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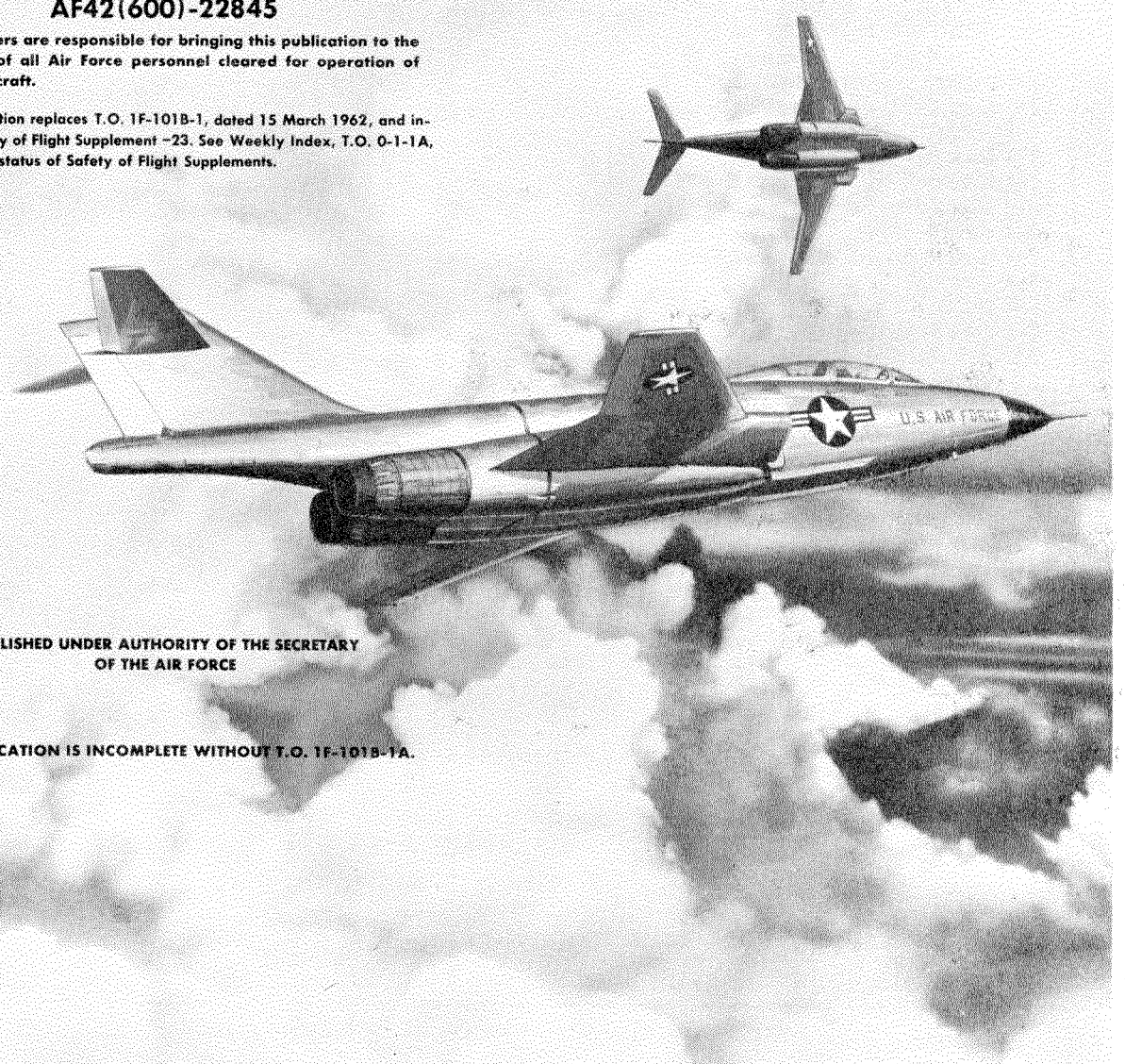
FLIGHT MANUAL

USAF SERIES F-101B AND F-101F AIRCRAFT

AF33(600)-29841
AF42(600)-22845

Commanders are responsible for bringing this publication to the attention of all Air Force personnel cleared for operation of subject aircraft.

This publication replaces T.O. 1F-101B-1, dated 15 March 1962, and includes Safety of Flight Supplement -23. See Weekly Index, T.O. 0-1-1A, for current status of Safety of Flight Supplements.



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FB33-TPG

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CURRENT STATUS OF AIRCREWS' ABBREVIATED CHECKLIST

T.O. 1F-101B-(CL)1-1
15 July 1963

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

ADDITIONAL COPIES OF THIS PUBLICATION MAY BE OBTAINED AS FOLLOWS:

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

G
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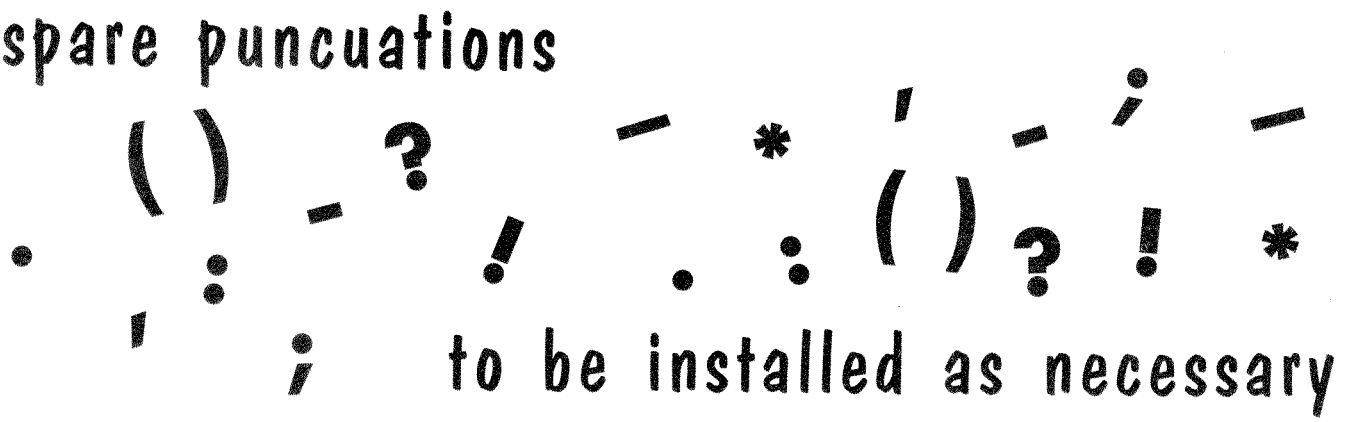


SCOPE This manual contains the necessary information for safe and efficient operation of the F-101B. These instructions provide you with a general knowledge of the airplane, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and therefore, basic flight principles are avoided.

SOUND JUDGMENT Instructions in this manual are for a crew inexperienced in the operation of this airplane. This manual provides the vest possible operating instructions under most circumstances but it is a poor substitute for sound judgment. Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures.

HOW TO BE ASSURED OF HAVING LATEST DATA Refer to T.O. 0-1-1A which is issued weekly and devoted soley to the listing of all current Flight Manuals, Safety of Flight Supplements and Checklists. Its frequency of issue and brevity assures an accurate, up-to-date listing of these publications.

PERMISSIBLE OPERATIONS The Flight Manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations are prohibited unless specifically covered herein. Clearance must be obtained before any questionable operation is attempted which is not specifically permitted in this manual.

CHECKLISTS The Flight Manual contains only amplified checklists. Abbreviated checklists have been issued as separate technical orders - see the back of the title page for T.O. number and date of your latest checklist. Line items in the Flight Manual and checklists are identical with respect to arrangement and item number. Whenever a Safety of Flight Supplement affects the abbreviated checklist, write in the applicable change on the affected checklist page. As soon as possible, a new checklist page, incorporating the supplement, will be issued. This will keep handwritten entries of Safety of Flight Supplement information in your checklist to a minimum.

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

WARNING

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

CAUTION

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

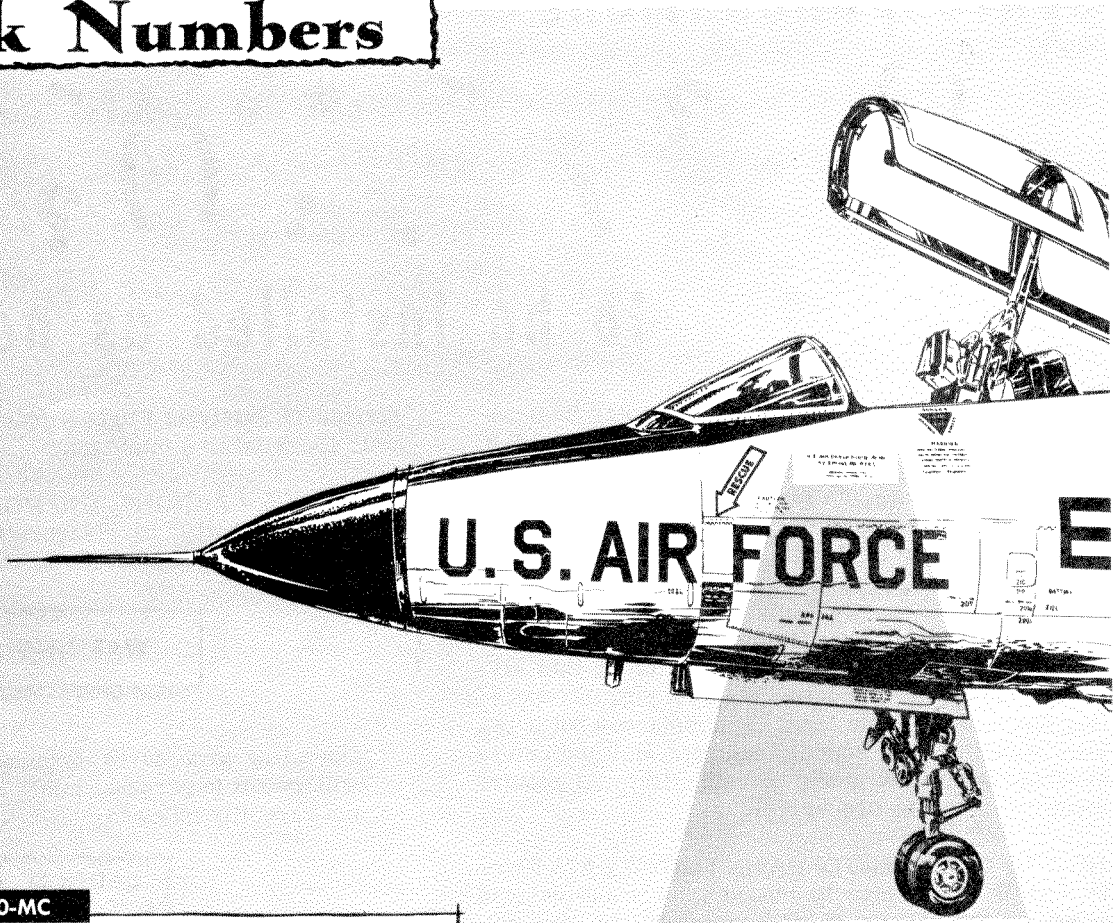
Note

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

CHANGE SYMBOL Revised text is indicated by a black vertical line in the outer margin of the page. The symbol indicates changes made in the current change. No symbol is used to indicate revised illustrations.

YOUR RESPONSIBILITY–TO LET US KNOW Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual Program are welcomed. These should be forwarded through your Command Headquarters to Service Engineering Division, Hill A.F.B., Utah, Attn: OONEO.

Block Numbers



U. S. AIR FORCE F-101B-40-MC
A. F. SERIAL 56-233A

or

U. S. AIR FORCE F-101F-51-MC
A. F. SERIAL 56-244A

F-101B-40-MC
A.F. SERIAL 56-233A THRU 56-237A

F-101B-45-MC
A.F. SERIAL 56-238A THRU 56-240A

F-101B-50-MC
A.F. SERIAL 56-241A THRU 56-243A

F-101F-51-MC
A.F. SERIAL 56-244A AND 56-245A

F-101B-55-MC
A.F. SERIAL 56-248A THRU 56-250A

F-101F-56-MC
A.F. SERIAL 56-246A AND 56-247A

F-101B-60-MC
A.F. SERIAL 56-251A, 56-252A, 56-254A THRU 56-257A

F-101F-61-MC
A.F. SERIAL 56-253A

F-101 TYPE AND MODEL
B SERIES LETTER (PILOT AND R I O)
40 BLOCK NUMBER (PILOT AND R I O)
MC MCDONNELL AIRCRAFT CORP.

or

F-101 TYPE AND MODEL
F SERIES LETTER (DUAL CONTROL)
51 BLOCK NUMBER (DUAL CONTROL)
MC MCDONNELL AIRCRAFT CORP.

FB33-102-1D

F-101B-65-MC
A.F. SERIAL 56-258A, 56-259A, 56-261A, 56-263A THRU 56-268A

F-101F-66-MC
A.F. SERIAL 56-260A AND 56-262A

F-101B-70-MC
A.F. SERIAL 56-269A THRU 56-273A, 56-278A THRU 56-280A

F-101F-71-MC
A.F. SERIAL 56-274A THRU 56-277A

F-101B-75-MC
A.F. SERIAL 56-281A THRU 56-288A, 56-290A THRU 56-293A, 56-295A THRU 56-298A

F101F-76-MC
A.F. SERIAL 56-289A, 56-294A, 56-299A

F-101B-80-MC
A.F. SERIAL 56-300A THRU 56-303A, 56-305A THRU 56-307A, 56-309A THRU 56-311A, 56-313A THRU 56-315A, 56-317A THRU 56-319A, 56-321A THRU 56-323A, 56-325A THRU 56-327A, 57-247A THRU 57-262A

F-101F-81-MC
A.F. SERIAL 56-304A, 56-308A, 56-312A, 56-316A, 56-320A, 56-324A, 56-328A

F-101B-85-MC
A.F. SERIAL 57-264A THRU 57-266A, 57-268A THRU 57-270A, 57-272A THRU 57-274A, 57-276A THRU 57-278A, 57-280A THRU 57-282A, 57-284A THRU 57-286A, 57-288A THRU 57-291A, 57-293A THRU 57-296A, 57-298A THRU 57-301A, 57-303A THRU 57-306A

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F-101F-91-MC
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F-101B-95-MC
A.F. SERIAL 57-358A THRU 57-364A, 57-366A THRU 57-371A, 57-373A THRU 57-378A, 57-380A THRU 57-385A, 57-387A THRU 57-392A, 57-394A THRU 57-399A, 57-401A THRU 57-406A

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F-101B-100-MC
A.F. SERIAL 57-408A THRU 57-413A, 57-415A THRU 57-420A, 57-422A THRU 57-427A, 57-429A THRU 57-448A, 57-450A THRU 57-452A

F-101F-101-MC
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A.F. SERIAL 58-305A THRU 58-310A, 58-312A THRU 58-317A, 58-319A THRU 58-323A, 58-325A THRU 58-330A, 58-332A THRU 58-337A, 58-339A THRU 58-342A

F-101F-111-MC
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F-101B-115-MC
A.F. SERIAL 59-391A, 59-392A, 59-394A THRU 59-399A, 59-401A THRU 59-406A, 59-408A THRU 59-412A, 59-414A THRU 59-418A, 59-420A THRU 59-424A, 59-426A THRU 59-436A, 59-438A THRU 59-440A

F-101F-116-MC
A.F. SERIAL 59-393A, 59-400A, 59-407A, 59-413A, 59-419A, 59-425A, 59-437A

F-101B-120-MC
A.F. SERIAL 59-441A, 59-442A, 59-444A THRU 59-448A, 59-450A THRU 59-453A, 59-455A THRU 59-459A, 59-461A THRU 59-465A, 59-467A THRU 59-471A, 59-473A THRU 59-477A, 59-479A THRU 59-483A

F-101F-121-MC
A.F. SERIAL 59-443A, 59-449A, 59-454A, 59-460A, 59-466A, 59-472A, 59-478A

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BLOCK DESIGNATION CODES

CODE

The information contained in this Manual is applicable to F-101B and F-101F airplanes, block 40 (56-233) through block 120 (59-483). Effectivity differences within this group of airplanes are designated by block number symbols which appear on illustrations and within the text. Effectivity differences within a block of airplanes is designated by airplane serial number followed by the block number symbol. An illustration or paragraph heading bearing a block number symbol indicates that the information is pertinent only to that block of airplanes. When no symbol appears, the information is applicable to all blocks within the scope of coverage. See Block Numbers Diagram.

EXAMPLE

40	Pertains to all airplanes in block 40 (56-233 thru 56-237).
40 THRU 50	Pertains to all airplanes in block 40 thru block 50 (56-233 thru 56-245).
40 THRU 56-247 55	Pertains to all airplanes in block 40 thru airplane 56-247 in block 55 (56-233 thru 56-247).
56-248 55 THRU 120	Pertains to airplane 56-248 in block 55 and all subsequent airplanes thru block 120 (56-248 thru 59-483).

Note

Block numbers which do not end in a "0" or "5" identify dual control airplanes. Dual control airplanes are not identified in this manual by their block numbers but are reflected in the next lower block number ending in "0" or "5".

EXAMPLE: Block 111 dual control airplanes are reflected by block 110.

Block 56 dual control airplanes are reflected in block 55.

TIME COMPLIANCE TECHNICAL ORDERS

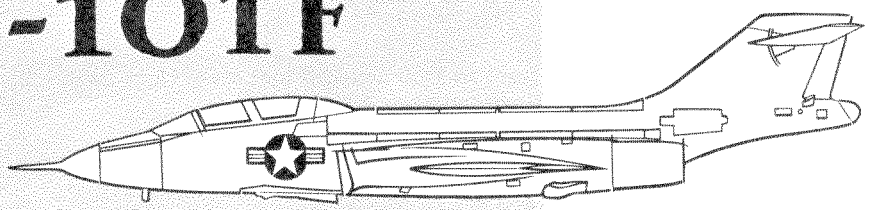
The following is a list of T. C. T. O. s which are referenced in this Flight Manual:

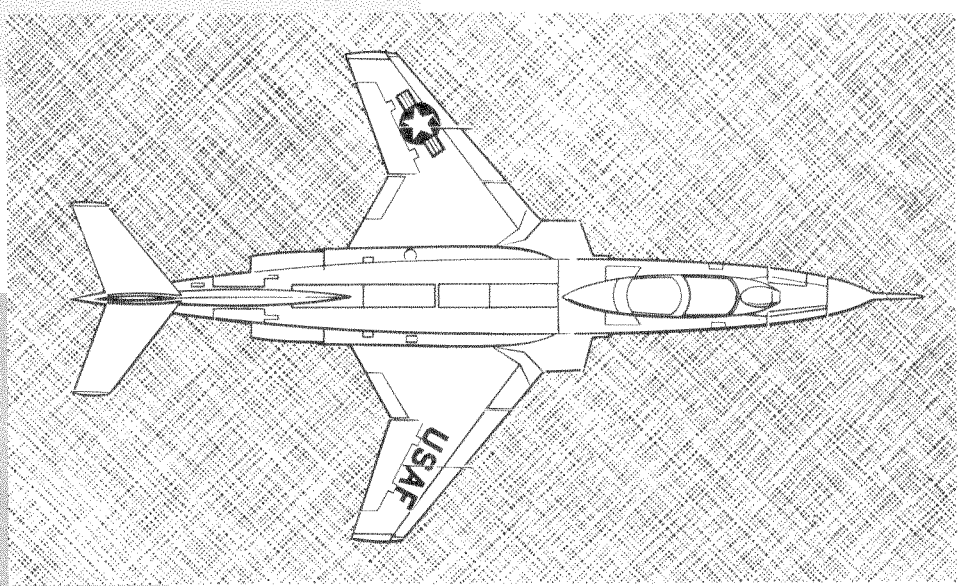
T. C. T. O. NUMBER	SUBJECT OR EFFECT OF MANUAL
1F-101-857	Adds personal leads safety retention clips.
1F-101-882	Adds Pitch Boundary Indicator.
1F-101-883	Gives pilot control of CADC & PCS Heater elements.
1F-101-922	Adds Alternate Microphone switch, Front Cockpit
1F-101-924	Adds a tail hook down warning light to left console, front cockpit.
1F-101-957	Rear cockpit configuration change (IIP).
1F-101-959	Adds seat-man separator to the Ejection Seat.
1F-101-968	Installs Emergency Fuel System Telelight.
1F-101-972	Improves Safetying of Armament Selector Panel.

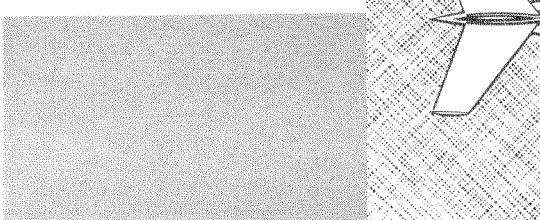
T. C. T. O. NUMBER (Cont)	SUBJECT OR EFFECT OF MANUAL (Cont)
1F-101-983	Relocates "Eject" light in rear cockpit and eject light switch in front cockpit.
1F-101-1012	Adds Safety wire to alternate canopy jettison handle on ejection seat.
1F-101-1051	Installs new survival kit release handle.
1F-101B-571	Permits RIO to operate UHF radio from rear cockpit.
1F-101B-626	Gives pilot a new UHF channel indicator on instrument panel.
1F-101B-641	Provides full open exhaust nozzles during idle to prevent off-idle stalls and stalls encountered during transients.
1F-101B-752	Provides "Eject" light in rear cockpit and eject light switch in front cockpit for emergency communications between aircrew.
1F-101B-754	Adds provisions for MATTS Scoring Device.
1F-101B-761	Adds Boost Pump failure indication.

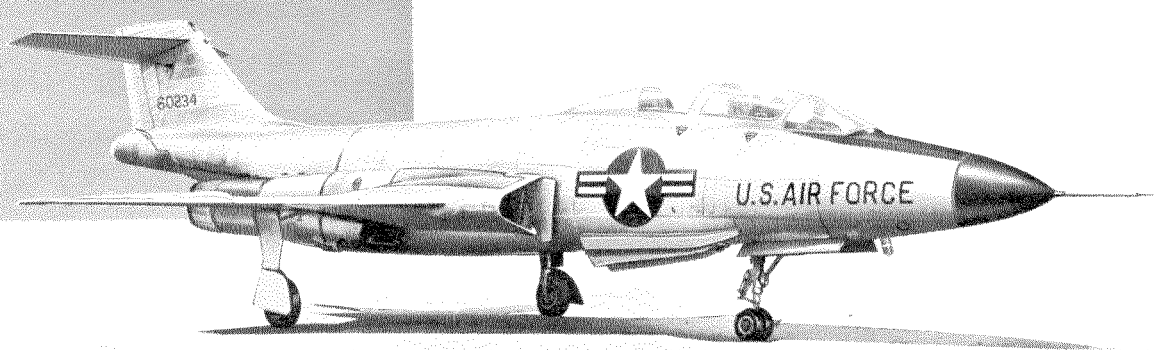
VOODOO

F-101B and F-101F









FB33-TQ B

section I Description

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AIRPLANE

The F-101B airplane is a two place, supersonic, all weather interceptor built by McDonnell Aircraft. Dual control equipment can be installed to provide secondary operation as a pilot trainer. In airplanes equipped with dual controls, the rear cockpit installations and functional capabilities are discussed when applicable under the appropriate headings of each section. No provisions are made for operating the landing gear, wing flaps, speed brakes and drag chute, or to initiate or terminate afterburning or for engine shutdown from the rear cockpit of the dual controlled airplanes. All fire control radar is controlled by the radar intercept officer in the rear cockpit. The fire control radar provides for ground controlled interception, using data link transmission from the ground to provide steering information to the pilot. The airplane is powered by two axial flow turbojet engines with afterburners. The airplanes' features are very thin short, swept back wings with engine intakes at the roots, and a swept back empennage with a controllable, one piece horizontal stabilizer mounted high on the vertical stabilizer. The control surfaces are positioned by irreversible hydraulic actuators to provide desirable control effectiveness throughout the entire speed range. Aerodynamic pilot feel is simulated by an artificial feel system. The wing flaps are hydraulically operated and electrically controlled. Panel type speed brakes are installed on the aft portion of each side of the fuselage and may be utilized at all speeds. The fuel supply system can be serviced in flight by the probe and drogue method, and on the ground by the single point pressure system. A single canopy encloses both cockpits. A drag chute located in the empennage is deployed after landing to reduce landing roll. An identification light on the left side of the fuselage at the rear cockpit provides illumination of other airplanes for visual identification.

AIRPLANE DIMENSIONS

The approximate over-all dimensions of the airplane are as follows:

Span	39 feet 8 inches
Length	71 feet 1 inch
Height	18 feet 0 inches

The minimum turning radius is 47'9" with the nose gear deflected its maximum of 40°.

AIRPLANE GROSS WEIGHT

Empty Weight

The approximate empty weight of the airplane in the armament configuration, including ungageable fuel (lines, pumps, manifolds, etc.), and two crewmembers, is 31,300 pounds for the (40) THRU ▸ 56-247 (55) airplanes and 32,200 pounds for the 56-247 (55) THRU ▸ (120) airplanes.

Ramp Weight

The approximate ramp gross weight of the airplane in the armament configuration, including full internal load, pilot and crew member, is as follows:

(40) THRU ▸ 56-247 (55)

Airplane without external tanks	44,800 pounds
Airplane with two full external tanks	51,100 pounds

56-248 (55) THRU ▸ (120)

Airplane without external tanks	45,700 pounds
Airplane with two full external tanks	51,950 pounds

Armament Weights

Approximate weights of individual airplane armament are as follows:

MB-1	837.7 pounds
GAR-2A	127 pounds
MB-1 Ballast Weight	838 pounds

Refer to Section V for additional weight information and limitations.

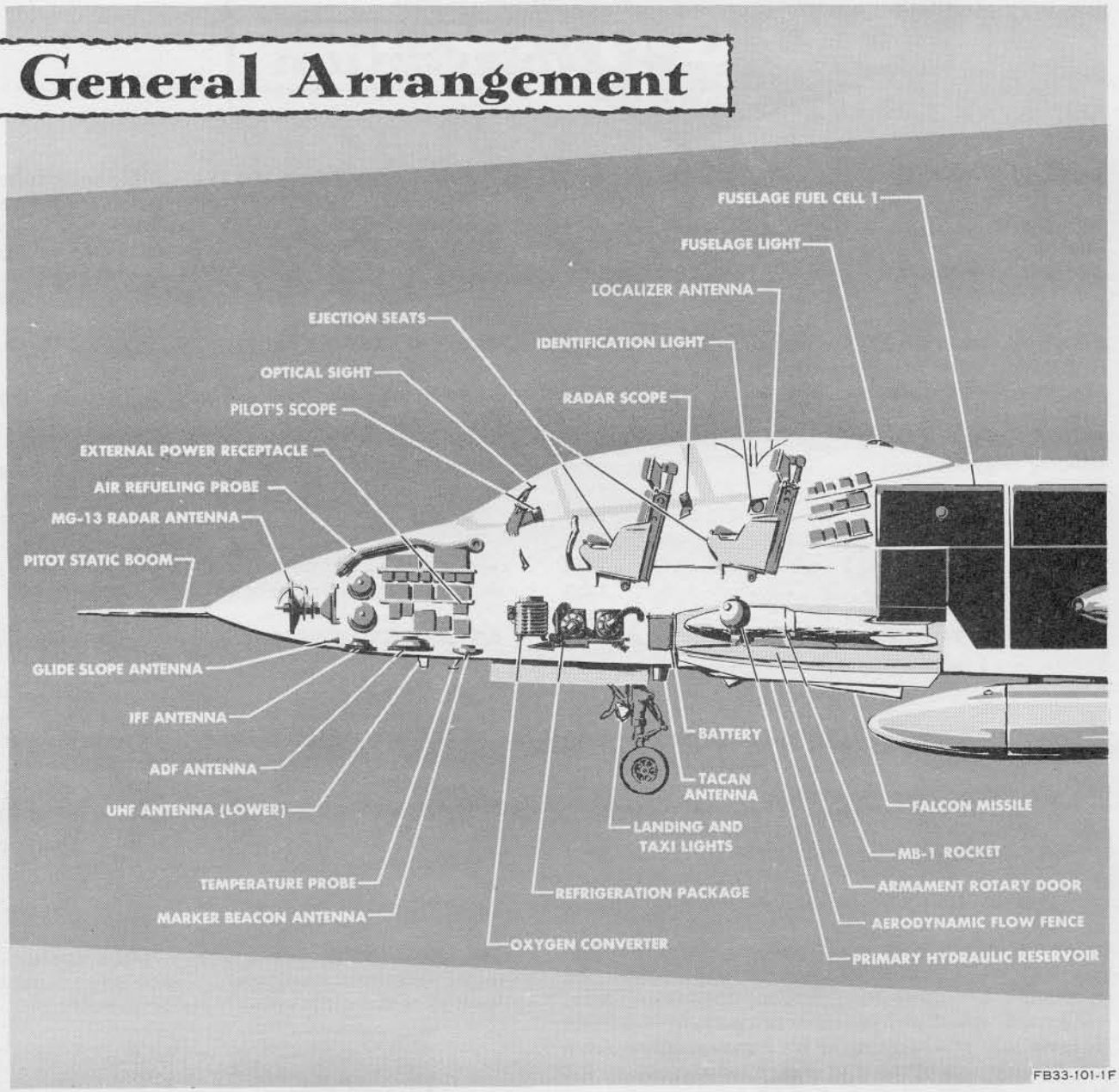


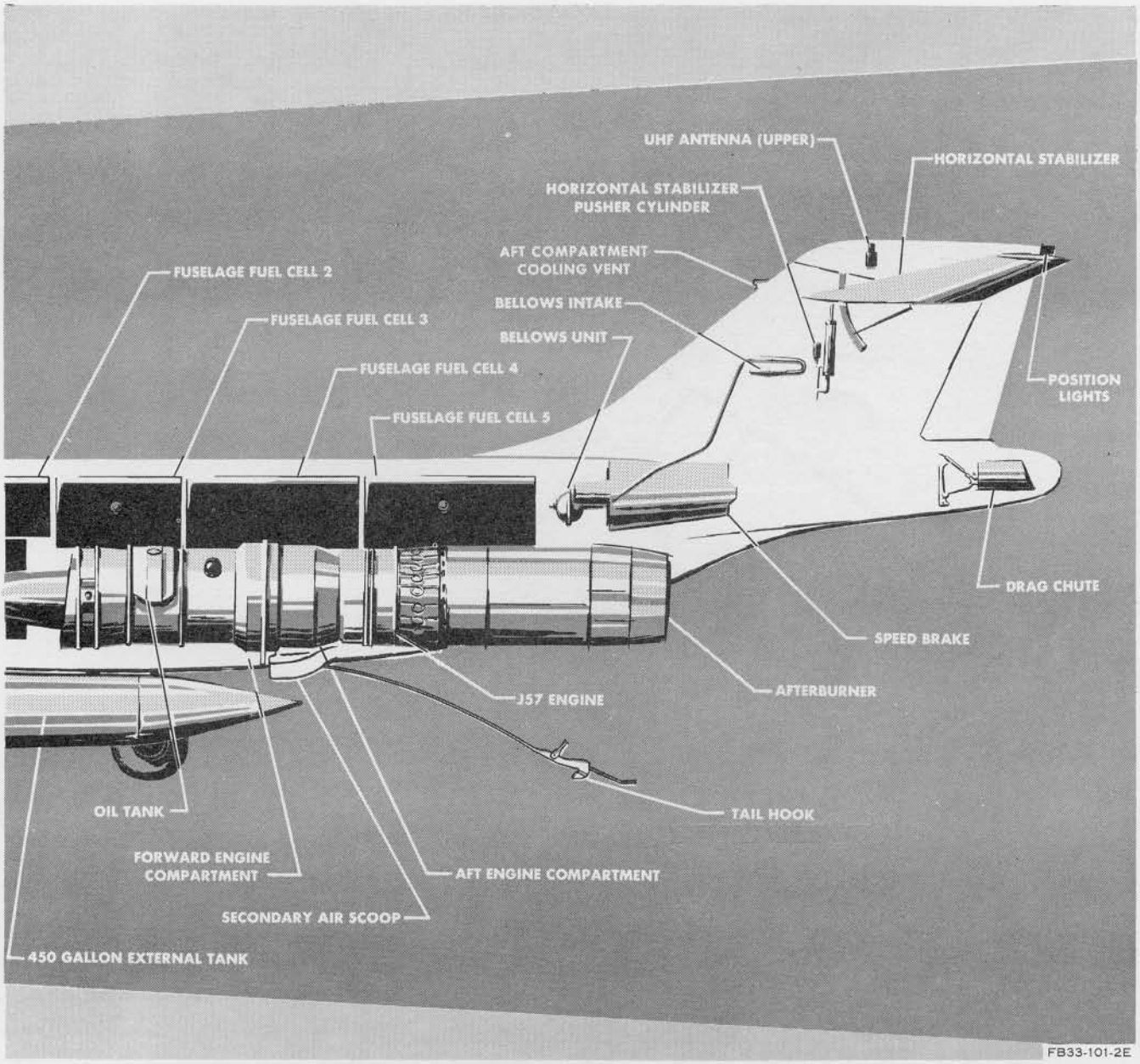
Figure 1-1

ARMAMENT

The airplane has provisions for launching two MB-1 rockets and two GAR-2A missiles. The armament is carried on a rotary door on the underside of the fuselage aft of the nose gear well The rotary door stores two MB-1 rockets on the internal bay and two GAR-2A missiles externally. The armament is fired by the MG-13 Fire Control System. For additional information on the armament system, refer to T.O. 1F-101B-1A.

ENGINE

Airplane thrust is provided by two Pratt & Whitney J57-P-55 turbojet engines in the 56-248 (55) THRU (120) airplanes, while (40) THRU 56-247 (55) airplanes are equipped with J57-P-53 turbojet engines. The engines (figure 1-2) are equipped with afterburners, and are mounted side by side in the aft lower portion of the center fuselage. The rated sea level static thrust of the P57-P-55 engine is approximately 10,700 pounds at Military thrust, and at approximately 16,900 pounds with afterburning at Maximum thrust. The J57-P-53 engine produces approximately 10,200 pounds thrust at Military thrust and 16,000 pounds with afterburning at Maximum thrust. In further descriptions of these engines, the J57-P-55 engine will be discussed primarily and only the differences of the J57-P-53 will be mentioned. Basically, the engine consists of a 16-stage, two-unit compressor, a combustion chamber comprising 8 annularly disposed units or "cans", served



by a dual fuel manifold; a three-stage turbine and an afterburner. The compressor is made up of a nine-stage, low speed, low pressure unit, driven by the combined second and third stages of the turbine; and a seven-stage high-speed, high pressure unit, driven by the first stage of the turbine. The low speed compressor unit powers an accessory drive at the front of the engine, and the high speed compressor powers the accessory group beneath the center portion of the engine. A bleed valve is installed to prevent compressor stalls during acceleration and deceleration at any altitude. The valve is open when the engine is started, then closes as the engine reaches a surge-free speed, and reopens when the engine decelerates (refer to Engine Bleed Valves, Section VII). Refer to Section VII for additional information on the engine.

ENGINE FUEL CONTROL SYSTEM

Note

The fuel control system for each engine is complete in itself and the two systems are identical. For simplicity of discussion, the following considers only one system and should be assumed duplicated for the other engine.

Fuel flow to the engine is mechanically controlled by throttle operation and is further regulated by the various units shown in figure 1-3. Since afterburner fuel control is practically independent of the main engine system it is discussed in this section under Afterburner System.

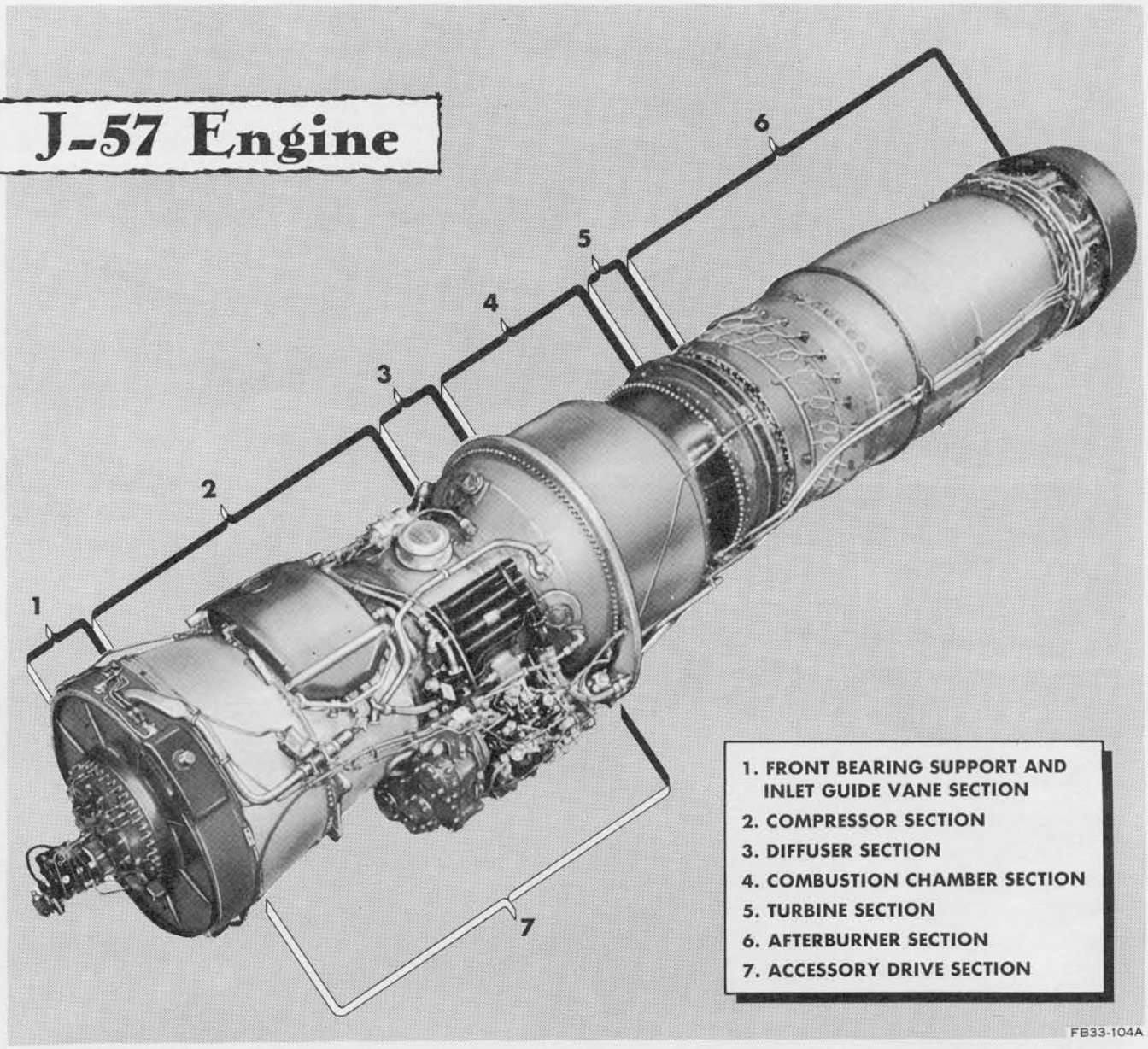


Figure 1-2

Fuel Pump Unit

The engine-driven fuel pump unit consists of three individual pumps mounted in the center accessory group. A centrifugal fuel pump receives fuel from the engine feed tank (No. 2) and in turn supplies it, under pressure, to two gear-type pumps. One pump supplies the main engine system, the other the afterburner system. Construction is such that failure of one pump leaves the others unaffected. A transfer valve is also a part of the fuel pump unit. The transfer valve automatically directs afterburner fuel pump output to the main engine system in the event of failure of the engine fuel pump.

Note

With failure of the engine fuel pump, the main engine system will receive all the fuel it requires from the afterburner fuel pump. Any additional output can then be utilized for afterburner operation. At altitude, normal operation of both can be expected, but with the greatly increased fuel demand at low altitudes, some loss in afterburner thrust may be noticed.

Engine Fuel Control

An engine-driven hydromechanical engine fuel control mounted on the accessory gear case (figure 1-3) serves to establish a fuel flow to the engine which will result in the thrust output selected by the pilot. In addition to a normal fuel control, the engine fuel control incorporates an emergency fuel control for use in the event of failure of the normal fuel supply. The principle function of the normal control is to schedule engine fuel flow automatically in accordance with certain limiting factors imposed by the throttle position, engine speed,

Engine Fuel Control System

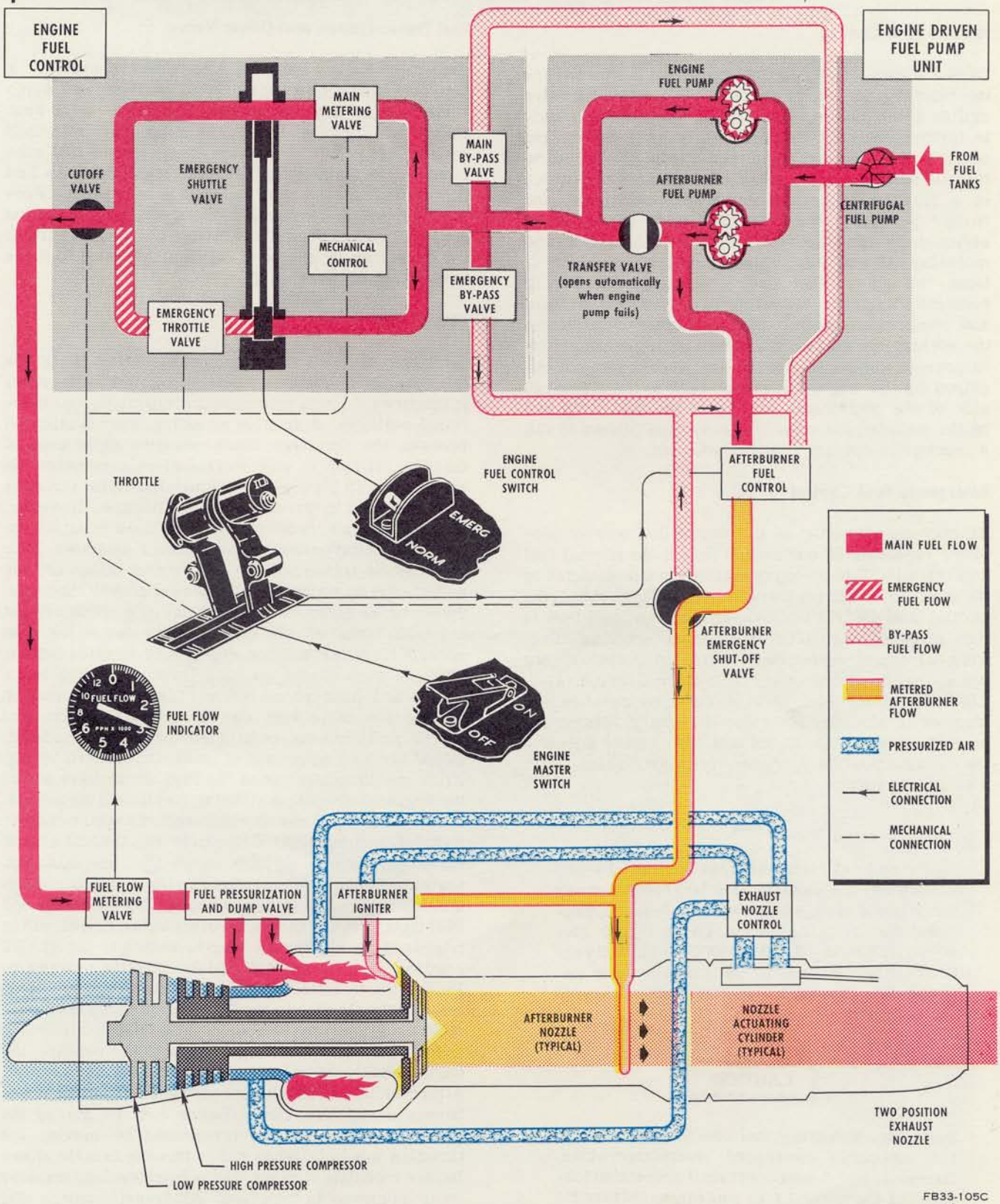


Figure 1-3

and compressor inlet temperature. The engine fuel control also incorporates a cutoff valve which is mechanically actuated by the throttle. The valve is off whenever the throttle is placed at CLS'D.

Normal Fuel Control

During normal fuel control operation, the throttle is the primary control of the size of a metering valve orifice which governs fuel flow. The metering orifice is further controlled automatically by a mechanical control that senses flight conditions. Thus, using throttle setting, engine speed, inlet temperature (which is a function of altitude and flight conditions), and burner pressure, the control adjusts thrust output selected by the pilot with regulated changes in the metering valve orifice. During rapid engine accelerations, the normal fuel control schedules fuel flow to protect the engine from overspeed and overtemperature and compressor stalls. During rapid decelerations, the normal fuel control maintains a minimum fuel flow to prevent engine flameout. Any excess fuel not required by the engine is routed back to the discharge side of the centrifugal section of the fuel pump unit by the main bypass valve. This system utilizes 28 volt d-c power to operate a double solenoid.

Emergency Fuel Control

Emergency operation of the engine fuel control provides regulation of engine fuel flow if the normal fuel control fails. Emergency operation must be selected by the pilot. In selecting the emergency fuel control, the normal fuel control is disengaged and the fuel flow is then metered by an entirely different metering valve. This valve is directly connected to the throttle with the result that fuel flow, in effect, is manually controlled. The emergency fuel control does compensate for changes in altitude, however, the compensations are only effective up to 30,000 feet. (At higher altitudes the throttle must be successively retarded to maintain a constant rpm.)

Note

Under critical circumstances such as take-off, emergency fuel control may be selected at any throttle position, without excessive surge, provided the airplane is not above 10,000 feet density altitude. Above 10,000 feet density altitude, the position of the throttle must approximate the engine thrust level to avoid violent surge.

CAUTION

Since the emergency fuel control does not offer the automatic overspeed, overtemperature, flameout, and compressor stall prevention features of the normal fuel control, rapid throttle movements should be avoided during emergency fuel control operation.

The emergency bypass valve routes excess fuel back to the discharge side of the centrifugal element of the fuel pump. This system utilizes 28 volt d-c power to operate a double solenoid.

Fuel Pressurization and Dump Valve

This valve serves a dual function in the fuel system. It acts as a pressure operated flow divider and as a dump valve to eliminate unburned fuel from the engine upon shutdown. Pressure differential created within the unit as a direct result of fuel flow regulates the fuel supplied to the main engine and pilot manifolds. As fuel flow increases, the main manifold receives fuel. Proper proportion is maintained for efficient operation under all conditions. The absence of fuel pressure at the valve, as in shutdown, allows the valve to drain both manifolds overboard.

THROTTLES

A throttle (figure 1-4) for each engine is located on the left console to establish a desired engine thrust output. It functions through mechanical connections and electrical switches. A friction adjusting lever is mounted between the throttles which permits adjustment of throttle friction to suit individual requirements. In airplanes with the dual control installation the throttles are connected by direct mechanical linkage. However, the rear cockpit throttles cannot be used to initiate or terminate afterburning, or for engine shutdown. The microphone button and the radio cutout button are the only electrical connections to the rear cockpit throttles. Speed brake actuation and emergency ignition are not available from the rear cockpit. Included on the front cockpit throttles are the emergency ignition buttons (one for each engine on each throttle), speed brake switch and microphone button. Limit switches which control the main fuel shutoff valves, ignition, and afterburner systems are built into the throttle quadrant. Initial forward movement of the throttle from CLS'D to IDLE mechanically opens the fuel cutoff valve within the engine fuel control allowing fuel flow to the engine. It also actuates a switch which (with the engine master switch ON) completes the circuit to open the fuel shutoff valve and, in the (40) THRU 56-247 (55) airplanes operates relays which contribute to the continuity of the ignition and afterburner circuits. In the 56-248 (55) THRU (120) airplanes, the engine starting ignition circuit is triggered by moving the starter switch to the START position, and is not affected by throttle movement. Pulling the throttles inboard will allow further movement of the throttle to the OPEN position. This movement progressively increases thrust output by altering engine fuel control settings. At the OPEN position, the engine should be delivering its rated Military thrust. Afterburning can be initiated anywhere within the afterburner modulation range (figure 1-4) by moving the throttles outboard; and terminated by moving the throttles inboard. When either throttle is in the afterburner modulation range, the normal fuselage transfer pump sequence is bypassed. All transfer pumps that have fuel available to them are energized to insure adequate fuel transfer flow during afterburner op-

Throttles-Front Cockpit

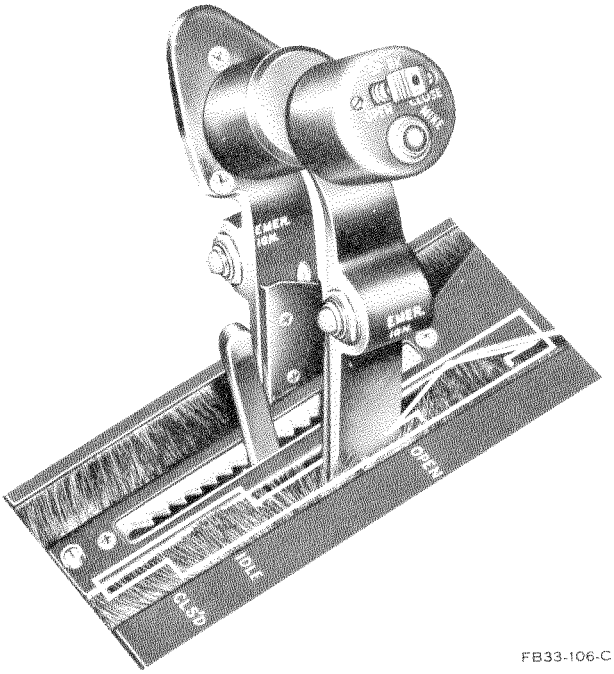


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Figure 1-4

eration, whenever the air refueling probe is not extended or fuel quantity in cell 2 is below 850 with probe extended or retracted. Movement of the throttle from the IDLE position to CLS'D requires the throttle to be moved outboard and retarded. At CLS'D, the fuel cutoff valve in the engine fuel control is closed, the fuel shutoff valve is closed, and in the (40) THRU 56-247 (55) airplanes, electrical continuity to the normal and afterburner ignition circuits is interrupted. In the 56-248 (55) THRU (120) airplanes, electrical continuity to the normal ignition circuit is interrupted when moving the engine start switches to STOP START-RESET, and is not affected by throttle movement.

ENGINE MASTER SWITCHES

These two-position engine master switches (figure 1-14) one for each engine, are mounted on the engine control panel and are guarded to prevent their being inadvertently moved. With dual controls installed, the engine master switches in the rear cockpit, located on the left console (figure 1-18) are safetied in the ON position. When placed from OFF to ON position they serve to operate the 28 volt d-c engine control circuit for the fuel boost and transfer pumps, direct power for the operation of the anti-ice valves and contribute to the continuity of the afterburner, normal ignition system and fuel shutoff valve circuit. The circuits for the fuel shutoff valves, which are normally operated by the throttles, are such that either circuit will be broken when its respective engine master switch is placed OFF regardless of the throttle position.

CAUTION

To prevent the possibility of cavitation of the main fuel line, do not place the engine master switch in the OFF position until the throttle is in the CLS'D position.

ENGINE FUEL CONTROL SWITCHES

A two-position toggle switch (figure 1-14), one for each engine, is mounted on the forward portion of the engine control panel to permit the selection of the emergency fuel control. The switch directs 28 volt d-c power to operate a double solenoid and has switch positions that are marked NORM and EMERG to indicate which fuel control has been selected.

TACHOMETERS

A tachometer for each engine (figure 1-15) in the front cockpit and (figure 1-19) in the rear cockpit with the dual control installation, is mounted on the instrument panel. The tachometer is an electrically operated instrument receiving power from a tachometer generator, independent of the airplane's electrical system.

EXHAUST TEMPERATURE GAGES

The exhaust temperature of each engine is indicated on individual temperature gages (figure 1-15) on the instrument panel and (figure 1-19) on the left vertical console in the rear cockpit with the dual control installation. Eight self-generating thermocouples, located aft of the turbine, provide current to the indicator which then gives an average reading.

ENGINE PRESSURE RATIO GAGES

The engine pressure ratio gages located on the instrument panel in the front cockpit, and (figure 1-19) on the left sub-panel in the rear cockpit with the dual control installation, present an indication of the ratio of engine turbine exhaust pressure to engine inlet pressure. The turbine exhaust indication is obtained by a pressure probe in the engine, through a transmitter and amplifier in the right hydraulic bay, and through the necessary tubing and connections. Engine inlet pressure is obtained through the pitot-static system which is connected to the transmitter. Thus, the system compares inlet and outlet pressures, computes a ratio of outlet to inlet pressure, and electrically reflects the information to the cockpit indicators so that the pilot may better determine engine operational efficiency. The system utilizes 115 volt single-phase a-c power. The gages are used to determine whether engine thrust output on the ground at full throttle is adequate for take-off. They are also used as a guide to set up

optimum inflight cruise thrust settings. The ratios are shown by a conventional dial needle. The gages are graduated from 1.2 to 3.4 in increments of tenths. Two windows are in the dial face, the upper marked "Cruise" and the lower marked "Take-Off". The ratios that appear in these windows are adjustable and are controlled by a knob on the lower left corner of each gage. Two single pointer index markers rotate about the edge of the gage when the knob is turned. The control knob must be pushed in and turned to set desired take-off ratio in the lower window, and pulled out before turning cruise ratio in the upper window. Take-off and cruise ratios are predetermined in accordance with take-off and flight temperatures, and information is set into the respective windows. During engine run-up, the indicator needle should be above the limit set by the take-off single pointer index marker. If the indication is below the limit, adequate thrust may not be available and take-off should not be attempted. Cruise pressure ratio is obtained by adjusting the throttle until the needle setting corresponds with the predetermined cruise ratio of the single pointer index marker.

