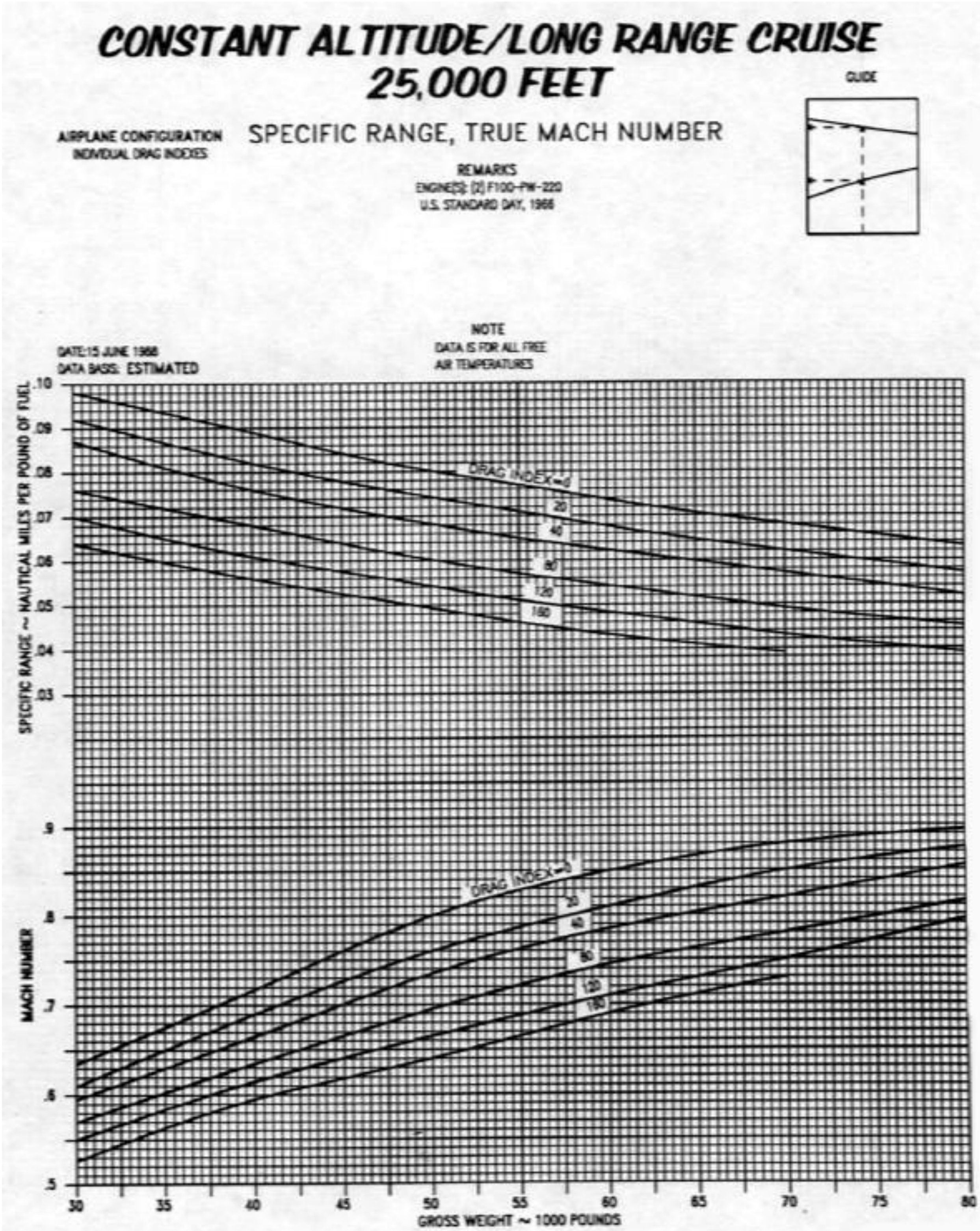

CONSTANT ALTITUDE/LONG RANGE CRUISE
25,000 FEET
SPECIFIC RANGE, TRUE MACH NUMBER
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
DATA IS FOR ALL FREE AIR TEMPERATURES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
SPECIFIC RANGE ~ NAUTICAL MILES PER POUND OF FUEL
.10
.09
.08
.07
.06
.05
.04
.03
DRAG INDEX=0
20
40
80
120
160
MACH NUMBER
.9
.8
.7
.6
.5
DRAG INDEX=0
20
40
80
120
160
30
35
40
45
50
55
60
65
70
75
80
GROSS WEIGHT ~ 1000 POUNDS

Figure A4-8

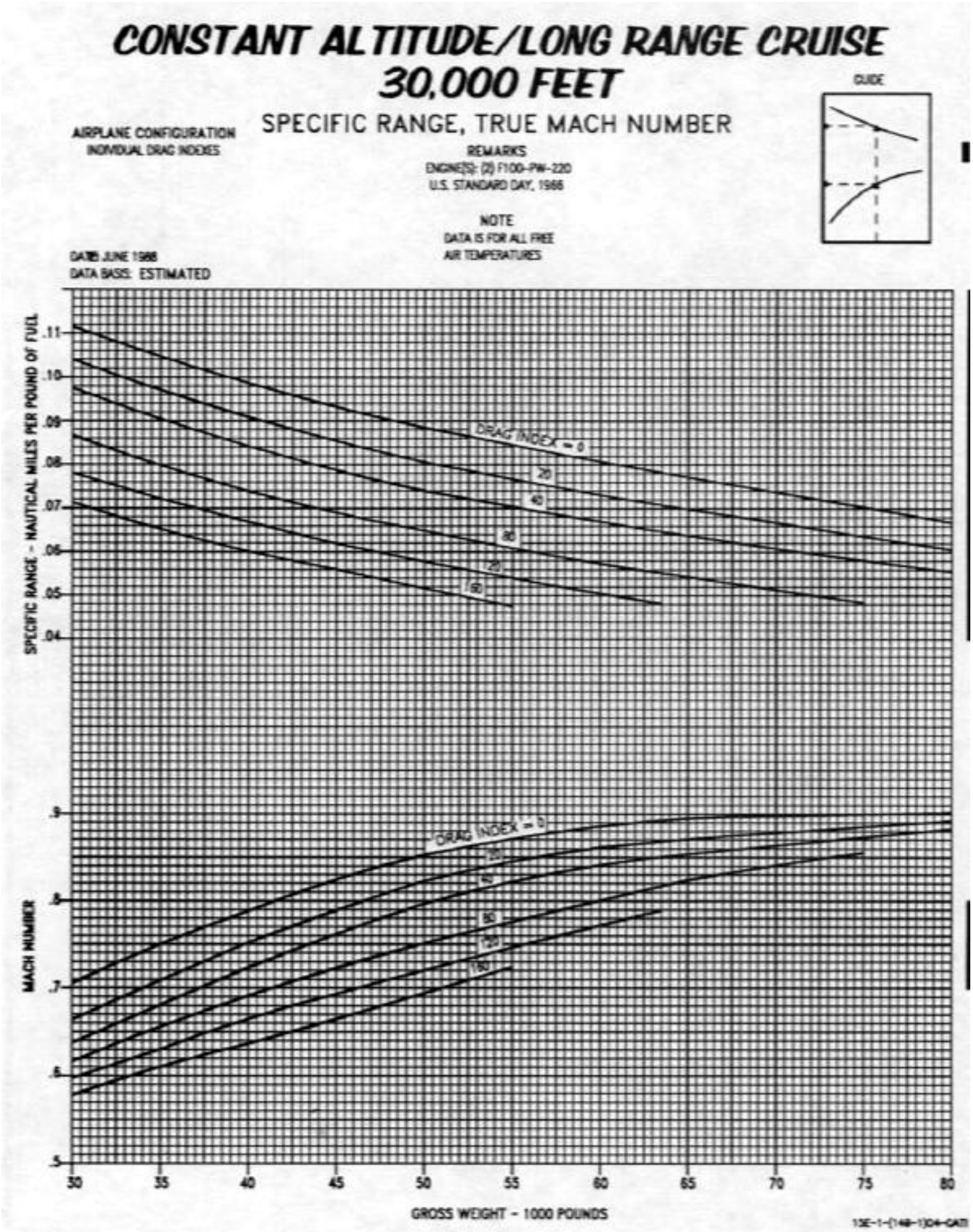

CONSTANT ALTITUDE/LONG RANGE CRUISE
30,000 FEET
SPECIFIC RANGE, TRUE MACH NUMBER
GUIDE
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
DATA IS FOR ALL FREE
AIR TEMPERATURES
DATE: JUNE 1988
DATA BASIS: ESTIMATED
SPECIFIC RANGE - NAUTICAL MILES PER POUND OF FUEL
DRAG INDEX = 0
MACH NUMBER
GROSS WEIGHT - 1000 POUNDS

Figure A-9

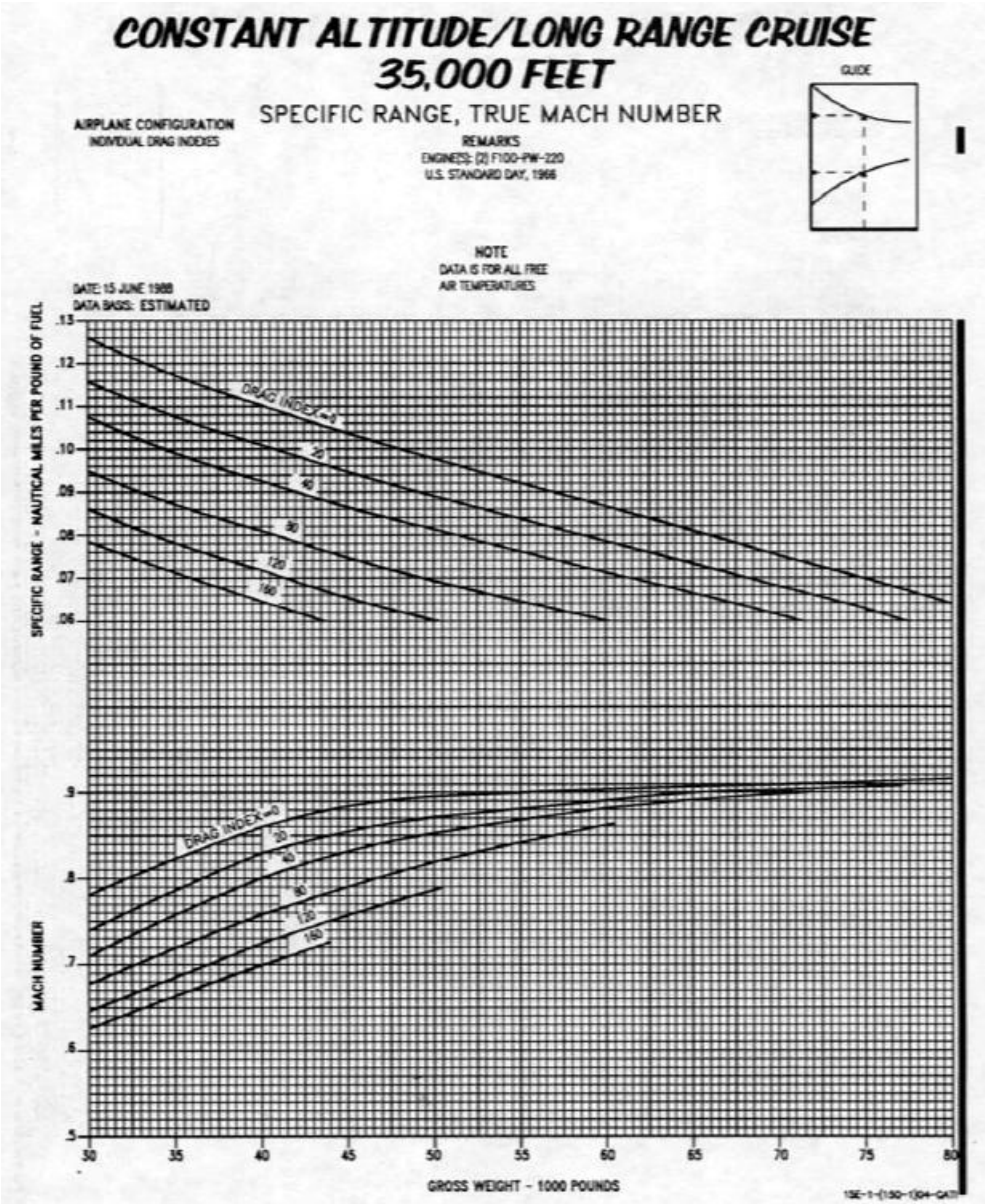

CONSTANT ALTITUDE/LONG RANGE CRUISE
35,000 FEET
SPECIFIC RANGE, TRUE MACH NUMBER
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
DATA IS FOR ALL FREE
AIR TEMPERATURES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
SPECIFIC RANGE - NAUTICAL MILES PER POUND OF FUEL
MACH NUMBER
DRAG INDEX=0
GROSS WEIGHT - 1000 POUNDS

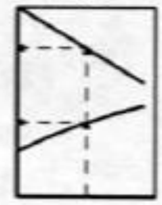
Figure A4-10

CONSTANT ALTITUDE/LONG RANGE CRUISE 40,000 FEET

SPECIFIC RANGE, TRUE MACH NUMBER

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966



NOTE
DATA IS FOR ALL FREE AIR TEMPERATURES

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

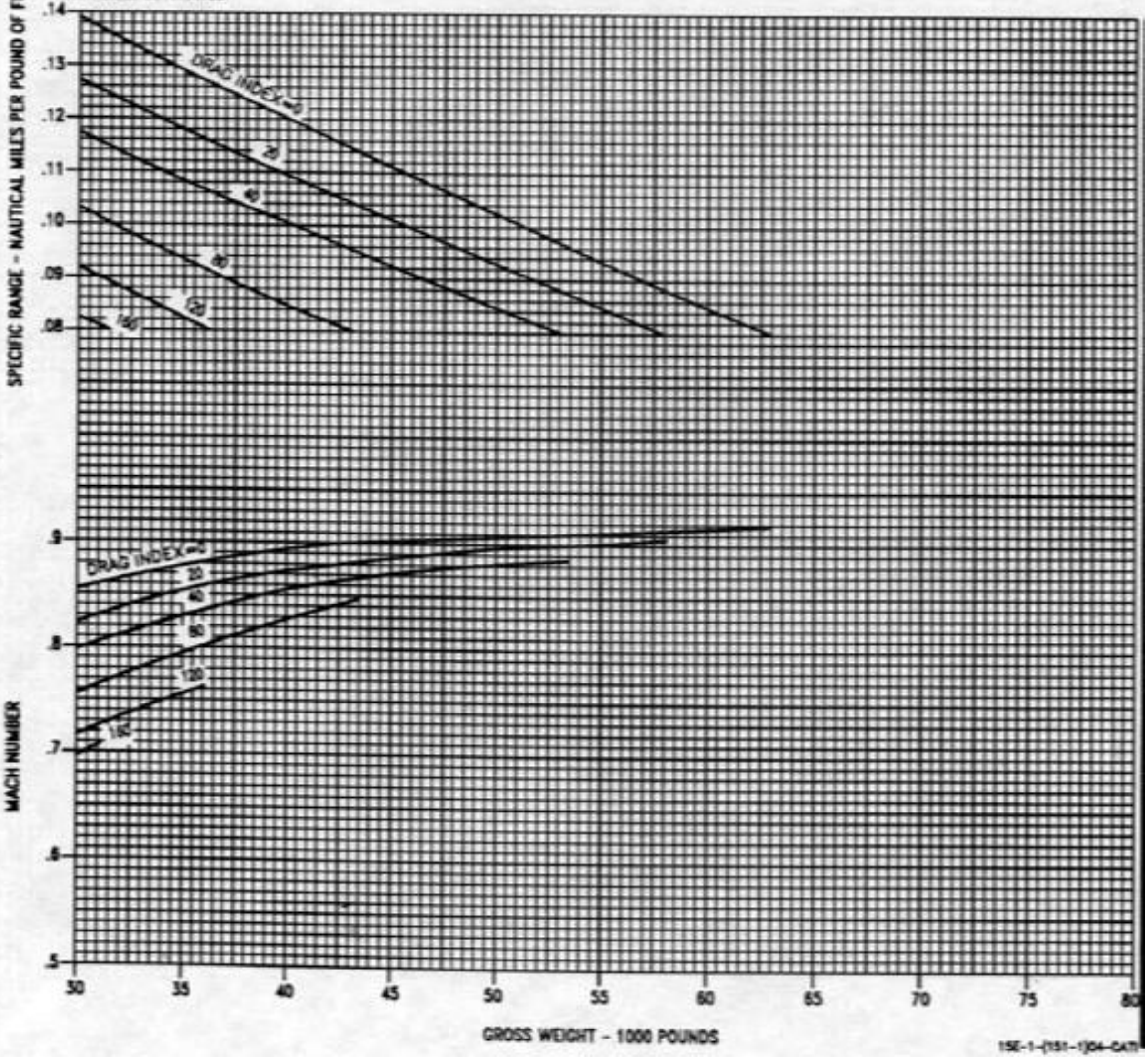


Figure A4-11

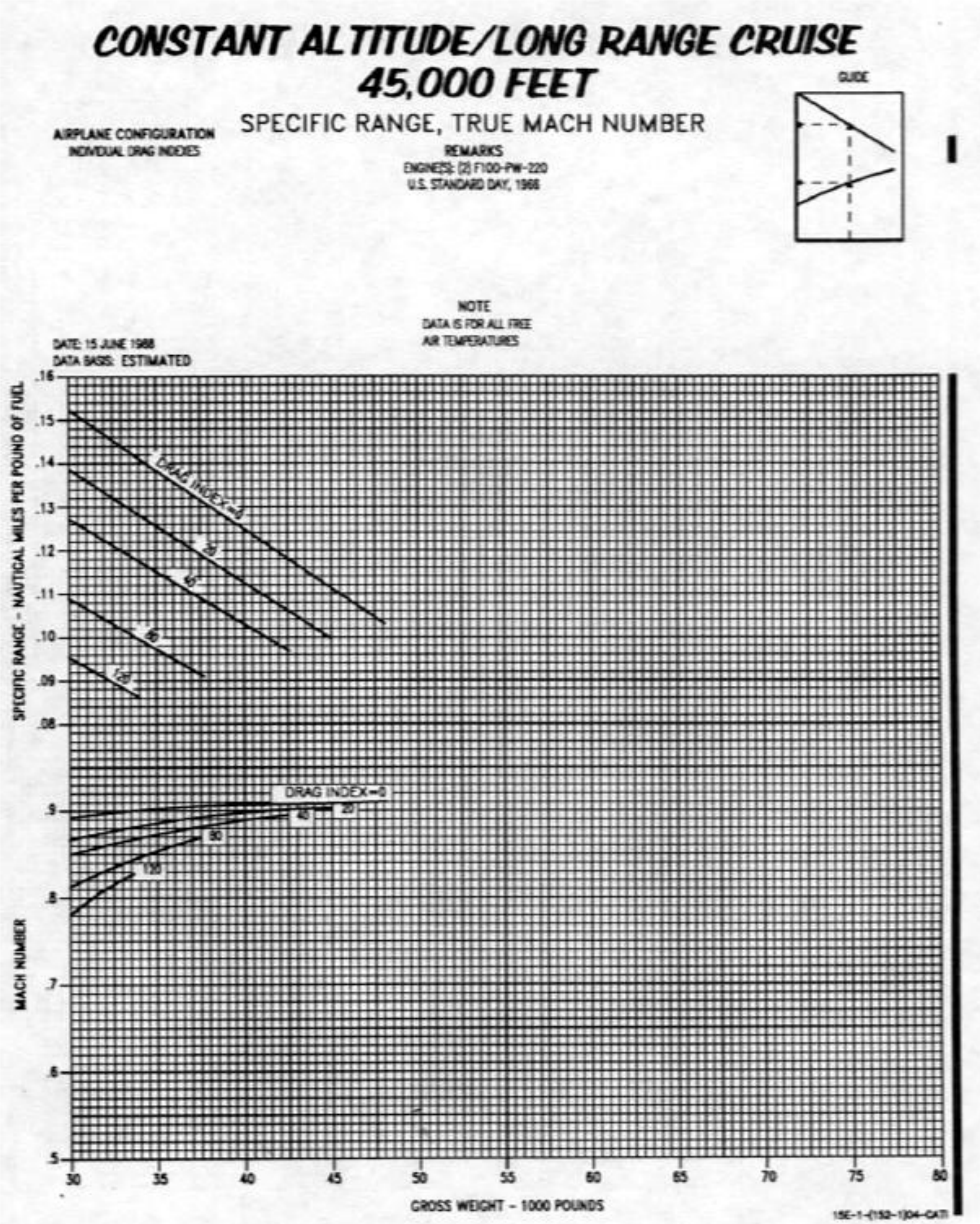

CONSTANT ALTITUDE/LONG RANGE CRUISE
45,000 FEET
SPECIFIC RANGE, TRUE MACH NUMBER
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
DATA IS FOR ALL FREE
AIR TEMPERATURES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
SPECIFIC RANGE - NAUTICAL MILES PER POUND OF FUEL
DRAG INDEX=0
20
40
80
120
MACH NUMBER
GROSS WEIGHT - 1000 POUNDS
15E-1-(152-1)04-CATI

Figure A4-12

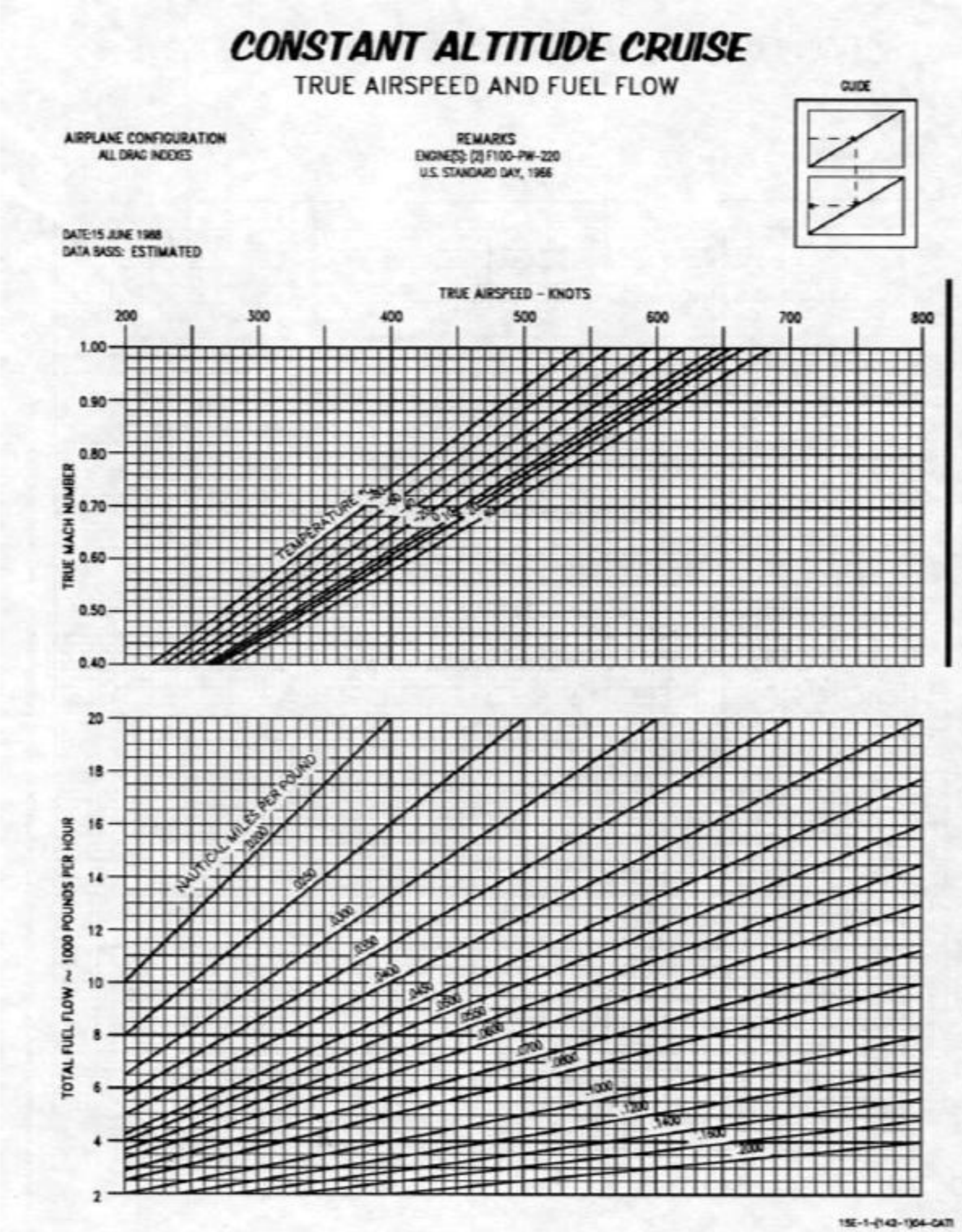

CONSTANT ALTITUDE CRUISE
TRUE AIRSPEED AND FUEL FLOW
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
TRUE AIRSPEED - KNOTS
TRUE MACH NUMBER
TEMPERATURE
NAUTICAL MILES PER POUND
TOTAL FUEL FLOW ~ 1000 POUNDS PER HOUR
15E-1-(143-1)04-CATI

Figure A4-13

LOW ALTITUDE CRUISE

GROSS WEIGHT - 35,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX										ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS		
		0	20	40	60	80	100	120	140	160			CRUISE	MIL	VMAX
SEA LEVEL (15°C)	360	7698	8339	8981	9642	10312	10982	11652	12350	13102		-40	.899	1.630	.975
	400	9013	9830	10682	11524	12388	13317	14271	15226	16196		-20	.937	1.330	.988
	440	10545	11629	12714	13873	15081	16289	17551	18823	20098		0	.974	1.140	.997
	480	12270	13641	15153	16671	18248	19845	21459	23088			20	1.009	.960	1.000
	520	14175	16073	17998	19999	22011	24038					40	1.042	.810	.999
	560	16437	18918	21440	22994										
	600	20162	23518												
	MIL	27165	26683	26270	25963	25643	25341	25023	24736	24485					
	VMAX	639.2	617.1	596.2	574.9	552.4	531.1	511.2	493.8	478.1					
5,000 FEET (5°C)	360	6584	7121	7663	8219	8776	9334	9891	10528	11168		-40	.916	1.400	.978
	400	7674	8372	9085	9797	10538	11357	12177	12998	13848		-20	.954	1.225	.987
	440	8955	9868	10782	11809	12840	13883	14954	16026	17181		0	.991	1.050	.998
	480	10414	11617	12909	14209	15554	16902	18362	19822	21289		20	1.027	.885	1.000
	520	12046	13658	15298	16974	18778	20614					40	1.061	.735	.998
	560	14114	16212	18407	20758										
	600	17699	20851												
	MIL	24312	24063	23708	23402	23013	22616	22260	21948	21676					
	VMAX	637.4	618.7	597.8	580.0	559.0	537.8	518.2	499.8	483.3					
10,000 FEET (-5°C)	360	5830	6073	6548	7030	7515	7999	8511	9037	9582		-40	.932	1.300	.977
	400	6507	7131	7755	8379	9044	9721	10398	11100	11822		-20	.972	1.130	.992
	440	7613	8408	9226	10082	10940	11841	12761	13677	14648		0	1.006	.960	1.001
	480	8841	9899	10990	12116	13269	14469	15683	16947	18254		20	1.048	.800	1.003
	520	10273	11646	13081	14548	16084	17677	19311				40	1.081	.650	1.006
	560	12077	13912	15841	17873	20003									
	600	15484	18399												
	MIL	21726	21419	21048	20749	20421	20020	19619	19302	19106					
	VMAX	533.5	617.8	597.5	580.0	562.8	542.8	522.8	504.8	488.5					
15,000 FEET (-15°C)	360	4900	5285	5687	6090	6492	6910	7344	7777	8211		-40	.950	1.225	.985
	400	5638	6157	6676	7212	7771	8321	8899	9488	10077		-20	.990	1.045	.997
	440	6533	7181	7883	8603	9329	10082	10834	11640	12460		0	1.029	.880	1.007
	480	7530	8433	9241	10309	11281	12206	13343	14486	15628		20	1.066	.725	1.012
	520	8730	9894	11128	12289	13704	15137	16590				40	1.101	.560	1.017
	560	10414	12018	13887	15606	17376									
	600	13727	16293												
	MIL	19013	18716	18298	17958	17679	17496	17303	17117	16962					
	VMAX	628.0	614.2	595.1	577.1	561.4	544.8	527.3	510.4	484.7					
20,000 FEET (-25°C)	360	4304	4835	4966	5298	5641	5999	6357	6715	7089		-40	.989	1.145	.992
	400	4888	5324	5758	6220	6694	7182	7648	8138	8637		-20	1.010	.985	1.003
	440	5607	6169	6761	7364	7982	8611	9270	9944	10639		0	1.049	.810	1.012
	480	6423	7190	7987	8768	9593	10450	11368	12283	13337		20	1.087	.655	1.017
	520	7416	8414	9452	10550	11691	12888	14230				40	1.123	.500	1.023
	560	9048	10507	12041	13884	15468									
	600	12371	14588												
	MIL	16591	16389	16157	15872	15766	15631	15508	15390	15257					
	VMAX	622.5	609.8	594.0	571.8	561.9	548.5	533.1	517.7	502.8					

Figure A4-14

LOW ALTITUDE CRUISE

GROSS WEIGHT - 40,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	VMAX
SEA LEVEL (15°C)	360	7780	8418	9058	9718	10382	11048	11715	12416	13183.	-40	.899	1.530	.976
	400	9089	9886	10733	11581	12420	13350	14310	15281	16228	-20	.937	1.330	.986
	440	10877	11687	12738	13895	15098	16301	17559	18826	20096	0	.974	1.140	.997
	480	12298	13683	15172	16685	18258	19850	21457	23079		20	1.009	.950	1.000
	520	14178	16071	17888	19986	21993	24014				40	1.042	.810	.999
	560	16501	18916	21431	23880									
	600	20132	23480											
	MIL	27175	26891	26275	25965	25645	25345	25027	24739	24480				
	VMAX	639.7	617.5	596.4	575.1	552.5	531.3	511.5	493.8	478.2				
5,000 FEET (5°C)	360	6690	7224	7765	8318	8871	9424	9987	10533	11259	-40	.918	1.400	.978
	400	7750	8448	9158	9864	10609	11428	12241	13066	13904	-20	.954	1.225	.987
	440	9014	9923	10838	11882	12887	13928	14994	16061	17184	0	.991	1.050	.998
	480	10446	11647	12834	14230	15570	16914	18369	19824	21285	20	1.027	.885	1.000
	520	12073	13677	15214	16985	18782	20614				40	1.061	.735	.998
	560	14118	16205	18398	20743									
	600	17680	20823											
	MIL	24315	24058	23711	23407	23017	22620	22261	21948	21679				
	VMAX	637.5	618.5	598.0	580.3	559.2	527.8	518.2	499.8	483.4				
10,000 FEET (-5°C)	360	5759	6199	6679	7159	7639	8120	8637	9158	9679	-40	.932	1.300	.977
	400	6811	7230	7850	8470	9139	9811	10485	11186	11902	-20	.972	1.130	.992
	440	7689	8477	9297	10149	11002	11902	12807	13732	14697	0	1.009	.960	1.001
	480	8899	9958	11042	12155	13312	14500	15718	16980	18280	20	1.046	.800	1.003
	520	10307	11676	13107	14570	16099	17687	19315			40	1.081	.650	1.006
	560	12103	13933	15857	17883	20004								
	600	15464	18368											
	MIL	21730	21423	21050	20752	20422	20018	19618	19302	19102				
	VMAX	633.7	618.0	597.8	580.2	562.8	542.7	522.8	504.8	488.3				
15,000 FEET (-15°C)	360	5060	5456	5853	6252	6650	7076	7506	7934	8363	-40	.950	1.225	.985
	400	5788	6263	6738	7336	7893	8446	9018	9603	10187	-20	.990	1.045	.997
	440	6628	7262	7987	8692	9419	10167	10918	11721	12526	0	1.029	.880	1.007
	480	7601	8504	9411	10375	11345	12363	13402	14540	15686	20	1.066	.725	1.012
	520	8790	9883	11182	12449	13753	15179	16628			40	1.101	.560	1.017
	560	10439	12037	13700	15616	17327								
	600	13757	16316											
	MIL	19016	18718	18293	17966	17679	17464	17289	17113	16958				
	VMAX	628.2	614.3	596.0	577.0	561.4	544.6	528.9	510.0	494.3				
20,000 FEET (-25°C)	360	4515	4841	5168	5499	5861	6206	6558	6917	7294	-40	.969	1.145	.992
	400	5067	5479	5921	6380	6839	7313	7801	8289	8795	-20	1.010	.965	1.003
	440	5728	6297	6885	7481	8104	8727	9389	10058	10758	0	1.049	.810	1.012
	480	6523	7275	8053	8849	9684	10536	11444	12363	13422	20	1.087	.655	1.017
	520	7492	8490	9526	10618	11767	12957	14291			40	1.123	.500	1.022
	560	9114	10670	12099	13741	15506								
	600	12329	14584											
	MIL	16588	16287	16155	15870	15762	15628	15502	15374	15250				
	VMAX	622.4	609.5	593.8	571.5	561.6	548.1	532.6	516.9	501.7				

15E1-(12)04

Figure A4-15

LOW ALTITUDE CRUISE

GROSS WEIGHT - 45,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

Altitude	KTAS	Drag Index 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	7886	8520	9154	9814	10478	11138	11801	12508	13251
	400	9142	9959	10803	11647	12491	13424	14363	15315	16280
	440	10635	11711	12787	13945	15143	16342	17597	18858	20124
	480	12329	13681	15198	16708	18275	19861	21484	23081	
	520	14198	16088	18000	19992	21993	24008			
	560	16505	18914	21423	23968					
	600	20118	23459							
	MIL	27182	26894	26278	25967	25648	25347	25028	24739	24487
	VMAX	638.9	617.8	596.6	575.2	552.7	531.5	511.5	493.8	478.2
5,000 FEET (5°C)	360	6819	7349	7890	8439	8988	9538	10112	10744	11375
	400	7841	8539	9243	9947	10699	11510	12321	13135	13978
	440	9082	9986	10903	11923	12944	13981	15043	16104	17225
	480	10499	11700	12982	14274	15609	16950	18299	19849	21304
	520	12108	13707	15340	17006	18799	20624			
	560	14139	16226	18409	20747					
	600	17881	20796							
	MIL	24317	24069	23716	23411	23017	22818	22260	21948	21873
	VMAX	637.7	619.1	598.2	580.5	559.2	537.7	518.2	499.6	483.2
10,000 FEET (-5°C)	360	5912	6362	6838	7315	7791	8276	8752	9309	9828
	400	6736	7351	7967	8588	9258	9923	10591	11298	12007
	440	7778	8582	9384	10231	11079	11979	12879	13803	14763
	480	8983	10020	11102	12222	13385	14549	15762	17020	18315
	520	10383	11725	13154	14613	16137	17721	19342		
	560	12136	13982	15881	17902	20017				
	600	15484	18282							
	MIL	21733	21428	21048	20752	20421	20018	19613	19297	19098
	VMAX	633.8	618.1	597.7	580.1	562.8	542.8	522.5	504.4	487.9
15,000 FEET (-15°C)	360	5281	5656	6050	6445	6850	7275	7698	8124	8568
	400	5924	6434	6946	7493	8043	8590	9166	9746	10328
	440	6744	7402	8100	8800	9532	10274	11028	11828	12625
	480	7694	8592	9500	10458	11428	12441	13482	14615	15758
	520	8858	10018	11242	12506	13810	15229	16671		
	560	10489	12083	13729	15561	17406				
	600	13790	16343							
	MIL	19014	18717	18290	17963	17676	17489	17294	17108	16962
	VMAX	628.1	614.3	594.8	578.3	561.1	544.2	528.5	509.4	493.5
20,000 FEET (-25°C)	360	4766	5088	5412	5769	6110	6480	6810	7182	7565
	400	5248	5668	6119	6574	7029	7508	7982	8475	8990
	440	5878	6452	7026	7636	8253	8878	9529	10203	10811
	480	6644	7291	8170	8961	9799	10644	11558	12484	13538
	520	7582	8581	9617	10704	11842	13047	14274		
	560	8187	10640	12165	13808	15563				
	600	12431	14811							
	MIL	15584	15383	15149	15869	15758	15623	15495	15368	15241
	VMAX	622.1	609.2	593.4	571.3	561.2	547.5	531.7	515.9	500.6

Altitude	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	VMAX
SEA LEVEL (15°C)	-40	.899	1.520	.975
	-20	.937	1.330	.986
	0	.974	1.140	.997
	20	1.009	.990	1.000
	40	1.042	.810	.999
5,000 FEET (5°C)	-40	.916	1.400	.976
	-20	.954	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET (-5°C)	-40	.932	1.300	.977
	-20	.972	1.130	.992
	0	1.009	.960	1.001
	20	1.046	.800	1.003
	40	1.081	.650	1.006
15,000 FEET (-15°C)	-40	.950	1.225	.985
	-20	.990	1.045	.997
	0	1.028	.880	1.007
	20	1.066	.725	1.012
	40	1.101	.580	1.017
20,000 FEET (-25°C)	-40	.967	1.148	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

1551-21304

Figure A4-16

LOW ALTITUDE CRUISE

GROSS WEIGHT - 50,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	8010	8839	9275	9930	10588	11246	11904	12619	13368
	400	9226	10042	10882	11722	12562	13499	14440	15381	16346
	440	10895	11767	12828	13898	15152	16385	17628	18894	20158
	480	12273	13734	15237	16735	18304	19885	21483	23094	
	520	14231	16118	18027	20013	22009	24015			
	560	16515	18919	21422	23958					
	600	20104	23437							
	MIL	27186	26597	26282	25983	25648	25346	25027	24739	24485
	VMAX	640.1	617.8	598.8	575.4	552.7	531.4	511.5	493.7	478.1
5,000 FEET (5°C)	360	6969	7495	8038	8583	9128	9873	10263	10890	11517
	400	7947	8647	9347	10047	10810	11616	12423	13238	14074
	440	9168	10069	10991	12007	13032	14068	15116	16172	17292
	480	10559	11761	13038	14328	15657	16998	18441	19885	21335
	520	12162	13746	15375	17035	18824	20644			
	560	14174	16257	18437	20768					
	600	17656	20781							
	MIL	24319	24061	23717	23410	23015	22618	22257	21942	21688
	VMAX	637.9	619.3	598.3	580.5	555.1	537.8	518.0	499.2	482.9
10,000 FEET (-5°C)	360	6081	6553	7025	7497	7970	8465	8977	9490	10002
	400	6883	7493	8104	8733	9398	10069	10724	11420	12137
	440	7894	8674	9500	10343	11192	12087	12982	13906'	14883
	480	9061	10111	11187	12308	13445	14629	15836	17094	18383
	520	10428	11785	13211	14669	16188	17768	19383		
	560	12176	14002	15917	17933	20041				
	600	15520	18414							
	MIL	21733	21425	21047	20751	20418	20007	19603	19291	19090
	VMAX	633.8	618.1	597.6	580.1	562.6	542.2	522.1	503.9	487.3
15,000 FEET (-15°C)	360	5497	5887	6278	6668	7088	7506	7927	8347	8766
	400	6106	6811	7128	7674	8220	8768	9343	9918	10493
	440	6884	7549	8246	8941	9673	10411	11168	11962	12758
	480	7815	8708	9618	10571	11541	12549	13596	14722	15881
	520	8950	10113	11331	12593	13900	15313	16750		
	560	10546	12135	13785	15595	17444				
	600	13841	16390							
	MIL	19011	18715	18282	17945	17671	17483	17285	17097	16944
	VMAX	627.9	614.2	594.5	578.5	560.7	543.8	525.8	508.8	492.5
20,000 FEET (-25°C)	360	5048-	5371	5715	6065	6415	6765	7134	7507	7880
	400	5469	5900	6350	6800	7261	7740	8218	8707	9223
	440	6056	6834	7212	7818	8431	9081	9719	10377	11097
	480	6793	7536	8317	9105	9948	10794	11703	12648	13693
	520	7700	8703	9741	10821	11960	13176	14495		
	560	9276	10730	12253	13898	15645				
	600	12488	14880							
	MIL	16576	16378	16140	15866	15751	15616	15485	15354	15228
	VMAX	621.6	608.9	592.8	571.0	560.6	546.7	530.6	514.6	499.0

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
SEA LEVEL	-40	.899	1.520	.975
	-20	.937	1.230	.986
	0	.974	1.140	.997
	20	1.009	.960	1.000
	40	1.042	.810	.999
5,000 FEET	-40	.918	1.400	.976
	-20	.954	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET	-40	.932	1.300	.977
	-20	.972	1.130	.982
	0	1.009	.960	1.001
	20	1.048	.800	1.003
	40	1.081	.650	1.006
15,000 FEET	-40	.950	1.225	.986
	-20	.990	1.045	.997
	0	1.029	.880	1.007
	20	1.066	.725	1.012
	40	1.101	.560	1.017
20,000 FEET	-40	.989	1.145	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

15E1-(12)04

Figure A4-17

LOW ALTITUDE CRUISE

GROSS WEIGHT - 55,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	8150	8776	9411	10065	10718	11372	12026	12781	13485
	400	9335	10153	10989	11824	12668	13604	14540	15476	16441
	440	10782	11849	12916	14079	15268	16458	17707	18959	20217
	480	12434	13787	15294	16792	18254	19931	21524	23130	
	520	14265	16149	18064	20036	22025	24030			
	560	16551	18951	21448	23978					
	600	20091	23416							
	MIL	27189	26700	26285	25968	25646	25345	25026	24736	24461
	VMAX	640.2	617.3	596.9	575.3	552.8	531.3	511.4	493.5	477.5
5,000 FEET (5°C)	360	7141	7688	8207	8748	9289	9830	10439	11062	11684
	400	8084	8780	9476	10172	10849	11761	12552	13385	14199
	440	9271	10187	11096	12107	13118	14153	15204	16258	17377
	480	10638	11843	13115	14402	15728	17067	18504	19942	21387
	520	12219	13807	15433	17088	18877	20690			
	560	14208	16288	18464	20789					
	600	17678	20798							
	MIL	24321	24060	23716	23409	23012	22611	22249	21935	21669
	VMAX	638.0	619.2	598.3	580.4	559.0	537.2	517.5	498.8	482.4
10,000 FEET (-5°C)	360	6304	6771	7239	7707	8176	8684	9192	9700	10207
	400	7052	7659	8266	8904	9582	10221	10882	11584	12298
	440	8028	8801	9632	10471	11323	12213	13103	14031.	14981
	480	9151	10213	11294	12404	13538	14720	15921	17178	18481
	520	10611	11883	13288	14744	16255	17834	19443		
	560	12241	14062	15976	17989	20090				
	600	15666	18446							
	MIL	21731	21424	21044	20747	20409	19998	19590	19280	19079
	VMAX	633.7	618.0	597.4	579.9	562.2	541.7	521.4	500.0	486.4
15,000 FEET (-15°C)	360	5763	6152	6541	6948	7367	7786	8206	8634	9075
	400	6312	6814	7342	7884	8425	8979	9649	10118	10702
	440	7047	7720	8411	9106	9839	10672	11338	12126	12917
	480	7950	8838	9751	10899	11870	12872	13728	14848	15983
	520	9054	10219	11430	12691	14002	15408	16841		
	560	10628	12212	13855	15665	17508				
	600	13908	16462							
	MIL	19006	18707	18273	17936	17665	17474	17274	17083	16933
	VMAX	627.4	613.8	594.0	576.0	560.1	542.8	524.8	507.2	491.2
20,000 FEET (-25°C)	360	5368	5711	6061	6410	6760	7127	7500	7872	8246
	400	5721	6188	6616	7063	7537	8012	8487	8993	9504
	440	6288	6841	7420	8028	8636	9278	9929	10639	11216
	480	6964	7708	8466	9282	10116	10974	11875	12838	13878
	520	7633	8840	9881	10956	12095	13324	14838		
	560	9379	10830	12350	13999					
	600	12536	14809							
	MIL	16588	16387	16123	15883	15744	15807	15474	15329	15212
	VMAX	621.0	606.2	591.7	570.3	555.9	546.5	529.1	512.8	497.0

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
SEA LEVEL	-40	.899	1.520	.975
	-20	.937	1.330	.988
	0	.974	1.140	.997
	20	1.009	.950	1.000
	40	1.042	.810	.999
5,000 FEET	-40	.916	1.400	.976
	-20	.954	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET	-40	.932	1.300	.977
	-20	.972	1.130	.992
	0	1.009	.980	1.001
	20	1.046	.800	1.003
	40	1.081	.650	1.005
15,000 FEET	-40	.950	1.225	.985
	-20	.990	1.045	.997
	0	1.029	.880	1.007
	20	1.066	.725	1.012
	40	1.101	.580	1.017
20,000 FEET	-40	.968	1.145	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

15E1-81804

Figure A4-18

LOW ALTITUDE CRUISE

GROSS WEIGHT - 60,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	8312	8934	9572	10222	10871	11521	12180	12910	13639
	400	9453	10273	11104	11938	12788	13719	14650	15582	16547
	440	10870	11933	12998	14164	15348	16535	17782	19038	20283
	480	12495	13859	15352	16845	18405	19976	21548	23188	
	520	14325	16204	18105	20080	22065	24064			
	560	16587	18983	21474	23999					
	600	20106	23424							
	ML	27193	26702	26284	25988	25645	25342	25019	24729	24476
	VMAX	640.4	618.0	598.9	575.2	552.5	531.2	511.0	493.2	477.5
5,000 FEET (5°C)	360	7334	7882	8398	8938	9472	10023	10641	11258	11876
	400	8237	8929	9620	10312	11106	11902	12698	13513	14341
	440	9385	10277	11216	12222	13228	14282	15309	16358	17480
	480	10728	11936	13203	14489	15808	17150	18582	20014	21453
	520	12285	13868	15491	17141	18929	20737			
	560	14258	16343	18517	20635					
	600	17700	20812							
	ML	24321	24058	23716	23407	23006	22602	22241	21924	21647
	VMAX	638.0	619.1	598.2	580.3	558.6	538.8	517.1	498.1	481.7
10,000 FEET (-5°C)	360	6553	7017	7480	7944	8429	8932	9435	9938	10481
	400	7248	7850	8453	9102	9766	10409	11088	11765	12482
	440	8172	8947	9781	10614	11470	12355	13238	14172	15116
	480	9268	10334	11400	12522	13648	14834	16030	17288	18568
	520	10607	11957	13378	14833	16338	17918	19620		
	560	12304	14123	16035	18045	20140				
	600	15628	18519							
	ML	21729	21421	21037	20740	20400	19982	19572	19268	19045
	VMAX	632.6	617.9	597.0	579.5	561.7	540.9	520.5	501.9	485.2
15,000 FEET (-15°C)	360	6062	6450	6849	7268	7686	8104	8528	8964	9409
	400	6544	7047	7584	8120	8657	9219	9794	10349	10949
	440	7230	7912	8599	9300	10028	10756	11528	12312	13122
	480	8102	8986	9903	10845	11820	12817	13884	14998	16131
	520	9176	10344	11550	12811	14129	15529	16958		
	560	10716	12238	13536	15746					
	600	12983	16527							
	ML	19000	18699	18261	17925	17667	17482	17259	17088	16916
	VMAX	627.3	612.4	593.3	575.4	559.4	541.7	523.3	506.9	489.4
20,000 FEET (-25°C)	360	5760	6109	6458	6806	7177	7548	7920	8292	8683
	400	6021	6470	6918	7384	7860	8336	8832	9344	9857
	440	6507	7076	7663	8268	8874	9521	10188	10854	11567
	480	7155	7906	8680	9481	10310	11177	12072	13064	14091
	520	7990	8993	10038	11118	12250	13486	14800		
	560	9488	10928	12466	14109					
	600	12791	14980							
	ML	16550	16264	16106	15890	15728	15596	15459	15321	15182
	VMAX	620.0	607.3	590.4	570.5	558.1	544.0	527.4	510.4	494.6

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	ML	V_{MAX}
SEA LEVEL	-40	.899	1.520	.975
	-20	.937	1.330	.986
	0	.974	1.140	.997
	20	1.009	.960	1.000
	40	1.042	.810	.999
5,000 FEET	-40	.918	1.400	.976
	-20	.954	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET	-40	.932	1.300	.977
	-20	.972	1.130	.992
	0	1.009	.960	1.001
	20	1.048	.800	1.003
	40	1.081	.650	1.005
15,000 FEET	-40	.950	1.225	.985
	-20	.990	1.045	.997
	0	1.029	.880	1.007
	20	1.068	.725	1.012
	40	1.101	.580	1.017
20,000 FEET	-40	.969	1.145	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

15E1-(12)04

Figure A4-19

LOW ALTITUDE CRUISE

GROSS WEIGHT - 65,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	8496	9113	9755	10401	11046	11692	12367	13092	13818
	400	9589	10413	11240	12067	12930	13857	14784	15711	16678
	440	10985	12043	13101	14276	15454	16642	17883	19125	20377
	480	12585	13954	15441	16929	18488	20053	21538	23233	
	520	14393	16287	18166	20135	22115	24108			
	560	16823	19015	21500	24019					
	600	20128	23440							
	MIL	27194	26700	26283	25964	25641	25336	25013	24722	24468
	VMAX	640.5	617.9	596.8	575.0	552.3	530.7	510.6	492.7	477.0
5,000 FEET (5°C)	360	7548	8080	8612	9145	9678	10258	10868	11480	12094
	400	8406	9092	9779	10487	11279	12071	12863	13679	14503
	440	9522	10410	11361	12362	13283	14297	15439	16488	17608
	480	10831	12047	13309	14593	15907	17261	18677	20104	21538
	520	12379	13956	15577	17221	19010	20812			
	560	14332	16407	18581	20692					
	600	17728	20834							
	MIL	24320	24065	23715	23401	22996	22593	22227	21910	21633
	VMAX	637.9	618.5	598.1	580.0	558.1	536.3	516.2	497.2	480.8
10,000 FEET (-5°C)	360	6820	7293	7758	8224	8726	9229	9731	10234	10767
	400	7484	8082	8673	9322	9971	10620	11307	12000	12692
	440	8344	9128	9957	10788	11648	12527	13407	14346	15286
	480	9412	10473	11537	12658	13779	14967	16167	17418	18689
	520	10719	12089	13485	14940	16439	18018			
	560	12400	14214	16128	18136	20222				
	600	15703	18595							
	MIL	21726	21416	21025	20733	20385	19964	19548	19251	19048
	VMAX	633.5	617.8	596.5	579.0	561.0	540.0	519.3	500.6	483.8
15,000 FEET (-15°C)	360	6292	6787	7204	7622	8040	8450	8900	9340	9780
	400	6802	7322	7856	8390	8934	9498	10057	10626	11241
	440	7444	8128	8807	9518	10239	10987	11745	12532	13364
	480	8281	9153	10083	11020	11999	12990	14071	15178	16310
	520	9316	10489	11694	12950	14278	15689	17094		
	560	10825	12406	14048	15850					
	600	14106	16653							
	MIL	18912	18681	18244	17912	17647	17448	17242	17045	16900
	VMAX	626.8	612.8	592.4	574.3	558.5	540.5	521.7	503.8	487.2
20,000 FEET (-25°C)	360	6230	6578	6933	7304	7674	8045	8426	8827	9229
	400	6358	6806	7285	7742	8219	8706	9220	9733	10258
	440	6773	7337	7936	8524	9155	9797	10441	11148	11851
	480	7368	8124	8894	9704	10627	11406	12293	13307	14334
	520	8179	9177	10227	11310	12437	13703	15001		
	560	9627	11080	12596	14259	–				
	600	13035	15208							
	MIL	16533	16335	16082	15857	15724	15580	15441	15299	15198
	VMAX	619.0	606.0	588.9	570.2	556.1	542.3	525.2	507.7	491.4

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
SEA LEVEL (15°C)	-40	.899	1.520	.975
	-20	.937	1.330	.988
	0	.974	1.140	.997
	20	1.009	.960	1.000
	40	1.042	.810	.999
5,000 FEET (5°C)	-40	.916	1.400	.978
	-20	.954	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET (-5°C)	-40	.932	1.300	.977
	-20	.972	1.130	.992
	0	1.009	.960	1.001
	20	1.046	.800	1.003
	40	1.081	.650	1.006
15,000 FEET (-15°C)	-40	.950	1.225	.986
	-20	.990	1.045	.997
	0	1.029	.880	1.007
	20	1.066	.725	1.012
	40	1.101	.560	1.017
20,000 FEET (-25°C)	-40	.969	1.145	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