CAUTION

In the event of a-c power failure, the gages will be inoperative. The needle will remain fixed at the indication at the time of power failure.

Note

Cruise ratio settings will vary due to temperature changes. Proper settings must be determined prior to flight from Appendix I, Performance Data.

OIL PRESSURE GAGES

The oil pressure gages (figure 1-15) one for each engine, are located on the instrument panel. These gages utilize 28 volt a-c power to transmit an indication of engine oil pressure in pounds per square inch.

FUEL FLOW INDICATORS

Two fuel flow indicators (figure 1-15), one for each engine, are located on the instrument panel. They indicate the rate, in pounds per hour, at which fuel is being consumed. Afterburner fuel flow is not indicated. The indicators utilize 28 volt a-c power.

ENGINE STARTER AND IGNITION SYSTEMS

Pneumatic Starter System

(40 THRU) 57-247 (55)

Pneumatic starters, which require an external source of compressed air, are installed on each engine. Both starters receive air through a single fitting in an access door (figure 2-11) on the right side of the airplane. Starter operation is initiated by moving the engine start switch, which electrically actuates valves in the air inlet lines. These valves automatically close when engine speed reaches approximately 35% rpm or placing the engine start switch in the STOP START position if the engine fails to start. The electrical circuit is such that only one starter valve can be opened at a time, and an interruption of starter operation also stops ignition.

Combustion Starter System

56-248 (55) THRU (120)

Combustion starters can be operated with the use of external air pressure or from air bottles located in the air inlet of each engine air duct. The starting system consists of two subsystems, the control system and the combustion system. The control system regulates the flow of fuel and air to the combustion chamber of the starter. To operate the starter, high pressure air from the air bottles or external air cart is supplied to the starter. Fuel is provided when starter is originally serviced upon installation and is thereafter primed from previous engine operation. Electrical power for ignition of the fuel air mixture is supplied by placing the start switch to the START position. Internal safety switches are provided to prevent overspeeding of the starter. Pneumatic starts can be performed with the J57-P55 engine providing the ground crew has installed a jumper wire on the starter. Refer to Starting Engines, Section II.

CAUTION

Internal air starts of both engines is an emergency procedure, in that, at best, it is improbable that enough air exists to start both engines.

Ignition System

(40) THRU 56-247 (55)

Engine ignition is accomplished by converting 28 volt d-c power from the battery bus, to high tension pulsating d-c power, which is then applied to the igniter plugs. Two independent units, either of which is adequate for ignition, supply individual igniter plugs in number 4 and 5 burner chambers. Continuous operation of the igniter plugs is not necessary since combustion is continuous once engine light-off is attained. With the engine master switches ON, and the engine start switches momentarily actuated, the ignition circuits are energized when the throttles are advanced from CLS'D to IDLE.

Ignition System

56-248 (55) THRU (120)

Engine ignition in these airplanes is accomplished the same as in the earlier system, except that the ignition circuits are energized when the engine start switches are moved to the START position. The ignition circuits are not affected by throttle movement.

Ignition Termination

Igniter operation in the (40) THRU (100) airplanes, is automatically terminated, along with starter operation, when engine speed reaches approximately 35% rpm. Igniter operation in the (105) THRU (120) airplanes is automatically terminated by a timer circuit, 15 seconds

after actuation of the engine start switches. Refer to Engine Master Switches, Throttles, and Engine Start Switches, this section.

Continuous Ignition System

The airplane is equipped with a continuous ignition system. This system provides a means for selecting continuous operation of the normal ignition system when icing is encountered, thereby precluding the probability of flameout due to ice ingestion. The system is controlled by the icing ignition switch (figure 1-14) located on the circuit breaker panel. With the engine master switches ON and throttle in IDLE, placing the icing ignition system to ON completes the circuit to supply 28 volt d-c power to actuate the emergency ignition relay and directs power to the ignition unit for both engines. Two red indicator lights (one for each engine) are located just above the icing ignition switch and will illuminate when continuous ignition is being utilized. For additional information of use of this system, refer to Section IX.

Throttles

Refer to Throttles, this section.

Engine Master Switches

Refer to Engine Master Switches, this section.

Engine Start Switches (40 THRU 56-247 55)

Three-position, spring-loaded toggle switches (figure 1-14) on the engine control panel energize the circuits which operate the starter air valves. These switches, one for each starter, have positions marked START, OFF and STOP START and operate on the battery bus. Momentarily placing the engine start switch to the START position energizes the circuit to open the air valve for the corresponding starter. When the switch is released, it will return to the OFF position with the automatic starter circuitry maintaining continuity for normal start. The circuit will remain energized until the engine reaches approximately 35% rpm or the switch is placed in the STOP START position.

Engine Start Switches (56-248 55 THRU 120)

Two-position toggle switches (figure 1-14) on the engine control panel energize the circuits which operate the starter air valves. The switch, one for each starter, have positions marked START and STOP START/RESET, and operate on the battery bus. To position the switch from STOP START/RESET to the START position, pull up on the engine start switch and push to the START position. Placing the engine start switch in the START position energizes the circuits to open the air valve to the corresponding starter. The engine start switch is held in the START position by an electrical solenoid. The engine start switch will automatically return to the STOP START/RESET position whenever the engine master switch is placed in the OFF position or in the event of an electrical failure between the engine start switch and the battery bus. Recycling of the engine start switch can be manually accomplished by physically placing the engine start switch to the STOP START/RESET position and then back to the START position. Starter operation will discontinue when the engine has attained approximately 35% rpm or after a time lapse of approximately 11-13 seconds.

Starter (Internal Air) Switch

The internal air starter switch (figure 1-14) is located on the circuit breaker panel and has two positions marked ON and OFF. This switch is inoperative in the 40 THRU 56-247 55 airplanes. In the 56-248 55 THRU 120 airplanes, air pressure from the air bottles is supplied to the combustion starter when the switch is placed in the ON position. This system facilitates starting in the event that an external source of compressed air is not available. The switch utilizes 24 volt d-c battery bus power.

Emergency Ignition Buttons

An emergency ignition button (figure 1-4) for each engine is installed on the aft face of each throttle. These buttons serve to energize the ignition circuits for air starts, independent of the starter circuits. The buttons are spring-loaded, and must be depressed with the engine master switch ON and the throttle out of the CLS'D position. An automatic timer provides continuous igniter operation for a period of 30 seconds after the button is released. Depressing the button with the engine master switch ON and the throttle in the CLS'D position will not provide ignition as the throttle cutoff limit switch will not be closed. Igniter operation cannot be terminated by the pilot after the ignition button is depressed. Therefore, it is necessary to wait 30 seconds after the button is released before ignition is automatically terminated. The ignition circuit utilizes 28 volt d-c electrical power. The ignition circuit also receives power from the emergency electrical system. Refer to Emergency Electrical System Provision, this section.

AFTERBURNER SYSTEM

The engine is equipped with an afterburner to produce increased thrust for maximum performance. Due to the extremely high fuel consumption, afterburning should be used only for short periods of time when the additional thrust is required. Fuel flow cannot be maintained for an appreciable length of time during maneuvers that create negative "g" forces. Refer to Section V for operating limits. Afterburner operation is initiated by moving the throttle outboard from the OPEN position. When the throttle is moved outboard, the electrically operated afterburner shutoff valve in the afterburner fuel control is opened. This action permits the flow of metered fuel to the afterburner nozzle and afterburner igniter. All fuselage transfer pumps with fuel available, are energized when either throttle is placed in the afterburner, whenever the air refueling probe is not extended or fuel quantity in cell 2 is below 850 pounds with probe extended or retracted.

The engine thrust can be modulated in the afterburner range and afterburning can be terminated only by moving the throttle out of detent position. Afterburner augmentation should increase engine thrust approximately 50% over rated military thrust. Modulation should be approximately 1-3% rpm and 0.3 epr.

Note

Afterburning cannot be initiated or terminated from the rear cockpit with the dual control installation.

CAUTION

Afterburner control operates normally when the engine fuel control switch is in the EMERG position. However, throttle movement must be cautious, with due regard for engine limitations, since basic engine fuel flow is manually selected and manually controlled by the throttle.

EXHAUST NOZZLE

A two-position, exhaust nozzle is installed at the end of the tailpipe. The nozzle is positioned to provide the most efficient exhaust nozzle area for either normal or afterburner engine operation. Full open exhaust nozzle provisions have been installed in the 110 THRU 120 airplanes. After incorporation of T.O. 1F-101B-641, 56-248 55 THRU 105 airplanes will also have full open exhaust nozzle provisions. The full open exhaust nozzle provides higher rpm without additional idle thrust in order to prevent off-idle engine stalls, and stalls during acceleration from idle. The nozzles will open whenever engine rpm is below 76% if airplane weight is on the landing gear. The nozzles will close whenever engine rpm is above 81% or weight on the landing gear is relieved.

Note

With either engine at a low power setting, the nozzles may cycle when gear is extended due to initial strut compression.

Exhaust Nozzle Control Unit

The operation of the exhaust nozzle is controlled by the exhaust nozzle control unit. It is essentially a spring-loaded, air pressure operated, air relay valve that ports high pressure air to either a nozzle open line or close line. When afterburning is initiated, air pressure is directed through the nozzle control unit repositioning the air relay valve against its spring force. This allows high pressure air to be directed to the nozzle actuators through the open line, causing the exhaust nozzle to open. The close line is ported to atmosphere. When afterburning is terminated, the air relay valve returns to its initial position, allowing high pressure air to enter the close line and close nozzle. The open line is then ported to atmosphere. In the 40 THRU 56-247 55 airplanes, the exhaust nozzle is controlled by unmetered afterburner fuel flow.

AFTERBURNER IGNITION SYSTEM

Afterburner ignition is accomplished by means of a "hot-streak" igniter which injects a charge of fuel into number 3 combustion chamber, causing a temporary overrich condition, which produces a flame streak through the turbine and into the afterburner fuel spray. Refer to figure 1-3. The igniter includes an air piston, which actually "squirts" the fuel charge, and a pilot valve that triggers the air piston. When afterburning is initiated a fuel pressure signal from the afterburner fuel control shuttles the pilot valve to a position that directs high pressure air behind the air piston. This in turn forces the air piston against its spring and discharges the fuel into number 3 combustion chamber. When afterburning ceases both the air piston and the pilot valve return to their former positions and the igniter is ready for its next sequence. The igniter is a "one-shot" device only, and will not recycle until afterburner fuel pressure is shut off (afterburning terminated). Therefore, if afterburner does not ignite (within 2 seconds at sea level, 3 to 4 seconds at altitude) it is necessary to momentarily move the throttles out of afterburner detent before attempting to relight.

AFTERBURNER FUEL SYSTEM

Afterburner Fuel Control

Fuel is metered by the afterburner fuel control unit in direct proportion to engine output, as indicated by combustion chamber pressure. Refer to figure 1-3. This pressure surrounds a bellows that is connected to a variable orifice area metering valve. As burner can pressure changes, the bellows is deflected to a new position and the metering valve is moved to provide correct fuel flow. The metered fuel is delivered to the afterburner fuel manifold and to the afterburner igniter. Afterburner and main engine fuel are proportioned in their flow and both will vary in response to throttle manipulation.

Afterburner Emergency Shutoff Valve

The afterburner system is shut off mechanically in the event the normal electrical control fails. The afterburner emergency shutoff valve (figure 1-3) is mechanically repositioned by the throttle when the throttle is moved out of the afterburner detent and retarded to a position equivalent to approximately 83% rpm. The repositioned afterburner emergency shutoff valve directs fuel from the afterburner fuel control back to the engine-driven fuel pump. This terminates afterburning and the lack of air pressure at the exhaust nozzle control unit causes the exhaust nozzle to close.

Note

Advancing the throttle past the afterburner cutoff point repositions the emergency shutoff valve and will initiate afterburning providing the failed electrical switch is still on.

OIL SYSTEM

Each engine employs a dry sump pressure-type, oil system supplied from a 7.1 U.S. gallon tank attached to the left side of each engine. The tank has a fully serviced capacity of 5.5 gallons. Oil flows from the tank to a gear-type pump which it supplies under pressure to the lubrication points. The pump supplies oil for adequate engine lubrication at all engine speeds and reaches normal pressure at idle rpm. Oil is returned under pressure by six scavenge pumps to an air-oil cooler, and if temperatures require, a fuel-oil cooler. It then returns to the tank from where it is recycled.

Note

The oil system should be serviced within 30 minutes after engine shutdown.

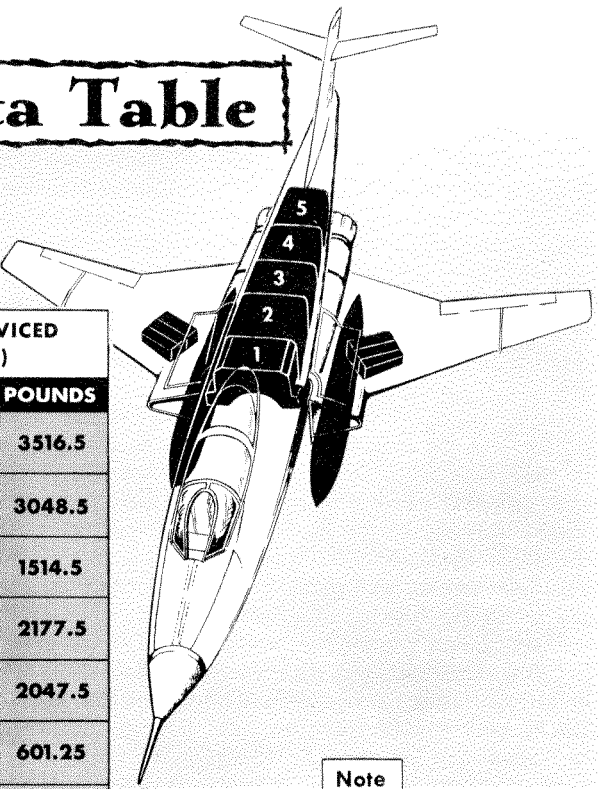
AIRPLANE FUEL SYSTEM

The airplane's fuel supply is contained in five bladder-type cells within the fuselage and three bladder cells in each wing. The fuselage cells are numbered 1 through 5, from forward to aft. Cell number 1 is actually two separate cells which are assembled as one cell. The fuel supply can be increased by mounting two 450 gallon droppable external tanks on the fuselage. All tanks are connected to the fuselage cells by refuel and transfer lines and the auxiliary fuel manifold. The system is designed for single-point refueling, but gravity flow filler openings are provided on cells 1, 3 and 5 in the 40 THRU 75 airplanes, and on the external tanks. The wing tanks have no gravity filler openings. The system is equipped for air refueling. Normal fuel transfer within the fuselage cells is accomplished by transfer pumps in cells 1, 4 and 5. In the 40 THRU 50 airplanes, the transfer operation begins with pumps number 1 and 5 running simultaneously. Each pump

Fuel Quantity Data Table

DATE: 15 APRIL 1960
DATA BASIS: **FLIGHT TEST**

TANK	NO.	USEABLE FUEL IN LEVEL FLIGHT (EACH)		FULLY SERVICED (EACH)	
		U.S.GALLONS	POUNDS	U.S.GALLONS	POUNDS
FUSELAGE CELL NO. 1	1	539	3503.5	541	3516.5
FUSELAGE CELL NO. 2	1	468	3042	469	3048.5
FUSELAGE CELL NO. 3	1	232	1508	233	1514.5
FUSELAGE CELL NO. 4	1	334	2171	335	2177.5
FUSELAGE CELL NO. 5	1	314	2041	315	2047.5
WING TANKS	2	92.5	601.25	92.5	601.25
FUEL LINES, PUMPS, Etc.	-	12	78	25	162.5
EXTERNAL TANKS	2	450	2925	450	2925



Note

WEIGHTS ARE BASED ON 6.5 POUNDS PER GALLON FOR STANDARD DAY TEMPERATURE.

TOTAL USABLE FUEL WITHOUT EXTERNAL TANKS – 2084 GALLONS (13,546 POUNDS)
TOTAL USABLE FUEL WITH EXTERNAL TANKS – 2984 GALLONS (19,396 POUNDS)
*REFER TO WEIGHT LIMITATIONS, SECTION V

FB33-1118

Figure 1-5

automatically stops as its respective cell empties. As pump number 5 stops, pump number 4 is energized. In the (65) THRU (120) airplanes, pump 5 will energize first, and cell 5 must empty before pumps 1 and 4 will energize. A malfunction of pump 5 before completion of transfer from cell 5 will preclude operation of pumps 1 and 4. Cells 1 and 4 will therefore feed only by gravity, or will transfer when the ALL PUMPS position is selected. All transfer pumps feed fuselage cells 2 and 3. Fuel from cell 3 is gravity fed to cell 2. All fuel down to level of interconnected check valves will transfer from cell to cell through gravity feed lines if transfer pumps become inoperative. A forward and an aft boost pump in cell 2 operate together to deliver fuel to the fuel manifold. A gravity feed line to the fuel manifold insures that the engines receive fuel in the event of boost pump failure. To insure a supply of fuel during a negative "g" loading or inverted flight, cell 2 is baffled and the aft boost pump has a pumping element at both the top and bottom end. Fuel transfer from the wing tanks and external tanks depends on air pressure from the engine compressor to force fuel out of the tanks. Air pressure from the engine compressor also provides pressurization of the wing tanks to prevent wing tank collapse. Transfer selector switches control the normal and emergency transfer of fuel within the fuselage cells, and the transfer from the wing tanks and external tanks to the fuselage cells. Fuel from the wing tanks and external tanks is transferred to the number 2 fuel cell when the wing tank and external tank transfer switches are in the NORM position, and the fuselage tanks transfer switch is in the NORM or ALL PUMPS position. When the fuselage tanks transfer switch is in the GRAV position, and wing tank and external tank transfer switches in NORM, fuel is transferred to all fuselage fuel cells through the auxiliary fuel shutoff valve. When the level in cell 2 is low, fuel may enter via the feed tank shutoff valve at the bottom of the cell, and at the top of the cell through the auxiliary fuel shutoff valve. When the cell 2 level reaches the upper element of the dual float switch the feed tank shutoff valve is closed. The auxiliary fuel shutoff valve will be open during EXT and WING transfer, but will be closed when any fuselage transfer pump is operating. There is no quantity gage for the wing tanks or external tanks. An indicator light illuminates during refueling when the wing tanks and external tanks are full and an auxiliary tank empty warning light illuminates when these tanks are empty. A feed tank fuel low level warning light on the telelight panel illuminates when the quantity of fuel in cell 2 is reduced to 1200 pounds. All transfer and boost pumps operate on 115/200 volt, three-phase, a-c power. The control circuits utilize 28 volt d-c power. Fuel tank quantities are listed in figure 1-5. Fuel specifications are given in figure 2-11. Fuel management information will be found in Section VII.

SINGLE POINT AND AIR REFUELING SYSTEM

Refer to Refueling Systems, Section IV.

FUEL PRESSURIZATION AND VENT SYSTEM

A fuel tank pressurization and vent system is provided to maintain a positive pressure in the fuselage cells during flight. This prevents tank collapse, minimizes fuel boiling and evaporation at high altitudes, and helps to insure a positive fuel supply to the engines. The system provides an exit for fuel in the event a flow control valve should fail during refueling operations. The tanks are vented to the atmosphere when the airplane is on the ground. This prevents pressure build-up caused by temperature changes. The vent lines terminate at two vent masts located in the tail cone at a point beneath the rudder. The masts are cut at different angles and are referred to as "high scarf" and "low scarf". The high scarf mast maintains pressure from .5 psi to 2.5 psi. The low scarf mast controls vent pressures in excess of 2.5 psi. The pressure selection is made through a pneumatically operated valve and actuated electrically by a pressure switch in the number one cell. In the event of a positive pressure greater than 2.5 psi, the valve is positioned to the low scarf vent. When the pressure drops to .5 psi, the valve is positioned to allow air from the high scarf vent to enter the cells.

FUEL TRANSFER SYSTEM

Fuel Boost and Transfer Pumps

There are two centrifugal type boost pumps mounted in the bottom of the number 2 fuselage fuel cell. The aft pump has a pumping element at both the top and bottom of the pump. The top element is provided to supply fuel to the engine-driven fuel pumps during inverted flight or negative "g" loads. Either pump has the capacity to supply enough fuel for two engine operation at Military thrust settings. Fuel transfer pumps are mounted in fuselage cells 1, 4 and 5. All fuel boost and transfer pumps receive electrical power from the 115/200 volt, three-phase, a-c bus. A check switch for each boost and transfer pump is located in the right wheel well.

Boost Pump Failure Warning Light

After T.O. 1F-101B-761, boost pump failure will be indicated in the cockpit (see figure 1-8). Pressure switches upstream of the boost pump check valves actuate telelights via the warning lights control box. The telelights are marked FWD BOOST PUMP OUT (No. 4 telelight) and AFT BOOST PUMP OUT (No. 5 telelight).

Engine Master Switches

Refer to Engine Master Switches, this section.

Throttles

Refer to Throttles, this section.

Fuselage Tanks Transfer Switch

The fuselage tanks transfer switch (figure 1-14) is a three-position toggle switch located on the fuel control panel. Its positions are marked NORM, GRAV, and ALL PUMPS. When the switch is in NORM position, fuselage transfer pumps are energized in proper sequence to deliver fuel to cells 2 and 3. When the switch is in GRAV position, the auxiliary fuel shutoff valve opens to permit wing and external fuel to be transferred to all fuselage cells, and de-energizes all transfer pumps to allow fuselage fuel transfer to cell 2 by gravity feed. When the switch is in ALL PUMPS position the emergency transfer circuit is energized and all transfer pumps operate. With the air refueling probe extended, all transfer pumps will be inoperative regardless of fuselage tanks transfer switch position, unless fuel in cell 2 is below 850 pounds. The 28 volt d-c bus supplies power to the fuselage transfer.

Note

When the quantity of fuel in cell 2 is reduced to 850 pounds the emergency transfer circuit automatically by-passes any combination of selections on the transfer switches and the refuel switch and all transfer pumps operate.

Wing Tank Transfer Switch

The wing tank transfer switch, (figure 1-14) is a two-position toggle switch located on the fuel control panel. Its positions are marked NORM and STOP. When the wing tank transfer switch is in the NORM position, the fueling control valves are opened, allowing fuel to flow through the fueling control valves to the auxiliary fuel manifold and/or the bottom of fuselage fuel cell number 2. When the wing tank transfer switch is in the STOP position, the fueling control valves are closed to prevent fuel flow. The switch utilizes 28 volt d-c power.

External Tank Transfer Switch

The external tank transfer switch is a two-position toggle switch located on the fuel control panel, (figure 1-14). Its positions are marked NORM and STOP. When the switch is in the NORM position, the pressurizing and vent shutoff valves and fueling control valves are opened to allow pressurized air from the engine compressor to enter the external tanks and force fuel out the fueling control valves. The fuel then flows to the auxiliary fuel manifold and/or the bottom of fuselage fuel cell number 2. When the switch is in the STOP position, the pressurizing and vent shutoff valves and fueling control valves are closed. The external tanks are then vented to the atmosphere. The switch utilizes 28 volt d-c power.

Refuel Switch

The refuel switch (figure 1-14) is a three-position toggle switch located on the fuel control panel. Its positions are marked NORM, REFUEL and EMERG. In the NORM position, the switch completes the continuity of the fuselage transfer pumps. When the switch is in REFUEL position hydraulic valves are positioned electrically to allow utility hydraulic pressure to extend the probe. Also, in this position, the windshield blower is placed into operation, transfer pumps are inoperative, and the pressurizing and vent shutoff valves for the wing tanks and external tanks are closed. When the switch is in EMERG position the normal operation of fuel transfer, selected by transfer switches, is restored and the windshield blower is inoperative, but the probe remains extended. The switch utilizes 28 volt d-c power. Refer to Refueling Systems, Section IV, for additional information.

CAUTION

Battery power will be depleted in approximately two hours if the refuel switch is inadvertently left in the REFUEL position after engine shutdown.

No. 5 Fuel Cell Lockout Switch

This two-position toggle switch is located adjacent to the single point refueling receptacle, (figure 2-11). The switch has positions marked NORMAL and CUTOFF. Placing the switch in the CUTOFF position, prior to single point refueling, will prevent fuel from entering the number 5 fuselage fuel cell. This switch is so arranged that when the single point refueling receptacle door is closed, the switch will be automatically returned to NORMAL. This switch utilizes 28 volt d-c power. Refer to Center of Gravity Limitations Section V, for utilization of this switch.

Fuel Quantity Gage

A fuel quantity gage (figure 1-15 and figure 1-18) installed in both cockpits with the dual control installation, indicates the quantity of fuel in pounds of any one fuselage cell or the total quantity of all fuselage cells. This gage is located on the right side of the instrument panel in the front cockpit and on the left console in the rear cockpit with dual controls installed. Both 115 volt, single-phase a-c and 28 volt d-c power is required for the operation of the gage.

Fuel Quantity Gage Tank Selector Knob

A Selector knob (figure 1-14) on the left console provides for the selection of the functions of the fuel quantity indicating system. It has positions marked 1 through 5, which will give indications of the fuel quantity in each fuselage cell. With the knob in TOTAL position the fuel quantity gage gives an indication of the quantity of fuel in all cells.

Note

The TOTAL fuel quantity indication is considered more accurate than the sum of the individual fuel cells. This eliminates the calibration errors of each individual cell.

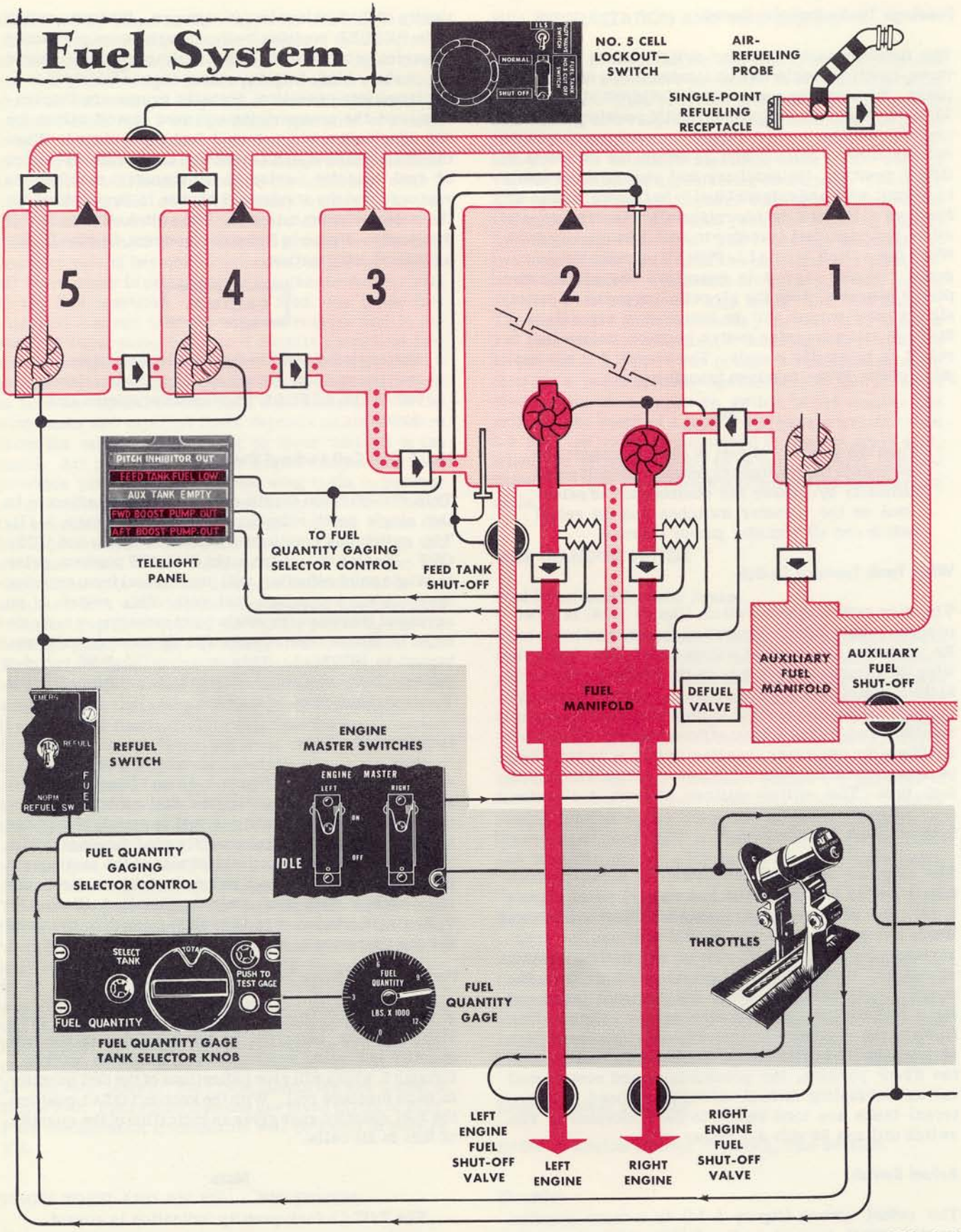


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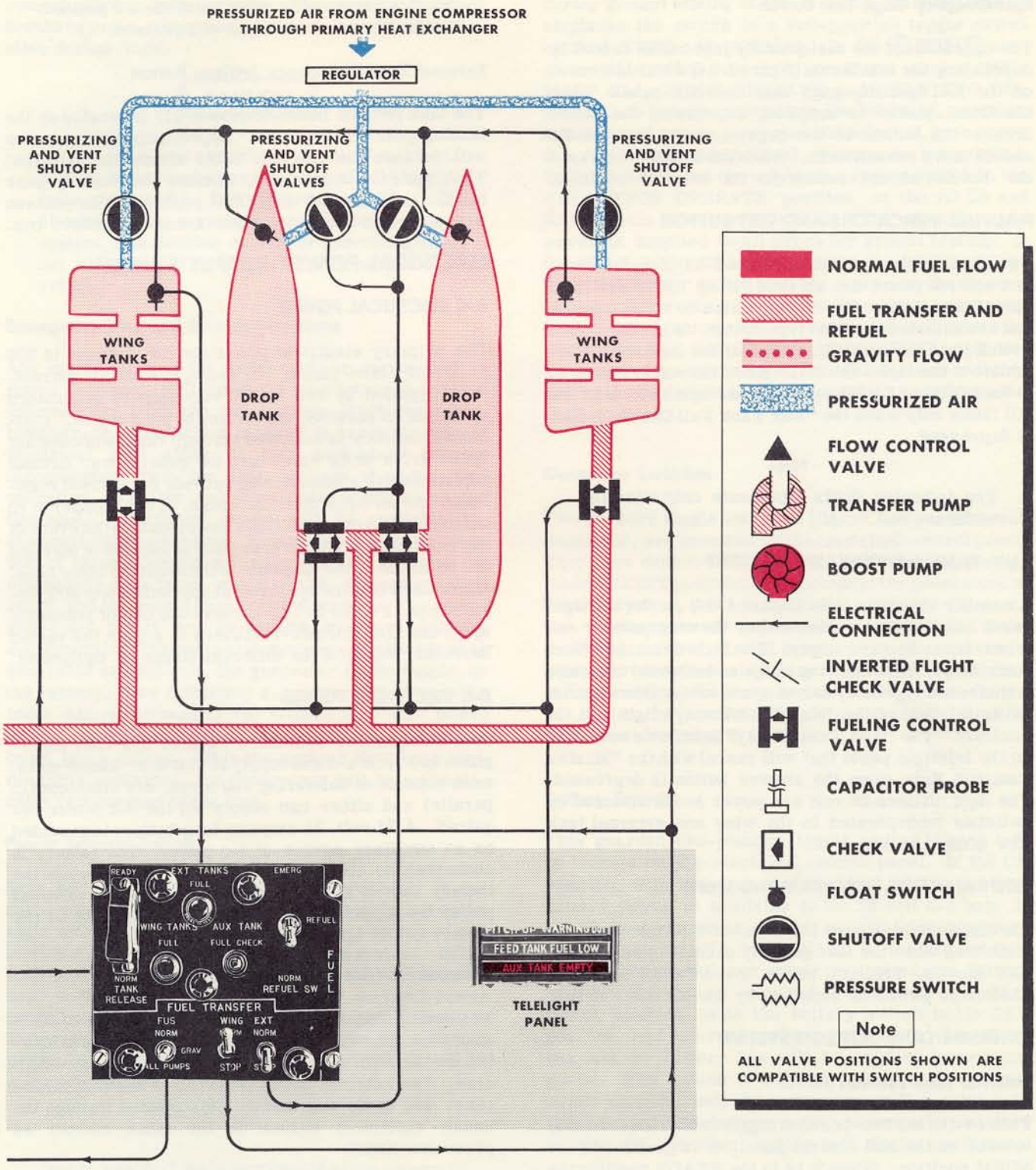
Figure 1-6



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Fuel Quantity Gage Test Button

The operation of the fuel quantity gage can be tested by depressing the test button (figure 1-14) which is located on the fuel quantity gage tank selector panel. When electrical power is supplied, depressing the button breaks the circuit to the gage, and the gage needle should move toward zero. When the button is released the needle should return to its original position.

FULL FUEL INDICATORS AND TEST BUTTON

Two green indicator lights (figure 1-14), located on the fuel control panel, are marked "Wing Tanks Full" and "Ext Tanks Full". The lights utilize 28 volt d-c power and are actuated by a float type switch. When the refuel switch is in the REFUEL position, the lights will illuminate if the tanks are full. When the refuel switch is in the NORM or EMERG position, the lights will indicate full tanks only when the "Aux Tank Full Check" button is depressed.

Note

The indicator lights illuminate only when the tanks are full.

AUX. TANK EMPTY WARNING LIGHT

An amber indicator light (figure 1-14) on the telelight panel will illuminate when either the wing tanks or external tanks become empty. The light is marked "Aux Tank Empty". If the wing tanks and external tanks are transferred together, both wing and external tanks must be empty before the "Aux Tank Empty" light will illuminate. The "Aux Tank Empty" light is the only light on the telelight panel that will cancel with the "Master Caution" light when the answer button is depressed. The light utilizes 28 volt a-c power and is actuated by switches incorporated in the wing and external tank flow control valves.

FEED TANK FUEL LOW WARNING LIGHT

An amber light (figure 1-14) on the telelight panel illuminates when the fuel quantity of cell 2 is reduced to 1200 pounds. The light reads "Feed Tank Fuel Low". Electrical power is supplied by the 28 volt a-c bus.

EXTERNAL TANK JETTISON SYSTEM

External Tank Jettison Switch

This switch is a two-position toggle switch (figure 1-14) located on the fuel control panel. It is guarded in the NORM position. When it is in the READY position the electrical circuit is complete to the external tank release button on the control stick. Depressing the button will then release both external tanks simultaneously. The switch operates on 28 volt d-c power.

Note

The external tank release switch circuit is completed through the landing gear handle. The landing gear handle must be in the UP position before the external tanks will jettison.

External Tank Emergency Jettison Button

The tank jettison button (figure 1-11) is located on the landing gear control panel. Depressing this red button will jettison the external tanks should the External Tank Release switch fail, whether the landing gear handle is in the UP or DOWN position. The jettison button circuit receives power from the battery bus.

ELECTRICAL POWER SUPPLY SYSTEM

A-C ELECTRICAL POWER

The primary electrical power for the airplane is 200/115 volt, three-phase, 400 cycle, alternating current. It is supplied by two 30,000 volt-ampere generators operating in parallel, one driven by each engine. Constant frequency is achieved through the use of constant speed drive units which turn the generators. Ground adjusted units automatically provide for current regulation and an equal division of load. They also serve to disconnect a generator from the circuit in the event of any malfunction. Either generator is capable of meeting the demands of the airplane in the event the other fails. Generators become operative at approximately 30% engine rpm. Figure 1-7 illustrates the use of transformers and transformer-rectifiers to supply the varied currents required by different items of equipment.

D-C ELECTRICAL POWER

Two transformer-rectifiers receive 200 volt, three-phase 400 cycle a-c and supply 28 volt d-c. These units, each capable of delivering 100 amps, are connected in parallel and either can supply all the d-c power required. A 24 volt, 11 ampere-hour battery is provided as an auxiliary source of d-c power. The battery is connected to the 28 volt d-c bus system when the battery switch is in the ON position or when external power is supplied. The battery is connected to the battery bus at all times. Refer to figure 1-7.

External Electrical Power Receptacle

To provide adequate power for ground operation of electrical equipment, an external power receptacle is located on the right side of the airplane below the cockpit area. The external power required is 200 volt, three-phase 400 cycle a-c and it is distributed through the entire electrical system in the same manner as generator output.

Circuit Breakers and Fuses

Most of the d-c circuits are protected by push-pull type circuit breakers. The circuit breakers (figure 1-14) for essential circuits are located on the pilot's left hand console outboard of the throttles and on the aft end (figure 1-18) of the RIO's and dual control left hand consoles. Two fuses for the 5 volt a-c instrument light bus are located on the cockpit lights

control panel in both cockpits. The remaining circuit breakers and a-c fuses are located on panels inaccessible during flight.

CAUTION

Circuit breakers should not be pulled or reset without a thorough understanding of all the effects and results. Pulling circuit breakers can eliminate from a system some related warning system, interlocking circuit or cancelling signal which would result in an undesirable reaction.

Emergency Electrical System Provisions

Any malfunction of the generator, or engine underspeed condition, will cause the generators to become disconnected from the bus system. Each generator, however, is of sufficient capacity to carry the normal electrical load alone. If both generators become disconnected from the line because of underspeed operation, possibly resulting from a double engine flameout, emergency power will be available for accomplishing an air start. Emergency d-c power from one of three sources will automatically energize the emergency fuel boost pump relays, emergency start relay, and the emergency ignition system. The emergency d-c power may be supplied by the windmilling a-c generators through a transformer-rectifier in each generator control unit, the generator fields supply, or the battery. Low frequency a-c power will operate the boost pumps, bypassing the tripped generator power circuit breakers through the energized emergency boost pump relays. After the engines have been successfully restarted, the generators will be automatically reconnected to the line.

Power Selector Switch

This two-position toggle switch (figure 2-11) is located adjacent to the external power receptacles on the right side of the airplane. It provides a means of selecting the source of power for the bus system. In the GEN position, generator output only is available to the bus; in the EXT PWR position, only external power (when connected) is furnished the bus. The power selector switch is so arranged that when the external power receptacle door is closed, the switch will be automatically returned to ON.

Note

Due to eventual wear or warpage of the external power receptacle door, the power selector switch could remain in the EXT PWR position when the door is closed. This condition would prevent generator output to the bus system.

AFCS and NAV System Power Switch

The AFCS and NAV system power switch (figure 2-11) located in the external power receptacle, is utilized during ground testing of the systems. In the 40 THRU 80 airplanes the switch is a two-position toggle switch marked TEST and NORMAL. In the 90 THRU 120 airplanes the switch has three positions marked NORMAL, ALL GYROS OPERATE and ONLY CVG OPERATE. With either switch in the NORMAL position, and external power connected and selected, gyro power for AFCS and navigational systems is interrupted. With the AFCS and Gyro Systems Power switch in the ALL GYROS OPERATE position, or the AFCS and NAV System Power switch in the TEST position, gyro power is supplied to all gyros for ground testing. In the ONLY CVG OPERATE position, the AFCS and Gyro Systems Power switch directs power to the Central Vertical Gyro only. Closure of the external power receptacle door automatically toggles the switches to the respective ALL GYROS OPERATE, or TEST positions, insuring gyro power in flight, in addition, these switches are by-passed when the external power switch is in the GEN position.

Generator Switches

Two guarded toggle switches (figure 1-8), one for each generator, are mounted on the electrical control panel. They have detented ON and OFF positions and a spring-loaded RESET position. They connect the generators to the bus system, and are normally left in the ON position unless there is a generator malfunction. If the generator control circuit breaker has disconnected a generator due to a temporary malfunction, which has been corrected, the generator can be reconnected to the bus system by momentarily placing the switch to RESET, then returning it to ON.

Battery Switch

This guarded two-position toggle switch (figure 1-8) is located on the electrical control panel. In the ON position, with no a-c power supplied the bus system, battery power is available to the 28 volt d-c bus. In the ON position, with a-c power supplied, transformer-rectifier output will be available to the battery bus. Whenever external a-c power is applied, the battery will be charged as required, regardless of battery switch position. With the battery switch in the OFF position, and external power supplied, the 28 volt d-c bus and the battery bus will be supplied by external power. With switch in OFF position, and no external power supplied, only the battery bus will receive battery power. The battery switch is normally retained in the ON position during all flight operations.

Voltmeter

This meter (figure 1-8) on the electrical control panel gives an indication of the voltage being supplied to the bus system whether supplied by generators or an external power source. It measures the voltage of only one phase of the three-phase power, hence will normally indicate 115 volts.

Electrical System

1 WITH THE EXTERNAL POWER SELECTOR SWITCH IN THE EXT. PWR. POSITION, AND EXTERNAL ELECTRICAL POWER APPLIED, THE BATTERY BUS IS CONNECTED TO THE 28 VOLT D-C BUS REGARDLESS OF BATTERY SWITCH POSITION.

2 OPERATES POWER CIRCUIT BREAKER. POWER CIRCUIT BREAKER WILL TRIP AND DISCONNECT GENERATOR FROM THE DISTRIBUTION SYSTEM WHEN THE GENERATOR SPEED IS BELOW NORMAL, GENERATOR EXCITATION IS NOT NORMAL, OR WHEN THERE IS OVER-VOLTAGE OR A SHORTED GENERATOR PHASE LEAD.

3 EMERGENCY D-C POWER IS AVAILABLE FROM THE D-C CONTROL BUS WITHIN THE A-C CONTROL UNIT. THIS BUS IS ENERGIZED FROM ANY ONE OF THREE SOURCES, DEPENDING UPON WHICH SOURCE VOLTAGE IS HIGHEST. THE THREE SOURCES ARE THE BATTERY, GENERATOR EXCITER, AND A TRANSFORMER—RECTIFIER WITHIN THE A-C CONTROL UNIT.

4 EMERGENCY A-C POWER IS PROVIDED BY THE GENERATOR DURING UNDERSPEED OPERATION. WHEN THE UNDERSPEED CONDITION EXISTS, THE GENERATORS WILL BE TRIPPED FROM THE NORMAL DISTRIBUTION BUS SYSTEM. HOWEVER, EMERGENCY D-C POWER IS PROVIDED TO ENERGIZE THE EMERGENCY BOOST PUMP RELAYS, WHICH, IN TURN, COMPLETES A CIRCUIT DIRECTLY FROM THE GENERATORS TO THE BOOST PUMPS.

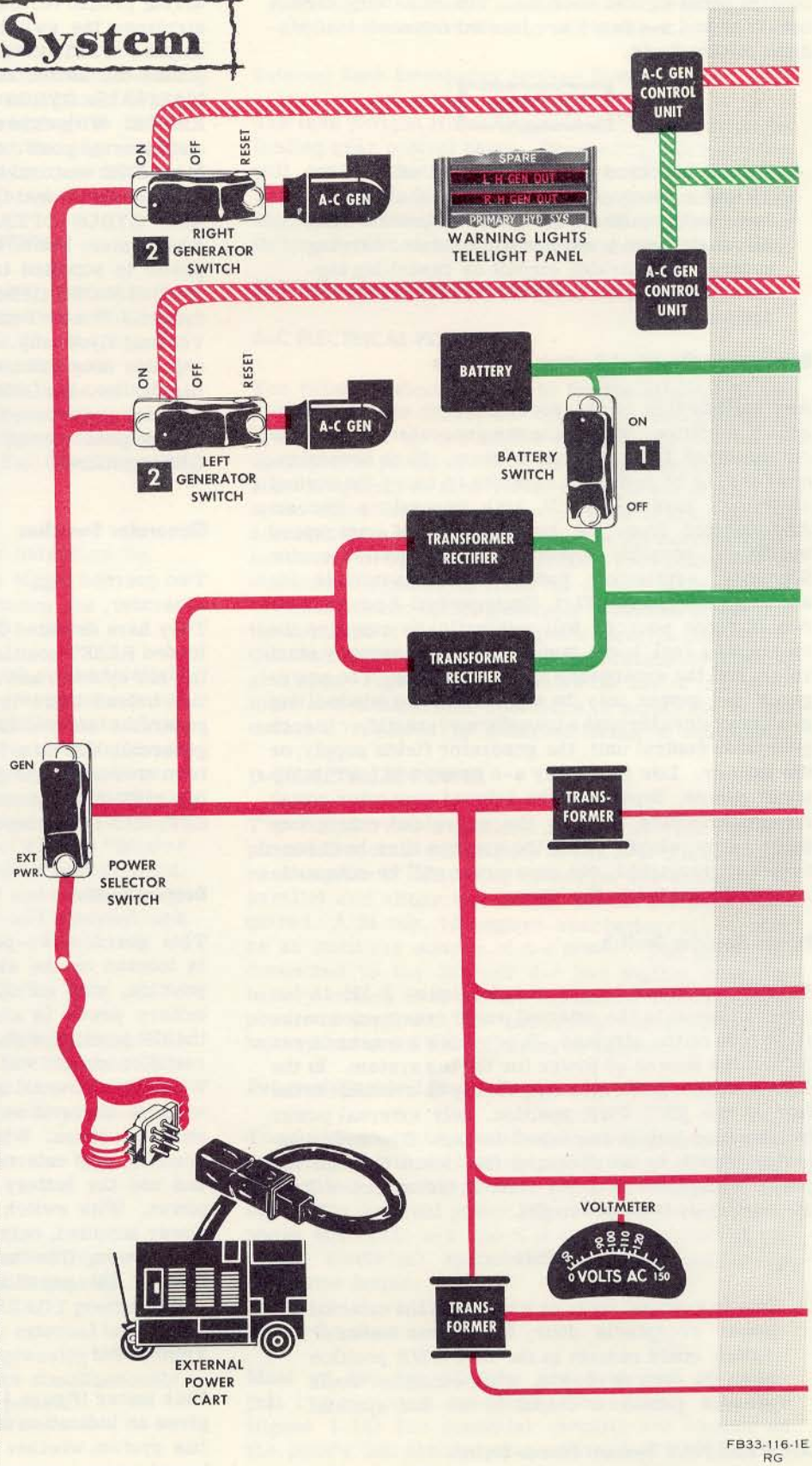

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Figure 1-7

4 200 V A-C (RIGHT) EMERGENCY BUS	FUEL BOOST PUMP *(ENERGIZED WHEN BOTH GENERATOR CIRCUIT BREAKERS ARE TRIPPED WITH ENGINES WINDMILLING)*		
3 24 V D-C EMERGENCY BUS	EMERGENCY BOOST PUMP CONTROL IGNITION *(ENERGIZED WHEN BOTH GENERATOR CIRCUIT BREAKERS ARE TRIPPED WITH ENGINES WINDMILLING)*		
4 200 V A-C (LEFT) EMERGENCY BUS	FUEL BOOST PUMP (INVERTED FLIGHT) *(ENERGIZED WHEN BOTH GENERATOR CIRCUIT BREAKERS ARE TRIPPED WITH ENGINES WINDMILLING)*		
BATTERY BUS	AFTERBURNER CANOPY EJECT LIGHT EMERGENCY TANK JETTISON ENGINE MASTER SWITCH	EXTERNAL POWER INTERLOCK FUEL SHUTOFF IGNITION LAUNCHER MANUAL CONTROL REFUEL	LEFT AND RIGHT ICING IGNITION STARTER (INTERNAL AIR) START SWITCH TAIL HOOK WING REFUEL
28 V D-C BUS	A-C EXTERNAL POWER AND LOAD BANK A-C GENERATOR CONTROL AN/AIC-10 (INTERCOMM) AN/ARC-34 (UHF COMMAND) AN/ARN-21 (TACAN NAV REC) AN/ARN-31 (ILS RECEIVER) AN/ARN-32 (MARKER BEACON) ANTI-SKID ARMAMENT CONTROL AND FIRING AR PILOT VALVE CHECK ATTITUDE INDICATOR AUTOMATIC FLIGHT CONTROL CABIN HEAT AND VENT CONTROL CHART BOARD AND COMPUTER LIGHTS ENGINE OVERHEAT TEST EXTERNAL FUEL TRANSFER EXTERIOR LIGHTS CONTROL	EQUIPMENT COOLING FACE MASK HEAT (PILOT) FACE MASK HEAT (RIO) FLAP POSITION INDICATOR FUEL BOOST PUMP (INVERTED FLIGHT) FUEL BOOST PUMP (FWD) FUEL QUANTITY FUEL TRANSFER FUEL VENT FUSELAGE LIGHT (DIM) GENERATOR CONTROL SWITCHES HEAT EXCHANGER IFF INSTRUMENT LIGHTS (SECONDARY) JET PUMP LANDING GEAR CONTROL LANDING GEAR LIGHTS CONTROL	NOSE GEAR STEERING PITCH CONTROL SYSTEM RADAR (MG-13) RUDDER FEEL AND TRIM SPEED BRAKES SEAT ADJUST SPEED BRAKE EMERGENCY RETRACT STABILIZER AND AILERON FEEL AND TRIM TAKE-OFF TRIM INDICATOR TANK JETTISON TURN AND SLIP INDICATOR UHF ANTENNA SWITCHES UTILITY LIGHT WARNING LIGHTS WINDSHIELD RAIN CLEARING WINDSHIELD DEFROSTER WING FUEL TRANSFER
115 V THREE-PHASE A-C BUS	ATTITUDE INDICATOR	HEADING INDICATING SYSTEM	
200 V THREE-PHASE A-C BUS	FUEL BOOST PUMPS FUEL TRANSFER PUMPS	RADAR (MG-13)	
115 V SINGLE-PHASE A-C BUS (T-3)	AUTOMATIC FLIGHT CONTROL SYSTEM AN/ARN-21 (TACAN NAV REC) AN/ARN-31 (ILS RECEIVER) ENGINE PRESSURE RATIO (LEFT)	ENGINE PRESSURE RATIO (RIGHT) ENGINE OVERHEAT GLIDE SLOPE RECEIVER IFF	IDENTIFICATION LIGHT LANDING AND TAXI LIGHTS WINDSHIELD RAIN CLEARING
115 V SINGLE-PHASE A-C BUS (T-2)	AUTOMATIC FLIGHT CONTROL SYSTEM CENTRAL AIR DATA COMPUTER HEADING INDICATING SYSTEM	CONSOLE FLOODLIGHTS (RIO) CONSOLE LIGHTS (RIO)	ELECTRONIC TEST PRIMARY INSTRUMENT LIGHTS (RIO)
115 V SINGLE-PHASE A-C BUS (T-1)	AIRSPEED INDICATOR (TRUE) AUTOMATIC FLIGHT CONTROL SYSTEM CABIN HEAT AND VENT CONSOLE FLOODLIGHTS (PILOT) CONSOLE LIGHTS (PILOT) ELECTRONIC TEST	EQUIPMENT COOLING FEEL TRIM INLET DE-ICING FUEL QUANTITY HORN POWER OXYGEN INDICATOR	PITOT HEAT PRIMARY HEAT EXCHANGER (PRIMARY) INSTRUMENT LIGHTS PUSHER POWER WINDSHIELD DEFROSTER
28 V A-C BUS	HEADING INDICATING SYSTEM ENGINE FUEL FLOW ENGINE OIL PRESSURE EXTERIOR LIGHTS	FUSELAGE LIGHTS (BRIGHT) HYDRAULIC PRESSURE (UTILITY) HYDRAULIC PRESSURE (PRIMARY)	LANDING GEAR POSITION INDICATOR TELELIGHT PANEL WARNING LIGHTS POWER
10 V A-C BUS	WARNING LIGHTS (DIM)		

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Right Sub Panel-Front Cockpit

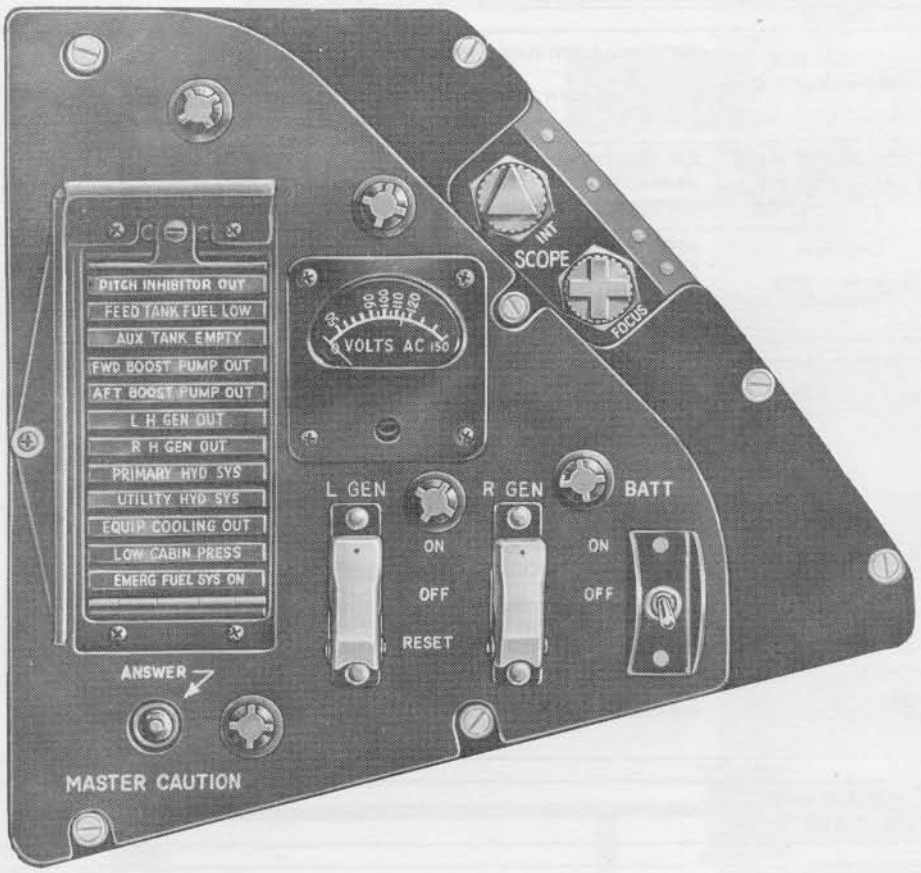

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Figure 1-8

Generator Warning Lights

A warning light (figure 1-8) for each generator is located on the telelight panel. The lights read "LH Gen Out" and "RH Gen Out". When either generator is disconnected from the bus for any reason, the respective warning light and the "Master Caution" light illuminate. Refer to Telelight Panel, this section.

HYDRAULIC POWER SUPPLY SYSTEM

Hydraulic power is supplied by two completely separate systems; a primary and a utility system, each with an operating pressure of 3000 psi. Each system has two pumps, one driven by the right engine and one driven by the left engine. The loss of one pump, in either system, presents no limitations since one pump can supply fluid in adequate quantity for all normal operation. See figure 1-9.

PRIMARY SYSTEM

The primary system is utilized to supply hydraulic pressure for operation of one section of the ailerons and horizontal stabilizer tandem power cylinders. Also, the primary system supplies pressure for operation of nose gear steering. See figure 1-9.

UTILITY SYSTEM

The utility hydraulic system supplies power to the rudder (yaw damper), pusher actuator, wheel brakes, air refueling probe, armament rotary door, flaps, landing gear, speed brakes, emergency brake accumulator, and to one section of the aileron and horizontal stabilizer tandem power cylinders. A priority valve in the utility system will deny pressure to all but the aileron, rudder, horizontal stabilizer, pusher actuator, and wheel brakes should the operating pressure drop below 1800 psi. Utility hydraulic system failure results in complete loss of AFCS operation. Refer to figure 1-9.

Hydraulic Pressure Gages

Two pressure gages (figure 1-14), one for each system, are mounted side by side on the left console, just forward of the throttles. The gages are actuated by transmitters utilizing 28 volt a-c and indicate system pressure in psi.

Hydraulic Pressure Warning Light

A warning light (figure 1-8) for each system is located on the telelight panel. The lights read "Primary Hyd Sys" and "Utility Hyd Sys". Illumination of these lights give an indication of any one of the four hydraulic pumps. If the pressure from either pump in the utility or the primary system drops below 700 psi, the respective warning light and "Master Caution" light illuminates.

FLIGHT CONTROL SYSTEM

The control stick serves only to position valves, through mechanical linkage, in such a manner that control surface movement is proportional to control stick movement. The horizontal stabilizer and ailerons utilize power from both the primary and utility hydraulic systems, while the rudder is operated by the utility system alone. See figure 1-9.

ARTIFICIAL FEEL AND TRIM SYSTEM

All of the power cylinders are irreversible in that they transmit none of the airloads back to the stick or rudder pedals. To compensate for this, and to provide the pilot with stick and rudder forces to which he has become accustomed, separate artificial feel systems are provided. The same irreversibility features tend to "snub" the control surfaces, making control locks unnecessary. Each of the primary controls can be trimmed electrically. Autopilot servos are tied into all controls. Portions of the autopilot system can be used, independent of automatic flight to provide yaw damping. Provisions are made whereby the ailerons, rudder and stabilizer can be simultaneously trimmed for take-off. Refer to Take-Off Trim Button, this section.

Stabilizer Feel and Trim

"Feel" is induced into the horizontal stabilizer control system by stabilizer bellows forces. The bellows assembly is located just forward of the speed brake well. Bellows forces are obtained from ram air pressure acting on a bellows (figure 1-1), and will therefore vary with airspeed and air density. The ram air intake duct contains a molded type thermostatically controlled heater to prevent icing of the duct and subsequent loss of stabilizer feel. The heater utilizes 115 volt a-c electrical power that is available to the heater whenever a-c power is supplied to the airplane. This bellows force is supplied to a variable balance assembly which is connected to the control stick through control linkage. The control linkage is such that fore and aft stick movements cause the balance assembly to rotate. As the balance assembly rotates, control stick movements are resisted by the bellows force. The resistance, as transmitted to the stick through the linkage, is the artificial feel. The application of ram air pressure on the bellows makes possible a more accurate simulation of the stick forces encountered under varying flight conditions. Another stick force factor and aid in preventing the airplane from being subjected to "g" loads beyond its structural capabilities, is the incorporation of a viscous damper in the feel system. This unit will provide a much greater resistance to any abrupt or sudden stick movement, either fore or aft. A bobweight is also installed on the stick which will increase stick forces with an increase in "g" load. Horizontal stabilizer trim is accomplished through the use of the same mechanisms which provide artificial "feel", namely, the bellows force acting on the balance assembly. An electric actuator in the balance assembly varies the point at which the bellows force is applied to the balance assembly. The actuator is energized by the lateral and longitudinal trim switch located on the control stick grip, or by the take-off trim button on the pilot's instrument panel. When airborne, full travel of the stabilizer can be obtained with the trim system.

Aileron Feel and Trim

A spring cartridge, one end of which is attached to the aileron linkage, supplies "feel" to this system. It is designed so that movement in either direction requires compression of the spring and subsequently resistance to movement. Trim is provided by attaching the other end of this same cartridge to an electric actuator. When energized, the actuator moves the entire aileron linkage, thereby repositioning the neutral or no feel position. The actuator is energized by the lateral and longitudinal trim switch on the control stick or by the take-off trim button on the pilot's instrument panel. See figure 1-15.

Rudder Feel and Trim

The difference in the forces exerted on opposite sides of a piston within a hydraulic cylinder offers the resistance to rudder pedal movement necessary to produce the required "feel". This cylinder joins the rudder linkage in such a manner that control movement in either direction tends to extend the cylinder. At slower airspeeds, full hydraulic system pressure is diverted to both sides of the piston, but due to the difference in area of the two sides of the piston, some resistance to pedal movement is offered. At an airspeed of 290 (±10) knots, an airspeed switch is actuated which in turn operates a valve shutting off hydraulic pressure to the extension side of the pistion. This means that full hydraulic pressure then opposes rudder control movement, greatly increasing the feel forces. Trim is accomplished by varying the neutral, or no-load position of the control linkage. This is made possible by including an electric actuator in the feel system which by extension and retraction moves the entire rudder control system proportionally. The actuator is energized by the rudder trim switch on the left console or by the take-off trim button on the pilot's instrument panel.

Yaw Damper(Stability Augmentation)

A hydraulic actuated, electrically controlled yaw damper system is used to insure turn coordination and improve dynamic directional characteristics. The

Hydraulic Power System

TYPICAL

*OPERATING PRESSURE–3000 PSI

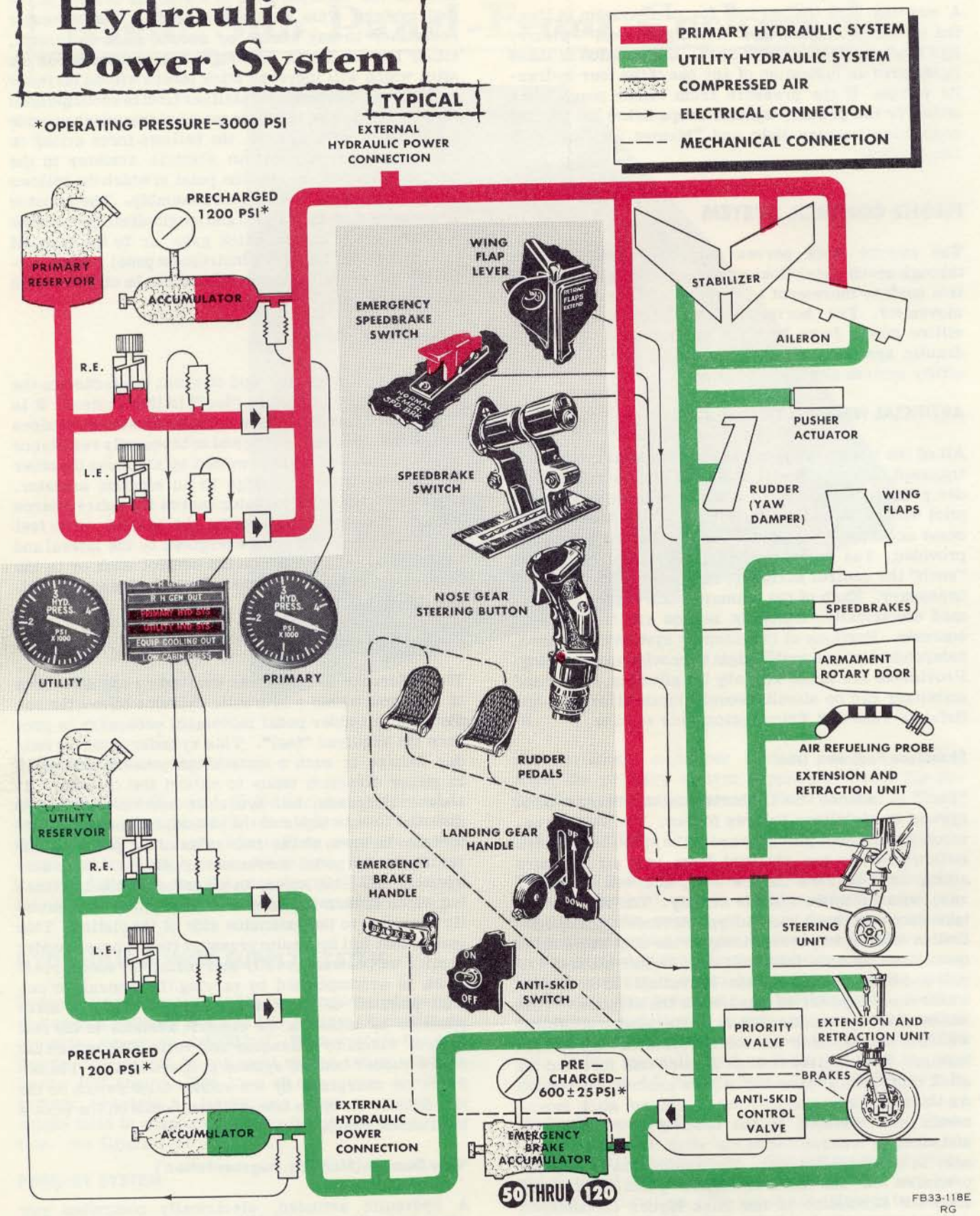


Figure 1-9

system operates when the yaw damper switch (figures 1-14) is in the DAMPER position or when the AFCS is operating. In some airplanes the DAMPER position is marked STAB-AUG. The rudder servo is connected to the rudder pedals by a linkage assembly which permits yaw damping and auto-pilot maneuvers without disturbing the rudder pedals. In the event of any electrical failure the yaw damper will automatically disengage and the yaw damper switch will return to the STAND-BY position. To re-engage the yaw damper the switch must be manually placed to the DAMPER position. The yaw damper may also be electrically disconnected by holding the stick paddle switch depressed. The damper switch on the AFCS function selector panel will remain at the DAMPER (STAB-AUG) position and the yaw damper will automatically re-engage when the paddle switch is released. The yaw damper should be used during all flight operations. The yaw damper system uses utility hydraulic power, 115 volt, single-phase a-c power and 28 volt d-c electrical power. The yaw damper system is protected by the AFCS circuit breakers.

CONTROL STICK

The control stick is mechanically connected to the control valves at the aileron and horizontal, stabilizer actuators and provides a means of lateral and longitudinal control of the airplane. In dual control equipped airplanes, the control sticks are mechanically linked to provide airplane control from either cockpit. Movement of the control stick mechanically positions control valves to direct hydraulic pressure to the applicable control surface actuator. Hydraulic pressure to the actuator will be blocked off automatically when desired control surface deflection is obtained. The pilot's stick grip (figure 1-10), incorporates the lateral and longitudinal trim switch, external tank release button, armament trigger, nose gear steering button, and the alternate microphone button after incorporation of T.O. 1F-101-922. The dual control stick incorporates the same functions except the external tank release button and armament trigger are inoperative.

PADDLE SWITCH

The paddle switch (figure 1-10), located on the forward side of the control stick, provides a readily accessible means of disengaging the autopilot and releasing the pusher, yaw damper, and anti-skid systems. Depressing the lever will disengage the autopilot and it must be re-engaged if AFCS operation is desired, however, the pusher, yaw damper and anti-skid systems are released only while the lever is held depressed and will return to normal operation when lever is released. Power for the paddle switch is 28 volt d-c.

RUDDER PEDALS

Conventional hanging-type rudder pedals, mechanically linked to hydraulic control valves at the rudder actuator, provide a means of directional control of the airplane. Movement of the pedals mechanically positions the control valves to direct hydraulic pressure to the

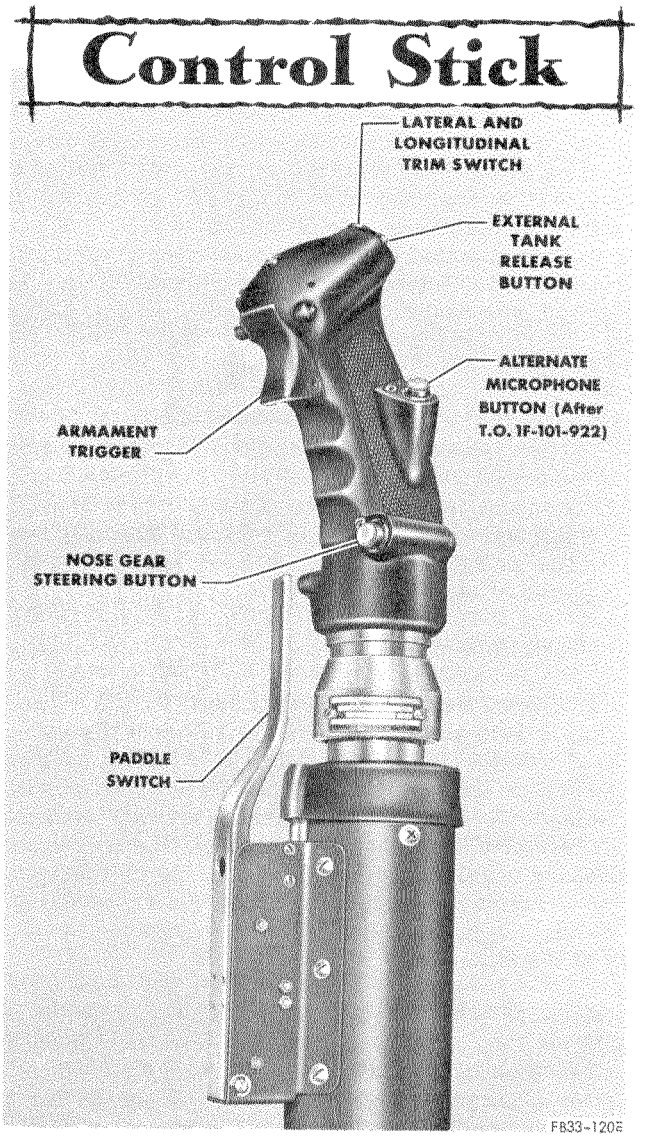


Figure 1-10

rudder actuator. Hydraulic pressure to the actuator will close off automatically when desired rudder deflection is proportional to rudder pedal movement. The rudder pedals are collectively adjusted fore and aft by the crank on the lower portion of the pedestal panel (figure 1-15). Toe action on the rudder pedals applies wheel brakes. Refer to Wheel Brake System, this section. With nose gear steering system engaged, movement of the rudder pedal maintains directional control during ground operation. In airplanes equipped with dual controls, the rudder pedals in the rear cockpit are individually adjusted by pulling down on the locking pins (located inboard of the rudder pedals) and positioning pedals with feet. Refer to Nose gear Steering System, this section.

LATERAL AND LONGITUDINAL TRIM SWITCH

The lateral and longitudinal trim switch (figure 1-10), located on the control stick, is a five-position switch, spring-loaded to the mid (OFF) position. Moving the

switch to the LEFT induces left wing-down trim; to the RIGHT, right wing-down. Pushing the trim switch FORWARD applies nose-down trim; moved AFT, nose-up trim is applied. Do not attempt manual trim with AFCS engaged since the AFCS will retrim. Before actuating the take-off trim button, apply aft trim. If the airplane is trimmed nose down, the system will not trim the stabilizer. Electrical power for the trim switch is supplied by the 28 volt d-c bus. These conditions are duplicated on the control stick in the rear cockpit with dual controls installed.

WARNING

The trim switch may occasionally stick in an actuated position, resulting in application of extreme trim. If this condition occurs in flight, the trim switch must be returned manually to the center OFF position after the desired amount of trim is obtained.

RUDDER TRIM SWITCH

The rudder trim switch is located on the left consoles (figure 1-14 and figure 1-18), of both cockpits with the dual control installation. The three-position toggle switch is spring-loaded to the OFF (center) position. Actuation of this switch, either right or left, energizes an electric actuator to reposition the feel system linkage to provide appropriate trim. Moving the switch to L, trims for nose-left; to R, trims for nose-right. Electrical power for the switch is supplied by the 28 volt d-c bus.

TAKE-OFF TRIM BUTTON

The take-off trim button (figure 1-15), located on the pilot's instrument panel, provides a means for the pilot to simultaneously trim all flight controls (ailerons, rudder and stabilizer) to proper position for take-off. Depressing this button energizes the electric actuators to reposition the ailerons and rudder and the stabilizer balance assembly to obtain the control settings for take-off. The take-off trim position of the ailerons and rudder is neutral (+2°); the stabilizer balance assembly is extended to induce a nose-down trim condition. The switch must be held depressed until illumination of the take-off trim light indicates that all flight controls are properly trimmed for take-off. Electrical power is supplied from the 28 volt d-c bus.

CAUTION

The take-off trim button should not be used in flight, as a dangerous or undesirable flight attitude may result.

TAKE-OFF TRIM LIGHT

A green indicator light (figure 1-15), located adjacent the take-off trim switch on the pilot's instrument panel, is provided to give the pilot an indication that take-off trim has been attained. With the switch held depressed, the light will illuminate when all flight controls have reached take-off trim. Releasing the take-off trim switch will cause the light to go out. If the airplane is in an excessive nose down trim, it is possible for the stabilizer not to trim and the light not to illuminate. By manually trimming the airplane to a nose high condition and then depressing the take-off trim button, the system will trim normally for take-off. This light utilizes 28 volt d-c power and can be dimmed and tested by the warning light test and dim button on the pilot's lighting control panel.

YAW DAMPER (STABILITY AUGMENTATION) SWITCH

This two-position toggle switch (figures 1-14) on the AFCS panel, is spring-loaded to STAND-BY and held in the DAMPER position by a solenoid. In the event of an electrical malfunction, it will automatically revert to STAND-BY. In some airplanes, the DAMPER position is marked STAB-AUG. The switch is normally retained in the DAMPER position. The damper will reengage upon release of the paddle switch on the control stick if the yaw damper switch is in the DAMPER position. Electrical power is supplied from the 28 volt d-c bus.

PITCH CONTROL SYSTEM (PCS)

The pitch control system provides an audible, physical and, after the incorporation of T.O. 1F-101-882, a visual warning of impending pitch-up flight conditions. The system utilizes two separate sensing units; one to operate the pcs warning horn (audible) and pitch boundary indicator (visual), and one to operate the pcs pusher (physical). Each sensing unit utilizes an angle of attack vane, a Mach scheduler, a stabilizer rate sensor, and one channel in a dual channel control box. The angle of attack vanes, located on each side of the forward fuselage, sense the angle of airflow over the wings. The right angle of attack vane operates the warning horn and pitch boundary indicator, and the left angle of attack vane operates the pusher. The Mach schedulers measure the ratio between pitot and static pressures and converts this ratio into electrical impulses which are supplied to the dual channel control box. The stabilizer rate sensors convert the actual stabilizer rate of travel into electrical impulses which are also supplied to the dual channel control box. The dual channel control box then coordinates this information and actuates the pcs horn and pusher when necessary. The pusher valves, in turn, allow hydraulic pressure to enter the stabilizer actuator which repositions the stabilizer to a nose down condition.

WARNING

Once the pusher is actuated, immediate corrective action must be taken by moving the control stick further forward. However, the pusher force can be overpowered by applying a 27.5 pound aft stick force in excess of the normal maneuvering force.

The pitch control system is controlled through the pcs control panel (figure 1-14). Electrical power required to operate the system is taken from the 115 volt a-c bus and the 28 volt d-c bus (figure 1-7).

Pitch Boundary Indicator (PBI)

During flight the PBI (figure 1-15) continuously measures the airplane wing angle of attack and the horn and pusher boundaries in units of alpha. Wing angle of attack is shown by the alpha W needle while horn and pusher boundaries are displayed by the alternately striped rectangular needles. When accurately calibrated, this instrument continuously shows the difference between current wing angle of attack and that angle of attack where the horn and pusher will be encountered. Thus, the pilot can use this instrument during high "g" symmetrical maneuvers to obtain the maximum maneuverability without encountering the horn and pusher. The PBI is powered by 28 volt d-c and 28 volt, 400 cycle a-c.

Pusher Switch

The pusher switch (figure 1-14) is a two-position ON-OFF toggle switch. The switch admits 28 volt d-c and 115 volt 400 cycles a-c current to the pusher system whenever power is applied to the airplane. The OFF position terminates electrical power to the pusher system and opens the pusher hydraulic by-pass valve.

CAUTION

The pusher switch should be placed in the OFF position if the pitch inhibitor out light illuminates or at any other indication of a pcs malfunction.

Horn Switch

The horn switch (figure 1-14), a two-position ON-OFF toggle switch, is guarded in the ON position. The switch guard is safety wired ON. The switch admits 28 volt d-c and 115 volt 400 cycle a-c power to the horn system whenever power is applied to the airplane. The OFF position, which terminates electrical power to the horn system, should not be used unless a system malfunction occurs.

Pusher Release (Paddle Switch)

The pusher release lever (figure 1-10) is located on the forward side of the control stick. The lever must be held depressed to disengage the pusher portion of the system. The horn will still function even though the lever is actuated. When the lever is released, the pusher will resume normal operation. Power for the lever is 28 volt d-c.

CAUTION

Operation of the paddle switch on the control stick will only momentarily release pusher operation. Normal stick forward motion is required to prevent the pusher from re-engaging when lever is released.

Pitch Inhibitor Out Light

An amber light which reads " Pitch Inhibitor Out" (figure 1-8) located on the telelight panel illuminates under any of the following conditions: Any electrical power failure within the system, the horn or pusher switch in the OFF position; or if the signals from the Mach schedulers are not comparable. The light utilizes 28 volt a-c power.

Note

- With gear or flaps down, only the horn portion of the system will function. Under these conditions, the pusher system will not operate and the horn system has no stabilizer rate sensing.
- If the pusher portion of the pitch control system is actuated during flight, the autopilot will automatically disengage. Thus, the autopilot must be manually re-engaged for continued use.

WING FLAPS

Hydraulically operated, electrically controlled, zap type flaps are located inboard of the ailerons on the trailing edge of each wing. Each flap is attached to the wing by four links which permit the flaps to move aft as well as down when extended. The flaps are held in the down position by hydraulic pressure and in the up position by mechanical locks. A limit switch terminates flap up travel as soon as the flaps are up and locked. The flaps will remain down or in an intermediate position if utility hydraulic pressure is lost during or after flap operation. Simultaneous operation of each flap is assured by a flow divider which provides equal flow to each flap actuator. The airspeed switch that controls the rudder feel system also automatically retracts the flaps at 290 ± 10 knots and prevents flap extension above this speed. If the wing flap lever is left DOWN, the flaps will automatically extend when the airspeed drops below approximately 290 knots.

CAUTION

During ground operation, repositioning the flap lever while the flaps are being extended will result in serious damage to the flaps and may prevent any subsequent flap operation. The airload will prevent this damage while airborne.

No intermediate flap positions are available and there are no provisions for emergency extension or retraction of the flaps.

WING FLAP LEVER

The two-position wing flap lever (figure 1-14) is located on the left console. It has positions marked RETRACT and EXTEND. In the EXTEND position, a solenoid valve is energized by 28 volts d-c, directing utility hydraulic pressure to extend the flaps to the "full down", 50 degree position. The solenoids remain energized and pressure is maintained on the actuating cylinders, holding the flaps in the EXTEND position. Placing the lever in the RETRACT position actuates solenoids to deliver utility hydraulic pressure for retraction. However, once the flaps are locked up, limit switches de-energizes the circuit.

WING FLAP POSITION INDICATOR

A conventional indicator (figure 1-11) on the landing gear control panel utilizes 28 volt d-c power to indicate flap position full up or down. The flap position indication is obtained from the left flap and indicates flap position in percent of travel.

AUDIO HEADSET SIGNAL

Refer to Landing Gear Warning Buzzer, this section.

SPEED BRAKES

Panel type speed brakes are installed on the aft portion of each side of the fuselage. The panels are hydraulically operated, from the utility system, and electrically controlled with 28 volt d-c power. In normal operation, hydraulic pressure acts to both open and close the speed brakes.

SPEED BRAKE SWITCH

A serrated toggle switch (figure 1-4) located on the right throttle grip controls the speed brake hydraulic control valve to position the speed brakes. This switch, powered by the 28 volt d-c bus, has three fixed positions: OPEN, CLOSE and a neutral position. Any degree of speed brake deflection can be obtained during either the extension or retraction cycle by returning the switch to neutral when speed brakes reach desired position.

EMERGENCY SPEED BRAKE SWITCH

This switch (figure 1-14) on the engine control panel is guarded in the NORMAL position. Should the normal operating system fail with the speed brakes extended, placing this switch to the IN position will operate a valve relieving the hydraulic pressure and allowing the air loads to force the panels to a trail position. Power required is supplied by the 28 volt d-c bus.

LANDING GEAR SYSTEM

The fully retractable tricycle landing gear consists of a dual wheel nose gear and single wheel main gear which are hydraulically operated (utility system) and electrically (28 volt d-c) controlled. The main wheels retract inboard into the wings; the nose wheel retracts forward into a compartment in the nose. When the landing gear is retracted, the compartments are covered by flush doors. The doors operate automatically with the landing gear, and in the case of the main wheel doors, the operation is hydraulic; with the nose wheel doors, it is through mechanical linkage. The doors remain open when the landing gear is extended. The main landing gear inboard doors will automatically open whenever hydraulic pressure and external electrical power is applied or during the starting cycle. The gear is mechanically locked in both the retracted and extended positions. Landing gear extension for both normal and emergency will take place in approximately 8 to 10 seconds, while retraction occurs in approximately 4 seconds. A compressed air bottle is installed for emergency extension of the landing gear in the event the normal hydraulic system fails. An overrun barrier hook is mounted on the nose gear and the main gear door panels have been reinforced to improve MA-1A barrier engagement.

LANDING GEAR SHOCK STRUTS

The main landing gear shock struts are the conventional air-oil type that will be compressed when the landing gear is being retracted. The struts are compressed for stowage in the wings by relieving air pressure in the inflation chamber. Air pressure in the inflation chamber is dumped overboard as the landing gear is retracting. As the landing gear is being lowered, air pressure is metered from a high pressure storage chamber in the strut to the inflation chamber, extending the strut to its normal landing condition. The high pressure storage chamber contains enough air pressure to cycle the gear approximately 12 times. Additional landing gear cycling will cause the strut to collapse and remain in that condition. An air pressure indicating pin located on the top of the strut will extend approximately 9/16 of an inch when the storage chamber is fully serviced (3000 psi). The air pressure in the storage chamber will decrease each time the gear is cycled and consequently the pin extension will decrease proportionally.

CAUTION

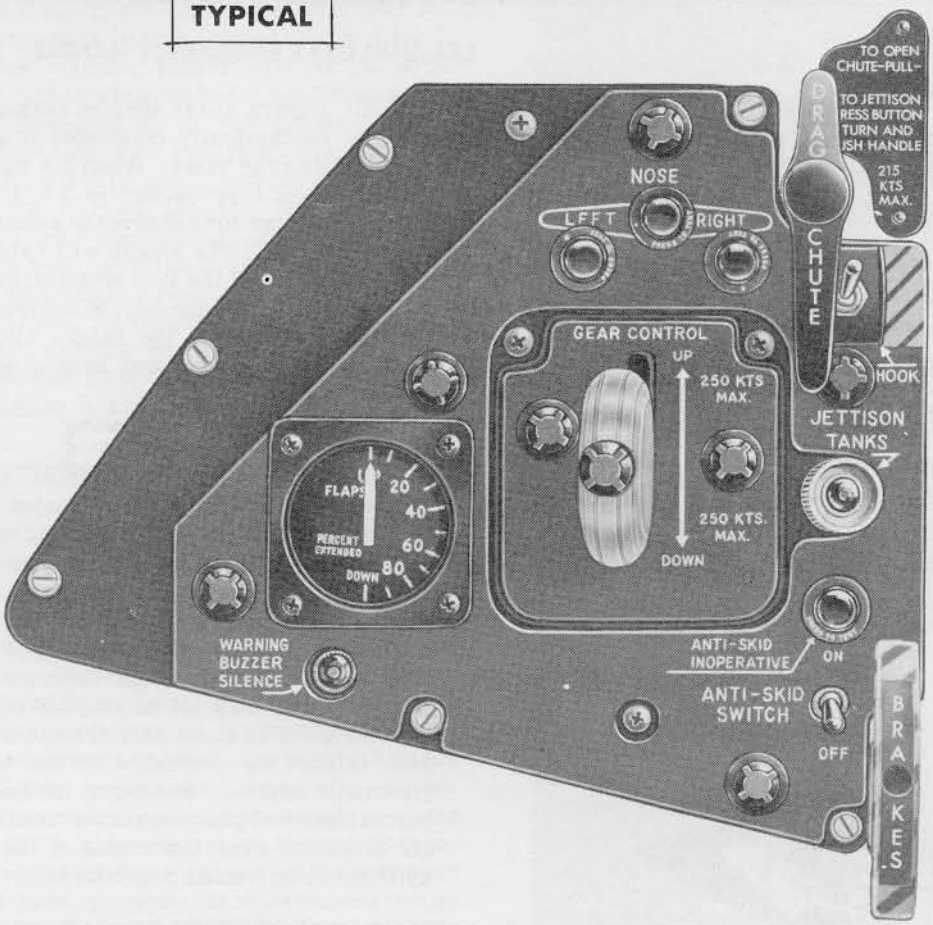
While on the ground, the gear strut may be extended even though there is no air pressure in storage (pin retracted). Consequently the pin is the only indication that the storage chamber is partially or fully serviced (pin extended).

LANDING GEAR GROUND LOCKS

Individual clamps for the main gears, and a pin for the nose gear, can be installed on the ground to prevent inadvertent retraction during servicing and ground handling. The locks have regulation red streamers

Left Sub Panel-Front Cockpit

TYPICAL



FB33-123F

Figure 1-11

attached and must be removed prior to flight. The landing gear ground locks should not be removed prior to starting at least one engine. Hydraulic pressure to the downside of the landing gear actuator will not be available prior to starting engines and there is the possibility that the landing gear could collapse. See figure 1-12.

LANDING GEAR HANDLE

Normal operation of the landing gear is accomplished by means of the landing gear handle (figure 1-11) located on the landing gear control panel. This two-position handle, which has positions marked UP and DOWN, mounts a wheel-shaped knob which contains a warning light. Placing the handle in either position actuates switches which in turn operate a solenoid valve to direct hydraulic pressure. When the landing gear is up and locked, limit switches disengage the solenoids relieving the system of pressure. When the landing gear is extended and locked, limit switches hold the solenoids engaged and pressure is available at all times. The system utilizes 28 volt d-c electrical power which is supplied through the landing gear circuit breaker (figure 1-14). To preclude accidental operation of the landing gear handle, limit switches enable a lever latch mechanism to hold the handle down whenever any of the landing gear struts are compressed. When the struts extend after take-off, a 28 volt d-c solenoid releases the latch mechanism, permitting normal operation of the handle. The latch mechanism can be overridden by exerting a force of approximately 35 pounds on the handle. This permits emergency gear retraction on the ground when necessary.

WARNING

With hydraulic pressure available, the landing gear will retract any time the landing gear handle is moved to UP.

Landing Gear Ground Locks

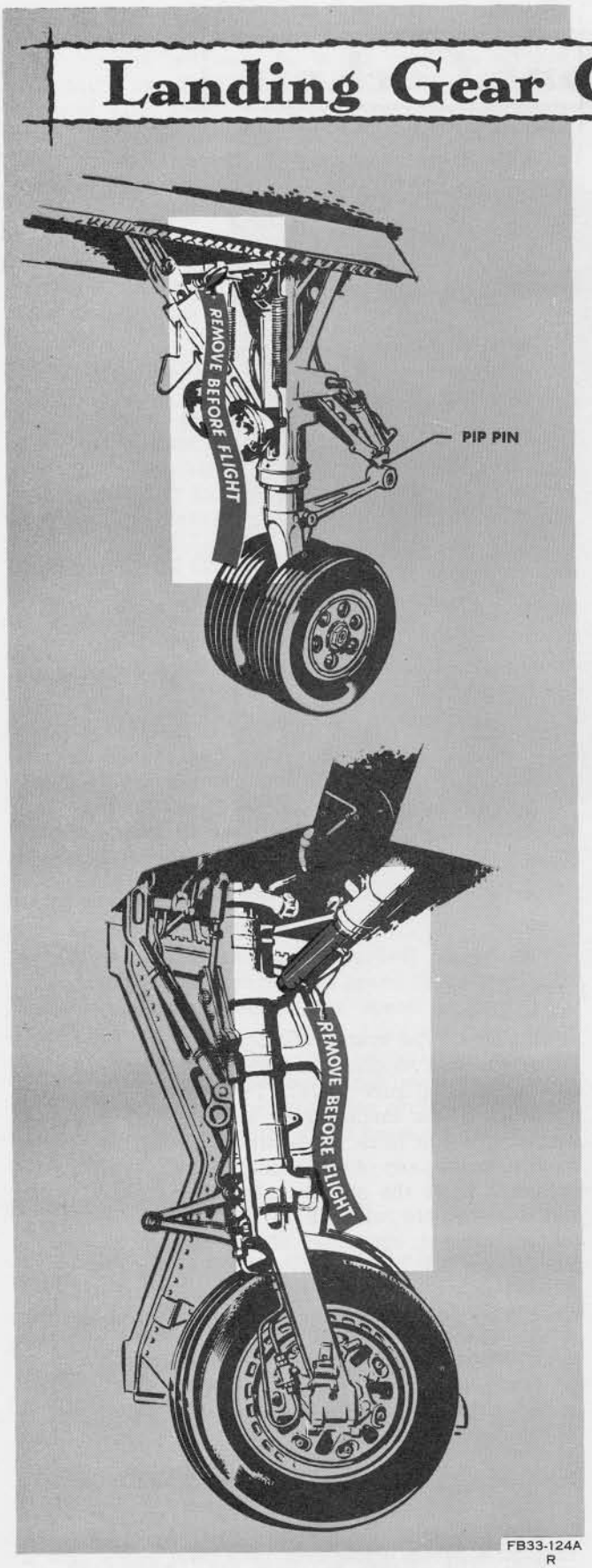


Figure 1-12

LANDING GEAR EMERGENCY HANDLE

This handle (figure 1-14) located outboard of the left console, is mechanically connected to a compressed air bottle discharge valve. When the handle is pulled to its full travel (approximately 3 3/4 inches) air is directed to the gear down side of the actuating cylinder, extending the gear. The handle will remain at its extended position until the trip lever directly under the handle is released and the handle returned to the normal position. Returning the handle allows the compressed air to be vented and normal gear operation restored.

CAUTION

The emergency system is actuated only upon failure of the normal system and will extend the gear pneumatically. The emergency landing gear lowering system utilizes the same source of compressed air as the alternate pneumatic starting system. Approximately 1500 psi is required, therefore, emergency gear lowering may not be available if air pressure is used to make an alternate start. The gear cannot be retracted by the emergency pneumatic system. Returning the handle to the normal (stowed) position allows the compressed air from the gear down side of the actuating cylinder to be vented overboard.

LANDING GEAR POSITION INDICATORS

Individual green indicator lights (figure 1-11) are provided to indicate a gear down and locked condition. The lights are mounted in a group on the landing gear control panel. When the landing gear handle is in the UP position the lights will not be illuminated. With the landing gear handle in the DOWN position the lights will illuminate as each individual gear is down and locked. These lights operate on 10/28 volt a-c and are tested by the warning light test button and dimmed by the button on the pilot's lighting control panel.

LANDING GEAR WARNING LIGHTS

A warning light on the left side of the pilot's instrument panel and a light in the landing gear handle illuminate for any of the following reasons:

1. Gear handle position does not correspond to gear position.
2. Any gear unsafe.
3. Main gear doors unlocked.
4. Flaps down - Gear up - Either or both throttles retarded below military thrust.

The lights utilize 28 volt d-c power.

LANDING GEAR WARNING BUZZER AND SILENCER

At any time during flight when the landing gear position does not coincide with the selected position of the landing gear handle or the throttles are retarded past Military thrust with the flaps down and the landing gear retracted, an intermittent buzzer tone will be audible in the headset. The warning buzzer will not sound as throttles are retarded when both gear and flaps are up. This signal is dependent on 28 volt d-c but does not function in conjunction with any radio equipment. A push-button (figure 1-11) on the landing gear control panel silences the warning buzzer. The buzzer will remain silenced until the landing gear has been extended or retracted, the flaps have been extended or retracted, or a throttle has been advanced to military thrust and retarded. Actuation of any of these will again sound the warning buzzer. The landing gear warning light should be used as the primary warning device to determine a gear safe or unsafe condition.

NOSE GEAR STEERING SYSTEM

The airplane is provided with a steerable nose gear system which allows directional control during taxiing. The system is also available from the rear cockpit when dual controls are installed. The system is electrically selected (28 volt d-c) and hydraulically (primary system) operated, (see figure 1-10). Nose gear steering is engaged by depressing the nose gear steering button on the stick grip. A holding relay is incorporated to preclude the pilot having to hold the nose gear steering button depressed. Depressing and releasing the button will engage the nose gear steering system. When the button is depressed the second time, steering will remain engaged, but will disengage when the button is released. Engaging the system electrically selects hydraulic pressure to the steering unit. This unit permits the nose gear to be steered, by rudder pedal movement, through a 40 degree arc either side of center. Further travel may be accomplished by differential braking but the steering unit is not operational beyond the 40 degree position. The system should be engaged while the rudder and nose gear are in the neutral or centered position. A safety switch prevents engagement of the steering system when the weight of the airplane is off the nose gear (strut extended) or when the gear is retracted. The nose gear steering unit further serves as a shimmy damper.

WHEEL BRAKE SYSTEM

The power brake system is operated from the utility hydraulic system, and incorporates segmented rotor type brakes, which are mounted integrally with the main landing gear wheels. Multiple disks are used to increase braking efficiency, aid in heat dissipation, and prevent brake seizure due to disk warpage caused from high temperatures. The brakes are operated by toe action on the rudder pedals, which meters utility hydraulic system pressure to force the brake disks together. Since the power brake valves are metering type valves, hydraulic pressure cannot be felt at the pedals. A soft, full travel pedal is characteristic of this type brake.

Note

The airplane is not equipped with parking brakes.

WHEEL BRAKE ANTI-SKID SYSTEM

An electrically controlled anti-skid system is incorporated in the wheel brake system to prevent skidding and shorten the landing roll. The system detects the start of a skid condition of the wheels and releases the brakes when this occurs. Use of the anti-skid system offers protection from skids when the normal braking technique is used, and provides maximum braking efficiency under all runway conditions. The electrical system consists of an arming switch which is utilized to energize the system, a warning light that illuminates when the system is inoperative. A fail safe circuit automatically returns the brake system to normal in the event the anti-skid system releases the brakes for an excessive period of time. A release lever is provided on the control stick to disarm the anti-skid system in the event of a malfunction.

Note

If brakes are lost during taxiing, without loss of utility hydraulic pressure, disengage the anti-skid system by depressing the anti-skid release switch.

Wheel brakes and the anti-skid system are operative at all times. A skid detector unit mounted in each main gear senses the rate of change of wheel speed as well as rotation of the wheel. These detectors supply electrical signals to the system control unit, which controls the anti-skid control valves in the brake lines. The control valves direct the flow of hydraulic pressure applied by the pilot to the wheel brakes or to the return line. If either wheel starts to skid after the brakes are applied the detector sends a "skid" signal to the control unit. The control unit, in response to this signal closes the anti-skid control valves to release the brakes and also prevents additional pressure from reaching the brakes. As the skid condition is corrected by this automatic brake release, the anti-skid control valves open and allows metered pressure to reach the brakes. The anti-skid system maintains this automatic skid control cycling of the brakes as long as the brakes are applied and skid conditions prevail. If the brakes are released by the system for a continuous period of 3 seconds, the control box automatically shuts off the system and normal braking technique is necessary.

Anti-Skid Switch

This two-position toggle switch (figure 1-11) is located on the landing gear control panel. When the switch is ON, 28 volt d-c electrical power is available to the anti-skid system. The anti-skid system is shut off by placing the switch to OFF. The normal braking technique as described in Section VII, should be used regardless of the switch position.

Emergency Pneumatic System

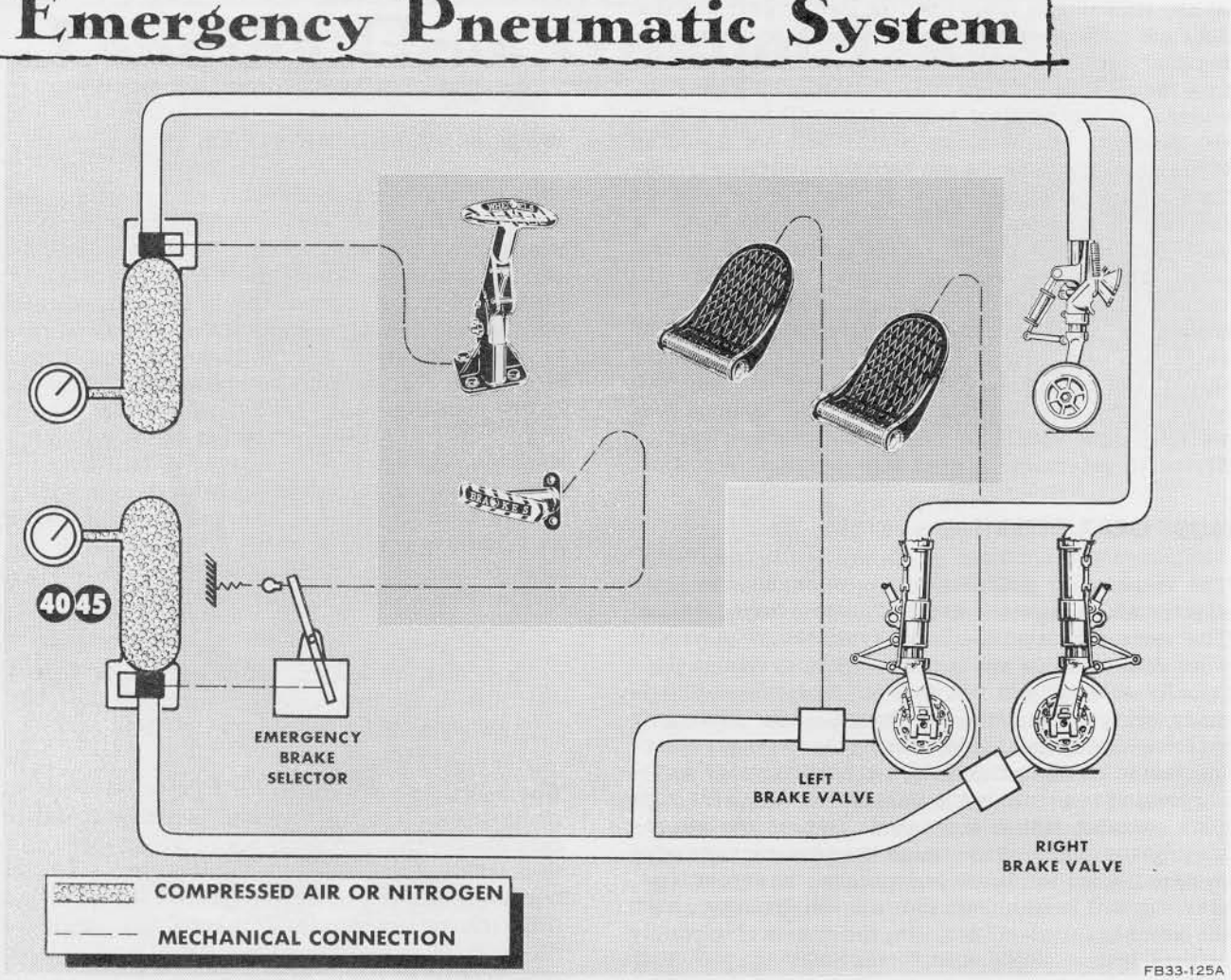


Figure 1-13

Anti-Skid Inoperative Light

This amber light (figure 1-11) is located on the landing gear control panel. This light will illuminate when the anti-skid switch is OFF or when the system is inoperative. The light utilizes 28 volt d-c electrical power.

Anti-Skid Release (Paddle Switch)

The anti-skid release lever (figure 1-10) is located on the control stick. This lever is provided to disengage the anti-skid system during the landing roll if a malfunction occurs or is suspected in the system. The lever must be held depressed to disengage the anti-skid system. Normal braking will be immediately available when the lever is depressed, but the anti-skid Inoperative light will not illuminate for approximately 3 1/2 seconds. The lever utilizes 28 volt d-c electrical power.

CAUTION

If a system malfunction is suspected, or if the anti-skid inoperative light illuminates during the landing roll, the brakes should be released before the release lever is actuated to prevent skidding when the system is disengaged.

EMERGENCY AIR BRAKES 4045

An emergency air bottle (figure 1-13), charged to 3000 psi pressure can be deployed by the pilot, if the normal system should fail. It is actuated by pulling the emergency brake handle which is mounted on the vertical panel of the left console. Brakes are then applied the same as in normal system operation, except braking action is limited due to depletion of air supply. At least three full brake applications are available.

EMERGENCY HYDRAULIC BRAKES (50 THRU 120)

An emergency hydraulic accumulator (figure 1-9) stores hydraulic fluid under 3000 psi pressure and can be deployed by the pilot if the normal hydraulic system fails. The emergency brake accumulator is charged with fluid from the utility hydraulic system, and in the event of utility system failure, is precautionarily isolated by a check valve. This accumulator is located in the forward wall of the nose wheel well, and is discharged by pulling the emergency brake handle, which is mounted on the vertical panel of the left console. The emergency brake handle is also installed in the rear cockpit in airplanes equipped with dual controls. Brakes are then applied in the same manner as the normal system operation, except braking action is limited due to depletion of hydraulic pressure. Three to four full brake applications are available.

Emergency Brake Handle

The emergency brake handle located on the vertical panel of the left console provides the pilot a means of stopping the airplane should the normal braking system fail. Pulling the handle approximately 5 inches releases air pressure in the (40 45) airplanes or hydraulic pressure in the (50 THRU 120) airplanes to two metering valves incorporated with the brake pedals. Anti-skid protection is not available when the emergency brake system is employed.

CAUTION

The pilot should not attempt to taxi with normal brake system failure.

DRAG CHUTE SYSTEM

The airplane is equipped with a 16-foot ring slot type parachute which is deployed by the pilot after touchdown to aid in reducing landing roll distances. The drag chute may also be utilized for pitch-up or spin recovery as outlined in Section VI. The chute is carried in a compartment within the empennage at the base of the vertical stabilizer. The chute is pulled into the airstream by a pilot chute when the spring-loaded compartment door is released. The design of the attaching mechanism is such that should the compartment door open inadvertently, without operating the cockpit control handle, the chute will be released and fall free of the airplane. The drag chute is retained to the airplane structure upon normal deployment. There is no "breakaway" fitting within the attaching mechanism.

CAUTION

The drag chute is normally deployed for each landing, and is considered a servicing item, (see figure 2-11).

DRAG CHUTE HANDLE

The ratchet-type drag chute handle (figure 1-11) above the landing gear control panel is mechanically connected to the drag chute mechanism in the tail. Pulling the handle approximately 3 inches serves two functions: It locks the attaching mechanism so the drag chute cannot pull free, and it releases the drag chute door. Returning the handle to the IN position jettisons the chute. However, as an aid in preventing accidental jettisoning, it is necessary to press the lock button on the handle and turn the handle one-quarter turn clockwise before it can be returned to the normal position.

TAIL HOOK

The tail hook, located on the aft-underside of the fuselage, may be utilized to stop the airplane during takeoff or landing emergencies. The hook assembly consists of a spring leaf, a point (hook), and actuating solenoid which is controlled electrically from the cockpit. The hook assembly is under tension when in the up position. The solenoid triggers the uplatch mechanism and allows the hook to swing down under pressure. A safety pin is installed to prevent accidental drop during ground operation and is removed during the exterior inspection.

TAIL HOOK SWITCH

The tail hook switch, a two-position toggle switch spring-loaded to the off (up) position, is installed on the Landing Gear Control Panel (figure 1-11). The tail hook circuit is operated by the battery bus and is "hot" at all times. The switch, when momentarily actuated to the down position, supplies 28 volt d-c power to the release solenoid of the tail hook uplatch mechanism, allowing the spring leaf tail hook assembly to drop.

WARNING

If the tail hook switch is actuated while the tail hook safety pin is installed, the tail hook will not drop. The uplatch, however, will be released and the tail hook will come down when the safety pin is removed. Stay clear of the tail hook at all times, as fatal injuries may result from being struck by the tail hook if released.

Tail Hook Down Warning Light

After the incorporation of T.O. 1F-101-924, a tail hook down warning light (figure 1-14) will be mounted adjacent to the wing flap lever and landing lights control panel on the left console. The light will illuminate when the tail hook is down. The light utilizes 28 volt d-c electrical power.

PITOT-STATIC SYSTEM

The pitot-static system supplies the pitot and static pressure necessary to operate various flight instruments and system components. Pitot pressure is applied by an electrically heated pitot boom mounted on the nose of the airplane. The heating element of the boom is operated by the pitot heat switch (figure 4-2) on the air-conditioning control panel. Electrical power to the heating element is supplied from the 115 volt, single-phase a-c bus. Static pressure for the cabin safety valve and cabin pressure regulator are supplied by two flush vents, one on each side of the forward nose section. Static pressure for the instruments is supplied by static vents located on the pitot boom. Both pitot and static pressure are supplied to the airspeed pressure switch which retracts the flaps and actuates the rudder feel system at a predetermined airspeed (290 knots IAS); the Mach schedulers of the Pitch control system; and the true airspeed and Mach Indicating system to assist in the computation of true airspeed. Both pitot and static pressure are also supplied to the central air data computer. Static pressure alone is supplied to the altimeter, and vertical velocity indicator. Pitot pressure alone is supplied to the epr gauges.

INSTRUMENTS

Most of the instruments are electrically operated, (see figure 1-7). Some instruments, such as the accelerometer, are self-contained and do not require external power. In airplanes with the dual control installation, all primary flight instruments are installed in the rear cockpit (figure 1-19).

Note

For information regarding instruments that are an integral part of a particular system, refer to applicable paragraphs in this section and Section IV.

MA-1 ALTIMETER

Both cockpits are equipped with a conventional sensitive altimeter, (figure 1-15) mounted on the instrument panel. This instrument, utilizing static pressure, provides the pilot with a constant indication of barometric altitude. Three pointers on the face of the instrument move over a scale graduated in 20-foot increments, with major division every hundred feet from zero to one thousand feet. The large pointer indicates hundreds of feet and makes one revolution for each 1000 feet of altitude. An intermediate pointer indicates thousands of feet and makes one revolution for each 10,000 feet of altitude. An additional small pointer indicating tens of thousands of feet is painted on a black disc with an extension line terminating in a triangular section. The pointers and barometric scale can be set manually by turning the knob in the lower left corner of the instrument. A striped warning indicator is also provided to prevent the pilot from misinterpreting the altimeter reading. Above 16,000 feet the striped area is covered; below that altitude however, the warning stripes are visible indicating to the pilot he is flying at or below 16,000 feet. Refer to Appendix (figure A1-4) for altimeter position error correction.

VERTICAL VELOCITY INDICATOR

A conventional vertical velocity indicator (figure 1-15) with a scale for 0 to 6000 fet./min. climb or descent, is installed on the instrument panel of the airplane.

ME-1 AIRSPEED/MACH INDICATOR

40 THRU 56-247 55

The ME-1 airspeed/Mach indicator (figure 1-15) is installed in these airplanes. This indicator gives indicated airspeed (IAS), true airspeed (TAS), and Mach number. Indicated airspeed is read from the fixed scale. An index marker is included for referencing any desired in-flight speed as well as landing speed. Mach number is read on a movable scale and rotates with altitude changes so that the indicating pointer will show the Mach number that is equal to the indicated airspeed. The true airspeed reading is "true" only in the sense that the indicated airspeed has been corrected for temperature and pressure. The installation correction must still be applied. Refer to Appendix (figure A1-2) for airspeed position and error correction.

ME-4 AIRSPEED/MACH INDICATOR

56-248 55 THRU 120

The ME-4 airspeed indicator gives indicated airspeed (IAS) and Mach number. The airspeed and Mach pointer is fixed to a rotating plate. This pointer indicates IAS and Mach number when the airspeed is above 250 knots. The Mach scale rotates under the airspeed pointer plate and is visible through a cutout in the plate. The Mach scale has a range from Mach .5 to Mach 2.2 and rotates with altitude so that the indicating pointer will show the Mach number equal to the indicated airspeed for the particular flight altitude. An index marker is included for referencing any desired inflight speed as well as landing speed. A movable red and black limiting hand automatically shows the maximum allowable equivalent airspeed (EAS) of the airplane in a clean configuration.