15E1-(21)04

Figure A4-20

LOW ALTITUDE CRUISE

GROSS WEIGHT - 70,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

ALTITUDE	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	8598	9315	9958	10597	11238	11880	12573	13293	14013
	400	9747	10570	11393	12215	13092	14014	14938	15858	16827
	440	11101	12158	13218	14392	15568	16756	17991	19227	20477
	480	12676	14049	15531	17014	18572	20132	21713	23303	
	520	14462	16330	18226	20190	22168	24153			
	560	16690	19079	21558	24071					
	600	20161	23458							
	MIL	27192	26898	26281	25981	25635	25329	25004	24711	24458
	VMAX	640.4	617.8	596.7	574.8	551.8	530.3	510.1	492.1	478.3
6,000 FEET (3°C)	360	7781	8320	8849	9378	9907	10513	11122	11730	12339
	400	8598	9281	9964	10686	11483	12271	13068	13876	14695
	440	9867	10550	11514	12510	13506	14541	15577	16631	17748
	480	10948	12171	13428	14712	16020	17369	18790	20212	
	520	12477	14049	15668	17307	19098	20895			
	560	14298	16471	18644	20943					
	600	17811	20916							
	MIL	24319	24052	23706	23394	22986	22577	22211	21893	21614
	VMAX	637.9	618.6	597.7	579.6	557.6	535.5	515.3	496.3	479.8
10,000 FEET (-5°C)	360	7132	7596	8069	8552	9064	9558	10068	10676	11117
	400	7701	8296	8821	9585	10205	10865	11551	12238	12928
	440	8532	9327	10151	10975	11843	12717	13604	14537	15470
	480	9569	10625	11692	12808	13921	15115	16300	17565	18830
	520	10845	12197	13607	15064	16558	18137			
	560	12459	14008	16219	18229	20309				
	600	15790	18878							
	MIL	21721	21411	21020	20722	20388	19941	19618	19232	19026
	VMAX	633.2	617.4	596.0	578.4	560.1	538.9	517.8	499.0	482.0
18,000 FEET (-16°C)	360	6767	7184	7601	8018	8438	8875	9314	9753	10192
	400	7092	7627	8161	8695	9257	9819	10381	10981	11597
	440	7684	8361	9038	9756	10473	11214	11987	12790	13618
	480	8474	9347	10278	11210	12194	13179	14276	15377	16508
	520	9468	10647	11853	13103	14440	15828			
	560	10945	12535	14175	15968					
	600	14228	16779							
	MIL	18977	18658	18226	17898	17625	17421	17218	17018	16878
	VMAX	626.1	611.6	591.5	574.0	557.4	538.9	519.8	501.4	484.8
20,000 FEET (-25°C)	360	6791	7158	7527	7897	8268	8683	9063	9483	9983
	400	6715	7170	7649	8127	8609	9123	9638	10153	10728
	440	7065	7650	8251	8858	9501	10146	10828	11536	12266
	480	7604	8368	9137	9956	10782	11664	12574	13593	14813
	520	8384	9377	10433	11521	12641	13930	15221		
	560	9776	11231	12747	14421					
	600	13282	15458							
	MIL	16512	16314	16061	15853	15712	15582	15420	15270	15094
	VMAX	617.8	604.8	587.5	569.8	556.9	540.0	522.5	504.1	486.7

ALTITUDE	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
SEA LEVEL	-40	.898	1.520	.975
	-20	.937	1.330	.988
	0	.974	1.140	.997
	20	1.009	.950	1.000
	40	1.042	.810	.999
6,000 FEET	-40	.918	1.400	.978
	-20	.954	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET	-40	.932	1.300	.977
	-20	.972	1.130	.992
	0	1.009	.950	1.001
	20	1.048	.800	1.003
	40	1.081	.650	1.006
18,000 FEET	-40	.950	1.225	.985
	-20	.990	1.045	.997
	0	1.029	.880	1.007
	20	1.068	.725	1.012
	40	1.101	.580	1.017
20,000 FEET	-40	.969	1.145	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

15E1-(134)04

Figure A4-21

LOW ALTITUDE CRUISE

GROSS WEIGHT - 75,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

Altitude	KTAS	Drag Index 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	8914	9538	10175	10811	11448	12085	12799	13514	14230
	400	9919	10737	11556	12375	13256	14183	15100	16023	16992
	440	11244	12293	13368	14535	15704	16894	18125	19356	20604
	480	12783	14162	15629	17120	18674	20229	21806	23390	
	520	14560	16422	18318	20276	22248	24227			
	560	16758	19145	21518	24126					
	600	20176	23473							
	MIL	27190	26895	26279	25955	25629	25321	24992	24700	24442
	VMAX	640.3	617.7	595.6	574.4	551.4	529.7	509.3	491.3	475.5
5,000 FEET (5°C)	360	8062	8590	9118	9646	10213	10821	11428	12036	12645
	400	8808	9487	10168	10923	11706	12488	13278	14092	14906
	440	9837	10716	11698	12687	13684	14715	15747	16808	17918
	480	11080	12311	13582	14847	16150	17503	18918	20335	
	520	12588	14155	15773	17411	19200	20990			
	560	14483	16565	18740	21038					
	600	17894	20597							
	MIL	24317	24047	23699	23386	22873	22561	22192	21872	21592
	VMAX	637.7	618.3	597.3	579.1	555.8	534.8	514.1	495.1	478.3
10,000 FEET (-5°C)	360	7463	7928	8407	8908	9410	9912	10421	10980	11498
	400	7959	8653	9193	9833	10473	11141	11823	12506	13200
	440	8724	9541	10259	11184	12053	12923	13818	14748	15874
	480	9751	10801	11873	12984	14111	15289	16479	17738	
	520	10985	12339	13743	15201	16689	18270			
	560	12815	14418	16330	18340					
	600	15907	18792							
	MIL	21718	21403	21009	20712	20347	19915	19484	19208	19001
	VMAX	632.9	617.0	595.3	577.8	559.1	537.6	516.1	497.0	480.0
15,000 FEET (-15°C)	360	7230	7648	8062	8482	8920	9358	9796	10236	10721
	400	7422	7957	8492	9043	9606	10169	10749	11365	11982
	440	7952	8626	9312	10025	10738	11493	12260	13048	13913
	480	8685	9587	10493	11431	12410	13411	14506	15606	16732
	520	9645	10830	12039	13282	14632	16018			
	560	11085	12686	14218	18107					
	600	14392	18951							
	MIL	18959	18832	18208	17883	17621	17411	17190	16993	16852
	VMAX	626.2	610.4	590.4	573.2	556.1	537.1	517.0	498.5	481.4
20,000 FEET (-25°C)	360	7394	7763	8133	8520	8920	9321	9721	10150	10603
	400	7142	7620	8098	8579	9093	9608	10123	10684	11258
	440	7371	7978	8580	9212	9860	10518	11229	11940	12718
	480	7881	8640	9422	10233	11078	11952	12899	13912	14926
	520	8604	9806	10655	11751	12898	14181			
	560	9942	11390	12907	14592					
	600	13610	15796							
	MIL	16488	16288	16040	15848	15697	15540	15368	15238	15007
	VMAX	616.2	602.7	586.1	569.4	555.6	537.2	518.8	500.0	481.1

Altitude	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
SEA LEVEL	-40	.899	1.520	.975
	-20	.937	1.330	.988
	0	.974	1.140	.997
	20	1.009	.960	1.000
	40	1.042	.810	.999
5,000 FEET	-40	.918	1.400	.976
	-20	.964	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET	-40	.932	1.300	.977
	-20	.972	1.130	.992
	0	1.009	.960	1.001
	20	1.046	.800	1.003
	40	1.081	.650	1.005
15,000 FEET	-40	.950	1.225	.985
	-20	.990	1.045	.997
	0	1.029	.880	1.007
	20	1.066	.725	1.012
	40	1.101	.580	1.017
20,000 FEET	-40	.989	1.146	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

1561-B10D4

Figure A4-22

LOW ALTITUDE CRUISE

GROSS WEIGHT - 80,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160
SEA LEVEL (15°C)	360	9154	9765	10418	11061	11684	12344	13055	13758	14478
	400	10117	10931	11745	12580	13468	14281	15293	16223	17185
	440	11289	12436	13618	14880	15847	17040	18288	19482	20738
	480	12901	14289	15761	17242	18752	20241	21515	23494	
	520	14681	16517	18412	20365	22330	24306			
	560	16827	19211	21678	24181					
	600	20241	23534							
	MIL	27187	26692	26271	25949	25622	25308	24979	24685	24427
	VMAX	640.1	617.5	596.2	574.0	550.9	528.9	508.5	490.4	474.5
5,000 FEET (5°C)	360	8354	8882	9410	9941	10547	11154	11761	12368	12992
	400	9033	9707	10390	11187	11944	12722	13517	14325	15130
	440	10018	10902	11888	12874	13873	14899	15925	16994	18058
	480	11226	12466	13713	14988	16296	17657	19068	20478	
	520	12717	14276	15898	17541	19323	21108			
	560	14590	16662	18839	21131					
	600	17577	21079							
	MIL	24315	24041	23691	23373	22957	22529	22189	21848	21568
	VMAX	632.5	617.9	596.8	578.5	556.0	533.4	512.8	492.6	476.3
10,000 FEET (-5°C)	360	7620	8252	8793	9294	9796	10297	10834	11372	11910
	400	8240	8858	9498	10139	10786	11469	12151	12834	13554
	440	8968	9762	10597	11431	12295	13160	14065	14968	15912
	480	9939	10985	12081	13166	14299	15472	16669	17922	
	520	11143	12499	13898	15350	16850	18428			
	560	12747	14543	16457	18470					
	600	16024	18906							
	MIL	21706	21391	20997	20698	20321	19883	19442	19181	18972
	VMAX	632.5	616.3	594.6	577.0	557.8	538.0	514.0	494.8	477.4
15,000 FEET (-15°C)	360	7767	8181	8606	9042	9480	9917	10367	10851	11336
	400	7783	8219	8881	9425	9989	10653	11170	11787	12406
	440	8242	8916	9620	10332	11067	11823	12589	13418	14281
	480	8922	9814	10735	11681	12654	13677	14765	15868	
	520	9839	11020	12232	13489	14832	16217			
	560	11238	12817	14481	16264					
	600	14662	17130							
	MIL	18925	18598	18186	17864	17604	17381	17158	16965	16822
	VMAX	624.2	606.9	589.3	572.2	554.6	534.6	516.1	495.3	477.8
20,000 FEET (-25°C)	360	8212	8599	8994	9389	9784	10215	10663	11110	11557
	400	7641	8120	8603	9118	9634	10160	10726	11301	11876
	440	7740	8247	8864	9616	10287	10967	11681	12427	13238
	480	8190	8939	9742	10554	11422	12297	13297	14308	
	520	8865	9866	10910	12014	13193	14469			
	560	10122	11571	13080	14778					
	600	13839	16133							
	MIL	16455	16258	16020	15839	15890	15611	15351	15197	14882
	VMAX	614.3	600.7	584.7	568.5	554.0	533.7	514.1	495.1	471.8

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
SEA LEVEL	-40	.899	1.520	.975
	-20	.937	1.330	.988
	0	.974	1.140	.997
	20	1.009	.960	1.000
	40	1.042	.810	.999
5,000 FEET	-40	.916	1.400	.976
	-20	.954	1.225	.987
	0	.991	1.050	.998
	20	1.027	.885	1.000
	40	1.061	.735	.998
10,000 FEET	-40	.932	1.300	.977
	-20	.972	1.130	.992
	0	1.009	.960	1.001
	20	1.046	.800	1.003
	40	1.081	.650	1.005
15,000 FEET	-40	.950	1.225	.985
	-20	.990	1.045	.997
	0	1.029	.880	1.007
	20	1.066	.725	1.012
	40	1.101	.580	1.017
20,000 FEET	-40	.969	1.145	.992
	-20	1.010	.965	1.003
	0	1.049	.810	1.012
	20	1.087	.655	1.017
	40	1.123	.500	1.023

15E1-(1)2504

Figure A4-23

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 35,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2)F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
25,000 FEET (-35°C)	360	3832	4102	4371	4661	4953	5245	5540	5850	6160	-80	.900	1.480	.958
	400	4274	4628	5008	5389	5776	6179	6583	6996	7429	-60	.946	1.250	.979
	440	4816	5310	5803	6316	6839	7376	7929	8498	9111	-40	.988	1.035	.998
	480	5486	6120	6787	7481	8162	8895	9664	10504	11375	-20	1.030	.880	1.007
	520	6331	7198	8096	9036	10016	11095	12226			0	1.070	.720	1.018
	560	7938	9269	10671	12190									
	600	11574	13496											
	MIL	14838	14548	14349	14033	13843	13619	13411	13182	12963				
	VMAX	617.9	606.4	591.2	570.1	559.2	546.3	532.8	516.9	501.0				
30,000 FEET (-44°C)	360	3476	3713	3952	4192	4435	4688	4942	5195	5462	-80	.919	1.025	.936
	400	3778	4089	4399	4719	5047	5374	5717	6066	6415	-60	.966	1.010	.978
	440	4195	4602	5024	5451	5890	6338	6807	7309	7823	-40	1.010	.955	1.001
	480	4716	5260	5811	6385	6979	7616	8293	8993	9749	-20	1.052	.785	1.008
	520	5439	6169	6943	7758	8609	9541	10584			0	1.043	.810	1.011
	560	6977	8170	9434										
	600	10962	12626											
	MIL	12731	12638	12513	12043	12026	11692	11387	11045	10689				
	VMAX	612.3	600.0	586.3	556.6	555.4	541.9	528.1	512.8	494.9				
35,000 FEET (-54°C)	360	3293	3491	3698	3906	4114	4333	4557	4782	5014	-80	.940	.930	.943
	400	3444	3704	3972	4240	4519	4803	5089	5409	5729	-60	.987	.990	.988
	440	3720	4067	4414	4774	5135	5533	5939	6377	6825	-40	1.032	.915	1.010
	480	4113	4583	5034	5522	6040	6594	7170	7794		-20	1.076	.740	1.018
	520	4707	5353	6023	6722	7493	8252				0	1.117	.570	1.023
	560	6247	7342	8546										
	600	10293												
	MIL	10560	10292	10003	9352	9304	9023	8781	8421	8074				
	VMAX	603.3	588.1	572.3	543.1	540.7	526.9	513.1	492.9	472.3				
40,000 FEET (-57°C)	360	3484	3684	3844	4030	4234	4439	4644	4882	5082	-80	.944	.915	.945
	400	3364	3587	3816	4046	4304	4584	4831	5116	5400	-60	.992	.985	.992
	440	3444	3730	4021	4332	4660	5008	5372	5746		-40	1.037	.930	1.019
	480	3684	4055	4442	4849	5288	5748	6240			-20	1.081	.765	1.033
	520	4119	4649	5198	5783	6469					0	1.122	.800	1.048
	560	5677	6538	7585										
	600													
	MIL	8188	7991	7714	7376	7179	6918	6586	6162	5852				
	VMAX	591.1	577.1	561.2	542.8	531.1	515.4	490.7	468.9	426.4				
45,000 FEET (-57°C)	360	4911	5080	5250	5420	5589					-80	.944	.915	.946
	400	3896	3912	4129	4268	4601					-60	.992	.985	.993
	440	3414	3583	3960	4258	4580					-40	1.037	.930	1.018
	480	3436	3770	4119	4485	4889					-20	1.081	.765	1.037
	520	3768	4203	4674	5218						0	1.122	.800	1.037
	560	5311	6066											
	600													
	MIL	6242	6058	5888	5682	5420	2278	2278	2278	2278				
	VMAX	573.8	560.1	547.7	531.3	508.3								

15E1-02804

Figure A4-24

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 40,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX								
		0	20	40	60	80	100	120	140	160
25,000 FEET (-35°C)	360	4091	4359	4648	4936	5227	5518	5826	6134	6442
	400	4472	4838	5215	5593	5986	6385	6784	7206	7635
	440	4984	5473	5965	6481	6998	7539	8088	8687	9273
	480	5818	6254	6915	7591	8288	9035	9788	10638	11504
	520	6437	7286	8200	9137	10111	11193	12325		
	560	8030	9382	10763	12286					
	600	11737	13558							
	ML	14880	14542	14343	14032	13831	13609	13397	13163	12929
	VMAX	617.3	604.9	590.8	570.1	558.5	545.7	531.8	515.6	499.3
30,000 FEET (-44°C)	360	3816	4054	4294	4542	4798	5049	5303	5577	5851
	400	4048	4358	4671	4997	5323	5660	6007	6354	6732
	440	4408	4816	5238	5661	6104	6548	7035	7531	8060
	480	4884	5420	5983	6552	7158	7789	8478	9182	9934
	520	5574	6308	7081	7880	8744	9692	10710		
	560	7102	8293	9556						
	600	11158								
	ML	12722	12527	12495	12041	11995	11670	11360	10984	10581
	VMAX	611.2	598.7	585.1	556.5	554.8	541.0	527.8	509.9	490.7
35,000 FEET (-54°C)	360	3792	3989	4209	4433	4657	4881	5128	5379	5633
	400	3781	4051	4321	4608	4894	5194	5518	5839	6182
	440	3998	4246	4701	5061	5449	5864	6281	6728	7184
	480	4334	4789	5258	5758	6280	6840	7434	8061	
	520	4880	5523	6193	6894	7691	8644			
	560	6819	7621	8882						
	600									
	ML	10458	10235	9927	9348	9258	8966	8662	8239	7835
	VMAX	599.5	584.9	568.4	543.0	538.5	524.1	507.2	485.5	461.8
40,000 FEET (-57°C)	360	4506	4709	4925	5142	5362	5578	5794		
	400	3821	4184	4425	4687	4968	5254	5543		
	440	3797	4092	4417	4750	5112	5482	5868		
	480	3968	4262	4765	5203	5659	6159			
	520	4376	4908	5464	6094	6776				
	560	6070	6989							
	600									
	ML	8089	7884	7901	7273	7080	6737	6129	2806	2806
	VMAX	584.1	570.4	555.2	542.7	525.2	501.3	455.5		
45,000 FEET (-57°C)	360	6965	7121	7257	7464					
	400	5018	5249	5480	5710					
	440	4127	4429	4748	5061					
	480	3882	4250	4838	5061					
	520	4151	4824	5182						
	560	5953								
	600									
	ML	6087	5932	5751	5398	2276	2276	2276	2276	2276
	VMAX	572.3	550.9	536.8	506.1					

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS		
		CRUISE	ML	V_{MAX}
25,000 FEET	-80	.900	1.480	.959
	-60	.945	1.250	.976
	-40	.988	1.035	.996
	-20	1.030	.880	1.007
	-0	1.070	.720	1.018
30,000 FEET	-80	.919	1.025	.936
	-60	.968	1.010	.978
	-40	1.010	.955	1.001
	-20	1.052	.785	1.008
	-0	1.043	.810	1.011
35,000 FEET	-80	.940	.930	.943
	-60	.987	.980	.988
	-40	1.032	.915	1.010
	-20	1.075	.740	1.016
	-0	1.117	.570	1.023
40,000 FEET	-80	.944	.915	.945
	-60	.992	.985	.992
	-40	1.037	.930	1.019
	-20	1.081	.765	1.033
	-0	1.122	.600	1.048
45,000 FEET	-80	.944	.915	.946
	-60	.992	.985	.993
	-40	1.037	.930	1.018
	-20	1.081	.765	1.027
	-0	1.122	.600	1.037

15E1-(127)04

Figure A4-25

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 45,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
26,000 FEET (-30°C)	380	4392	4582	4972	5262	5565	5863	6171	6479	6797	-80	.900	1.480	.959
	400	4713	5086	5458	5839	6232	6628	7034	7457	7880	-60	.945	1.250	.978
	440	5183	5668	6166	6676	7193	7736	8278	8873	9474	-40	.988	1.035	.998
	480	5777	6415	7071	7748	8439	9187	9950	10808	11673	-20	1.030	.880	1.007
	520	6587	7421	8325	9264	10244	11320	12453			0	1.070	.720	1.018
	560	8138	9468	10887	12289									
	600	11859	13687											
	MIL	14681	14533	14330	14031	13818	13595	13375	13137	12895				
	VMAX	616.5	604.1	589.9	570.0	557.7	544.9	530.3	513.8	497.0				
30,000 FEET (-44°C)	380	4244	4489	4742	4995	5247	5517	5790	6063	6344	-80	.919	1.025	.938
	400	4358	4673	5000	5327	5667	6015	6383	6744	7135	-60	.966	1.010	.978
	440	4656	5071	5488	5918	6358	6816	7308	7807	8345	-40	1.010	.955	1.001
	480	5093	5633	6189	6752	7374	8014	8701	9418	10182	-20	1.052	.785	1.008
	520	5738	6477	7253	8067	8913	9882	10856			0	1.043	.810	1.011
	560	7240	8429	9709										
	600	11401												
	MIL	12711	12814	12482	12040	11958	11625	11318	10894	10464				
	VMAX	609.8	598.9	582.9	558.4	553.0	539.2	525.8	505.6	485.1				
36,000 FEET (-64°C)	380	4402	4624	4846	5064	5335	5586	5829	6108	6378	-80	.940	.930	.943
	400	4209	4490	4778	5065	5389	5713	6047	6401	6754	-60	.987	.980	.988
	440	4200	4658	5023	5411	5821	6250	6702	7163		-40	1.032	.915	1.010
	480	4592	5054	5533	6038	6579	7138	7747			-20	1.075	.760	1.018
	520	5092	5738	6407	7106	7937					0	1.117	.670	1.023
	560	6911	7959	9242										
	600													
	MIL	10421	10163	9832	9348	9201	8881	8523	8045	7560				
	VMAX	595.3	580.8	565.1	542.8	535.7	518.9	498.0	470.8	426.7				
40,000 FEET (-67°C)	380	6274	6488	6702	6916	7129					-80	.944	.915	.945
	400	4685	4944	5230	5517	5812					-60	.992	.985	.992
	440	4250	4597	4948	5323	5706					-40	1.037	.930	1.019
	480	4277	4697	5137	5597	6108					-20	1.081	.765	1.033
	520	4688	5237	5827	6509						0	1.122	.600	1.048
	560	6834	7576											
	600													
	MIL	7972	7726	7489	7223	6877	2806	2806	2806	2806				
	VMAX	575.8	561.9	548.1	533.8	512.4								
45,000 FEET (-67°C)	380	9502	9681								-80	.944	.916	.948
	400	6952	7181								-60	.992	.985	.993
	440	5241	5560								-40	1.037	.930	1.016
	480	4546	4968								-20	1.081	.765	1.027
	520	4654	5225								0	1.122	.600	1.037
	560													
	600													
	MIL	5953	5817	2276	2276	2276	2276	2276	2276	2276				
	VMAX	582.4	542.2											

15E1-B1404

Figure A4-26

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 50,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
25,000 FEET (-35°C)	380	4732	5061	5350	5648	5955	6252	6583	6894	7228	-60	.900	1.480	.959
	400	5005	5379	5758	6152	6647	6948	7372	7796	8230	-50	.945	1.250	.978
	440	5415	5884	6293	6904	7430	7987	8523	9118	9713	-40	.988	1.035	.998
	480	5962	6604	7255	7937	8630	9381	10183	11014	11878	-20	1.030	.880	1.007
	520	6721	7573	8478	9421	10411	11480	12817			-0	1.070	.720	1.016
	560	8247	9574	10975	12499									
	600	12019	13858											
	MIL	14887	14520	14312	14031	13803	13578	13348	13104	12850				
	VMAX	618.3	603.0	588.7	570.0	558.9	543.9	528.3	511.5	493.9				
30,000 FEET (-44°C)	380	4806	5067	5311	5583	5858	6128	6415	6722	7028	-60	.919	1.025	.936
	400	4709	5038	5368	5712	6062	6413	6802	7196	7592	-50	.968	1.010	.978
	440	4950	5371	5798	6238	6687	7150	7673	8212	8753	-40	1.010	.955	1.001
	480	5336	5874	6431	7012	7630	8288	8968	9700		-20	1.062	.785	1.008
	520	5936	6676	7455	8268	9116	10110	11121			-0	1.043	.810	1.011
	560	7388	8580	9884										
	600	11300												
	MIL	12694	12597	12433	12038	11916	11575	11223	10777	10296				
	VMAX	607.5	594.6	580.2	566.3	551.3	537.1	521.3	500.0	477.1				
35,000 FEET (-54°C)	380	5433	5663	5942	6210	6479	6752	7018	7258		-60	.940	.930	.943
	400	4773	5061	5388	5711	6047	6402	6758	7119		-50	.987	.980	.988
	440	4651	5021	5413	5828	6264	6721	7189			-40	1.032	.915	1.010
	480	4876	5346	5860	6393	6954	7582	8181			-20	1.075	.740	1.018
	520	5344	5993	6668	7403	8235					-0	1.117	.570	1.023
	560	7283	8379	9684										
	600													
	MIL	10328	10068	9728	9343	9122	8779	8219	7384	4196				
	VMAX	589.9	575.8	560.4	542.7	531.8	514.2	480.9	423.5					
40,000 FEET (-57°C)	380	6298	6505	6715	6925						-60	.944	.915	.945
	400	5909	6204	6499	6794						50	.992	.985	.992
	440	4981	5340	5727	6126						-40	1.037	.930	1.019
	480	4712	5182	5631	6151						-20	1.081	.765	1.033
	520	5060	5638	6321							-0	1.122	.600	1.046
	560	7281												
	600	-												
	MIL	7809	7580	7367	6955	2806	2806	2806	2806	2806				
	VMAX	568.4	554.0	543.5	517.8									
45,000 FEET (-57°C)	380	12227									-60	.944	.915	.948
	400	9153									-50	.992	.985	.993
	440	6892									-40	1.037	.930	1.016
	480	5601									-20	1.081	.765	1.027
	520	5404									-0	1.122	.600	1.037
	560													
	600													
	MIL	5810	2276	2276	2276	2276	2276	2276	2276	2276				
	VMAX	541.6												

15E1-(1)2804

Figure A4-27

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 55,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX								
		0	20	40	60	80	100	120	140	160
25,000 FEET (-35°C)	360	5234	5524	5829	6135	6441	6754	7086	7417	7749
	400	5334	5709	6106	6503	6902	7327	7752	8183	8658
	440	5679	6168	6669	7175	7707	8239	8818	9407	10028
	480	6176	6821	7475	8154	8881	9606	10411	11256	12121
	520	6903	7761	8680	9607	10611	11677	12815		
	560	8390	9715	11119	12847					
	600	12243	14100							
	MIL	14650	14602	14288	14030	13762	13555	13308	13067	12790
	VMAX	613.5	601.5	587.1	569.9	555.7	542.8	525.7	508.2	489.7
30,000 FEET (-44°C)	360	5488	5735	6004	6274	6576	6879	7183	7493	7818
	400	5175	5507	5859	6210	6576	6970	7365	7778	8206
	440	5271	5697	6141	6585	7080	7577	8111	8657	9217
	480	5810	6158	6710	7318	7938	8613	9310	10040	
	520	6155	6904	7688	8508	9390	10377			
	560	7561	8758	10088						
	600	12082								
	MIL	12872	12675	12379	12035	11867	11507	11098	10595	10023
	VMAX	604.5	591.8	577.3	558.2	549.2	534.2	515.2	491.4	481.8
35,000 FEET (-54°C)	360	7106	7370	7635	7899	8165	8430			
	400	5398	5723	6058	6412	6769	7137			
	440	5098	5502	5921	6371	6834	7311			
	480	5175	5681	6206	6775	7374	8002			
	520	5638	6298	6989	7790	8628				
	560	7743	8902							
	600									
	MIL	10208	9924	9816	9338	8984	8450	4198	4198	4198
	VMAX	583.4	589.2	555.3	542.4	524.0	494.8			
40,000 FEET (-57°C)	360	10646	10853	11068						
	400	7799	8088	8377						
	440	5954	6360	6750						
	480	5303	5798	6324						
	520	5515	6188	6903						
	560									
	600									
	MIL	7648	7454	7046	2806	2806	2806	2806	2806	2806
	VMAX	557.7	547.2	523.1						

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS		
		CRUISE	MIL	V_{MAX}
25,000 FEET	-80	.900	1.480	.959
	-60	.945	1.250	.978
	-40	.988	1.035	.996
	-20	1.030	.880	1.007
	-0	1.070	.720	1.018
30,000 FEET	-80	.919	1.025	.938
	-60	.966	1.010	.978
	-40	1.010	.955	1.001
	-20	1.052	.785	1.006
	-0	1.043	.810	1.011
35,000 FEET	-80	.940	.930	.943
	-60	.987	.990	.988
	-40	1.032	.915	1.010
	-20	1.076	.740	1.016
	-0	1.117	.670	1.023
40,000 FEET	-80	.944	.915	.945
	-60	.992	.986	.992
	-40	1.037	.930	1.019
	-20	1.061	.768	1.033
	-0	1.122	.800	1.048

Figure A4-28

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 60,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX									ACTUAL OAT DEG. C	TEMP EFFECTS FACTORS		
		0	20	40	60	80	100	120	140	160		CRUISE	MIL	V_{MAX}
26,000 FEET (-36°C)	360	5813	6118	6423	6733	7083	7394	7724	8071	8443	-80	.900	1.480	.959
	400	5688	6084	6482	6881	7308	7736	8167	8644	9121	-60	.945	1.250	.978
	440	5972	6477	6982	7511	8047	8609	9202	9805	10468	-40	.998	1.035	.998
	480	6426	7065	7728	8398	9125	9863	10698	11526	12400	-20	1.030	.880	1.007
	520	7107	7972	8863	9817	10838	11813	13042			-0	1.070	.720	1.016
	560	8540	9866	11273	12807									
	600	12491												
	MIL	14629	14476	14258	14016	13759	13629	13267	12987	12716				
	VMAX	612.1	599.8	585.0	569.1	554.3	541.0	522.1	503.4	484.5				
30,000 FEET (-44°C)	360	6480	6781	7082	7383	7706	8029	8352	8676	9000	-80	.919	1.025	.938
	400	5748	6097	6450	6845	7240	7643	8072	8501	8938	-60	.966	1.010	.978
	440	5628	6072	6520	7012	7514	8047	8597	9180		-40	1.010	.955	1.001
	480	5901	6462	7048	7670	8338	9018	9758			-20	1.062	.785	1.008
	520	6410	7182	7944	8774	9694	10879				-0	1.043	.610	1.011
	560	7764	8962	10323										
	600	12533												
	MIL	12644	12548	12332	12033	11804	11418	10919	10203	9523				
	VMAX	600.8	589.5	574.1	558.1	546.4	530.6	504.8	472.7	431.2				
35,000 FEET (-54°C)	360	8981	9244	9508	9771	10034					-80	.940	.930	.943
	400	6489	6846	7216	7577	7943					-60	.987	.980	.988
	440	5689	6118	6583	7063	7543					-40	1.032	.915	1.010
	480	5651	6079	6648	7241	7877					-20	1.076	.740	1.018
	520	5971	6658	7406	8253						-0	1.117	.570	1.023
	560	8298	9477											
	600													
	MIL	10075	9785	9497	9174	8712	4198	4198	4196	4198				
	VMAX	578.0	563.0	550.0	534.4	510.2								
40,000 FEET (-57°C)	360	13440	13643								-80	.944	.915	.945
	400	9811	10095								-60	.992	.985	.992
	440	7289	7691								-40	1.037	.930	1.019
	480	6133	6689								-20	1.081	.765	1.033
	520	6142	6869								-0	1.122	.600	1.048
	560													
	600													
	MIL	7504	7141	2808	2806	2808	2808	2808	2806	2808				
	VMAX	549.8	528.9											

Figure A4-29

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 65,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
20,000 FEET (-36°C)	360	6437	6744	7071	7397	7723	8068	8434	8802	9170	-80	.900	1.480	.958
	400	6158	6557	6962	7389	7818	8257	8735	9212	9705	-60	.948	1.250	.978
	440	6299	6807	7329	7868	8415	9012	9608	10261	10928	-40	.988	1.035	.998
	480	6703	7340	8007	8688	9420	10186	11018	11860		-20	1.030	.880	1.007
	520	7333	8206	9112	10053	11092	12177				0	1.070	.720	1.016
	560	8685	10009	11420	12960									
	600	12793												
	MIL	14603	14440	14217	13987	13731	13490	13193	12903	12807				
	VMAX	610.0	597.4	582.3	567.5	552.7	538.3	517.7	497.8	477.4				
30,000 FEET (-44°C)	360	8064	8380	8698	9016	9334	9651	9969			-80	.919	1.025	.936
	400	6361	6738	7137	7536	7967	8400	8834			-60	.968	1.010	.978
	440	6079	6530	7026	7532	8071	8625	9193			-40	1.010	.955	1.001
	480	6207	6774	7402	8049	8739	9484	10212			-20	1.062	.785	1.006
	520	6680	7445	8240	9072	10040	11030				0	1.043	.610	1.011
	560	8006	9207	10606										
	600													
	MIL	12813	12482	12279	12029	11716	11306	10536	5308	5308				
	VMAX	596.8	584.2	570.5	556.0	542.9	525.2	488.5						
35,000 FEET (-54°C)	360	11115	11274	11633	11893						-80	.940	.930	.943
	400	8018	8277	8738	9095						-60	.987	.980	.988
	440	6446	6917	7408	7902						-40	1.032	.915	1.010
	480	6034	6607	7205	7849						-20	1.075	.740	1.016
	520	6379	7094	7942	8809						0	1.117	.570	1.023
	560	8904												
	600													
	MIL	9910	9652	9381	8885	4196	4196	4196	4196	4196				
	VMAX	568.6	557.0	544.5	520.2									
40,000 FEET (-57°C)	360	16049									-80	.944	.915	.945
	400	12140									-60	.992	.985	.992
	440	9157									-40	1.037	.930	1.019
	480	7333									-20	1.081	.765	1.033
	520	6945									0	1.122	.600	1.048
	560													
	600													
	MIL	7128	2806	2806	2806	2808	2806	2806	2806	2806				
	VMAX	528.1												

Figure A4-30

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 70,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX								
		0	20	40	60	80	100	120	140	160
28,000 FEET (-36°C)	360	7298	7723	8065	8432	8799	9167	9549	9947	10345
	400	6698	7112	7540	7967	8428	8904	9382	9892	10418
	440	6661	7178	7721	8264	8857	9458	10099	10769	11442
	480	7008	7667	8340	9060	9798	10622	11459	12322	
	520	7582	8463	9377	10334	11373	12471			
	560	8867	10191	11608	13156					
	600	13169								
	MIL	14675	14400	14181	13954	13690	13422	13116	12777	12385
	VMAX	607.8	594.7	579.9	565.6	550.4	533.5	512.3	488.8	452.2
30,000 FEET (-44°C)	360	9817	10233	10550	10867	11185	11502			
	400	7293	7700	8128	8556	8996	9430			
	440	6594	7101	7609	8159	8718	9291			
	480	6557	7168	7803	8456	9208	9964			
	520	6980	7770	8598	9498	10486				
	560	8292	9488	10847						
	600									
	MIL	12578	12411	12221	12025	11853	10947	5308	5308	5308
	VMAX	582.1	579.4	568.6	565.8	538.2	508.1			
36,000 FEET (-64°C)	360	13602	13752	14007						
	400	9907	10284	10621						
	440	7521	8015	8508						
	480	6665	7268	7918						
	520	6828	7626	8512						
	560	9648								
	600									
	MIL	9768	9606 -	9114	4198	4198	4198	4198	4196	4198
	VMAX	582.3	550.4	531.4						

ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS		
	CRUISE	MIL	V_{MAX}
-80	.900	1.480	.959
-60	.945	1.250	.979
-40	.988	1.035	.998
-20	1.030	.880	1.007
-0	1.070	.720	1.016
-80	.919	1.025	.938
-60	.968	1.010	.978
-40	1.010	.955	1.001
-20	1.032	.785	1.008
-0	1.043	.610	1.011
-80	.940	.930	.943
-60	.987	.980	.988
-40	1.030	.916	1.010
-20	1.075	.740	1.018
-0	1.117	.540	1.023

Figure A4-31

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 75,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160
25,000 FEET (-35°C)	360	8684	9042	9405	9794	10182	10571	10972	11348	11738
	400	7338	7767	8203	8683	9162	9652	10178	10706	11233
	440	7072	7616	8161	8748	9350	9980	10653	11328	
	480	7301	7981	8673	9419	10200	11044	11902		
	520	7857	8731	9658	10637	11674	12761			
	560	9075	10400	11824	13383					
	600	13588								
	MIL	14542	14358	14146	13918	13640	13342	12985	12558	11971
	VMAX	604.8	591.7	577.5	563.4	547.5	528.0	503.2	474.4	437.4
30,000 FEET (-44°C)	360	11941	12253	12566	12878	13190				
	400	8519	8952	9391	9829	10268				
	440	7295	7818	8380	8944	9535				
	480	6982	7624	8307	9011	9774				
	520	7327	8135	8988	9987	10981				
	560	8822	9887	11368						
	600									
	MIL	12521	12244	12168	11850	11251	5308	5308	5308	5308
	VMAX	586.8	574.3	562.9	548.5	527.4				
36,000 FEET (-54°C)	360	18325	16572							
	400	11882	12234							
	440	8841	9338							
	480	7459	8121							
	520	7425	8310							
	560									
	600									
	MIL	9629	9357	4198	4198	4198	4198	4198	4198	4198
	VMAX	555.3	543.4							

	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
25,000 FEET	-80	.900	1.480	.959
	-60	.945	1.250	.978
	-40	.988	1.035	.998
	-20	1.030	.880	1.007
	-0	1.070	.720	1.018
30,000 FEET	-80	.919	1.025	.536
	-60	.968	1.010	.978
	-40	1.010	.955	1.001
	-20	1.052	.785	1.006
	-0	1.043	.610	1.011
36,000 FEET	-80	.940	.930	.943
	-60	.987	.980	.988
	-40	1.032	.915	1.010
	-20	1.075	.740	1.018
	-0	1.117	.570	1.023

Figure A4-32

HIGH ALTITUDE CRUISE

GROSS WEIGHT - 80,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUN 1988
DATA BASIS: ESTIMATED

REMARKS
ENGINES: (2) F100-PW-220

TOTAL FUEL FLOW - LB/HR

	KTAS	DRAG INDEX 0	20	40	60	80	100	120	140	160	ACTUAL OAT DEG. C	TEMP EFFECTS-FACTORS CRUISE	MIL	V_{MAX}
26,000 FEET (-36°C)	360	10510	10913	11284	11671	12057	12444	12831	13217		-80	.900	1.480	.959
	400	7975	8432	8908	9384	9892	10416	10938	11470		-60	.945	1.250	.978
	440	7588	8116	8699	9306	9937	10614	11292	11985		-40	.988	1.035	.998
	480	7645	8330	9062	9814	10854	11507	12388			-20	1.030	.880	1.007
	520	8145	9041	9975	10998	12067					-0	1.070	.720	1.018
	560	9317	10647	12083	13654					-				
	600	14136												
	MIL	14459	14308	14113	13888	13579	13224	12781	12016	7173				
	VMAX	601.4	588.3	575.2	560.6	543.8	519.8	489.1	440.5					
30,000 FEET (-44°C)	360	14182	14489	14796	15103	15410					-80	.919	1.025	.938
	400	10267	10698	11128	11559	11990					-60	.968	1.010	.978
	440	8033	8600	9180	9777	10368					-40	1.010	.955	1.001
	480	7487	8183	8875	9634	10407					-20	1.052	.785	1.006
	520	7709	8552	9468	10482						-0	1.043	.610	1.011
	560	8995	10350											
	600													
	MIL	12444	12276	12104	11831	10747	5308	5308	5308	5308				
	VMAX	581.7	570.3	558.1	539.4	498.8								
36,000 FEET (-54°C)	360	18897									-80	.940	.930	.943
	400	14103									-60	.987	.980	.988
	440	10578									-40	1.032	.915	1.010
	480	8583									-20	1.075	.740	1.018
	520	8162									-0	1.117	.570	1.023
	560													
	600													
	MIL	9448	4198	4198	4198	4198	4198	4198	4198	4198				
	VMAX	547.8												

Figure A4-33

CONSTANT ALTITUDE CRUISE

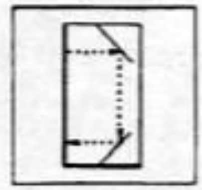
LANDING GEAR EXTENDED
CRUISE SPEED-250 KCAS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

DATE: 15 JUNE 1988
DATA BASIS: **ESTIMATED**

REMARKS
ENGINE(S): (2) F100-PW-220
DATA APPLICABLE FOR ANY TEMPERATURE

NOTE
- LANDING GEAR DRAG MUST ALSO BE INCLUDED WHEN CALCULATING TOTAL DRAG INDEX
- DI = 40 FOR NOSE GEAR DI = 25 FOR EACH MAIN GEAR
- SPEEDS RESTRICTED TO 250 KCAS WITH GEAR EXTENDED.



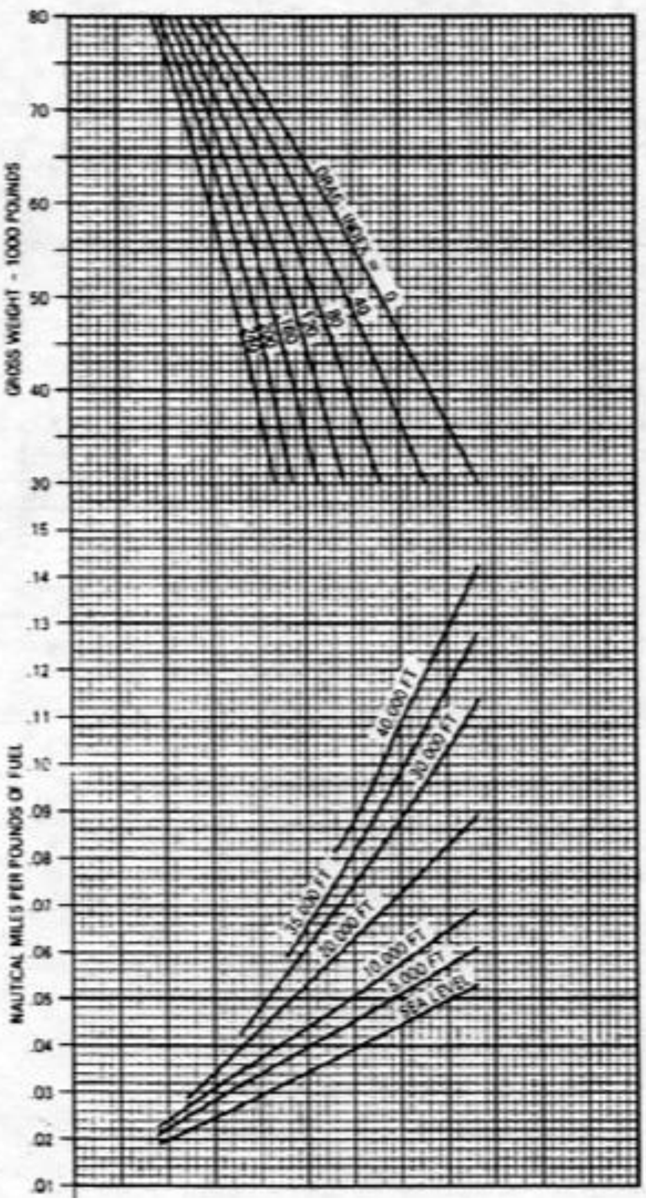


Figure A4-34

PART 5

ENDURANCE

MAXIMUM ENDURANCE CHARTS

These charts (figures A5-1 and A5-2) present optimum endurance altitude and maximum endurance specifics (fuel flow and Mach number) for various combinations of effective gross weight and altitude.

USE (ALTITUDE AND BANK ANGLE CHART)

Enter the Altitude and Bank Angle chart with the average gross weight. If bank angles are to be considered, follow the gross weight curve until it intersects the bank angle to be used, then project horizontally right to obtain effective gross weight. If bank angles are not to be considered, enter the chart at the effective gross weight scale. From this point, proceed horizontally right to intersect the applicable drag index curve, then project vertically down to read optimum endurance altitude.

USE (FUEL FLOW AND MACH NUMBER CHART)

Enter the fuel flow and Mach number plots on the Fuel Flow and Mach Number chart with the effective gross weight, then horizontally to intersect the optimum endurance altitude curve. From this point, project vertically down to intersect the applicable drag index curve, then horizontally to read fuel flow or true Mach number.

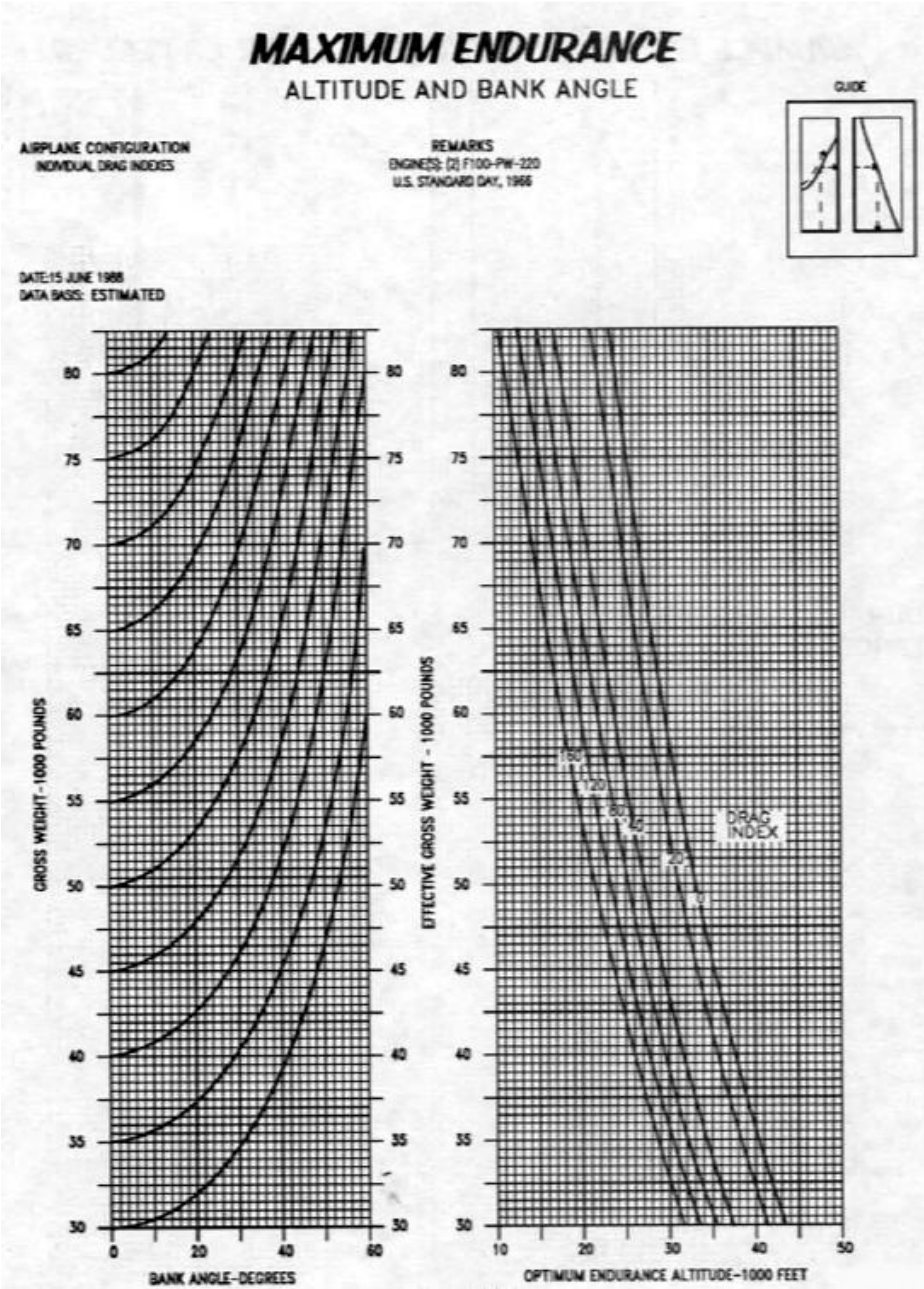
ENDURANCE-LANDING GEAR EXTENDED

This chart (figure A5-3) presents constant altitude endurance and maximum endurance specifics (fuel flow, calibrated airspeed, and altitude) for various combinations of gross weight and drag index.

USE

If bank angles are to be considered, utilize the method described in the previous section to determine the effective gross weight. To obtain constant altitude endurance specifics, enter the left side of the chart at the effective gross weight scale. From this point, proceed horizontally right to intersect the applicable drag index curve, then project downward to intersect with the desired altitude. From this point, project horizontally left to read the fuel flow. To obtain the calibrated airspeed, project downward from the altitude-fuel flow intersection to intersect with the applicable drag index curves on the airspeed chart, project horizontally left from this point to read the calibrated airspeed.

To obtain maximum endurance specifics, the right side of the chart is used. Enter the chart at the effective gross weight and project horizontally left to intersect with the applicable drag index curve. From this point, project downward to read the maximum endurance altitude from the horizontal scale. Project further downward to intersect with the applicable drag index curve and project horizontally right to read the fuel flow or the calibrated airspeed.



MAXIMUM ENDURANCE
ALTITUDE AND BANK ANGLE
GUIDE
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE:15 JUNE 1988
DATA BASIS: ESTIMATED
GROSS WEIGHT - 1000 POUNDS
EFFECTIVE GROSS WEIGHT - 1000 POUNDS
BANK ANGLE-DEGREES
OPTIMUM ENDURANCE ALTITUDE-1000 FEET
DRAG INDEX
160
120
80
40
20
0

Figure A5-1

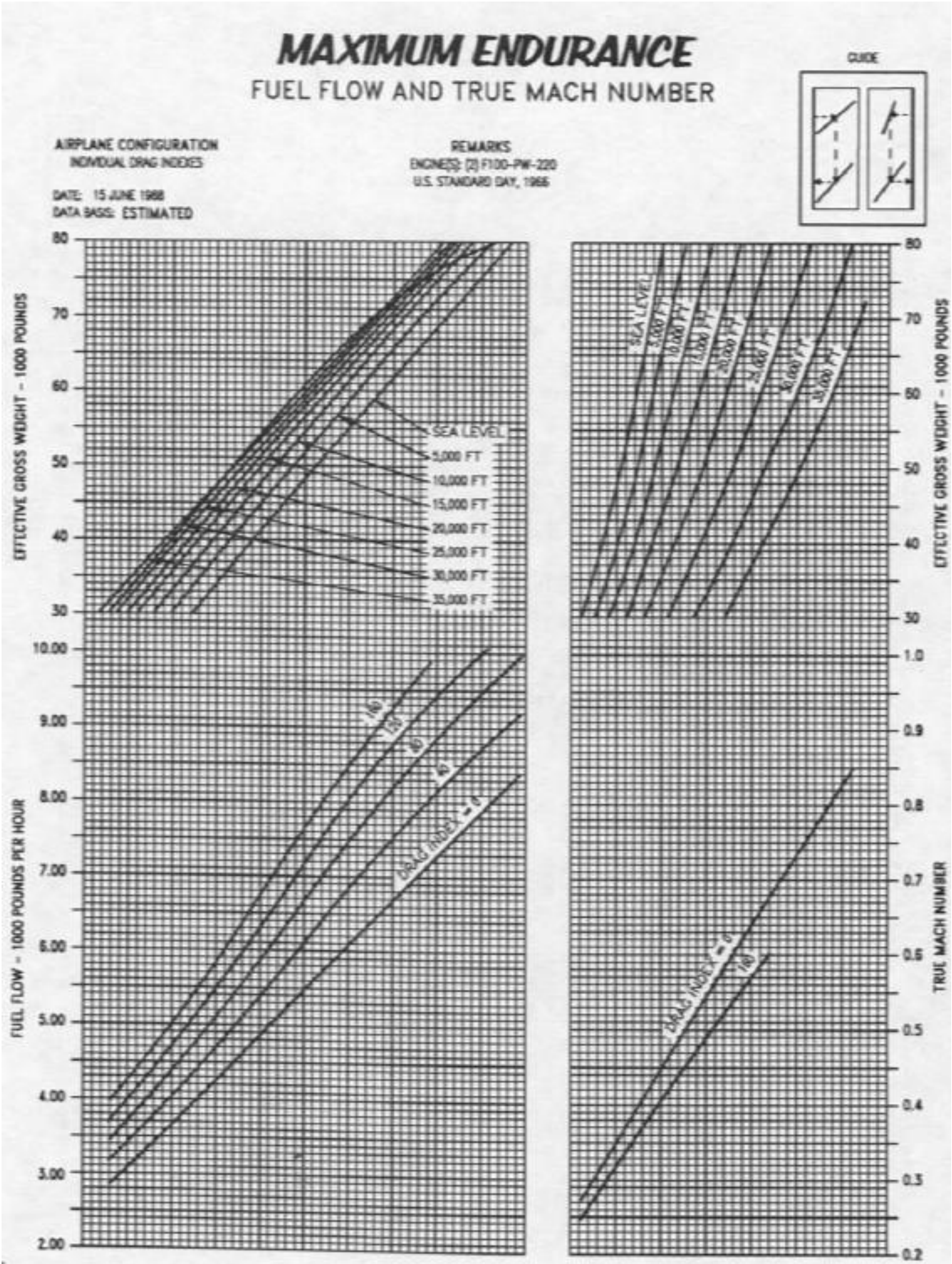
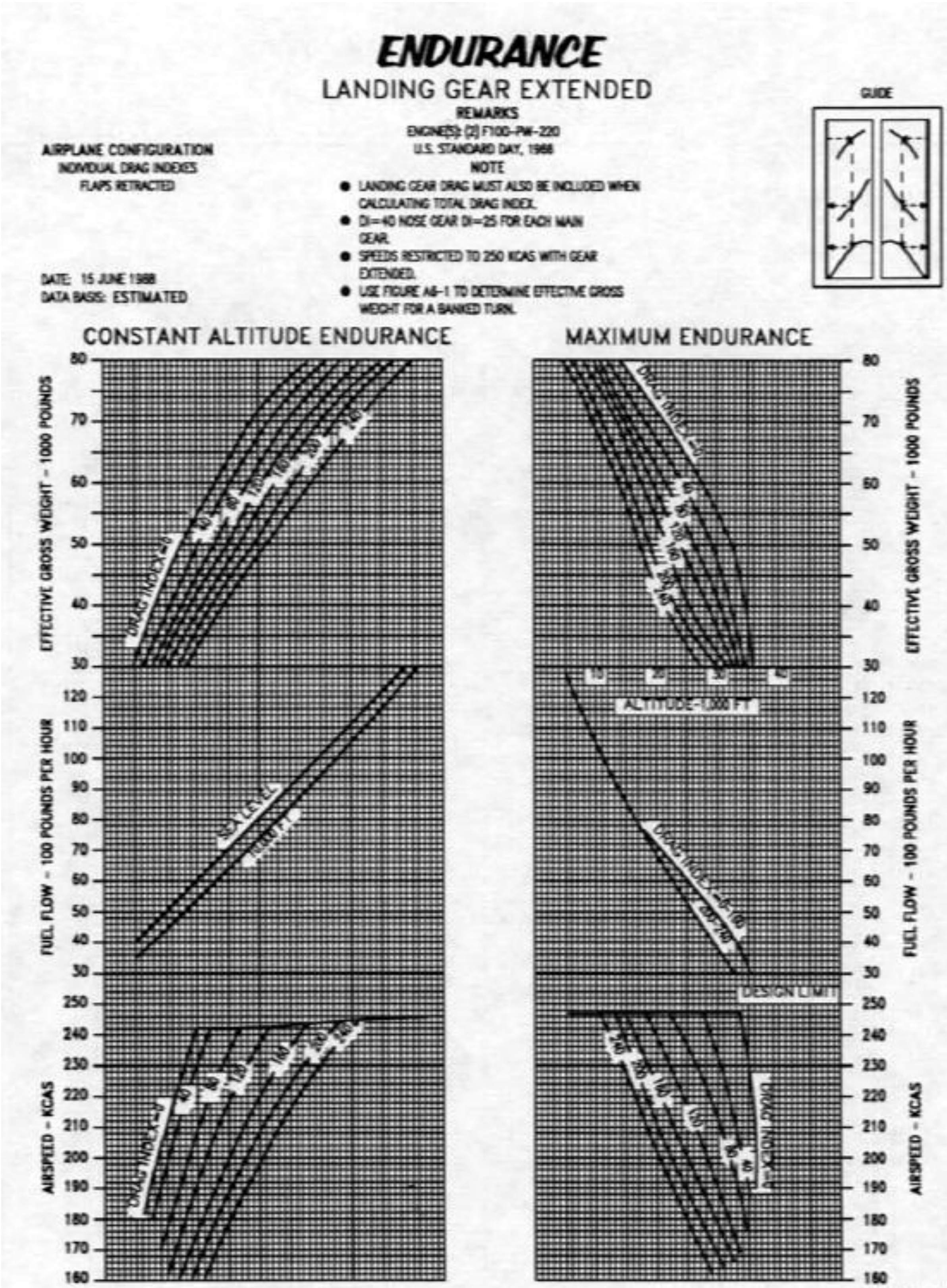

MAXIMUM ENDURANCE
FUEL FLOW AND TRUE MACH NUMBER
GUIDE
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
EFFECTIVE GROSS WEIGHT - 1000 POUNDS
FUEL FLOW - 1000 POUNDS PER HOUR
TRUE MACH NUMBER
SEA LEVEL
5,000 FT
10,000 FT
15,000 FT
20,000 FT
25,000 FT
30,000 FT
35,000 FT
DRAG INDEX = 0
40
80
120
160

Figure A5-2



ENDURANCE
LANDING GEAR EXTENDED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
LANDING GEAR DRAG MUST ALSO BE INCLUDED WHEN CALCULATING TOTAL DRAG INDEX.
DI=40 NOSE GEAR DI=25 FOR EACH MAIN GEAR.
SPEEDS RESTRICTED TO 250 KCAS WITH GEAR EXTENDED.
USE FIGURE A6-1 TO DETERMINE EFFECTIVE GROSS WEIGHT FOR A BANKED TURN.
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
FLAPS RETRACTED
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
CONSTANT ALTITUDE ENDURANCE
MAXIMUM ENDURANCE
EFFECTIVE GROSS WEIGHT - 1000 POUNDS
FUEL FLOW - 100 POUNDS PER HOUR
AIRSPEED - KCAS
SEA LEVEL
ALTITUDE-1,000 FT
DESIGN LIMIT

Figure A5-3

PART 6

DESCENT

DESCENT CHARTS

The Descent charts (figures A6-1 to A6-5) present distance, time, total fuel used, and Mach number in the descent. Incremental data may be obtained for distance, time, and fuel by subtracting data corresponding to level-off altitude from the data for the original cruising altitude.