Note

As altitude is increased, changes in outside air density cause the Maximum Allowable Airspeed Pointer to move to a lower IAS reading.

TRUE AIRSPEED INDICATOR

Both cockpits are provided with a true airspeed indicator (figure 1-15). True airspeed is displayed through a window in the face of the indicator. A true airspeed computer and transmitter employs a temperature bulb and diaphragms to sense changes in temperature and

altitude and mechanically corrected an IAS indication to a TAS indication. The entire unit is remotely located and synchro motors, through the airspeed amplifier, are used to operate the indicator on the panel. 115 volt, single-phase a-c is necessary for proper operation and all three indications are dependent on reliable pitot and static pressures.

ATTITUDE INDICATOR (MM-3)

The MM-3 attitude indicator receives its operating signals from a displacement gyro and a rate switching gyro. The indicator is a reliable instrument giving very little acceleration or deceleration pitch error. These instruments give visual indications of the airplane's attitude about the pitch and roll axes. Changes in airplane attitude are electrically relayed from control units to the indicators causing displacement of the indicator sphere in relation to a fixed miniature airplane. The amount of displacement is directly proportional to the actual airplane attitude deviation from level flight. The indicators are unlimited in roll, but will indicate pitch only up to 85 degrees in a climb or dive. Beyond 85 degrees, a 180 degree controlled precession "flips" the sphere 180 degrees in roll. Horizontal markings with 5 degrees of separation are on the face of the sphere and show accurate airplane attitudes during climbs or dives. The Indicator requires 115 volt a-c power. The Attitude Warning flag of the indicator is located in lower left corner of the instrument. The flag will retract approximately one minute after power is supplied. This automatic operation eliminates manual caging of the instrument. Complete failure of a-c power will cause the Attitude Warning flag to appear. Item 19 of figure 1-15 shows the location of the attitude indicator in the pilot's instrument panel.

WARNING

- The Attitude Warning flag does not indicate instrument accuracy. It only indicates that the attitude indicator is not receiving power. The absence of the flag does not necessarily mean that the attitude indicator is displaying correct information (since the flag does not indicate mechanical malfunctions). Therefore, periodically in flight, attitude indications given by the indicator should be checked against other flight instruments, such as the directional indicator, the turn-and-slip indicator and the vertical velocity indicator.

- A small error in pitch will result from accelerations or decelerations. A slight climb indication is displayed after accelerating and a slight dive indication is displayed after decelerating. This error is most noticeable as the airplane breaks ground after the take-off run. The attitude indicator will show a climb indication error of approximately one degree. The exact amount of error will depend upon the acceleration and elapsed time of each individual take-off. An erection system will automatically eliminate the error after the termination of acceleration.

A pitch trim knob is provided on the indicator for the pilot to center the horizontal bar in relation to the fixed miniature airplane.

TURN-AND-SLIP INDICATOR

This conventional indicator (figure 1-15) on the instrument panel operates on 28 volt d-c power and does not exhibit any noticeable error during entries into turns.

ACCELEROMETER

A three pointer accelerometer (figure 1-15) and (figure 5-1) is located on the main instrument panel and indicates flight loads on the airplane from -4 to +10 "g's" in the 40 THRU 56-273 70 airplanes and -2 to +8 "g's" in the 56-274 70 THRU 120 airplanes. In addition to a conventional indicating pointer, this instrument incorporates two recording pointers (one for positive "g" loads and one for negative "g" loads). These recording pointers remain at the maximum travel positions reached by the indicating pointer, thereby giving a record of maximum "g" loads encountered. The recording pointers can be reset to the normal (1 "g") position by depressing the knob on the lower corner of the instrument. The accelerometer is a self-contained unit and therefore requires no external power.

MAGNETIC (STANDBY) COMPASS

A conventional magnetic compass, (figure 1-15) mounted above the instrument panel, is provided for navigation in event of instrument or electrical malfunction. A compass correction card is located on the canopy frame.

Standby Compass Light Switch

The magnetic (standby) compass light switch (figure 1-15) is located on the forward cockpit pedestal panel. This switch turns the light on in the magnetic compass. The switch is powered by 28 volt d-c.

DIRECTIONAL INDICATOR

Refer to Directional Indicator (Slaved) System, Section IV.

WARNING LIGHT TEST AND DIMMER CIRCUITS

The warning light test and dimmer circuits provide a means of testing and dimming the bulbs in all warning, caution and indicator lights in both cockpits simultaneously, except for the eject, tail hook warning and roll stabilization lights.

Left Console-Front Cockpit

TYPICAL

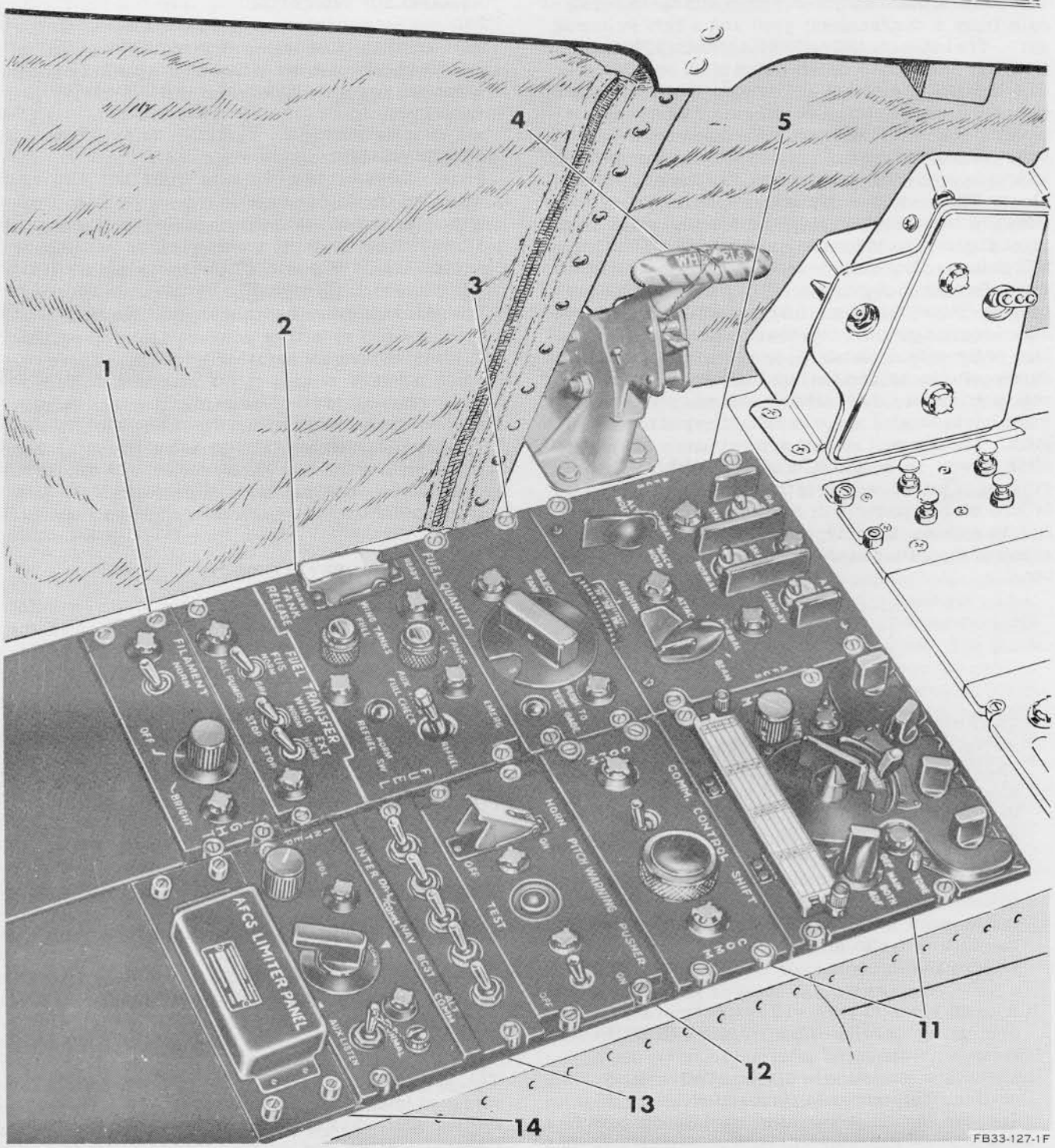
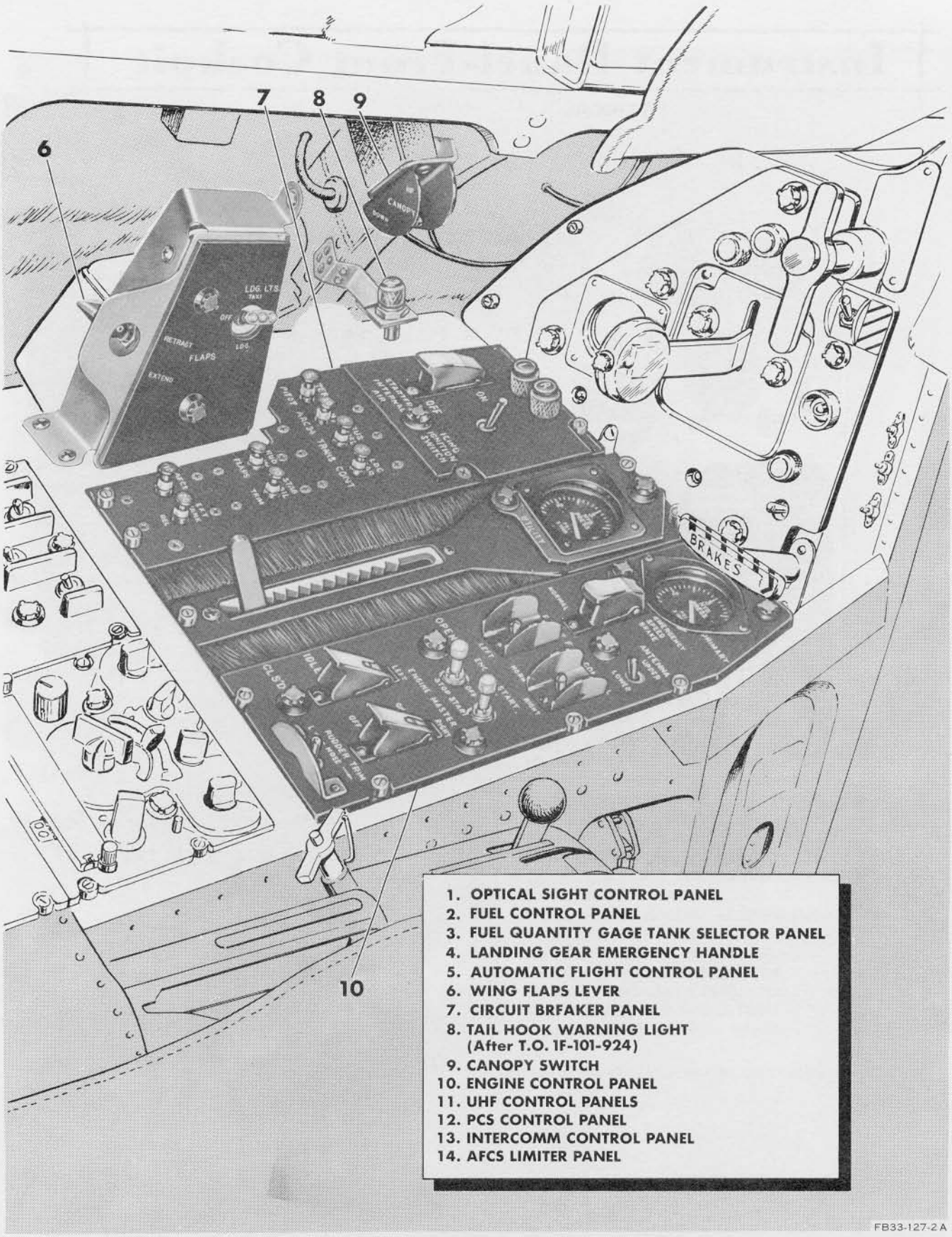


Figure 1-14



1. OPTICAL SIGHT CONTROL PANEL
2. FUEL CONTROL PANEL
3. FUEL QUANTITY GAGE TANK SELECTOR PANEL
4. LANDING GEAR EMERGENCY HANDLE
5. AUTOMATIC FLIGHT CONTROL PANEL
6. WING FLAPS LEVER
7. CIRCUIT BRFAKER PANEL
8. TAIL HOOK WARNING LIGHT (After T.O. 1F-101-924)
9. CANOPY SWITCH
10. ENGINE CONTROL PANEL
11. UHF CONTROL PANELS
12. PCS CONTROL PANEL
13. INTERCOMM CONTROL PANEL
14. AFCS LIMITER PANEL

FB33-127-2 A

Instrument Panel-Front Cockpit

TYPICAL

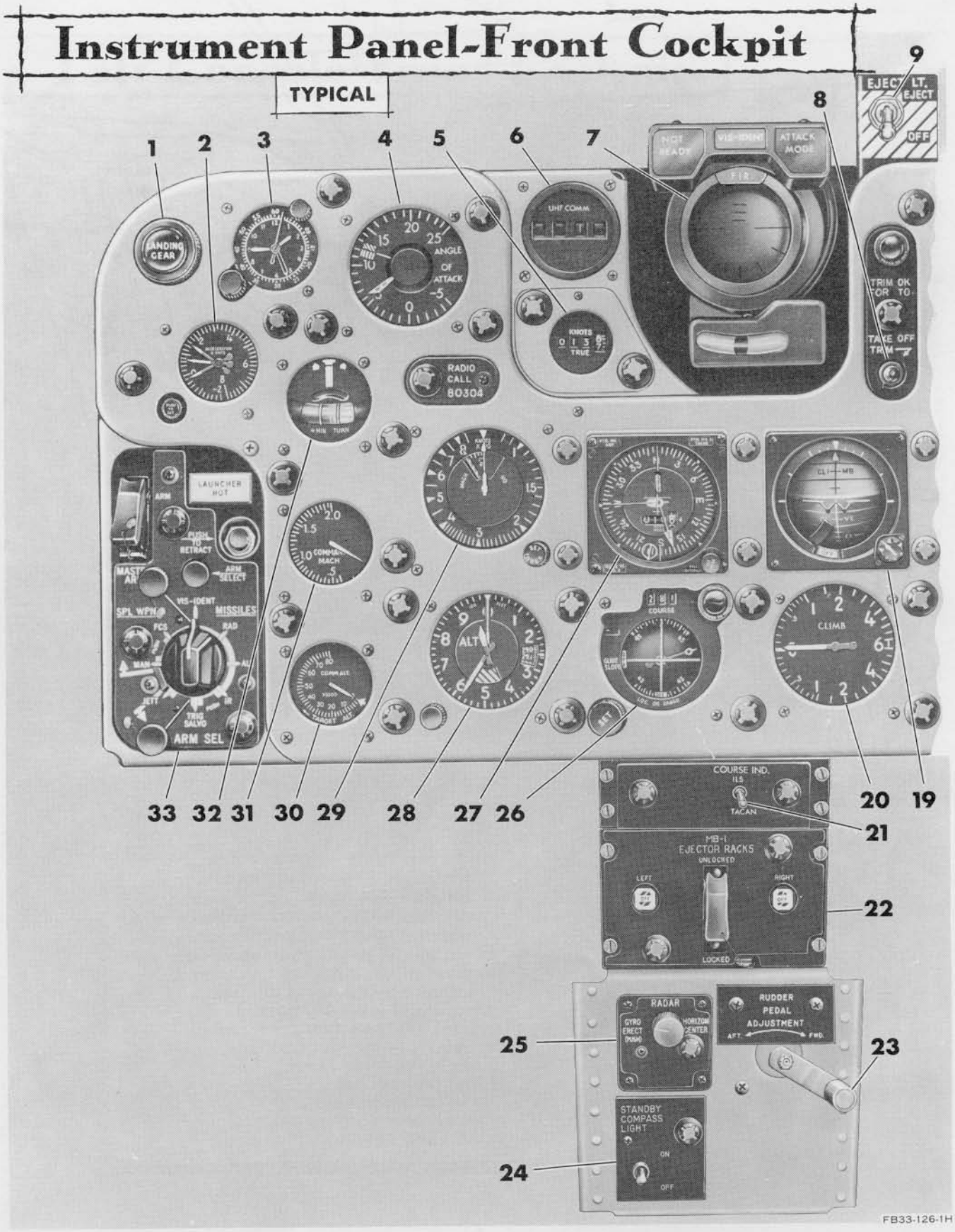
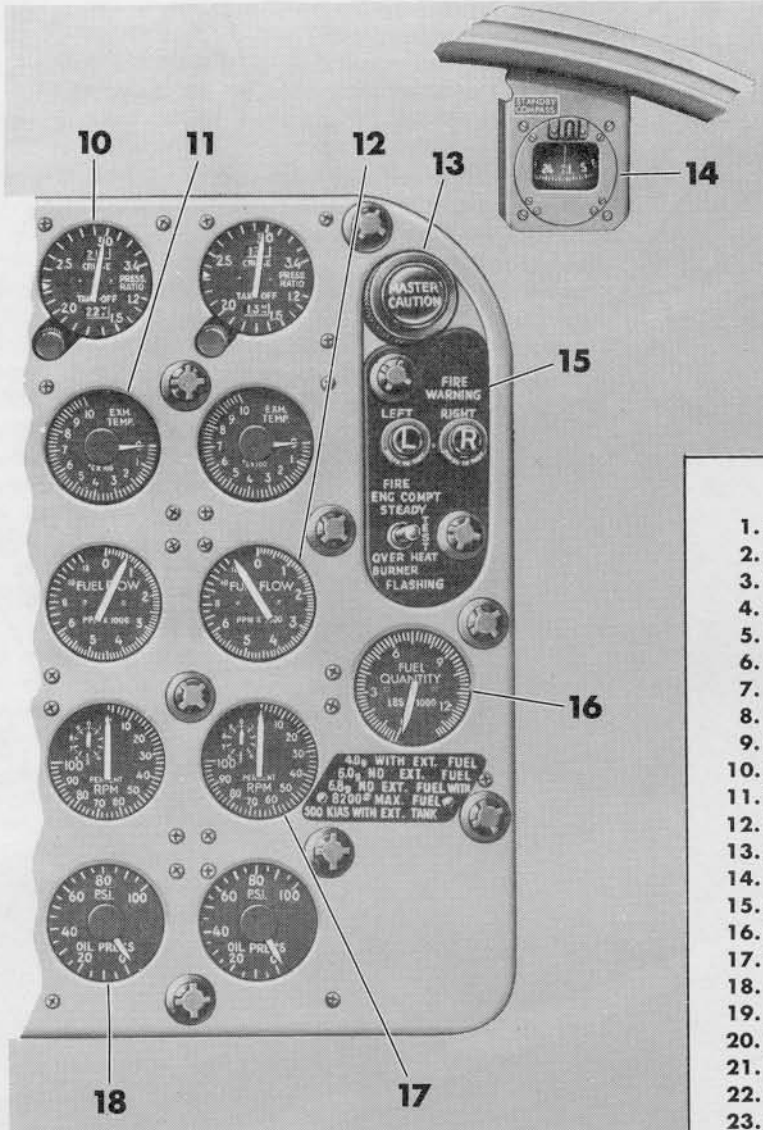
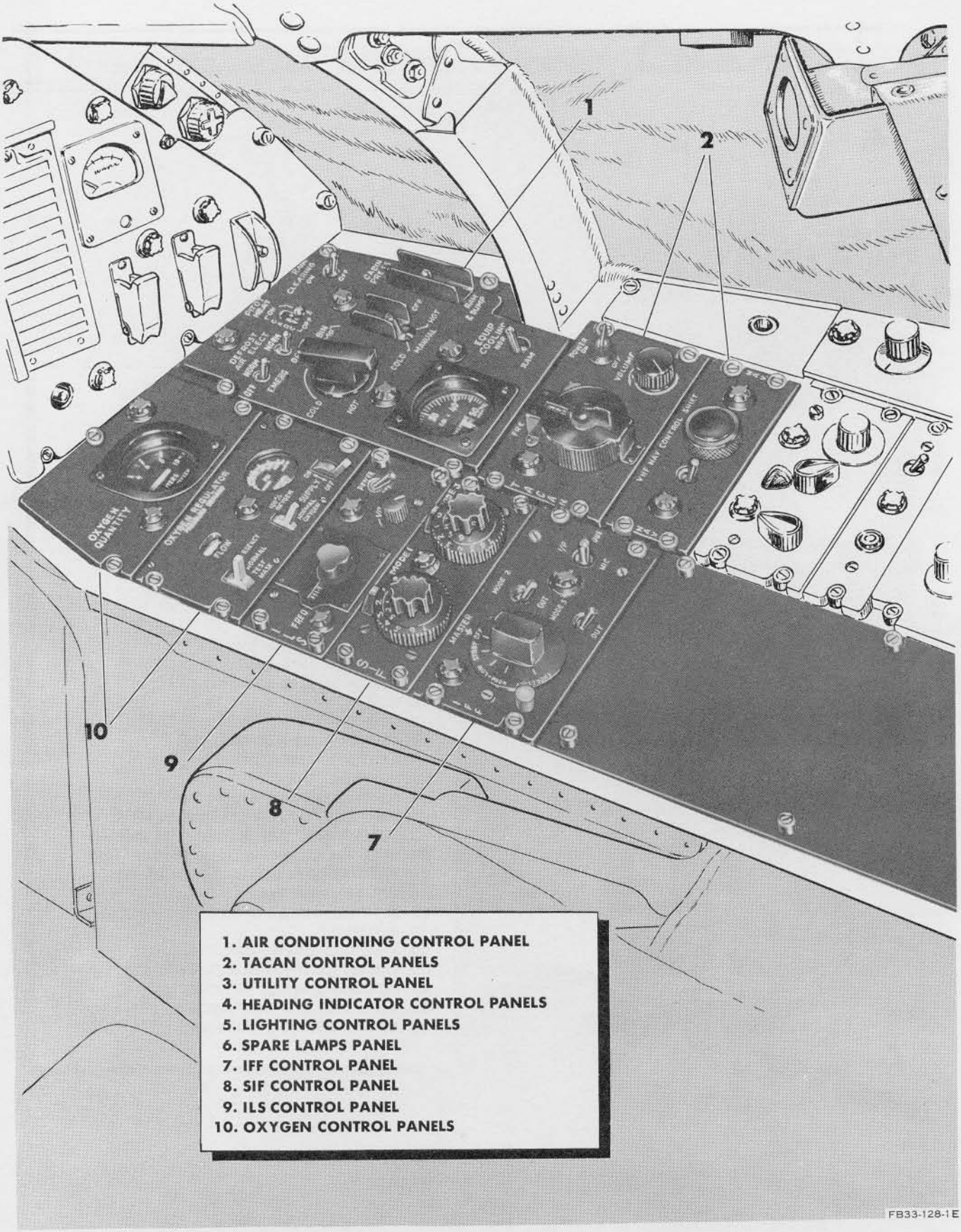


Figure 1-15



1. LANDING GEAR WARNING LIGHT
2. ACCELEROMETER
3. CLOCK
4. PITCH BOUNDARY INDICATOR
5. TRUE AIRSPEED INDICATOR
6. CHANNEL FREQUENCY INDICATOR
7. PILOT'S SCOPE
8. TAKE-OFF TRIM BUTTON
9. EJECT WARNING LIGHT SWITCH
10. ENGINE PRESSURE RATIO GAGES
11. EXHAUST TEMPERATURE GAGES
12. FUEL FLOW GAGES
13. MASTER CAUTION LIGHT
14. MAGNETIC (STANDBY) COMPASS
15. FIRE WARNING TEST PANEL
16. FUEL QUANTITY GAGE
17. TACHOMETERS
18. OIL PRESSURE GAGES
19. ATTITUDE INDICATOR
20. VERTICAL VELOCITY INDICATOR
21. ILS-TACAN SWITCH
22. MB-1 EJECTOR RACKS LOCK PANEL
23. RUDDER PEDAL ADJUSTMENT CRANK
24. STANDBY COMPASS LIGHT SWITCH
25. PILOT'S SCOPE IND. CONTROL PANEL
26. COURSE INDICATOR
27. BEARING–DISTANCE–HEADING INDICATOR
28. ALTIMETER
29. AIRSPEED/MACH INDICATOR
30. TARGET ALTITUDE INDICATOR
31. COMMAND MACH INDICATOR
32. TURN AND SLIP INDICATOR
33. ARMAMENT CONTROL PANEL

FB33-126-2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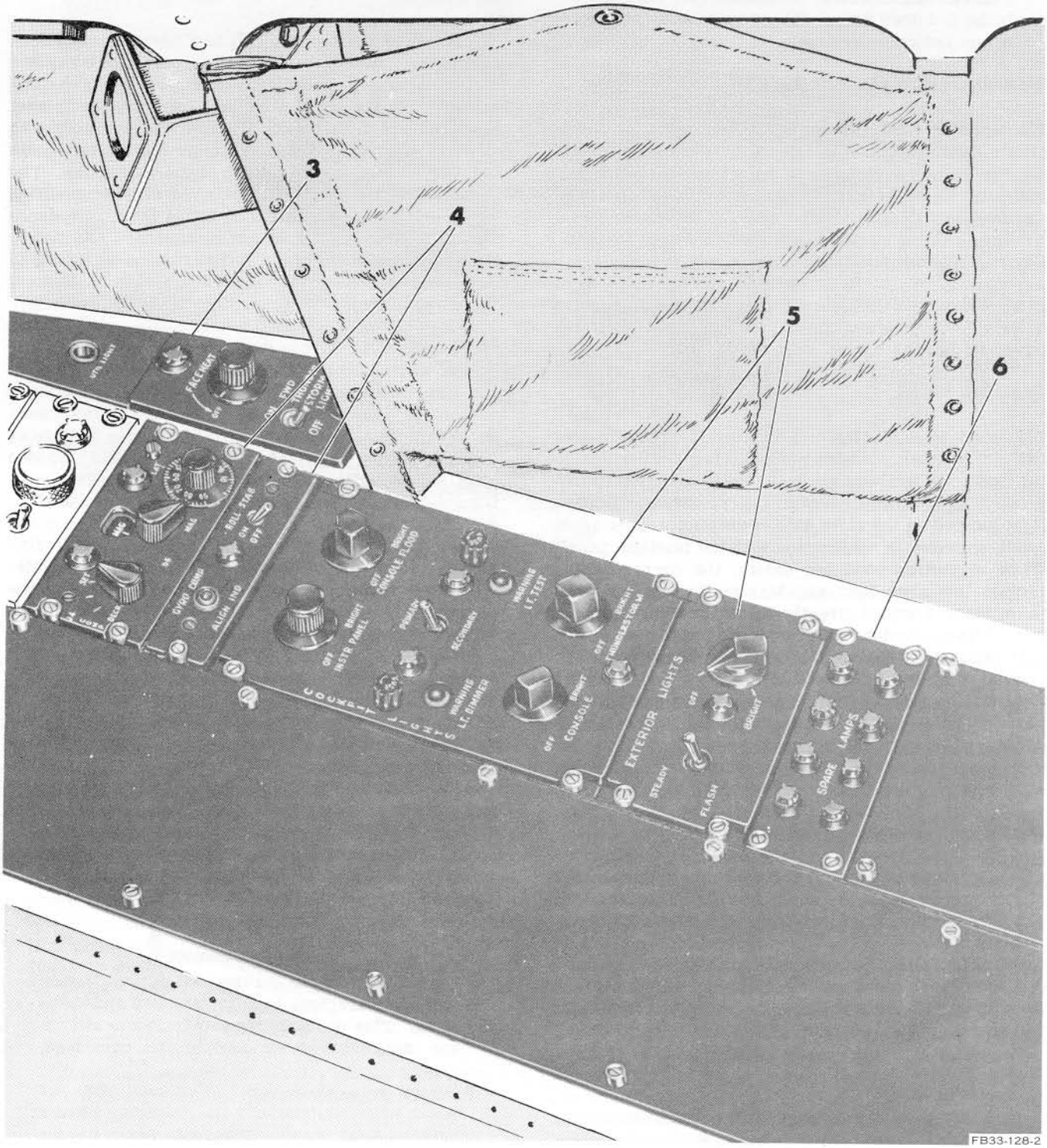
1. AIR CONDITIONING CONTROL PANEL
2. TACAN CONTROL PANELS
3. UTILITY CONTROL PANEL
4. HEADING INDICATOR CONTROL PANELS
5. LIGHTING CONTROL PANELS
6. SPARE LAMPS PANEL
7. IFF CONTROL PANEL
8. SIF CONTROL PANEL
9. ILS CONTROL PANEL
10. OXYGEN CONTROL PANELS
FB33-128-1E

Figure 1-16

Right Console-Front Cockpit

TYPICAL



WARNING LIGHT TEST BUTTON

The warning light test button (figure 1-16) on the pilot's lighting control panel is depressed to check all warning, caution and indicator lights in both cockpits simultaneously. The instrument lights must be ON when checking the warning lights dimmer circuit.

Note

The warning light test circuit merely tests the bulbs and does not provide an operational check of any indicator system.

WARNING LIGHT DIMMER BUTTON

The warning light dimmer button (figure 1-16) on the pilot's lighting control panel provides a means of testing the dimming circuits of all warning, caution and indicator lights in both cockpits simultaneously. The warning light dimmer button may also be used to dim a warning, caution or indicator light that comes on during flight. The instrument light knob must be ON, before the warning lights can be dimmed. When the instrument lights are turned OFF, the warning light circuit reverts to bright. Depressing the button applies 10 volt a-c power to dim the lights.

TELELIGHT PANEL

The telelight panel (figure 1-8) located on the electrical control panel contains twelve amber caution indicator lights. A telelight glare shield is installed to improve telelight panel readability. The Master Caution light located on the right side of the pilot's instrument panel operates in conjunction with the telelight panel. When a caution condition exists, the corresponding caution indicator light and Master Caution light will illuminate. Located directly below the telelight panel is the Answer Button. Depression of the Answer Button will cause the Master Caution light to go out. The caution indicator lights will go out only when the condition has been corrected. The Auxiliary Tank Empty warning light will go out when the Answer Button is depressed or when Wing or External Tank Transfer switch is placed in STOP position. The telelights utilize 28 volt and 10 volt a-c power.

Master Caution Light

An amber light (figure 1-15) located on the front cockpit instrument panel and on the rear cockpit instrument panel in dual equipped airplanes (figure 1-19) illuminates when any of the warning lights on the telelight panel illuminate. This warns the pilot to check the telelight panel for a malfunction. This light utilizes 28 volt and 10 volt a-c power and is tested by 28 volt d-c power.

Answer Button

A push button switch (figure 1-8), on the electrical control panel, is depressed to cause the Master Caution light to go out. With one exception, the light on the telelight panel remains on until the malfunction is remedied. When the Auxiliary Tank Empty warning light is on, depressing the button causes both the warning light and the Master Caution light to go out. The "Answer Button" utilizes 28 volt a-c power.

EMERGENCY EQUIPMENT

SURVIVAL EQUIPMENT

Survival Kit

The survival kit (figure 1-17) is of fiberglas construction with a foam rubber cushion topper. The container is divided into two sections; an emergency oxygen compartment in the aft section, and a survival equipment compartment in the front. It is intended to be used with a back style parachute. A compressible parachute support is attached to the top of the aft section. The survival kit is intended to be used with the modified MA-2 helmet and the MC-3 or MC-4 partial pressure coverall. The rigid survival container is attached to the accessory rings of the B-5 parachute by means of adjustable straps and snaps provided with the container. The front section of the container (survival equipment stowage) is equipped with a vented waterproof inner container. It is held in the container by two diagonal straps with quick release fittings. The MB-4 one-man life raft, (when applicable) is stowed on top of the inner container. The container is designed with a closed-lever type release handle located at the top right front side. A handle lock (20 pounds plus or minus 5 pounds pull) is located on the underside of the handle. When the release handle is pulled while the kit is in the seat; e.g., an emergency ground landing requiring quick egress from the airplane, the kit is completely disengaged from the pilot and the raft does not inflate. When the same release handle is pulled after the parachute is deployed, the kit is released from the kit hardware side locks, the kit-to-man disconnect separates, the lid unlocks, the raft inflates, and the drop line to which the raft and kit are attached remains attached to the parachute harness by the drop line attaching hardware. The cables to the lid locks, raft valve and drop line attachment fittings are controlled by an arming plunger in the bottom of the kit. When the kit separates from the seat, the arming plunger extends and connects the cables to the release handle. Normally, the kit is attached to and detached from the parachute harness by means of snaps that engage the accessory rings of the parachute harness.

WARNING

- Do not release the survival kit during descent until the parachute is fully deployed and stabilized. This prevents the survival kit or attaching drop line from fouling the parachute.
- Do not release the survival kit until after descent to an altitude safe for breathing without supplemental oxygen. The emergency oxygen supply will be cut off when the survival kit is released.

Survival Kit

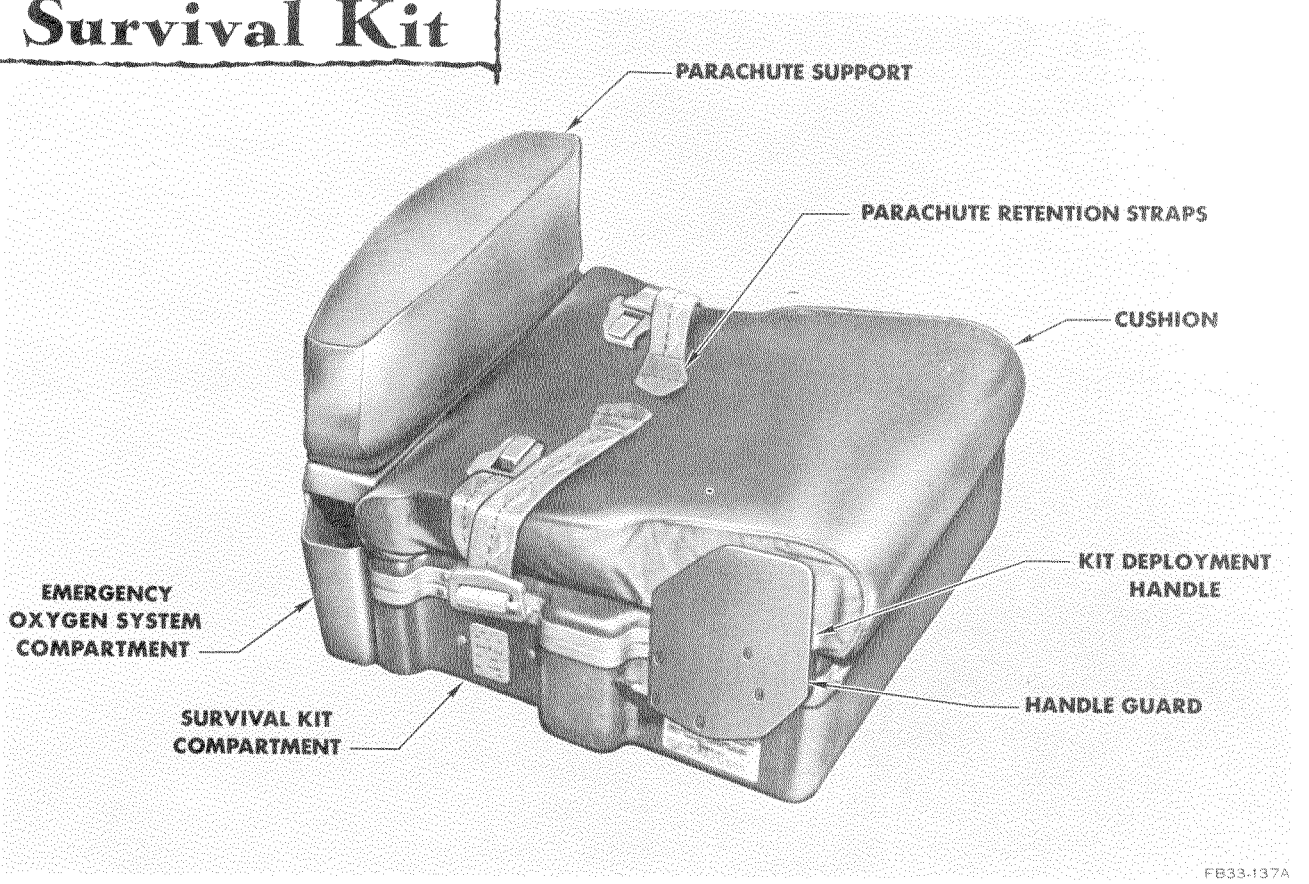


Figure 1-17

Survival Kit Oxygen System

The survival kit oxygen system consists basically of a regulator and oxygen cylinder assembly and a kit-to-man disconnect. Attached to the kit-to-man disconnect are hoses leading to the capstan connection and to a modified type CRU-8/P connector or manifold block. A "green apple" cable extends from the kit-to-man disconnect for manual actuation of the kit oxygen supply. The manifold block includes a provision for connecting the airplane oxygen supply from a panel mounted regulator and a connection for the hose leading to the modified MA-2 helmet. Oxygen under pressure is automatically delivered to the suit when the cabin altitude is above 40,000 feet. If emergency oxygen is needed below these altitudes for emergency descent or bailout, the "green apple" must be pulled to activate the system. Refer to Section IV "Oxygen System Preflight Check" for proper oxygen mask connector attachment.

CAUTION

Once the emergency oxygen supply has been activated, it will become completely depleted.

Note

When pressure suit operation is not required, the oxygen package may be removed from the survival kit and the space utilized for survival items.

ENGINE FIRE AND OVERHEAT DETECTOR SYSTEM

Two complete and separate overheat detecting systems are installed for each engine. The engine compartment fire detector is located forward on the fireseal in the compressor and accessory section, while the burner compartment overheat warning detector is located aft in the combustion-turbine-tailpipe area. The systems primarily consist of heat sensitive continuous sensing elements mounted throughout their respective area, indicator lights in the cockpit and test circuits. The system requires 115 volt a-c, the indicator lights 28 and 10 volts a-c and the test circuits 28 volt d-c.

Burner Overheat and Fire Warning Lights

Two lights (figures 1-15 and 1-21) on the pilot's instrument panel and on the rear cockpit instrument panel in dual equipped airplanes (figure 1-19), serve as a warning for both systems on each engine. A fire condition in the engine area causes the light to burn steadily while overheat in the burner compartment will cause the light to flash. These lights are dimmed and tested by the warning light dim and test switches on the pilot's cockpit lights control panel.

Left Console-Rear Cockpit -Dual

TYPICAL

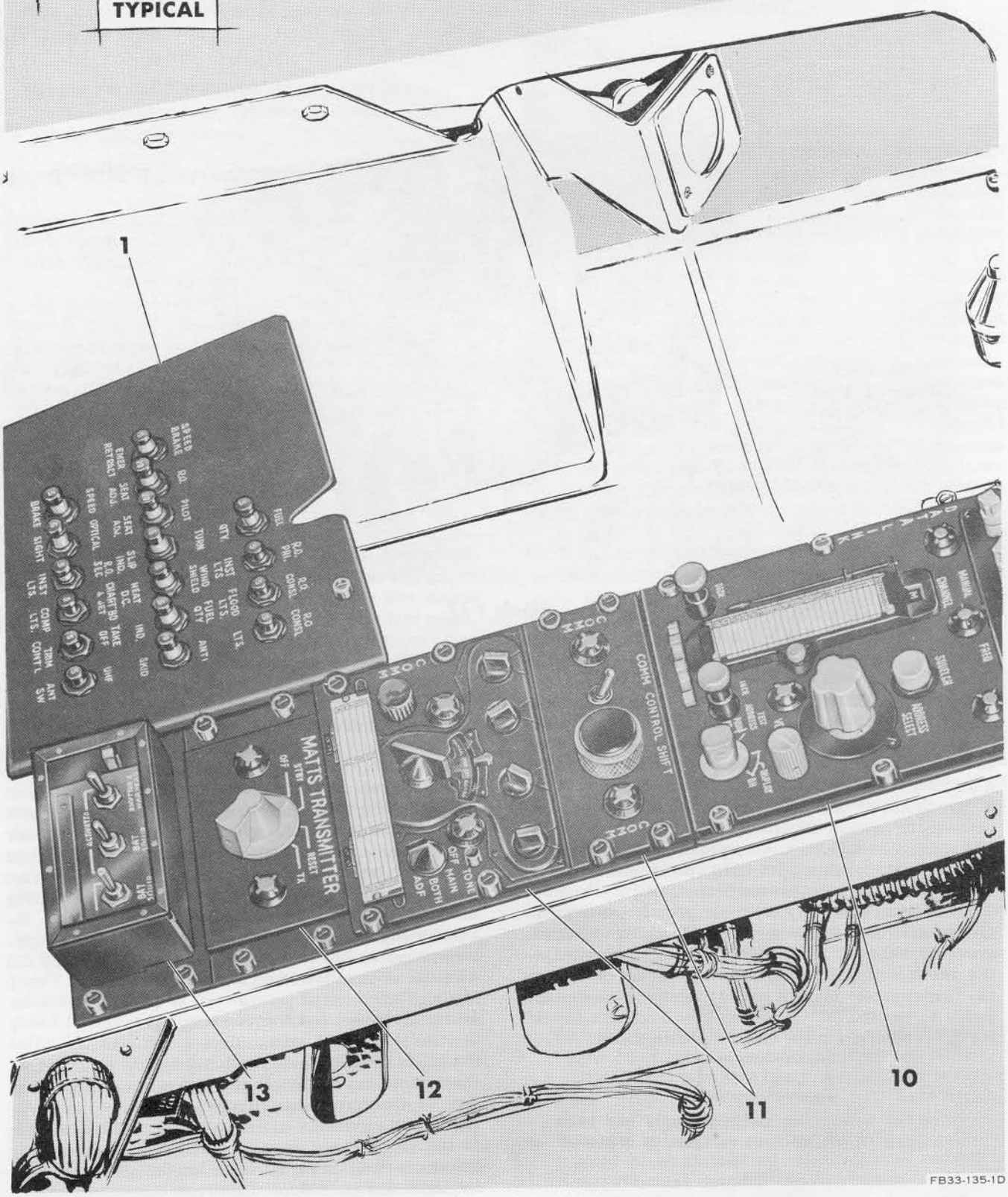
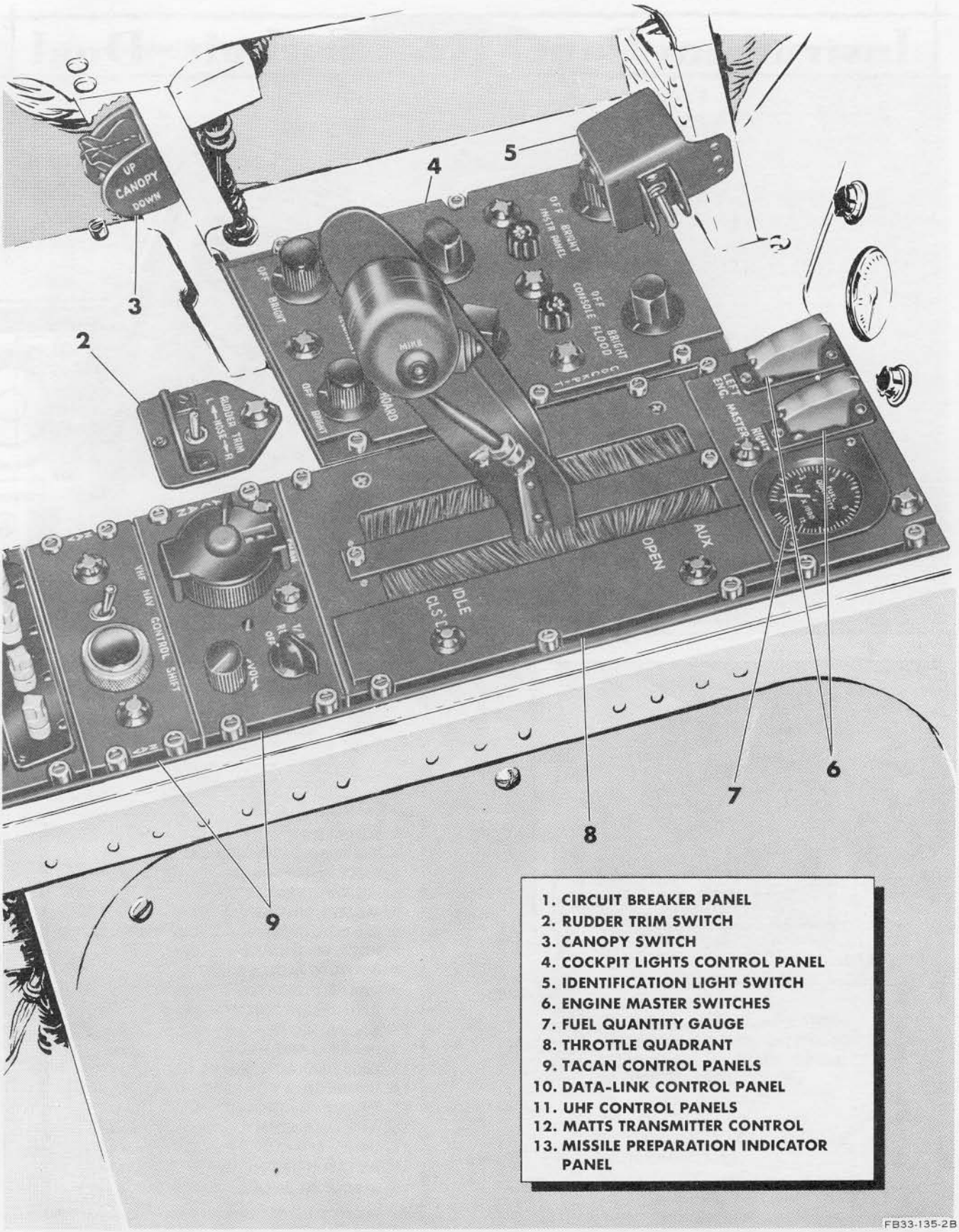


Figure 1-18



1. CIRCUIT BREAKER PANEL
2. RUDDER TRIM SWITCH
3. CANOPY SWITCH
4. COCKPIT LIGHTS CONTROL PANEL
5. IDENTIFICATION LIGHT SWITCH
6. ENGINE MASTER SWITCHES
7. FUEL QUANTITY GAUGE
8. THROTTLE QUADRANT
9. TACAN CONTROL PANELS
10. DATA-LINK CONTROL PANEL
11. UHF CONTROL PANELS
12. MATTS TRANSMITTER CONTROL
13. MISSILE PREPARATION INDICATOR PANEL

FB33-135-2B

Instrument Panel-Rear Cockpit -Dual

TYPICAL

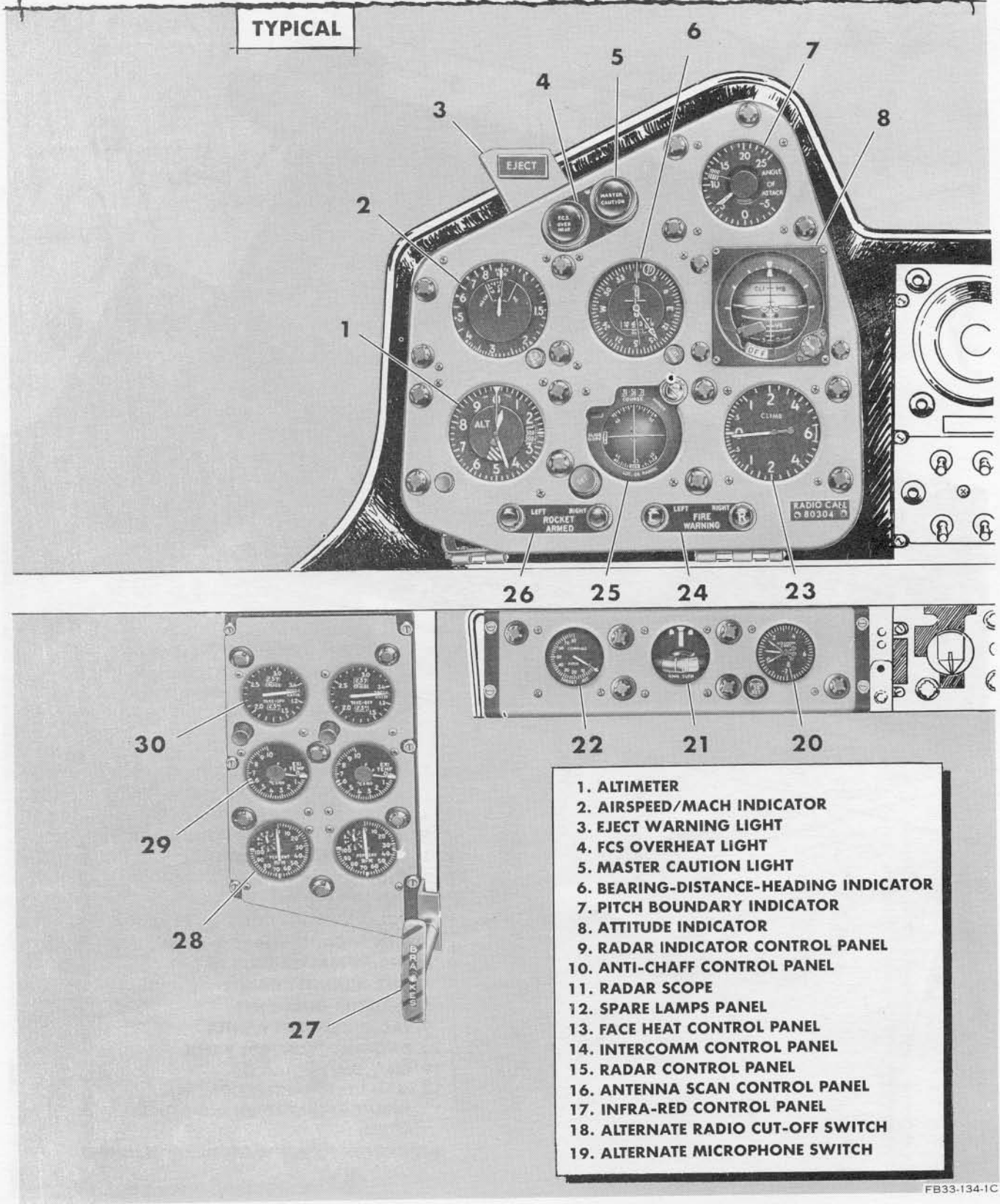
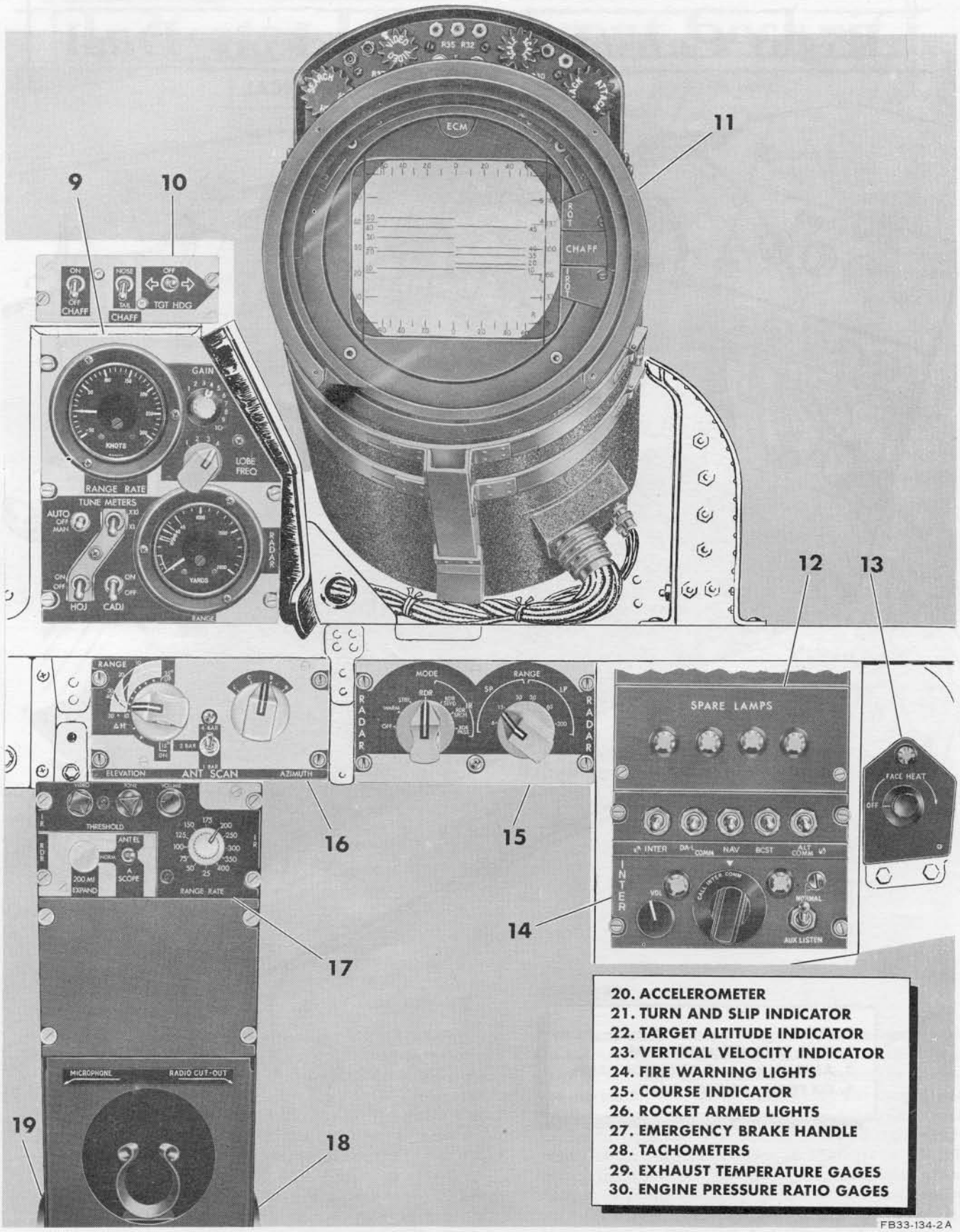


Figure 1-19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GAIN
KNOTS
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TUNE METERS
YARDS
RANGE
HOJ
CADJ
ANT SCAN
ELEVATION
AZIMUTH
MODE
RANGE
RADAR
SPARE LAMPS
FACE HEAT
INTER
THRESHOLD
ANT EL
A SCOPE
200 MI EXPAND
RANGE RATE
MICROPHONE
RADIO CUT-OUT
20. ACCELEROMETER
21. TURN AND SLIP INDICATOR
22. TARGET ALTITUDE INDICATOR
23. VERTICAL VELOCITY INDICATOR
24. FIRE WARNING LIGHTS
25. COURSE INDICATOR
26. ROCKET ARMED LIGHTS
27. EMERGENCY BRAKE HANDLE
28. TACHOMETERS
29. EXHAUST TEMPERATURE GAGES
30. ENGINE PRESSURE RATIO GAGES

FB33-134-2A

Right Console-Rear Cockpit-Dual

TYPICAL

Figure 1-20

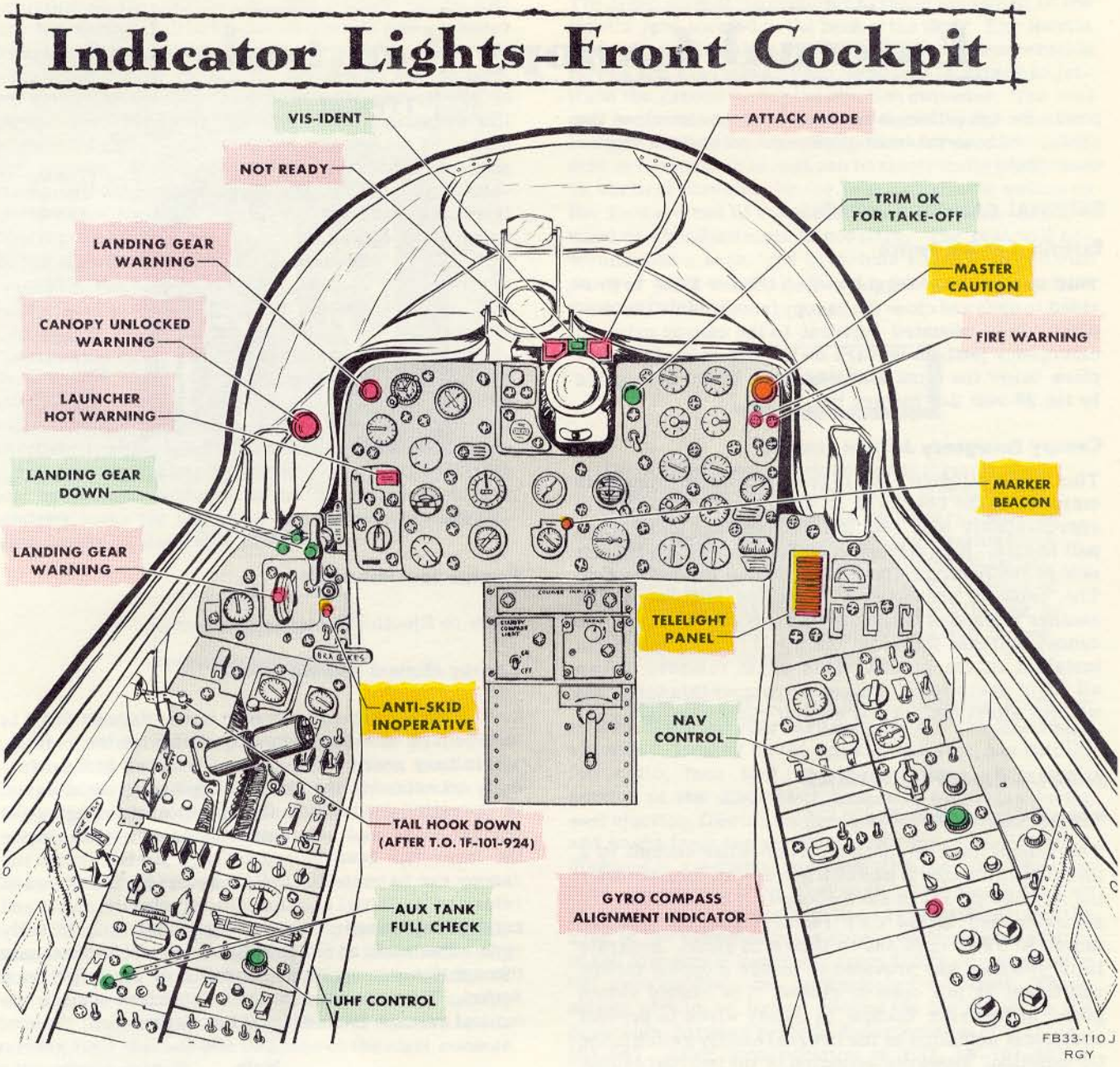

Figure 1-21

Engine Fire Detector Test Switch

This three-position toggle switch (figure 1-15) adjacent to the fire warning light, serves to test the operation of the system. Since the test circuit establishes the same condition as actuation of a detector, the entire system is actually tested, not just the indicator light. When placed in the ENG. COMPT. position, the detectors in the engine compartment of both engines are tested with normal operation indicated in each case by steady operation of the lights. Placing the switch in the OVERHEAT-BURNER position tests the detectors in the burner compartment of each engine and will cause a flashing light. The center position of the switch is OFF.