USE

Enter the upper plot of the appropriate chart at the cruising altitude, project horizontally right to intersect both series of drag index curves. From the altitude-drag index intersection in the first series, project vertically down to read time to descend. Enter the lower plot at the cruising altitude and project horizontally right to intersect the applicable drag index curve on the fuel graph. Continue horizontally right and intersect the curve on the Mach number graph. From the altitude-drag index intersection on the fuel graph, descend vertically and read the total fuel used in the descent. From the intersection on the Mach number graph, project vertically down to read true Mach number.

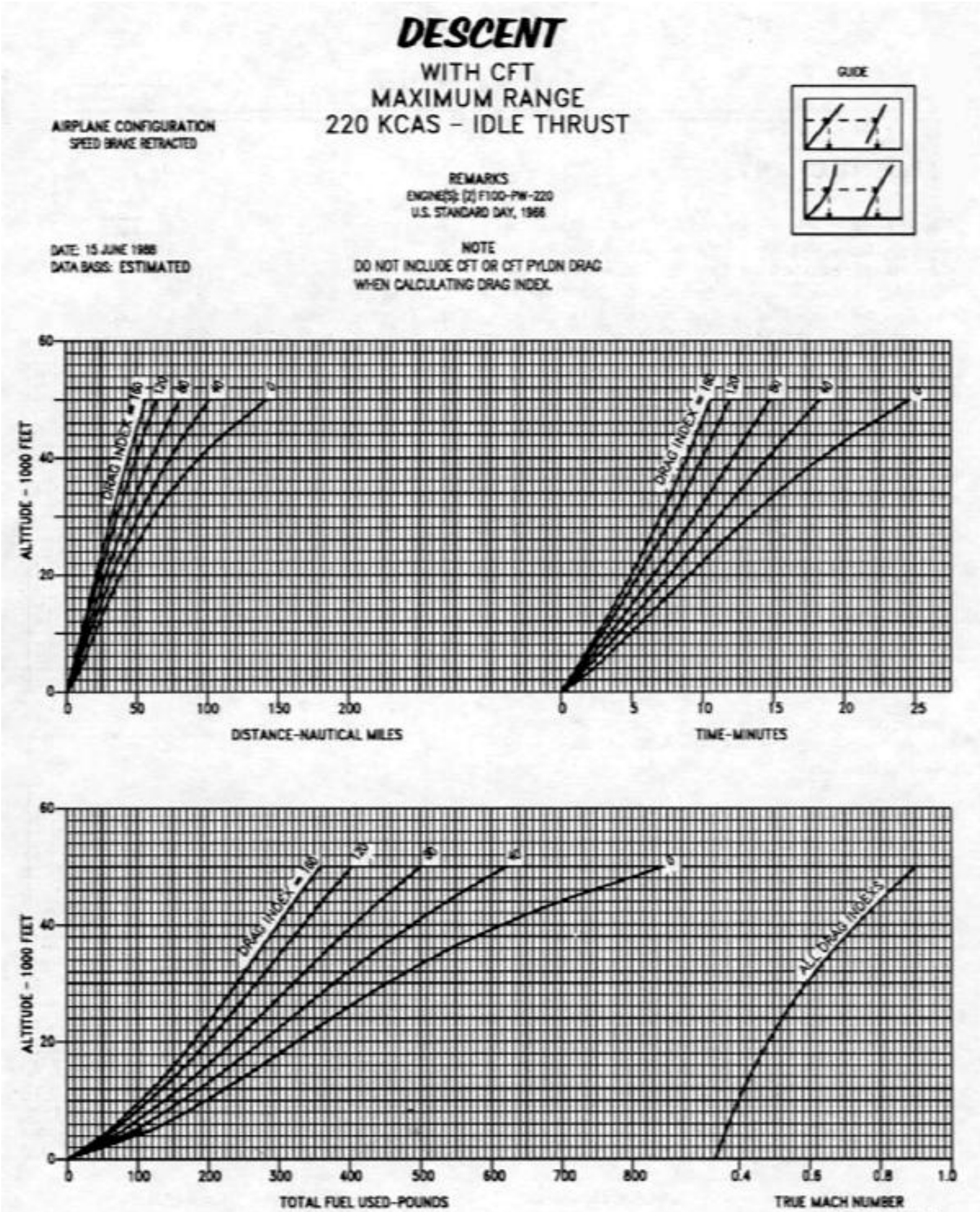

DESCENT
WITH CFT
MAXIMUM RANGE
220 KCAS – IDLE THRUST
AIRPLANE CONFIGURATION
SPEED BRAKE RETRACTED
GUIDE
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
NOTE
DO NOT INCLUDE CFT OR CFT PYLON DRAG
WHEN CALCULATING DRAG INDEX.
ALTITUDE – 1000 FEET
DRAG INDEX = 160
120
80
40
0
DISTANCE-NAUTICAL MILES
TIME-MINUTES
TOTAL FUEL USED-POUNDS
ALL DRAG INDEXES
TRUE MACH NUMBER

Figure A6-1

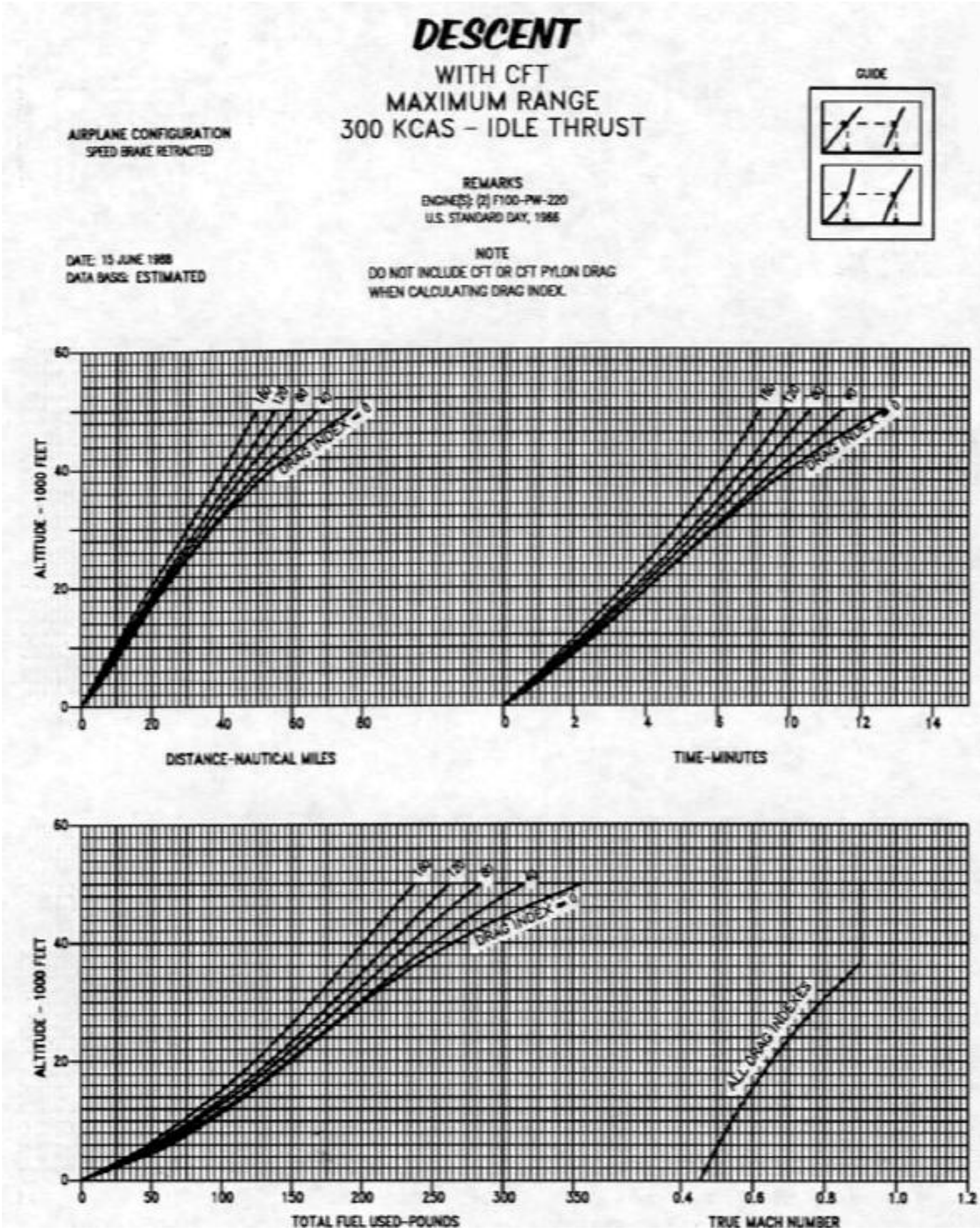

DESCENT
WITH CFT
MAXIMUM RANGE
300 KCAS – IDLE THRUST
GUIDE
AIRPLANE CONFIGURATION
SPEED BRAKE RETRACTED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
NOTE
DO NOT INCLUDE CFT OR CFT PYLON DRAG
WHEN CALCULATING DRAG INDEX.
ALTITUDE - 1000 FEET
DRAG INDEX = 0
DISTANCE-NAUTICAL MILES
TIME-MINUTES
TOTAL FUEL USED-POUNDS
ALL DRAG INDEXES
TRUE MACH NUMBER

Figure A6-2

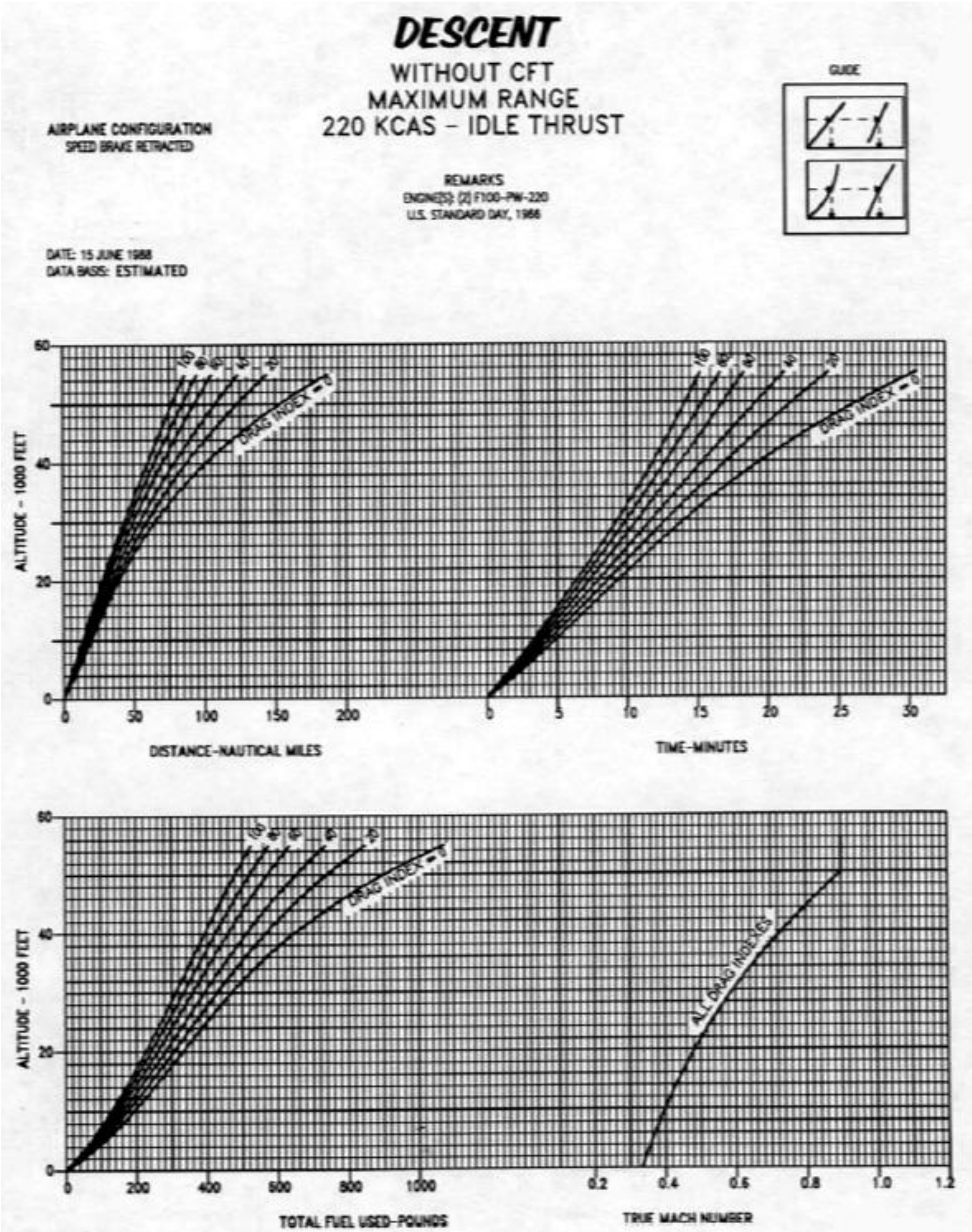

DESCENT
WITHOUT CFT
MAXIMUM RANGE
220 KCAS – IDLE THRUST
AIRPLANE CONFIGURATION
SPEED BRAKE RETRACTED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
ALTITUDE – 1000 FEET
DRAG INDEX = 0
DISTANCE-NAUTICAL MILES
TIME-MINUTES
TOTAL FUEL USED-POUNDS
TRUE MACH NUMBER
ALL DRAG INDEXES

Figure A6-3

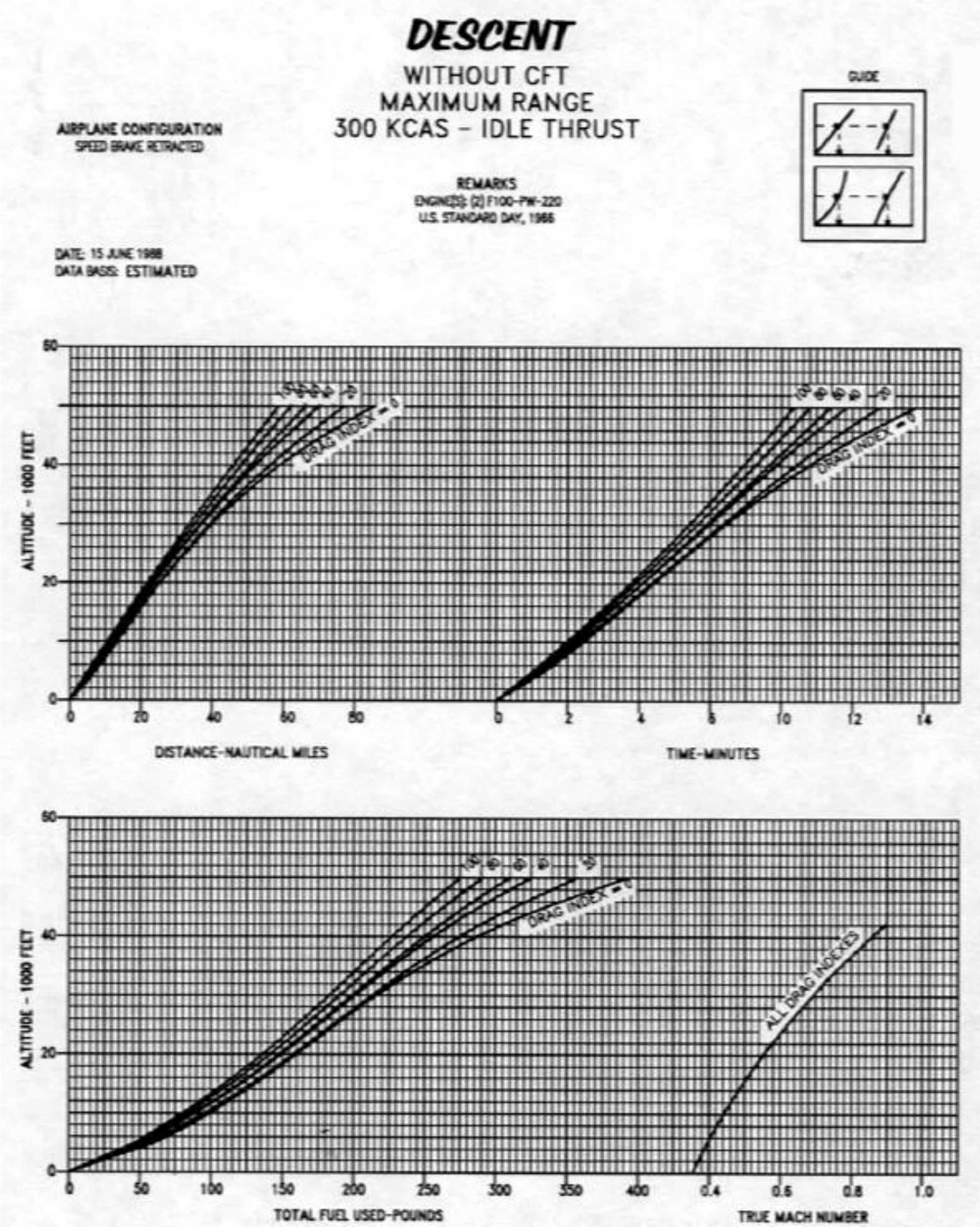

DESCENT
WITHOUT CFT
MAXIMUM RANGE
300 KCAS - IDLE THRUST
AIRPLANE CONFIGURATION
SPEED BRAKE RETRACTED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
DRAG INDEX = 0
ALTITUDE - 1000 FEET
DISTANCE-NAUTICAL MILES
TIME-MINUTES
ALL DRAG INDEXES
TOTAL FUEL USED-POUNDS
TRUE MACH NUMBER

Figure A6-4

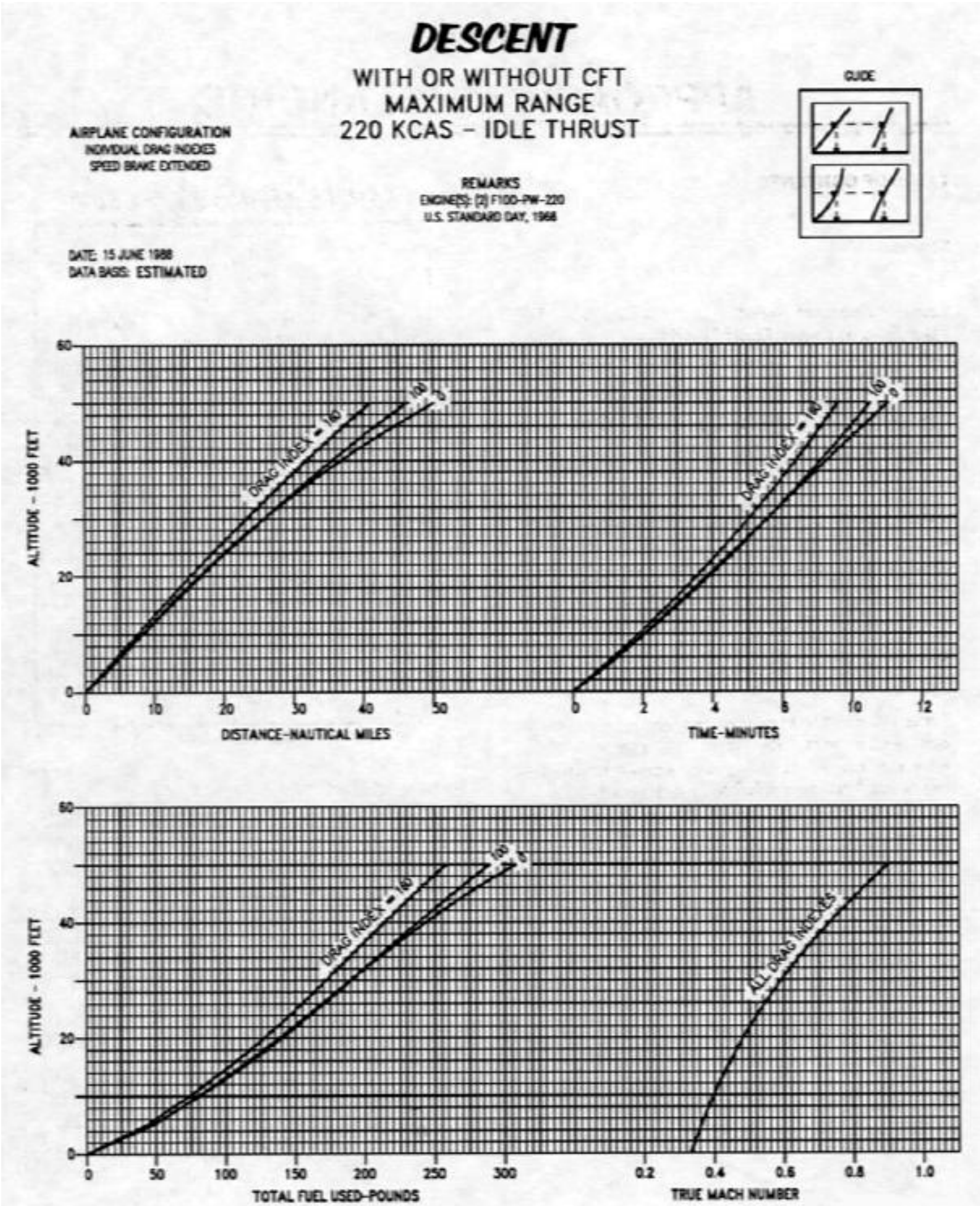

DESCENT
WITH OR WITHOUT CFT
MAXIMUM RANGE
220 KCAS - IDLE THRUST
AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES
SPEED BRAKE EXTENDED
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
GUIDE
ALTITUDE - 1000 FEET
DRAG INDEX = 180
100
0
DISTANCE-NAUTICAL MILES
TIME-MINUTES
TOTAL FUEL USED-POUNDS
ALL DRAG INDEXES
TRUE MACH NUMBER

Figure A6-5

PART 7

APPROACH AND LANDING

LANDING APPROACH SPEED CHART

The Landing Approach Speed chart (figure A7-1) provides recommended approach speed for various gross weights of the aircraft. The data is plotted for flaps either up or down.

USE

Enter the chart at the estimated landing gross weight and project vertically up to the appropriate flap reflector line. From this point, project horizontally left to read recommended approach speed.

MAXIMUM APPROACH GROSS weight

The Maximum Approach Gross Weight chart (figure A7-2) provides the maximum gross weight at which the aircraft can perform a single-engine maximum power climb after experiencing an engine failure. The data presented are based on the requirement that the aircraft be able to climb at a rate of 500 feet per minute at approach speed at the existing ambient temperature and pressure altitude.

USE

Enter the chart at the existing ambient temperature and ambient pressure. Project horizontally right at the existing ambient temperature and project vertically up at the existing ambient pressure. The intersection of the two projections represent existing conditions with respect to a standard day. From this point, project horizontally right to the existing ambient pressure altitude and then descend vertically to determine the appropriate density ratio. Continue descending vertically to intersect existing ambient temperature. From this point, project horizontally left to the effective Drag Index and then descend vertically to read the gross weight.

LANDING DISTANCE CHART

These charts (figure A7-3 to A7-5) provide landing roll distance information. One chart provides data for a normal landing using aerodynamic braking. The other provides data for a landing roll utilizing the technique of lowering the nose immediately after touchdown and applying maximum anti-skid braking. The variable of temperature, altitude, gross weight, effective wind, and runway condition are taken into consideration.

USE

Enter the chart with the runway temperature and project vertically up to the applicable pressure altitude. From this point, proceed horizontally right to the landing gross weight, then descend vertically to the wind baseline. Parallel the nearest guideline down to the effective headwind or tailwind for the appropriate runway condition. From this point, project vertically down to the appropriate runway condition reflector, then horizontally left to read ground roll. Continue further left to the appropriate runway condition reflector, then vertically down to read total distance required when landing over a 50 foot obstacle.

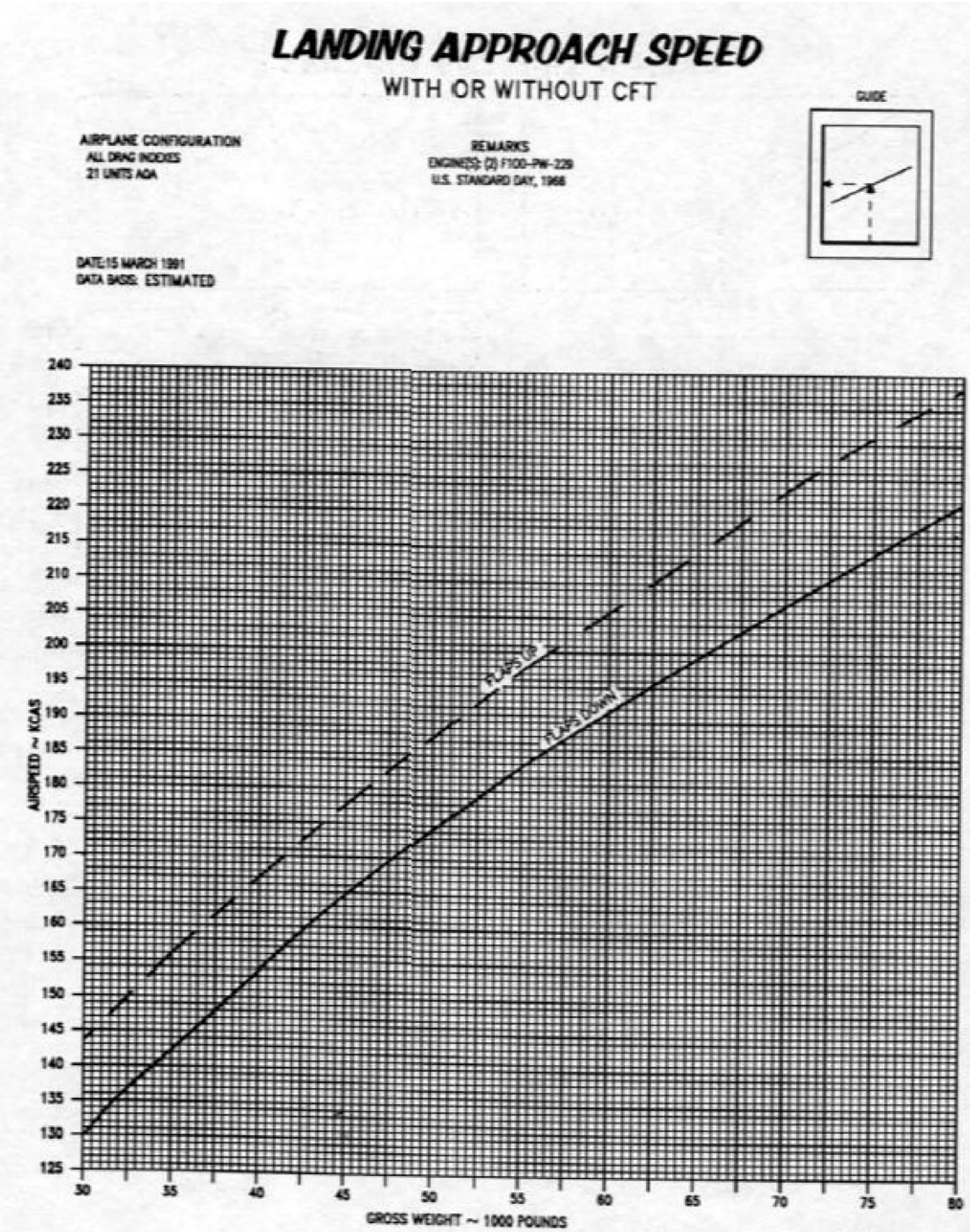

LANDING APPROACH SPEED
WITH OR WITHOUT CFT
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
21 UNITS AOA
REMARKS
ENGINE(S): (2) F100-PW-229
U.S. STANDARD DAY, 1966
GUIDE
DATE:15 MARCH 1991
DATA BASIS: ESTIMATED
AIRSPEED ~ KCAS
GROSS WEIGHT ~ 1000 POUNDS
FLAPS UP
FLAPS DOWN

Figure A7-1

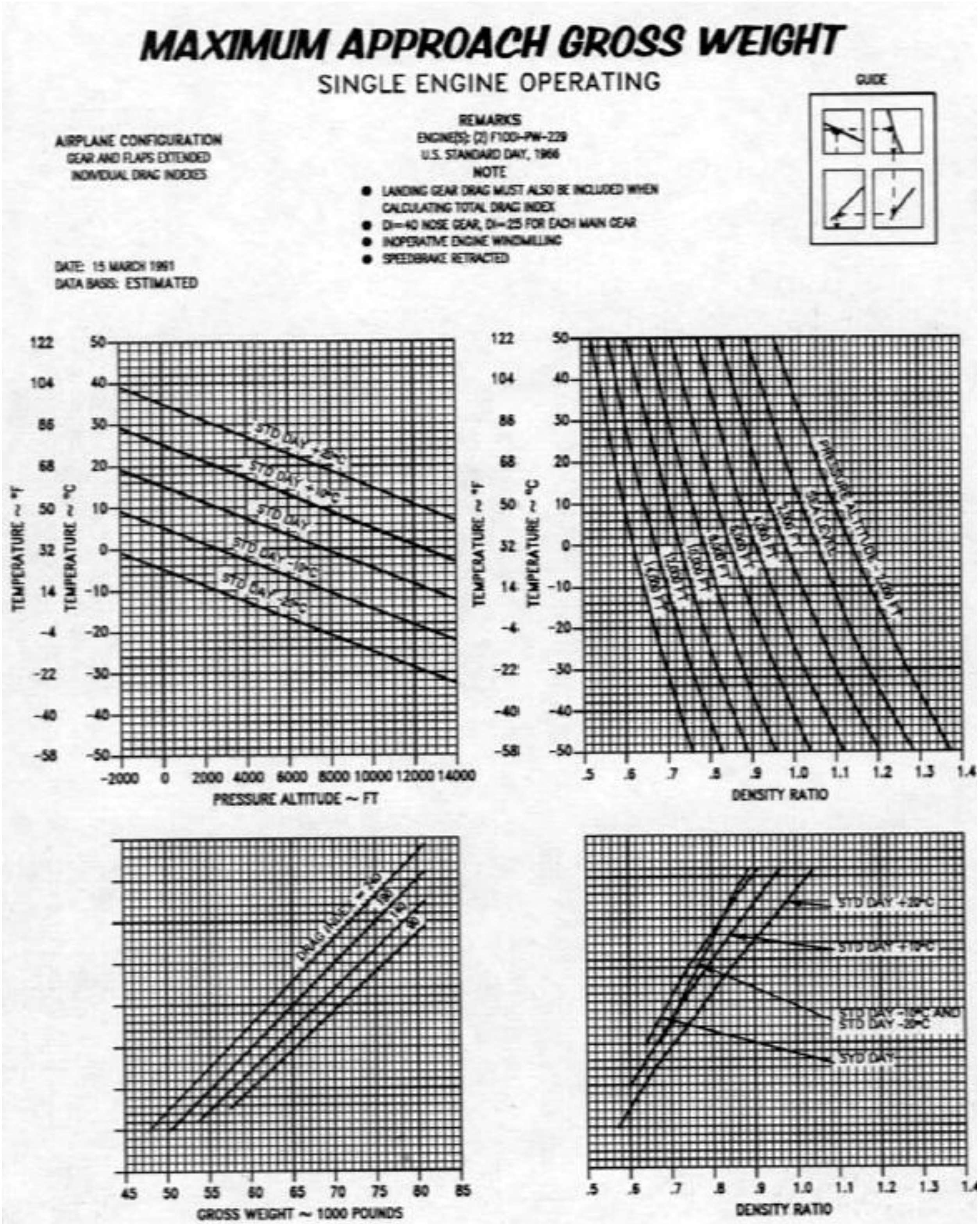

MAXIMUM APPROACH GROSS WEIGHT
SINGLE ENGINE OPERATING
GUIDE
AIRPLANE CONFIGURATION
GEAR AND FLAPS EXTENDED
INDIVIDUAL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-229
U.S. STANDARD DAY, 1966
NOTE
LANDING GEAR DRAG MUST ALSO BE INCLUDED WHEN CALCULATING TOTAL DRAG INDEX
DI=40 NOSE GEAR, DI=25 FOR EACH MAIN GEAR
INOPERATIVE ENGINE WINDMILLING
SPEEDBRAKE RETRACTED
DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED
TEMPERATURE ~ °F
TEMPERATURE ~ °C
STD DAY +20°C
STD DAY +10°C
STD DAY
STD DAY -10°C
STD DAY -20°C
PRESSURE ALTITUDE ~ FT
PRESSURE ALTITUDE ~ 2,000 FT
SEA LEVEL
DENSITY RATIO
DRAG INDEX = 50
GROSS WEIGHT ~ 1000 POUNDS
STD DAY -10°C AND STD DAY -20°C

Figure A7-2

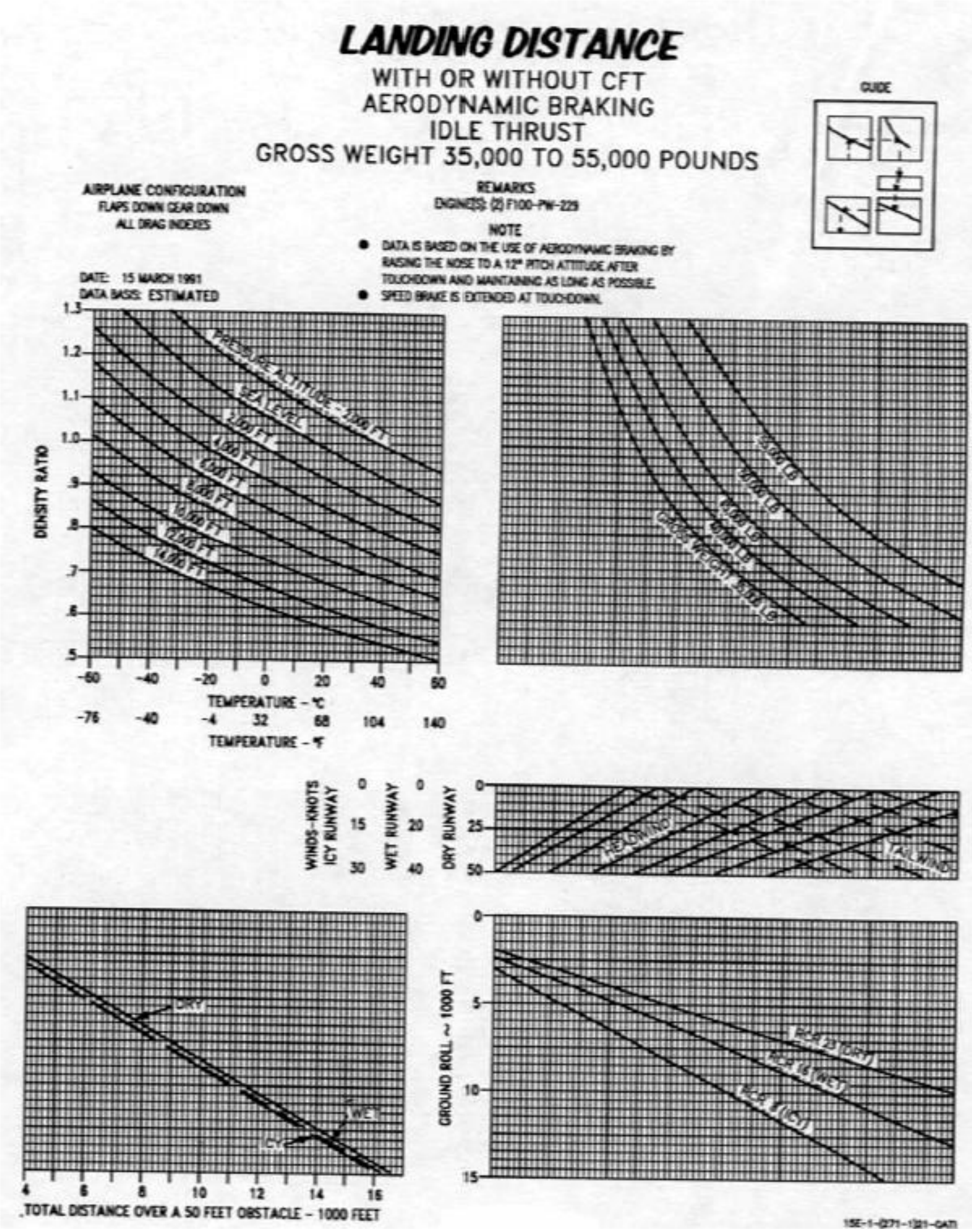

LANDING DISTANCE
WITH OR WITHOUT CFT
AERODYNAMIC BRAKING
IDLE THRUST
GROSS WEIGHT 35,000 TO 55,000 POUNDS
GUIDE
AIRPLANE CONFIGURATION
FLAPS DOWN GEAR DOWN
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-229
NOTE
DATA IS BASED ON THE USE OF AERODYNAMIC BRAKING BY RAISING THE NOSE TO A 12° PITCH ATTITUDE AFTER TOUCHDOWN AND MAINTAINING AS LONG AS POSSIBLE.
SPEED BRAKE IS EXTENDED AT TOUCHDOWN.
DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED
DENSITY RATIO
PRESSURE ALTITUDE -2000 FT
SEA LEVEL
2000 FT
4000 FT
6000 FT
8000 FT
10,000 FT
12,000 FT
14,000 FT
TEMPERATURE – °C
TEMPERATURE – °F
GROSS WEIGHT 35,000 LB
40,000 LB
45,000 LB
50,000 LB
55,000 LB
WINDS–KNOTS
ICY RUNWAY
WET RUNWAY
DRY RUNWAY
HEADWIND
TAILWIND
DRY
WET
ICY
GROUND ROLL ~ 1000 FT
RCR 23 (DRY)
RCR 12 (WET)
RCR 5 (ICY)
TOTAL DISTANCE OVER A 50 FEET OBSTACLE – 1000 FEET
15E-1-(271-1)21-CATI

Figure A7-3

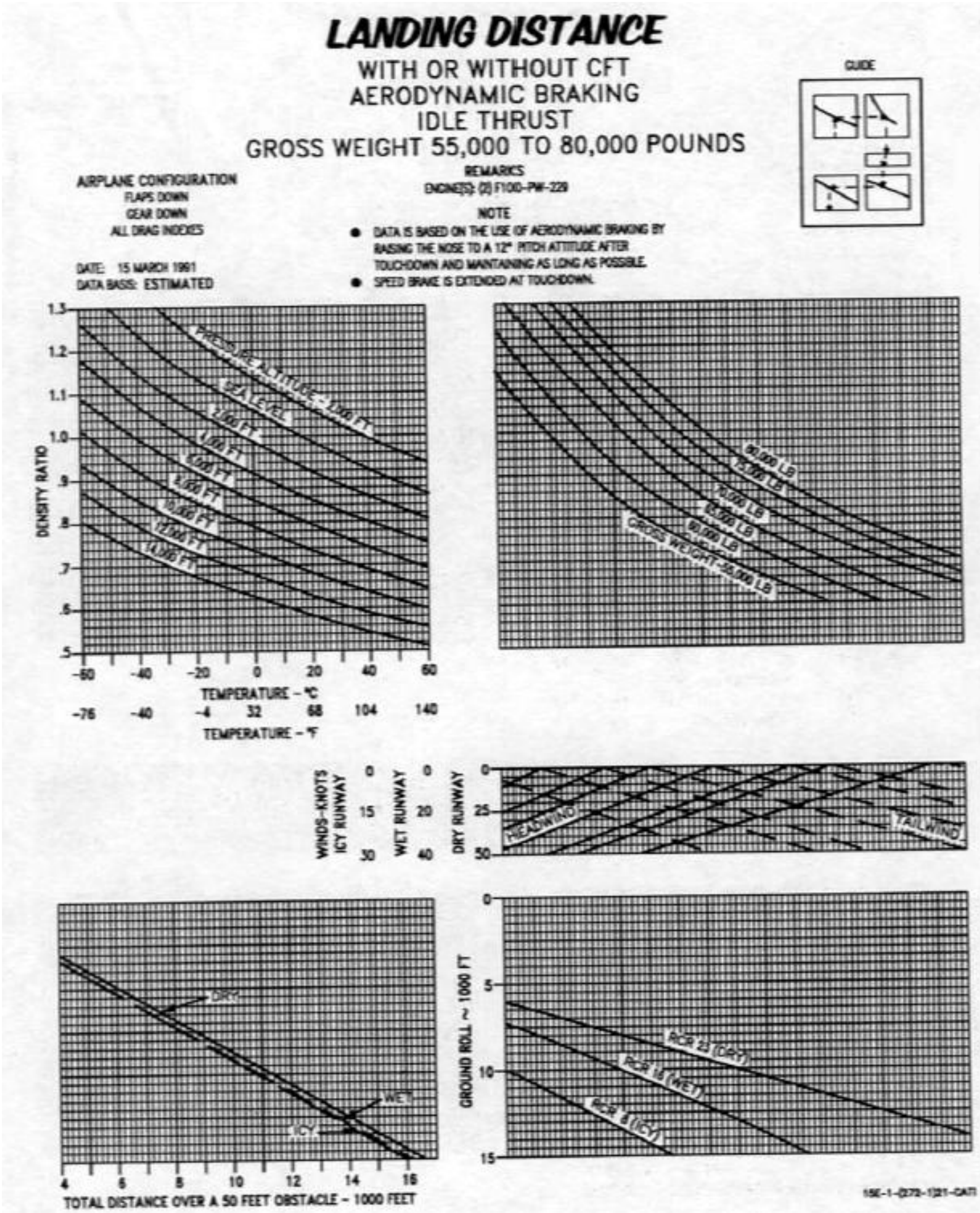

LANDING DISTANCE
WITH OR WITHOUT CFT
AERODYNAMIC BRAKING
IDLE THRUST
GROSS WEIGHT 55,000 TO 80,000 POUNDS
GUIDE
AIRPLANE CONFIGURATION
FLAPS DOWN
GEAR DOWN
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-229
NOTE
DATA IS BASED ON THE USE OF AERODYNAMIC BRAKING BY RAISING THE NOSE TO A 12° PITCH ATTITUDE AFTER TOUCHDOWN AND MAINTAINING AS LONG AS POSSIBLE.
SPEED BRAKE IS EXTENDED AT TOUCHDOWN.
DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED
DENSITY RATIO
PRESSURE ALTITUDE ~ -1,000 FT
SEA LEVEL
TEMPERATURE ~ °C
TEMPERATURE ~ °F
GROSS WEIGHT ~ 55,000 LB
HEADWIND
TAILWIND
WINDS~KNOTS ICY RUNWAY
WET RUNWAY
DRY RUNWAY
DRY
WET
ICY
TOTAL DISTANCE OVER A 50 FEET OBSTACLE ~ 1000 FEET
GROUND ROLL ~ 1000 FT
RCR 23 (DRY)
RCR 12 (WET)
RCR 5 (ICY)

Figure A7-4

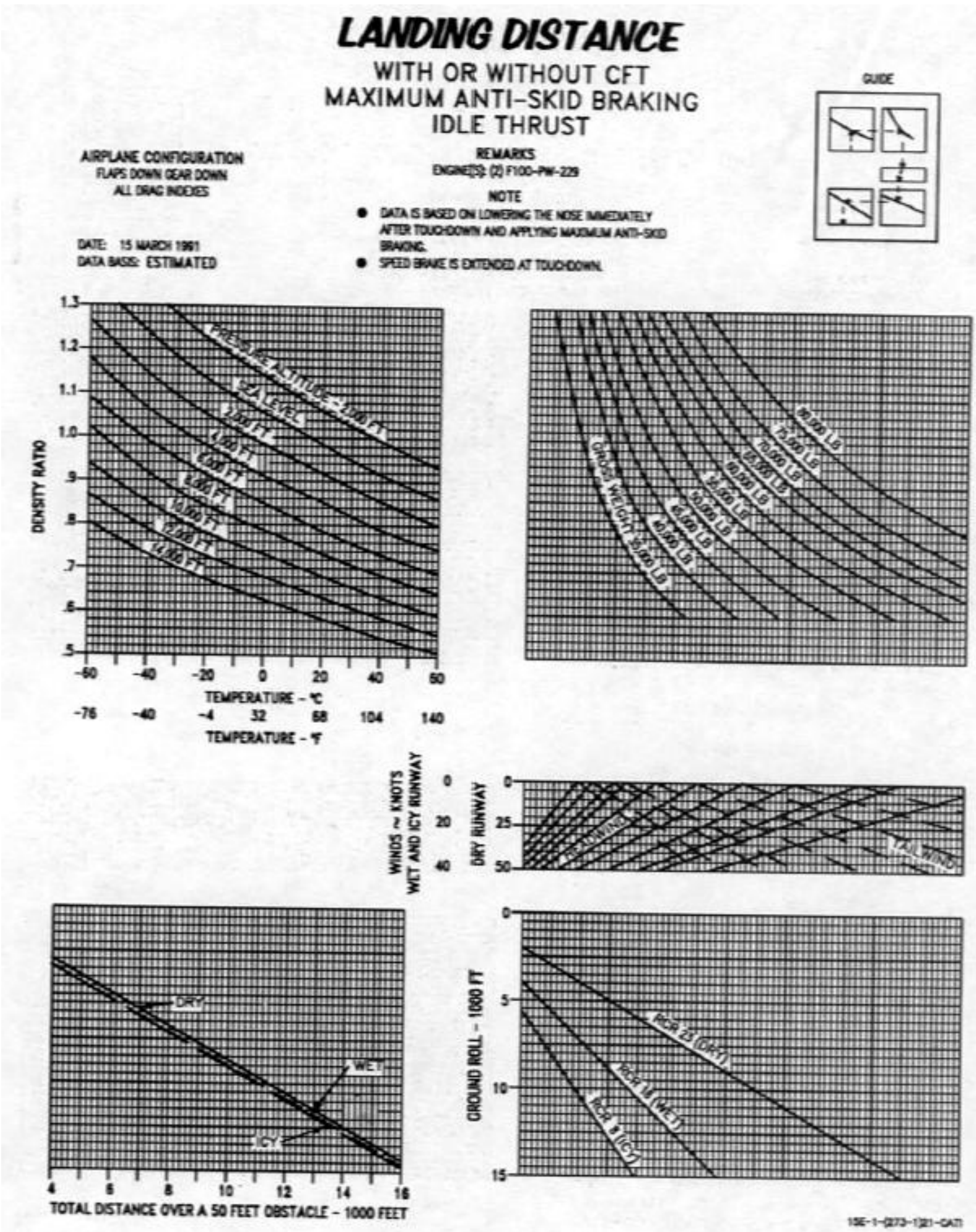

LANDING DISTANCE
WITH OR WITHOUT CFT
MAXIMUM ANTI-SKID BRAKING
IDLE THRUST
GUIDE
AIRPLANE CONFIGURATION
FLAPS DOWN GEAR DOWN
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-229
NOTE
DATA IS BASED ON LOWERING THE NOSE IMMEDIATELY AFTER TOUCHDOWN AND APPLYING MAXIMUM ANTI-SKID BRAKING.
SPEED BRAKE IS EXTENDED AT TOUCHDOWN.
DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED
DENSITY RATIO
PRESSURE ALTITUDE = 2000 FT
SEA LEVEL
TEMPERATURE - °C
TEMPERATURE - °F
GROSS WEIGHT
WINDS ~ KNOTS
WET AND ICY RUNWAY
DRY RUNWAY
TAIL WIND
DRY
WET
ICY
TOTAL DISTANCE OVER A 50 FEET OBSTACLE - 1000 FEET
GROUND ROLL - 1000 FT
RCR 23 (DRY)
RCR 12 (WET)
RCR 5 (ICY)

Figure A7-5

PART 8

COMBAT PERFORMANCE

LEVEL FLIGHT ENVELOPE

These charts (figures A8-1 to A8-14) present the aircraft level flight speed envelope for various configurations and average combat gross weights. Parameters of the envelopes extend from the maximum lift coefficient to maximum thrust Mach number at 0G acceleration throughout the altitude range. For each configuration, envelopes are presented for a standard day and standard day plus/minus 10 C. In addition to the maximum attainable Mach number at 0G acceleration, each standard day curve indicates Mach number at 0.03G acceleration. Figure A8-14 shows the relationship between maximum Mach number and Vmax for a selected configuration.

USE

Enter the chart with the desired combat altitude and project horizontally to intersect the applicable standard day 0.03G and 0G acceleration power curves. From these points, proceed vertically down to read the 0.03G Mach number and the maximum attainable Mach number in level flight.

MAXIMUM SPEED-LEVEL FLIGHT

This chart (figure A8-15 and A8-16) presents level flight maximum speed at military power for drag indexes from 0 to 160 for gross weight with 50% internal fuel remaining. The maximum speeds are listed by Mach/KCAS at 0G acceleration and 0.03G (0.5 knots per second) acceleration for various altitudes. For a given altitude, maximum speeds are provided for standard temperature, and ten degrees above and below standard temperature.

USE

Enter chart at nearest computed drag index and read maximum speeds for 0G and 0.03G accelerations at selected altitude with applicable temperature. For most accurate results, use standard interpolation techniques to determine maximum speeds.

DIVE RECOVERY CHARTS

These charts (figures A8-17, A8-18A Pages 1 to 7, and A8-18B Pages 1 to 4) present the airplane's dive recovery capability for various speeds (subsonic and supersonic), altitudes, and dive angles. The supersonic charts include airplane structural limit curves to determine the maximum dive angle that can be achieved without exceeding the structural limit speed during dive recovery.

USE

Enter the applicable chart with the altitude at the start of the pull-out and project horizontally right to intersect the curve for the Mach number at the start of the pull-out. From this point, project vertically down to intersect the dive angle at the start of pull-out, then horizontally left to read altitude lost during pull-out.

LOW ALTITUDE COMBAT PERFORMANCE CHART

This table (figure A8-19) presents specific fuel flow values (pounds per minute) for maximum thrust operation at constant calibrated airspeeds of 300, 400, 500, 600, and 700 KCAS. The data for altitudes of sea level, 5,000 and 10,000 feet. Fuel flow values are computed for US Standard Day. However, correction factors are given for non-standard day temperatures. The standard day temperature is listed with the altitude. If the actual temperature at a particular altitude differs from the standard day temperature, refer to the TEMP. EFFECTS column to determine the appropriate temperature correction factor.

USE

Enter the table with the desired altitude and calibrated airspeed and project horizontally right to the specific fuel flow column to read specific fuel flow for a standard day. To obtain the specific fuel flow for a non-standard day, multiple the specific fuel flow for a standard day by the non-standard day temperature correction factor obtained from the TEMP. EFFECTS column.

COMBAT FUEL MANAGEMENT CHART

This chart (figure A8-20) presents a relative comparison between engine power setting and fuel usage in pounds per minute. The chart emphasizes the effect of power setting on combat fuel management. Data presented are for engine power settings of a military power, mid-range afterburner and maximum afterburner at altitudes from a sea level to 40,000 feet and airspeeds between Mach 0.8 and Mach 1.1.

USE

Enter the chart at the desired altitude and project horizontally right to the selected Mach/engine power setting. From this point project vertically down to read fuel usage in pounds per minute.

COMBAT FUEL FLOW CHART

These charts (figures A8-21 to A8-25) present a relative comparison between high airspeeds at stabilized level flight and fuel flow in pounds per minute. Data presented are for two non-CFT configurations and seven CFT configurations, based on F100-PW-229 engines.

USE

Enter the desired altitude and project horizontally right to the selected Mach number curve. From this point project vertically down to read the fuel flow in pounds per minute.

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTOR CHARTS

These charts (figures A8-26 to A8-37) present the overload warning systems symmetrical allowable load factor capability for various Mach numbers, altitudes, and airplane gross weights.

USE

Enter the appropriate chart with the desired Mach number and project horizontally to the desired altitude. From this point, descend vertically to applicable gross weight then project horizontally left to read the airplane symmetrical allowable load factor given by OWS. When

CFTs are installed, enter the applicable CFT/Aircraft interface charts based on CFT fuel quantity with the desired Mach number and project horizontally to the desired altitude. From this point, descend vertically to the applicable aircraft gross weight, then project horizontally left to read the CFT/airplane symmetrical allowable load factor. The combined allowable load factor is the less of the two (airplane and CFT/airplane interface).

LEVEL FLIGHT ACCELERATION CHARTS

These charts (figures A8-38 to A8-46) are used to determine the time to accelerate in level flight between two Mach numbers. The curves are presented for various configurations with initial gross weights. Each chart shows maximum and military thrust acceleration at 10,000 feet and maximum thrust acceleration at 40,000 feet. The curves are presented for a standard day and standard day plus/minus 10C. The origin for each curve is 250 KCAS and 0.03G acceleration points are indicated on each curve.

USE

Each applicable configuration chart with initial Mach number and altitude, and project horizontally to appropriate thrust/standard day curve. Project vertically down to initial Mach time reference. Enter chart again with final Mach number, project horizontally to the same curve, and project vertically down to the final Mach time reference. To determine time to accelerate, subtract initial Mach number time reference from final Mach number time reference.

SUSTAINED LEVEL TURNS

These charts (figures A8-47 to A8-55) present the maximum sustained level rate turn and corresponding maximum sustained load factor for a given Mach number and altitude. The charts are based on maximum thrust for various aircraft configurations. Bank angles are shown for corresponding load factors, and a formula is provided to calculate radius of turn.

USE

Enter chart with Mach number and project vertically up to applicable rate of turn and load factor altitude curves. Project horizontally left from rate of turn altitude curve to maximum sustained rate of turn. Project horizontally left from load factor altitude curve to the maximum sustained load factor corresponding to the maximum sustainable turn rate. Project horizontally right from the load factor altitude curve to bank angle corresponding to the maximum sustained load factor.

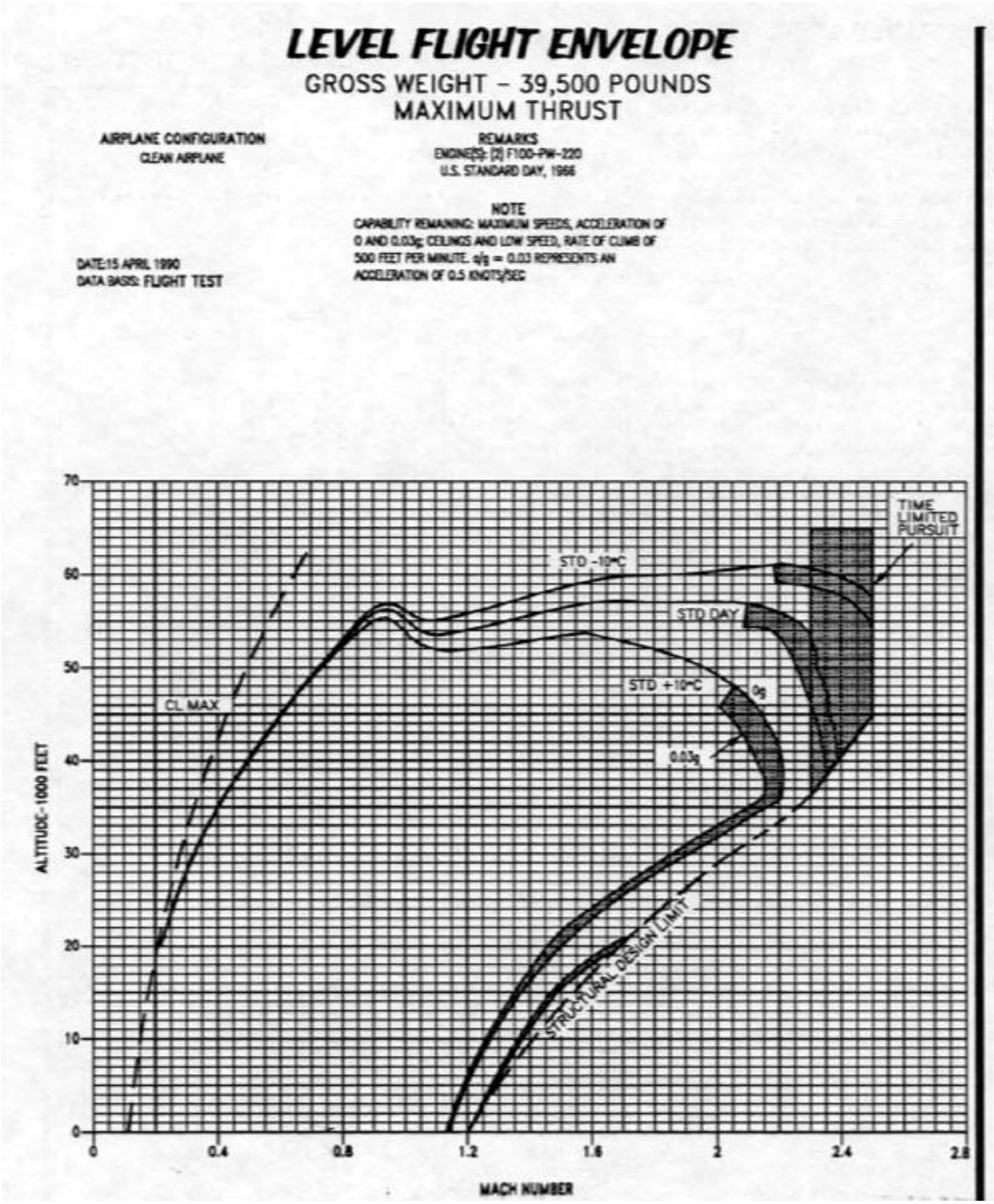

LEVEL FLIGHT ENVELOPE
GROSS WEIGHT – 39,500 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
CLEAN AIRPLANE
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC
DATE:15 APRIL 1990
DATA BASIS: FLIGHT TEST
TIME LIMITED PURSUIT
STD -10°C
STD DAY
STD +10°C
0g
0.03g
CL MAX
STRUCTURAL DESIGN LIMIT
ALTITUDE-1000 FEET
0
10
20
30
40
50
60
70
0.4
0.8
1.2
1.6
2
2.4
2.8
MACH NUMBER

Figure A8-1

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 41,500 POUNDS
MAXIMUM THRUST

AIRPLANE CONFIGURATION
(4)AIM-7

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

DATE:15 APRIL 1990
DATA BASIS: FLIGHT TEST

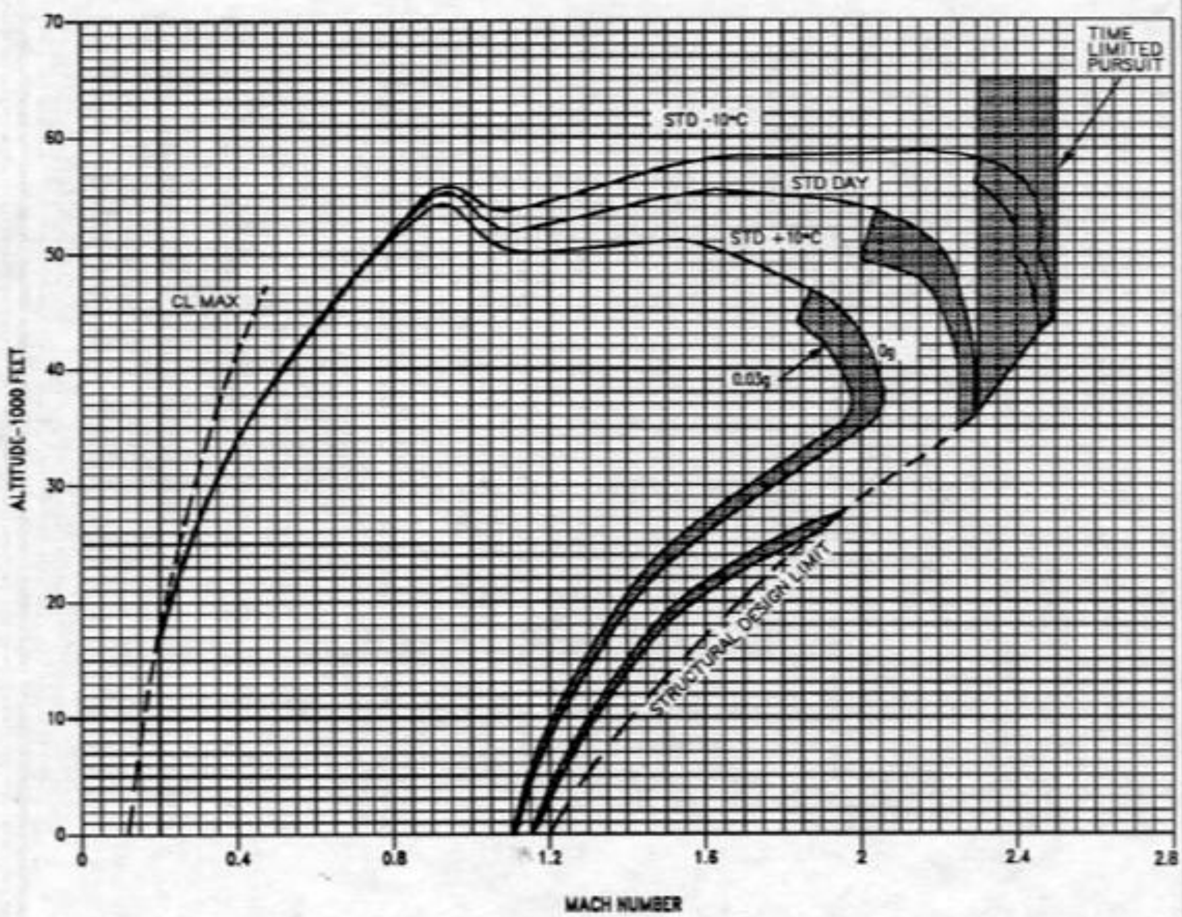


Figure A8-2

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 52,500 POUNDS
MAXIMUM THRUST

AIRPLANE CONFIGURATION
–4CFT, (4)AIM-9, (4)AIM-7

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST

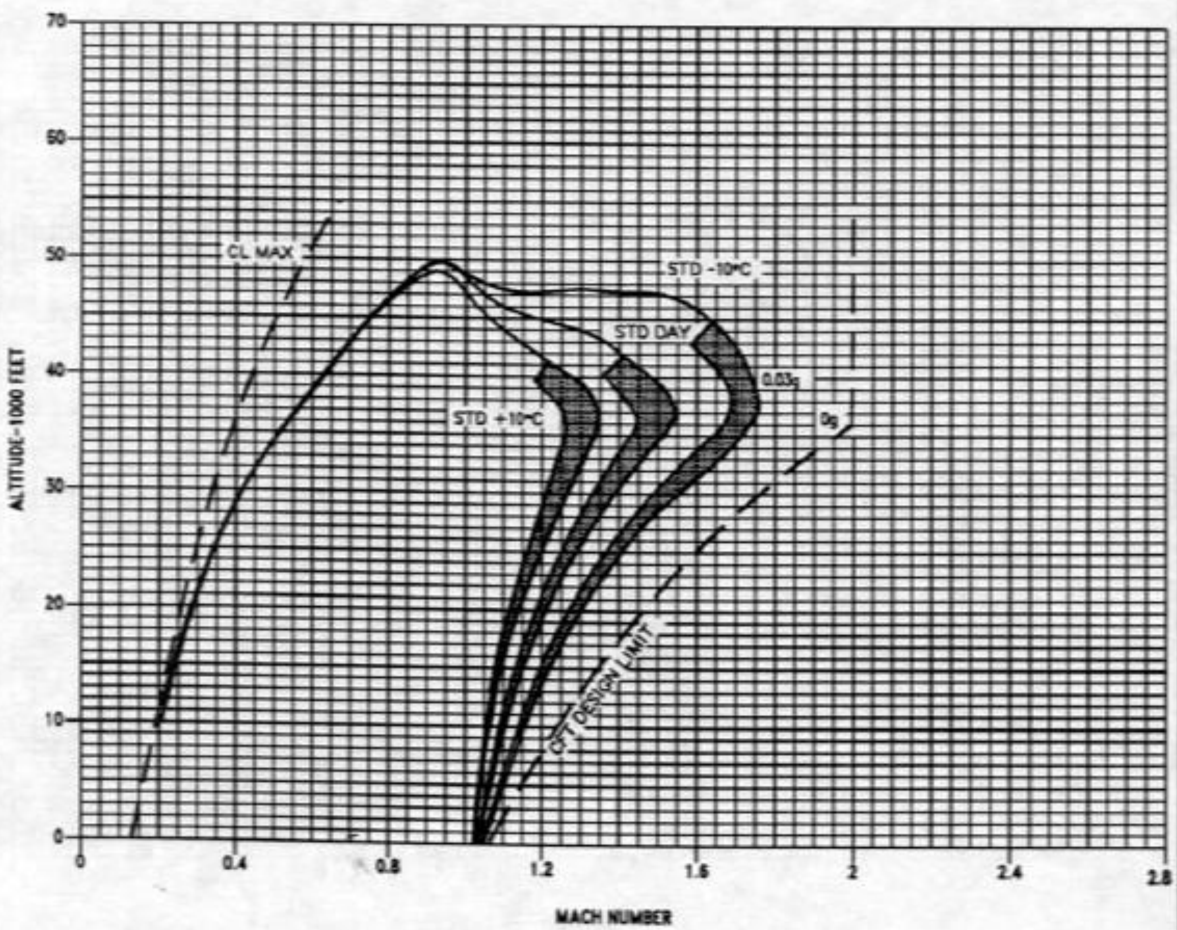


Figure A8-3

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 53,700 POUNDS
MAXIMUM THRUST

AIRPLANE CONFIGURATION
-4CFT, LANTIRN, (4)AIM-9,
(4)AIM-7

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST

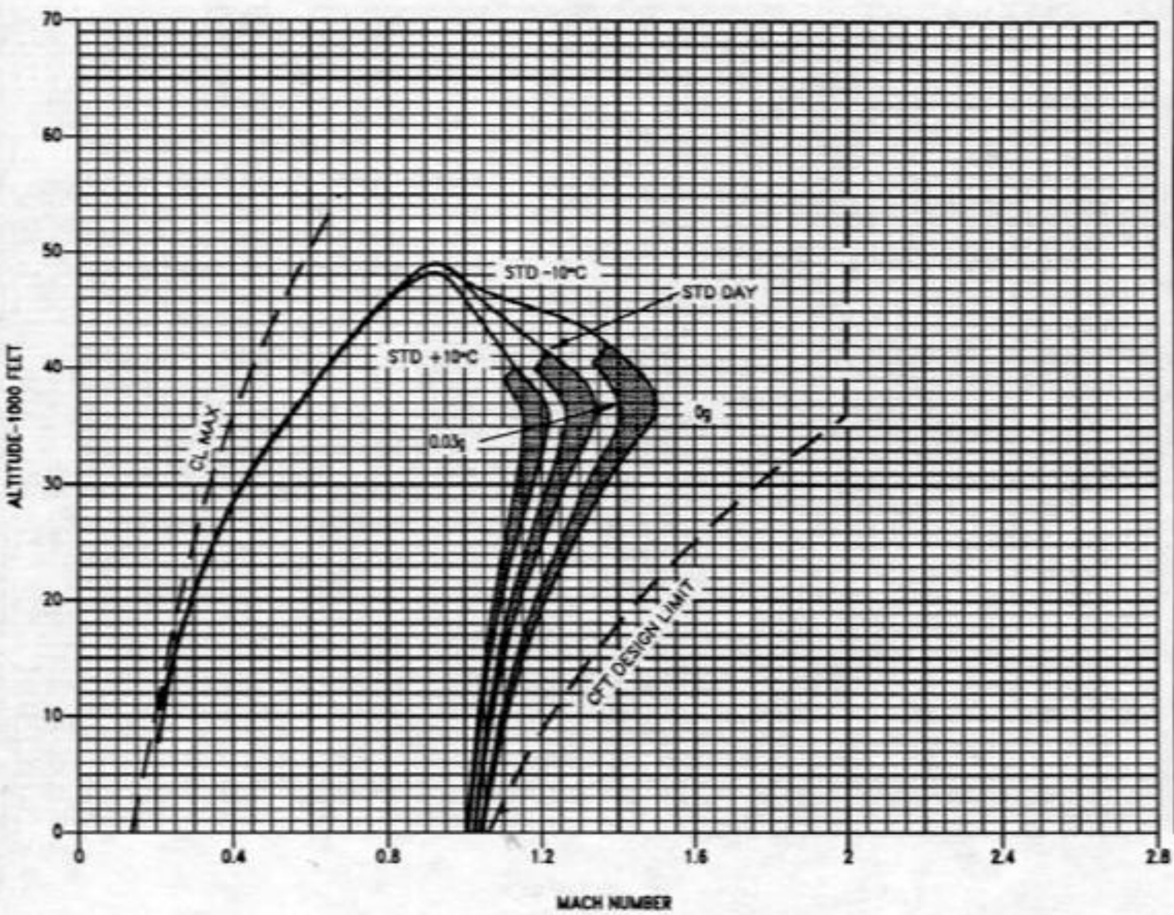


Figure A8-4

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 55,600 POUNDS
MAXIMUM THRUST

AIRPLANE CONFIGURATION
-4CFT, LANTIRN, (4)AIM-9,
(2)MK-84

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g, CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC.

DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST

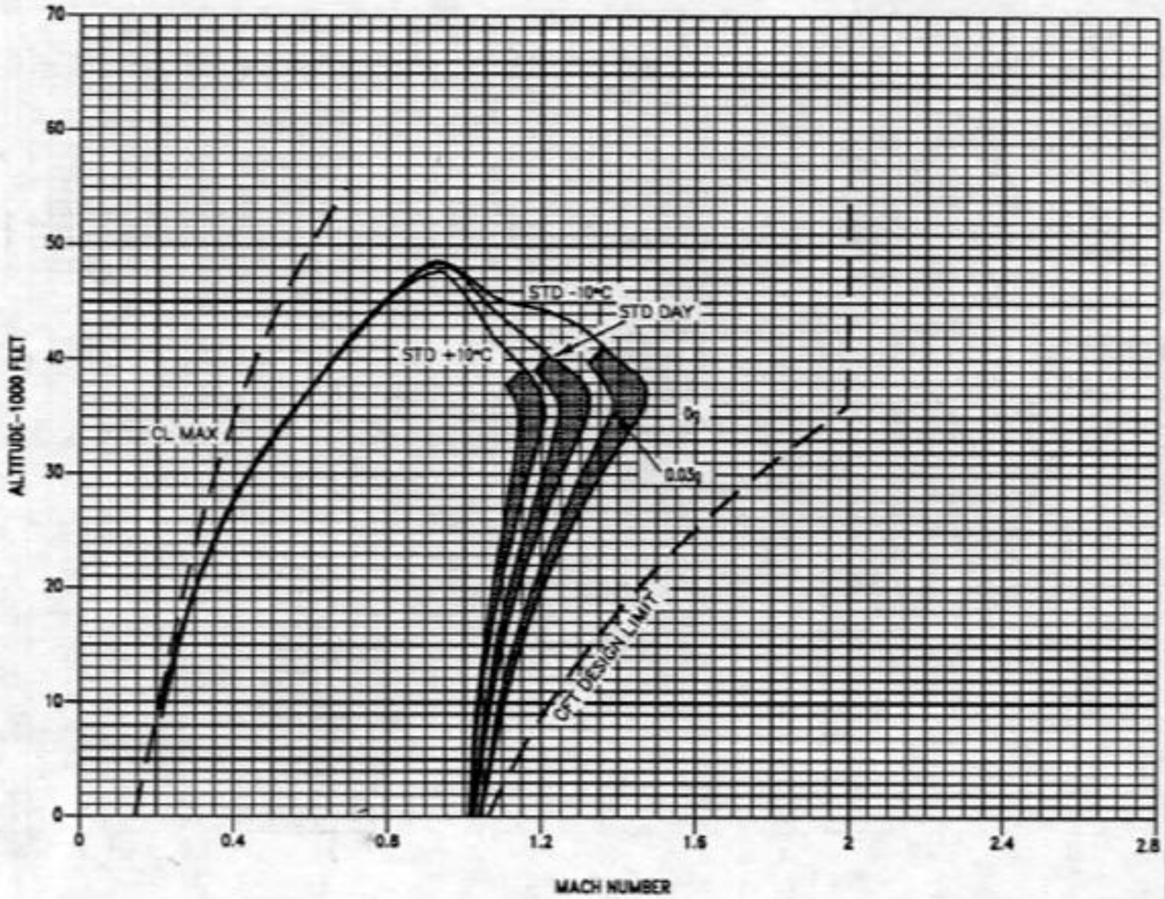


Figure A8-5

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 55,900 POUNDS
MAXIMUM THRUST

AIRPLANE CONFIGURATION
-4CFT, LANTIRN, (4)AIM-9,
(6)CBU-89

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST

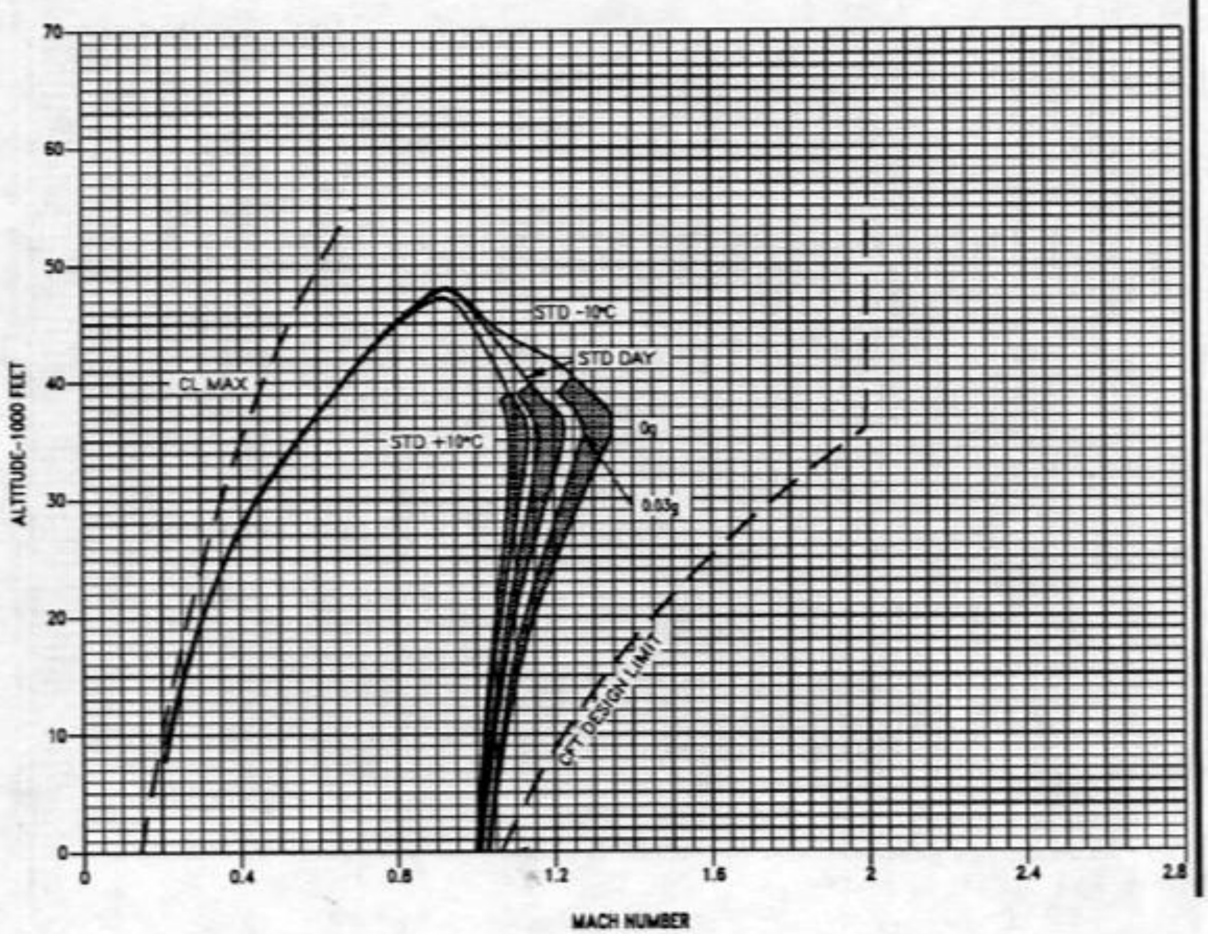


Figure A8-6

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 57,700 POUNDS
MAXIMUM THRUST

AIRPLANE CONFIGURATION
-CFT, LANTIRN, (4)AIM-9,
(12)MK-82

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST

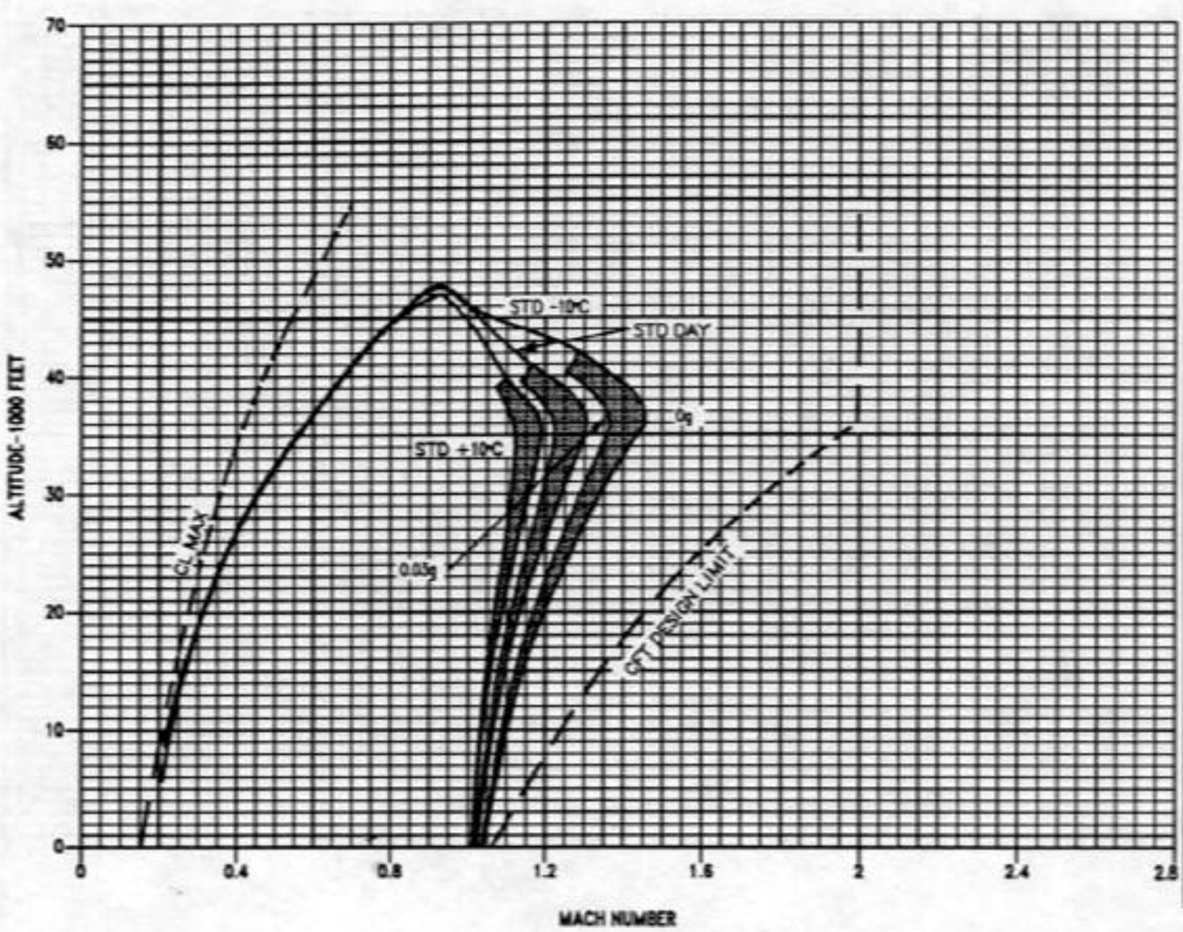


Figure A8-7

Version 1.1 – 9 July 2011

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 59,500 POUNDS
MAXIMUM THRUST

AIRPLANE CONFIGURATION
-4CFT, LANTIRN, (4)AIM-9,
(4)MK-84

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST

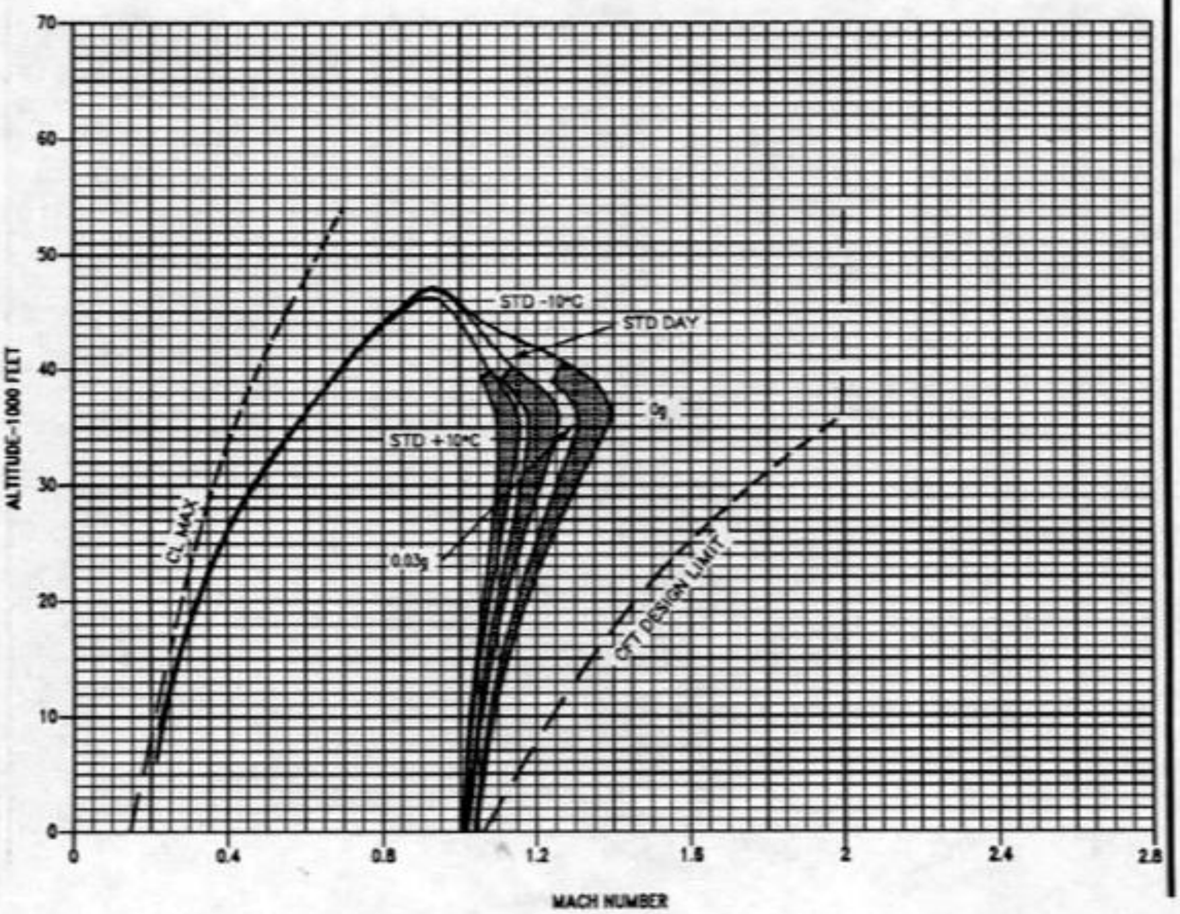


Figure A8-8

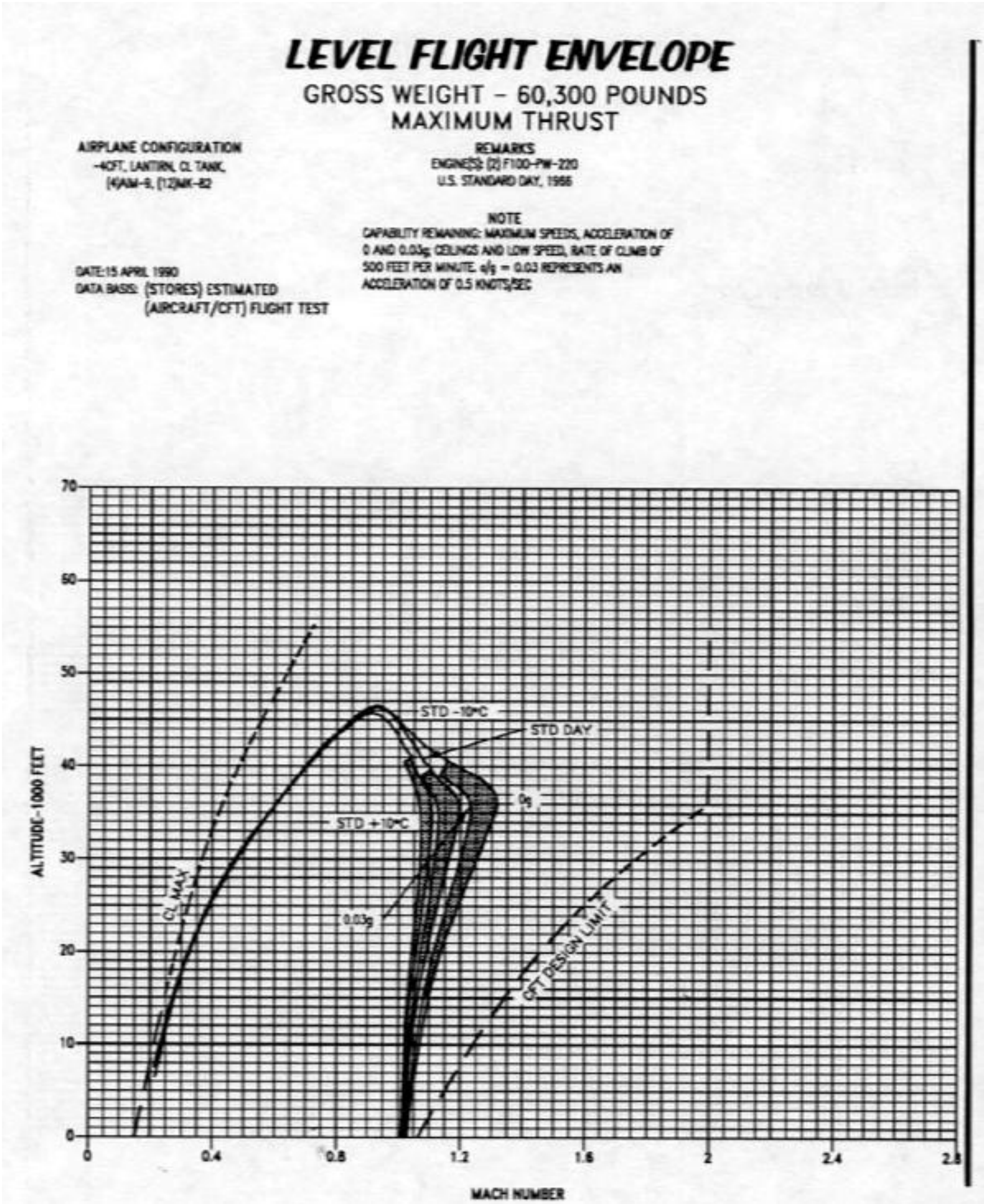

LEVEL FLIGHT ENVELOPE
GROSS WEIGHT – 60,300 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4CFT, LANTIRN, CL TANK,
(4)AIM-9, (12)MK-82
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0 AND 0.03g CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE. a/g = 0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
STD -10°C
STD DAY
0g
STD +10°C
0.03g
CL MAX
CFT DESIGN LIMIT
ALTITUDE - 1000 FEET
70
60
50
40
30
20
10
0
0
0.4
0.8
1.2
1.6
2
2.4
2.8
MACH NUMBER

Figure A8-9

LEVEL FLIGHT ENVELOPE

MILITARY THRUST
GROSS WEIGHT – 40,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE

- CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE.
- CFT DRAG MUST BE INCLUDED WHEN TOTAL DRAG INDEX IS CALCULATED.

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

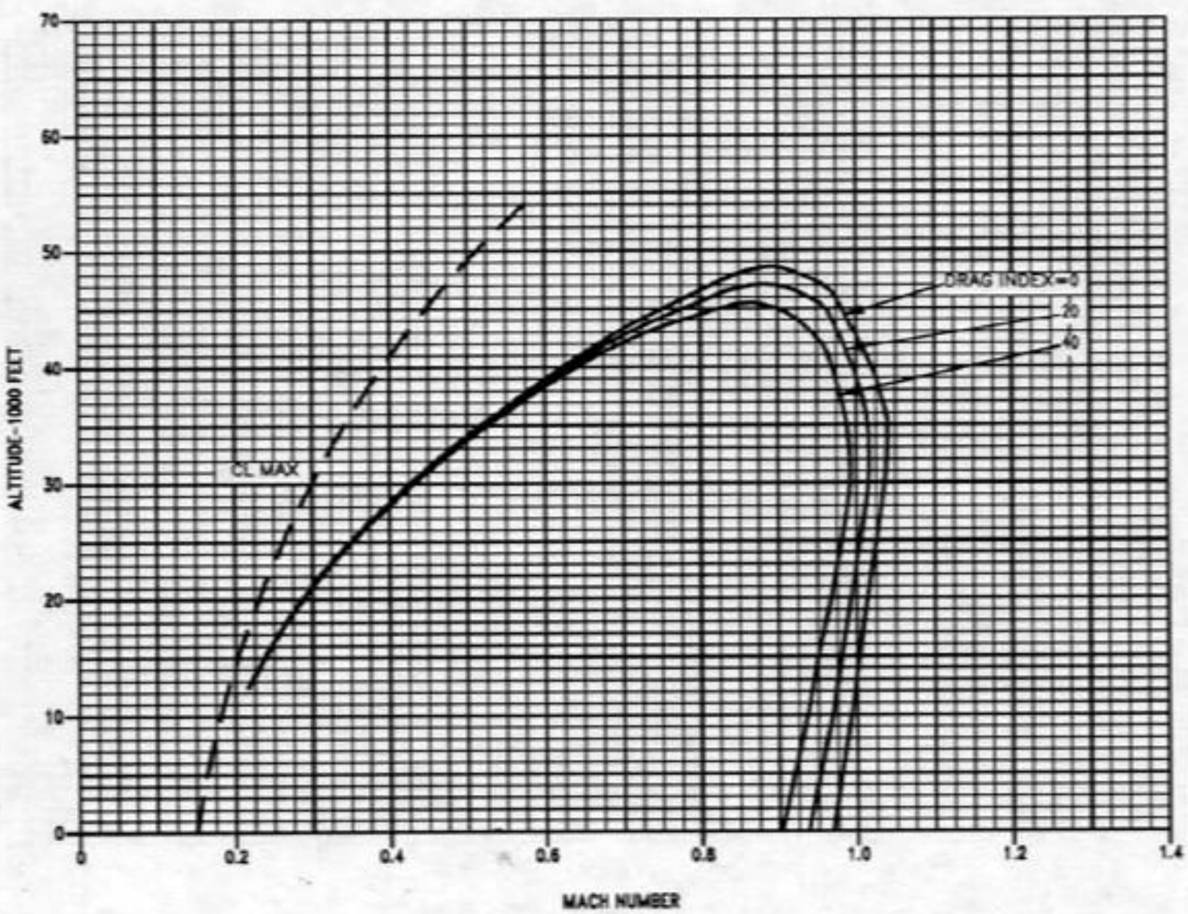


Figure A8-10

LEVEL FLIGHT ENVELOPE

MILITARY THRUST
GROSS WEIGHT – 50,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

NOTES
- CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0g, CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE.
- CFT DRAG MUST BE INCLUDED WHEN TOTAL DRAG INDEX IS CALCULATED.

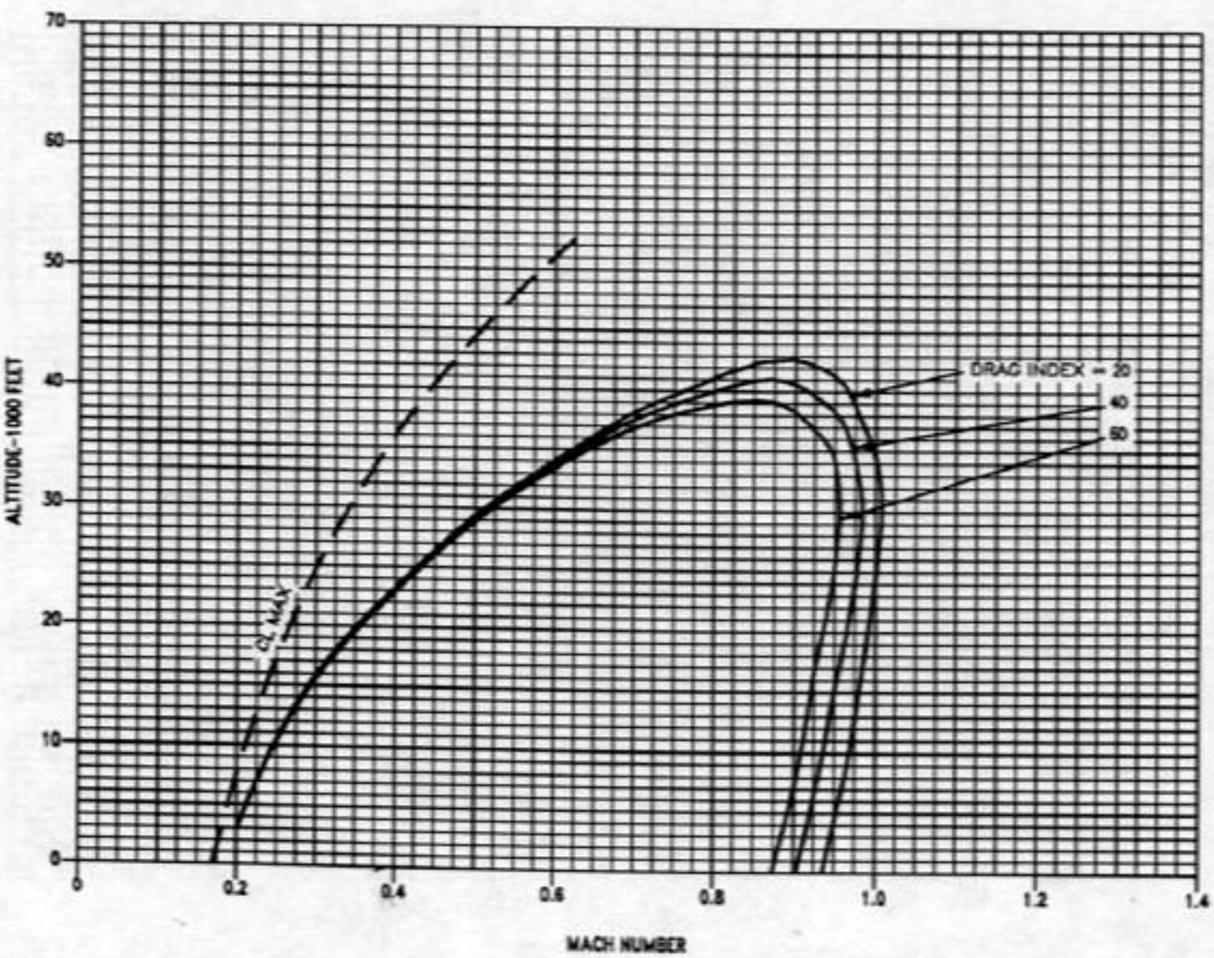


Figure A8-11

LEVEL FLIGHT ENVELOPE

MILITARY THRUST
GROSS WEIGHT – 60,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTES
- CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE.
- CFT DRAG MUST BE INCLUDED WHEN TOTAL DRAG INDEX IS CALCULATED

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

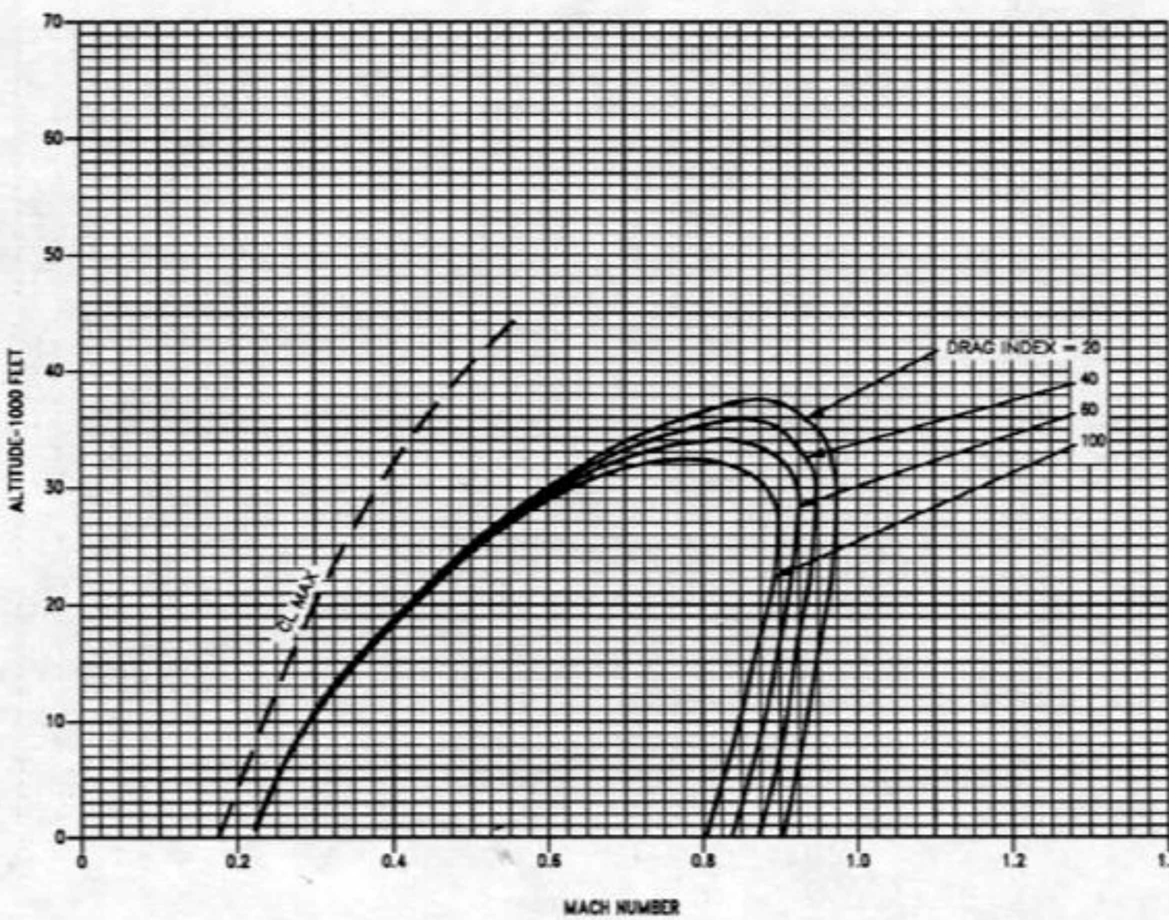


Figure A8-12

LEVEL FLIGHT ENVELOPE

MILITARY THRUST
GROSS WEIGHT – 70,000 POUNDS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTES
- CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE.
- CFT DRAG MUST BE INCLUDED WHEN TOTAL DRAG INDEX IS CALCULATED.

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

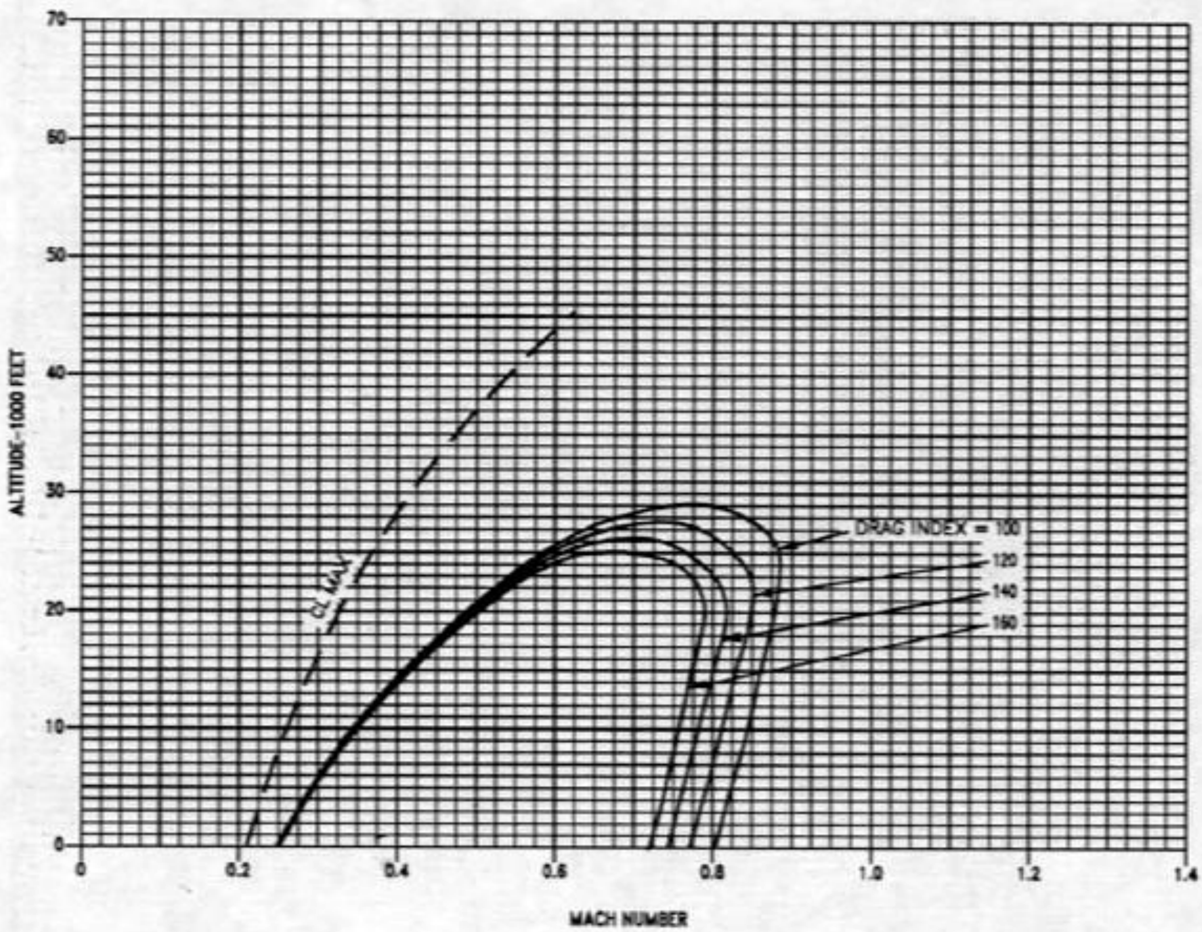


Figure A8-13

LEVEL FLIGHT ENVELOPE

GROSS WEIGHT – 41,500 POUNDS

AIRPLANE CONFIGURATION
(4)AIM-7

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
CAPABILITY REMAINING: MAXIMUM SPEEDS, ACCELERATION OF 0_g; CEILINGS AND LOW SPEED, RATE OF CLIMB OF 500 FEET PER MINUTE.