CANOPY

The clam-shell canopy is opened, closed and locked by an electric motor-driven actuator. Opening the canopy may be accomplished manually from inside or outside the airplane, and in an emergency the canopy can be jettisoned by means of a cartridge-type remover from inside or outside. The canopy is hinged at the rear and opens to an angular position of 28 degrees. A rubber strip, installed on the canopy, forms a seal when the canopy is in the closed position, permitting pressurization to the cockpit. The design of the seal is such that the pressure differential will tend to make the seal more secure. Since the canopy utilizes battery bus

External Canopy Controls

power for operation, it is possible to open or close the canopy without external power or without the engine operating.

EXTERNAL CANOPY CONTROLS

External Canopy Switch

This two-position toggle switch (figure 1-22) is provided to open and close the canopy from outside the airplane. It is mounted adjacent to the canopy external emergency jettison lanyard on the left side of the airplane below the front of the canopy. Power is supplied by the 28 volt d-c battery bus.

Canopy Emergency Jettison Lanyard

This lanyard (figure 1-22) is provided to gain immediate entrance to the cockpit in an emergency. The cable is approximately nine feet in length and has an attached pull handle. It is stowed in an access door, on the left side of the fuselage above the external canopy switch. The cable is connected to a canopy initiator and is another method of jettisoning the canopy. The exterior canopy jettison initiator has a red flagged safety pin installed on the ground. This pin is removed before all flight operations. Failure to remove this safety pin will not affect the normal cockpit canopy jettison system.

INTERNAL CANOPY CONTROLS

Internal Canopy Switches

The canopy can be operated from either cockpit by a three-position toggle switch (figure 1-14) located under the left canopy sill of each cockpit. The switches are spring-loaded to the OFF (center) position and are moved to UP to open and to DOWN to close. Separate limit switches are provided to insure stopping canopy movement at full open or closed. The canopy switch guard in the rear cockpit is safety wired to prevent accidental actuation of the internal canopy switch to the UP position. However actuation of the internal canopy switch to the DOWN position can be accomplished without breaking the safety wire. Battery bus 28 volt d-c power is provided for canopy operation.

Note

The actuating mechanism is such that the canopy can be stopped in an intermediate position simply by releasing the canopy switch, allowing it to return to OFF. However, due to the weight of the canopy on the actuator, the canopy will have a slight down-drive effect after the switch is released. The canopy switch may be used to open the canopy so that is may be blown off by slip stream in case of canopy jettison malfunction during an inflight emergency. However, in certain flight conditions, air loads may prevent the canopy from opening by this method.

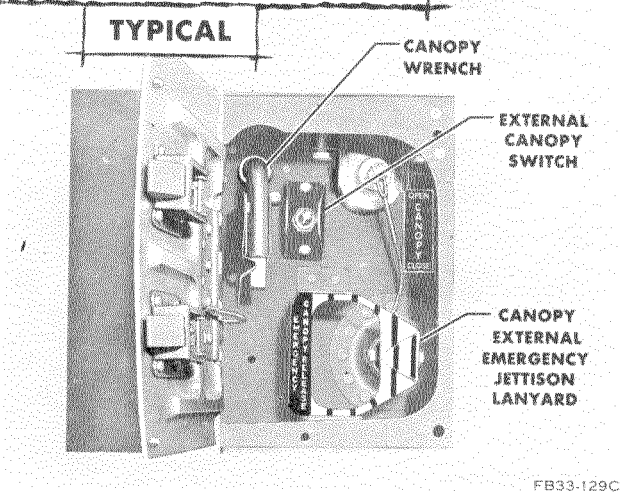

Figure 1-22

Ejection Seat Handgrips

Refer to Ejection Seats, in this section.

Canopy Manual Release Levers

The canopy manual release lever (figure 3-4) is mounted on the left forward portion of the canopy, within easy reach of the pilot. The lever is mechanically connected to the canopy actuating mechanism and in operation serves the functions of disengaging the normal drive and unlatching the canopy locks. Once the lever has been moved through its full travel the canopy can be pushed up. When released, the lever will return to its initial position, re-engaging the clutch and maintaining canopy position either partially or fully open. The shaft on which the lever is mounted extends through the canopy, terminating in a flush 3/8 inch socket. This permits use of a wrench to operate the manual release from outside the airplane.

Note

The canopy cannot be relocked with the canopy manual release lever. Locking must be accomplished with the normal electrical actuating mechanism.

Canopy Alternate Jettison Handle

The canopy can be jettisoned without arming the seats for ejection by pulling up on the canopy alternate jettison handle (figure 1-23) located in the left side of the seat forward of the shoulder harness inertia reel handle. Either crewmember can jettison the canopy.

Note

If canopy should fail to jettison after raising handgrips, the canopy alternate jettison handle can be actuated to fire canopy initiator.

Actuation of the canopy alternate jettison handle will fire the canopy initiator cartridge and gas pressure from the initiator will fire a booster initiator which will actuate the canopy remover. The canopy will jettison, but since the ejection seat handgrips are stowed in normal down positions, the seat catapult triggers will be guarded and uncocked and the seat will not be armed for ejection. Actuation of the canopy alternate jettison handle will not lock the inertia reel. The canopy alternate jettison handle is guarded and locked in the normal DOWN position by a spring-loaded guard-latch hinged to the handle. After the incorporation of T.O. 1F-101-1012, the canopy alternate jettison handle will be safety wired in the down and locked position. The guard-latch is spring-loaded to the UP position and when pushed down will unlock the canopy alternate jettison handle. The canopy alternate jettison handle is actuated by squeezing the guard latch down toward the jettison handle then pulling both upwards. The canopy alternate jettison handle is ground safetied by the same red flagged seat safety "T" pin that safeties the ejection seat handgrips. Insertion of the "T" pin in the left seat handgrip locks the handgrips and canopy alternate jettison handle in their safe positions.

WARNING

When the "T" pin is installed, the canopy alternate jettison handle guard latch can be pushed down but the canopy alternate jettison handle cannot be pulled up. The "T" pin should be removed prior to flight and installed in left handgrip before leaving the seat.

Canopy Unlocked Warning Light

A red "Canopy Not Locked" warning light (figure 1-21) is mounted on the left cockpit sill and is illuminated any time the canopy is not closed and locked, provided 28 volt a-c is available. It is operated by the canopy "locked" limit switch and is tested and dimmed by the warning light test and dim switches on the right console in the pilot's cockpit.

EJECTION SEAT

Note

The ejection seat is identical for the two crewmembers. Each crewmember can jettison the canopy and eject his own seat, but cannot eject the seat of the other crewmember.

The ejection seat (figure 1-23), permits the crewmember to eject from the airplane at almost any speed or flight attitude and is equipped with an automatic-opening safety belt to aid in separation from the seat after ejection. The free ends of the shoulder harness are connected to the buckle of the safety belt and separate from the buckle when the belt opens automatically. The fixed ends of the shoulder harness are bolted to the inertia reel located on the back of the seat. The inertia reel locks automatically under 2 to 3 "g" deceleration forces and also when either handgrip is raised to jettison the canopy during the ejection sequence. The reel can be manually locked or unlocked by the shoulder harness inertia reel handle located forward on the left side of the seat. The seat can be electrically positioned in vertical direction by the seat adjustment switch on the forward end of the right side of the seat. No forward or aft adjustment is possible. The seat will accommodate a back-type parachute and is equipped with an over land survival kit and a removable parachute support bulkhead.

WARNING

Do not use a seat cushion or any form of shock absorbing device to the above standard configuration. If ejection is necessary, serious spinal injury can result when the ejection force compresses the added absorbing device and enables a direct force on the pilot or in event of a forced landing, the crewmember will sink in the seat and the shoulder straps will loosen, increasing chances of injury.

Disconnect fittings for the seat positioning leads are located at the left rearward disconnect. The disconnect assembly, located on the front of the seat, has fittings for radio, face heat and oxygen hoses. The lower portion of the disconnect assembly separates during seat ejection, freeing the crewmember's personal leads and hoses from the airplane. The upper portion of the disconnect assembly remains with the pilot when the pilot separates from the seat after ejection. Two personal leads retainer straps are fastened around the base of the personal leads to prevent the upper portion of the disconnect assembly from flying up and striking the crewmember or crewmember's helmet. These straps should be looped around the leg straps on the parachute harness prior to incorporation of T.O. 1F-101-857. After incorporation of T.O. 1F-101-857, a spring clip will be added to each end of the personal leads disconnect mounting bracket. This will prevent the upper portion of the disconnect assembly from flying up and striking the crewmember or crewmember's helmet.

WARNING

Prior to incorporation of T.O. 1F-101-857, it is imperative that the crewmember secure the personal leads retainer straps properly to prevent the upper portion of the disconnect assembly from flying around during ejection and thereby preventing possible serious injury to the pilot.

Ejection Seat

TYPICAL BOTH COCKPITS

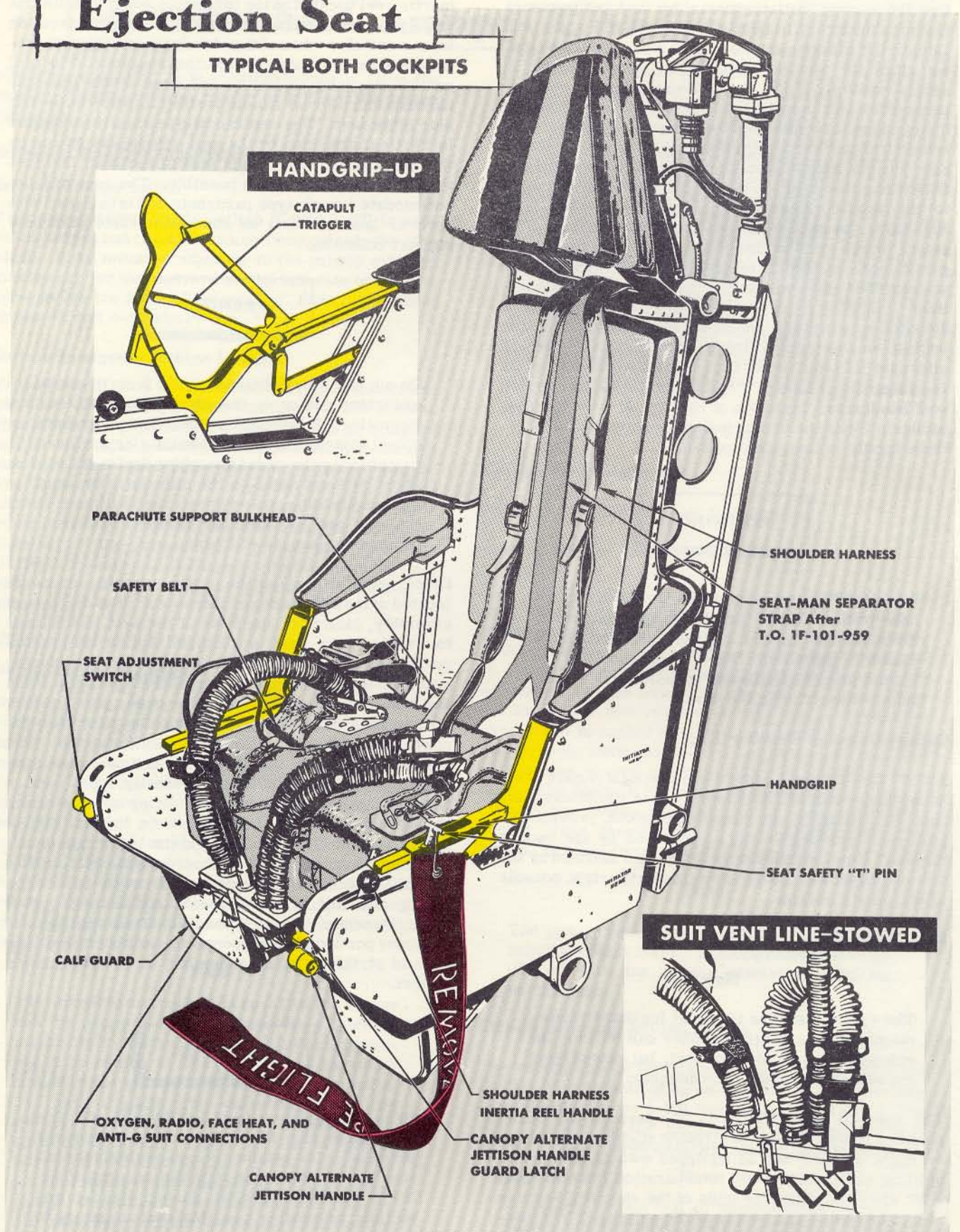

Figure 1-23

FB33-130G
R Y

Canopy jettison and seat ejection sequence controls are incorporated in the interconnected seat handgrips forward of the armrests. The canopy is jettisoned and the seat armed for ejection by raising either of the interconnecting handgrips. Seat ejection is accomplished by squeezing either of the seat catapult triggers in the handgrips. Upward travel of the seat trips the lap belt initiator which opens the safety belt. The canopy can be jettisoned without arming the seat for ejection by pulling up on the guarded canopy alternate jettison handle located forward of the shoulder harness inertia reel handle on the left side of the seat. If ejecton is necessary and the canopy fails to jettison after lifting the handgrips, or pulling up on the canopy alternate jettison handle, ejection through the canopy can be accomplished by squeezing the catapult triggers. The seat is ground safetied against canopy jettison and seat ejection by installing a red flagged ground safety "T" pin in the left handgrip. The "T" pin prevents raising the handgrips and also prevents pulling up the canopy alternate jettison handle. The non-adjustable headrest, armrests and calfguards are located such as to afford maximum protection when used correctly during ejection. The ejection seat is not equipped with stirrups. Positioning the feet on the rudder pedals will provide maximum clearance during ejection and eliminate shock loads that would be imposed with the feet back against the calguard of the seat. The seat handgrips after being raised for canopy jettison, can be grasped for catapult trigger actuation with the arms down firm against the armrests.

CHAFF DISPENSER

An ejection seat chaff dispenser is installed on the right side and to the rear of the headrest on each ejection seat. Upon seat ejection, the chaff dispenser automatically disperses radar reflective chaff and marks the ejection location to aid in rescue operations.

EJECT WARNING LIGHT SWITCH

After incorporation of T.O. 1F-101B-752, an Eject Warning Light switch (figure 1-15) will be installed on the instrument panel. This two-position lever lock toggle switch has positions marked EJECT and OFF. When the switch is placed in the EJECT position, a red "Eject" Warning Light on the aft cockpit instrument panel will illuminate. Illumination of this Eject Warning Light indicates to aft seat occupant that he should eject. After the incorporation of T.O. 1F-101-983 the switch will be relocated to the left console.

EJECTION SEAT HANDGRIPS

The two mechanically interconnected handgrips (figure 1-23) located forward of the armrest are used to actuate canopy jettison initiator cartridge and are normally stowed flush with the seat. When raised, they actuate the canopy initiator cartridge, cock the automatic belt initiator, lock the inertia reel, and expose and cock the seat catapult triggers. Gas pressure from the canopy initiator actuates the canopy remover. Lifting either handgrip will also lift the other handgrip and jettison the canopy.

Note

If canopy fails to jettison after raising handgrips, the canopy alternate jettison handle may be pulled upward to fire the canopy initiator.

SEAT CATAPULT TRIGGERS

A seat catapult trigger (figure 1-23) is incorporated in each ejection seat handgrip. The triggers are used to fire the seat catapult initiator cartridges to eject the seat from the airplane. Each trigger fires an individual initiator cartridge and each initiator supplies sufficient pressure to fire the seat catapult.

WARNING

Both initiators are connected by flexible pressure hose to a common check valve located behind the headrest. A single hose routes pressure from the valve upwards to the catapult. If necessary to disarm a seat that has raised handgrips, the hose connecting the check valve and catapult must be cut.

Note

If one of the hoses connecting an initiator and check valve is cut, the other initiator can still eject the seat if its seat catapult trigger is actuated.

Each trigger works independently of the other and ejection can be accomplished by pulling up, or squeezing either trigger. Normally the triggers are guarded by the ejection seat handgrips and their link mechanisms to the catapult initiators are uncocked when the seat handgrips are in normal full down position. When the handgrips are raised to canopy jettison position the catapult triggers are exposed and their link mechanisms to the catapult initiators are cocked.

AUTOMATIC OPENING SAFETY BELTS

The automatic-opening safety belt is used in this airplane. See figure 1-24. The primary purpose of the automatic-opening safety belt is to extend the maximum and minimum altitudes at which escape may be successfully accomplished with the ejection seat. In high altitude ejection (above 15,000 feet) use of the automatic safety belt and automatic parachute avoids deployment of the parachute until altitudes with sufficient oxygen are reached. The aneroid action of the parachute release mechanism delays the opening of the parachute until the pilot free falls below the critical altitude. In low altitude ejection, use of the automatic

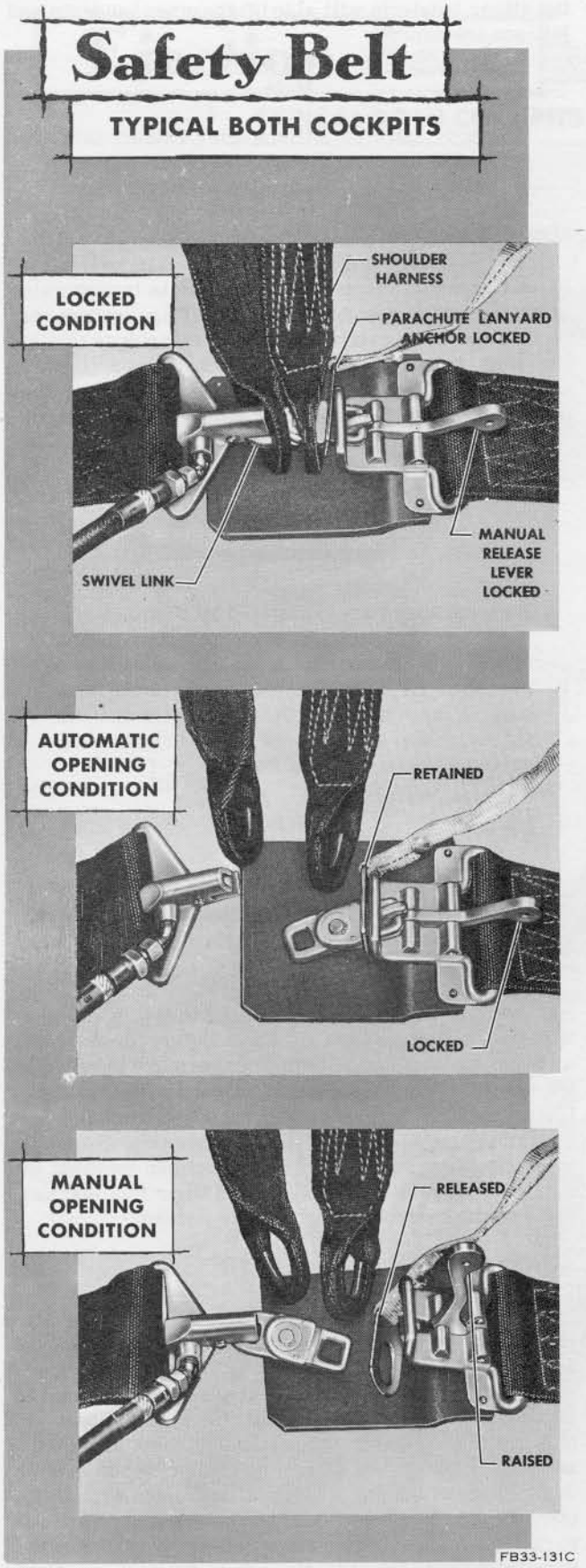

Figure 1-24

system greatly reduces the time required for separation from the ejection seat and deployment of the parachute, and consequently reduces the altitude required for ejection.

WARNING

Under no circumstances should the automatic safety belt be manually opened prior to ejection, regardless of altitude.

The release of the safety belt (figure 1-24) is accomplished by manual operation by the pilot or by gas pressure from a separate automatically controlled source. The M-12 initiator opens the safety belt 1 second after ejection. This power source applies approximately 1500 psi pressure through a 36-inch length hi-pressure hose which actuates a piston within the belt, releasing the right portion of the swivel link thus opening the belt. The right portion of the swivel link is locked at all times to the automatic release mechanism. The left portion of the swivel link is manually locked into a conventional manual release lever. To attach the safety belt place both shoulder harness loops over the manual release end of the swivel link then the automatic parachute lanyard anchor (ring-shaped) is placed over the manual release end of the swivel link, and the swivel link is locked into the manual release lever. When the belt is manually opened the automatic parachute lanyard anchor is released so that inadvertent actuation of the automatic parachute will not occur. During automatic operation of the safety belt, the automatic parachute lanyard anchor remains firmly locked on the swivel link, thereby causing actuation of the parachute timer knob as the pilot separates from the seat.

WARNING

- The automatic parachute lanyard anchor loop need not be connected to the swivel link to enable closing of the manual release lever. However, it must be connected to insure operation of the automatic parachute.
- The parachute lanyard anchor must be connected in the proper manner or the pilot probably will not separate from the seat after ejection. Refer to figure 1-25.

SHOULDER HARNESS INERTIA REEL HANDLE

The inertia reel handle (figure 1-23) is used to manually lock or unlock the shoulder harness inertia reel. When unlocked, the inertia reel permits normal forward and aft movement of the pilot's shoulders. When

locked, the reel prevents forward movement, but when the pilot leans aft, the reel automatically takes up slack in the shoulder harness and locks the harness in successive rearward lock positions. When pushed forward, the handle detents in the LOCK position and locks the inertia reel. When pulled aft, the handle detents in the UNLOCKED position and unlocks the reel for normal forward and aft movement. Acceleration and deceleration of 2 to 3 "g's" will automatically lock the reel when the handle is in UNLOCKED position and the reel will remain locked until the handle is moved forward to LOCK and moved back to UNLOCKED. The reel can be manually locked during maneuvers, flight in rough air, or as a safety precaution prior to a forced landing. When ejection seat handgrips are raised to jettison the canopy, a control cable from the left handgrip will lock the inertia reel if the inertia reel handle is unlocked and the reel has not been automatically locked by deceleration. Pulling up on the canopy alternate jettison handle will not cause the reel to lock and, if reel lock is desired in this condition, it must be accomplished by the inertia reel handle.

Note

- The shoulder harness inertia reel is designed for forward and aft acceleration. If violent side movement is expected, the shoulder harness should be locked manually as side loads will not automatically lock the inertia reel.
- An inertia reel preflight check can be made by moving the inertia reel handle from UNLOCKED to LOCK and back to UNLOCKED and then pulled suddenly on the shoulder harness straps. The reel should lock and a succession of releases of the harness straps should result in a succession of locked reel positions. The reel should then unlock when the handle is moved to LOCK and back to UNLOCKED.

SEAT ADJUSTMENT SWITCH

The three-position seat adjustment switch (figure 1-23) is mounted on the forward end of the right side of the

Zero Delay Lanyard

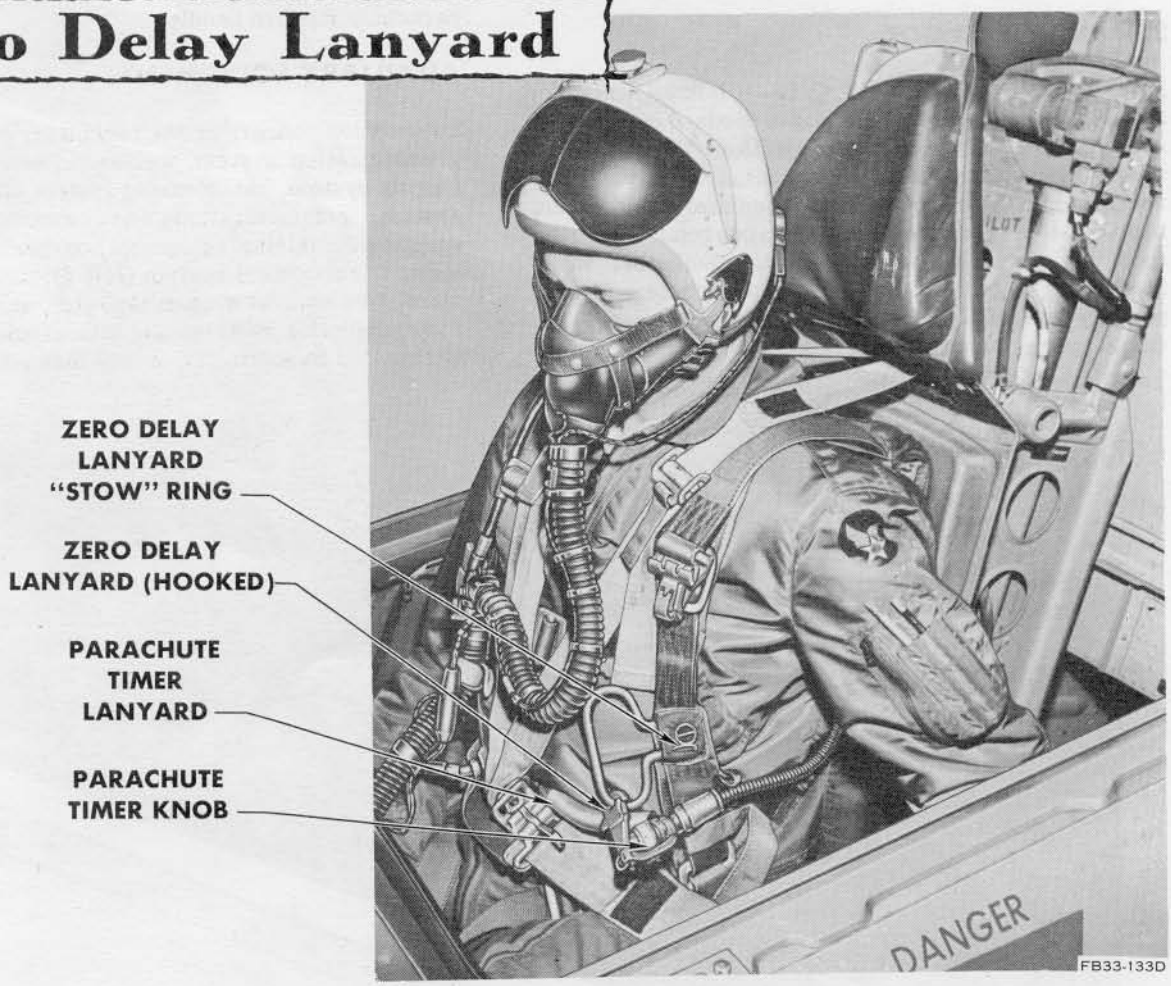

Figure 1-25

seat in both cockpits and is used to adjust the seat height. The switch is spring-loaded to the center OFF position. Holding the switch in the UP position will raise the seat, and holding the switch downward in the DOWN position will lower the seat. When released, the switch returns to center OFF position and the seat locks in the vertical position at which the switch was released. The seat adjustment switch requires 28 volt d-c power. The seat cannot be manually adjusted in height and no forward or aft adjustment is possible.

LOW ALTITUDE ESCAPE EQUIPMENT

A zero delay lanyard and, after the incorporation of T.O. 1F-101-959, a seat-man separator are provided to optimize "low" altitude escape characteristics. The seat-man separator works in conjunction with the automatic opening safety belt, so that the moment the safety belt opens, the pilot is physically separated from the seat. The zero delay lanyard connects the parachute arming knob to the parachute ripcord handle. When the pilot separates from the seat and the parachute arming knob is pulled, the parachute ripcord handle is also pulled, allowing immediate parachute deployment.

SEAT - MAN SEPARATOR

After the incorporation of T.O. 1F-101-959 a seat-man separator is installed on the seat to produce mechanical seat-man separation during an ejection. The separator assembly consists of a strap and a rotary actuator. The rotary actuator is mounted immediately below, and behind the seat headrest. The strap is connected to the front of the seat bucket and the rotary actuator. When in a static condition, the pilot's parachute and seat pack sit over the strap. During the ejection sequence, cartridge produced high pressure air unlocks the safety belt and spins the rotary actuator. The rotary actuator then brings the strap taught and "snaps" the pilot from the seat.

ZERO DELAY LANYARD

The zero delay lanyard connects the parachute arming knob to the parachute ripcord handle in order to bypass the time sequence of the automatic-opening parachute. When the pilot separates from the seat, and the parachute arming knob is pulled, the parachute ripcord handle is also pulled, allowing immediate parachute deployment. Thus, the zero delay lanyard must be connected to the parachute ripcord handle at very low altitudes and low airspeeds. At higher altitudes and airspeeds, the lanyard must be disconnected from the parachute ripcord handle and stowed, allowing the automatic-opening parachute timer to actuate the parachute below critical opening speeds and below the prescribed altitude. The fastening or unfastening of the zero delay lanyard to the parachute ripcord handle must be done manually and at the correct times by the crewmember as outlined in Section II. A ring attached to the parachute harness is provided for stowage of the lanyard when it is not hooked into the parachute ripcord handle.

AUXILIARY EQUIPMENT

Information concerning the cockpit air conditioning and pressurization system, windshield defrosting and defogging system, rain clearing system, engine anti-icing system, communication and associated electronic equipment, lighting equipment, oxygen system, automatic flight control system (MB-5), navigation equipment, fire control system (MG-13), armament equipment, refueling systems and miscellaneous equipment is supplied in Section IV of this manual.

section II Normal Procedures

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PREPARATION FOR FLIGHT

The responsibility for the thorough accomplishment of airplane preflight is primarily the pilot's. However, whenever both crewmembers are present a thorough briefing is necessary so that no procedures are overlooked. Refer to Crew Duties, Section VIII.

FLIGHT RESTRICTIONS

Refer to Section V for detailed airplane and engine limitations.

FLIGHT PLANNING

Refer to Appendix I to determine fuel consumption, correct airspeed, thrust settings and altitude required for the intended flight mission.

SCRAMBLE CHECKLIST

Certain items in paragraphs "Before Taxiing", "Taxiing" and "Pre-Take-Off Airplane Check" are printed in ***Boldface Italic*** type. Only these items are MANDATORY for alert checks. Other items may be checked if time and conditions permit. The normal checklist resumes with "Pre-Take-Off Engine Check". Refer to Before Taxiing, this section.

TAKE-OFF AND LANDING DATA CARD

Complete the Take-Off and Landing Data Card contained in the Aircrew's Abbreviated Checklist, T.O. 1F-101B-(CL)1-1. Refer to Part 11, Appendix I, for detailed information.

WEIGHT AND BALANCE

Refer to Handbook of Weight and Balance Data, T.O. 1-1B-40.

ENTRANCE

Cockpit entry and exit is gained by use of a metal ladder which hooks over the left cockpit sill.

PREFLIGHT CHECK

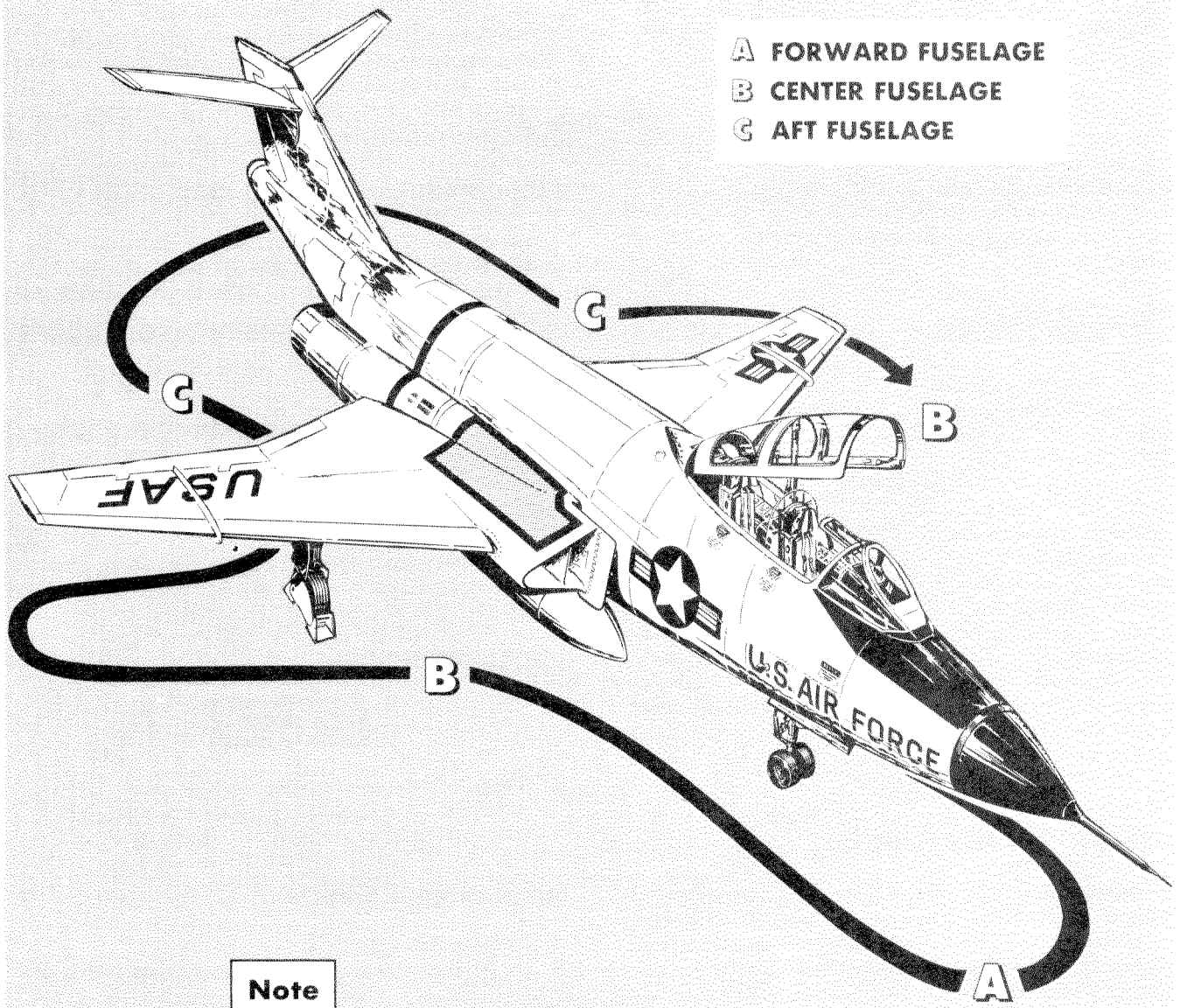
CAUTION

The pilot's exterior inspection is an abbreviated checklist, and should not be used to fulfill requirements of the airplane pre-flight inspection.

BEFORE EXTERIOR INSPECTION

1. Form 781 - CHECK
   Check Form 781 for engineering status and release. Note servicing entries for proper amounts of fuel, oil, oxygen and armament. Insure that main landing gear tire limitations have not been exceeded. See Main Landing Gear Tire Points, this section. For servicing points, see figure 2-11.
2. Armament status plaque - CHECK
   Check the armament status plaque for proper armament load.
3. Ejection seat safety pin - INSTALLED
   Check that the ejection seat handgrips are in the full down position and that the seat safety pin, with red warning flag attached, is properly installed through the left hand grip. Also, after the incorporation of T.O. 1F-101-1012, check the alternate canopy ejection handle, below the left hand grip, safetied.

Exterior Inspection



Note

BASIC INSPECTION ITEMS THAT SHOULD BE CONSIDERED THROUGHOUT THE EXTERIOR INSPECTION, INCLUDES CHECKING FOR: CRACKS, DISTORTIONS, LOOSE OR MISSING ITEMS, DUCT AREAS CLEAR, COVERS REMOVED, INDICATIONS OF DAMAGE, FLUID LEAKAGE, AND GENERAL CLEANLINESS. AFTER PERFORMING REQUIRED INSPECTIONS, MAKE SURE ALL ACCESS DOORS ARE SECURELY FASTENED.

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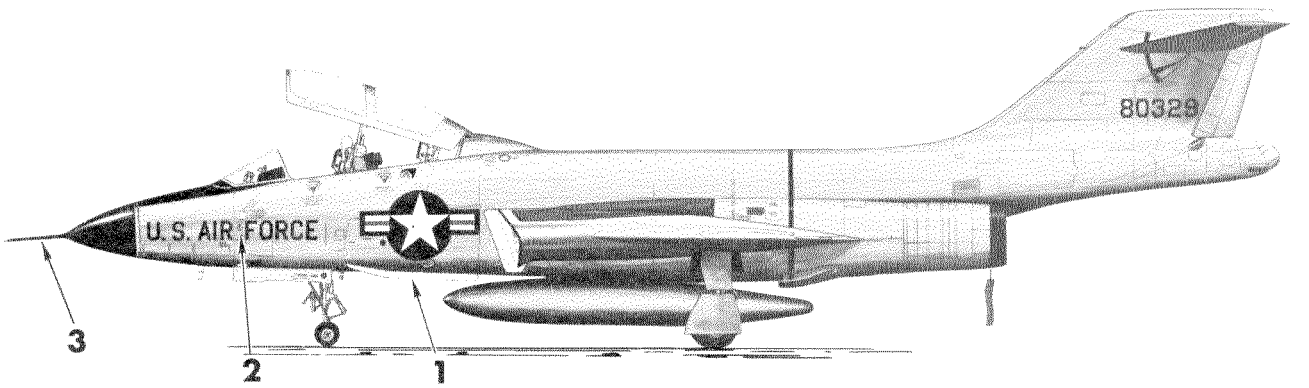
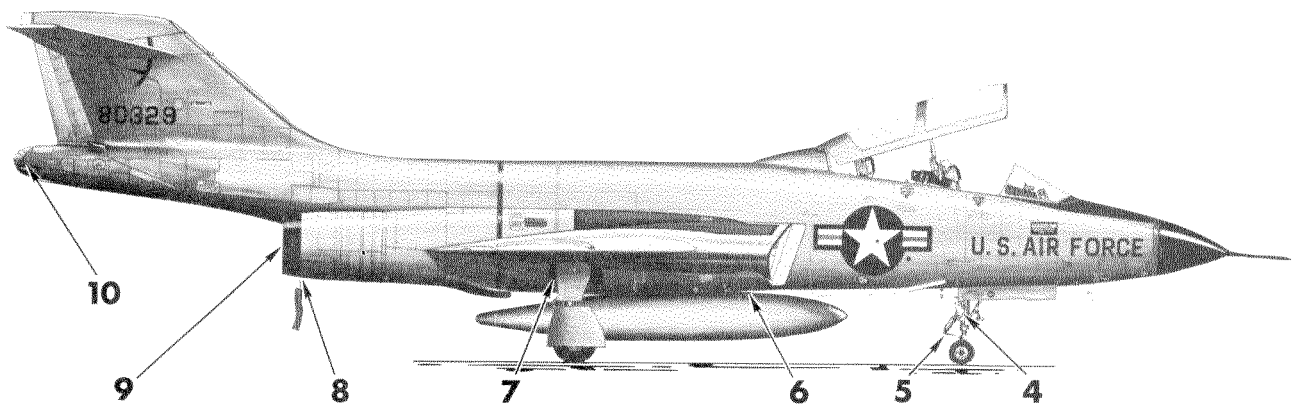
Figure 2-1





A FORWARD FUSELAGE

1. ARMAMENT BAY-CHECK
   a. ARMAMENT LOAD
2. EXTERNAL CANOPY CONTROLS-CHECK
   a. OXYGEN VENT VALVE IN BUILD-UP POSITION
   b. CANOPY EMERGENCY JETTISON LANYARD IN PLACE
   c. LANYARD SAFETY PIN REMOVED
   d. CANOPY WRENCH IN PLACE
3. PITOT STATIC BOOM
4. NOSE GEAR AND WELL AREA-CHECK
   a. EMERGENCY BRAKE VALVE IN OFF POSITION
5. NOSE GEAR PIP PIN PROPERLY INSTALLED

B CENTER FUSELAGE AND WING AREA

6. EXTERNAL TANK-CAP SECURE AND PIN REMOVED
7. MAIN GEAR AND WELL AREA-CHECK
   a. COMPRESSION LINKAGE MOVES FREELY
   b. STORAGE CHAMBER PRESSURE INDICATOR PIN EXTENDING

WARNING

IF ANY UNUSUAL RESISTANCE IS ENCOUNTERED DO NOT PULL THE TAIL HOOK SAFETY PIN UNTIL THE TAIL HOOK IS RELATCHED.

C AFT FUSELAGE AREA

8. CHECK TAIL HOOK SAFETY PIN REMOVED
9. EXHAUST AREA-CHECK
10. DRAG CHUTE INSTALLED
    a. CHECK TAB SHOWING
11. CHECK LEFT SIDE SAME AS RIGHT SIDE

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4. Landing gear handle - DOWN
   Physically check the landing gear handle in the down position.
5. Master arm switch - SAFE
   Switch should be safetied and sealed in the SAFE position if armament is aboard.
6. Armament selector knob - VIS-IDENT
   Safety detent knob should be safetied and sealed when applicable.
7. MB-1 ejector racks lock switch - LOCKED
   Switch should be safetied and sealed in the LOCKED position if MB-1 is aboard.
8. Battery switch - OFF

EXTERIOR INSPECTION

Perform exterior inspection as outlined in figure 2-1.

REAR COCKPIT INTERIOR CHECK (SOLO FLIGHTS)

For solo flight, the following inspection for the rear cockpit must be made prior to entering the airplane.

1. Circuit breakers - IN
2. Engine master switches - ON (DUAL)
   Check engine master switches safety wired ON.
3. Emergency brake handle - IN AND SECURE (DUAL)
4. Radar master switch - OFF
5. Oxygen supply lever - OFF
6. All loose items - SECURE
   Secure safety belt, shoulder harness, radio lead, face heat, oxygen and anti-G suit hoses.

Note

In some airplanes a nylon sling has been provided to restrict the movement of the RIO's personal leads, thereby eliminating the possibility of them interfering with the movement of the rear cockpit control stick.

FRONT COCKPIT INTERIOR CHECK

Before External Electrical Power Is Connected-

Note

If a battery start is to be made, certain items of this check cannot be accomplished. Those items omitted will be accomplished after the engines have been started and airplane electrical power is available.

1. Throttles - CLS'D
2. Tail hook switch - UP & SAFETIED

WARNING

The tail hook switch is operated by the battery bus and is "hot" at all times. The switch, if momentarily actuated to the down position, supplies battery bus power to the uplatch release mechanism allowing the tail hook to drop.

3. Pitot heat switch - OFF

CAUTION

Check that the pitot heat switch is OFF prior to having external electrical power connected to prevent damaging the pitot tube and PCS/CADC vanes.

CONTINUED ON NEXT PAGE

FRONT COCKPIT INTERIOR CHECK CONTINUED

4. Survival kit, safety belt, and shoulder harness - FASTEN
   - Attach the survival kit straps to the parachute harness.
   - Attach the shoulder harness and parachute lanyard to the safety belt.
   - Connect the zero delay lanyard to the parachute ripcord handle.

WARNING

Make sure the automatic-opening safety belt is properly fastened. The safety belt should be pulled tight prior to tightening the shoulder harness. Secure the automatic-opening parachute lanyard anchor to the safety belt and check the zero delay lanyard hooked to the parachute ripcord handle.

5. Publications and flight data - CHECK
   Check that appropriate Flight Information Publications and other necessary publications are included and that they are current.

With External Electrical Power Connected–

Note

Gyro instruments will not be available unless the AFCS and NAV SYSTEM POWER is in the ALL GYRO OPERATE position.

6. Seat and rudder pedals - ADJUST
   After adjusting the seat, adjust the rudder pedals by use of the hand crank located on the pedestal panel.
7. AFCS Limiter panel - SECURE
8. Optical sight illumination knob - CHECK AND OFF
9. Intercomm control panel - CHECK
   - Channel selector knob - COMM
   - Emergency listen switch - NORMAL
10. Pusher and horn switches - ON
    Check the horn switch guard safety wired down.
11. UHF command radio - ON
    - Control switch - BOTH
    - Frequency selector knob - AS REQUIRED
    - Volume control knob - AS DESIRED
12. Fuselage tanks transfer switch - NORM
13. Wing tank transfer switch - STOP
14. External tank transfer switch - STOP
15. Refuel switch - NORM
16. Auxiliary tank full check button - DEPRESS
    Check wing and external tanks full if applicable.
17. External tanks release switch - NORM
18. Fuel quantity - CHECK
    Turn the fuel quantity gage tank selector knob to all positions and check the fuel quantity.
19. Fuel quantity gage tank selector knob - NO. 2 CELL
20. Emergency landing gear handle - IN AND SECURE
21. Flap lever - CHECK
    Check the wing flap lever position that it corresponds to the flap position.
22. Landing and taxi light switch - OFF
23. Circuit breakers - IN

*24. Starter (internal air) switch - OFF

*25. Icing ignition switch - OFF

CONTINUED ON NEXT PAGE

*Some airplanes

FRONT COCKPIT INTERIOR CHECK CONTINUED

26. Speed brake switch - CLOSED
27. Engine master switches - OFF
28. Engine start switches - OFF
29. Engine fuel control switches - NORM
30. Antenna selector switch - UPPER
31. Emergency speed brake switch - NORMAL
32. Emergency brake handle - IN AND SECURE
33. Anti-skid system - ON AND TEST
    After turning the anti-skid switch ON, depress the anti-skid release paddle switch and observe the illumination of the "Anti-Skid Inoperative" light after 3 1/2 seconds.
34. Flap and landing gear indicators - CHECK
    Check the flap position indicator for proper indication. Check the three (green) landing gear indicator lights ON.
35. Drag chute handle - IN AND SECURE
36. Accelerometer - SET
37. Airspeed index pointer - SET (as desired)
38. Altimeter - SET

WARNING

It is possible to incorrectly set the altimeter by 10,000 feet. Therefore, check that the altimeter 10,000 foot pointer is reading correctly.

39. Vertical velocity indicator - CHECK
    Check that the vertical velocity indicator needle is positioned at zero.
40. Attitude indicator - CHECK
41. Pilot's scope - CHECK
    Check that the pilot's scope is clean and free of cracks or damage.
42. Take-off trim - SET
    Check stabilizer and aileron trim and recheck for illumination of the "Trim O.K. for T.O." light.
43. Fire warning system - TEST
    Test the steady and flashing operation of the left and right fire warning lights through use of the test switch.
44. Instrument panel - SECURE
45. ILS/TACAN switch - AS REQUIRED
46. MB-1 ejector racks lock switch - LOCKED
47. MB-1 ejector racks lock annunciators - LOCKED
48. Generator switches - ON
49. Oxygen control panels - CHECK
    - Oxygen quantity gage - CHECK
      Check that oxygen quantity is sufficient for the intended mission. Refer to Oxygen Duration Chart, figure 4-9.
    - Oxygen supply lever - ON
    - Oxygen emergency lever - TEST
      Hold in TEST position and check for system recovery.
    - Oxygen diluter lever - 100% O_2
      Refer to Oxygen System Preflight Check, Section IV.
    - Oxygen supply pressure gage - WITHIN LIMITS
50. IFF/SIF - AS DIRECTED
51. Defrost switches - NORM
52. Pitot heat - TEST AND OFF
    Momentarily turn pitot heat switch ON and observe ground crew signal that the pitot heat, PCS and CADC vane heaters are operative. Return the pitot heat switch to OFF.
53. Rain clearing switch - OFF

CONTINUED ON NEXT PAGE

FRONT COCKPIT INTERIOR CHECK CONTINUED

54. Cabin air temperature knob - AS DESIRED
    Set cabin air temperature knob to produce the desired cockpit temperature for existing climatic conditions.
55. Cabin air temperature switch - AUTO
56. Cabin pressure switch - NORM

Note

On hot and humid days, the cabin pressure switch may be positioned to RAM & DUMP to prevent excessive fogging within the cockpit during take-off.

57. Equipment cooling switch - NORM
58. ILS/TACAN - ON
    Navigation control shift light - AS DESIRED
59. Function selector switch - MAG
60. Roll stabilization switch - ON
61. Face heat - OFF
62. Warning lights - TEST
    - Instrument lights knob - ON
    - Warning light test button - DEPRESS
      All warning, caution and indicator lights will illuminate.
    - Warning light dimmer button - DEPRESS then RELEASE
      All warning, caution, and indicator lights will dim when the button is depressed and will remain dim when the button is released.
    - Instrument lights knob - OFF
      All warning, caution and indicator lights should revert to bright.
    - Warning light test button - RELEASE
63. Cockpit and exterior lights - AS REQUIRED
    Check operation of cockpit lights and set at desired brilliance. Check exterior lights in STEADY, FLASH, BRIGHT and DIM positions. Check landing and taxi lights. Obtain signal from the ground crew that these lights are operational.