DATE: 15 APRIL 1990
DATA BASIS: FLIGHT TEST

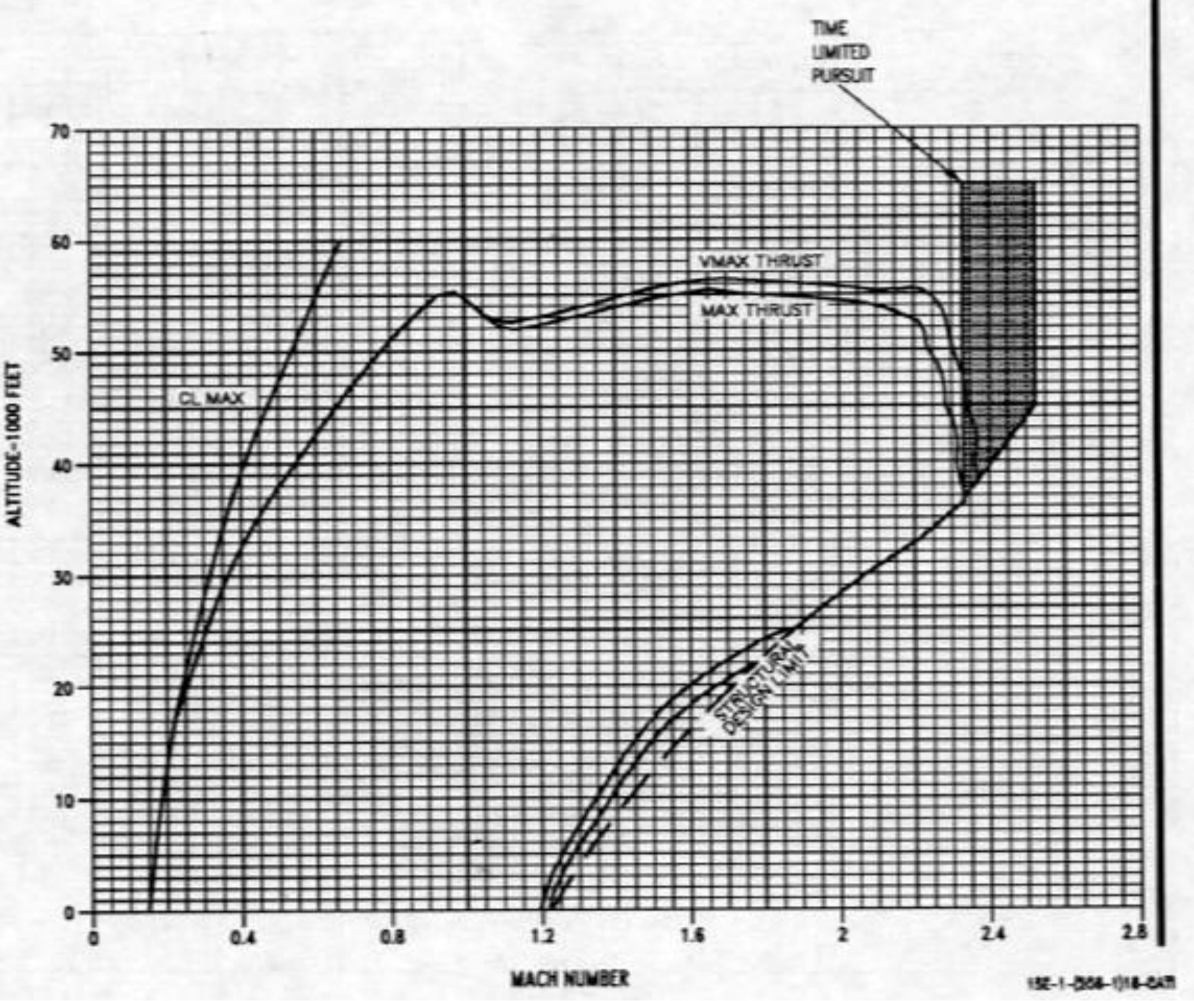


Figure A8-14

MAXIMUM SPEED - LEVEL FLIGHT
MILITARY POWER - DRAG INDEX 0 TO 60

REMARKS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

ENGINES: (2) F100-PW-220
U.S.STANDARD DAY, 1966

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

NOTE

- CFT DRAG MUST BE INCLUDED WHEN TOTAL DRAG INDEX IS CALCULATED
- a/g=0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

		MAXIMUM SPEED MACH/KCAS							
		GROSS WEIGHT – 40,000 POUNDS				GROSS WEIGHT – 50,000 POUNDS			
DRAG INDEX		0	0	20	20	40	40	60	60
ALTITUDE (FT)	TEMP °C	a/g=0.0	a/g=0.03	a/g=0.0	a/g=0.03	a/g=0.0	a/g=0.03	a/g=0.0	a/g=0.03
S.L.	5.0	0.99/651	0.98/648	0.96/633	0.95/629	0.93/612	0.92/606	0.90/594	0.89/586
	15.0	0.97/641	0.96/636	0.93/618	0.93/612	0.90/598	0.89/589	0.87/576	0.86/566
	25.0	0.95/630	0.94/623	0.91/604	0.90/598	0.88/581	0.86/569	0.84/554	0.82/541
5000	-4.9	1.00/610	0.99/607	0.97/596	0.96/591	0.94/576	0.93/569	0.91/559	0.90/553
	5.1	0.98/602	0.98/599	0.95/584	0.94/578	0.92/564	0.91/556	0.89/547	0.88/537
	15.1	0.97/592	0.96/586	0.93/569	0.92/562	0.90/550	0.88/539	0.86/528	0.84/516
10000	-14.8	1.01/570	1.00/567	0.99/558	0.98/554	0.96/541	0.95/534	0.93/524	0.92/517
	-4.8	0.99/562	0.99/558	0.97/548	0.96/542	0.94/529	0.92/521	0.91/513	0.90/505
	5.2	0.98/554	0.97/549	0.95/536	0.94/528	0.92/517	0.90/508	0.89/499	0.86/486
20000	-34.6	1.03/490	1.02/485	1.01/479	1.00/475	0.98/467	0.97/461	0.95/449	0.94/444
	-24.6	1.01/482	1.00/477	0.99/471	0.98/466	0.97/458	0.95/447	0.94/442	0.92/433
	-14.6	1.00/475	1.00/470	0.98/464	0.96/457	0.94/446	0.92/436	0.92/432	0.90/422
30000	-54.4	1.06/412	1.03/404	1.02/401	1.01/393	0.99/385	0.97/375	0.95/368	0.94/361
	-44.4	1.04/407	1.02/400	1.02/397	1.00/391	0.99/383	0.96/374	0.95/368	0.91/312
	-34.4	1.02/398	1.00/392	1.00/389	0.98/382	0.97/375	0.94/364	0.94/364	0.91/352
35000	-64.3	1.04/368	1.02/358	1.02/356	0.99/347	0.97/339	0.94/327	0.95/330	0.91/312
	-54.3	1.04/366	1.02/357	1.02/356	0.99/348	0.97/339	0.94/328	0.95/330	0.91/312
	-44.3	1.02/360	1.01/353	1.00/352	0.98/344	0.97/337	0.94.326	0.95/329	0.90/312
40000	-66.5	1.02/320	0.99/309	1.00/311	0.97/300	0.95/295	—	0.90/278	—
	-56.5	1.02/319	0.99/309	1.00/311	0.97/300	0.95/295	—	0.91/278	—
	-46.5	1.01/315	0.98/306	0.99/307	0.96/298	0.94/292	—	0.90/278	—

Figure A8-15

MAXIMUM SPEED - LEVEL FLIGHT

MILITARY POWER - DRAG INDEX 80 TO 160

REMARKS

AIRPLANE CONFIGURATION
INDIVIDUAL DRAG INDEXES

ENGINES: (2) F100-PW-220
U.S.STANDARD DAY, 1966

DATE: 15 JUNE 1988
DATA BASIS: **ESTIMATED**

NOTE

- CFT DRAG MUST BE INCLUDED WHEN TOTAL DRAG INDEX IS CALCULATED
- a/g=0.03 REPRESENTS AN ACCELERATION OF 0.5 KNOTS/SEC

		MAXIMUM SPEED MACH/KCAS									
		GROSS WEIGHT—60,000 POUNDS				GROSS WEIGHT—70,000 POUNDS					
DRAG INDEX		80	80	100	100	120	120	140	140	160	160
ALTITUDE (FT)	TEMP °C	a/g=0.0	a/g=0.03	a/g=0.0	a/g=0.03	a/g=0.0	a/g=0.03	a/g=0.0	a/g=0.03	a/g=0.0	a/g=0.03
S.L.	5.0	0.87/573	0.85/561	0.83/551	0.81/538	0.80/531	0.78/514	0.77/512	0.75/496	0.75/495	0.73/480
	15.0	0.84/553	0.81/539	0.80/532	0.78/517	0.77/510	0.75/493	0.74/492	0.72/476	0.72/477	0.70/460
	25.0	0.80/529	0.77/512	0.77/507	0.74/491	0.74/487	0.71/468	0.71/470	0.68/452	0.69/455	0.66/436
5000	-4.9	0.89/543	0.87/531	0.86/524	0.84/511	0.83/506	0.80/488	0.80/488	0.77/469	0.77/470	0.74/453
	5.1	0.86/526	0.84/510	0.83/505	0.80/489	0.79/484	0.76/464	0.76/466	0.73/447	0.74/450	0.71/431
	15.1	0.83/506	0.80/489	0.80/486	0.77/467	0.76/463	0.73/442	0.73/446	0.70/426	0.71/431	0.67/410
10000	-14.8	0.91/510	0.89/499	0.88/494	0.85/480	0.85/475	0.81/455	0.82/457	0.78/438	0.79/441	0.75/422
	-4.8	0.88/496	0.86/481	0.85/477	0.82/459	0.81/455	0.77/433	0.78/438	0.75/417	0.76/423	0.72/402
	5.2	0.85/478	0.82/457	0.81/456	0.78/436	0.78/435	0.73/410	0.75/418	0.71/395	0.72/403	0.68/380
20000	-34.6	0.93/439	0.91/430	0.91/429	0.89/417	0.88/414	0.83/389	0.85/399	0.79/370	0.82/383	0.76/360
	-24.6	0.91/429	0.88/415	0.89/417	0.85/399	0.85/399	0.80/373	0.82/384	0.76/353	0.79/370	0.72/335
	-14.6	0.89/417	0.85/397	0.86.401	0.81/378	0.81.379	0.74/345	0.78/363	0.71/327	0.75/348	0.67/309
30000	-54.4	0.93/369	0.87/331	0.90/347	—	—	—	—	—	—	—
	-44.4	0.93/369	0.87/332	0.90/348	—	—	—	—	—	—	—
	-34.4	0.91/360	0.83/317	0.88/336	—	—	—	—	—	—	—
35000	-64.3	0.88/304	—	—	—	—	—	—	—	—	—
	-54.3	0.89/305	—	—	—	—	—	—	—	—	—
	-44.3	0.89/304	—	—	—	—	—	—	—	—	—
40000	-66.5	—	—	—	—	—	—	—	—	—	—
	-56.5	—	—	—	—	—	—	—	—	—	—
	-46.5	—	—	—	—	—	—	—	—	—	—

Figure A8-16

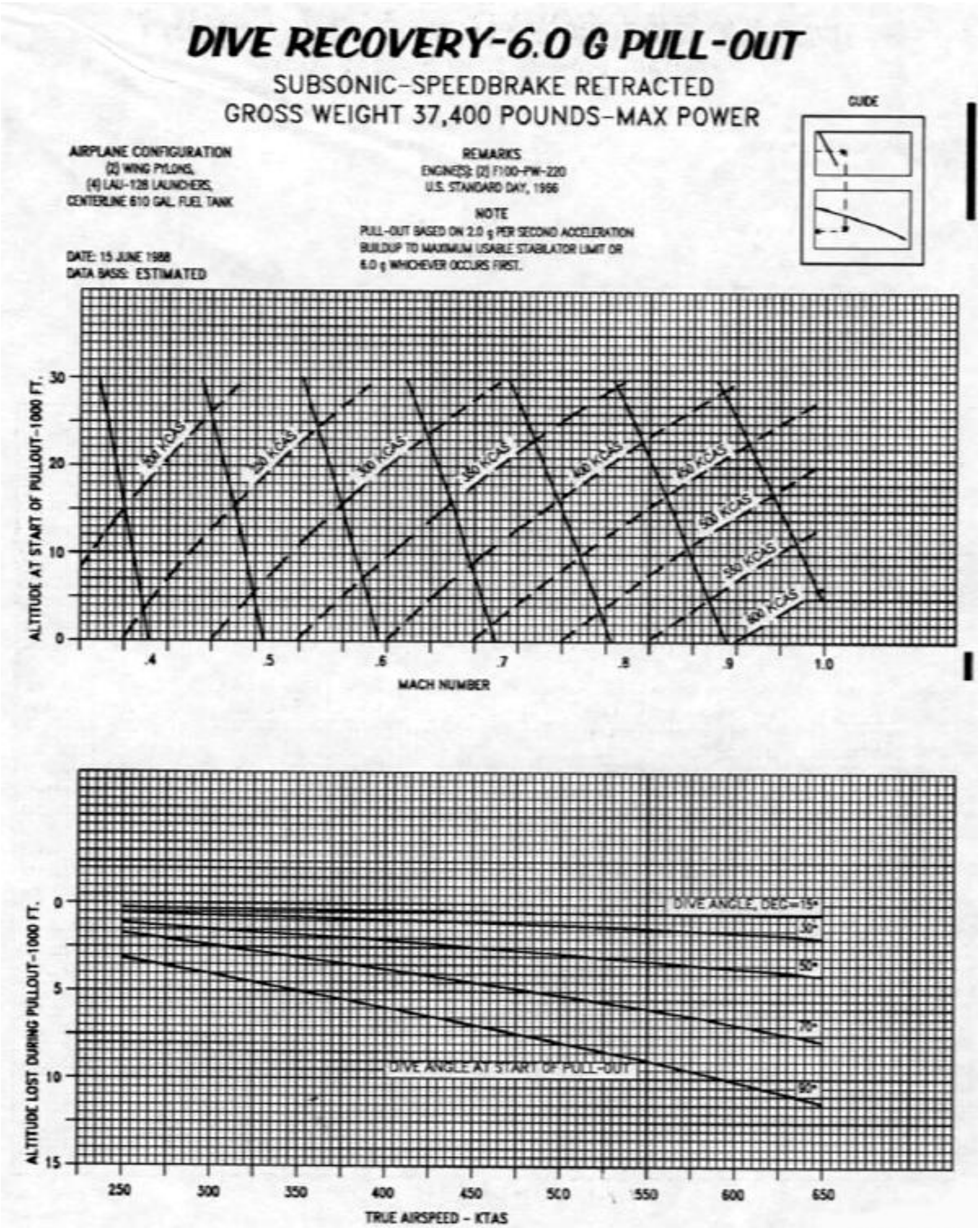

DIVE RECOVERY-6.0 G PULL-OUT
SUBSONIC-SPEEDBRAKE RETRACTED
GROSS WEIGHT 37,400 POUNDS-MAX POWER
GUIDE
AIRPLANE CONFIGURATION
(2) WING PYLONS,
(4) LAU-128 LAUNCHERS,
CENTERLINE 610 GAL FUEL TANK
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
NOTE
PULL-OUT BASED ON 2.0 g PER SECOND ACCELERATION BUILDUP TO MAXIMUM USABLE STABILATOR LIMIT OR 6.0 g WHICHEVER OCCURS FIRST.
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
ALTITUDE AT START OF PULLOUT-1000 FT.
300 KCAS
350 KCAS
400 KCAS
450 KCAS
500 KCAS
550 KCAS
600 KCAS
MACH NUMBER
ALTITUDE LOST DURING PULLOUT-1000 FT.
DIVE ANGLE, DEG=15°
30°
50°
70°
90°
DIVE ANGLE AT START OF PULL-OUT
TRUE AIRSPEED - KTAS

Figure A8-17

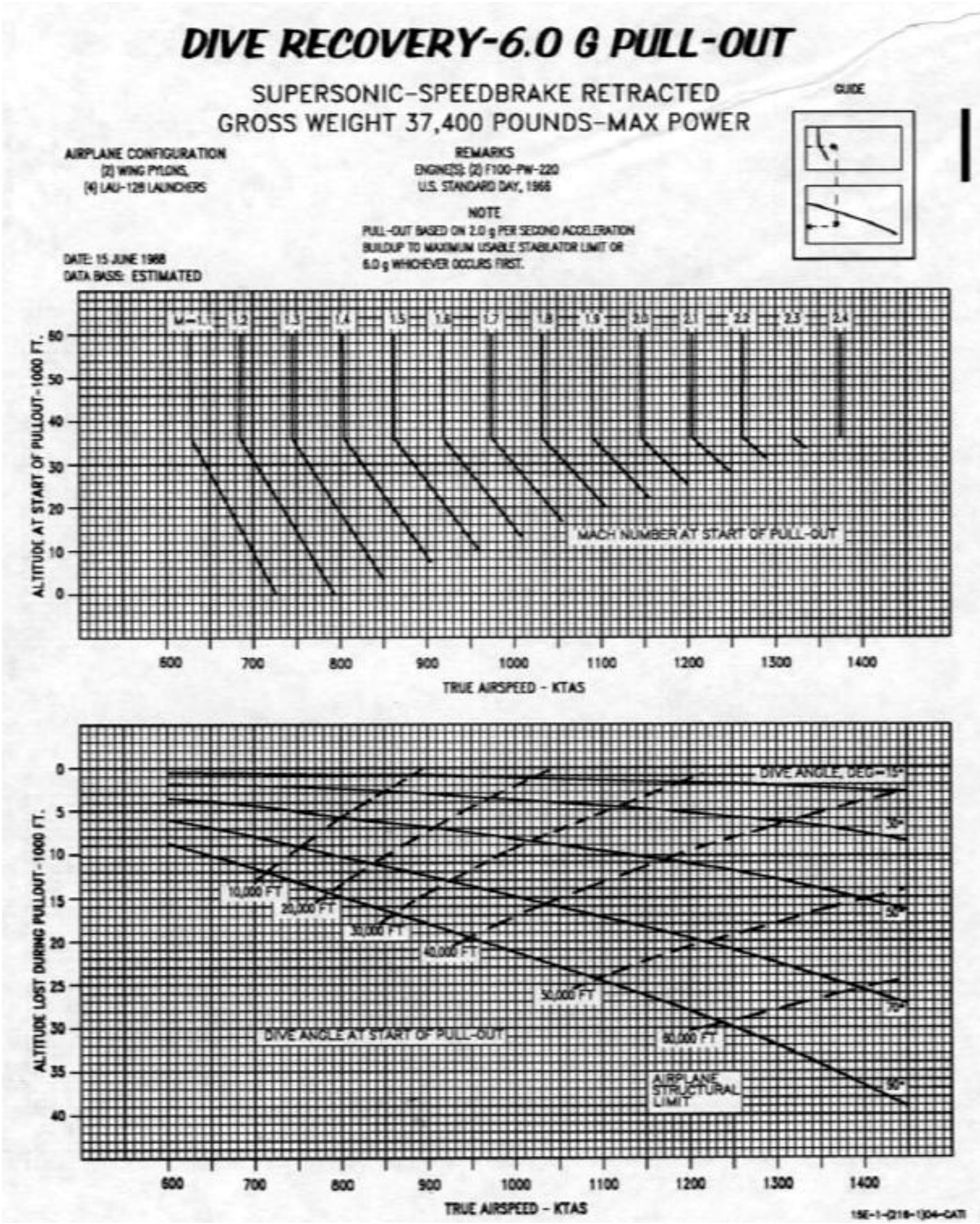


Figure A8-18A Page 1 of 7

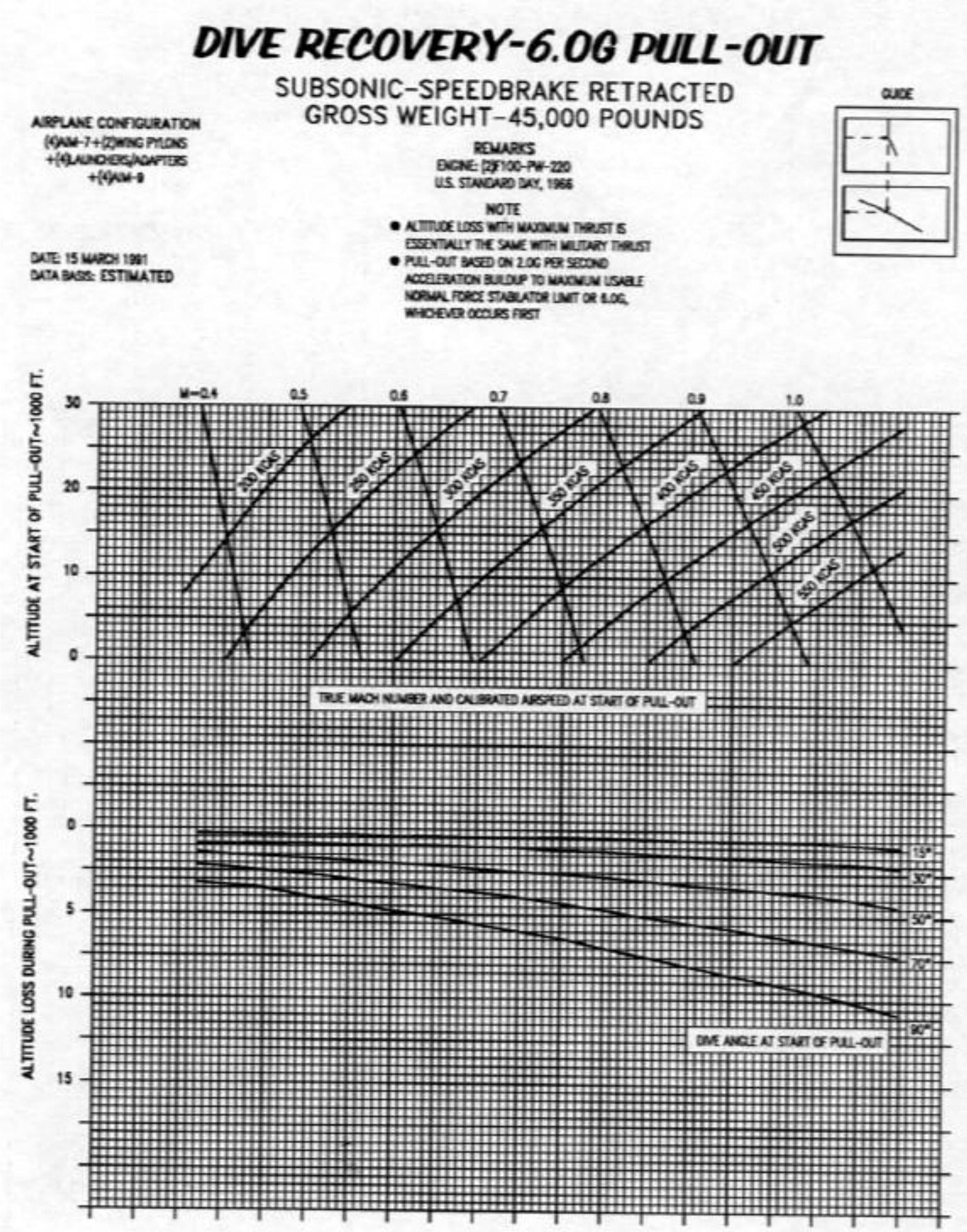


Figure A8-18A Page 2 of 7

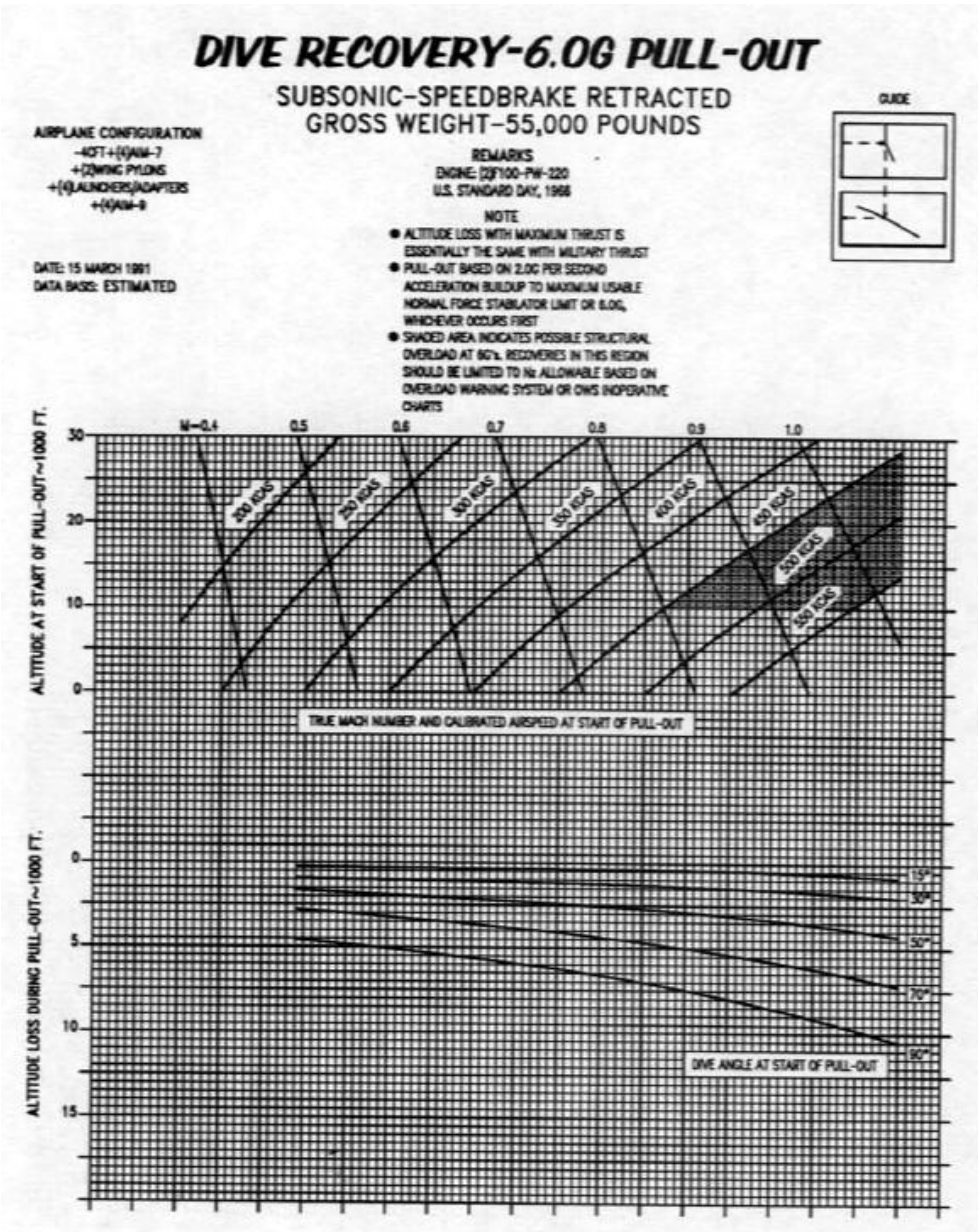


Figure A8-18A Page 3 of 7

DIVE RECOVERY-6.0G PULL-OUT

SUPERSONIC-SPEEDBRAKE RETRACTED
GROSS WEIGHT-55,000 POUNDS

AIRPLANE CONFIGURATION
-4CFT+(4)AIM-7
+(2)WING PYLONS
+(4)LAUNCHERS/ADAPTERS
+(4)AIM-9

DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED

REMARKS
ENGINE: (2)F100-PW-220
U.S. STANDARD DAY, 1966

NOTE
- ALTITUDE LOSS WITH MAXIMUM THRUST IS ESSENTIALLY THE SAME WITH MILITARY THRUST
- PULL-OUT BASED ON 2.0G PER SECOND ACCELERATION BUILDUP TO MAXIMUM USABLE NORMAL FORCE STABILATOR LIMIT OR 6.0G, WHICHEVER OCCURS FIRST
- SHADED AREA INDICATES POSSIBLE STRUCTURAL OVERLOAD AT 9G's. RECOVERIES IN THIS REGION SHOULD BE LIMITED TO Nz ALLOWABLE BASED ON OVERLOAD WARNING SYSTEM OR OWS INOPERATIVE CHARTS

GUIDE

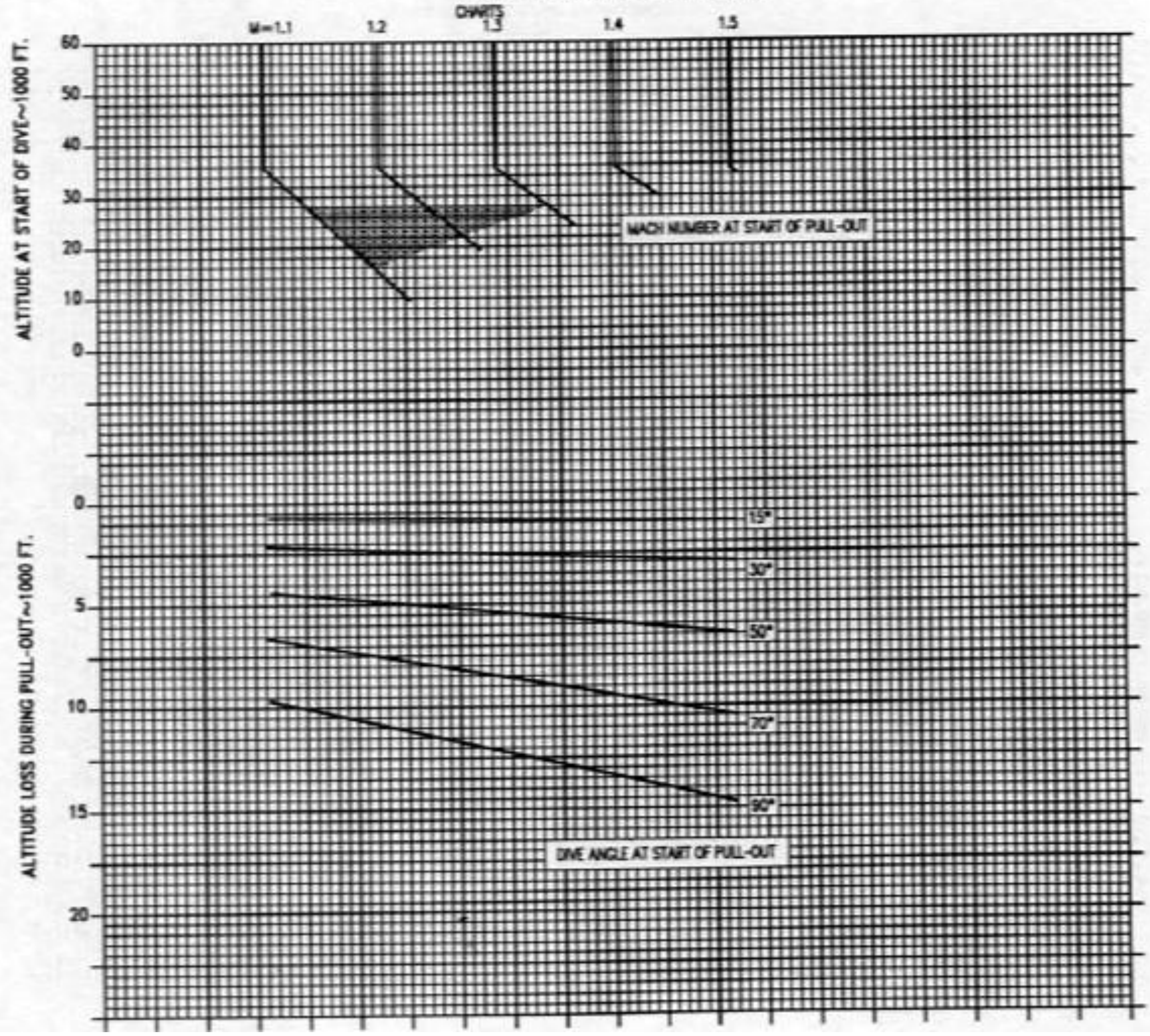
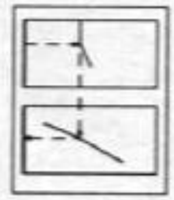


Figure A8-18A Page 4 of 7

DIVE RECOVERY-6.0G PULL-OUT

SUBSONIC-SPEEDBRAKE RETRACTED
GROSS WEIGHT-65,000 POUNDS

GUIDE



AIRPLANE CONFIGURATION
-4CFT+LANTIRN PODS
+(12)MK-82+(2)WING PYLONS
+(4)LAUNCHERS/ADAPTERS
+(4)AIM-9

DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED

REMARKS
ENGINE: (2)F100-PW-220
U.S. STANDARD DAY, 1966

NOTE

- ALTITUDE LOSS WITH MAXIMUM THRUST IS ESSENTIALLY THE SAME WITH MILITARY THRUST
- PULL-OUT BASED ON 2.0G PER SECOND ACCELERATION BUILDUP TO MAXIMUM USABLE NORMAL FORCE STABILATOR LIMIT OR 6.0G, WHICHEVER OCCURS FIRST
- SHADED AREA INDICATES POSSIBLE STRUCTURAL OVERLOAD AT 66%. RECOVERIES IN THIS REGION SHOULD BE LIMITED TO Nz ALLOWABLE BASED ON OVERLOAD WARNING SYSTEM OR OWS INOPERATIVE CHARTS

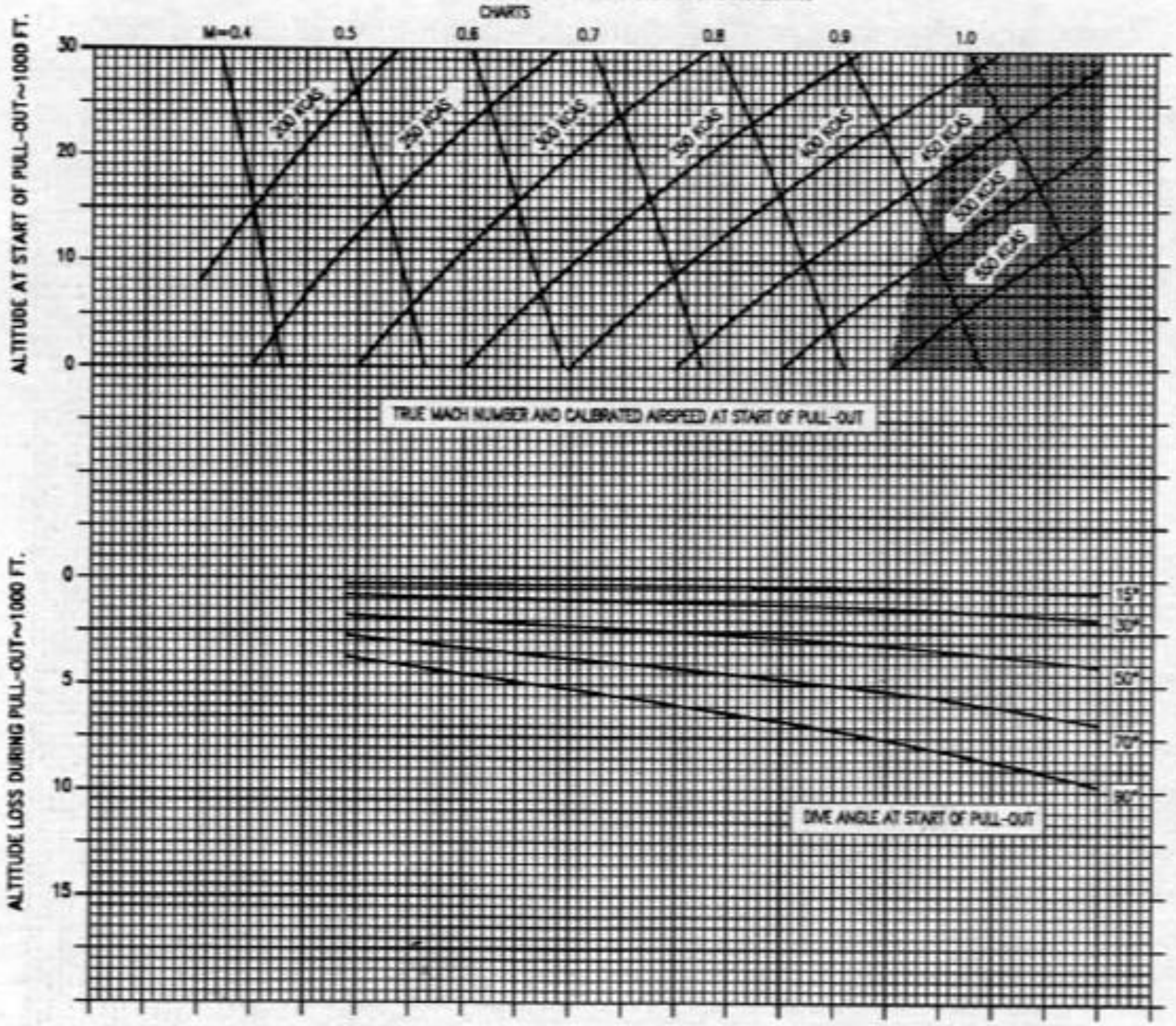


Figure A8-18A Page 5 of 7

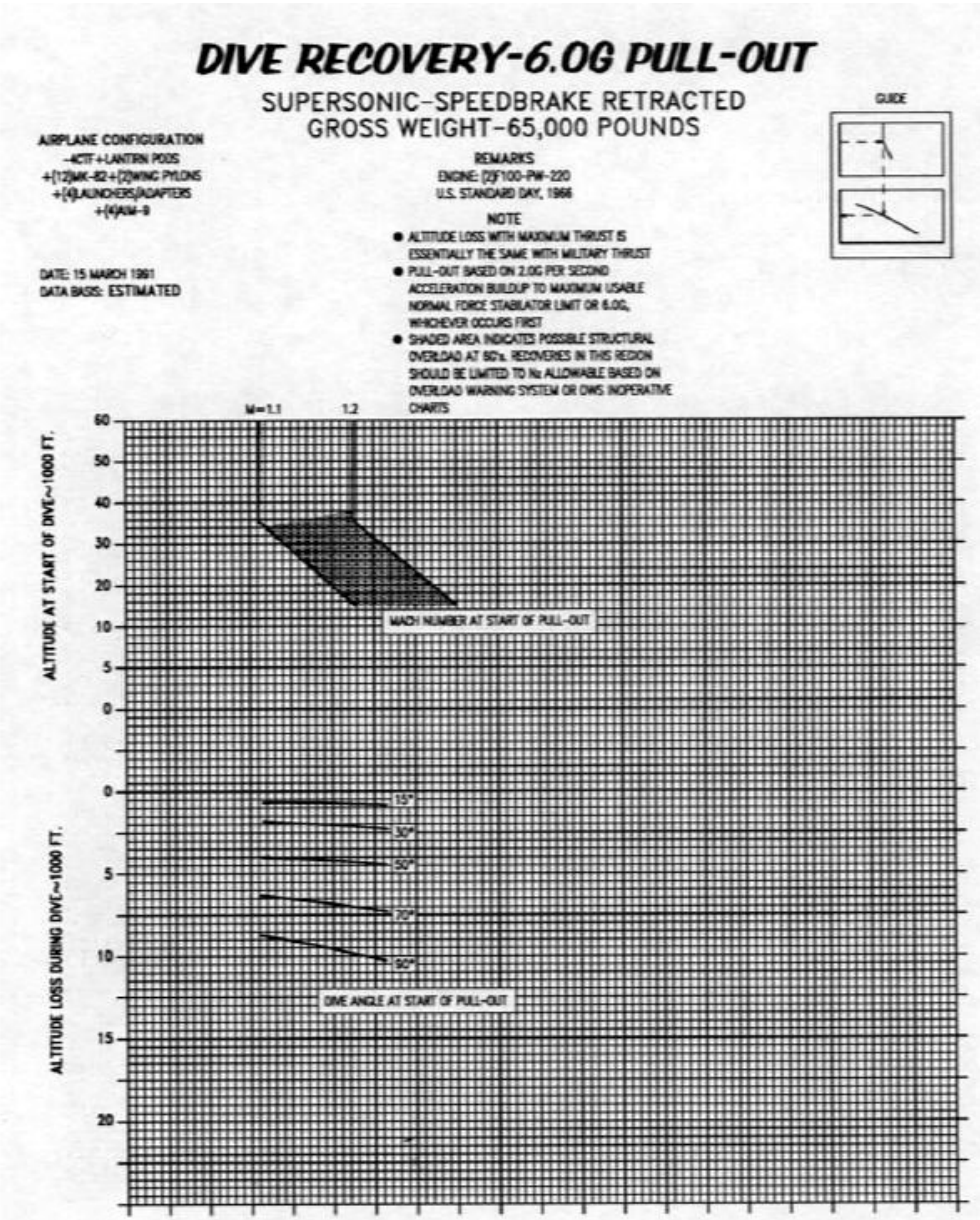
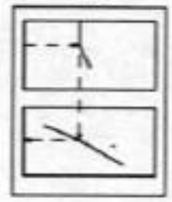


Figure A8-18A Page 6 of 7

DIVE RECOVERY-6.0G PULL-OUT

SUBSONIC–SPEEDBRAKE RETRACTED
GROSS WEIGHT–70,000 POUNDS

GUIDE



AIRPLANE CONFIGURATION
-4CFT+LANTIRN PODS
+(12)MK-82+(2)WING PYLONS
+(4)LAUNCHERS/ADAPTERS
+(4)AIM-9+CENTERLINE PYLON/TANK

DATE: 15 MARCH 1991
DATA BASIS: ESTIMATED

REMARKS
ENGINE: (2)F100-PW-220
U.S. STANDARD DAY, 1966

NOTE

- ALTITUDE LOSS WITH MAXIMUM THRUST IS ESSENTIALLY THE SAME WITH MILITARY THRUST
- PULL-OUT BASED ON 2.0G PER SECOND ACCELERATION BUILDUP TO MAXIMUM USABLE NORMAL FORCE STABILATOR LIMIT OR 6.0G, WHICHEVER OCCURS FIRST
- SHADED AREA INDICATES POSSIBLE STRUCTURAL OVERLOAD AT 6G's. RECOVERIES IN THIS REGION SHOULD BE LIMITED TO Nz ALLOWABLE BASED ON OVERLOAD WARNING SYSTEM OR OWS INOPERATIVE CHARTS

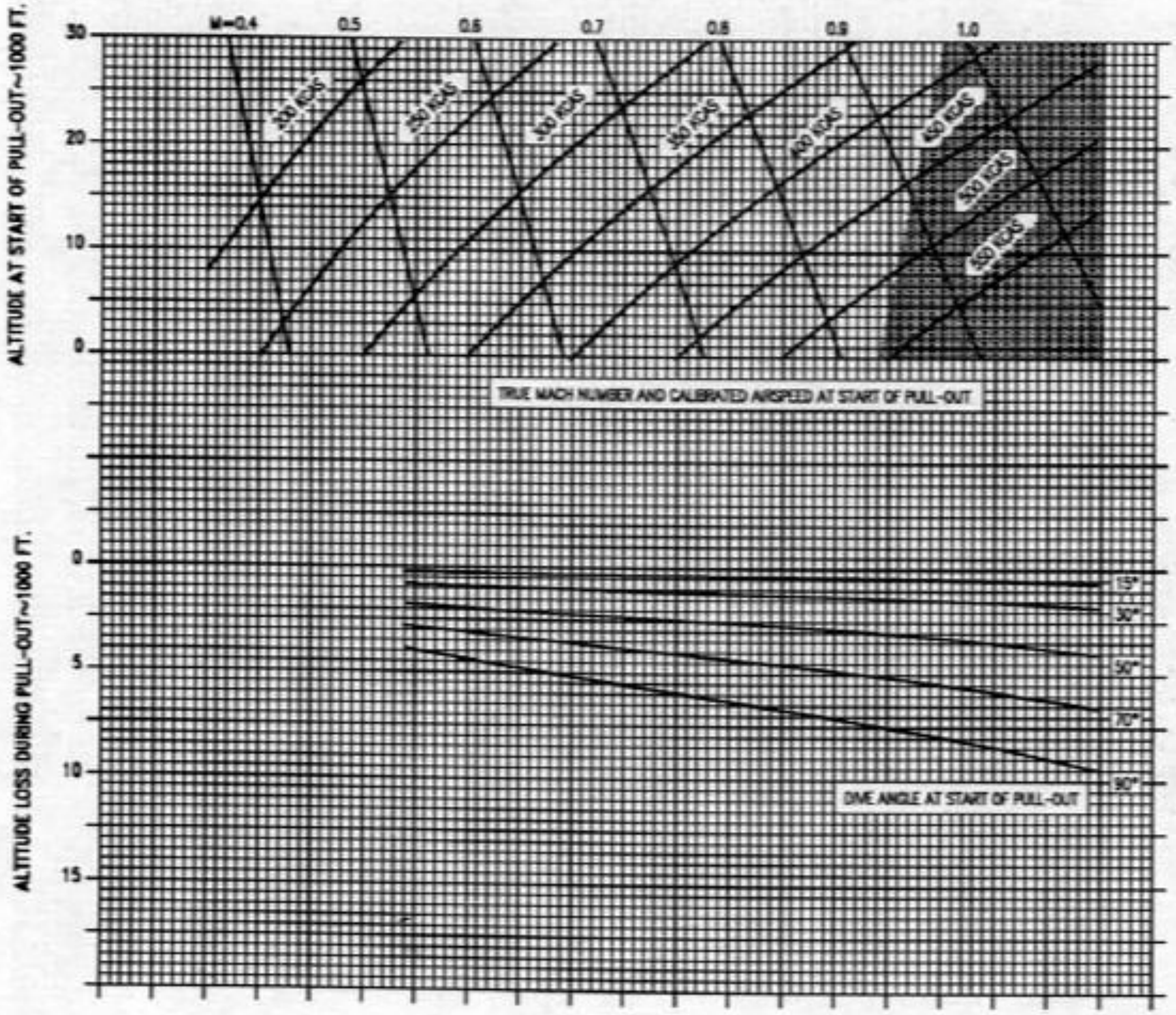


Figure A8-18A Page 7 of 7

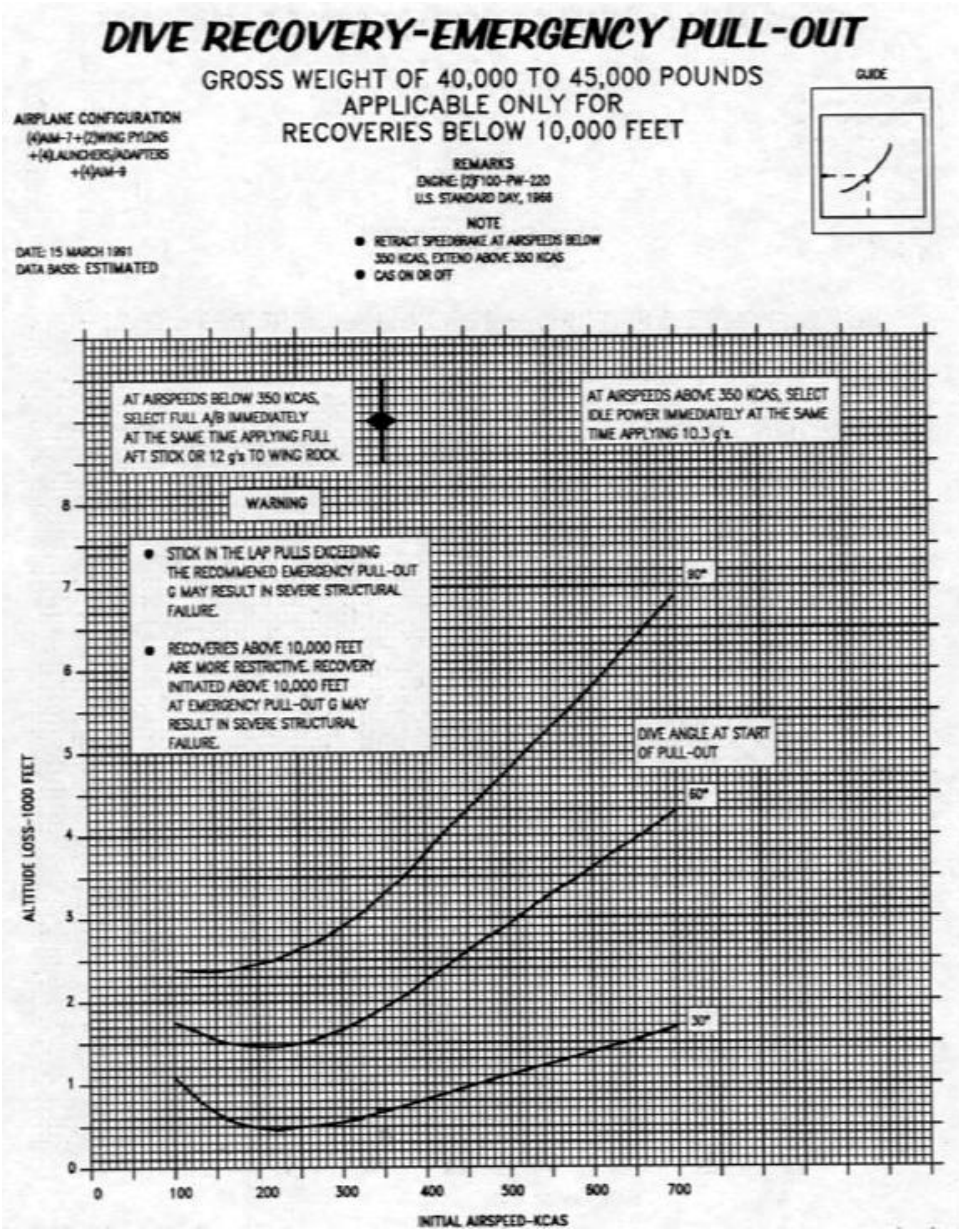


Figure A8-18B Page 1 of 4

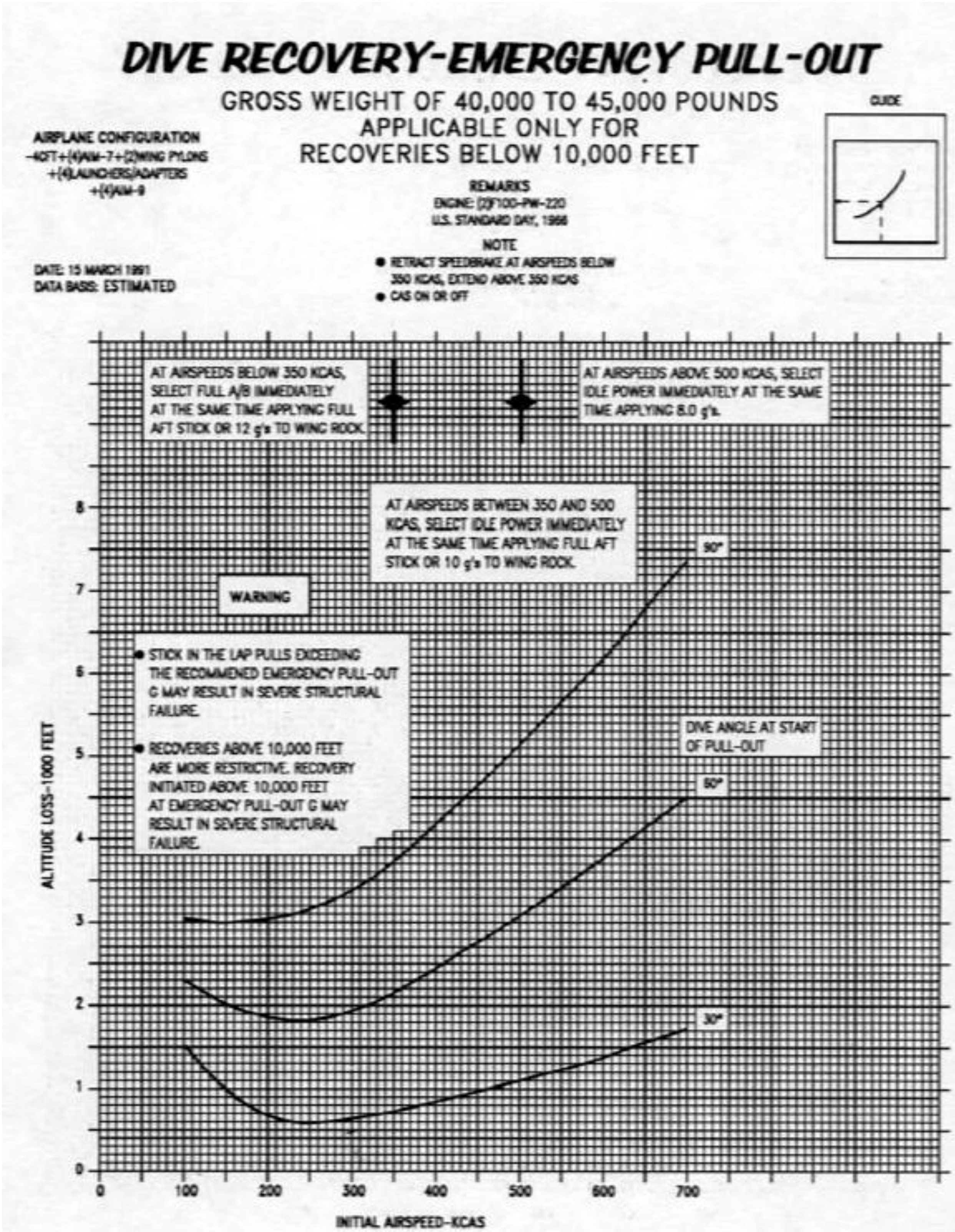


Figure A8-18B Page 2 of 4

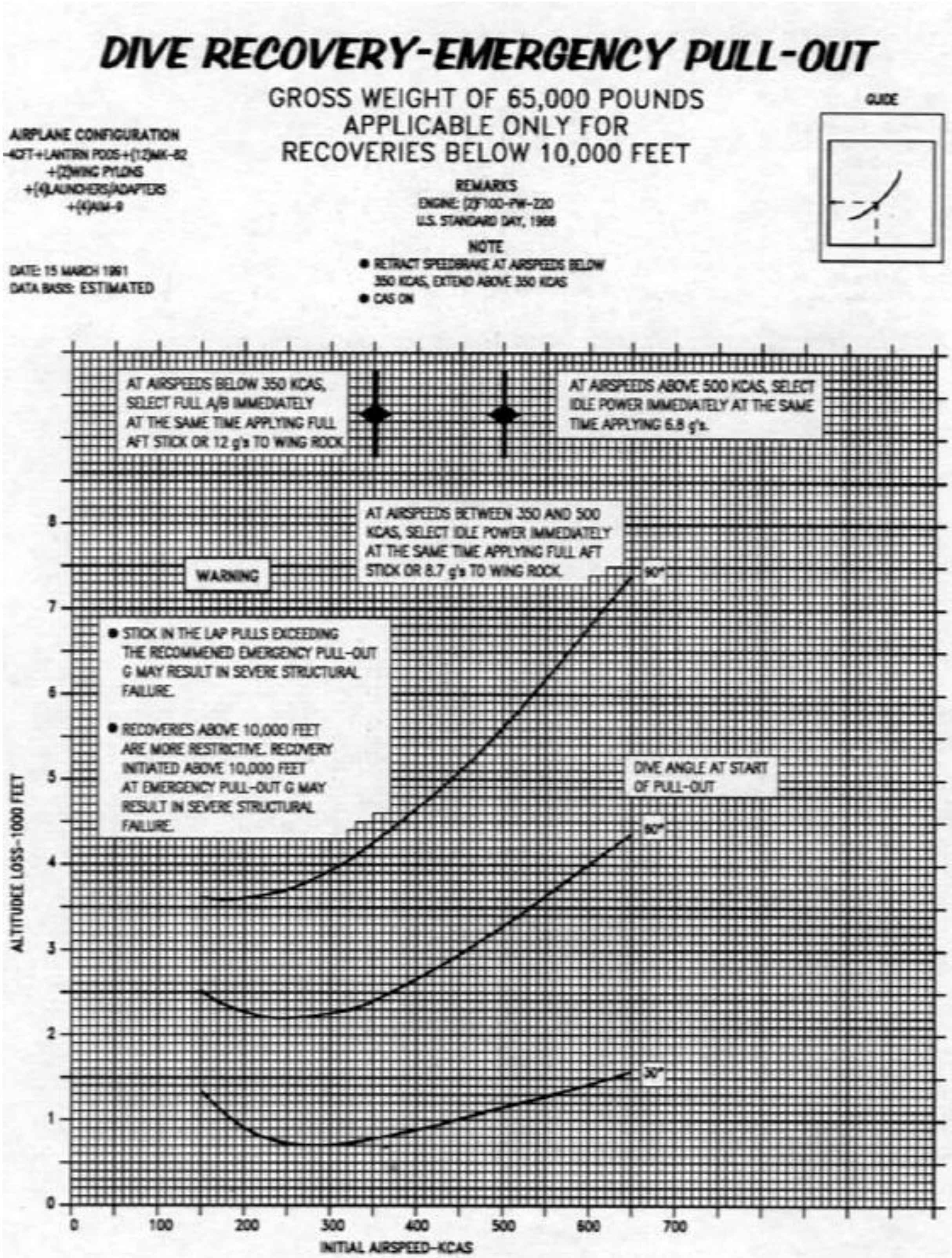


Figure A8-18B Page 3 of 4

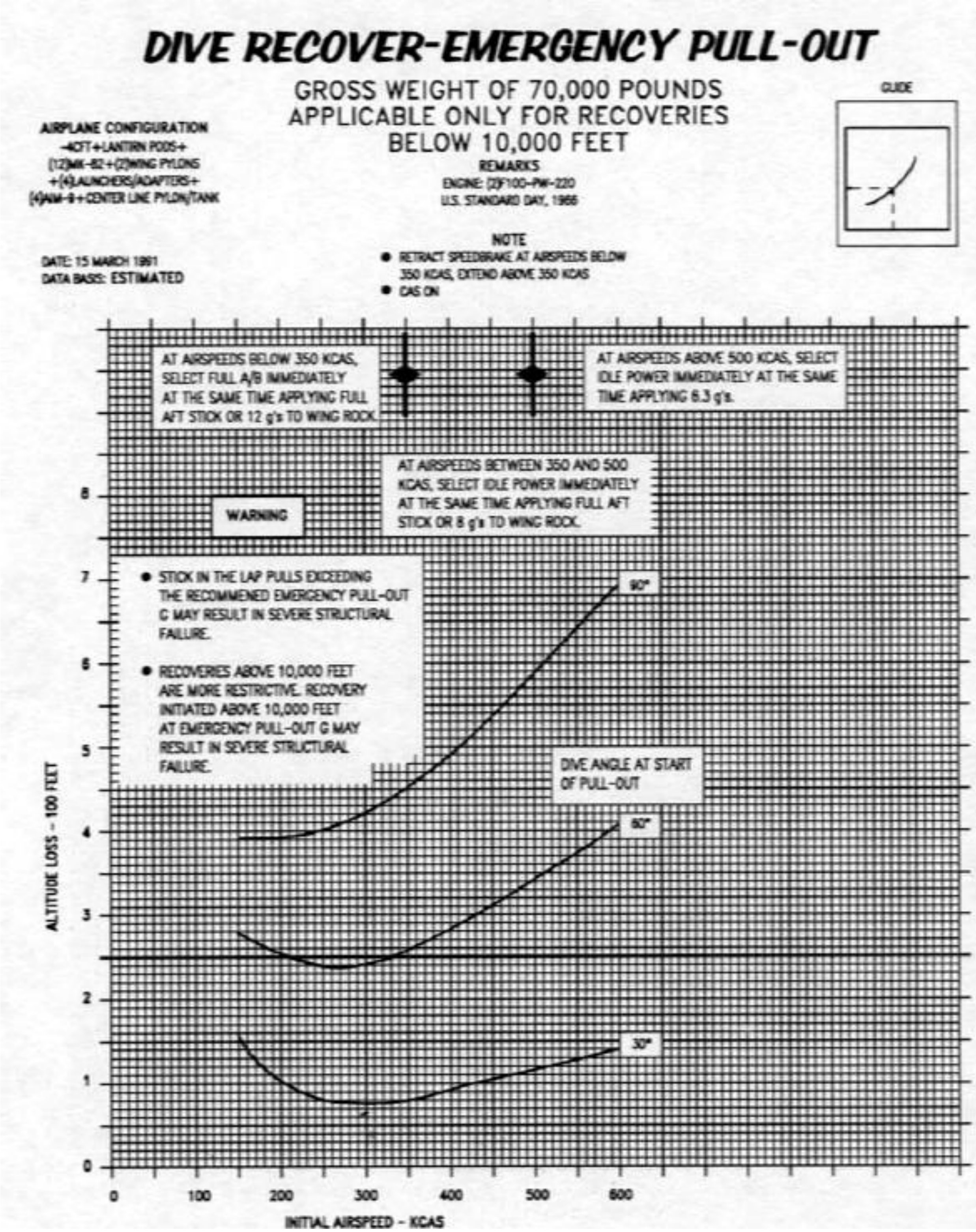


Figure A8-18B Page 4 of 4

LOW ALTITUDE COMBAT PERFORMANCE

MAXIMUM THRUST

AIRPLANE CONFIGURATION
ALL DRAG INDEXES

REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966

DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED

	CONSTANT KCAS	SPECIFIC FUEL FLOW-LB/MIN	TEMPERATURE EFFECTS: ACTUAL OAT DEG C	TEMPERATURE EFFECTS: CORRECTION FACTOR
SEA LEVEL (15°C)	300	1793	-40	1.19
	400	1936	-20	1.17
	500	2103	0	1.07
	600	2196	20	.98
	700	2526	40	.90
5000 FEET (5.1°C)	300	1579	-40	1.21
	400	1724	-20	1.14
	500	1901	0	1.03
	600	2113	20	.94
	700	2341	40	.86
10,000 FEET (-4.8°C)	300	1388	-40	1.18
	400	1540	-20	1.08
	500	1722	0	.97
	600	1934	20	.88
	700	2208	40	.81

Figure A8-19

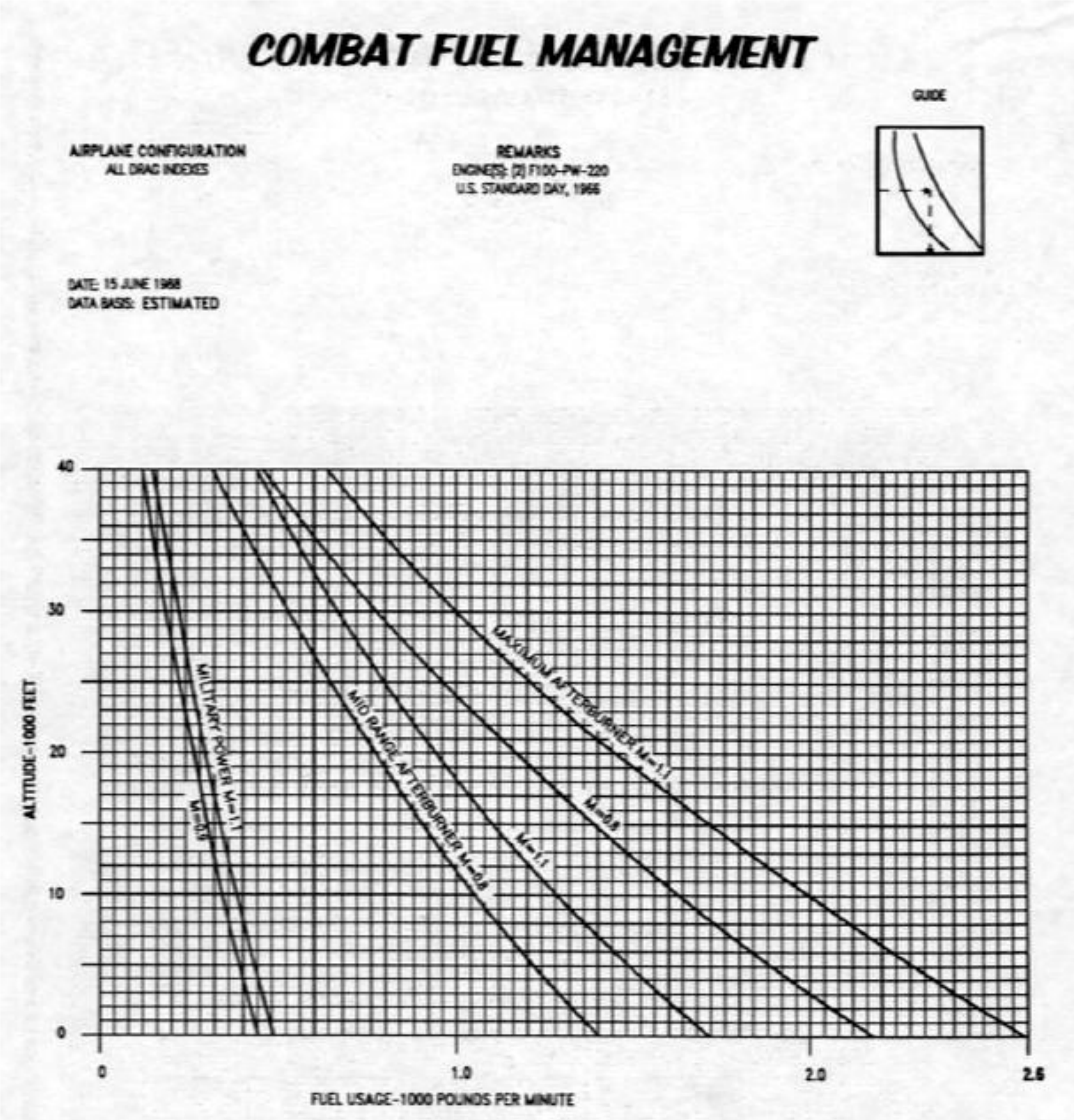

COMBAT FUEL MANAGEMENT
AIRPLANE CONFIGURATION
ALL DRAG INDEXES
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
ALTITUDE-1000 FEET
40
30
20
10
0
MILITARY POWER M=1.1
M=0.8
MID RANGE AFTERBURNER M=0.8
M=1.1
MAXIMUM AFTERBURNER M=1.1
M=0.8
0
1.0
2.0
2.6
FUEL USAGE-1000 POUNDS PER MINUTE

Figure A8-20

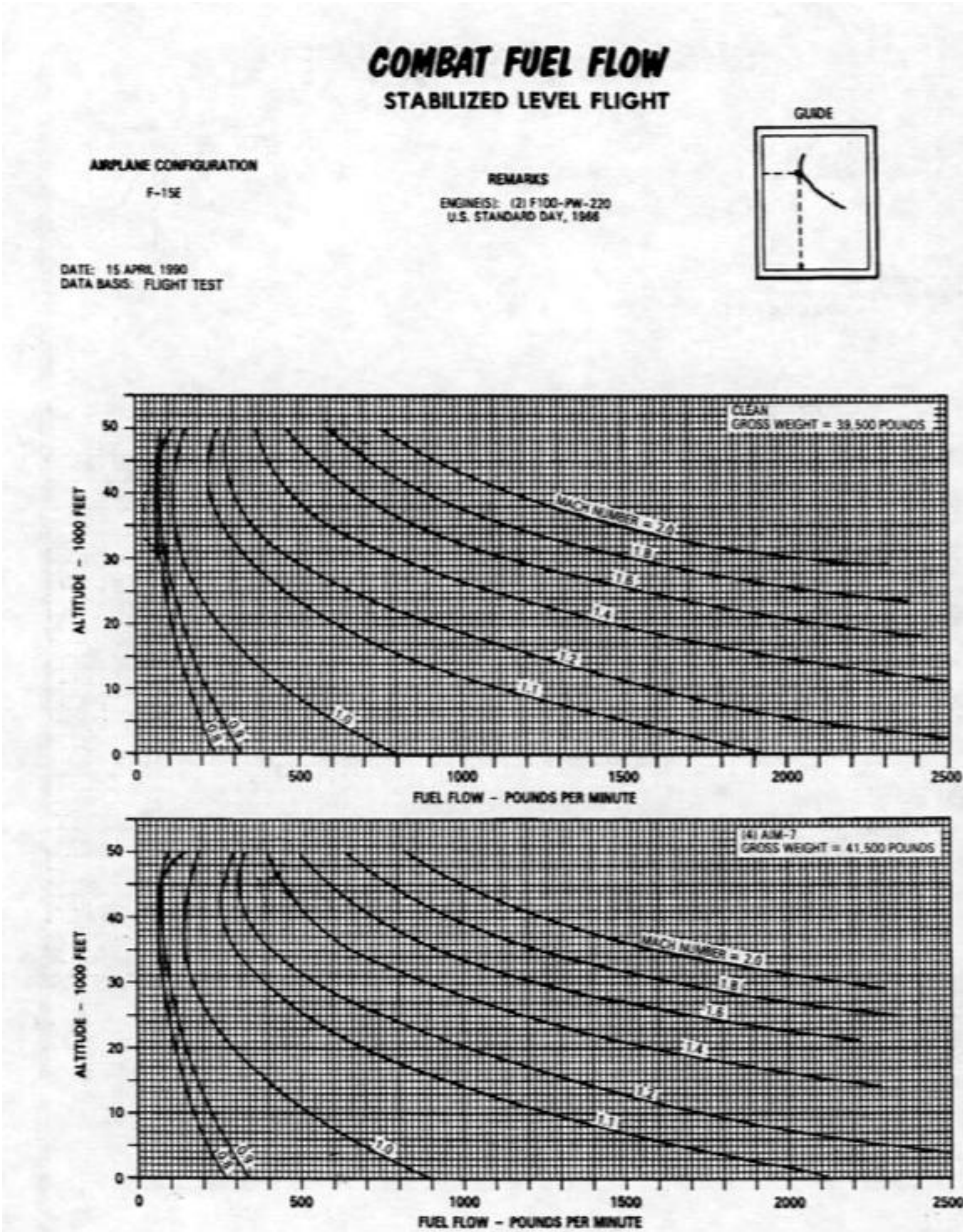

COMBAT FUEL FLOW
STABILIZED LEVEL FLIGHT
GUIDE
AIRPLANE CONFIGURATION
F-15E
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 APRIL 1990
DATA BASIS: FLIGHT TEST
CLEAN
GROSS WEIGHT = 39,500 POUNDS
MACH NUMBER = 2.0
1.8
1.6
1.4
1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
FUEL FLOW - POUNDS PER MINUTE
(4) AIM-7
GROSS WEIGHT = 41,500 POUNDS
MACH NUMBER = 2.0
1.8
1.6
1.4
1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
FUEL FLOW - POUNDS PER MINUTE

Figure A8-21

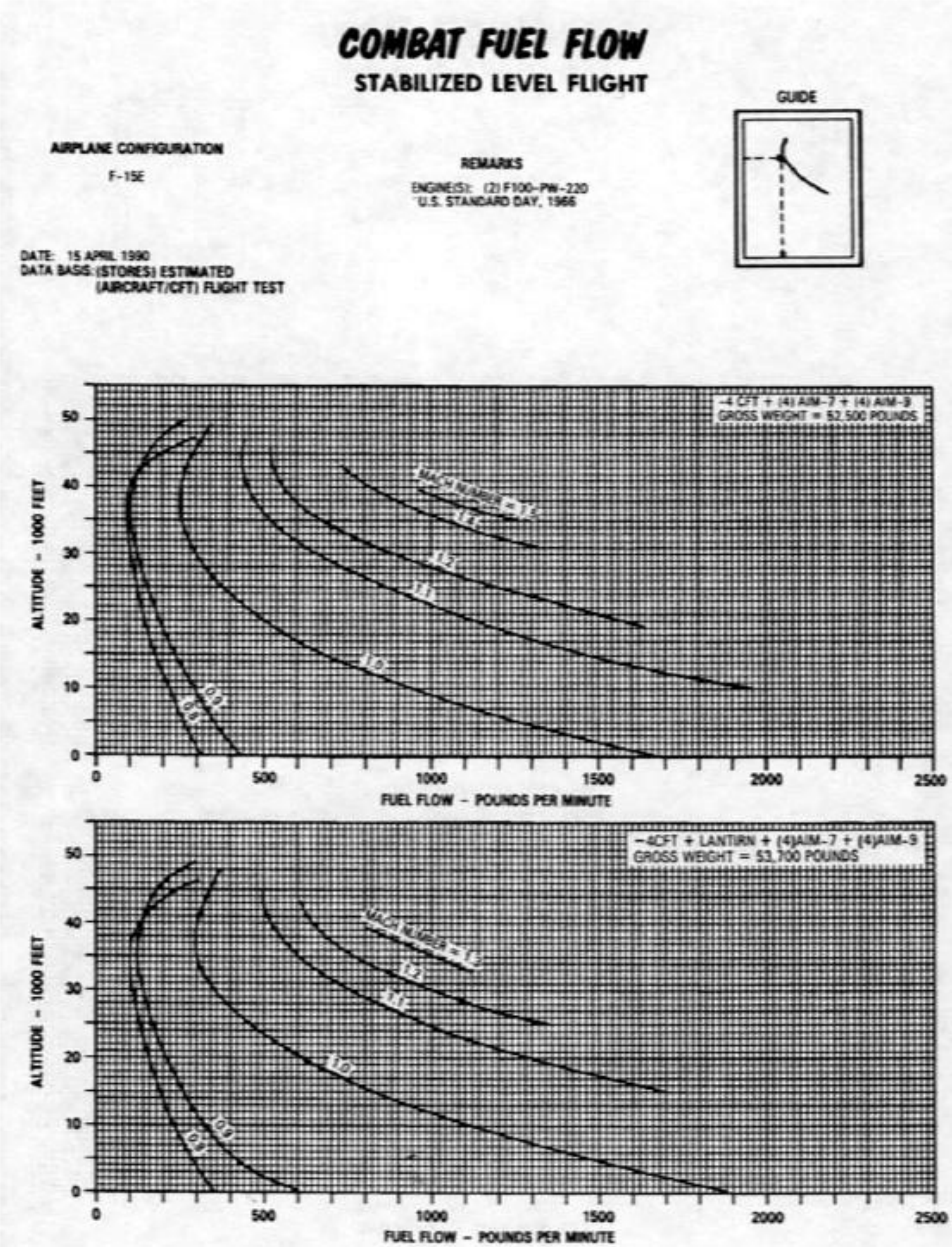

COMBAT FUEL FLOW
STABILIZED LEVEL FLIGHT
GUIDE
AIRPLANE CONFIGURATION
F-15E
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
-4 CFT + (4) AIM-7 + (4) AIM-9
GROSS WEIGHT = 52,500 POUNDS
MACH NUMBER = 1.5
1.4
1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
FUEL FLOW - POUNDS PER MINUTE
-4CFT + LANTIRN + (4)AIM-7 + (4)AIM-9
GROSS WEIGHT = 53,700 POUNDS
MACH NUMBER = 1.3
1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
FUEL FLOW - POUNDS PER MINUTE

Figure A8-22

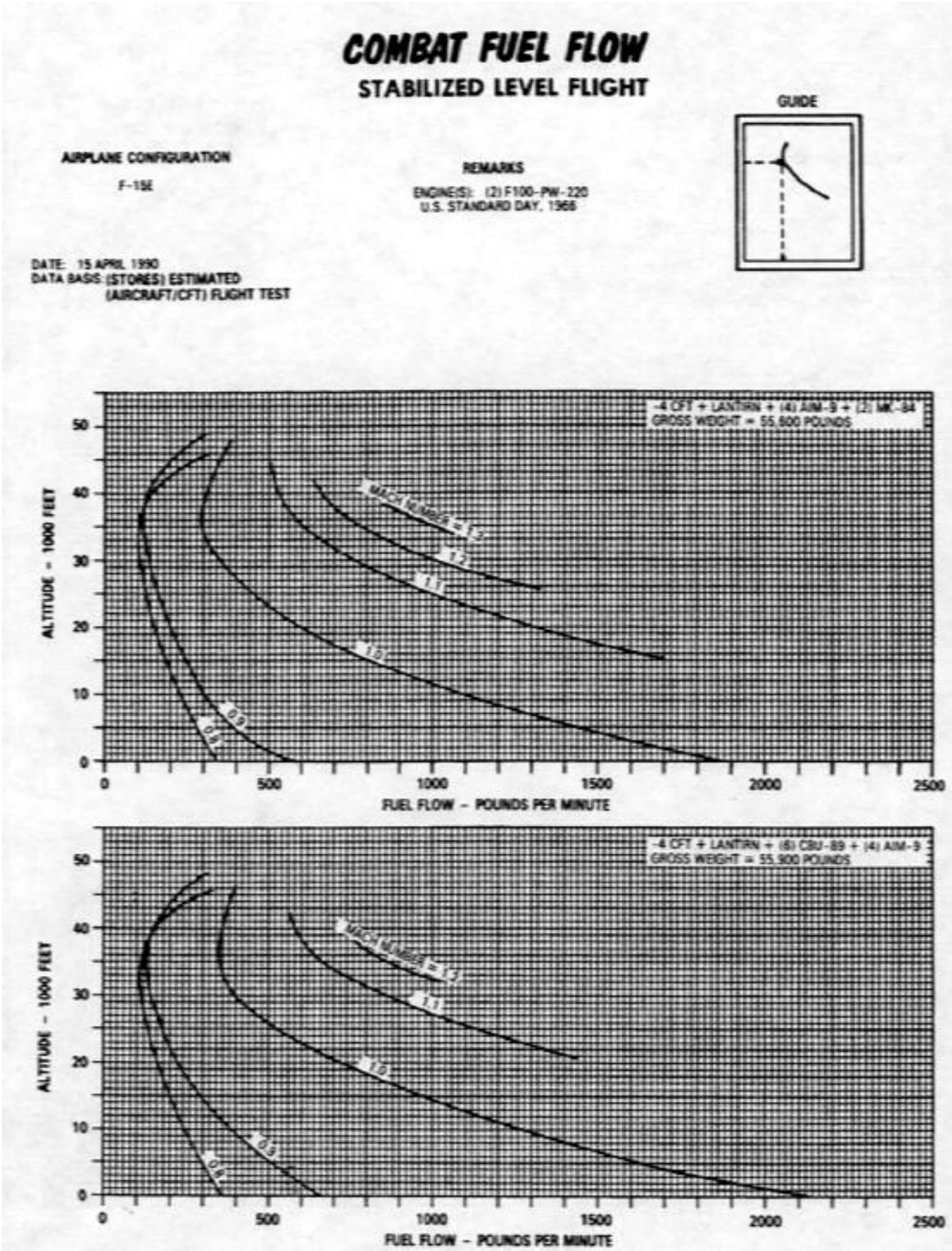

COMBAT FUEL FLOW
STABILIZED LEVEL FLIGHT
GUIDE
AIRPLANE CONFIGURATION
F-15E
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
-4 CFT + LANTIRN + (4) AIM-9 + (2) MK-84
GROSS WEIGHT = 55,600 POUNDS
MACH NUMBER = 1.3
1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
0
10
20
30
40
50
0
500
1000
1500
2000
2500
FUEL FLOW - POUNDS PER MINUTE
-4 CFT + LANTIRN + (6) CBU-89 + (4) AIM-9
GROSS WEIGHT = 55,900 POUNDS
MACH NUMBER = 1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
FUEL FLOW - POUNDS PER MINUTE

Figure A8-23

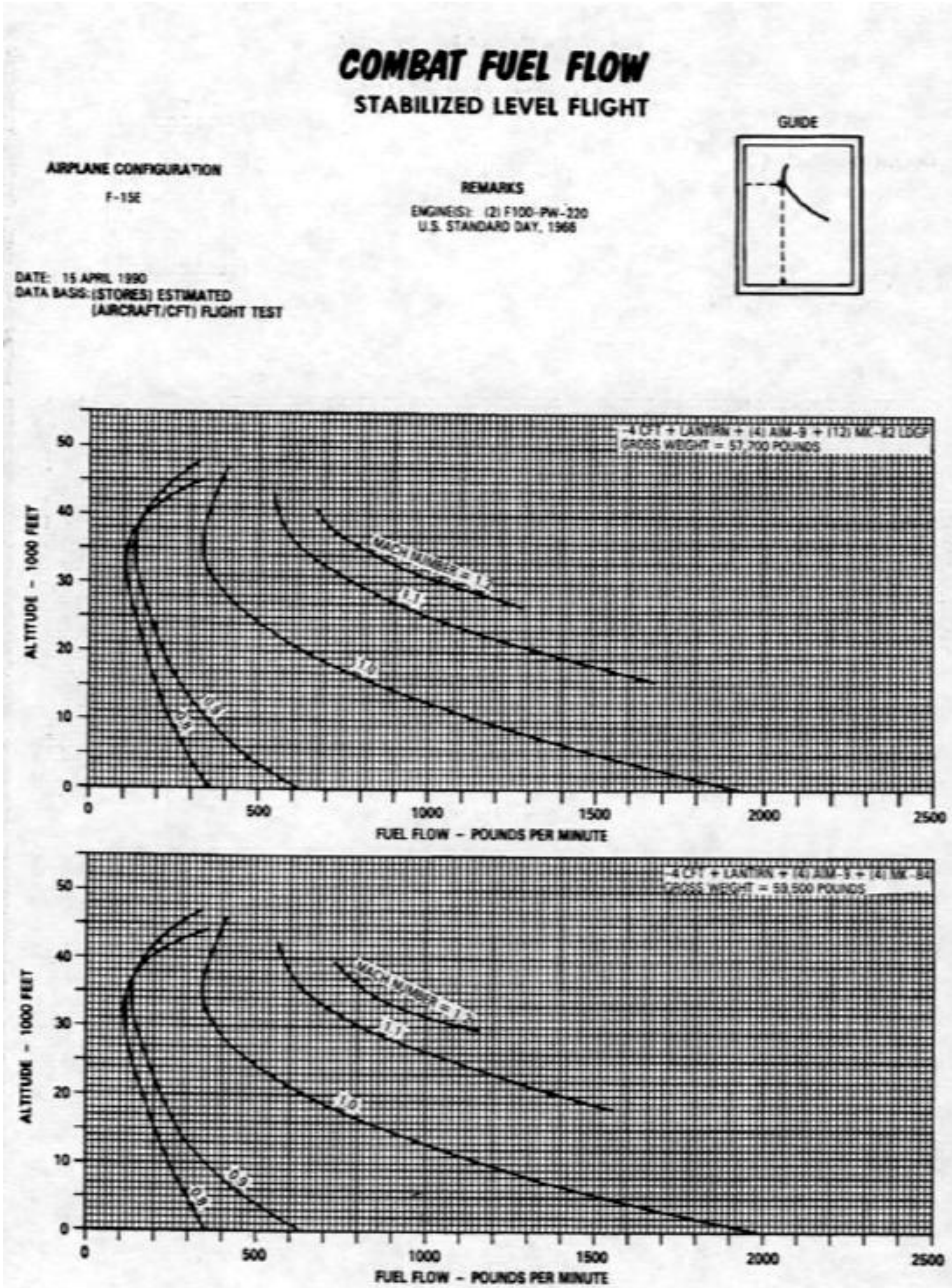

COMBAT FUEL FLOW
STABILIZED LEVEL FLIGHT
GUIDE
AIRPLANE CONFIGURATION
F-15E
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
4 CFT + LANTIRN + (4) AIM-9 + (12) MK-82 LDGP
GROSS WEIGHT = 57,700 POUNDS
MACH NUMBER = 1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
FUEL FLOW - POUNDS PER MINUTE
4 CFT + LANTIRN + (4) AIM-9 + (4) MK-84
GROSS WEIGHT = 59,500 POUNDS
MACH NUMBER = 1.2
1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
FUEL FLOW - POUNDS PER MINUTE

Figure A8-24

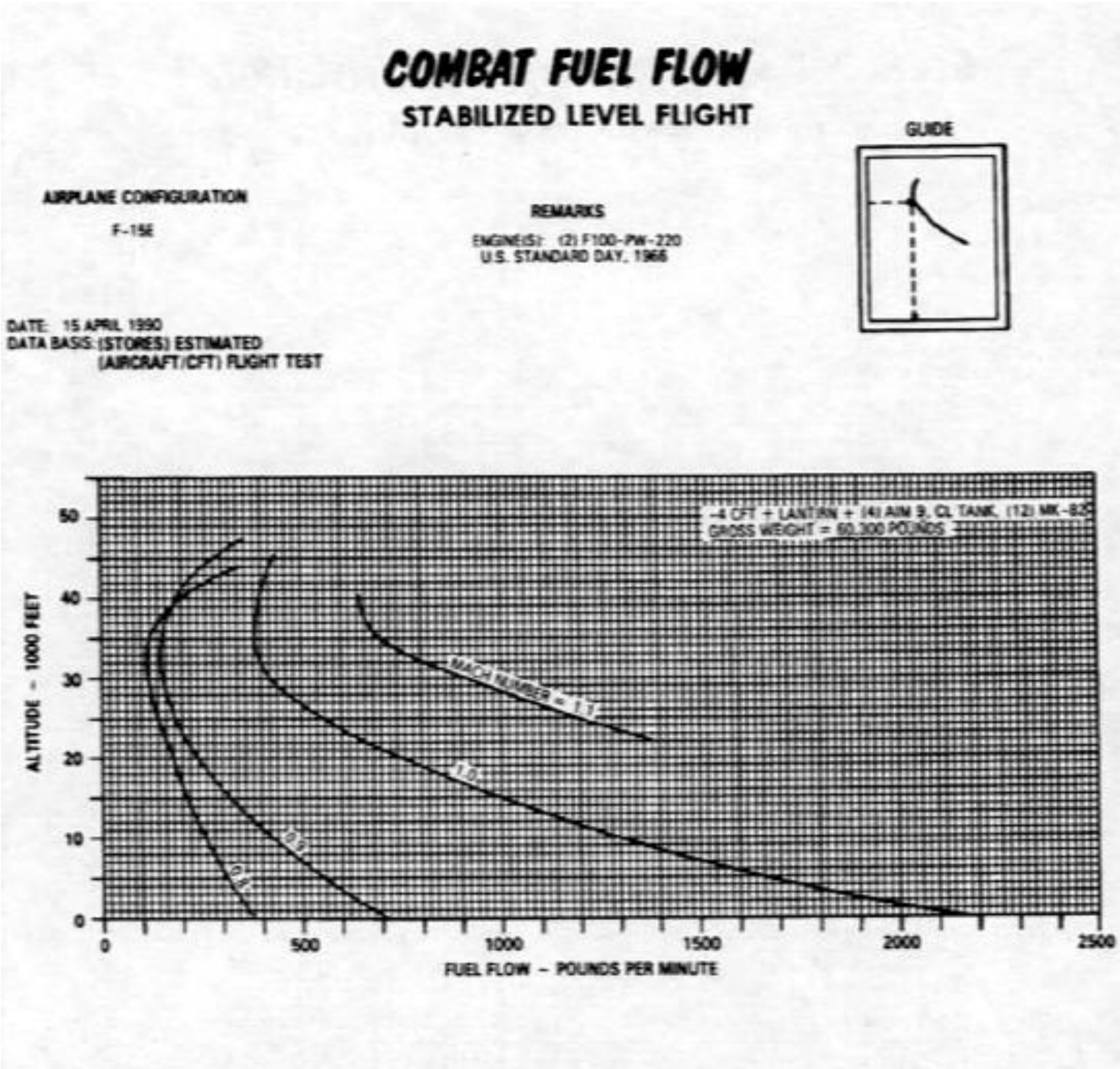

COMBAT FUEL FLOW
STABILIZED LEVEL FLIGHT
GUIDE
AIRPLANE CONFIGURATION
F-15E
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
-4 CFT + LANTIRN + (4) AIM 9, CL TANK, (12) MK-82
GROSS WEIGHT = 60,300 POUNDS
MACH NUMBER = 1.1
1.0
0.9
0.8
ALTITUDE - 1000 FEET
0
10
20
30
40
50
0
500
1000
1500
2000
2500
FUEL FLOW - POUNDS PER MINUTE

Figure A8-25

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS

NOTE

1. NO WING TANKS OR STORES
2. CFT NOT INSTALLED

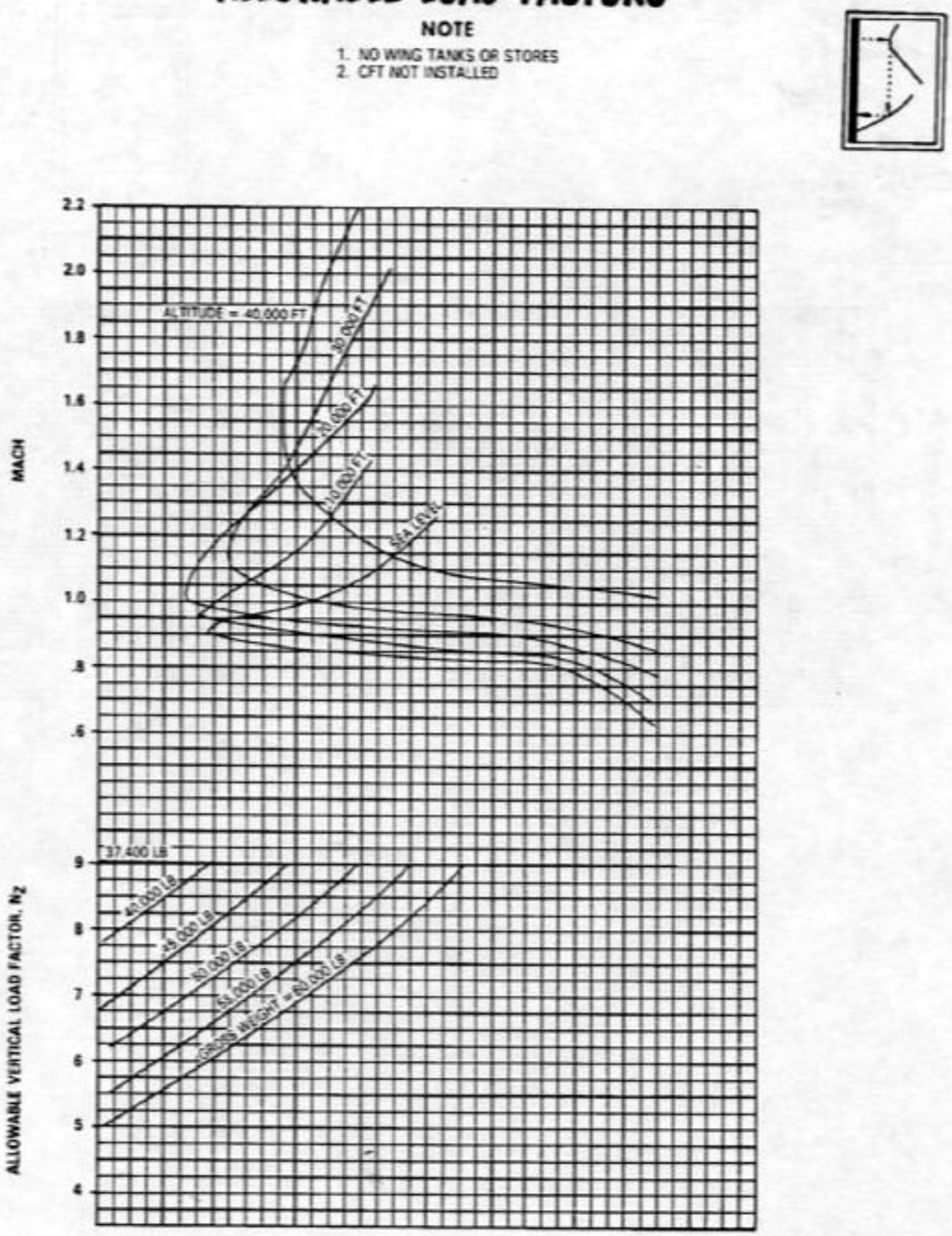


Figure A8-26

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

TANKS OR STORES ON WING STATIONS 2 AND 8

NOTE

1. CFT NOT INSTALLED

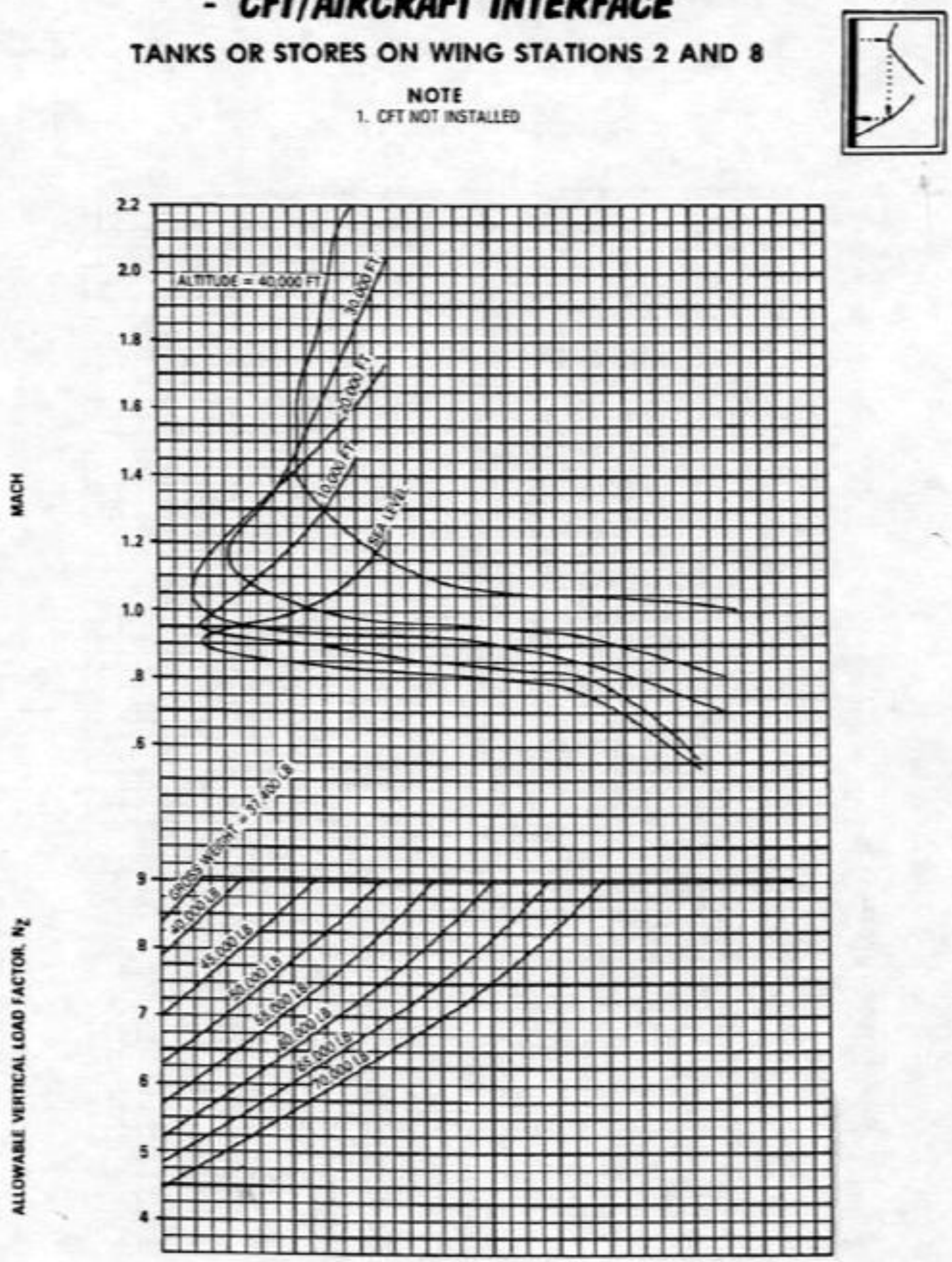


Figure A8-27

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

CFT STORE STATIONS CLEAN

NOTE

1. NO WING TANKS OR STORES
2. BASED ON CFT WEIGHT = 2106 LB + FUEL PER SIDE

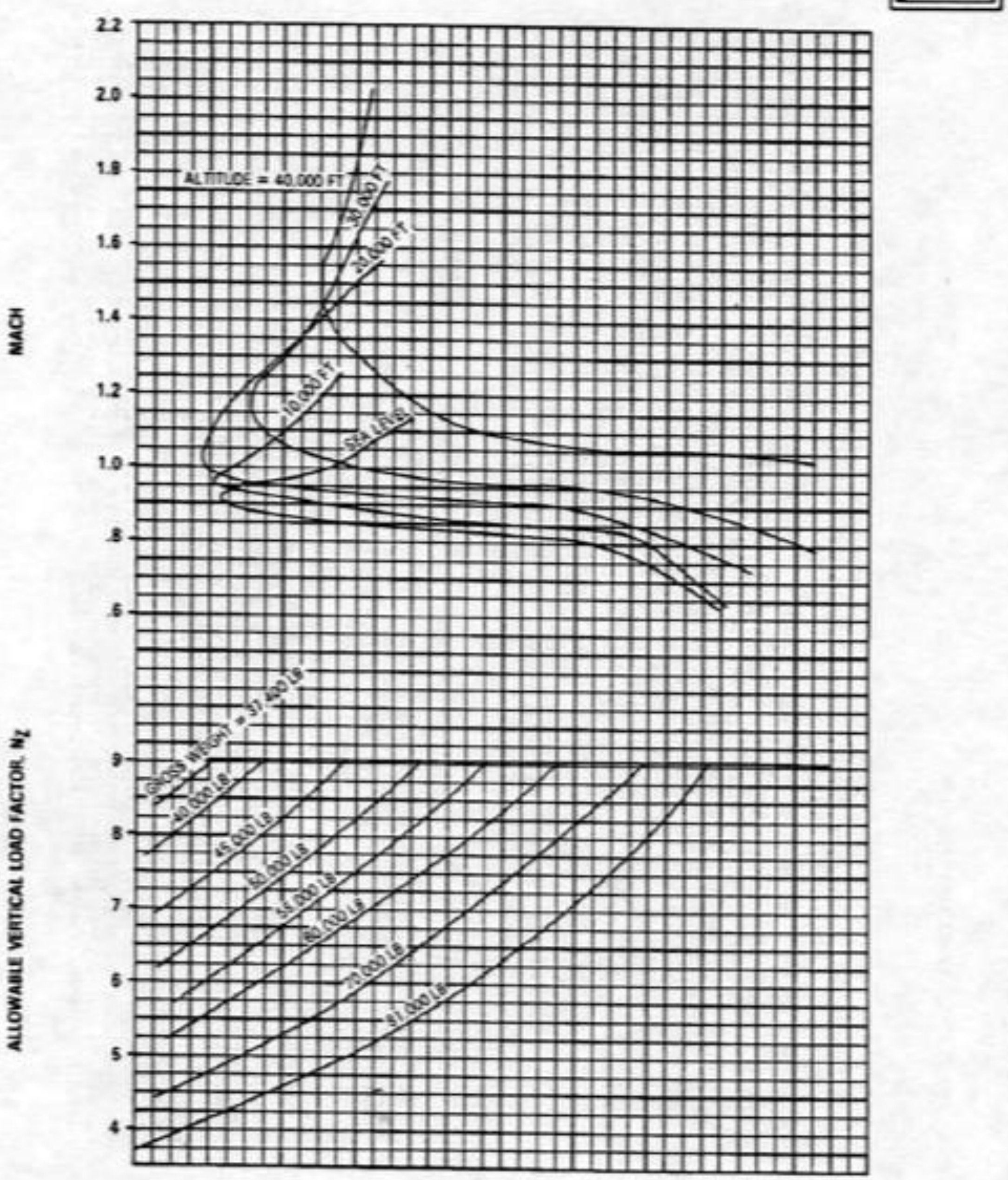


Figure A8-28

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

TANKS OR STORES ON WING STATIONS 2 AND 8

CFT STORE STATIONS CLEAN

NOTE

1. BASED ON CFT WEIGHT = 2106 LB + FUEL PER SIDE

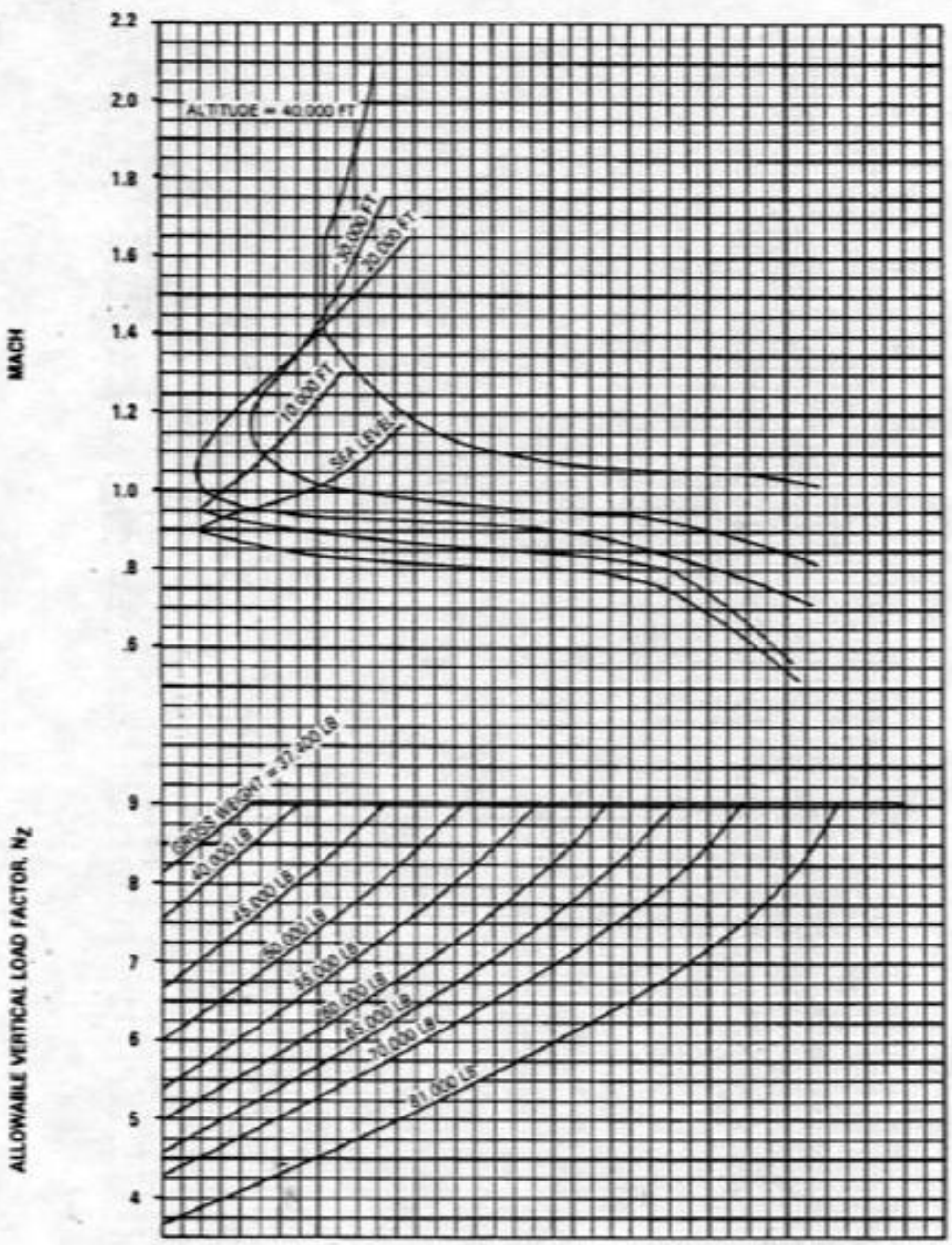


Figure A8-29

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

AIM-7 MISSILES ON CFT STORE STATIONS

NOTE

1. NO WING TANKS OR STORES
2. BASED ON CFT WEIGHT = 3126 LB + FUEL PER SIDE

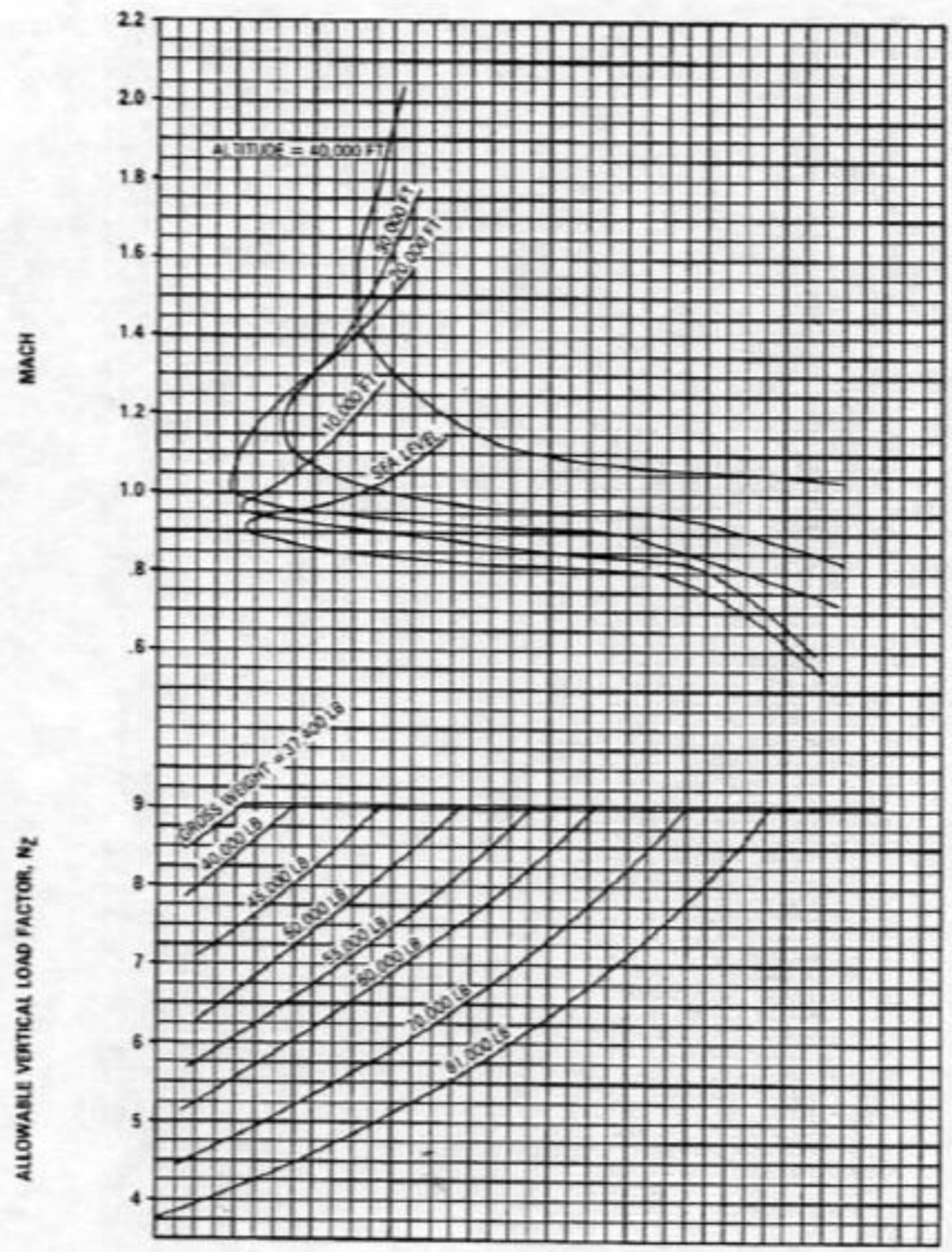


Figure A8-30

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

AIM-7 MISSILES ON CFT STORE STATIONS
TANKS OR STORES ON WING STATIONS 2 AND 8

NOTE

1. BASED ON CFT WEIGHT = 3126 LB + FUEL PER SIDE

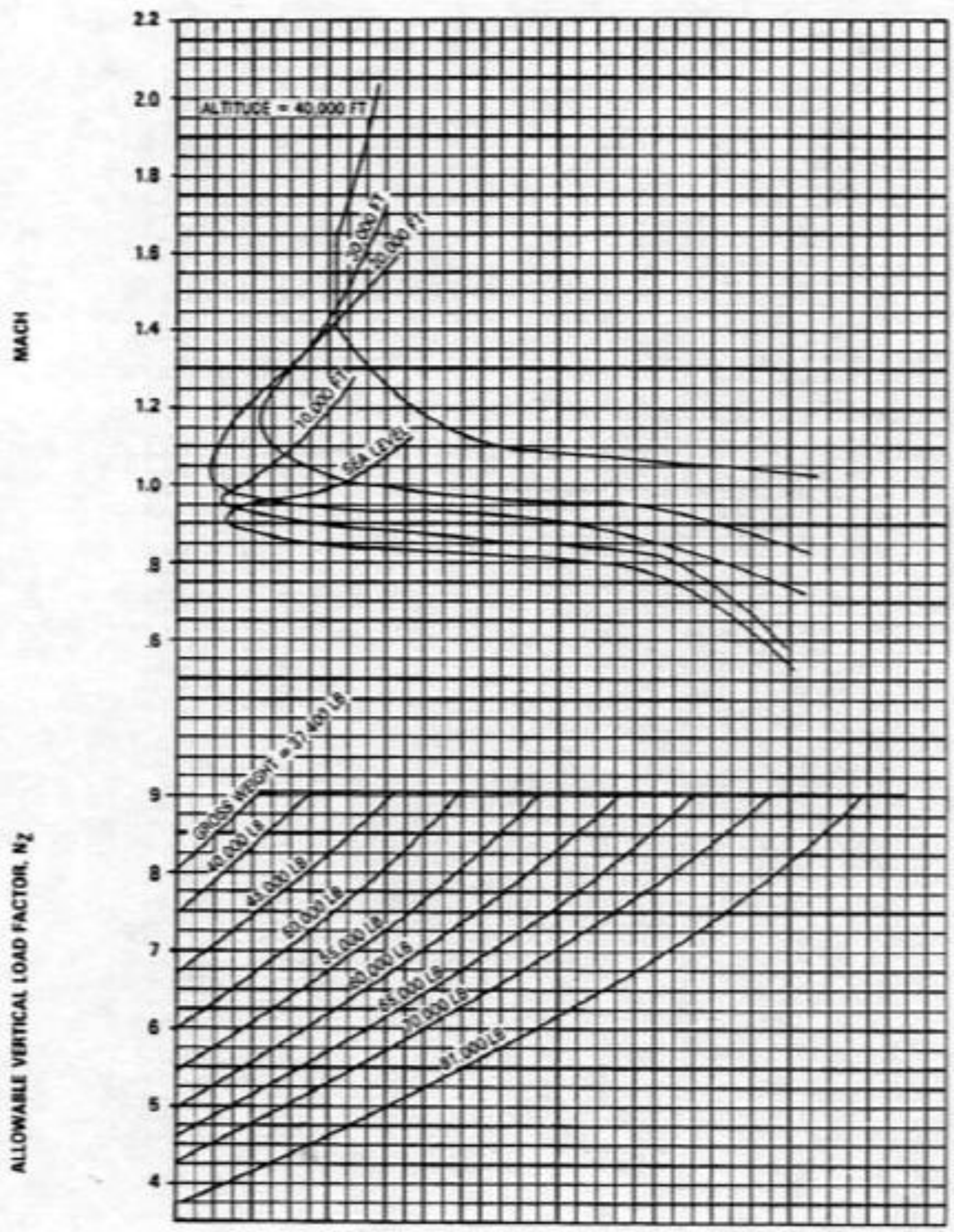


Figure A8-31

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

STORE ON CENTER INBOARD CFT STORE STATION

NOTE

1. NO WING TANKS OR STORES
2. EXTERNAL STORES LIMITATIONS MAY BE MORE RESTRICTIVE
3. BASED ON CFT WEIGHT = 4406 LB + FUEL PER SIDE