REAR COCKPIT INTERIOR CHECK (DUAL FLIGHTS WITH DUAL CONTROLS)

Before External Electrical Power is Connected-

1. Ejection seat safety pin - INSTALLED
   Check that the ejection seat handgrips are in the full down position and that the ejection seat safety pin, with red warning flag attached, is properly installed in the left handgrip.
2. Radar master switch - OFF
3. Survival kit, safety belt, and shoulder harness - FASTEN
   - Attach the survival kit straps to the parachute harness.
   - Attach the shoulder harness and parachute lanyard to the safety belt.
   - Connect the zero delay lanyard to the parachute ripcord handle.

WARNING

Make sure the automatic-opening safety belt is properly fastened. The safety belt should be pulled tight prior to tightening the shoulder harness. Secure the automatic-opening parachute lanyard anchor to the safety belt and check the zero delay lanyard hooked to the parachute ripcord handle.

4. Circuit breakers - IN
5. Identification light - OFF

CONTINUED ON NEXT PAGE

REAR COCKPIT INTERIOR CHECK (DUAL FLIGHTS WITH DUAL CONTROLS) CONTINUED

With External Electrical Power Connected—

6. Seat and rudder pedals - ADJUST
   After adjusting the seat, adjust the rudder pedals by pulling down on the locking pins (located inboard of the rudder pedals) and position pedals with feet.
7. Airplane channel selector - SET
8. Station channel selector - SET
9. TACAN - ON
   Navigation control shift light - AS DESIRED
10. Cockpit lights - AS REQUIRED
    Set all cockpit light controls as the mission requires.
11. Engine master switches - ON
    Check engine master switches safety wired ON.
12. Emergency brake handle - IN AND SECURE
13. Airspeed index pointer - AS DESIRED
14. Altimeter - SET

WARNING

It is possible to incorrectly set the altimeter by 10,000 feet. Therefore, check that the altimeter 10,000-foot pointer is reading correctly.

15. Vertical velocity indicator - CHECK
    Check that the vertical velocity monitor is positioned at zero.
16. Fire warning lights - CHECK
    Check the steady and flashing operation of the left and right warning lights when the pilot in the front cockpit actuates the test switch.
17. Accelerometer - SET
18. UHF command radio - ON
19. Radar scope control switches - OFF
    Turn all control knobs counterclockwise.
20. Intercomm control panel - CHECK
    - Channel selector knob - COMM
    - Emergency listen switch - NORMAL
21. Face heat - OFF
22. Oxygen control panel - CHECK
    - Oxygen emergency lever - NEUTRAL
    - Oxygen supply lever - ON
    - Oxygen diluter lever - NORMAL
      Remain on NORMAL oxygen throughout engine start, taxi, and take-off, and report any fumes to the pilot in the front cockpit. Refer to Oxygen System Preflight Check, Section IV.
    - Oxygen supply pressure gage - 300 PSI
23. Warning lights - CHECK
    Check illumination and dimming of all warning, caution, and indicator lights when the pilot in the front cockpit actuates the test and dimmer switches.

BEFORE STARTING ENGINES

Before starting engines, be sure that wheels are chocked, and the danger areas fore and aft are clear. The rotational planes of the engine and starter turbine wheels (marked by a red stripe on fuselage) should be clear of personnel.

Note

If electrical power cart does not supply 28 volt d-c power, a "good" battery must be installed in the airplane to obtain a start.

WARNING

- Suction at the intake duct is sufficient to kill or severely injure personnel drawn into or pulled suddenly against duct.
- Danger areas aft of the airplane are created by high exhaust temperature and velocities. The danger increases with afterburner operation. See figure 2-2.

Whenever practicable, start and run up engines on paved surface to minimize the possibility of foreign objects being drawn into the compressor with resultant engine damage.

Danger Areas

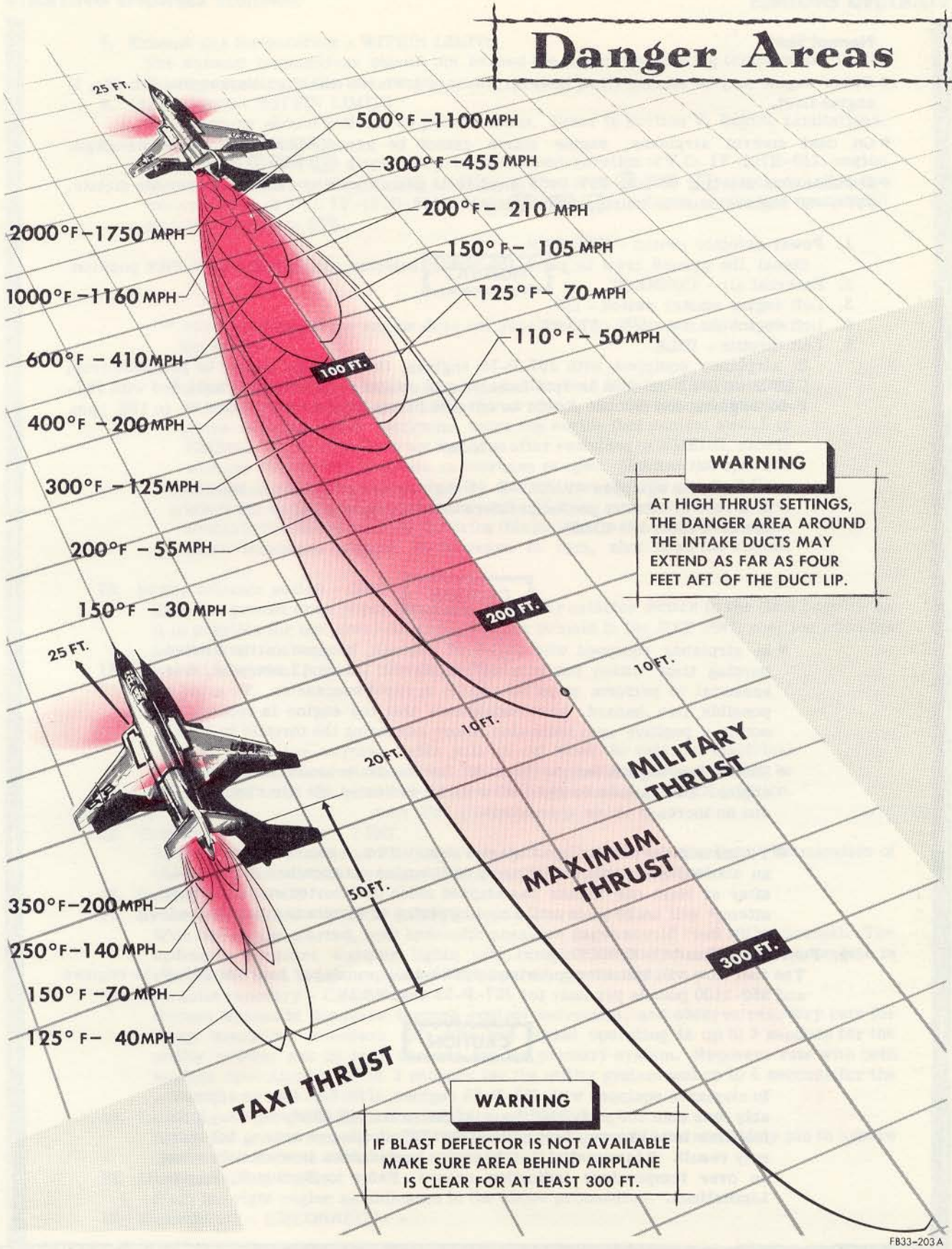

Figure 2-2

STARTING ENGINES

Normal Start

- Either engine may be started first; however, these procedures establish starting the left (No. 1) engine first.
- On dual control airplanes, engine starts cannot be accomplished from the rear cockpit.
- Simultaneous starting of both J57-P-55 engines is permitted if tactical requirements dictate. J57-P-53 engines must be started individually.

1. Power selector switch - EXT PWR
   Signal the ground crew to place the power selector switch in the EXT PWR position.
2. External air - CONNECT
3. Left engine master switch - ON
4. Left engine start switch - START
5. Left throttle - IDLE
   In airplanes equipped with J57-P-55 engines, the throttles should be advanced from CLS'D to IDLE as soon as rpm indication is obtained. In airplanes equipped with J57-P-53 engines, the throttle should be advanced from CLS'D to IDLE at 12% to 16% rpm.

Note

In airplanes equipped with J57-P-53 engines, a start should be indicated by a rise in exhaust gas temperature within 20 seconds after the throttle has been moved to IDLE.

CAUTION

- In airplanes equipped with J57-P-55 engines, because of the limited burning time within the combustion starter (11 to 13 seconds), it is essential to perform steps (4) and (5) in rapid succession. To avoid a possible fire hazard, however, assure that the engine is rotating by noting a positive rpm indication before advancing the throttle to IDLE.
- Should the engine fail to light-off within 10 seconds, shut down the engine. The failure to light-off will be indicated by: No rise in EGT and no increase above approximately 18% rpm.
- To prevent the possibility of starter destruction, a second attempt after an aborted start will not be made until engine rotation has stopped and after at least one minute has elapsed since the aborted start. A third attempt will not be made until a cooling period of 45 minutes has elapsed.

6. Fuel flow indicator - CHECK
   The fuel flow will indicate approximately 800-1000 pounds per hour for J57-P-55 engines and 850-1100 pounds per hour for J57-P-53 engines.

CAUTION

In airplanes equipped with J57-P-55 engines, if the fuel flow is appreciably less than 800 pounds per hour, a false start will likely result. If the fuel flow is in excess of approximately 1300 pounds per hour, a hot start may result. It is essential that the engine be shut down immediately when an over temperature indication occurs. Refer to Section V, Engine Limitations.

CONTINUED ON NEXT PAGE

STARTING ENGINES CONTINUED

7. Exhaust gas temperature - WITHIN LIMITS
   The exhaust temperature should not exceed the maximum starting temperature limits during transition to the idle range.
8. Oil pressure - WITHIN LIMITS
   Oil pressure should indicate 35 psi minimum. Refer to Section V, Engine Limitations.
9. Idle rpm - STABILIZED
   In the 56-248 55 THRU 105 airplanes, prior to the incorporation of T.O. 1F-101B-641, engine idle rpm should stabilize at 59% to 61%. In the 56-248 55 THRU 105 airplanes, after the incorporation of T.O. 1F-101B-641, and the 110 THRU 120 airplanes, engine idle rpm should stabilize at 63% to 65%.

CAUTION

- After ignition, if the engine does not accelerate to 25% rpm, shut down the engine.
- After ignition, if the engine does not accelerate to idle rpm, but remains at some intermediate speed, 25% rpm or above, and the exhaust temperature remains below maximum, move the engine fuel control switch to EMERG. If the rpm does not increase after switching to EMERG, slowly advance the throttle to obtain an increase in rpm. Monitor the rpm and exhaust temperature very closely. Do not exceed 1200 pph fuel flow. When the engine rpm increases beyond 45% rpm, return the fuel control switch to the NORM position. If during this procedure the exhaust temperature increases without an increase in rpm, shut down the engine.

10. Power selector switch - GEN
    Have the ground crew physically place the power selector switch in the GEN position as it is possible for the power selector switch to remain in the EXT PWR position when the access door is closed.
11. External electrical power - DISCONNECT

Note

The generator warning lights will go out when the external electrical power source is disconnected. However, generator output cannot be assured until the power selector switch is placed in the GEN position.

12. Transformer-rectifier - TEST
    With the battery switch OFF, press any "press-to-test" warning light. Illumination of the light indicates that the transformer-rectifiers are operational.
13. Battery switch - ON
14. Hydraulic pressure - WITHIN LIMITS
    With one engine started, both hydraulic pressure gages should read within normal. The hydraulic pressure warning lights will remain illuminated until the other engine is started and both hydraulic systems are operating normally.
15. Hydraulic recovery - CHECK
    Reduce hydraulic pressure through control movement, and observe recovery rate for pump operation. Recovery rate with one engine operating is up to 3 seconds for the utility system and up to 5 seconds for the primary system. Recovery rate with both engines operating is up to 2 seconds for the utility system and up to 4 seconds for the primary system.
16. Landing gear ground locks and safety pins - REMOVE
    Signal the ground crew to display the landing gear ground locks and safety pin to assure their removal from the airplane.
17. Start remaining engine.
    Start the right engine as indicated in the above procedures.
18. External air - DISCONNECT

CONTINUED ON NEXT PAGE

STARTING ENGINES CONTINUED

Battery Start

- The procedures for a battery start are the same as a normal start except that fuel flow, oil pressure, and hydraulic pressure gages will be inoperative until airplane generator electrical power is available.
- For battery starts, the external power selector switch should be placed in EXT PWR position to prevent interruption of the start cycle when the generator underspeed switch closes.
- If ground crews are not available, the power selector switch may be placed to GEN position prior to engine start. With the switch in this position, a-c electrical power will be available when the generator comes on the line at approximately 30% rpm.

Internal Air Start

- The procedures for an internal air start are the same as a normal start except that the internal air switch must be placed to ON prior to engine start.
- During internal air starts, the starter should be placed to STOP/START at 25% rpm to conserve air volume.
- The internal air supply (3000 psi) is adequate for one (1) start on each engine; however, unless the bottles are recharged prior to flight, sufficient air may not be available for emergency gear extension.
- After engines are started on internal air, place the internal air switch to OFF.

Pneumatic Start (J57-P-55 only)

- The procedures for a pneumatic start are the same as a normal start except ground crews must install a jumper wire on the starter to prevent inadvertent ignition.
- During pneumatic starts, the starter switch should be placed to STOP/START at 25% rpm to conserve air volume.

ENGINE GROUND OPERATION

After satisfactory starts are accomplished, allow the engines to idle until instrument readings stabilize. No engine warm-up is necessary. As soon as the engines stabilize at idle speed with normal gage indications, the throttles may be opened to full thrust.

BEFORE TAXIING

Note

All check items printed hereafter in ***Boldface Italic*** type are mandatory for alert checks. Non-boldface items may be checked if time and conditions permit. The normal checks are resumed with "Pre-Take-Off Engine Check".

1. ***Pitch Control System—Test***
   AFCS Engage Switch—AFCS
   Signal ground crew to position angle of attack sensors in the full up position.

WARNING

After the incorporation of T.O. 1F-101-883, the angle-of-attack vane heaters will be energized through the pitot heat switch. Therefore, before the ground crew positions the angle-of-attack vanes, visually recheck the pitot heat switch OFF.

Note

In gusty or high wind conditions it may be necessary for the ground crew to hold the sensors in the desired positions.

Control Stick—AFT OF NEUTRAL
PCS Test Button—DEPRESS
Depressing the test button will energize the warning horn and engage the pusher. The pusher will cause the AFCS engage switch to move to STAND-BY.

- Angle-of-attack vanes - FULL DOWN POSITION
- Slowly rotate the right (horn) vane to the up position and observe the alpha-w needle of the pitch boundary indicator. When the alpha-w needle meets the boundary wand, the warning horn will sound.
- Control stick - FULL FORWARD
- Angle-of-attack vanes - ON REFERENCE MARK (RED LINE PAINTED ON FUSELAGE)
- Rapidly move control stick - FULL AFT
  The stabilator rate sensor will engage the pusher and energize the warning horn.
- Overpower the pusher force.
  The pusher may be overpowered with an aft stick force of approximately 27 pounds.
- Pusher release switch - DEPRESS
  Depressing the pusher release switch will disengage the pusher, however, the horn will continue until the PCS test button is released.

2. ***Pusher Switch–OFF***
3. Automatic flight control system - TEST

Note

A 2 minute warm-up period must be allowed prior to autopilot operation.

- AFCS engage switch - AFCS
- Paddle switch - DEPRESS
  Depressing the paddle switch will cause the AFCS engage switch to move to STAND-BY. There will be no rudder deflection with stick movement while the paddle switch is held depressed. The yaw damper will re-engage and there will be rudder deflection with stick movement when the paddle switch is depressed.

CONTINUED ON NEXT PAGE

BEFORE TAXIING CONTINUED

4. Command signal limiter - TEST
   - Signal ground crew to position central air data angle of attack sensor to the full down position.
   - AFCS engage switch - AFCS
   - Signal ground crew to slowly rotate the sensor to the full up position.
   - The command signal limiter will engage while the ground crew is rotating the sensor and the control stick will move forward.
5. Manual flight control system - CHECK
   - AFCS engage switch - STAND-BY
   - Rapidly but smoothly move the control stick fore and aft. Confirm that there is no binding of the controls, and stabilizer movement corresponds to stick movement.
6. ***Stab. Augmentation Switch–STAB-AUG***
7. Speed brakes - TEST
   Extend and retract the speed brakes. Check hydraulic recovery during the cycle.
8. ***Flaps–EXTEND & CHECK***
   Extend the wing flaps and obtain signal from the ground crew that the flaps are full down. Check that the flap indicator corresponds to the flap position.
9. ***Emergency Fuel Control–TEST***
   - Left throttle - IDLE
   - Left engine fuel control switch - EMERG

Note

A slight fluctuation in fuel flow at IDLE position indicates that the emergency fuel control is operating.

   - Left engine fuel control switch - NORMAL
     Recheck fuel flow fluctuation to insure that the normal fuel control is operating.
   - Check right engine as outlined above.
   - Check telelight panel for illumination of telelight.
10. ***Seat Safety Pin–REMOVE***
    Pull the ejection seat safety pin from the left handgrip and stow in an accessible place.

WARNING

Do not pull up either handgrip. The seat and canopy ejection systems are fully armed when the safety pin is removed.

11. ***Chocks–REMOVE***

CAUTION

When the chocks are pulled, have feet on the brakes since there is no parking brake on the airplane.

12. ***Nose Gear Steering–ENGAGE***

TAXIING

1. Brakes - TEST
   After initial roll, apply brakes to check operation.

Note

Use nose gear steering as much as possible to minimize use of brakes.

CAUTION

- Do not exceed 25 knots while taxiing to prevent excessive tire wear and brake heat. Be careful not to ride the brakes.
- Adjust canopy so that minimum side motion will occur to prevent excessive side loads from damaging canopy mechanism.
- The canopy should be closed (with unlocked warning light out) and adequate distance between airplanes maintained during formation taxiing. An open canopy may become damaged from jet blast.
- Maintain a minimum distance of 125 feet from the exhaust blast of another airplane that is operating at Military thrust and 200 feet from the exhaust blast of an airplane that is operating at Maximum thrust to prevent damage to the canopy.
- While taxiing, do not attempt turns in excess of nose gear steering limits (40° either side of center).

2. ***Flight Instruments–CHECK OPERATION***
   Check all flight instruments and set the attitude indicator pitch trim knob pointer to the zero bias index. (This should place the miniature aircraft in approximately 4 degrees nose low position, thus providing a picture of the aircraft's inflight attitude relative to level flight conditions at normal cruise airspeed). Select appropriate navigational aids to be used for the departure and set navigational instruments and switches as required.

PRE-TAKE-OFF AIRPLANE CHECK

1. ***Seat Safety Pin–REMOVED***
   Visually check the seat safety pin removed and stowed.
2. ***Zero Delay Lanyard–HOOKED***
   Check the zero delay lanyard hooked to the parachute ripcord handle.
3. ***Canopy–CLOSED, LIGHT OUT***
   Check the canopy defogging ducts mated and the canopy unlock warning light out.
4. ***Take-off Trim–SET***
   Depress the take-off trim button until the "Trim OK for T.O." light illuminates.
5. ***EPR Gages–SET***
   Check that the cruise and take-off pressure ratio values in the pressure ratio gages window agree with their corresponding outer pointers.
6. ***Voltmeter–115V***
7. ***Battery–ON***
8. ***Oxygen Flow–BLINKING***
   Check for blinker operation of the oxygen system.

CONTINUED ON NEXT PAGE

PRE-TAKE-OFF AIRPLANE CHECK CONTINUED

Note

During take-off the pilot's oxygen diluter lever should be 100% O_2 and the RIO's diluter lever should be NORMAL O_2. If any fumes are detected they should be reported to the pilot immediately.

9. *Pitot Heat Switch—ON*
   On the ground, moisture may collect in the pitot-static tube after exposure to rain or high humidity. Heat will help to eliminate the entrapped moisture.

CAUTION

Warm-up time for pitot heat is approximately one minute at 32°F. Allow sufficient heating time if taking off in freezing rain or other visible moisture with surface temperatures at or near freezing.

PRE-TAKE-OFF ENGINE CHECK

1. Left throttle - OPEN

Note

If engine stalls or other malfunctions prevent reaching full Military thrust within 14 seconds, flight should be aborted.

2. Engine pressure ratio gage - WITHIN LIMITS
   When engine speed has stabilized, the gage pointer should fall within the width of the take-off index marker.

Note

The air defroster, cabin pressure or engine anti-ice system could cause engine EPR to be low. If the power check is made in a strong crosswind, the upwind engine EPR will tend to be slightly high and the downwind engine slightly low.

3. Engine instruments - WITHIN LIMITS
   Refer to Section V, Instrument Markings.
4. Left throttle - IDLE
5. Check right engine as outlined above.

MINIMUM EPR GAGE SETTINGS
56-249 (55) THRU (70)

AMBIENT TEMPERATURE		TAKE-OFF SETTING		AMBIENT TEMPERATURE		TAKE-OFF SETTING	
°C	°F	LEFT	RIGHT	°C	°F	LEFT	RIGHT
49	120	1.97	2.00	14	58	2.25	2.30
48	118	1.98	2.01	13	56	2.25	2.31
47	116	1.99	2.02	12	54	2.26	2.32
46	114	1.99	2.03	11	52	2.27	2.33
44	112	2.01	2.04	10	50	2.28	2.34
43	110	2.01	2.05	9	48	2.29	2.35
42	108	2.02	2.06	8	46	2.30	2.36
41	106	2.04	2.07	7	44	2.31	2.37
40	104	2.04	2.07	5	42	2.32	2.38
39	102	2.05	2.08	4	40	2.34	2.39
38	100	2.06	2.09	3	38	2.34	2.40
36	98	2.07	2.11	2	36	2.35	2.41
35	96	2.08	2.12	1	34	2.36	2.42
34	94	2.09	2.13	0	32	2.37	2.43
33	92	2.09	2.13	-1	30	2.38	2.44
32	90	2.10	2.14	-2	28	2.39	2.45
31	88	2.11	2.15	-3	26	2.40	2.46
30	86	2.12	2.16	-5	24	2.41	2.47
29	84	2.13	2.17	-6	22	2.42	2.49
28	82	2.14	2.18	-7	20	2.42	2.50
27	80	2.15	2.19	-8	18	2.43	2.51
25	78	2.16	2.20	-9	16	2.43	2.52
24	76	2.17	2.21	-10	14	2.45	2.53
23	74	2.17	2.22	-11	12	2.46	2.54
22	72	2.18	2.23	-12	10	2.47	2.55
21	70	2.19	2.24	-13	8	2.48	2.56
20	68	2.20	2.25	-14	6	2.49	2.56
19	66	2.21	2.26	-16	4	2.51	2.59
18	64	2.22	2.27	-17	2	2.51	2.59
17	62	2.23	2.28	-18	0	2.52	2.60
16	60	2.23	2.28	-19	-2	2.52	2.61

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MINIMUM EPR GAGE SETTINGS
(75) THRU (120)

AMBIENT TEMPERATURE		TAKE-OFF SETTING	AMBIENT TEMPERATURE		TAKE-OFF SETTING
°C	°F		°C	°F	
49	120	2.01	3	38	2.40
48	118	2.01	2	36	2.41
47	116	2.02	1	34	2.42
46	114	2.03	0	32	2.43
44	112	2.04	-1	30	2.44
43	110	2.05	-2	28	2.45
42	108	2.06	-3	26	2.46
41	106	2.07	-5	24	2.48
40	104	2.08	-6	22	2.49
39	102	2.08	-7	20	2.50
38	100	2.09	-8	18	2.51
36	98	2.10	-9	16	2.52
35	96	2.11	-10	14	2.53
34	94	2.12	-11	12	2.54
33	92	2.13	-12	10	2.56
32	90	2.14	-13	8	2.57
31	88	2.15	-14	6	2.58
30	86	2.16	-16	4	2.59
29	84	2.17	-17	2	2.60
28	82	2.18	-18	0	2.61
27	80	2.19	-19	- 2	2.62
25	78	2.20	-20	- 4	2.63
24	76	2.21	-21	- 6	2.64
23	74	2.22	-22	- 8	2.66
22	72	2.23	-23	-10	2.67
21	70	2.24	-24	-12	2.68
20	68	2.25	-26	-14	2.69
19	66	2.26	-27	-16	2.70
18	64	2.26	-28	-18	2.71
17	62	2.27	-29	-20	2.72
16	60	2.28	-30	-22	2.73
14	58	2.29	-31	-24	2.75
13	56	2.30	-32	-26	2.76
12	54	2.31	-33	-28	2.77
11	52	2.32	-34	-30	2.78
10	50	2.33	-35	-32	2.79
9	48	2.35	-37	-34	2.80
8	46	2.36	-38	-36	2.81
7	44	2.37	-39	-38	2.82
5	42	2.38	-40	-40	2.83
4	40	2.39			

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Figure 2-3

TAKE-OFF

NORMAL TAKE-OFF

Note

- The procedures set forth produce the results shown in the Take-Off Charts, Part 2 of Appendix I. Refer to figure 2-4.
- When large puddles of water are present on the runway, it is possible to get compressor stalls and afterburner blowout in both engines during take-off at speeds from 80 to 100 knots. This is caused by water thrown into the engine intakes from wakes created by the nose wheel.

1. Brakes - APPLY
2. Throttles - 80% RPM
   Smoothly advance throttles to approximately 80% rpm.
3. Icing ignition switch - AS REQUIRED
   When taking off on runway with large puddles of water or flight through icing conditions is encountered, place the icing ignition switch ON. However, as soon as icing ignition is not required, the icing ignition switch should be placed in the OFF position to preserve igniter plug life.

Note

All icing ignition time should be noted on Form 781 after landing.

4. Instruments and warning lights - CHECK
   Recheck the instruments for proper indications and check that all warning lights are out.
5. Brakes - RELEASE
6. Throttles - OPEN

Note

- Shifting throttles outboard from the OPEN position ignites the afterburner for Maximum thrust take-off.
- Under standard day conditions or with lower temperatures, extremely rapid acceleration will be experienced during afterburner take-off.

7. Use nose gear steering for directional control until the rudder becomes effective at approximately 70 knots IAS.
8. Ease the nose gear off the runway at approximately 155 knots IAS, and establish a take-off attitude of approximately 5 degrees pitch.

WARNING

Do not rotate the airplane to an extreme nose high attitude or the airplane may take-off in a semi-stalled, out-of-control condition.

9. Allow the airplane to fly off runway at take-off airspeed.

Note

Nose gear lift-off speed and take-off speed must be increased appropriately for heavy gross weight conditions.

Typical Take-Off

NORMAL TAKE-OFF GROSS WEIGHT 45,500 LB (CLEAN)

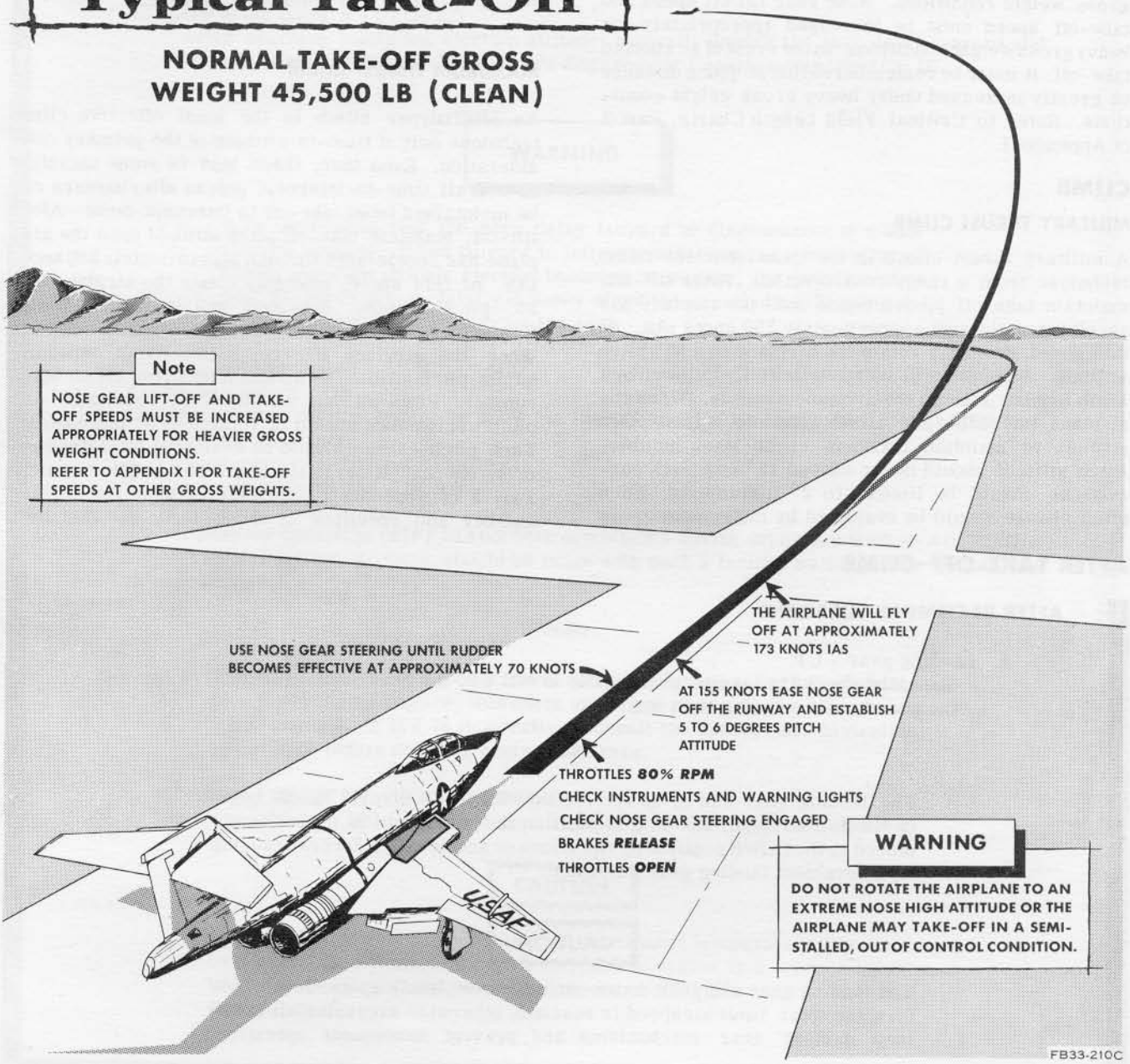


Figure 2-4

MINIMUM RUN TAKE-OFF

A minimum run take-off is the same as a normal afterburner take-off in this airplane.

CROSSWIND TAKE-OFF

Under crosswind conditions, the airplane tends to "weathervane" into the wind immediately after releasing the brakes. Nose gear steering must be utilized to maintain directional control until the rudder becomes effective at approximately 70 to 90 knots, depending upon crosswind intensity. Avoid using brakes as take-off run will be increased. As take-off speed is approached and the airplane starts to fly, it tends to "cock" into the wind and "skip" on the downwind tire until fully airborne. This tendency should be corrected through normal crosswind control procedures. Refer to Appendix I.

HEAVY GROSS WEIGHT TAKE-OFF

A heavy gross weight take-off is accomplished in the same manner as a normal take-off with the following exceptions and additions: It is strongly recommended that all heavy gross weight take-offs be made with

afterburner. Main landing gear tire failure becomes critical with extended take-off ground roll under heavy gross weight conditions. Nose gear lift off speed and take-off speed must be increased appropriately for heavy gross weight conditions. In the event of an aborted take-off, it must be remembered that stopping distance is greatly increased under heavy gross weight conditions. Refer to Critical Field Length Charts, Part 2 of Appendix I.

CLIMB

MILITARY THRUST CLIMB

A military thrust climb is the most efficient climb technique from a range consideration. After lift-off, maintain take-off pitch attitude until the airplane has accelerated through approximately 350 knots IAS. At this speed, smoothly rotate the airplane to a 10° pitch attitude. Airspeed will increase initially followed by a Mach number rise as the airplane ascends. When the airplane intercepts the climb schedule, adjust pitch attitude to maintain optimum climb Mach number. Pitch attitude should never exceed 15° and pitch corrections should be limited to 2° increments. Each pitch change should be evaluated by instrument cross checks. Refer to Military Thrust Climb charts, Part 3 of Appendix I, to obtain optimum climb Mach number and specifics of time, fuel, and distance.

MAXIMUM THRUST CLIMB

An afterburner climb is the most effective climb technique only if time-to-altitude is the primary consideration. Even then, there may be some sacrifice in overall time-to-intercept unless afterburners can be maintained from take-off to intercept-point. After lift-off, maintain take-off pitch attitude until the airplane has accelerated through approximately 350 knots IAS. At this speed, smoothly rotate the airplane to a 25° pitch attitude. Airspeed will increase initially followed by a Mach number rise as the airplane ascends. When the airplane intercepts the climb schedule, adjust pitch attitude to maintain optimum climb Mach number. Pitch attitude should never exceed 30° and pitch corrections should be limited to 5° increments. Each pitch change should be evaluated by instrument cross checks. Refer to Maximum Thrust Climb charts, Part 3 of Appendix I, to obtain optimum climb Mach number and specifics of time, fuel, and distance.

AFTER TAKE-OFF-CLIMB

AFTER BECOMING AIRBORNE

1. Landing gear - UP
   Manually check the landing gear handle is full UP, the gear position indicators out, and the gear handle warning light out.

Note

The landing gear can be up and locked without the control handle being in the full UP position. In this position the handle can be inadvertently moved to the DOWN position by vibrations or acceleration forces, causing an inadvertent landing gear extension.

CAUTION

The landing gear and gear doors should be completely up and locked before the gear limit airspeed is reached, otherwise excessive air loads may damage gear mechanisms and prevent subsequent operation.

2. Flaps - RETRACT
   The flaps should be up before reaching the flap limit airspeed. Check flap indicator.
3. Throttles - AS REQUIRED
   As soon as Maximum thrust is no longer needed, turn off the afterburner.
4. Engine pressure ratio gages - CHECK
   When terminating afterburner operations, engine pressure ratio may momentarily drop and then return to its original setting. Visually check engine pressure ratio gages for proper operation.

Note

If the engine pressure ratio should drop, and remain at a low setting, the exhaust nozzles have failed to close. Reduce thrust on the affected engine to idle or recycle the afterburner to close the exhaust nozzles. Refer to Afterburner Failure, Section III.

DURING CLIMB

1. Zero delay lanyard - STOWED
   After reaching minimum ejection altitude, manually unhook the zero delay lanyard and "stow". Refer to Zero Delay Lanyard Engagement Requirements, Section III.

WARNING

It is imperative that the zero delay lanyard be disconnected at a safe ejection altitude. If the lanyard is left attached to the parachute ripcord handle and high altitude ejection becomes necessary, the crew member may be seriously or fatally injured since the parachute will open immediately upon separation from the seat.

2. AFCS engage switch - AS REQUIRED
3. Pusher switch - ON
   The pusher switch should be placed in the ON position while passing through 5000 feet terrain clearance.
4. Oxygen diluter lever - AS REQUIRED
5. Cabin pressure switch - NORM
6. IFF - CHECKED
   If positive operation of IFF has not been established during departure with an Air Traffic Control Facility, a check should be made with such a facility as soon after take-off as practicable.

Note

For airplanes operating on Radar Controlled Airways, or through Positive Controlled Airspace, this check must be performed prior to entering these regions. If IFF is inoperative, consult the appropriate navigation publication before entering controlled areas.

7. Altimeter - 29.92" Hg, OR AS REQUIRED
   Upon reaching 23,500 feet, reset the altimeter to 29.92" Hg or as required.

CAUTION

Monitor the exhaust temperature. If the exhaust temperature increases to its maximum limit, without an increase in engine rpm, reduce thrust to maintain the exhaust temperature within allowable limits. Refer to figure 5-2.

AFTER LEVEL-OFF

1. Fuel Quantity Selector Switch - TOTAL
2. Fuselage Tank Transfer Switch - GRAV
3. External and Wing Tank Fuel - TRANSFER
   Refer to Fuel System Management, Section VII.
4. Fuselage Tank Transfer Switch - NORM
   When external and wing tanks are empty, return fuselage tank switch to NORM. Refer to Fuel System Management, Section VII.
5. Command signal limiter - CHECK
   A flight check of the CSL operation will be accomplished prior to intercept training. This check may be accomplished at 20,000 or 35,000 feet indicated altitudes as follows:

CONTINUED ON NEXT PAGE

AFTER LEVEL-OFF CONTINUED

a. With AFCS engaged, level aircraft at 20,000 feet with airspeed stabilized at .70 IMN, or 35,000 feet with airspeed stabilized at .80 or .90 IMN.
b. Make slow stick coordinated turn with increasing back stick pressure. Regulate power to maintain given airspeed.
c. The CSL should limit approximate "g" loading according to the amount of fuel remaining as shown in "CSL Boundaries", this section.

CSL BOUNDARIES

Fuel Remaining (Lbs.)	20,000 Ft. (.70 IMN)	35,000 Ft. (.80 IMN)	35,000 Ft. (.90 IMN)
17,000	1.80	1.25	1.80
15,000	1.85	1.30	1.90
11,000	2.00	1.40	2.10
9,000	2.10	1.45	2.20
7,000	2.35	1.55	2.35

Note

Accelerometer indications should be accurate within .2 "g".

d. The horn and pusher should not actuate before CSL limiting at .70 or .80 IMN. However, the horn may blow at .90 IMN. Any malfunction during this check will negate any flying involving autopilot operation or CSL.

ARMAMENT SAFETY CHECK

1. Master arm switch - SAFE
   Switch should be safetied and sealed in the SAFE position when armament is aboard.
2. Armament selector knob - VIS-IDENT
   Safety detent knob should be safetied and sealed when applicable.
3. Vis-Ident indicator light - ILLUMINATED
4. Arm-Select window - BLANK
5. MB-1 Ejector racks lock switch - LOCKED
   Switch should be safetied and sealed in the LOCKED position when MB-1 is aboard.
6. MB-1 Ejector racks annunciators - LOCKED
7. Armament safety check - CALL COMPLETE

CAUTION

This armament safety check should be accomplished prior to all practice intercepts.

CRUISE

Cruise control data for various gross weights and several configurations are contained in Appendix I. For information on continuous ignition when icing is encountered, refer to Ice and Rain, Section IX.

Note

For missions requiring low altitude work, the pusher should be turned ON and OFF when climbing/descending through 5000 feet. The zero delay lanyard should be unhooked/hooked when climbing/descending through minimum ejection altitude. Refer to Zero Delay Lanyard Engagement Requirements, Section III.

FLIGHT CHARACTERISTICS

Refer to Section VI for information regarding flight characteristics.

WEAPONS DELIVERY PROCEDURES

MB-1 ROCKET DELIVERY

Lead Collision Attack (Automatic Fire)

1. MB-1 ejector racks lock switch - UNLOCKED
2. Left and right ejector rack annunciators - READY
3. Armament selector knob - SPL-WPN-FCS
4. Arm select annunciator - OK
5. Master arm switch - ARM
6. Rocket armed light - ON
   RIO observes which rocket is armed and informs pilot.
7. Attack mode light - ON
8. Radar mode selector knob - RDR DOMINANT (RIO)
9. HOJ switch - CHECK OFF (RIO)
10. Steering dot - CENTERED
    The pilot may engage the AFCS coupler for automatic attack steering.
11. Armament trigger - SECOND DETENT
    Depress and hold the armament trigger switch upon shrinking of the steering circle ("B" time).
12. Escape maneuver - EXECUTE
    Execute the preplanned escape maneuver. Refer to Escape Procedures, this section.
13. Armament Safety Check - ACCOMPLISH
    Refer to Armament Safety Check, this section.

Lead Collission Attack (Manual Fire)

1. MB-1 ejector racks lock switch - UNLOCKED
2. Left and right ejector rack annunciators - READY
3. Armament selector knob - SPL-WPN-FCS
4. Arm select annunciator - OK
5. Master arm switch - ARM
6. Rocket armed light - ON
   RIO observes which rocket is armed and informs pilot.
7. Attack mode light - ON
8. Radar mode selector knob - RDR DOMINANT (RIO)
9. HOJ switch - CHECK OFF (RIO)
10. Establish stern position, zero aspect angle - ACCOMPLISH
    RIO will give commands as necessary to establish a dead astern position with sufficient range to accomplish speed control, steering, and firing.
11. Establish approximately 100 knot rate of closure - ACCOMPLISH
12. Armament selector switch - SPL-WPN-MAN

WARNING

Whenever the armament selector knob is in the SPL-WPN-MAN position, the armament trigger is hot.

13. Steering dot - CENTERED
14. Armament trigger switch - SECOND DETENT
    Press to second detent at range determined by RIO.
15. Escape maneuver - EXECUTE
    Refer to Escape Procedures, this section.
16. Armament Safety Check - ACCOMPLISH
    Refer to Armament Safety Check, this section.

CONTINUED ON NEXT PAGE

MB-1 ROCKET DELIVERY CONTINUED

Pursuit ATOT Attack

1. MB-1 ejector racks lock switch - UNLOCK
2. Left and right ejector rack annunciators - READY
3. Armament selector knob - SPL-WPN-MAN

WARNING

Whenever the armament selector knob is in the SPL-WPN-MAN position, the armament trigger is hot.

4. Arm select annunciator - OK
5. Master arm switch - ARM
6. Rocket armed light - CHECK
   RIO observes which rocket armed light is illuminated and informs pilot.
7. Attack mode light - ON
8. Radar mode selector knob - RDR DOMINANT (RIO)
9. HOJ switch - ON (RIO)
10. Attack option - ACCOMPLISH

Note

The following options for completing attack, are predictated on the aircrew having been forced into the pursuit attack due to ECM. The options begin with the most degraded condition (ATOT) and progress to the most desirable (Lead Collision).

ATOT

- ATOT lock-on - ACCOMPLISH (RIO)
- Armament trigger switch - SECOND DETENT
  Depress the trigger to second detent at firing range determined by radar burn through (RIO) or optical ranging.

ATOT to HOJ (Manual Fire)

- Radar lock-on - ACCOMPLISH (RIO)
- Armament trigger switch - SECOND DETENT
  Depress the trigger to second detent at the firing range determined by the RIO from range meter or radar scope.

ATOT to HOJ (Automatic Fire)

- Radar lock-on - ACCOMPLISH (RIO)
- Armament selector knob - SPL-WPN-FCS
- Armament trigger switch - SECOND DETENT

ATOT to Lead Collision

- Radar lock-on - ACCOMPLISH (RIO)
- Armament selector knob - SPL-WPN-FCS
- HOJ switch - OFF (RIO)
- Armament trigger switch - SECOND DETENT

11. Escape maneuver - EXECUTE
    Refer to Escape Procedures, this section.
12. Armament Safety Check - ACCOMPLISH
    Refer to Armament Safety Check, this section.

CONTINUED ON NEXT PAGE

MB-1 ROCKET DELIVERY CONTINUED

Pursuit IR Attack

1. MB-1 ejector racks lock switch - UNLOCK
2. Left and right ejector rack annunciators - READY
3. Armament selector knob - SPL-WPN-MAN

WARNING

Whenever the armament selector knob is in the SPL-WPN-MAN position, the armament trigger is hot.

4. Arm select annunciator - OK
5. Master arm switch - ARM
6. Rocket armed light - CHECK
   RIO observes which rocket armed light is illuminated and informs pilot.
7. Attack mode light - ON
8. Radar mode selector knob - IR DOMINANT (RIO)
   Select any of the IR modes, RDR SLVD, RDR SRCH, RDR PASS.

Note

The IR attack may continue using any of the options listed below. The options listed give conditions and procedures for upgrading the attack from the most degraded situation (IR pursuit) to the most desirable (lead collision).

9. Attack option - ACCOMPLISH

IR, RDR SLVD/SRCH/PASS (no radar lock-on - Manual Fire)

- IR lock-on - ACCOMPLISH (RIO)
- Armament trigger - SECOND DETENT
  Depress the trigger to second detent at firing range determined by radar or IR ranging (RIO)

IR, RDR SLVD (radar tracking - Manual Fire)

- IR lock-on - ACCOMPLISH (RIO)
- Radar lock-on - ACCOMPLISH (RIO)
- Armament trigger switch - SECOND DETENT
  Depress the trigger to second detent at firing range determined by the RIO from range meter or radar scope.

IR, RDR SLVD (radar tracking - Automatic Fire)

- IR lock-on - ACCOMPLISH (RIO)
- Radar lock-on - ACCOMPLISH (RIO)
- Armament selector knob - SPL-WPN-FCS
- Armament trigger switch - SECOND DETENT

CONTINUED ON NEXT PAGE

MB-1 ROCKET DELIVERY CONTINUED

IR Dominant (RDR SLVD) to Radar Dominant (Lead Collision)

- IR lock-on - ACCOMPLISH (RIO)
- Radar lock-on - ACCOMPLISH (RIO)
- Radar mode selector knob - RDR DOMINANT (RIO)
- HOJ switch - CHECK OFF (RIO)
- Armament selector knob - SPL-WPN-FCS
- Armament trigger switch - SECOND DETENT

CAUTION

When switching from IR dominant to RDR dominant during an attack, radar lock-on should have been accomplished (if possible) while in the IR dominant mode. If radar lock-on is not accomplished prior to mode switching, a delay of 8 to 14 seconds may occur in radar transmitter and receiver functions.

10. Escape maneuver - EXECUTE
    Refer to Escape Procedures, this section.
11. Armament Safety Check - ACCOMPLISH
    Refer to Armament Safety Check, this section.

Pursuit Optical Attack

1. Radar mode selector knob - RDR, IR MODE, or STBY (RIO)
   The radar knob must be in ON or STBY position for an optical firing.
2. MB-1 ejector racks lock switch - UNLOCKED
3. Left and right ejector rack annunciators - READY
4. Armament selector knob - SPL-WPN-MAN

WARNING

Whenever the armament selector knob is in the SPL-WPN-MAN position, the armament trigger is hot.

5. Arm select annunciator - OK
6. Master arm switch - ARM
7. Rocket armed lights - CHECK
   RIO observes which rocket armed light is illuminated and informs pilot.
8. Attack mode light - ON
9. Optical sight - UNSTOW
   Unstow optical sight by reaching over glare shield and raising the knob on the left side of the sight.
10. Optical sight filament switch - NORM
    Set filament switch to the NORM position. If reticle does not illuminate, set switch to the ALT position.
11. Optical sight illumination knob - AS DESIRED
12. Armament trigger switch - SECOND DETENT
    Depress the armament trigger switch when within the estimated optimum range to target. The MB-1 rocket fires approximately 2.5 seconds after the trigger is depressed.
13. Escape maneuver - EXECUTE
    Refer to Escape Procedures, this section.
14. Armament Safety Check - ACCOMPLISH
    Refer to Armament Safety Check, this section.

GAR-2A DELIVERY

The GAR-2A missile may be fired using the lead collision or the pursuit attack.

Lead Collision Attack

1. Armament selector knob - IR
2. Arm select annunciator - OK
3. Master arm switch - ARM
4. Attack mode light - ON
5. Radar mode selector knob - RDR DOMINANT (RIO)
6. HOJ switch - CHECK OFF (RIO)
7. Armament trigger switch - SECOND DETENT
8. Breakaway maneuver - EXECUTE
9. Armament Safety Check - ACCOMPLISH
   Refer to Armament Safety Check, this section.

Pursuit ATOT Attack

Note

GAR-2A armament cannot be fired manually if a range lock-on exists.

WARNING

GAR-2A missile circuits transfer from the aircraft power source to internal battery power at computer "B" time or at optics option "B" time (trigger 1). Battery life remaining then becomes 2 minutes. However, if "B" signal drops out (lock-on lost or trigger released), the remaining active battery life is 2 minutes minus the time in "B" time and minus 29 seconds of "B" time hold.

1. Armament selector knob - IR
2. Arm selector annunciator - OK
3. Master arm switch - ARM
4. Attack mode light - ON
5. HOJ switch - ON (RIO)
6. Mode selector switch - RADAR DOMINANT (RIO)
7. ATOT lock-on - ACCOMPLISH (RIO)
8. Armament trigger switch - FIRST DETENT
   Minimum of 13 seconds required to complete first detent armament preparation.
9. Armament trigger switch - SECOND DETENT
   Depress the trigger to second detent at firing range determined by radar burn through (RIO) or optical ranging. A minimum of 3 seconds is required in second detent to complete armament preparation and firing.
10. Breakaway maneuver - EXECUTE
11. Armament Safety Check - ACCOMPLISH

Note

If a range lock-on is acquired on GAR-2A ATOT attack, a computer firing will occur on a pursuit course. The pilot must depress the trigger to second detent. If range lock-on cannot be maintained the pilot must release the trigger and reselect the desired trigger position to establish the optics option.

CONTINUED ON NEXT PAGE

GAR-2A DELIVERY CONTINUED

Pursuit Optical Attack

Note

GAR-2A armament cannot be fired manually if a range lock-on exists.

1. Radar master switch - RADAR, IR MODE or STBY (RIO)
2. Armament selector knob - IR
3. Arm select annunciator - OK
4. Master arm switch - ARM
5. Attack mode light - ON
6. Optical sight - UNSTOW
   Unstow optical sight by reading over glare shield and raising the knob on the left side of the sight.
7. Optical sight filament switch - NORM
   Set filament switch to the NORM position. If reticle does not illuminate, set switch to the ALT position.
8. Optical sight illumination knob - AS DESIRED
9. Armament trigger switch - FIRST DETENT
   A minimum of 13 seconds is required to complete first detent armament preparations.
10. Armament trigger switch - SECOND DETENT
    Depress second detent at firing range determined by radar burn through (RIO) or optical sight ranging. A minimum of three seconds is required in second detent to complete armament preparation and firing.
11. Breakaway maneuver - EXECUTE
12. Armament Safety Check - ACCOMPLISH
    Refer to Armament Safety Check, this section.

Pursuit IR Dominant

1. Mode selector - IR DOMINANT (RIO)
   Select either IR/RDR SLVD/SRCH/PASS
2. IR lock-on - ACCOMPLISH (RIO)
3. Armament selector knob - IR
4. Arm select annunciator - OK
5. Master arm switch - ON
6. Attack mode light - ON
7. Armament trigger switch - FIRST DETENT
   A minimum of 13 seconds is required to complete first detent armament preparation.
8. Armament trigger switch - SECOND DETENT
   Depress the trigger to second detent at firing range determined by radar or IR ranging (RIO) or optical ranging.
9. Breakaway maneuver - EXECUTE
10. Armament Safety Check - ACCOMPLISH

Note

If radar lock-on can be acquired, a computer generated pursuit firing can be completed. The pilot must go to second detent before the computer E signal is generated. As long as an IR dominant mode has been selected, the computer continues to develop a pursuit course. If radar range lock-on is acquired, the attack should be upgraded to a lead collision attack (select RDR dominant and check the HOJ switch OFF).

ESCAPE PROCEDURES

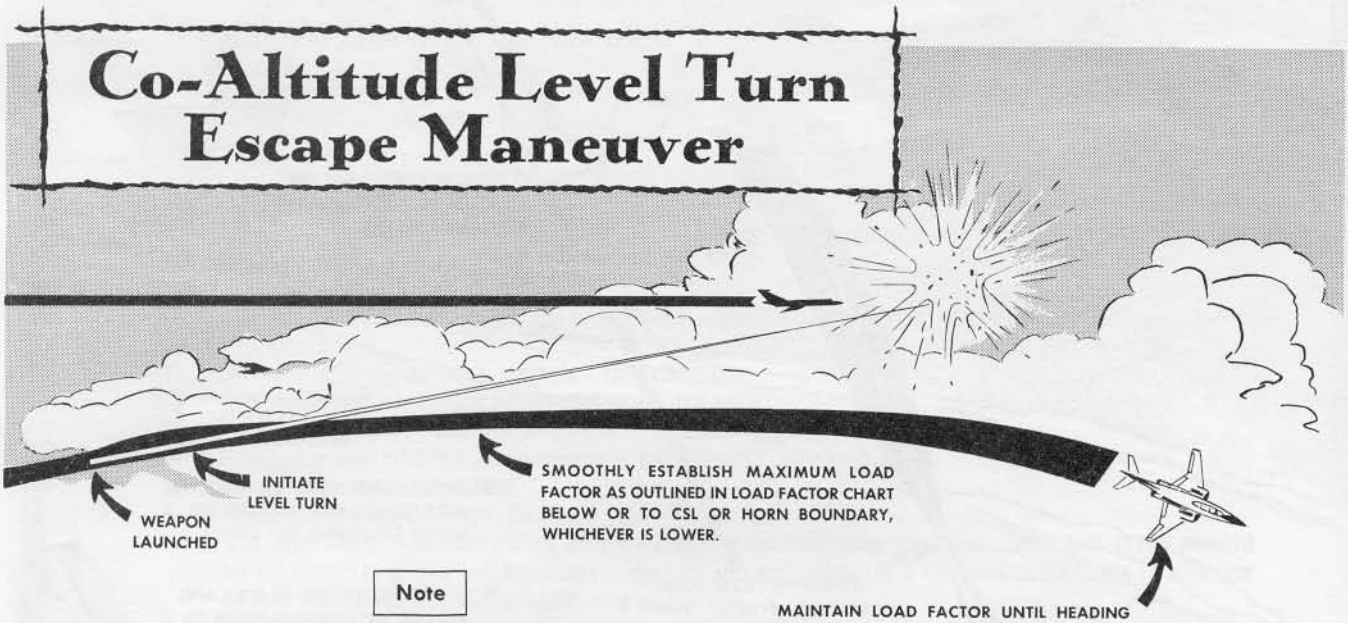
MB-1 CO-ALTITUDE ESCAPE

Immediately upon firing the MB-1 rocket, perform the following:

1. Level turn - INITIATE
   Roll the aircraft into a level turn to the left or right and smoothly apply stick back pressure to obtain the "g" loading available. The CSL or horn boundary should not be exceeded.
2. Level turn - COMPLETE
   Hold the turn for a heading change of at least 90°. At high altitudes, a diving turn escape may be used which would result in a slight reduction in REM dosage over the level turn. However, the resulting loss of altitudes may hinder a re-attack.