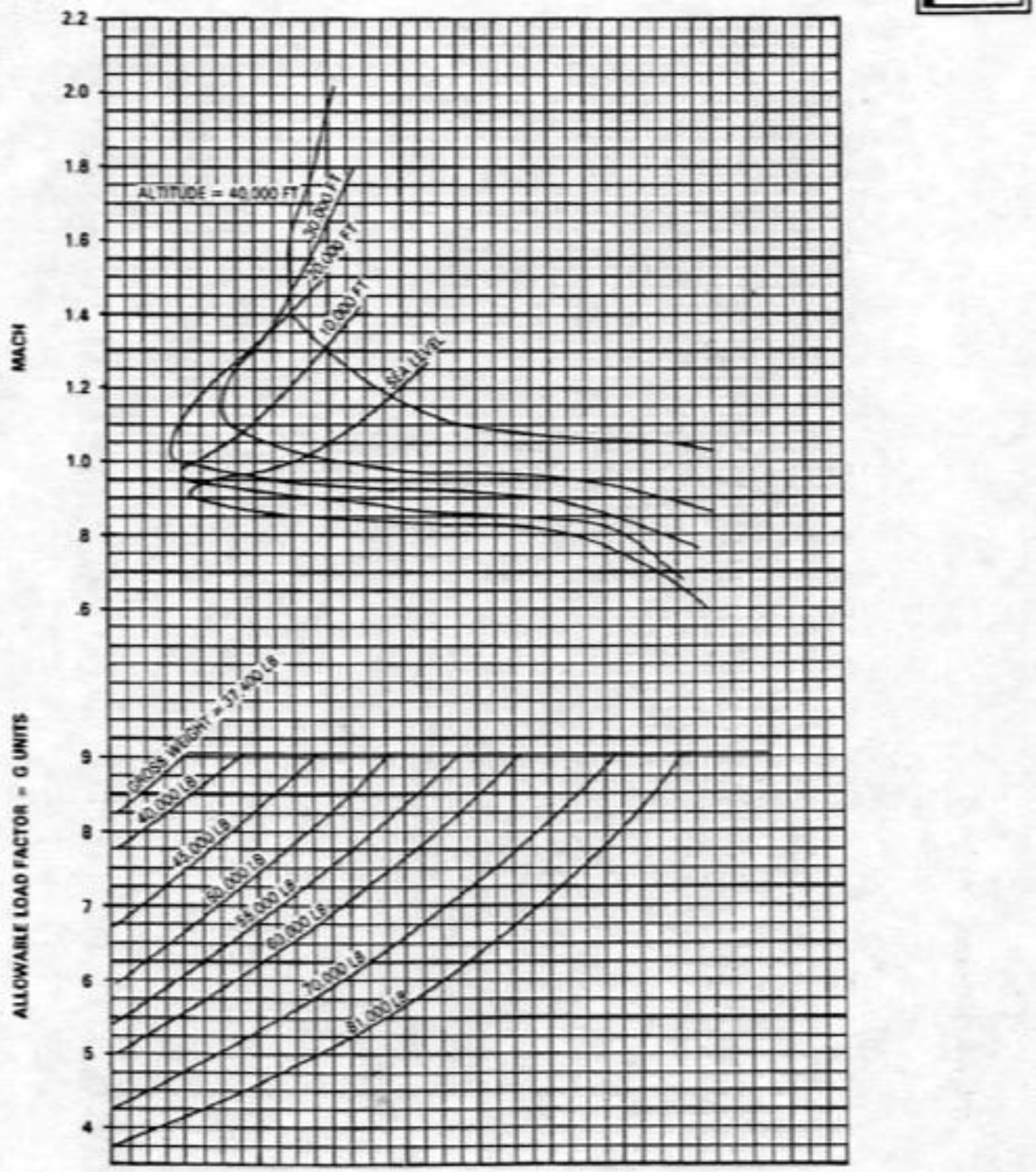


Figure A8-32

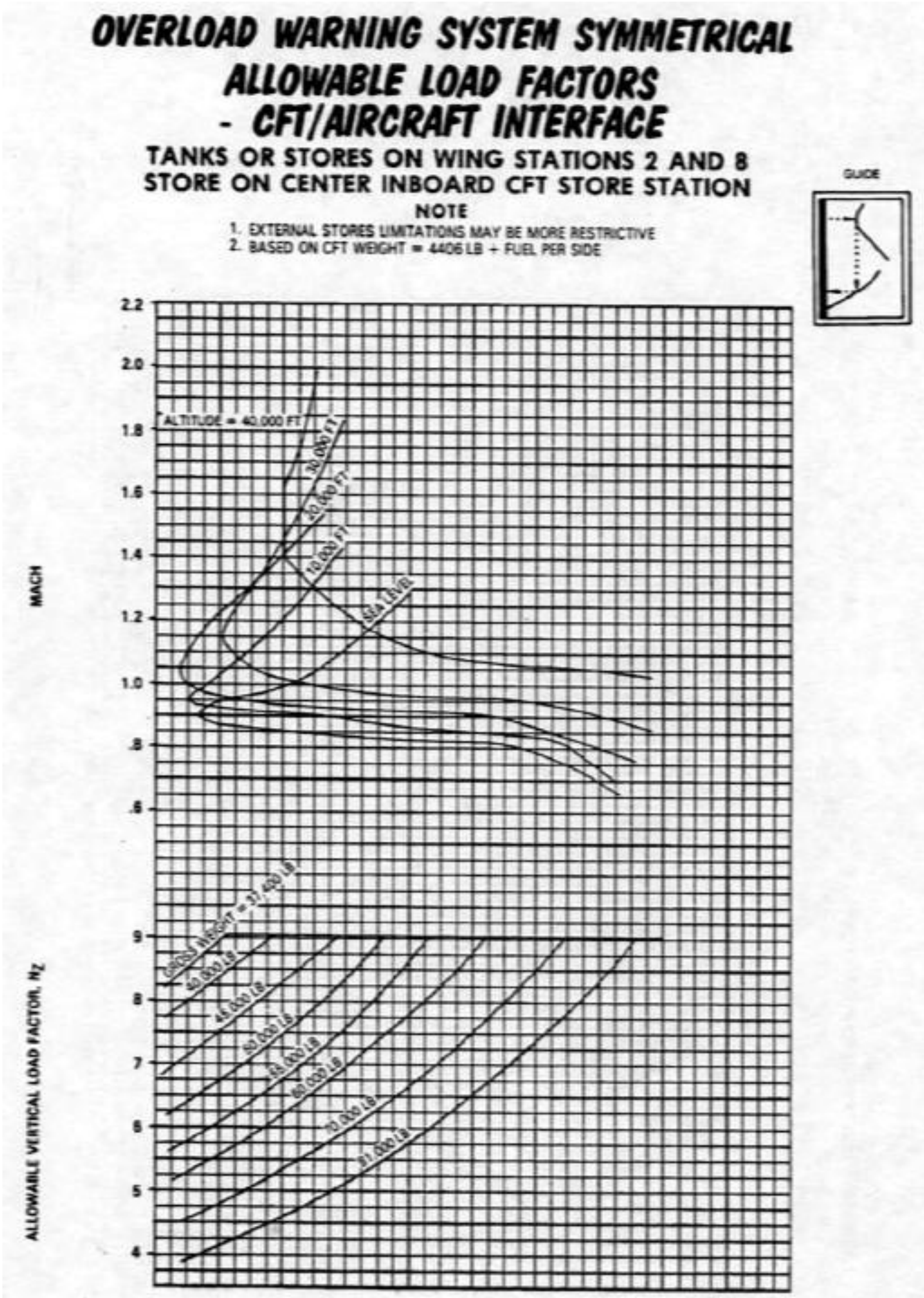

OVERLOAD WARNING SYSTEM SYMMETRICAL
ALLOWABLE LOAD FACTORS
- CFT/AIRCRAFT INTERFACE
TANKS OR STORES ON WING STATIONS 2 AND 8
STORE ON CENTER INBOARD CFT STORE STATION
NOTE
1. EXTERNAL STORES LIMITATIONS MAY BE MORE RESTRICTIVE
2. BASED ON CFT WEIGHT = 4406 LB + FUEL PER SIDE
GUIDE
MACH
ALTITUDE = 40,000 FT
30,000 FT
20,000 FT
10,000 FT
SEA LEVEL
ALLOWABLE VERTICAL LOAD FACTOR, NZ
GROSS WEIGHT = 37,400 LB
40,000 LB
45,000 LB
50,000 LB
55,000 LB
60,000 LB
70,000 LB
81,000 LB

Figure A8-33

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

STORES ON FWD AND AFT INBOARD CFT STORE STATIONS

NOTE

1. NO WING TANKS OR STORES
2. EXTERNAL STORES LIMITATIONS MAY BE MORE RESTRICTIVE
3. BASED ON CFT WEIGHT = 6306 LB + FUEL PER SIDE

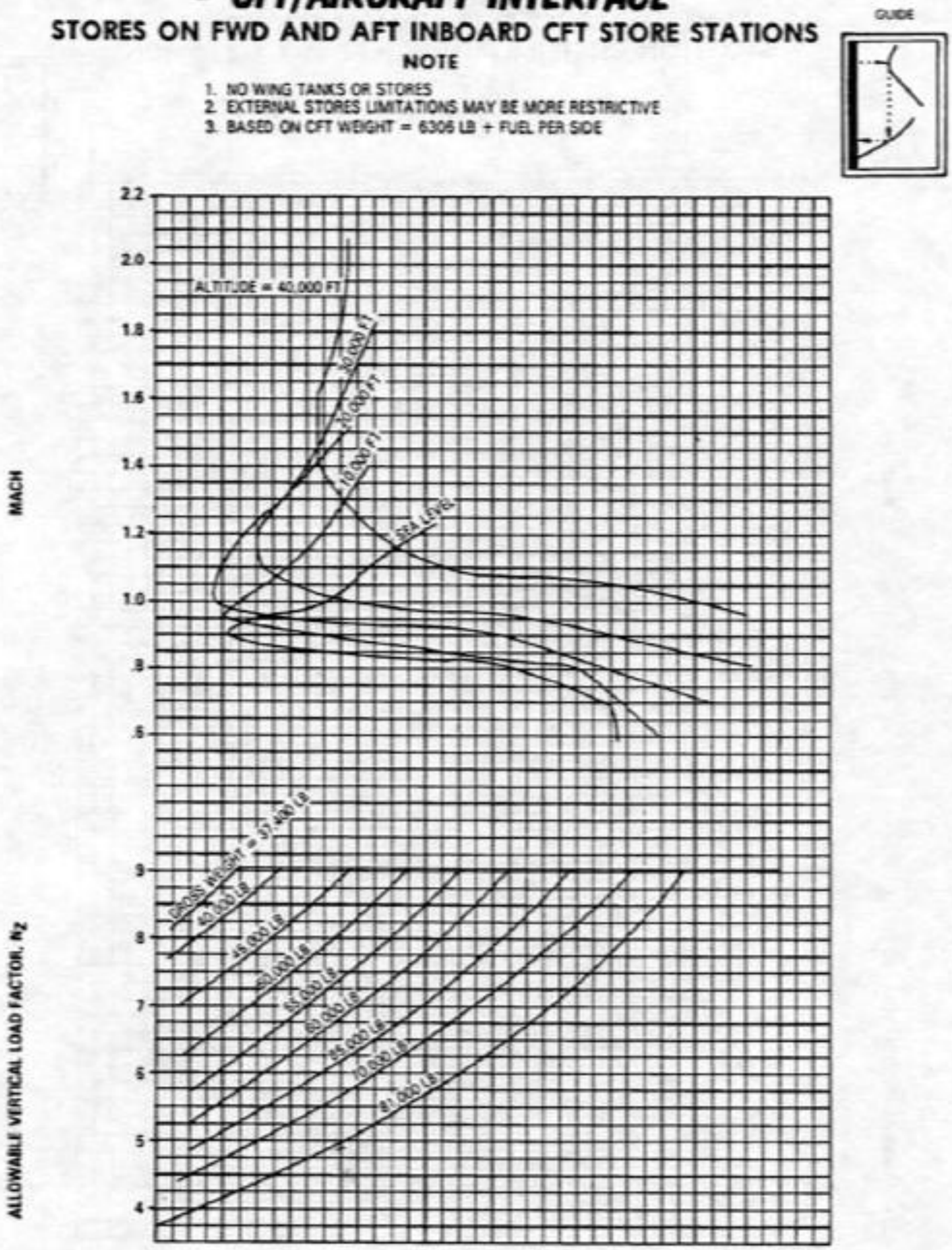


Figure A8-34

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

TANKS OR STORES ON WING STATIONS 2 AND 8
STORES ON FWD AND AFT INBOARD CFT STORE STATIONS

NOTE

1. EXTERNAL STORES LIMITATIONS MAY BE MORE RESTRICTIVE
2. BASED ON CFT WEIGHT = 6306 LB + FUEL PER SIDE

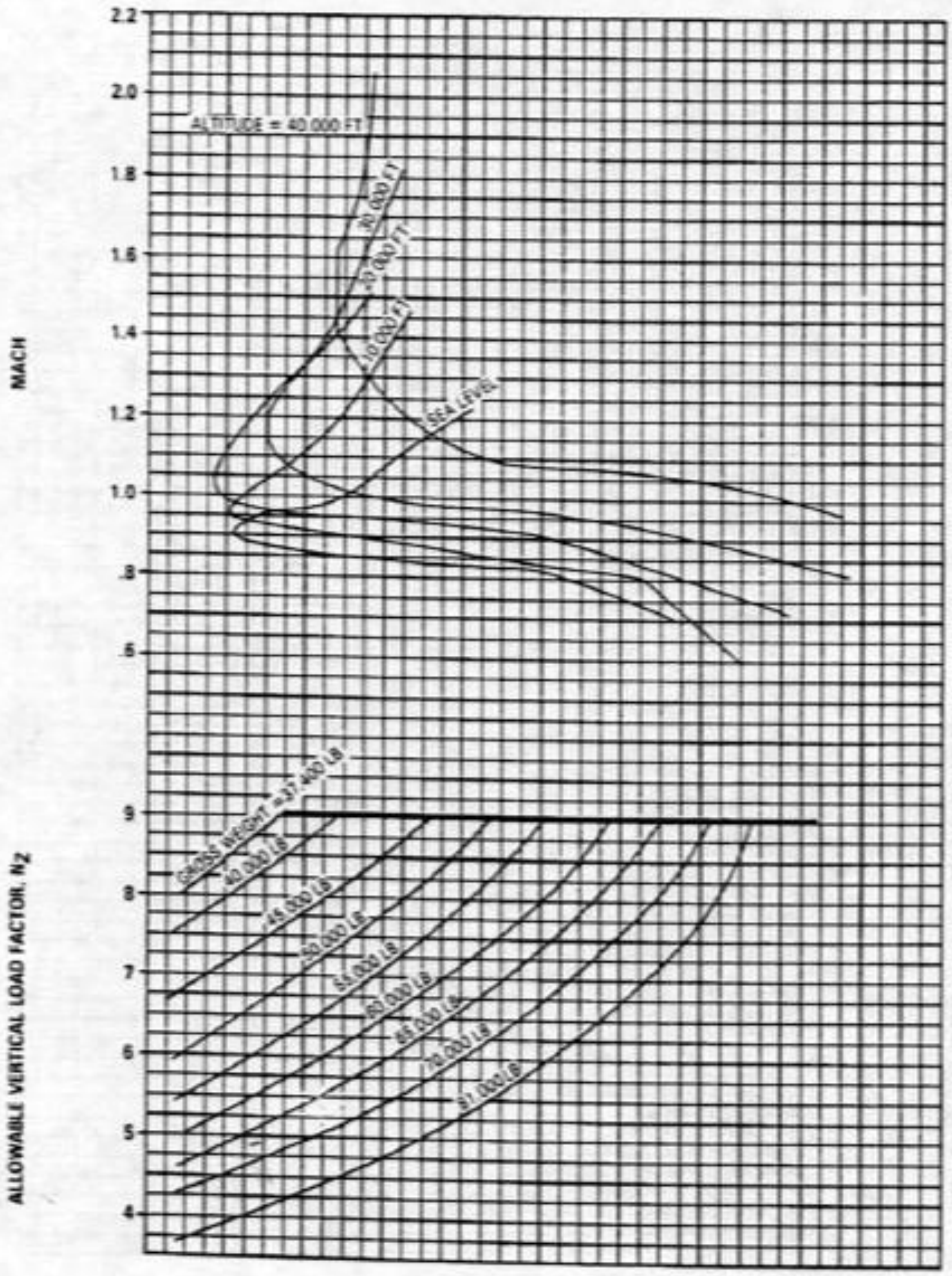


Figure A8-35

OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

STORES ON ALL CFT STORE STATIONS

NOTE

1. NO WING TANKS OR STORES
2. EXTERNAL STORES LIMITATIONS MAY BE MORE RESTRICTIVE
3. BASED ON CFT WEIGHT = 7806 LB + FUEL PER SIDE

GUIDE

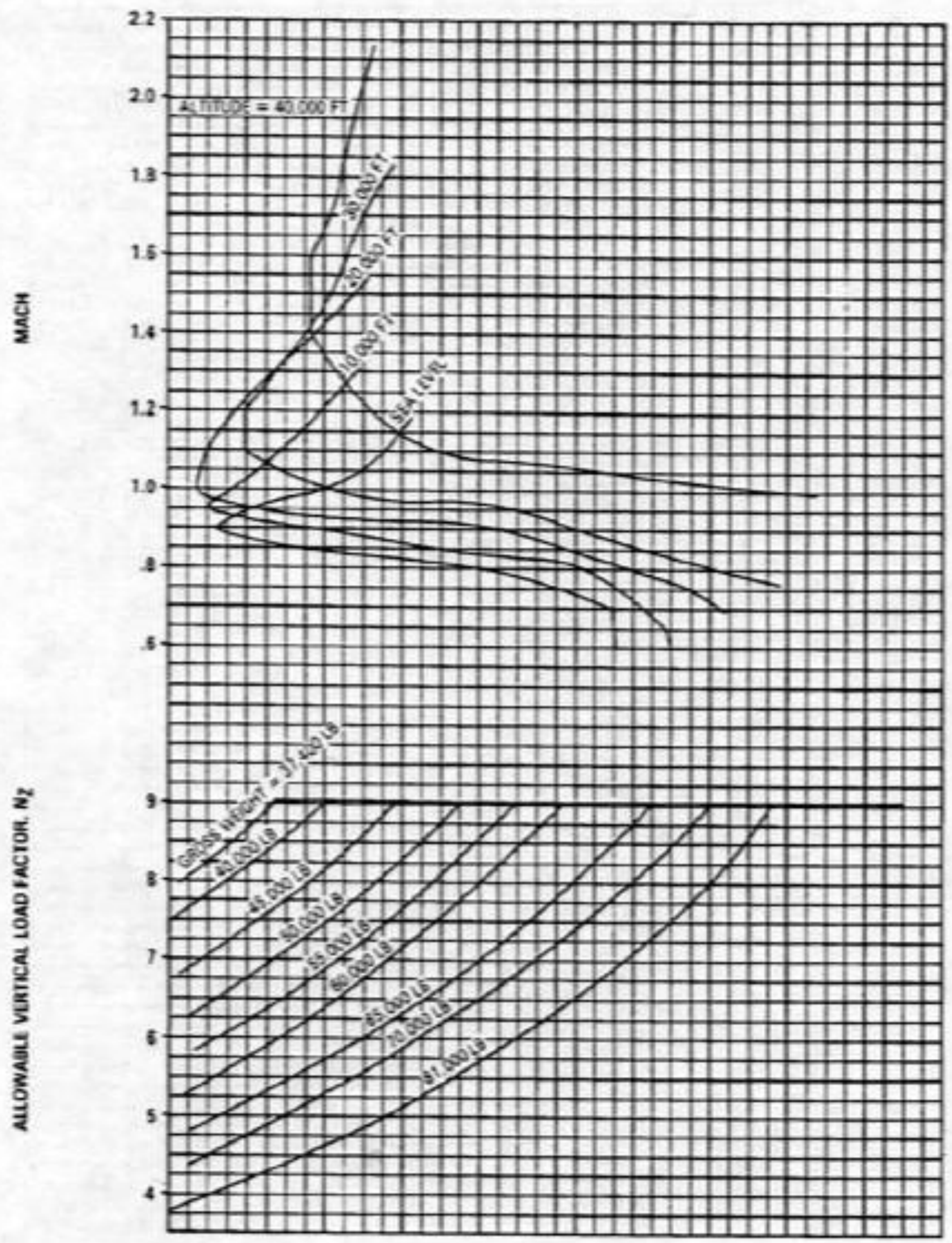


Figure A8-36

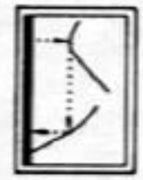
OVERLOAD WARNING SYSTEM SYMMETRICAL ALLOWABLE LOAD FACTORS - CFT/AIRCRAFT INTERFACE

TANKS OR STORES ON WING STATIONS 2 AND 8
STORES ON ALL CFT STORE STATIONS

NOTE

1. EXTERNAL STORES LIMITATIONS MAY BE MORE RESTRICTIVE
2. BASED ON CFT WEIGHT = 7806 LB + FUEL PER SIDE

GUIDE



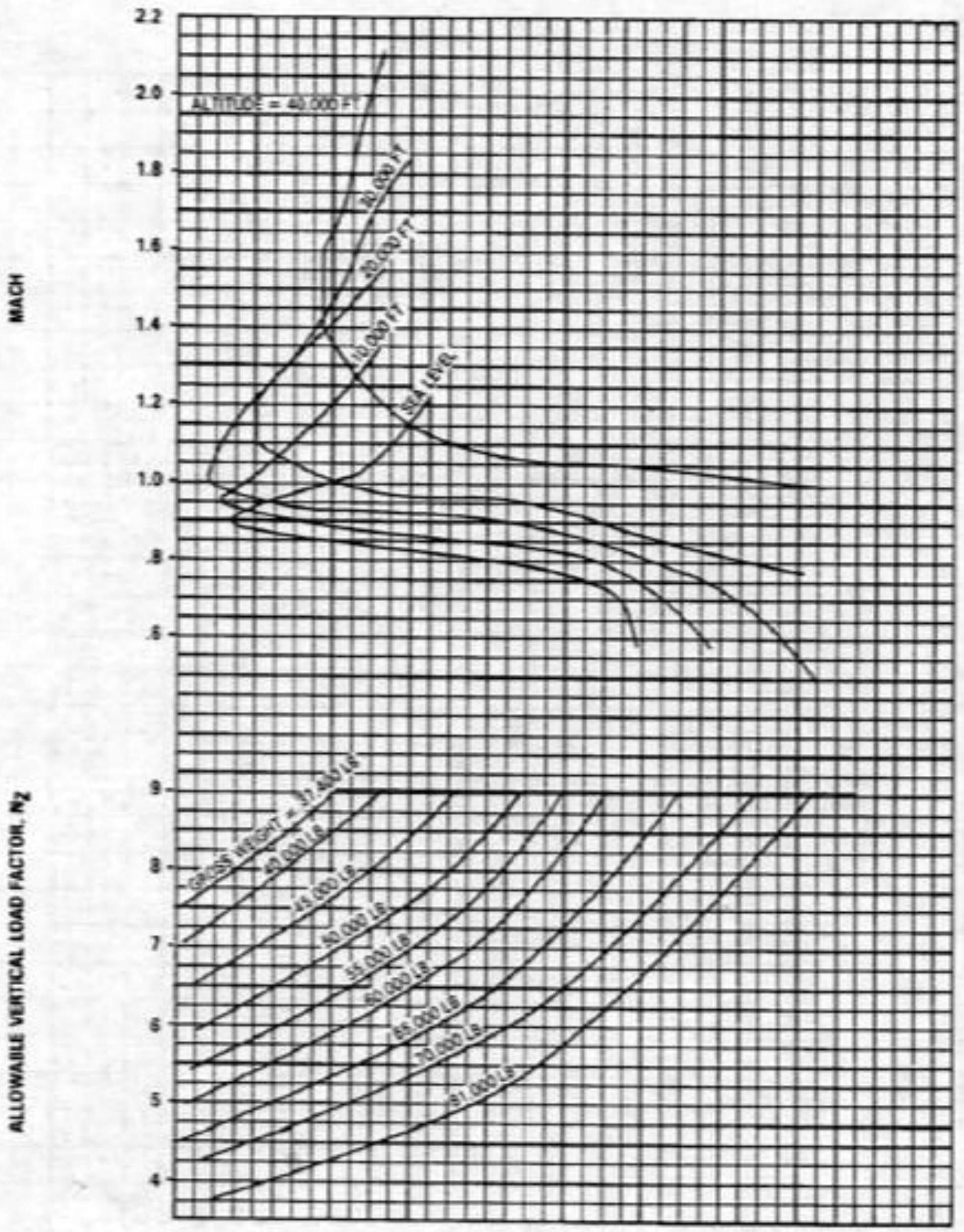


Figure A8-37

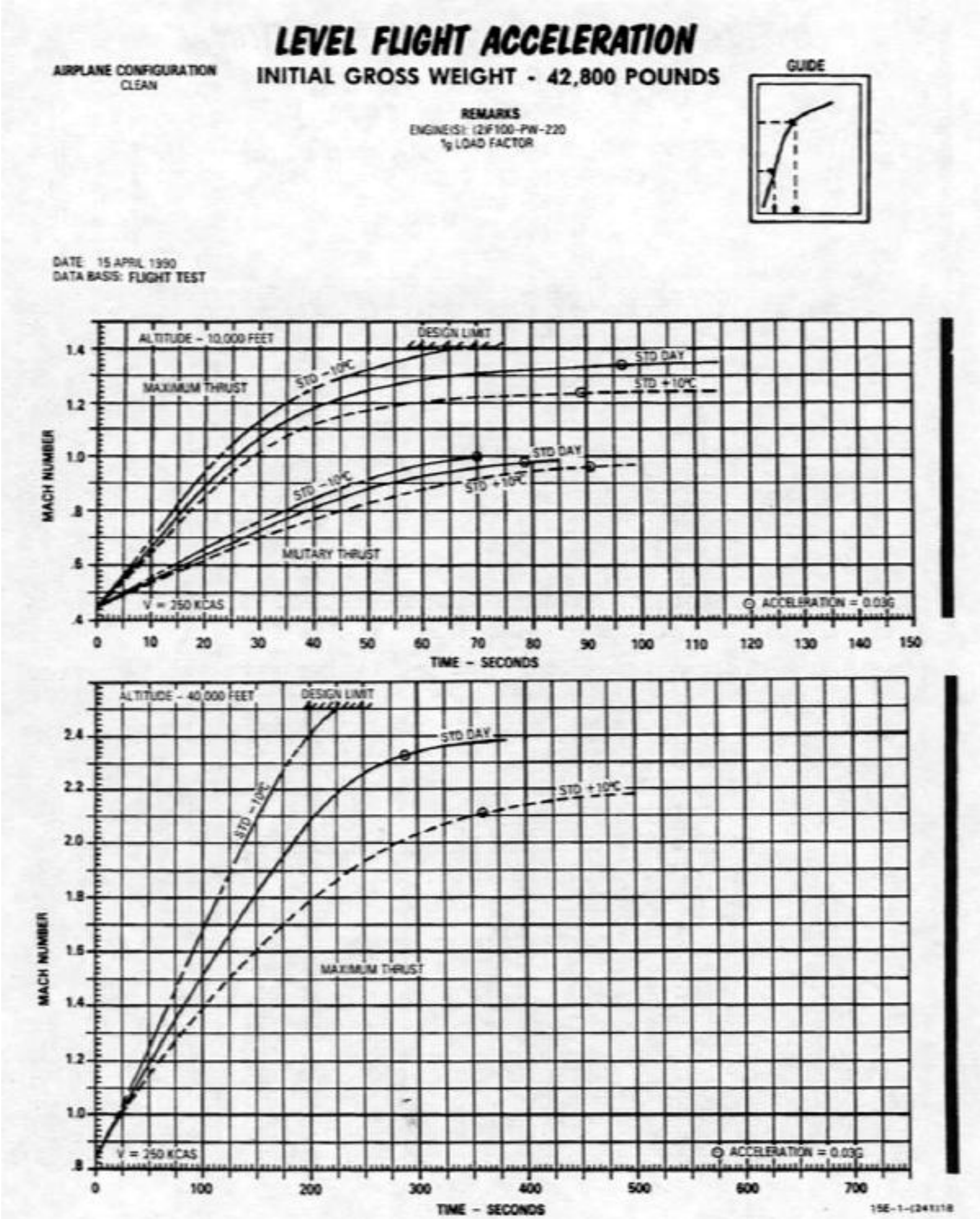

LEVEL FLIGHT ACCELERATION
AIRPLANE CONFIGURATION
CLEAN
INITIAL GROSS WEIGHT - 42,800 POUNDS
REMARKS
ENGINE(S): (2)F100-PW-220
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS: FLIGHT TEST
ALTITUDE - 10,000 FEET
DESIGN LIMIT
STD DAY
STD -10°C
STD +10°C
MAXIMUM THRUST
MILITARY THRUST
V = 250 KCAS
ACCELERATION = 0.03G
MACH NUMBER
TIME - SECONDS
ALTITUDE - 40,000 FEET
MAXIMUM THRUST
15E-1-(241)18

Figure A8-38

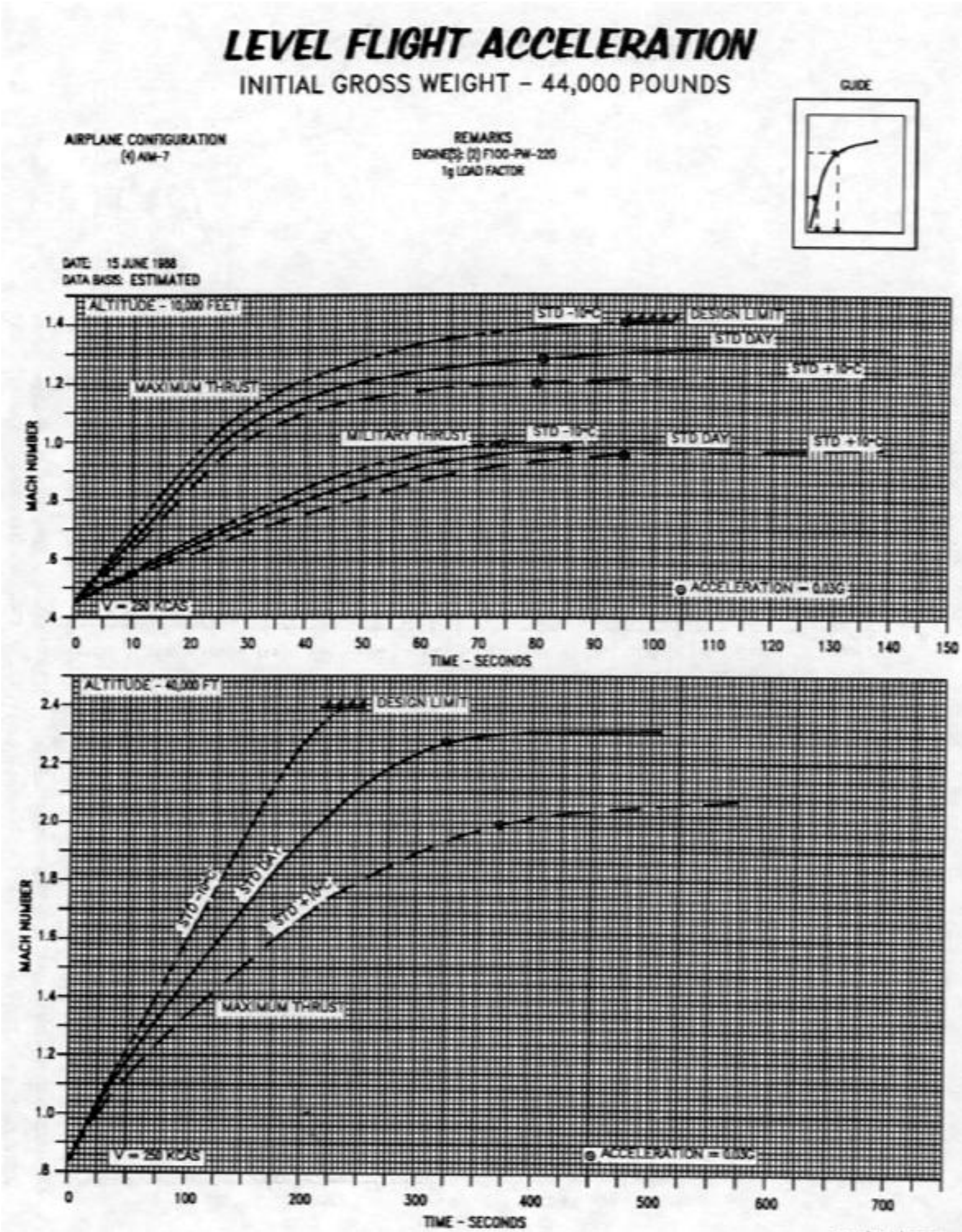

LEVEL FLIGHT ACCELERATION
INITIAL GROSS WEIGHT – 44,000 POUNDS
GUIDE
AIRPLANE CONFIGURATION
(4) AIM-7
REMARKS
ENGINE(S): (2) F100-PW-220
1g LOAD FACTOR
DATE: 15 JUNE 1988
DATA BASIS: ESTIMATED
ALTITUDE – 10,000 FEET
STD -10°C
DESIGN LIMIT
STD DAY
STD +10°C
MAXIMUM THRUST
MILITARY THRUST
ACCELERATION – 0.03G
V – 250 KCAS
MACH NUMBER
TIME – SECONDS
ALTITUDE – 40,000 FT
STD -10°C
STD DAY
STD +10°C
MAXIMUM THRUST

Figure A8-39

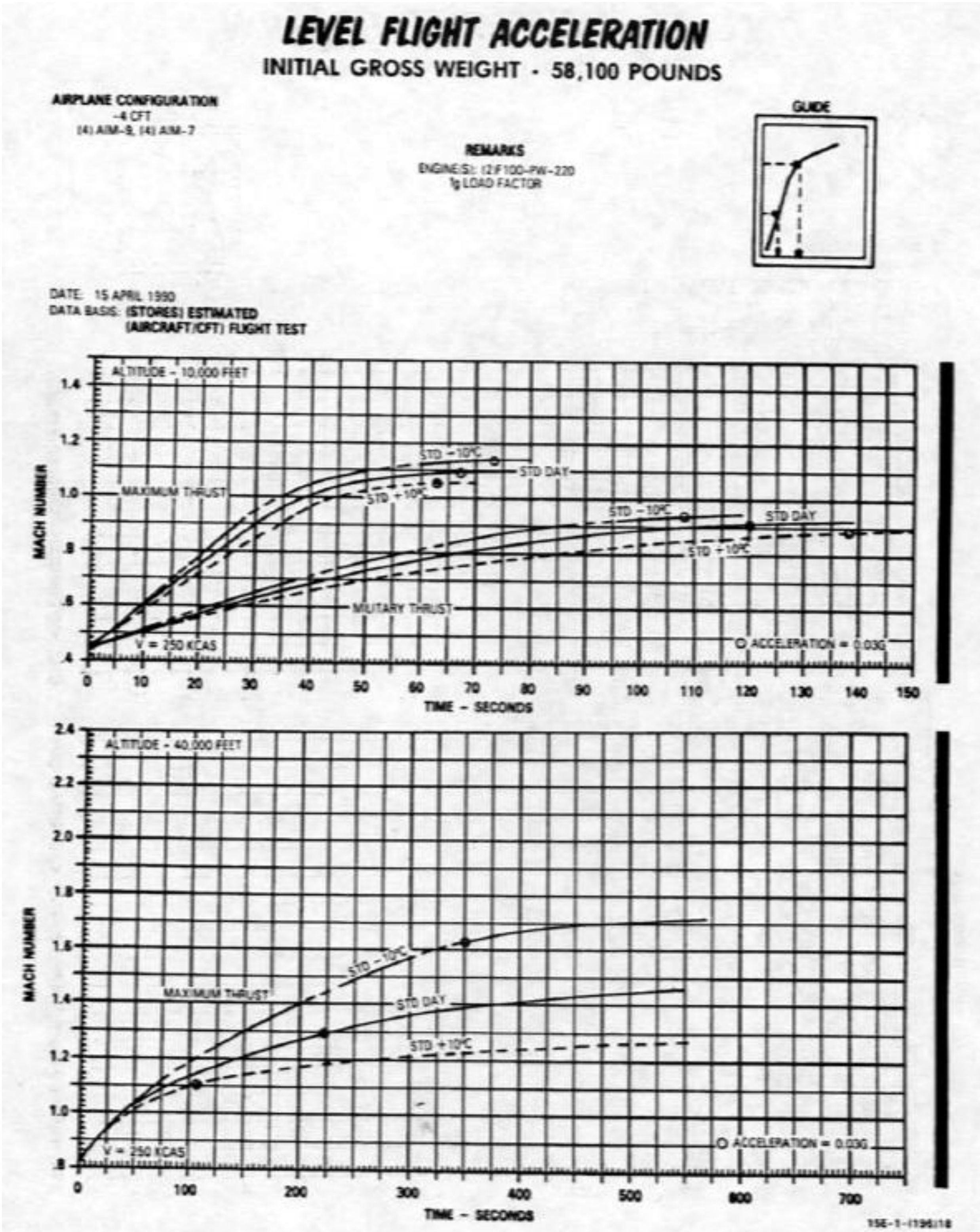

LEVEL FLIGHT ACCELERATION
INITIAL GROSS WEIGHT - 58,100 POUNDS
AIRPLANE CONFIGURATION
-4 CFT
(4) AIM-9, (4) AIM-7
REMARKS
ENGINE(S): (2) F100-PW-220
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
ALTITUDE - 10,000 FEET
MAXIMUM THRUST
STD -10°C
STD DAY
STD +10°C
MILITARY THRUST
V = 250 KCAS
O ACCELERATION = 0.03G
MACH NUMBER
TIME - SECONDS
ALTITUDE - 40,000 FEET
15E-1-(196)18

Figure A8-40

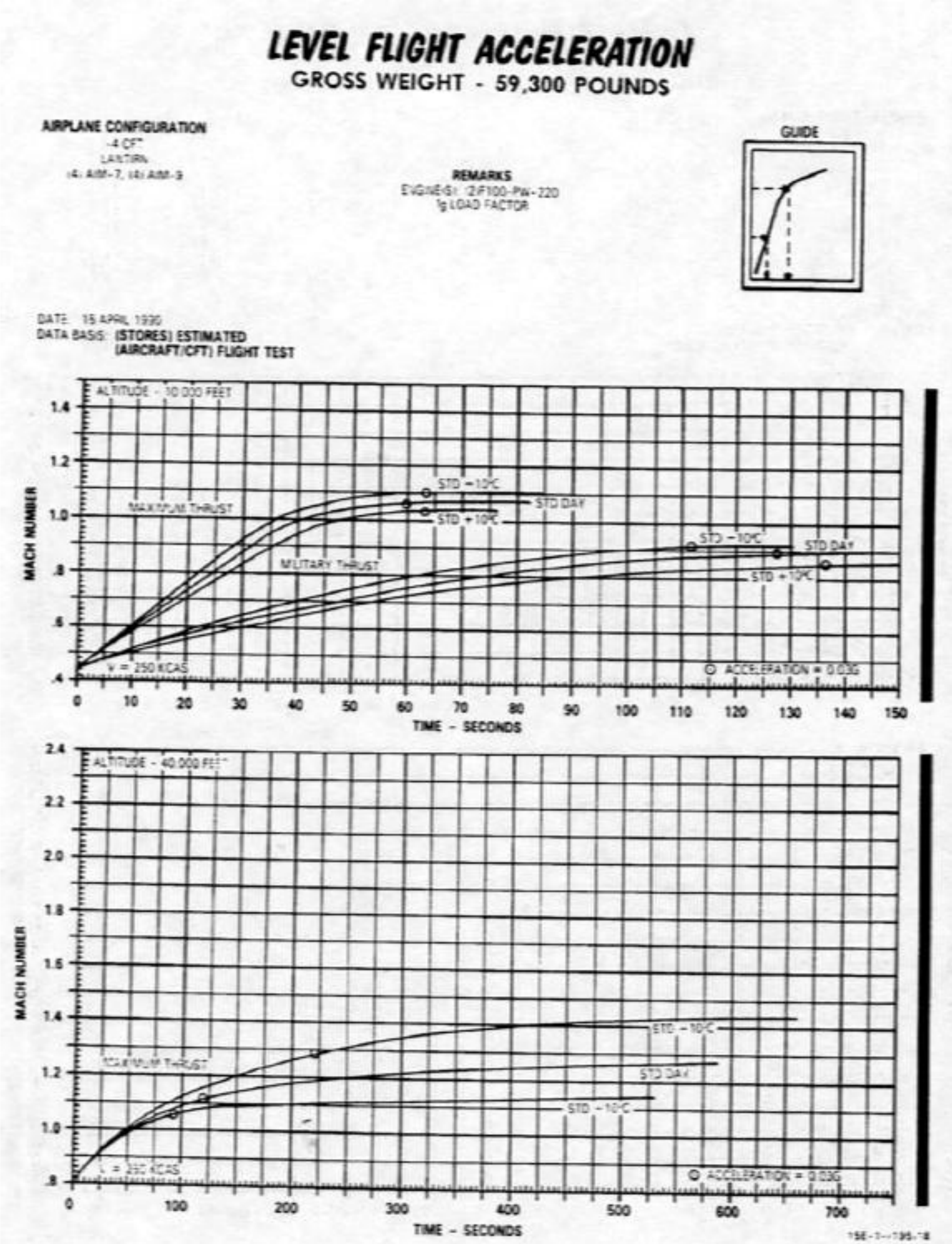

LEVEL FLIGHT ACCELERATION
GROSS WEIGHT - 59,300 POUNDS
AIRPLANE CONFIGURATION
REMARKS
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
ALTITUDE - 10,000 FEET
MAXIMUM THRUST
MILITARY THRUST
STD -10°C
STD DAY
STD +10°C
V = 250 KCAS
ACCELERATION = 0.03G
MACH NUMBER
TIME - SECONDS
ALTITUDE - 40,000 FEET

Figure A8-41

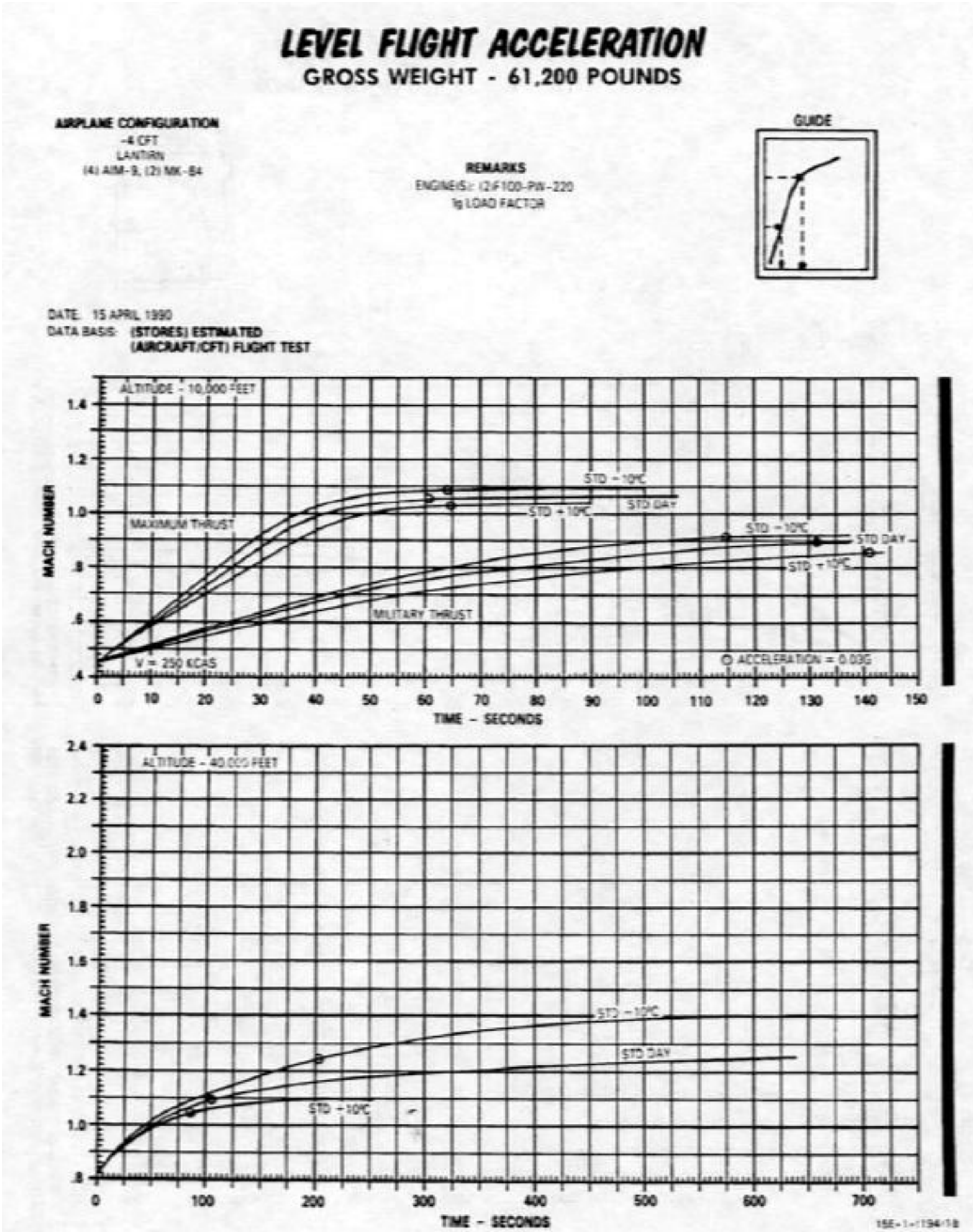

LEVEL FLIGHT ACCELERATION
GROSS WEIGHT - 61,200 POUNDS
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-9, (2) MK-84
REMARKS
ENGINE(S): (2)F100-PW-220
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
ALTITUDE - 10,000 FEET
MAXIMUM THRUST
MILITARY THRUST
STD - 10°C
STD DAY
STD + 10°C
V = 250 KCAS
ACCELERATION = 0.03G
MACH NUMBER
TIME - SECONDS
ALTITUDE - 40,000 FEET
15E-1-(194)18

Figure A8-42

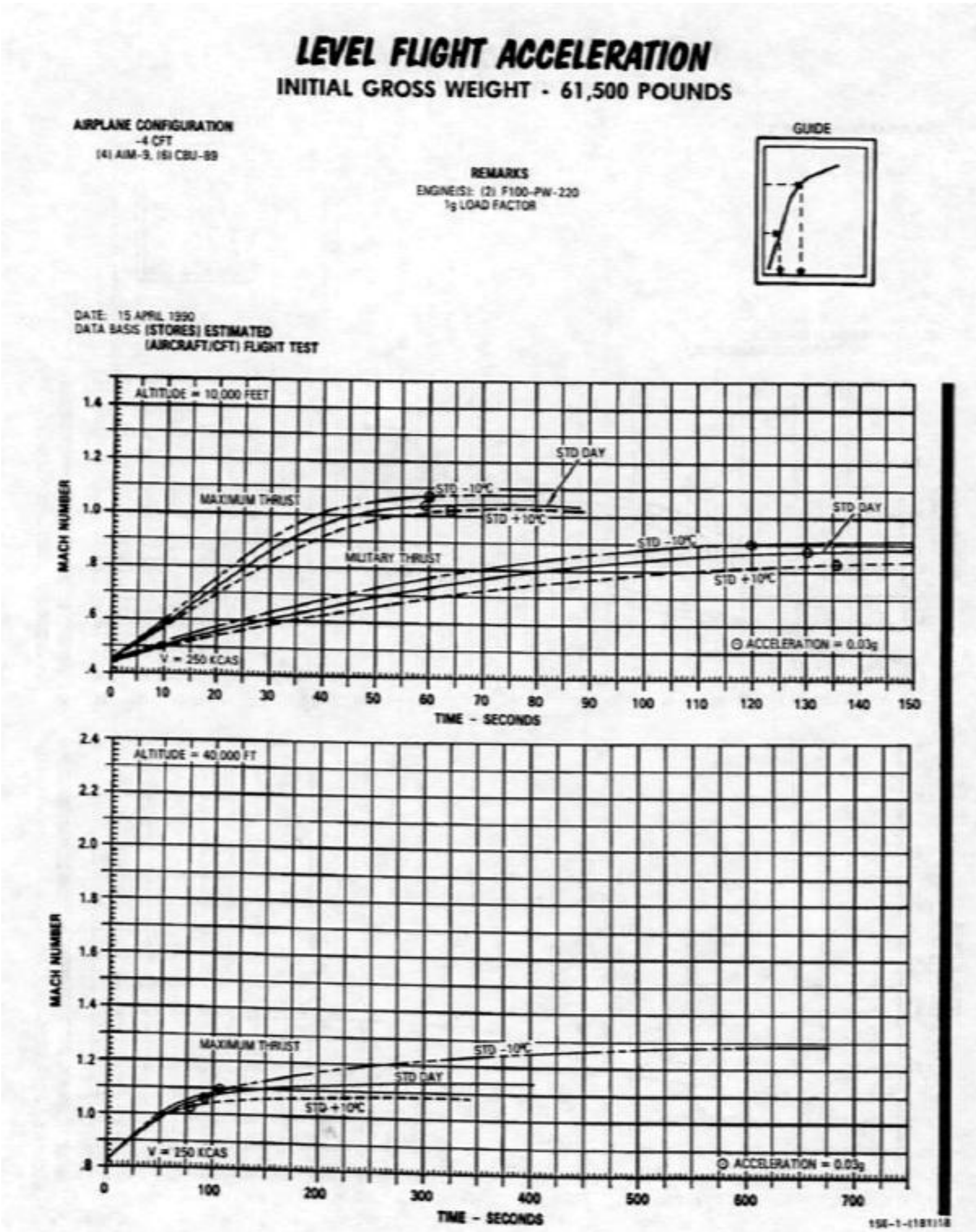

LEVEL FLIGHT ACCELERATION
INITIAL GROSS WEIGHT - 61,500 POUNDS
AIRPLANE CONFIGURATION
-4 CFT
(4) AIM-9, (6) CBU-89
REMARKS
ENGINE(S): (2) F100-PW-220
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
ALTITUDE = 10,000 FEET
MAXIMUM THRUST
STD DAY
STD -10°C
STD +10°C
MILITARY THRUST
V = 250 KCAS
ACCELERATION = 0.03g
MACH NUMBER
TIME - SECONDS
ALTITUDE = 40,000 FT
15E-1-(181)18