WARNING

To prevent flash blindness, the crew must not look at the burst area. The aircraft should not be flown through the atomic cloud.



Note

A SHALLOW CLIMB MAY BE MADE FROM A LOW ALTITUDE ATTACK FOR TERRAIN AVOIDANCE. A SHALLOW DIVE CAN BE MADE FROM A HIGH ALTITUDE ATTACK TO FURTHER AVOID RADIATION DOSAGE AFTER AN MB-1 LAUNCH.

ALTITUDE (FEET)	LEVEL TURN LOAD FACTOR	OPTIMUM HEADING CHANGE (DEGREES)
SL-8000	2 "G", CSL OR HORN	90°
8000-17000	3 "G", CSL OR HORN	90°
17000-52,500	4 "G", CSL OR HORN	90°

WARNING

TO PREVENT FLASH BLINDNESS, CONCENTRATE ON THE INSTRUMENT PANEL AFTER MB-1 LAUNCH.

Figure 2-5

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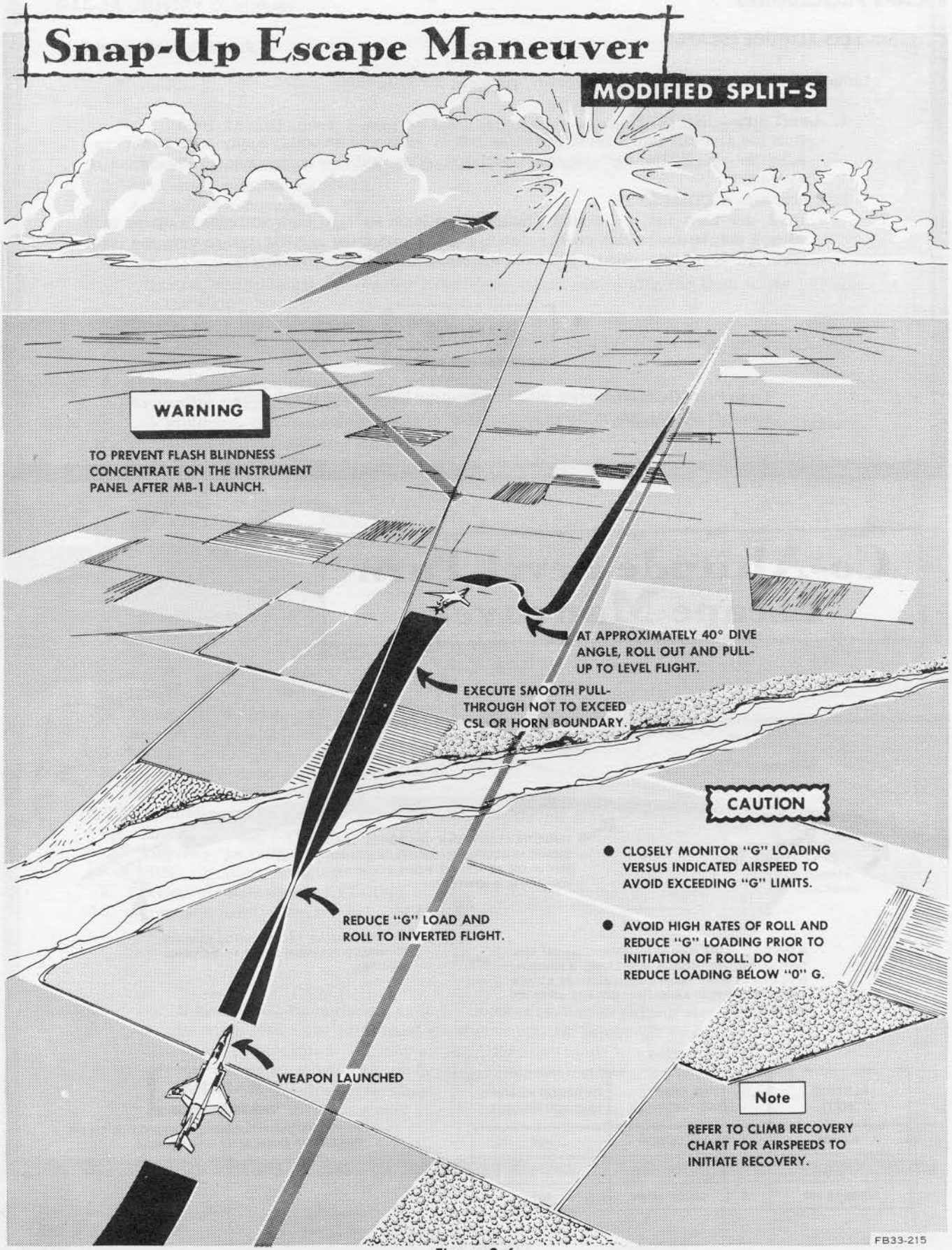
Snap-Up Escape Maneuver
MODIFIED SPLIT-S
WARNING
TO PREVENT FLASH BLINDNESS CONCENTRATE ON THE INSTRUMENT PANEL AFTER MB-1 LAUNCH.
AT APPROXIMATELY 40° DIVE ANGLE, ROLL OUT AND PULL-UP TO LEVEL FLIGHT.
EXECUTE SMOOTH PULL-THROUGH NOT TO EXCEED CSL OR HORN BOUNDARY.
CAUTION
● CLOSELY MONITOR "G" LOADING VERSUS INDICATED AIRSPEED TO AVOID EXCEEDING "G" LIMITS.
● AVOID HIGH RATES OF ROLL AND REDUCE "G" LOADING PRIOR TO INITIATION OF ROLL. DO NOT REDUCE LOADING BELOW "0" G.
REDUCE "G" LOAD AND ROLL TO INVERTED FLIGHT.
WEAPON LAUNCHED
Note
REFER TO CLIMB RECOVERY CHART FOR AIRSPEEDS TO INITIATE RECOVERY.
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Figure 2-6

MB-1 SNAP-UP ESCAPE

The snap-up attack is an attack used when the altitude of the target, or time factor involved, precludes the co-altitude attack. Therefore, these escape procedures consider only snap-up maneuvers.

Immediately upon launch of the MB-1 during a snap-up attack, perform the following:

1. G-loading - REDUCE
   Smoothly reduce "g" loading toward but not below zero (0) "g".
2. Half-roll - EXECUTE
   Roll the aircraft to inverted flight and begin a smooth pull through not to exceed the CSL or horn boundary.
3. Roll-out - EXECUTE
   Upon reaching approximately a 40° dive angle while inverted, execute roll-out and begin pull-up to level flight.

Note

During the dive, engine thrust may be reduced as desired as speed increases to permit a 3 "g" pull-through without encountering horn boundary.

SIMULATED WEAPON DELIVERY PROCEDURES

The following procedures cover practice missions for the MSR, WSEM, and simulated MB-1 attacks when GAR-2A missiles are aboard.

MSR TRAINING MISSION

Automatic Attack

All phases of the practice attack may be flown. These procedures begin just prior to lock-on.

1. MB-1 ejector racks lock switch - UNLOCKED
   a. Check left and right annunciators - READY
2. Armament selector knob - SPL-WPN-FCS
3. Armament availability annunciator - OK
4. Master arm switch - ARM
5. Rocket armed light - ON (Call)
   The RIO observes which rocket armed light is on and informs pilot. The left lamp should be on indicating the left MSR has received an arm signal. If the left MSR fails to arm or is not installed, the right MSR will arm.
6. Attack mode light - ON
7. Steering dot - CENTERED
   The pilot may engage the AFCS coupler to execute the automatic attack.
8. Armament trigger switch - SECOND DETENT
   Depress and hold trigger 2 upon shrinking of the steering circle at B time. The MSR will record computer time-of-flight. The door rotates at D time, and preparation voltages at D and E time are recorded.
9. Armament fire signal - CHECK
   Check the pilot's scope for a fire signal. The eject signal (E time) will be recorded. The armament door will rotate to the normal position.
10. Pull-out maneuver - EXECUTE

CONTINUED ON NEXT PAGE

MSR TRAINING MISSION CONTINUED

11. Armament selector knob - AS REQUIRED
    a. To select the right MSR for another pass - VIS-IDENT to SPL-WPN-FCS
    b. To reselect the left MSR - TRIG-SALVO to SPL-WPN-FCS
    The system is now ready to begin another attack.

Note

After the first pass, the system will automatically select the right MSR for four (4) additional passes by placing the armament selector to VIS-IDENT and then selecting SPL-WPN. To reselect the left MSR, place the armament selector knob to TRIG-SALVO, then select SPL-WPN. A total of eight (8) passes are available if two simulators are installed.

12. Mission conditions - RECORD (RIO)
    For FCS evaluation purposes, record the following items:
    a. Type of armament (MSR or WSEM)
    b. Target altitude
    c. Interceptor altitude
    d. Interceptor true airpseed
    e. Detection range and azimuth
    f. Lock-on range and azimuth
    g. Rate of overtake
    h. Fire range
    i. Fire signal (or abort)

Manual Attack

The crew may manually check the armament fire circuits by simulating the manual attack.

1. Radar master switch - ON (RIO)
   The radar master switch must be ON during the optical attack.
2. MB-1 ejector racks lock switch - UNLOCKED
   a. Ejector racks left and right annunciators - READY
3. Armament selector knob - SPL-WPN-MAN
4. Armament availability annunciator - OK
5. Master arm switch - ARM
6. Rocket armed light - ON (RIO)
   The RIO observes which rocket armed light is on and informs pilot.
7. Attack mode light - ON
8. Armament trigger switch - SECOND DETENT
   Depress and hold trigger 2. The MSR will record time of flight. The door rotates at D time and preparation signals are recorded. The MSR will record an eject signal. The armament door rotates to the normal position.
9. Pull-out maneuver - EXECUTE
10. Armament selector knob - AS REQUIRED
    a. To select the right MSR for another manual attack - VIS-IDENT to SPL-WPN-MAN
    b. To reselect the left MSR for another manual attack - TRIG-SALVO to SPL-WPN-MAN
    The system is ready to begin another attack.

WSEM TRAINING MISSION

Automatic Attack

1. Armament selector knob - IR (RIO)
2. Armament availability annunciator - OK
3. Master arm switch - ARM
4. Attack mode light - ON
5. Steering dot - CENTERED
   The pilot may engage the AFCS coupler to execute the automatic attack.

CONTINUED ON NEXT PAGE

WSEM TRAINING MISSION CONTINUED

6. Armament trigger switch - SECOND DETENT
   Depress and hold trigger 2 upon shrinking of the steering circle at B time. Missile preparations at D and E time are recorded. The launchers extend at D time.
7. Armament fire signal - CHECK
   Check the pilot's scope for the fire signal. Both simulators record fire signals in ripple fire sequence. The launchers remain extended.
8. Launcher hot light - ON
   The launcher hot light will flash until the launchers are retracted.
9. Pull-out maneuver - EXECUTE
10. Armament selector knob - VIS-IDENT
    Select VIS-IDENT to clear the system misfire circuit. The RIO may also depress the auto search button or the master arm switch may be placed to S A F E to clear the misfire circuit.
11. Push to retract button - DEPRESS
    Actuate the push to retract button to retract the launchers. The launcher hot light will go out.
12. Armament selector knob - TRIG-SALVO to VIS-IDENT
    The system is now ready for a second attack. Fly alternate passes from left to right and right to left to check proper operation of the ripple fire system.
13. Mission conditions - RECORD (RIO)
    For FCS evaluation purposes, record the following items:

    a. Type of armament (MSR or WSEM)
    b. Target altitude
    c. Interceptor altitude
    d. Interceptor true airspeed
    e. Detection range and azimuth
    f. Lock-on range and azimuth
    g. Rate of overtake
    h. Fire range
    i. Fire signal (or abort)

Manual Attack

The crew may manually check the optical firing circuits by completing the following:

1. Radar master switch - ON (RIO)
   The radar master switch must be ON for an optical firing.
2. Armament selector knob - IR (RIO)
3. Armament availability annunciator - OK
4. Master arm switch - ARM
5. Attack mode light - ON
6. Armament trigger switch - SECOND DETENT
   The launchers will extend when the arming sequence is completed and the fire signals received by the WSEM.
7. Launcher hot light - ON
   The launcher hot light will flash until the launchers are retracted.
8. Pull-out maneuver - EXECUTE
9. Armament selector knob - VIS-IDENT
   Select VIS-IDENT to clear the misfire circuit. The misfire circuit may also be cleared by placing the master arm switch to SAFE.
10. Push to retract button - DEPRESS
    Actuate the push to retract button, the launcher hot light will go out.
11. Armament selector knob - TRIG-SALVO to VIS-IDENT
    The system is ready for another pass by reselecting the desired function.

SIMULATED MB-1 ATTACK (WITH GAR-2A MISSILES ABOARD)

With live GAR-2A missiles aboard, simulated MB-1 attacks may be flown ONLY with MB-1 dummy (MB-1T) or ballast rounds aboard.

1. MB-1 ejector racks lock switch - UNLOCKED
   a. Check left and right annunciators - READY
2. Armament selector knob - SPL-WPN-FCS
3. Armament availability annunciator - CHECK
   a. MB-1 dummy - OK
   b. Ballast round - NO
4. Master arm switch - SAFE
5. Attack mode light - OFF

Note

If the attack mode light illuminates at any time, discontinue the attack and place the ejector racks lock switch in the LOCKED position.

6. Rocket arm lights - OFF (Call)
   RIO checks that both lights are out and informs pilot.
7. Steering dot - CENTERED
8. Not ready light - ON AT B TIME
9. Armament trigger - SECOND DETENT
   Depress and hold trigger 2 upon shrinking of the steering circle at B time. Computer D and E signals are generated. The armament door will not rotate.
10. Armament fire signal - CHECK
11. Pull-out maneuver - EXECUTE

Note

Simulated missile attacks will not be attempted by F-101B aircrews when GAR-2A missiles are loaded on the airplane.

PRACTICE AIR START

WARNING

Before making a practice air start depress the emergency ignition button and check for a buzzing sound in the headset. If no buzzing sound is detected, do not attempt a practice air start.

This procedure accomplishes air starts on the right engine, however, practice air starts may be made on either. To make a practice air start:

1. Right throttle - IDLE
   Allow engine rpm to stabilize at idle.
2. Left throttle - LEVEL FLIGHT THRUST
   Advance left throttle to the thrust setting required to maintain level flight.
3. Right throttle - CLS'D
4. Depress emergency ignition button while advancing right throttle to IDLE.
5. Engine rpm and exhaust temperature - CHECK
6. If no start, engine fuel control switch to EMERG.
7. Repeat previous steps.

DESCENT

Note

Circumstances may arise which require a fast descent from high altitude. This may be accomplished by increasing the dive angle until limit airspeed and/or Mach number is reached.

CAUTION

Prior to rapid descent, windshield and canopy surfaces should have been preheated to prevent formation of frost or fog.

1. IFF - CHECKED
   Within one hour prior to estimated time of landing, a positive IFF check should be made with an Air Traffic Control Facility.
2. Altimeter - SET STATION PRESSURE
   Immediately prior to descending through flight level 240, reset altimeter to current station pressure or as required to compensate for instrument error.
3. Defrost switches - NORM

Note

The windshield defrosting and defogging system should be operated in the NORM position at all times. In this position, the system will maintain sufficient inside surface temperatures for the transparent areas to preclude the formation of frost or fog.

4. Icing ignition - AS REQUIRED
   When flight through icing conditions is encountered, place the icing ignition switch ON. However, as soon as icing ignition is not required the icing ignition switch should be placed in the OFF position to preserve igniter plug life.

BEFORE LANDING

Prior to Entering the Traffic Pattern

1. Zero delay lanyard - HOOKED
   See figure 3-5 for zero delay lanyard engagement requirements.
2. Fuel quantity - CHECK AND ON NO. 2
3. Master arm switch - SAFE
4. Armament selector knob - VIS-IDENT
5. MB-1 ejector racks lock switch - LOCKED
   Check the MB-1 ejector racks lock switch locked guard CLOSED.
6. Hydraulic pressure - WITHIN LIMITS
7. Pusher switch - OFF
   The pusher switch should be placed in the OFF position while descending through 5000 feet terrain clearance.
8. AFCS engage switch - STAND-BY
   The AFCS engage switch should be placed in the STAND-BY position prior to reaching 500 feet terrain clearance.
9. Safety belt and shoulder harness - SECURE

In the Pattern—

10. Break - 350 KNOTS IAS
11. Throttles - 80% RPM MINIMUM
12. Speed brakes - OPEN
13. At 250 knots IAS, speed brakes - CLOSED
14. Landing gear - DOWN
    Manually check that the landing gear handle is fully down.

Note

The landing gear can be down and locked without the control handle being in the full DOWN position. In this position the handle can be inadvertently moved to the UP position by vibration or acceleration forces, causing an inadvertent landing gear retraction.

CAUTION

Do not lower landing gear in turns or pull-ups as the "g's" encountered may damage the landing gear mechanism.

CONTINUED ON NEXT PAGE

BEFORE LANDING CONTINUED

15. Flaps - EXTEND
16. Turn base 2-3 miles out.
17. Base leg airspeed - 220-230 KNOTS IAS
18. Final - 2-3 MILES, 800 FEET, 2-1/2° -3° GLIDE SLOPE
19. Speed brakes - OPEN
20. Final approach speed - AS REQUIRED

LANDING

Note

The procedures set forth produce the results shown in the Landing Distance Charts in Part 8 of Appendix I. Refer to figure 2-5. Approach speed and touchdown speed quoted are for a clean airplane with 3000 pounds of fuel remaining. These speeds must be increased with heavier gross weight landings. Refer to landing Speeds Chart, Part 8 of Appendix I.

1. After flare-out, throttles - IDLE

WARNING

Do not attempt to flare or retard throttle prior to crossing the end of the runway because the airplane decelerates rapidly with throttles retarded to IDLE.

2. Drag chute - DEPLOY
3. Lower nose gear - 120 KNOTS IAS
4. Nose gear steering - AS REQUIRED
5. Employ normal braking technique.

WARNING

Brakes should be used with extreme caution above 110 knots because of the danger of blowing a tire. Above 110 knots, aerodynamic braking is much more effective.

Note

- Normally very light braking is required with the drag chute deployed. Some braking may be required for slowing the airplane to turn-off speeds. Even though the anti-skid system is operative, ease off the brakes below 20 knots to prevent landing gear chatter.
- This is not an automatic braking system and therefore, maximum brake pedal pressure should not be applied at touchdown and maintained throughout the landing roll. A normal braking technique should be used.

NORMAL LANDING

For a normal landing, fly the pattern as illustrated in figure 2-7 and observe airspeed limitations as outlined in Section V. Since steep approaches must be avoided to preclude an excessive rate of sink during flare-out a straight-in final approach of approximately two to three miles is recommended. Steeper final approaches are not recommended because there is a marked increase in energy required to flare the airplane from steeper finals, meaning higher than normal approach speeds plus a greater chance for error in pilot's judgement during rapid flare-outs from steep approaches. If speeds are dropped below those recom-

mended the airplane will develop a given rate of sink because the flow across the wings is not sufficient to produce the necessary lift to sustain the gross weight of the airplane along the desired flight path. This situation in a high gross weight airplane is more critical than a steep final approach since here too, you need energy to flare the airplane. In this low speed case, there is not even enough energy to keep if flying along the desired glide path, much less flare it out. The corrective action is, of course, thrust to regain your airspeed. More important, the preventive action is to hold recommended airspeeds. Maintaining the proper final approach speed and a 2-1/2°-3° glide slope angle provides a mild rate of descent (approximately 900 fpm) and will permit touchdown within the first 1000 feet of the runway. Do not attempt to flare or "chop" throttles prior to crossing the end of the runway as the airplane decelerates rapidly with throttles retarded to IDLE. After flare-out, retard throttles to IDLE, fly the airplane onto the runway and make a normal touchdown. Immediately after touchdown, deploy the drag chute. After the drag chute is deployed, raise the nose to a pitch attitude of approximately +10° to take advantage of the high aerodynamic drag. Do not exceed a pitch attitude of +13° as the tail pipes may scrape the runway. Above 110 knots, aerodynamic braking is much more effective and there is less chance of blowing a tire. At 120 knots, lower the nose to the runway and employ normal braking technique. As soon as the nose gear is on the runway, use nose gear steering for directional control. Plan to use the full length of the runway and use the brakes as necessary to stop on remaining runway. Normally very light braking will be required with the drag chute deployed. If maximum braking is required, smoothly apply brake pressure to a point where anti-skid cycling is maintained. Ease off the brakes below 20 knots to prevent landing gear chatter.

CROSSWIND LANDING

Carefully compensate for crosswind in the traffic pattern to guard against undershooting or overshooting the final turn. On final approach, use wing-low and crab combination to maintain course. Maintain normal approach speed aligning the airplane with the runway just prior to flare-out and landing with a wing-low crosswind correction. After touchdown, deploy the drag chute and maintain a normal nose-high attitude (approximately +10°) to take advantage of the high aerodynamic drag. Utilize rudder steering for directional control. Well before rudder effectiveness is lost, or at approximately 120 knots IAS (whichever occurs first), lower the nose gear to the runway and engage nose gear steering to maintain directional control. At lower airspeed during the landing roll, the ailerons may assist in directional control.

CAUTION

- The nose gear steering system becomes progressively more sensitive as speeds are increased above approximately 120 knots.
- Caution should be used in engaging nose gear steering with rudder deflected, as swerving of the airplane will result.
- The drag chute should be retained throughout the landing roll, however, if it is obvious that directional control cannot be maintained due to an extreme weather-vane effect, the drag chute should be jettisoned.

HEAVY GROSS WEIGHT LANDING

As landing gross weight increases, the landing pattern should be expanded and approach and touchdown speed should be increased accordingly. Follow procedures outlined in Typical Landing Pattern, figure 2-7, adding 5 knots to quoted airspeeds for each 1500 pounds over normal landing gross weight, i.e., a clean airplane with 6000 pounds of fuel remaining, final approach speed would be 185 knots IAS with a touchdown speed of approximately 170 knots IAS.

MINIMUM RUN LANDING

A minimum run landing is the same as a normal landing.

LANDING ON SLIPPERY RUNWAY

Wet or Icy Runway Landing

The technique for landing on wet or icy runways is essentially the same as that for a normal landing. Maintain airplane alignment carefully throughout final approach, touchdown and landing roll. Use rudder for directional control prior to nose down speed, and nose gear steering thereafter. If extremely slippery conditions exist, and optimum braking efficiency must be achieved; hold published airspeed on final, slowly reduce power so as to touchdown as near the approach end as possible. Deploy drag chute and use maximum aerodynamic braking. After the nose is lowered, smoothly apply brakes to the point at which anti-skid cycles. As the airplane decelerates, tire friction will increase, and brake pressure should be increased to continue braking to the point of anti-skid cycling.

Note

Under extremely slippery runway conditions braking efficiency will be very low when braking at high airspeeds. Initially, little if any deceleration will be noted as a result of wheel braking. As the aircraft slows the effect of braking and anti-skid cycling will become apparent. Do not interpret the initial lack of braking as a malfunctioning system. Turning anti-skid off under these conditions will eliminate the only system that can accurately sense a skid condition.

Landing Pattern

TYPICAL

NORMAL LANDING GROSS WEIGHT–34,500 LB

3000 LBS FUEL REMAINING AND PRIMARY ARMAMENT.

Note

REFER TO LANDING DISTANCE CHARTS IN APPENDIX I FOR FINAL APPROACH AND TOUCH DOWN SPEEDS AT OTHER GROSS WEIGHTS.

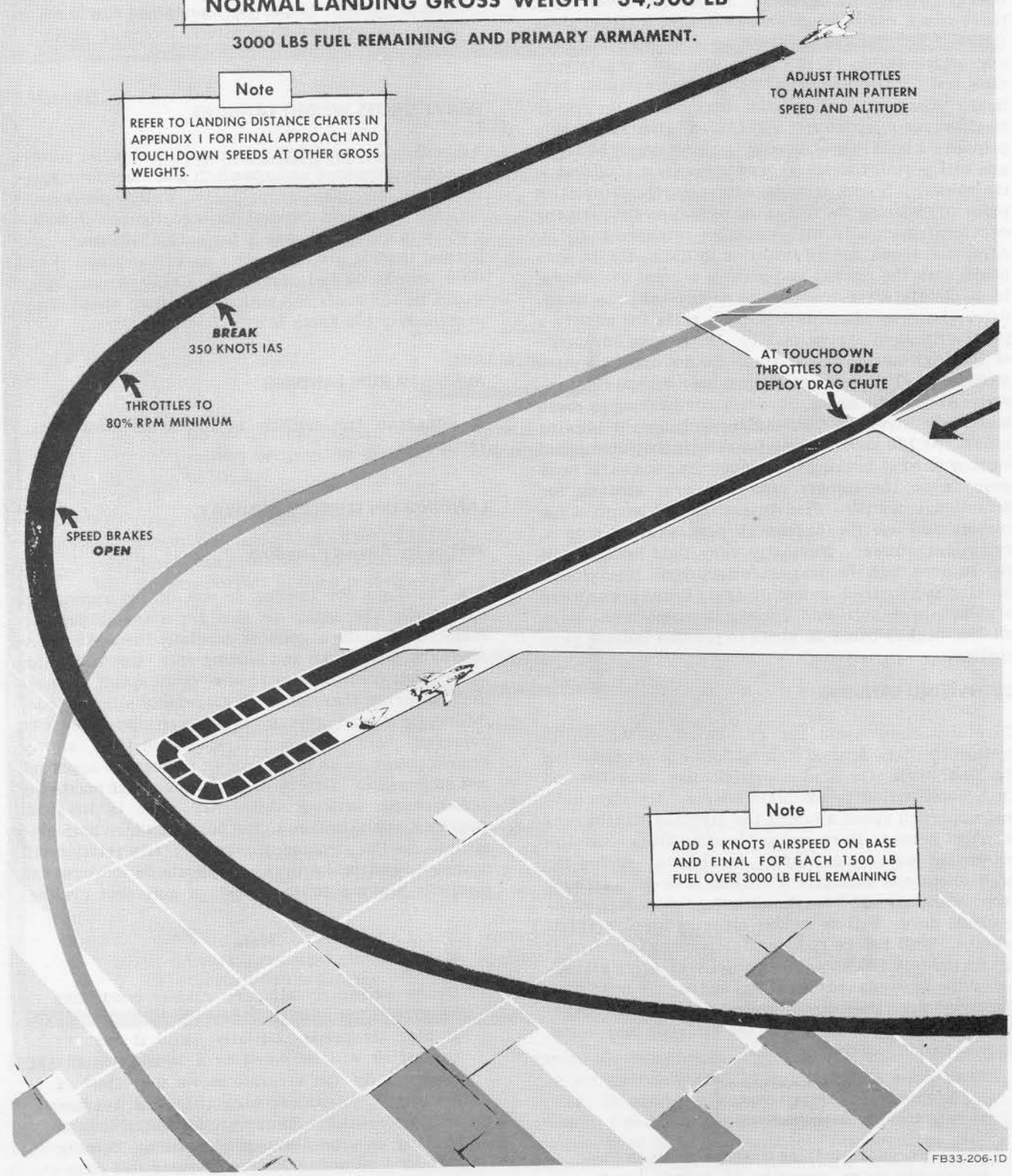
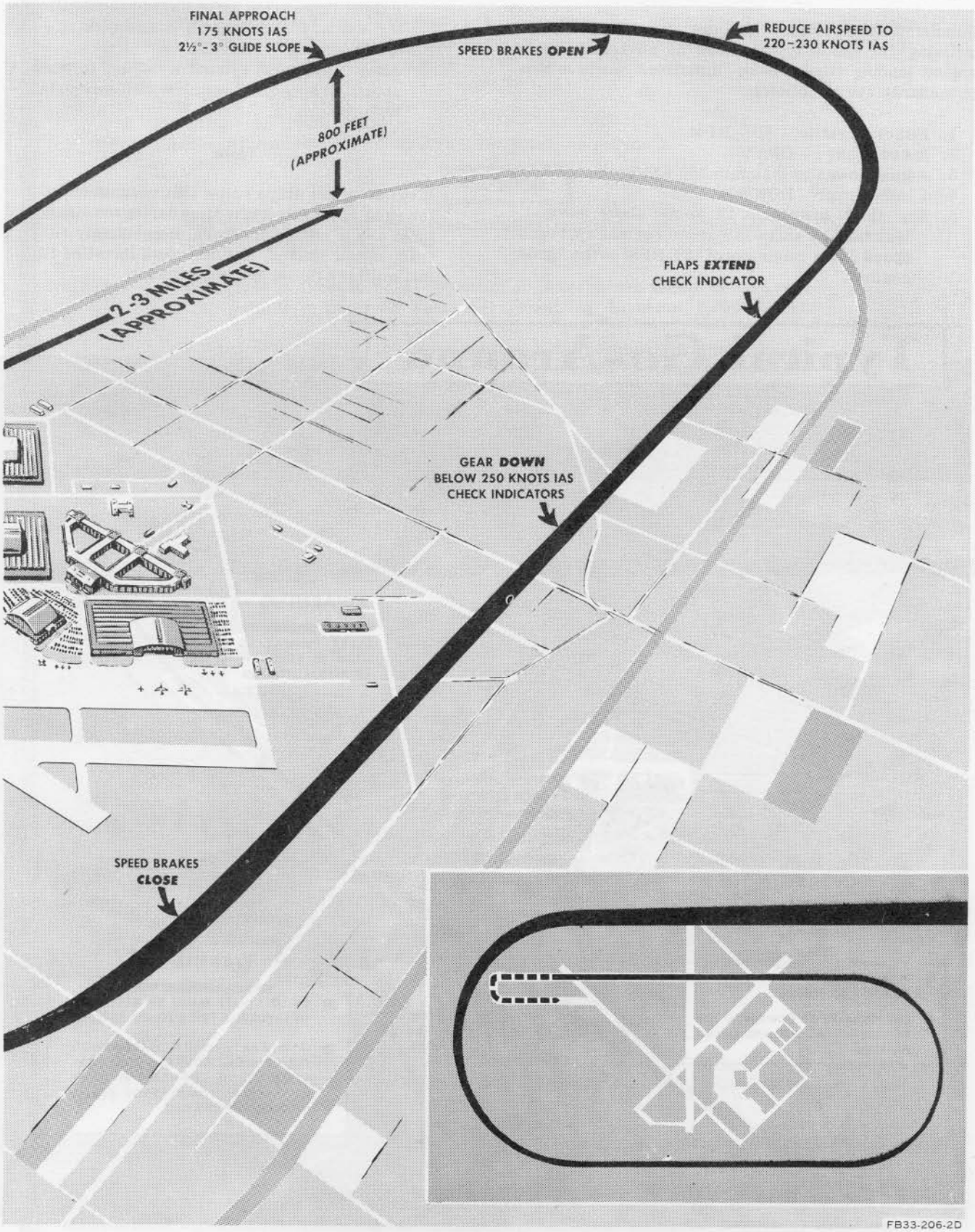


Figure 2-7


FINAL APPROACH
175 KNOTS IAS
2½°-3° GLIDE SLOPE
SPEED BRAKES OPEN
REDUCE AIRSPEED TO
220-230 KNOTS IAS
800 FEET
(APPROXIMATE)
2-3 MILES
(APPROXIMATE)
FLAPS EXTEND
CHECK INDICATOR
GEAR DOWN
BELOW 250 KNOTS IAS
CHECK INDICATORS
SPEED BRAKES
CLOSE
FB33-206-2D

SIMULATED SINGLE ENGINE LANDING

Simulated single engine landings should be practiced utilizing the same type pattern as an actual single engine landing (figure 3-2). Simulated single engine procedures are as follows:

1. Either throttle - 80% RPM
2. Speed brakes - OPEN
3. Adjust power to maintain 250 KIAS.
4. Landing gear - DOWN
5. Fly final approach 15 knots above normal. Maintain 15 knots IAS above normal approach speed and a minimum of 85% RPM on the "good engine".
6. Flaps - EXTEND (landing assured)
   Extend flaps prior to the flare to avoid ballooning and only when landing is assured.
7. Normal landing - COMPLETE
   After flaps are extended, adjust to normal approach speed and continue with normal landing procedures.

Note

If the airspeed drops below that recommended for final approach at any time during the simulated single engine approach, immediately retract speed brakes, advance both throttles to full military thrust and go around.

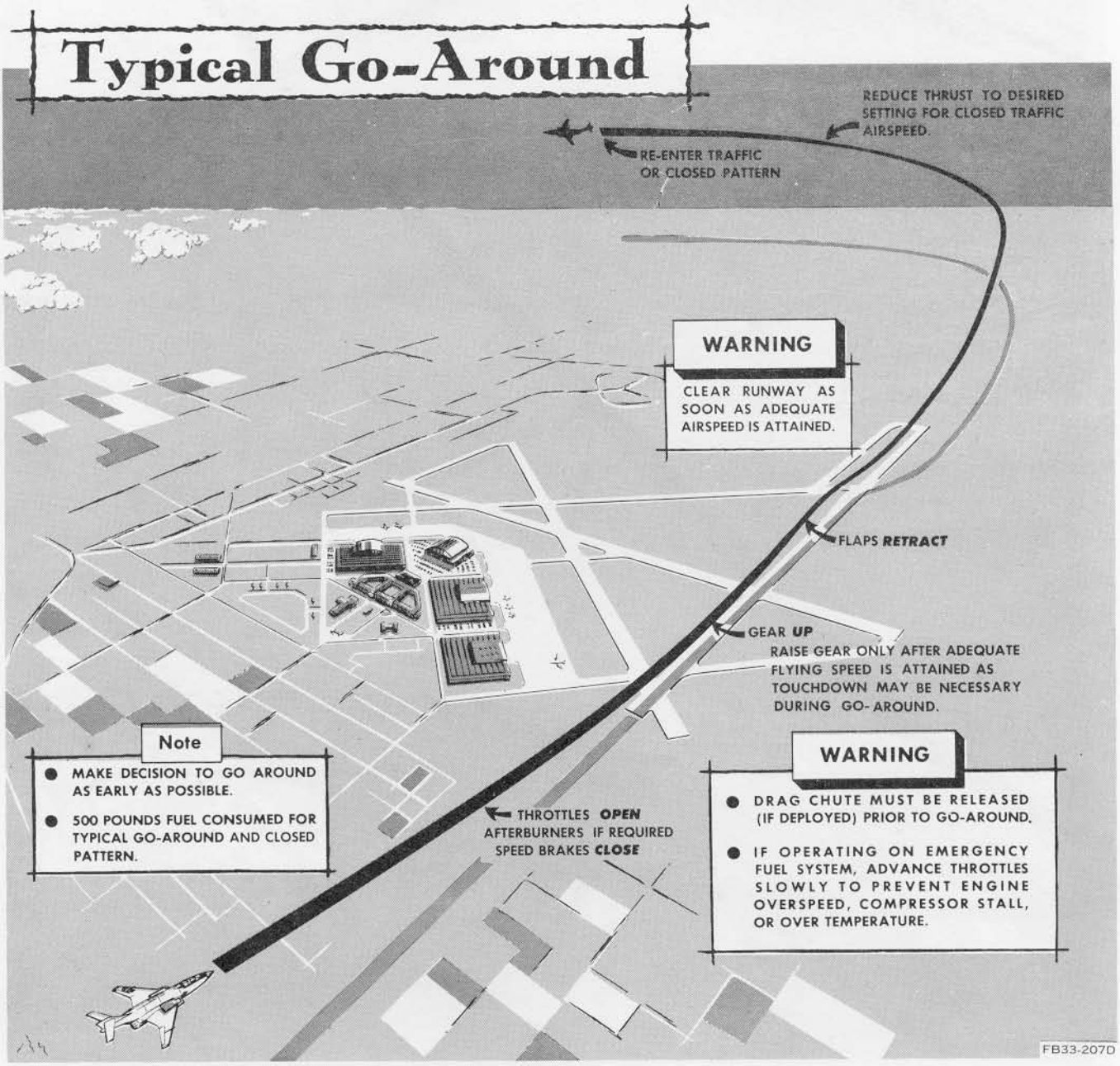


Figure 2-8

GO-AROUND

The decision to go-around should be made as early as possible. See figure 2-8. Approximately 500 pounds of fuel is consumed during a typical go-around and closed pattern. If decision is made to go-around, proceed as follows:

1. Drag chute - JETTISON (if deployed)
2. Throttles - AS REQUIRED
   Advance throttles to OPEN or AFTERBURNER as required.

CAUTION

- If decision is made to go-around after touchdown, do not exceed normal take-off attitude.
- Because of excessive fuel consumption, afterburner should be used only if definitely required when fuel remaining is below 3,000 pounds.
- Afterburner can be used when operating on emergency fuel control system; however, exercise caution during throttle movement to prevent compressor stall, engine overspeed and overtemperature.

3. Speed brake switch - CLOSE
   Simultaneously close speed brakes while advancing throttles.
4. Landing gear - UP
   Retract landing gear when definitely airborne and rate of climb is established.
5. Flaps - RETRACT
6. Clear runway as soon as practicable.

AFTER LANDING

After completing the landing roll, turn off the active runway and perform the following:

1. Flaps - RETRACT
2. Speed brakes - CLOSE
3. Ejection seat safety pin - INSTALL
4. Cockpit pressurization - RAM & DUMP

CAUTION

Attempting to open the canopy while the cockpit is pressurized may cause damage or loss of canopy. Prior to opening the canopy, check cabin pressure altimeter to insure that cockpit is fully depressurized.

Note

After clearing active runway, a single engine may be shut down for taxiing. Refer to Engine Shutdown Procedure, this section. Single engine taxiing requires no special technique.

CAUTION

- If there have been indications of hydraulic system malfunction, DO NOT attempt an engine shutdown until landing gear ground locks have been installed and wheels are chocked.
- If canopy is open during taxiing, do not exceed canopy open structural limit speed.
- Do not make sharp turns taxiing with the drag chute deployed to prevent chute from collapsing and subsequently damaging the chute.

CONTINUED ON NEXT PAGE

AFTER LANDING CONTINUED

5. All unessential electrical equipment - OFF
6. Drag chute - RELEASE
   The drag chute may be released at appropriate area.

CAUTION

Taxiing at high throttle settings with the drag chute deployed will lead to reduced service life of the drag chute. The pilot must avoid taxiing over drag chutes previously jettisoned by other airplanes so that the chute is not drawn into air intakes causing engine damage, or wrapped around the wheels. The drag chute should be jettisoned before taxiing downwind in winds exceeding 15 to 20 knots because of the possibility of chute collapsing and burning up by contact on hot areas of the exhaust nozzle.

ENGINE SHUTDOWN

Note

Either engine may be shutdown first, however, this procedure establishes the left engine (No. 1) first, to permit checking the right engine hydraulic system for proper operation.

1. Brakes - APPLY
2. Throttles - IDLE

Note

- Normally the engines will be sufficiently cooled to permit immediate shutdown. However, in instances where the engines have been operated above 85% rpm for periods exceeding one minute during the last five minutes prior to shutdown, it is recommended that they be operated below 85% rpm for 5 minutes in order to prevent seizure of the rotors.

- After the idle cooling period, operate the engine at 70% rpm for 30 seconds immediately before shutdown to insure complete oil scavenge.

3. Wheels - CHOCKED
   Get signal from ground crew that wheels are chocked before releasing brakes.
4. Left throttle - CLS'D
5. Hydraulic pressure - WITHIN LIMITS
6. Landing gear ground locks and nose gear safety pin - INSTALL (After shutting down one engine)
7. Right throttle - CLS'D
8. Engine master switches - OFF

Note

- On airplanes equipped with dual controls, engine master switches in rear cockpit remain safetied to ON.

- Check that engine decelerates freely and listen for excessive noises during shutdown.

9. Battery switch - OFF
10. Electrical switches (except generators) - OFF

BEFORE LEAVING AIRPLANE

1. Ejection seat safety pin - INSTALLED

CAUTION

- Insure that all of the pilot's and RIO's equipment and straps are free of cockpit controls and seat handgrips so that no damage is incurred, or that the handgrips are not accidentally pulled up when leaving the cockpit.
- Make sure automatic-opening parachute arming key does not foul when leaving cockpit to prevent chute from inadvertently opening.

2. Form 781 - COMPLETE

CAUTION

In addition to established requirements for reporting any system defects, unusual and excessive operations, the crew will also make entries in Form 781 to indicate when any limits in the Flight Manual have been exceeded.

Note

To prevent tire failures resulting from high brake heat generated during taxiing, take-off and landing, the minimum time between flights (turn around time) is one hour in the (40)(45) airplanes.

STRANGE FIELD PROCEDURES

Note

- These procedures should be utilized for servicing the airplane when applicable servicing instructions are not available.
- Airplane preflight and postflight inspections will be performed in accordance with T.O. 1F-101B-6-PR, Preflight Inspection Work cards, and T.O. 1F-101B-6-PO, Postflight Inspection Work cards.
- Aircrew should insure that the gear downlocks, external tank safety pins and tail hook pin are installed.

WARNING

Severe injury to ground personnel may result from inadvertent actuation of the tail hook switch while the tail hook safety pin is being installed.

ENGINE OIL SYSTEM

CAUTION

The engine oil system must be serviced within 30 minutes after engine shutdown.

Servicing Instructions

1. Open engine oil servicing access door 74 L/R.
2. Connect oil servicing unit and overflow hose to the oil tank fill and overflow fittings.
3. Pump oil through the fill hose until oil drains through the overflow hose.

Note

When oil flows from the overflow hose, the oil tank is full.

4. Allow the overflow hose to drain until the flow is reduced to a dribble.
5. Disconnect the servicing unit and overflow hose from the oil tank fill and overflow fittings and replace the "Fill" and "Overflow" line caps.
6. Close engine oil servicing access doors 74 L/R.

FUEL SYSTEM

Fuel servicing terminology:

Recommended - A fuel which has been proven to operate satisfactorily under all conditions.
Alternate - A fuel which can be used continuously with a possible loss of efficiency. The use of this fuel might result in increased maintenance or overhaul costs. Limitations of a significant nature, such as reduced rate of climb, altitude, range, etc., properly place a fuel in the alternate category rather than in the emergency category.
Emergency - A fuel which may cause significant damage to the engine or other systems and therefore, its use is limited to a one time flight.

Note

All tanks can be filled through the pressure refueling port. However, filling fuselage cell number 5 without armament or ballast installed will create an aft center of gravity condition. A cutoff switch is located within the pressure refueling access door to prevent fuel from entering fuselage cell number 5.

Single Point Refueling

Note

A battery must be installed in the airplane or an external power unit available.

1. Ground the airplane.
2. Ground the servicing unit to the airplane.
3. Open access door 208 and remove the safety cap from the pressure refueling receptacle.
4. Ground the refueling nozzle to the airplane.
5. Connect the refueling nozzle to the pressure adapter and commence refueling.

CAUTION

Fuel pressures should not exceed 60 psi, at 600 gpm. Higher pressures may damage lines or fittings.

6. When the fuel flow stops, the tanks are full. Close and remove the refueling nozzle.
7. Open defueling door 24.
8. Replace the pressure refueling safety cap and close access door 208.

HYDRAULIC SYSTEM RESERVOIRS

CAUTION

To avoid overfilling of either hydraulic system, the speed brakes must be CLOSED, the landing gear DOWN, flaps UP, refuel probe RETRACTED, emergency brake accumulator and system accumulators CHARGED, and rotary door in its NORMAL position. Failure to observe these precautions may result in the rupture of one or both hydraulic reservoirs.

1. Cycle the flight controls to relieve the airplane systems and accumulators of fluid pressure.
2. Open access door 212 L/R and depress button on reservoir filler cap to relieve reservoir of pressure. Remove filler cap.
3. Connect hydraulic power cart, type MJ-2 or MK-3 or equivalent, to filler port and fill reservoir to "full" line on reservoir sight gage.

Note

Direct "pouring-in" of hydraulic fluid invites atmospheric fluid contamination and should be used only as an emergency means of servicing the hydraulic reservoirs.

4. Disconnect the hydraulic power cart and replace the hydraulic reservoir filler cap.

HYDRAULIC SYSTEM ACCUMULATORS

Checking Air Charge

1. Cycle flight controls to relieve both systems of residual pressures.
2. Open small door in upper aft corner of access door 212 L/R.
3. Note air pressure reading on accumulator gauges. Maintain pressure for ambient temperature as follows:

100°F	1280 ± 50 PSI
70°F	1200 ± 50 PSI
40°F	1130 ± 50 PSI
0°F	1025 ± 50 PSI
-40°F	920 ± 50 PSI

Charging

1. Cycle flight controls to relieve both systems of residual pressures.
2. Open access door 212 L/R.
3. Remove valve cap from air valve and loosen 5/8 inch hex nut a maximum of two turns.
4. Charge accumulator with clean dry air or nitrogen.
5. Tighten swivel nut and cap valve.

BATTERY

The battery is located in the primary hydraulic compartment access door 212L. If electrolyte is low, add clear drinkable water to each cell as required. Do not exceed 3/8 inch above battery plates.

Battery Specification

Authorized - AN3151-2, 24 volts, 24 ampere hour.

LANDING GEAR TIRES

1. Obtain the following equipment or its equivalent:
   Gage Kit, Tire 0 to 400 psi, Stock No. 4910-506-8882; and Source of Clean Dry Air or Nitrogen (at least 300 psi).
2. Nose gear tires will be inflated to 175 psi for all gross weight configurations.
3. Main gear tires will be inflated according to take-off gross weight as follows:

Main gear tires 31 x 11.50 - 16 -
Up to 41,000 - 215 psi
41,001 to 45,600 - 250 psi
45,601 to 48,500 - 270 psi
48,501 to 51,500 - 285 psi
51,501 and up - 295 psi

Main gear tires 32 x 8.8:
Up to 41,000 - 235 psi
41,001 to 45,600 - 255 psi
45,601 to 48,500 - 275 psi
48,501 and Up - 290 psi

Tire Specifications

Nose gear - Extra high pressure, Type VII, 12 ply rating, nylon casing.

Main gear - 31 x 11.50 - 16, high speed, 22 ply, nylon casing; or
32 x 8.8, high speed, 22 ply, nylon casing.

Do not take off if accumulated tire points will be exceeded on landing. Point system are as follows:

(10)(15) AIRPLANES (32 x 8.8 TIRES)

GROSS WEIGHT AT TAKE-OFF	NO. OF POINTS
43,000 pounds or less	2
43,001 to 48,000 pounds	4
48,001 to 49,500 pounds	6
49,501 to 51,000 pounds	12
	Maximum 36

(50) THRU (120) AIRPLANES (31 x 11.5-16 TIRES)

Points Ramp temperature 95° or higher	Points Ramp temperature 94° or lower	Reason
4	2	Each take-off up to 49,500 pounds.
6	4	Each take-off from 49,501 pounds to maximum weights.
10	10	No drag chute landing with stopping or turn-off more than 9,000 feet.
20	20	No drag chute landing with light fuel load and turn-off less than 9,000 feet using minimum braking application. Maximum use of brakes will result in accumulation of 40 points.

CONTINUED ON NEXT PAGE

LANDING GEAR TIRES CONTINUED

Points Ramp temperature 95° or higher	Points Ramp temperature 94° or lower	Reason
40	40	Aborted take-off with drag chute 140 Knot Indicated Airspeed (KIAS) or more.
40	40	Aborted take-off without drag chute 100 KIAS or more.

A total of 36 points will be allowed for each tire in the 40 45 airplanes, and 40 points in the 50 THRU 120 airplanes. Upon reaching maximum points, the tire will be replaced. In no case will a take-off be executed which will make the total number of points exceed quoted maximum.

ENGINE STARTER AIR BOTTLES

1. To read engine starter air bottles gauges, open access door 67R 45 THRU 50 airplanes, or 257 55 THRU 120 airplanes.
2. Gauge readings for airplanes with pneumatic and STU-7A combustion starters should not be more than 3000 psi or less than minimum air pressure specified in the following table:

   100°F - 2970 psi
   70°F - 2810 psi
   40°F - 2650 psi
   20°F - 2540 psi
   0°F - 2440 psi
   -20°F - 2340 psi
   -40°F - 2225 psi
3. Remove valve cap and loosen 5/8 inch hex nut a maximum of two turns.
4. Charge bottle using clean dry air or nitrogen.
5. Tighten hex nut and cap valve.

STARTING UNIT

1. Use MC-11 Starting Unit, or a modified MA-1 with a high flow Besseler connector.
2. In absence of the above use any suitable source of clean, dry air at 3000 psi.

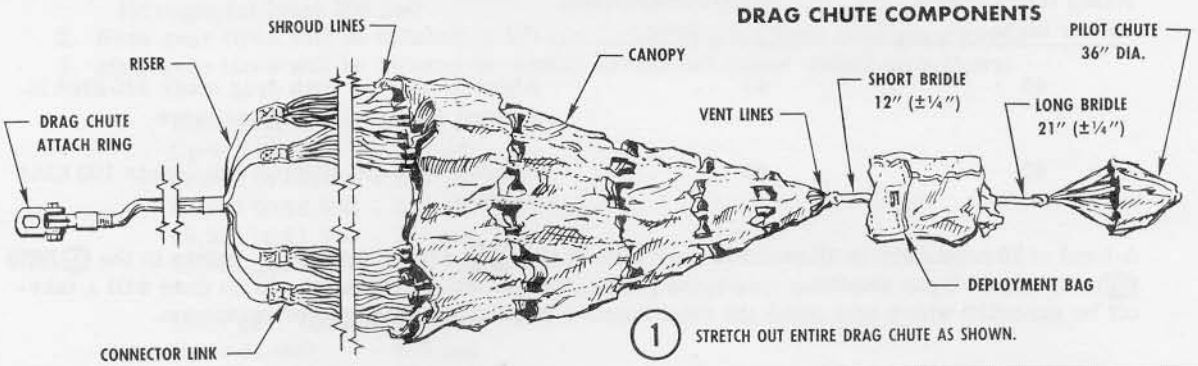
OXYGEN SYSTEM

Servicing connection for the oxygen system is in access door 205 40 THRU 75 airplanes, and access door 253 80 THRU 120 airplanes. Make sure the access door is securely closed after servicing.

WARNING

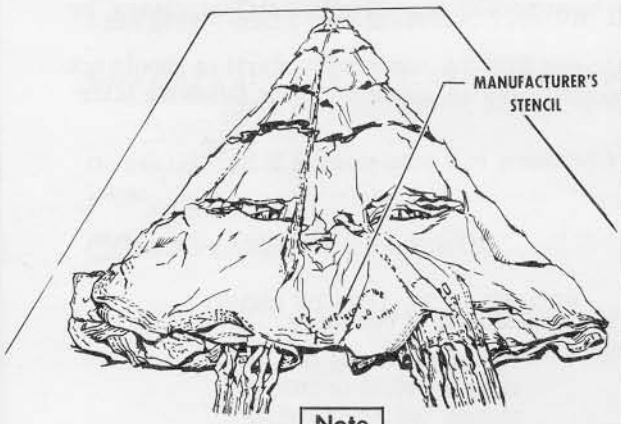
The oxygen system should be serviced by authorized personnel only.

Drag Chute Packing



(1) STRETCH OUT ENTIRE DRAG CHUTE AS SHOWN.

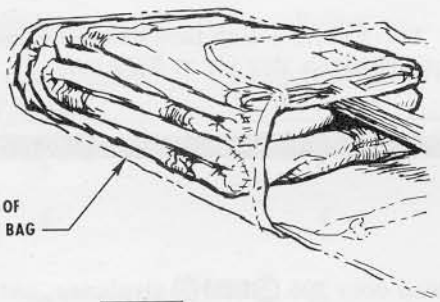
(2) SPREAD CANOPY WITH MANUFACTURER'S STENCIL UP. INDIVIDUALLY STRAIGHTEN SHROUD LINES, AND FOLD THE CORRESPONDING GORES AS SHOWN.



Note

MAKE CERTAIN THE SHROUD LINES ARE NOT TWISTED OR CROSSED.

(3) NEATLY FOLD LEFT AND RIGHT-HAND GORES INBOARD SO THAT CANOPY WILL BE APPROXIMATELY THE WIDTH OF DEPLOYMENT BAG, THEN PLACE WEIGHT i.e. WHEEL CHOCK ON CANOPY TO HOLD IT IN PLACE.



Note

(4) THE FOLLOWING STEPS DEAL WITH FOLDING CANOPY INTO DEPLOYMENT BAG. ILLUSTRATION SHOWS CANOPY PROPERLY FOLDED IN BAG. NOTE THAT EACH NEW FOLD IS FOLDED NEATLY OVER PREVIOUS FOLD. ALWAYS STRIVE TO FOLD CANOPY AS NEATLY AND SMOOTHLY AS POSSIBLE, TO INSURE MINIMUM THICKNESS AND VOLUME.

(5) PULL DEPLOYMENT BAG DOWN OVER CANOPY AND FOLD CANOPY INTO DEPLOYMENT BAG AS SHOWN IN STEP 4.

Note

IN FOLDING CANOPY INTO DEPLOYMENT BAG, ALWAYS STRIVE TO FILL THE CORNERS OF THE BAG WITH EACH FOLD.