Figure A8-43

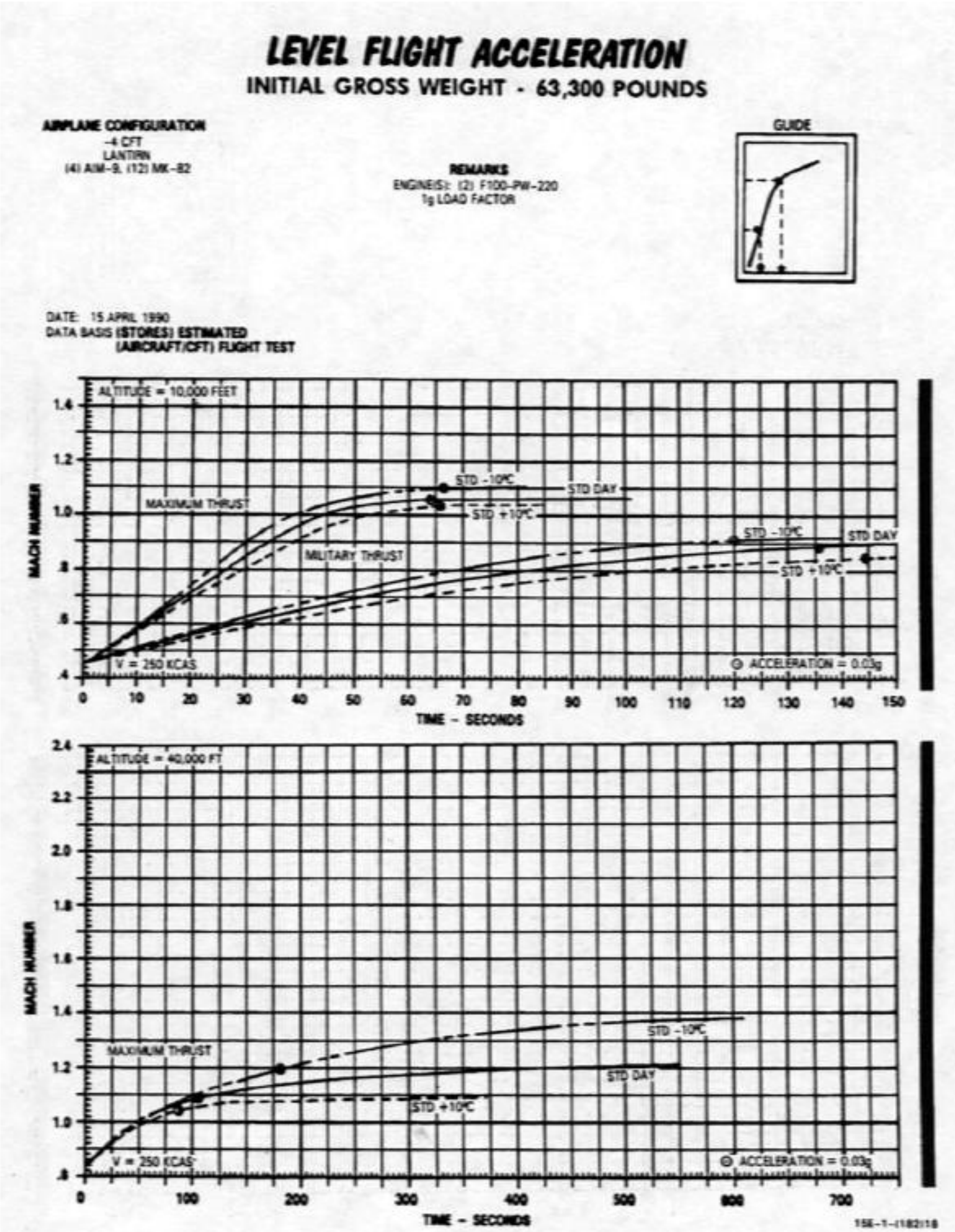

LEVEL FLIGHT ACCELERATION
INITIAL GROSS WEIGHT - 63,300 POUNDS
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-9, (12) MK-82
REMARKS
ENGINE(S): (2) F100-PW-220
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
ALTITUDE = 10,000 FEET
MAXIMUM THRUST
MILITARY THRUST
STD -10°C
STD DAY
STD +10°C
V = 250 KCAS
ACCELERATION = 0.03g
MACH NUMBER
TIME - SECONDS
ALTITUDE = 40,000 FT
15E-1-(182)18

Figure A8-44

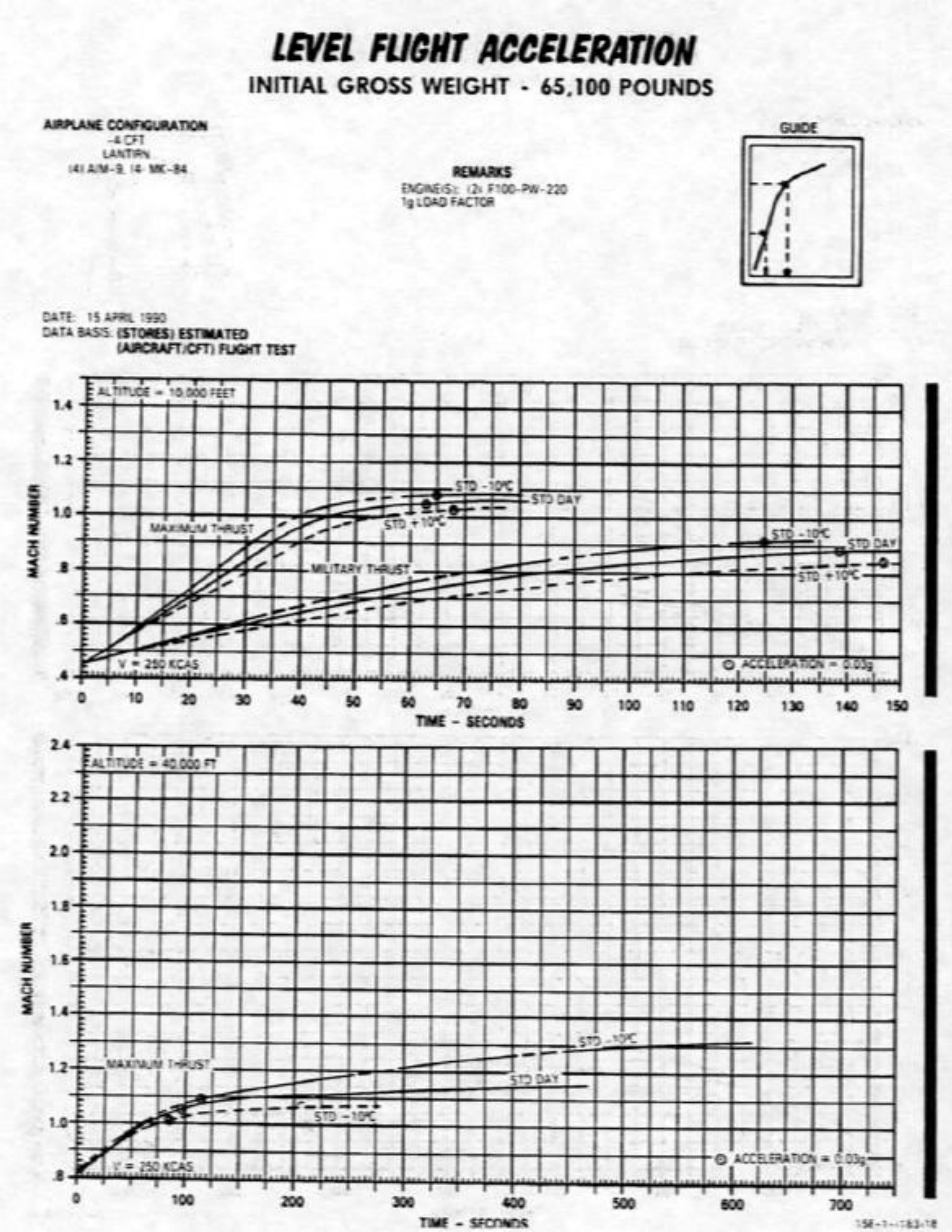

LEVEL FLIGHT ACCELERATION
INITIAL GROSS WEIGHT - 65,100 POUNDS
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-9, (4) MK-84
REMARKS
ENGINE(S): (2) F100-PW-220
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
ALTITUDE = 10,000 FEET
MAXIMUM THRUST
MILITARY THRUST
STD -10°C
STD DAY
STD +10°C
V = 250 KCAS
ACCELERATION = 0.03g
MACH NUMBER
TIME - SECONDS
ALTITUDE = 40,000 FT
MAXIMUM THRUST
STD -10°C
STD DAY
STD -10°C
V = 250 KCAS
ACCELERATION = 0.03g
MACH NUMBER
TIME - SECONDS
15E-1-(163)-18

Figure A8-45

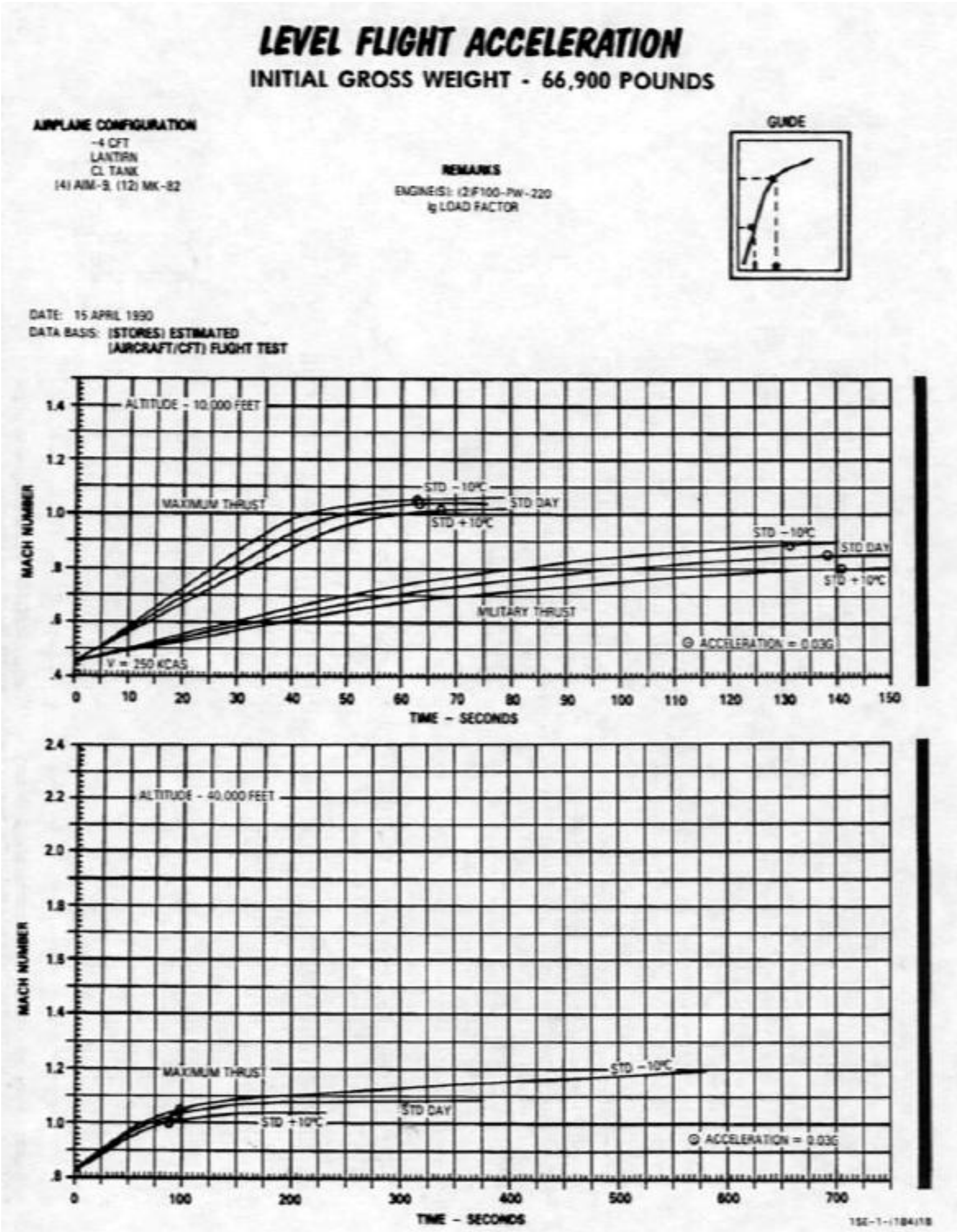

LEVEL FLIGHT ACCELERATION
INITIAL GROSS WEIGHT - 66,900 POUNDS
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
CL TANK
(4) AIM-9, (12) MK-82
REMARKS
ENGINE(S): (2)F100-PW-220
1g LOAD FACTOR
GUIDE
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
ALTITUDE - 10,000 FEET
MAXIMUM THRUST
STD -10°C
STD DAY
STD +10°C
MILITARY THRUST
ACCELERATION = 0.03G
V = 250 KCAS
MACH NUMBER
TIME - SECONDS
ALTITUDE - 40,000 FEET
15E-1-(184)18

Figure A8-46

SUSTAINED LEVEL TURNS

GROSS WEIGHT - 39,500 POUNDS
MAXIMUM THRUST

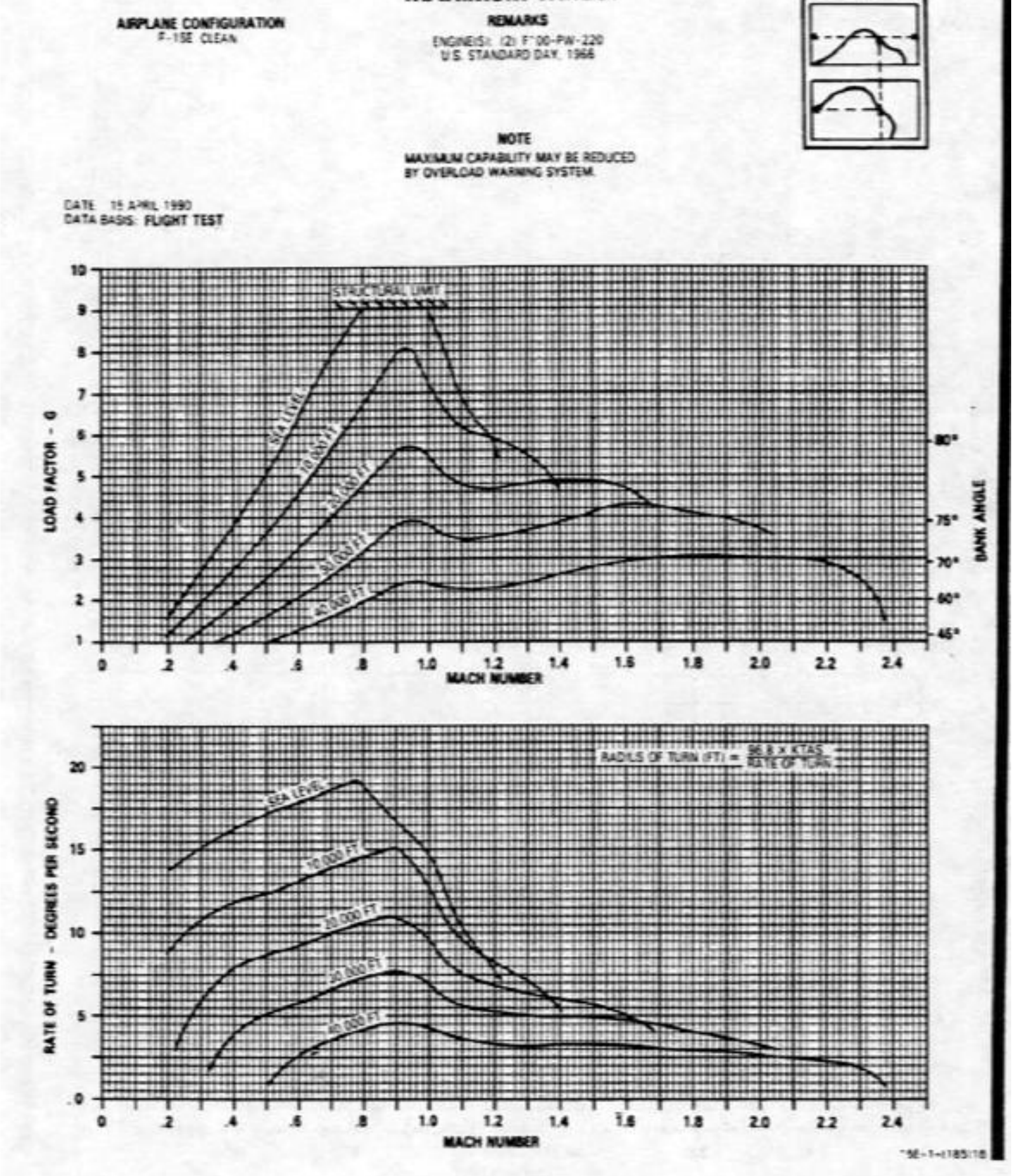


Figure A8-47

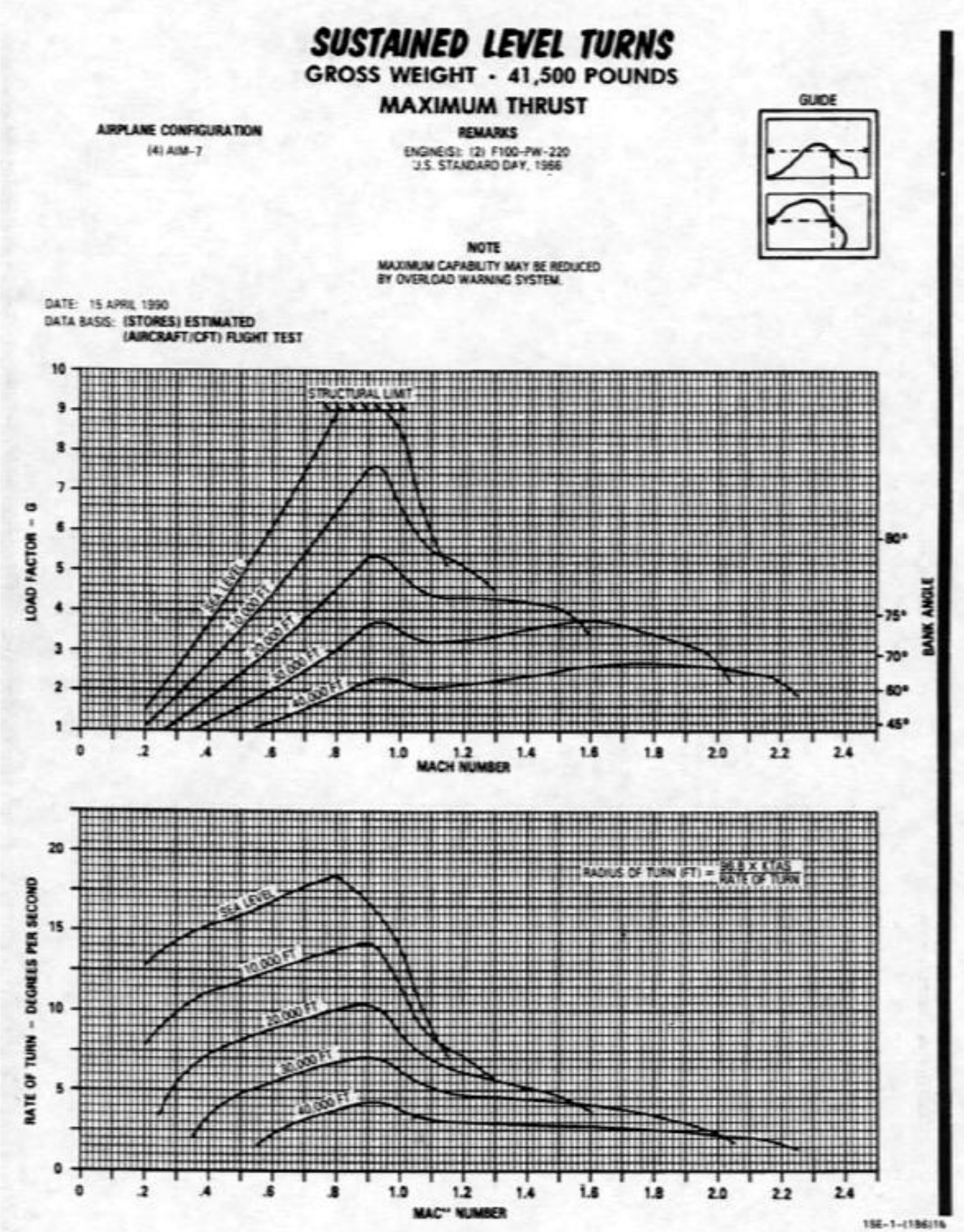

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 41,500 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
(4) AIM-7
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
STRUCTURAL LIMIT
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
LOAD FACTOR - G
BANK ANGLE
80°
75°
70°
60°
45°
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 96.8 X KTAS / RATE OF TURN
MAC" NUMBER
15E-1-(186)1%

Figure A8-48

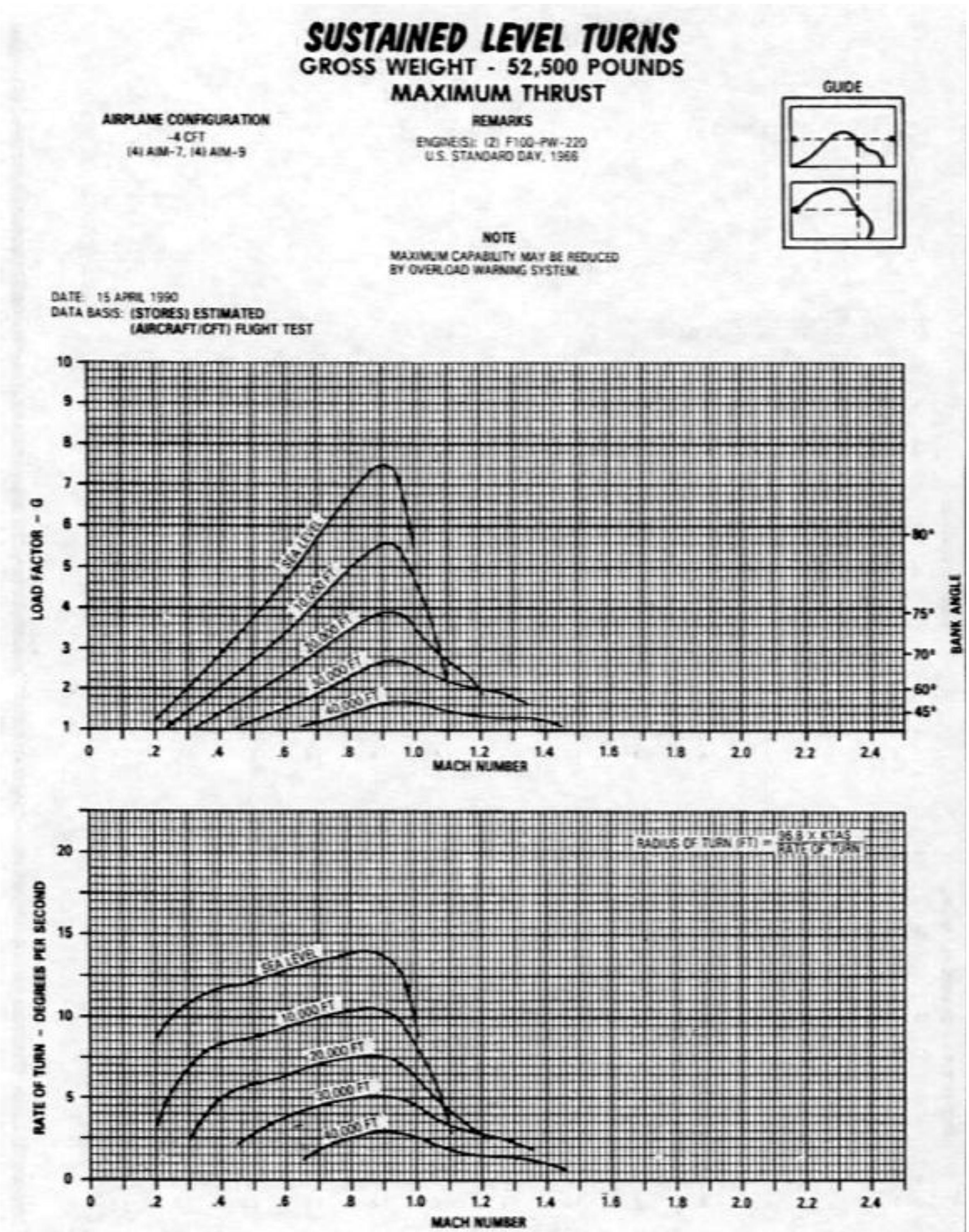

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 52,500 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4 CFT
(4) AIM-7, (4) AIM-9
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED
BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
LOAD FACTOR - G
BANK ANGLE
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 96.8 X KTAS / RATE OF TURN

Figure A8-49

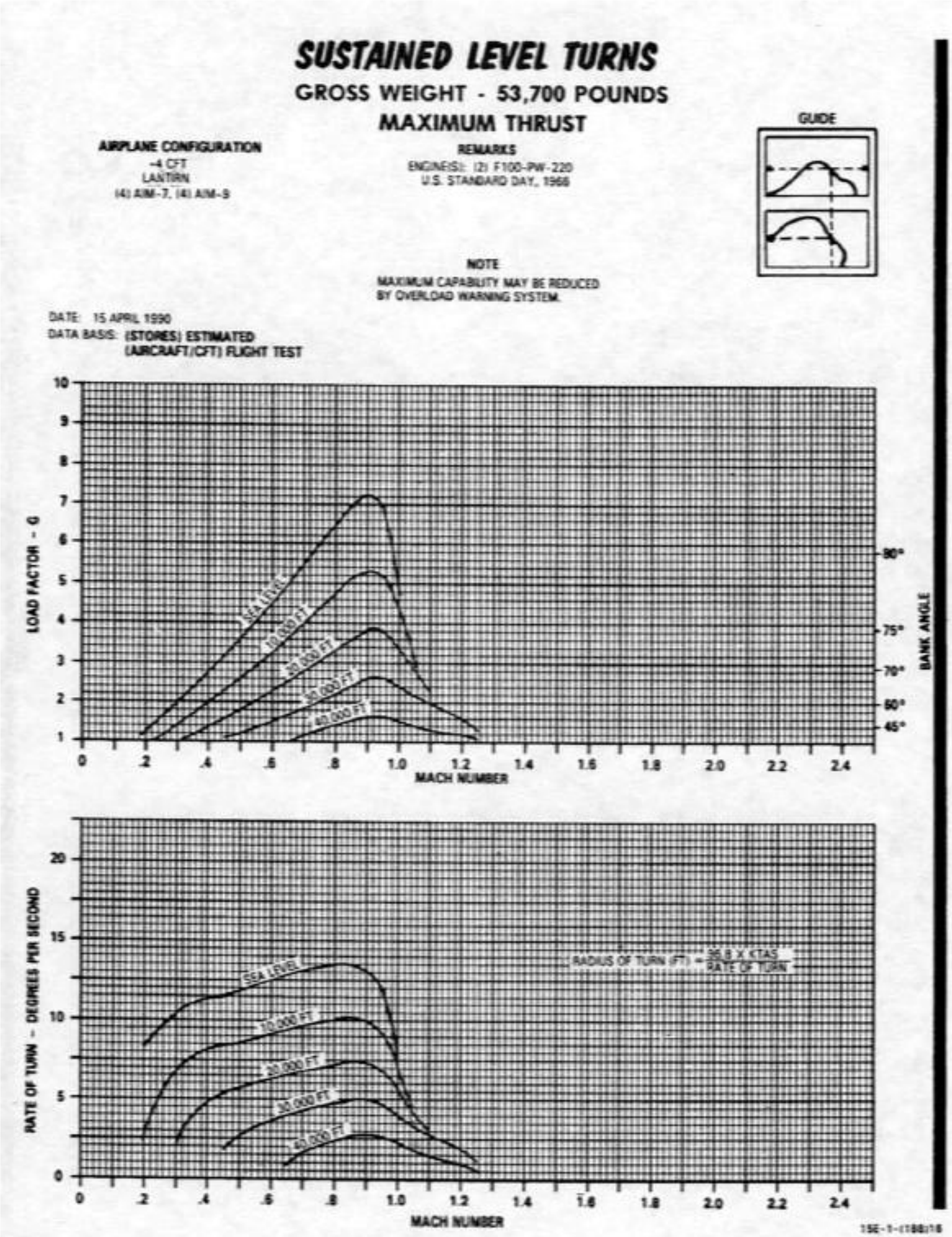

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 53,700 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-7, (4) AIM-9
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
LOAD FACTOR - G
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
BANK ANGLE
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 95.8 X KTAS / RATE OF TURN
15E-1-(188)16

Figure A8-50

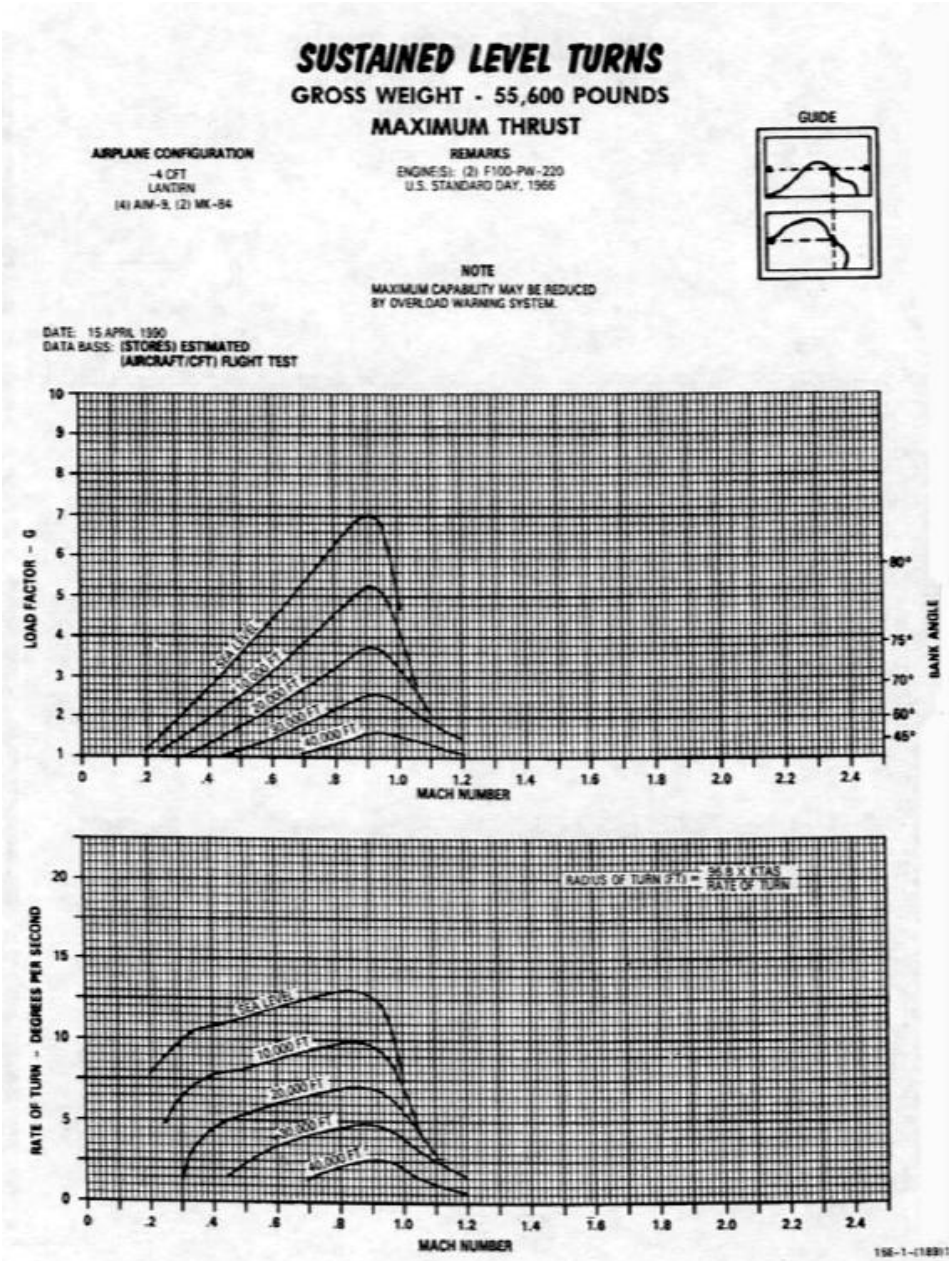

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 55,600 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-9, (2) MK-84
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED
BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
LOAD FACTOR - G
BANK ANGLE
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 96.8 X KTAS / RATE OF TURN

Figure A8-51

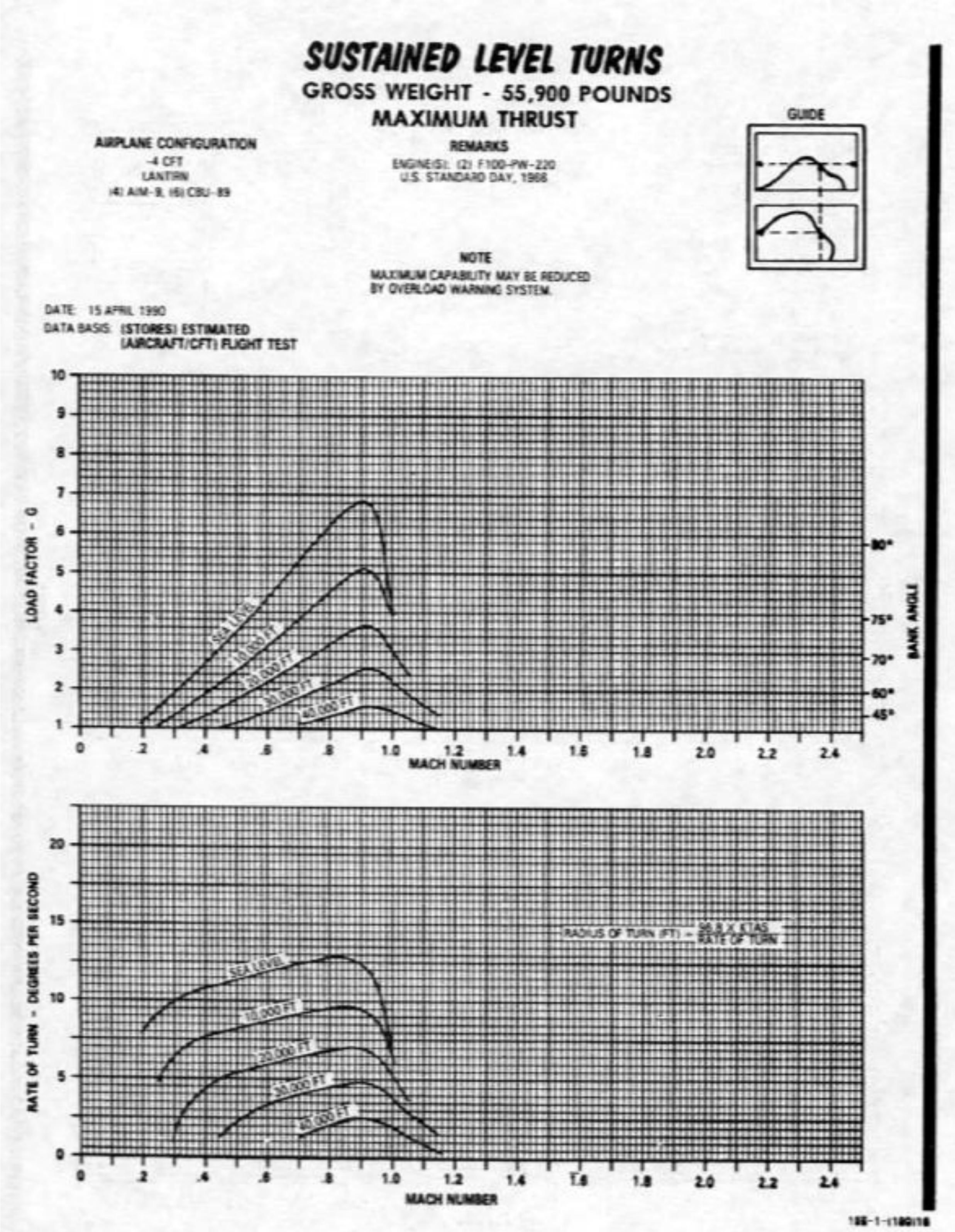

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 55,900 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-9, (6) CBU-89
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED
BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
LOAD FACTOR - G
BANK ANGLE
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 96.8 X KTAS / RATE OF TURN
15E-1-(180)18

Figure A8-52

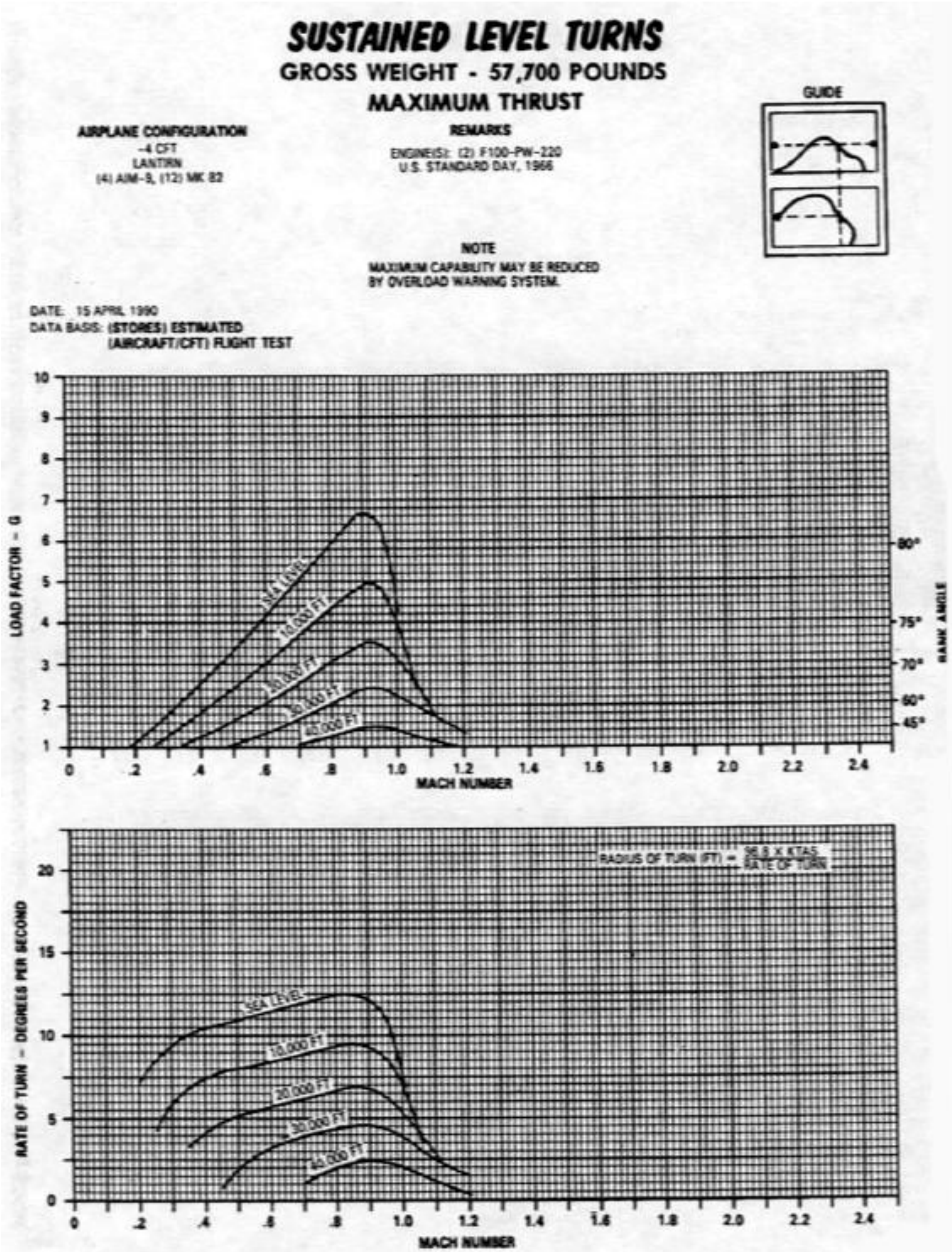

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 57,700 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-9, (12) MK 82
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED
BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
LOAD FACTOR - G
BANK ANGLE
80°
75°
70°
60°
45°
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 96.8 X KTAS / RATE OF TURN
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
MACH NUMBER

Figure A8-53

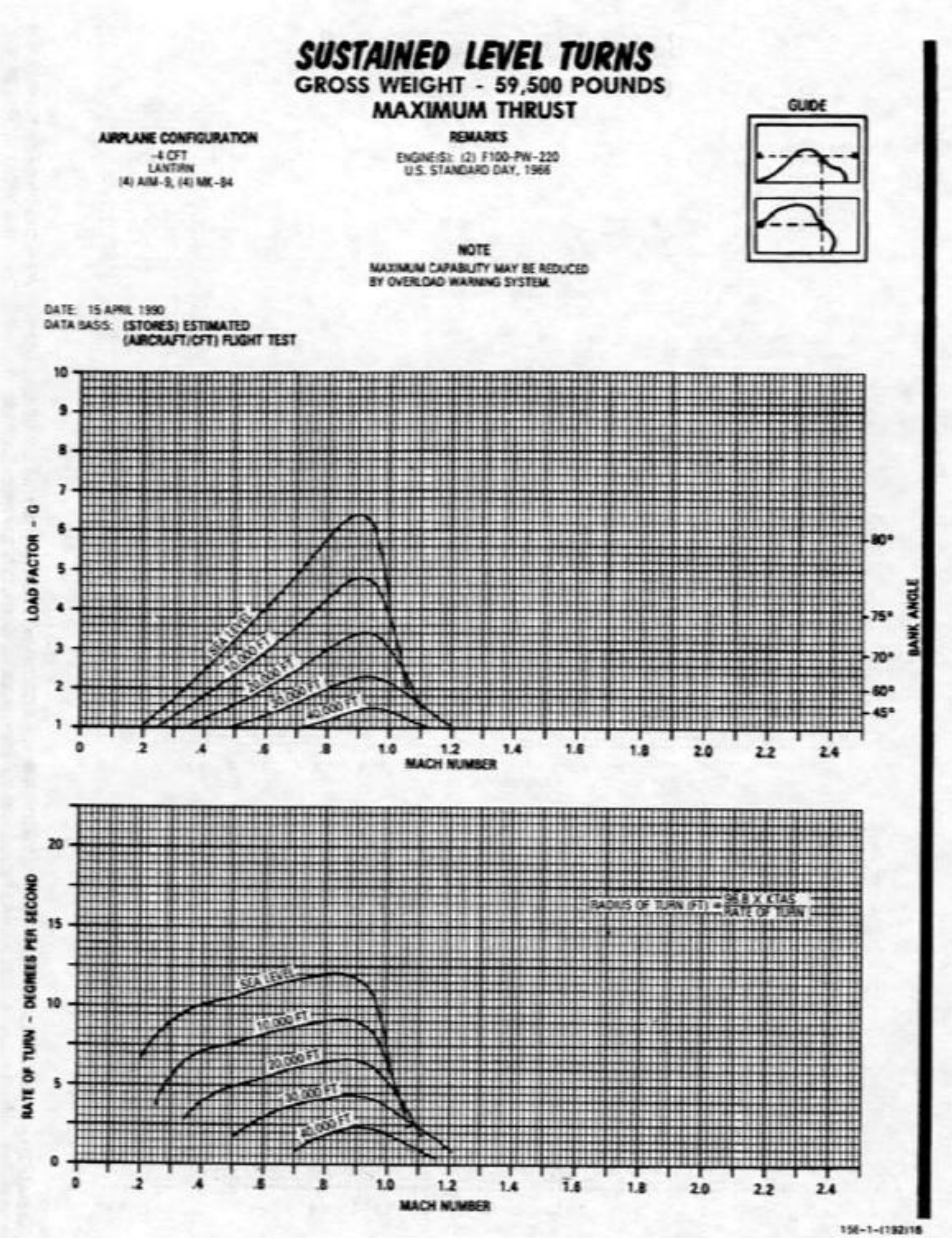

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 59,500 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
(4) AIM-9, (4) MK-84
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED
BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
LOAD FACTOR - G
BANK ANGLE
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 96.8 X KTAS / RATE OF TURN
15E-1-(192)18

Figure A8-54

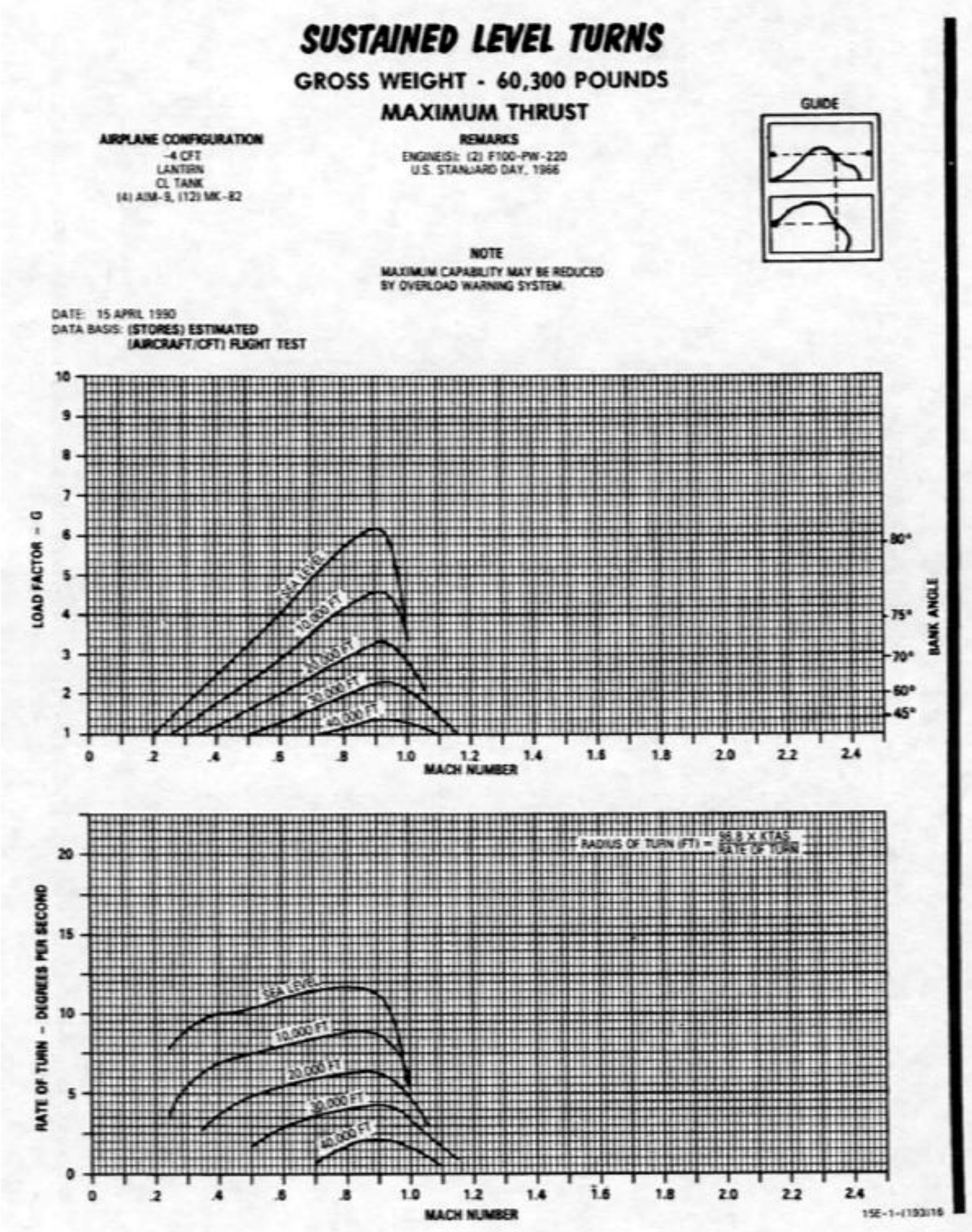

SUSTAINED LEVEL TURNS
GROSS WEIGHT - 60,300 POUNDS
MAXIMUM THRUST
AIRPLANE CONFIGURATION
-4 CFT
LANTIRN
CL TANK
(4) AIM-9, (12) MK-82
REMARKS
ENGINE(S): (2) F100-PW-220
U.S. STANDARD DAY, 1966
GUIDE
NOTE
MAXIMUM CAPABILITY MAY BE REDUCED BY OVERLOAD WARNING SYSTEM.
DATE: 15 APRIL 1990
DATA BASIS: (STORES) ESTIMATED
(AIRCRAFT/CFT) FLIGHT TEST
LOAD FACTOR - G
BANK ANGLE
SEA LEVEL
10,000 FT
20,000 FT
30,000 FT
40,000 FT
MACH NUMBER
RATE OF TURN - DEGREES PER SECOND
RADIUS OF TURN (FT) = 96.8 X KTAS / RATE OF TURN
15E-1-(193)16

Figure A8-55

APPENDIX B

CREDITS AND DISCLAIMER

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Diego Menedez
Ken Stallings
Gunnar Meeren
Bill Leaming
There are more but we've not gotten responses to our requests for their names.

I would like to take this time and place to thank all of those who not only participated but also stuck through with us on the journey today. To those who walked away, what can I say except I wish you the best…

DISCLAIMER

Note: While this POH was designed to strongly replicate the actual F-15E Flight Manual, USAF Technical Order 1F-15E-1, dated 15 August 1990, it must be remembered that this document is intended merely to support virtual flight operations of the MilViz F-15E in FSX. Nothing written in this document, nor in the modeling and presentation of the MilViz F-15E, should be used to support actual flight operations or to satisfy formal flight training without certification by the appropriate national aviation authorities. In addition, while modeling a F-15E aircraft, neither this aircraft nor the manuals are official products of McDonnell-Douglas Aviation, nor Boeing Aircraft, nor the USAF.

LIMITATIONS FOR THE MILVIZ F-15E Strike Eagle

We are selling you this product because we believe that most, if not all, of you wish to have the best F-15E Strike Eagle out on the market today. Even AFTER the "other" guys one is out.

Once you have installed the product, start FSX. You will be asked several times if you wish to allow this dll and that dll to install. Say yes to all. From now on, you will be asked to do this twice every time you start FSX. This is to prevent the Milviz F-15E from affecting other packages using similar technology. (other companies do this as well). If you do not wish this to happen further and would like to remove the offending dialogs, you can find an uninstaller in the Simobjects\Airplanes\Milviz F-15E\uninstaller directory. Run this and they will be gone. Should you wish to fly the Milviz F-15E again, merely run the installer.exe and it will be flyable again.

It needs to be stressed that there are some limitations in what you can do with this bird. They are listed below. These limitations and others in the weapons and radar system are not fixable. We will not be supporting them sorry to say. If you find a bug and we say that it is related to those systems or is in some way not fixable, Caveat Emptor I.e. it will not be fixed.

1) There are two dll's that need to be ok'd when you start FSX to fly and fight the plane. Failure to ok them will result in a brick. However, if you wish to fly something else, then say NO to both. We have supplied an exe that will remove these if and when you decide that you no longer wish to fly the Milviz F-15E.
2) Weapons will drop from the center of the plane rather than from the rack. However, if you have time to see this, you are not doing the drop correctly. You should be very busy pushing buttons and throwing switches…
3) If you are not in auto or are not descending, your dumb bombs may become space bombs. They will fly off into space.
4) The same can happen with GBU's but rarely does so. Therefore, it is suggested that you load up with GBU's and or LGB's.
5) Missiles work fine and will destroy not only targets of opportunity but also other F-15's (in MP). They will also work on future Milviz products… Of course, they may be able to fight back…
6) Note on the weapons release. Failure to get far enough away before they hit will damage or even kill you.
7) Multiplayer works but shared cockpit doesn't and will not be implemented.
8) The 4 MFD's in the back seat work but 3 of them are tied to the front. Note that most of the switchology in the back is tied to the front as well. (will not fix)
9) On startup, the radar may "blip" several times. Let it do so before trying to fire weapons on the ground. (In RL this would probably get you shot)
10) Occasionally the left engine will not start in both quick start and regular starting modes. The way around this is twofold: in QS, press and hold CTRL E for about a minute and the engine will start. In regular, make sure you start the left engine FIRST and do

nothing at all including switching views, switching knobs etc. DO NOTHING.

11) You MUST load up the weapons before starting engines. Shift 3 brings up the menu for that. Failure to do so will result in the plane shutting down and you will have to restart it. This is normal as we don't want you blowing it up. After all, it cost about 40 million.

12) When you load up fuel tanks, you must slide the fuel slider back and forth at least once per tank to "fill" them

13) The fuel system is a bit dorky. It may sometimes let you know that you have to switch tanks. Do so.

14) The fuel quantity gauge doesn't work as per TO. It never will. Do not ask.

15) When using internal lighting it is important to note that we are limited by what FSX can do, especially at dusk. When switching from a unlit panel to a lit panel, the panel will darken. We cannot fix this. Some of the switches do not work properly. Cannot fix this either.

16) We also suggest that you turn on panel lighting (eng lights) before turning on either console lights or storm/flood lights.

17) We are using "Lotus" style lights. They have inherent problems such as "cycling" or "cloud issues". The first means just cycle your landing gear and the issue should go away. (Do not use L for lights!). The second cannot be fixed and is caused by the fact that the lights are being projected on a polygon.

18) Occasionally, a tone will sound and nothing can, apparently be done to stop it. That is correct. Restart your flight.

19) Occasionally, the radar will stop functioning. This cannot be fixed.

20) If you are trying desperately to figure out how to use the radar and or fire the weapons, we have video tutorials available for those who purchased the product.

21) We are working on afterburner effects and gun effects. These will be added shortly after release in a patch.

We all thank you for your purchase and hope that, even though this one isn't at our best, you will continue to think of us as one of the best.