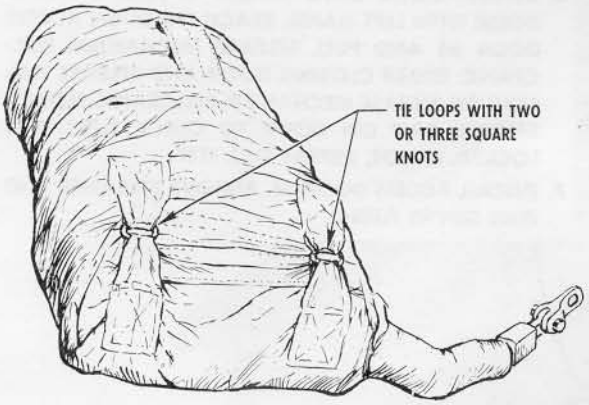
FB33-213-1

Figure 2-9

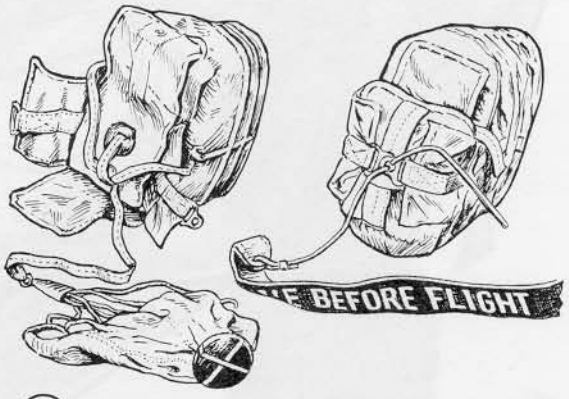
(6) WHEN FOLDING IS COMPLETE, PEEL BACK BAG TO EDGE OF FOLDED CHUTE COMPARTMENT AND PULL OUT FLAPS. STARTING FROM CENTER TO LEFT SIDE OF DEPLOYMENT BAG, MAKE TWO LOOPS WITH SHROUD LINES. FOLD LOWER FLAP UP AND UPPER FLAP DOWN OVER LOWER FLAP. PULL LOOPS OF LOWER FLAP THROUGH OPENINGS IN UPPER FLAP.

(7) WITH A HOOK OR STRONG CORD (HOOK PREFERRED) LOOP RISERS THROUGH LOOPS IN LOWER FLAP OF CANOPY COMPARTMENT AND PROCEED ALTERNATELY THROUGH LEFT AND RIGHT FLAP HOOPS. PROCEED UNTIL SHROUD LINES AND RISERS ARE STOWED ON TRAY AS SHOWN.

(8) PULL DEPLOYMENT BAG OVER SHROUD LINES AND PULL OUT FLAP. GRASP STOWAGE TRAY AND ACCORDION FOLD BACK TO CHUTE COMPARTMENT. DO NOT ROLL TRAY INTO DEPLOYMENT BAG.



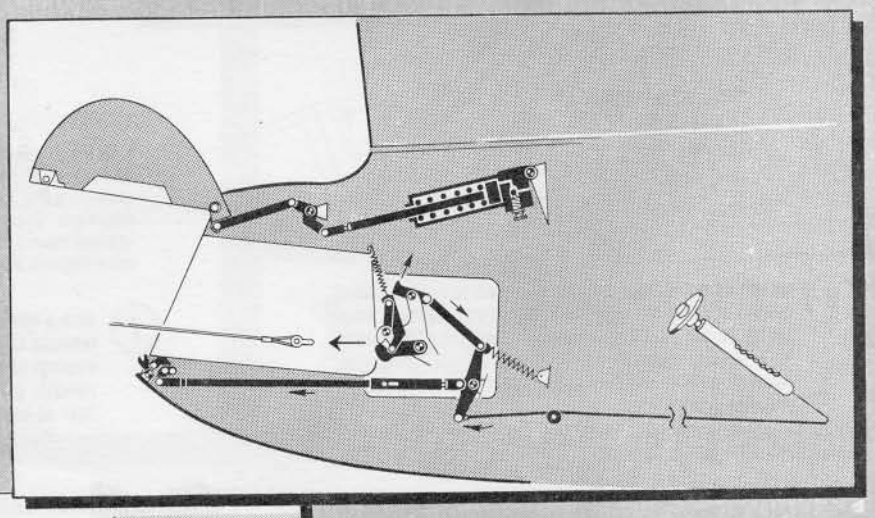
(9) FOLD SIDE FLAPS IN. LOWER UPPER FLAP AND RAISE LOWER FLAP. TIE DEPLOYMENT BAG LOOPS TOGETHER WITH 15 LB. TEST CORD.

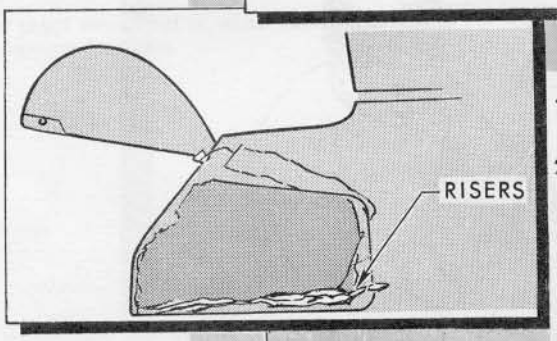


(10) INSTALL PILOT CHUTE BY COMPRESSING THE SPRING AND FOLDING OVER THE END FLAPS. THE PILOT CHUTE CAN BE HELD IN PLACE BY INSTALLING STREAMERED STEEL WIRE OR A SIMILAR PIECE OF CABLE.

FB33-213-2

Drag Chute Installation





1. CHECK DRAG CHUTE DOOR OPEN, DRAG CHUTE HANDLE IN NORMAL POSITION.
2. HOLDING DRAG CHUTE WITH PILOT CHUTE AFT, INSERT RISER ATTACH RING THROUGH HOLE IN FRONT OF CONTAINER AND FORCE THROUGH HOOK JAWS. ATTACH RING WILL CLICK INTO PLACE. INSURE THAT IT IS SQUARE AND NOT FOULING THE HOOK MECHANISM.
3. HOLD DEPLOYMENT BAG WITH RISERS DOWN, AND PULL RISERS OUT OF BAG. LOOP RISERS NEATLY IN BOTTOM OF CONTAINER AND INSERT DRAG CHUTE, KEEPING TENSION ON PORTION OF RISER LEADING TO ATTACH RING.
4. CHECK THROUGH DOOR 58 THAT CHUTE ATTACH RING IS PROPERLY INCLOSED IN RELEASE HOOK AND THAT MECHANISM IS CLEAR.
5. POSITION CHUTE SAFETY WIRE BETWEEN DOOR HINGE AND TAIL CONE.
6. DEPRESS DOOR UNTIL NEARLY CLOSED. HOLDING DOOR WITH LEFT HAND, REACH THROUGH ACCESS DOOR 58 AND PULL RELEASE MECHANISM BELLCRANK. FINISH CLOSING DOOR AND RELEASE TENSION ON RELEASE MECHANISM BELLCRANK. SLOWLY RELEASE GRIP ON DOOR TO CHECK THAT IT IS LOCKED. IF NOT, REPEAT THIS STEP.
7. INSTALL ACCESS DOOR 58. REMOVE STREAMER AND WIRE BEFORE FLIGHT.

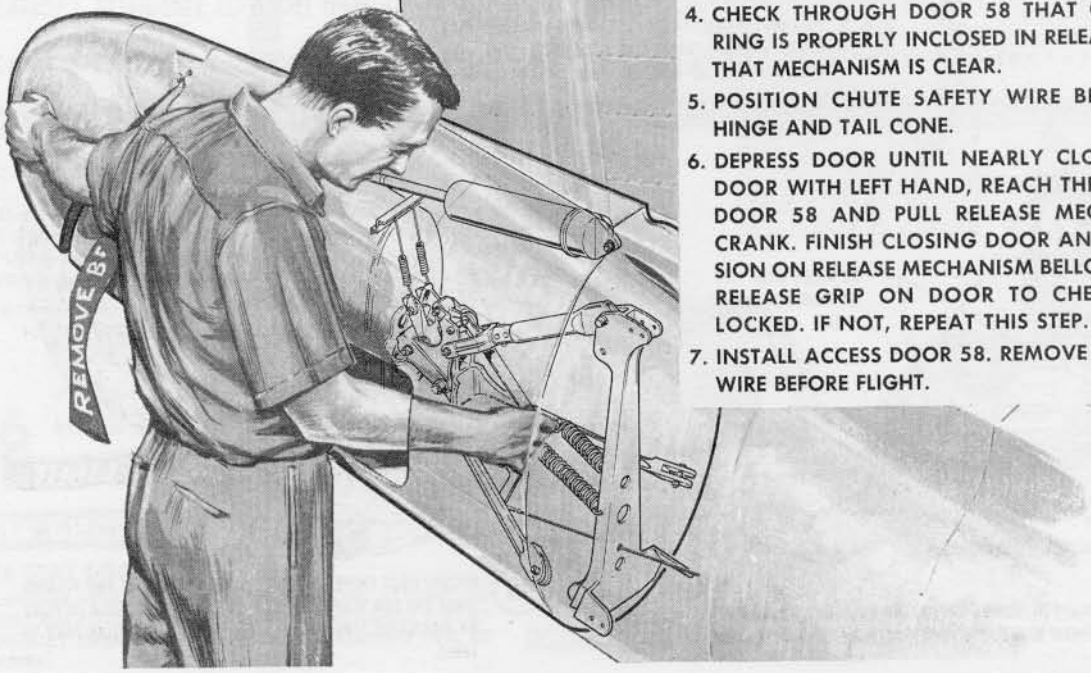


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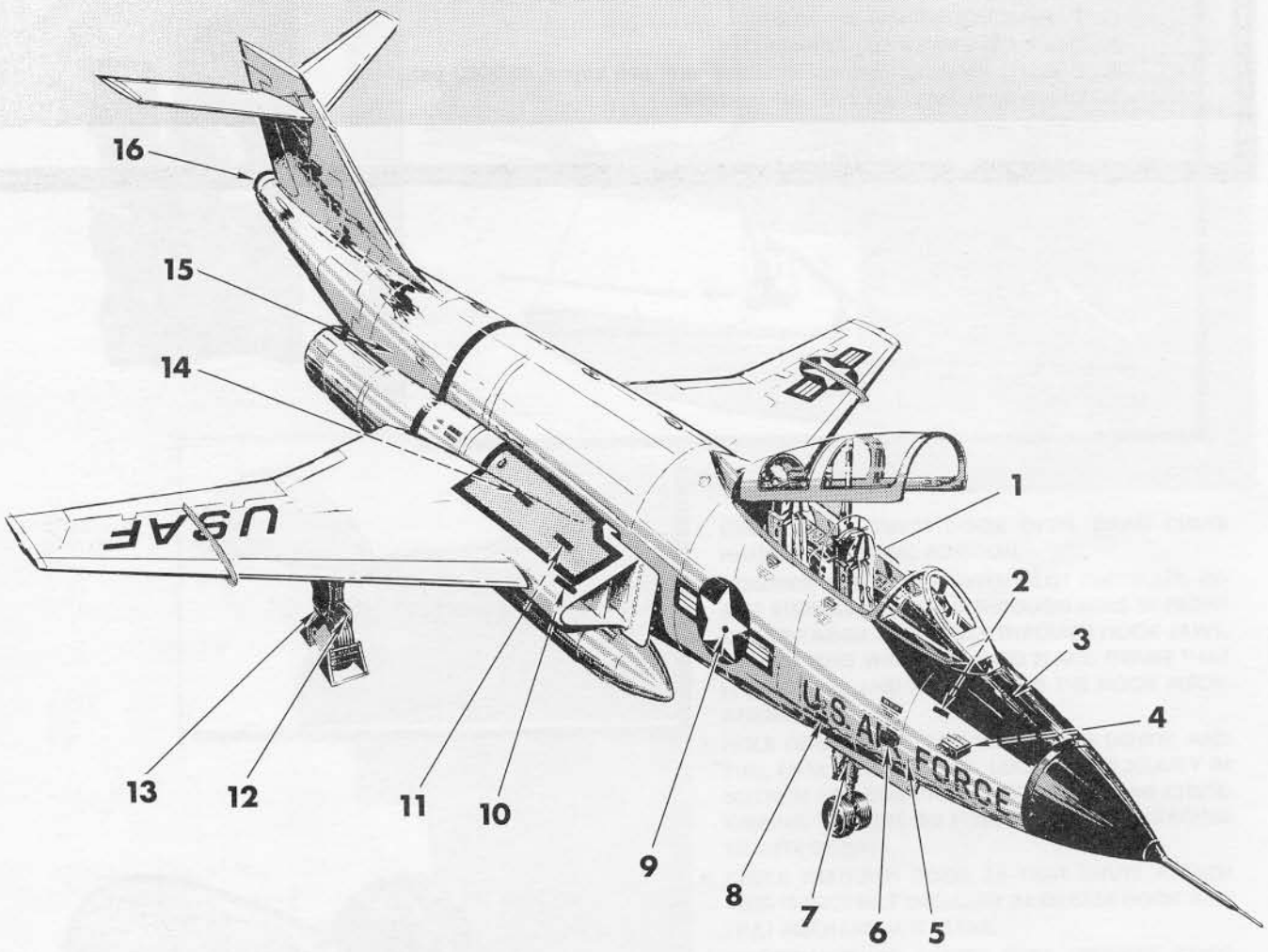
Figure 2-10

BRAKE EMERGENCY ACCUMULATOR (50 THRU 120)

1. Pull emergency brake handle in cockpit and pump brakes until no further action results.
2. Remove valve cap from accumulator air valve and loosen 5/8 inch hex nut a maximum of two turns.
3. Charge accumulator with clean dry air or nitrogen to 600 ± 25 psi.
4. Tighten hex nut and cap valve.
5. Reset the emergency brake valve.
6. Connect external hydraulic power cart and adjust to 3000 psi.
7. Disconnect external hydraulic power.

Servicing Diagram

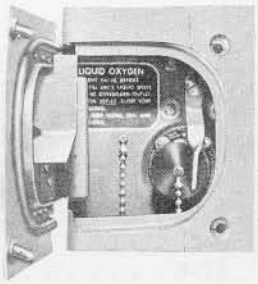


- HYDRAULIC FLUID MIL-O-5606(NATO H-515).
- FUEL JP-4 MILJ-5624E (NATO F-40).
  ALTERNATE FUEL JP-5.
  EMERGENCY FUEL—AVIATION GASOLINE MIL-G-5572, LOWEST GRADE AVAILABLE.
- COMMERCIAL FUEL—
  ASTM D1655-59T, JET B
  FREEZING POINT – 60° F
- SINGLE POINT REFUELING MAXIMUM PRESSURE 60 PSI AT 600 GPM
- OIL MIL-L-7808C-1(NATO O-148).
- OXYGEN MIL-O-27210A, TYPE II GRADE B.
- IF THE DRAG CHUTE HAS BEEN USED IT MUST BE REPACKED AND INSTALLED IN ACCORDANCE WITH THE INSTRUCTIONS IN T.O. 1F-101B-2-4 PRIOR TO THE NEXT FLIGHT.
- IF THE TAIL HOOK HAS BEEN USED IT MUST BE RELATCHED IN ACCORDANCE WITH THE INSTRUCTIONS IN T.O. IF-101B-2-8 PRIOR TO THE NEXT FLIGHT.

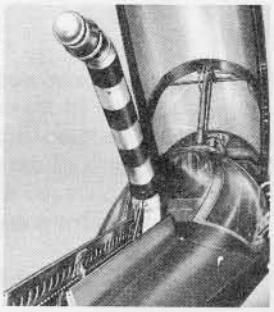
FB33-211-1E

Figure 2-11

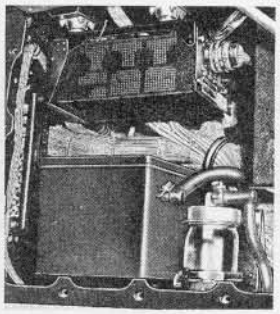
1. PRIMARY HYDRAULIC SYSTEM FILLER



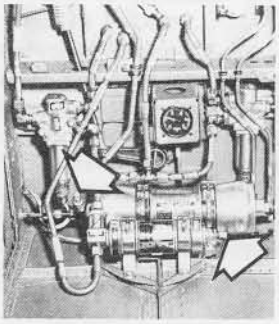
2. LIQUID OXYGEN FILLER



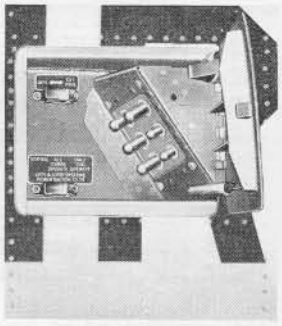
3. AIR REFUELING PROBE



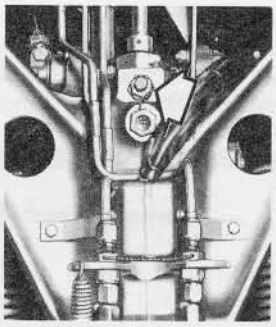
4. BATTERY



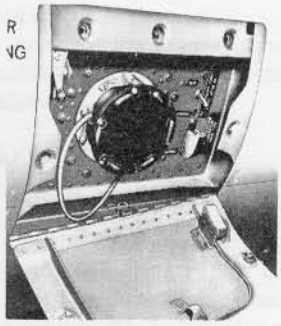
5. EMERG BRAKE ACCUM & ANTI-SKID PRESS MODULATOR



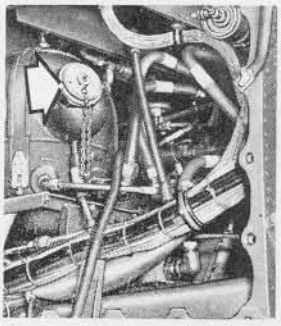
6. EXTERNAL POWER RECEPTACLE



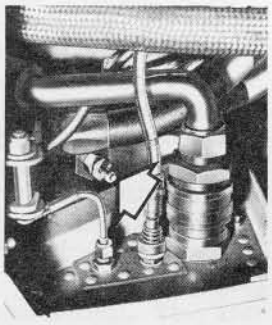
7. NOSE GEAR STRUT AIR FILLER



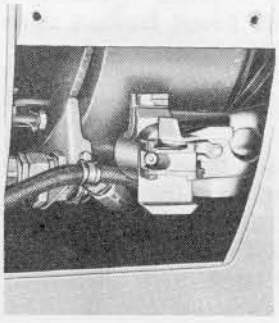
8. SINGLE POINT REFUELING



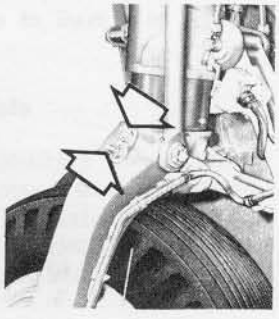
9. UTILITY HYDRAULIC SYSTEM FILLER



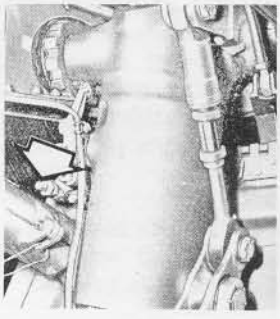
10. ENGINE STARTER AIR BOTTLES FILLER VALVE



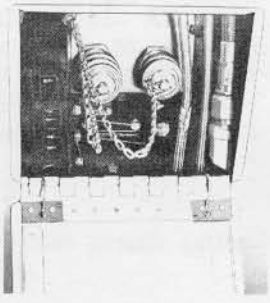
11. AIR STARTER CONNECTION



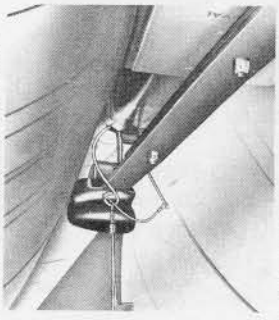
12. HYDRAULIC FLUID AND AIR FILLER



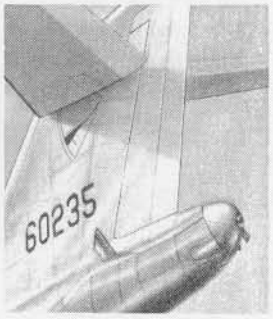
13. AIR FILLER



14. OIL SYSTEM FILLER



15. TAIL HOOK



16. DRAG CHUTE

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section III Emergency Procedures

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This section contains procedures to be followed to correct an emergency condition. These procedures will insure maximum safety for the crew and/or aircraft until a safe landing or other appropriate action is accomplished. Multiple emergencies, adverse weather and other peculiar conditions may require modification of these procedures. It is essential, therefore, that aircrews determine the correct course of action by use of common sense and sound judgement. As soon as possible, the pilot should notify the RIO of any existing emergency and of the intended action. Procedures appearing in bold face type, i.e. **ABORT TAKE-OFF**, are considered critical. Procedures appearing in small type are considered non-critical. They are defined as follows: CRITICAL. Those steps which must be performed immediately without reference to written checklists. These critical steps should be committed to memory. NON-CRITICAL. All other steps wherein there is time available to consult a checklist. When an emergency occurs, three basic rules are established which apply to airborne emergencies. They should be thoroughly understood by all aircrews.

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

ENGINE FAILURE

Jet engine failures are often the result of malfunction or incorrect operating technique of the fuel system. Engine instruments often provide indications of failure before flame-out occurs. Air starts should be accomplished, provided time and altitude permit, if the failure can be attributed to the reasons already noted. In the event of obvious mechanical failure within the engine, air starts should not be attempted. The airplane design is such that no system (hydraulic, electrical, etc.) is dependent on a specific engine. Thus, loss of an engine will not result in subsequent loss of a system.

SINGLE ENGINE FLIGHT CHARACTERISTICS

Single engine characteristics are essentially the same as the normal characteristics because of the location of the engines relative to the centerline of the airplane. In event of one engine failure, the tendency to yaw is negligible; however, there is a slight tendency for the aircraft to roll into the dead engine.

ENGINE FAILURE DURING TAKE-OFF

Before Airborne

If an engine fails before leaving the ground, the continuation of take-off is dependent on length of remaining runway, gross weight, airspeed, field elevation and ambient temperature and runway overrun barrier availability. Refer to Critical Field Length and Maximum Refusal Speed charts in Part 2 of Appendix I.

Note

- During take-off using Military thrust, where take-off will not be aborted, immediately advance operating engine to Maximum thrust and follow Engine Failure During Flight procedures, this section, as soon as possible.
- If an engine fails using Maximum thrust and take-off will not be aborted, retard "dead" engine throttle from afterburning range as soon as possible and follow Engine Failure During Flight procedures, this section.

If decision to stop is made:

1. **ABORT TAKE-OFF**
   Refer to Take-Off and Landing Emergencies, this section.

After Airborne

If an engine fails immediately after take-off, lateral and directional control of the airplane can be maintained if airspeed remains above stalling speed however, the ability to maintain altitude or to climb depends upon gross weight and air density. Since the pilot's actions will depend upon conditions mentioned above, after take-off, and at critical airspeeds with

heavy gross weight, the pilot must complete the following if level flight cannot be maintained.

1. OPERATING ENGINE–AFTERBURNER
   If afterburners were not being used, place remaining throttle in afterburner thrust.
2. LANDING GEAR–UP
3. EXTERNAL TANKS – JETTISON
   If altitude cannot be maintained, depress external tank emergency jettison button.
4. Continue flight straight ahead.
   Attempt no unnecessary maneuvers until safe airspeed and altitude are attained.
5. Flaps - RETRACT
   Retract flaps after safe airspeed is attained.
6. Failed engine - SHUTDOWN
   - Throttle - CLS'D
   - Engine master switch - OFF
7. Land as soon as practicable.

ENGINE FAILURE DURING FLIGHT

In the event an engine fails, perform the following:

1. Determine failed engine.
2. Throttle (failed engine) - CLS'D
3. For failure other than mechanical - ATTEMPT AIR START
   Refer to Air Start, this section, figure 3-1.
4. For obvious mechanical failure, engine - SHUTDOWN
5. Land as soon as practicable.

DOUBLE ENGINE FAILURE DURING FLIGHT

The possibility of a double engine failure is highly remote. However, failure of both fuel boost pumps above 30,000 feet may result in a double engine failure due to engine fuel starvation. If boost pump failure is the suspected cause of double flame-out, remain below 30,000 feet. Proceed as follows:

CAUTION

To maintain sufficient hydraulic pressure for airplane control, do not lower airspeed below 250 knots IAS.

1. Left throttle - CLS'D

Note

Placing the left throttle to CLS'D provides maximum gravity fuel flow to the right engine.

2. Right throttle - IDLE
3. Right engine emergency ignition button - DEPRESS
4. If no start by 30,000 feet right throttle - CLS'D
5. Left engine - ATTEMPT AIR START
   Refer to Air Start, this section, figure 3-1.

Note

If neither engine starts, attempt another start using the icing ignition switch and/or normal ground start switch to provide ignition.

6. Icing ignition switch - ON
7. Right engine - ATTEMPT AIR START
8. Left engine - ATTEMPT AIR START

WARNING

Do not under any circumstances select internal air if using the normal ground start switch for ignition. Starter destruction may result.

If neither engine starts, it can be assumed the ignition system is at fault due to a blown circuit breaker. If ignition system failure is suspected, procced as follows:

9. Generators - OFF

Note

With both generators disconnected from the bus system, emergency electrical power will be supplied to the emergency start relay from the windmilling generators or the battery.

10. Right engine - ATTEMPT AIR START
11. Left engine - ATTEMPT AIR START

Double Engine Failure at Low Altitude

In the event of double engine failure at extremely low altitude, and with sufficient airspeed available, the airplane should be pulled up (ZOOM-UP) to exchange airspeed for an increase in altitude. This will allow more time for accomplishing subsequent emergency procedures.

Note

Attempt an air start immediately upon detection of flame-out and repeat as many times as possible, during zoom-up. The point at which the climb should terminate will depend on whether the pilot intends to eject or continue attempting air starts. If the pilot intends to eject immediately, allow the airplane to climb as far as possible. Eject while the nose of the airplane is above the horizon and prior to reaching a stall or sink. If sufficient altitude is available, and the pilot decides to attempt more air starts, the climb should be terminated before the airspeed drops below 250 knots. If unable to accomplish an air start on one engine, eject prior to descending to minimum bailout altitude.

Air Start

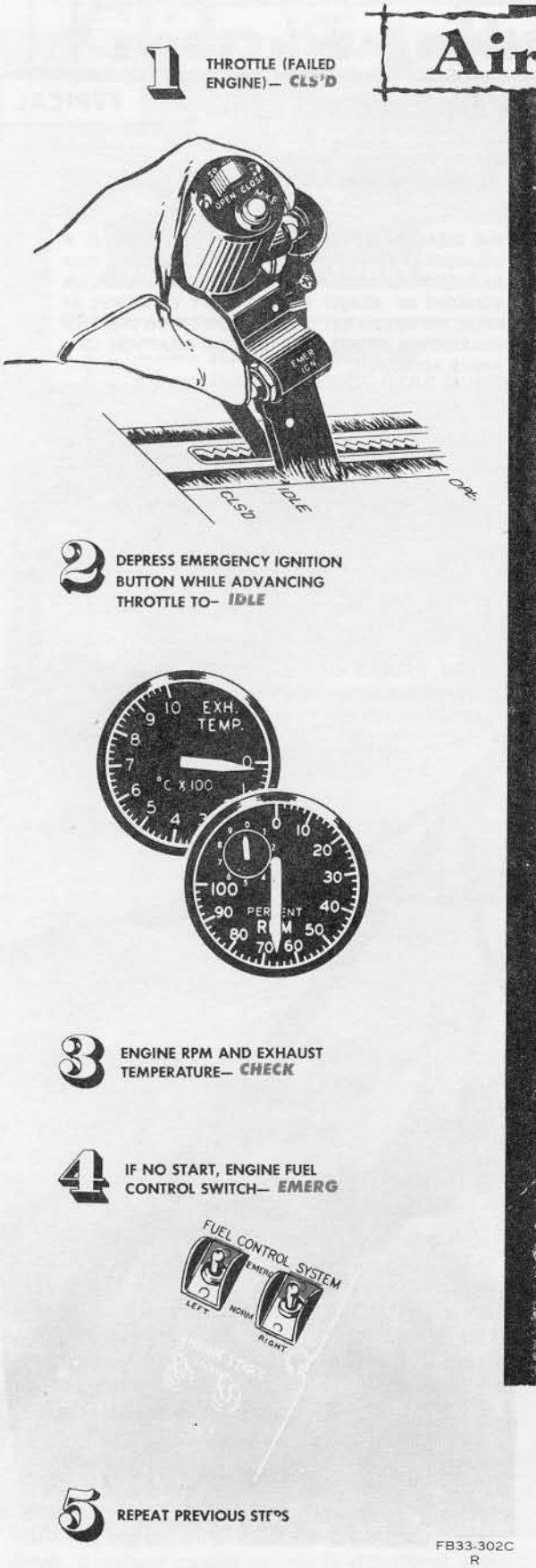


Figure 3-1

In the zoom-up maneuver, more altitude can be gained if the external tanks are jettisoned as soon as possible after flame-out. However, when jettisoning external tanks, consideration should be given to several factors such as terrain where tanks will fall, sufficient airspeed to allow time for pilot reaction and tank jettisoning, etc.

AIR START

Note

A normal relight and engine acceleration should not be expected above 30,000 feet. If a relight should be attempted above 30,000 feet and the engine does not accelerate above idle, shutdown the engine and descend to a lower altitude.

For Air Start Procedures, see figure 3-1. During normal air start, there may be no significant increase in exhaust temperature until the engine has accelerated to idle rpm. In the event that light-off does not occur within 20 seconds after throttle is advanced to IDLE, or the engine fails to accelerate to idle rpm within approximately 45 seconds after light-off, the start should be discontinued by retarding throttle to CLS'D. This action will also be necessary if the exhaust temperature exceeds maximum limitations or the oil pressure does not attain the minimum of 35 psi.

Note

- If a start is made with an engine which has cooled to an ambient temperature of -30°C (-22°F), the throttle should be left at IDLE for two minutes to warm-up the engine if flight conditions permit.
- If air start is made on emergency fuel system, exhaust temperature may be controlled by throttle manipulation between CLS'D and IDLE.

GLIDE DISTANCE

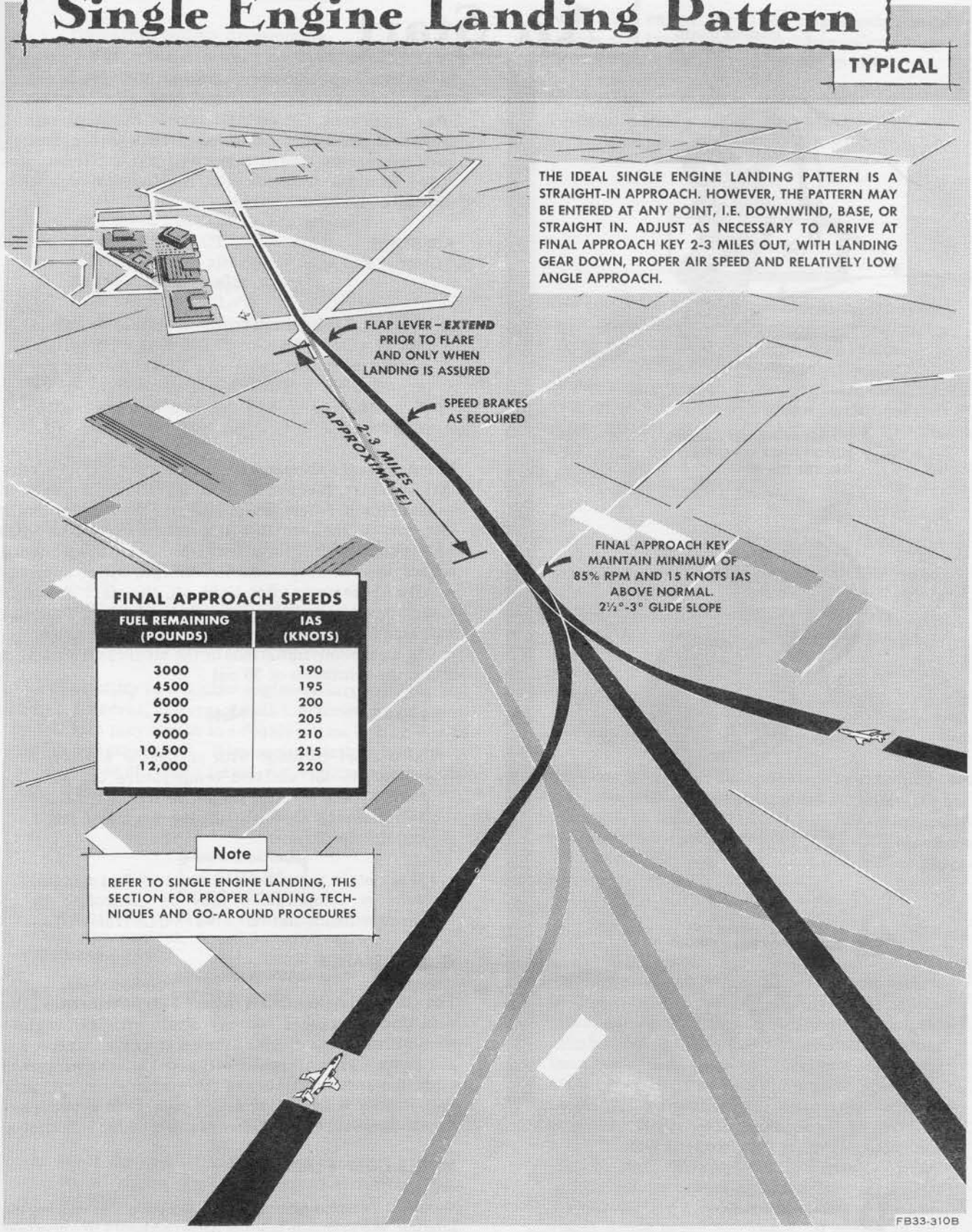
The Glide Distance Chart (figure 3-3) provides the pilot with glide distances he may attain with both engines windmilling from given altitudes at a given airspeed of 250 knots. This airspeed will provide near maximum glide distance capability of the airplane and will provide engine windmilling speed capable of keeping hydraulic pressure and recovery rates within safe limits.

SINGLE ENGINE LANDING

Should it become necessary to execute a single engine landing, the primary landing pattern should be a straight in approach assisted by GCA or ILS, if available for final approach positioning (figure 3-2). Steep

Single Engine Landing Pattern

TYPICAL



FINAL APPROACH SPEEDS

FUEL REMAINING (POUNDS)	IAS (KNOTS)
3000	190
4500	195
6000	200
7500	205
9000	210
10,500	215
12,000	220

Note

REFER TO SINGLE ENGINE LANDING, THIS SECTION FOR PROPER LANDING TECHNIQUES AND GO-AROUND PROCEDURES

Figure 3-2

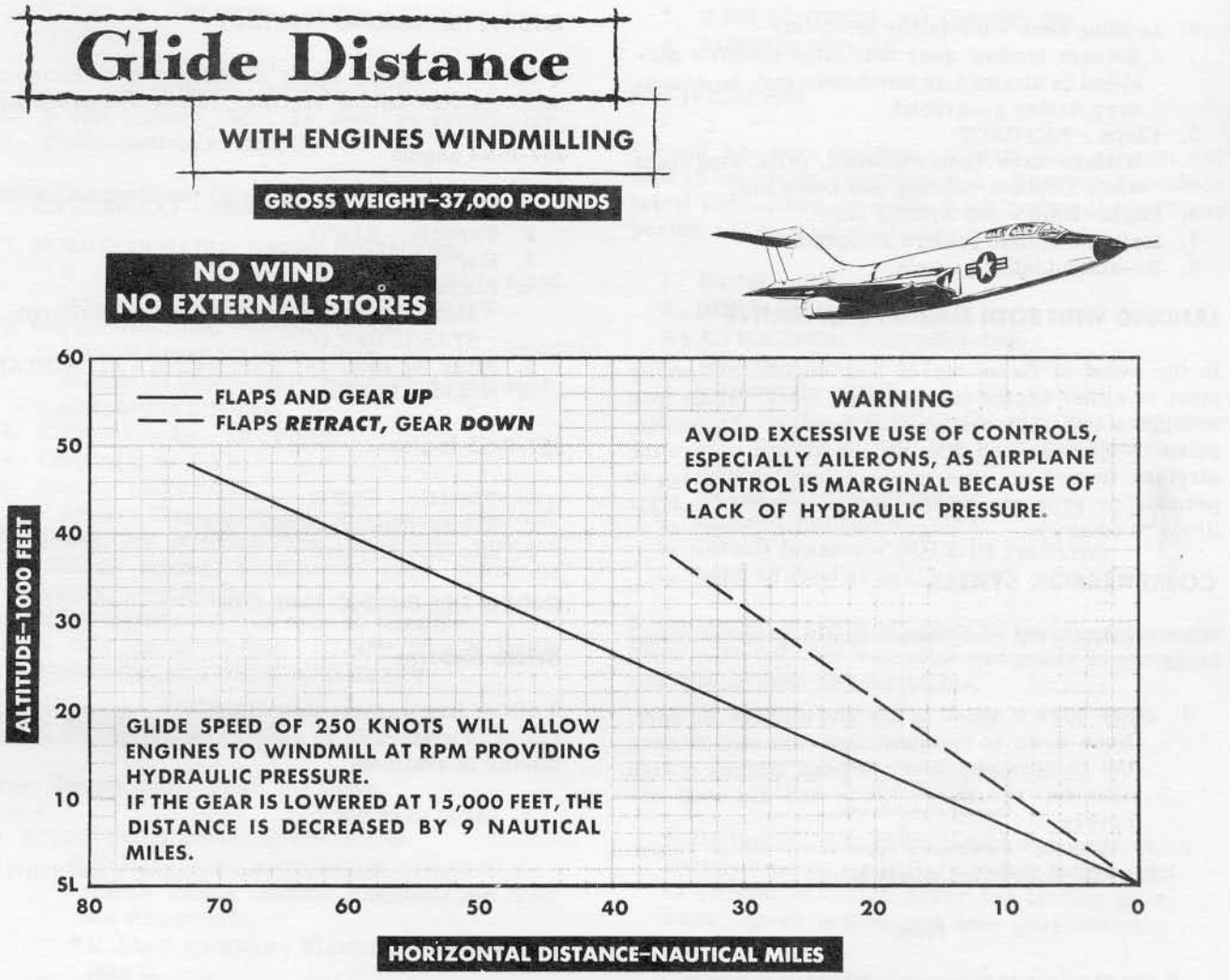


Figure 3-3

turns should be avoided during positioning for final approach.

1. Traffic entry - 250 knots IAS
2. Flaps - RETRACTED
3. Speed brakes - CLOSED
4. Landing gear - DOWN
5. Final approach - 2-3 miles, 2 1/2°-3° GLIDE SLOPE
6. Maintain 15 knots IAS above normal approach speed and a minimum of 85% RPM
7. Speed brakes - AS REQUIRED THEN CLOSE
8. Flaps - EXTEND (landing assured). Extend flaps prior to flare to avoid ballooning and only when landing is assured.

WARNING

With one engine inoperative and gear and flaps down, airplane cannot maintain altitude at any approach speed without afterburner.

9. Fly airplane down to the runway. Do not flare the airplane or retard throttle prior to crossing the end of the runway.
10. Speed brakes - OPEN (after touchdown).

SINGLE ENGINE GO-AROUND

1. Make decision to go-around early as possible.
2. Throttle - OPEN
   Smoothly advance throttle on operative engine to OPEN.

Note

Afterburner will be required if go-around is started after wing flaps have been extended.

3. Continue approach.
   Continue approach until sufficient airspeed to level off is attained.

4. Landing gear - UP (after level-off)
   Retract landing gear only after adequate airspeed is attained as touchdown may be necessary during go-around.
5. Flaps - RETRACT
   If flaps have been extended, raise wing flaps when airplane reaches 200 knots IAS.
6. Begin climb - 250 KNOTS IAS.
7. Maintain traffic pattern airspeed.
8. Re-enter traffic pattern.

LANDING WITH BOTH ENGINES INOPERATIVE

In the event of flame-out of both engines and no air start of either engine can be made, eject, rather than attempt a two engine flame-out landing. If possible, prior to ejection, the pilot should attempt to turn the airplane toward an area where injury or damage to persons or property on the ground or water is least likely to occur.

COMPRESSOR STALLS

When encountering compressor stalls, proceed as follows:

1. Nose down if speed is low and altitude permits.
   Nose down to maintain high ram airflow over the compressor face. If stall occurs at high altitude, reducing altitude will aid stall recovery.
2. If throttle movement preceded stall, return throttle to original position.

Note

If the airplane is supersonic when the compressor stall occurs, deceleration to subsonic airspeed should be accomplished as rapidly as possible by using speed brakes.

3. If stall continues, accompanied by a high EGT, throttle - CLS'D
4. Attempt airstart.
   After stabilized condition is obtained, attempt airstart; refer to AIR START, this Section.
5. Maintain subsonic speed and normal coordinated flight attitudes.

Note

Record on Form 781 any compressor stall and indicate duration and peak temperature of any overtemperature operation.

FIRE

The following procedures pertain to the first occurrence of a fire warning indication rather than an actual fire. The lights could illuminate due to an over-heat condition or perhaps an electrical short, therefore, the actual conditions that exist when a light illuminates may be difficult to determine. However, if upon first recognition an actual engine fire is obvious, the affected engine should be shutdown immediately.

ENGINE FIRE DURING STARTING

If the fire warning lights illuminate or there is evidence of fire during starting, follow this procedure:

J57-P-53 Engine

1. Electrical and air sources - CONNECTED
2. Throttle - CLS'D
3. Engine master switch - ON
4. Engine start switch - START
   Move engine start switch momentarily to START, then release.
5. After 20 seconds, start switch - STOP START
6. Abandon airplane.

J57-P-55 Engine

1. Throttle - CLS'D
2. Engine master switch - OFF
3. Abandon airplane.

ENGINE FIRE DURING TAKE-OFF

Before Airborne

If either fire warning light illuminates during take-off run, it is preferable to abort immediately, if sufficient runway is available.

1. **ABORT TAKE-OFF**

   Refer to Take-Off and Landing Emergencies, this section.

After Airborne

Note

The following procedures are applicable only to the phase immediately after take-off. If these procedures do not eliminate the emergency, refer to Engine Fire During Flight, this section.

Burner Compartment (Flashing) Light:

1. **NORMAL OPERATING ENGINE–AFTERBURNER**
   If afterburners were not being used, place remaining throttle in afterburner detent.
2. **THROTTLE (Engine Indicating Fire)–IDLE**
3. **CONTINUE FLIGHT STRAIGHT AHEAD**
   Attempt no unnecessary maneuvers until safe airspeed is attained.
4. External tanks - JETTISON
   If altitude cannot be maintained, depress external tank emergency jettison button.
5. Landing gear handle - UP
6. Flaps - RETRACT
   Retract flaps after safe airspeed is attained.
7. Check for positive fire indications such as fumes or trailing smoke or verification from another airplane.
8. If no fire, land as soon as practicable with reduced thrust setting.

9. If fire is confirmed, engine indicating fire - SHUT DOWN
   Throttle - CLS'D
   Engine master switch - OFF
10. If fire ceases, land as soon as practicable.
11. If fire continues - EJECT

Engine Compartment (Steady) Light:

1. NORMAL OPERATING ENGINE-AFTERBURNER
   If afterburners were not being used, place remaining throttle in afterburner detent.
2. ENGINE INDICATING FIRE-SHUT DOWN
3. CONTINUE FLIGHT STRAIGHT AHEAD
   Atempt no unnecessary maneuvers until such airspeed is attained.
4. External tanks - JETTISON
5. Landing gear - UP
6. Flaps - RETRACT
   Retract flaps after safe airspeed is attained.
7. Check for positive fire indications such as trailing smoke, verification from tower or another airplane.
8. If fire ceases, land as soon as possible.
9. If fire is confirmed - CLIMB TO A SAFE EJECTION ALTITUDE AND EJECT.

ENGINE FIRE DURING FLIGHT

Burner Compartment (Flashing) Light:

1. REDUCE THRUST ON AFFECTED ENGINE
   - If light goes out, continue flight at Reduced Thrust Setting And Land As Soon As Practicable.
   - If Light Continues Flashing, Proceed with Step 2.
2. CHECK FOR POSITIVE FIRE INDICATIONS SUCH AS FUMES OR TRAILING SMOKE
3. IF FIRE IS CONFIRMED, ENGINE (Indicating Fire) - SHUT DOWN
   - THROTTLE -CLS'D
   - ENGINE MASTER SWITCH-OFF
4. If no fire, land as soon as practicable.
5. If fire continues, EJECT

Engine Compartment (Steady) Light:

1. ENGINE INDICATING FIRE-SHUTDOWN
   - THROTTLE-CLS'D
   - ENGINE MASTER SWITCH-OFF
2. CHECK FOR POSITIVE FIRE INDICATIONS SUCH AS TRAILING SMOKE OR VERIFICATION FROM ANOTHER AIRPLANE.
3. IF FIRE IS CONFIRMED-EJECT
4. If no fire, land as soon as practicable.

ENGINE FIRE AFTER SHUTDOWN

1. THROTTLES-CLS'D
*2. STARTER (Internal Air) Switch-ON
3. ENGINE MASTER SWITCH-ON
4. ENGINE START SWITCH-START
5. IF FIRE CONTINUES, ALL SWITCHES OFF
6. ABANDON AIRPLANE

ELECTRICAL FIRE

Circuit breakers and fuses protect most circuits and tend to isolate an electrical fire. However, if an electrical fire occurs, perform the following if conditions permit and land as soon as practicable.

1. BATTERY -OFF
2. GENERATORS-OFF
3. ALL ELECTRICAL EQUIPMENT-OFF
4. Battery - ON
5. Generators - ON
6. Individually reposition the electrical switches ON, beginning with the most essential equipment first.
7. Isolate affected equipment.
8. Affected equipment - OFF
9. Circuit breaker - PULL (if available)
10. Land as soon as practicable.

If the cause of the fire cannot be found, continue the flight with only the essential equipment in operation and land as soon as practicable.

CAUTION

If the landing is to be made with both generator switches OFF, the battery switch must be ON to provide selective power for landing gear, flaps, speed brakes and nose gear steering.

ELIMINATION OF SMOKE AND FUMES

To eliminate smoke or fumes from the cockpit, proceed as follows:

Note

When necessary to depressurize the cockpit descend to 25,000 feet or below if possible.

1. OXYGEN DILUTER LEVER-100% O_2
2. OXYGEN EMERGENCY LEVER-EMERGENCY
3. CABIN PRESSURE SWITCH-RAM AND DUMP

Note

If above listed methods fail to clear smoke or fumes, and the situation warrants, the canopy may be jettisoned by the canopy alternate jettison handle. At any time the canopy is to be jettisoned, the RIO must be alerted. The RIO should position himself as low as possible prior to canopy jettison.

*Some airplanes

EJECTION

Escape from the airplane in flight should be made with the ejection seat. The basic seat ejection procedure is shown in figure 3-4.

Note

After incorporation of T.O. 1F-101B-752, the pilot can actuate the Eject Warning Light switch to notify aft seat occupant that he should eject.

WARNING

If time and conditions permit, the RIO should eject first to prevent the possibility of injury to the RIO from flying debris when the pilot ejects.

The study and analysis of escape techniques by means of ejection seat reveals that:

a. Ejection at airspeeds ranging from stall speed to 525 knots IAS results in relatively minor forces being exerted on the body, thus reducing injury hazard.
b. Appreciable forces are exerted on the body when ejection is performed at airspeed of 525 to 600 knots IAS rendering escape more hazardous.
c. At speeds above 600 knots IAS, ejection is extremely hazardous because of excessive forces on the body.

WARNING

- With the zero delay lanyard connected, maximum speed for ejection must be reduced to avoid parachute failure. The Zero Delay Lanyard Engagement Requirements chart (figure 3-5) graphically illustrates zero delay lanyard configurations based on altitude and indicated airspeed.

- Under controllable level flight conditions, ejection should be accomplished above 2,000 feet terrain clearance, whenever possible. Under out-of-control dive conditions, ejection should be accomplished with at least 15,000 feet terrain clearance. For other descending out-of-control conditions, ejection should be accomplished at the altitude as outlined in the applicable portion of Section VI.

LOW ALTITUDE EJECTION

During any low altitude ejection, the possibility of success can be greatly improved by zooming and ejecting while the nose of the airplane is above the horizon and the airspeed is at least 120 knots and not more than 525 knots IAS. The zoom-up maneuver will exchange airspeed for altitude, thus providing maximum terrain clearance at time of ejection, as well as reducing airspeed within safe limits for ejection. It must be remembered that attitude and airspeed conditions alone will not insure a successful ejection. If sink rate is allowed to become high after completing the zoom climb all advantages of the increased altitude may be lost. Ejecting while the nose of the airplane is above the horizon will result in a more nearly vertical trajectory for the seat and crewmember, thus providing more altitude and time for seat separation and parachute deployment. At low altitudes, a minimum airspeed of 120 knots IAS is recommended to assure rapid deployment of the chute. A determined effort to separate from the seat must be made as soon as the belt releases to obtain maximum terrain clearance when the parachute deploys. An effort should be made to "beat" the automatic function of the seat belt.

WARNING

Manually opening the seat belt removes the automatic parachute deployment feature.

Manually pull parachute ripcord handle immediately following seat separation for all ejections below 14,000 feet. This provides a safety factor since the parachute should deploy automatically.

The automatic-opening safety belt should never be opened before ejection for the following reasons:

a. If the safety belt is manually opened, the escape operation is considerably prolonged, the seatman separator (after the incorporation of T.O. 1F-101-959) will not function, and the automatic-opening feature of the parachute will be eliminated.
b. Manually opening the safety belt creates a hazard to survival during uncontrollable flight, since negative "g" forces may prevent the pilot from assuming the correct ejection position.
c. Manually opening the safety belt creates a hazard to survival if the pilot decides that he has insufficient altitude for ejection and is required to proceed with a forced landing. Both hands will probably be required to control the airplane and the pilot will not be able to fasten the safety belt and shoulder harness.
d. Manually opening the safety belt may cause the pilot to separate from the seat at any time during ejection. If the pilot separates from the seat immediately after the seat leaves the airplane, severe shock loads will be imposed on the body. The automatic-opening safety belt is designed to open 1 second after ejection, which is sufficient time for safe deceleration of the pilot while still in the seat.

In order to provide an improved low altitude escape capability, a parachute zero delay lanyard is provided to give a "zero-second" time delay in chute deployment after seat separation. The "zero-second" chute timing with the one second automatic-opening safety belt is known as a "one and zero" escape system. The lanyard connects the parachute arming knob to the parachute ripcord handle. When the pilot separates from the seat and the parachute arming knob is pulled, the parachute ripcord handle is also pulled allowing immediate parachute deployment. The zero delay lanyard must be connected to the parachute ripcord handle under low altitude and low airspeed conditions. At other altitude and airspeeds, the lanyard must be disconnected from the parachute ripcord handle and stowed to allow the automatic parachute timer to open the parachute below critical opening speeds and below the prescribed altitude. The lanyard must be fastened or unfastened from the parachute ripcord handle by the pilot at the correct time as outlined in figure 3-5. A ring on the parachute harness is provided for stowing the lanyard when it is not hooked in the parachute ripcord handle. There may be several lanyard configurations in service use, but their use will be identical and the hook and attaching positions will be similar. In order to determine the minimum possible ejection altitude, the type of parachute automatic release timer is all that must be known. The M3 seat ejection catapult, the C-9 canopy, the BA-15 pack and the automatic-opening safety belt one second (M12) initiator are exclusively used in all of the airplanes. Use the chart to determine the minimum emergency ejection altitude. For example, with no airplane sink rate, with the zero delay lanyard stowed, and a two second parachute (F-1A timer), minimum ejection altitude is 300 feet.

EMERGENCY MINIMUM EJECTION ALTITUDES

AUTOMATIC OPENING SAFETY BELT (INITIATOR)	ZERO DELAY LANYARD STOWED		ZERO DELAY LANYARD HOOKED
	2 SECOND PARACHUTE (F-1A TIMER)	1 SECOND PARACHUTE (F-1B TIMER)	ZERO SECOND PARACHUTE
	BA-15 PACK C-9 CANOPY	BA-15 PACK C-9 CANOPY	BA-15 PACK C-9 CANOPY
1 SECOND (M12 INITIATOR)	300 FT.	125 FT.	0 FT.

Note: These are emergency minimums. Ejection should be started above 2000 feet, if possible.

F833-3S1B

WARNING

Emergency minimum ejection altitudes quoted in this table were determined through extensive flight tests and are based on distance above terrain on initiation of seat ejection (i.e., time seat is fired). These figures do not provide any safety factor for such matters as equipment malfunction, delays in separating from the seat, etc. These figures are quoted only to show the minimum altitude that must be achieved in the event of such low altitude emergencies as fire on take-off. They shall not be used as the basis for delaying ejection when above 2,000 feet since accident statistics show a progressive decrease in successful ejections as altitude decreases below 2,000 feet. Therefore, whenever possible, eject above 2,000 feet.

HIGH ALTITUDE EJECTION

For a high altitude ejection, the basic ejection procedures (figure 3-4) is applicable. The "zoom-up" maneuver is still useful to slow the airplane to a safer ejection speed, or provide more time and glide distance as long as an immediate ejection is not mandatory.

WARNING

- During high altitude operation, the zero delay lanyard MUST NOT be hooked to the parachute ripcord handle. If the zero delay lanyard is hooked to the parachute ripcord handle, the safety feature of the automatic-opening parachute will be eliminated. If it becomes necessary to bailout at high altitude, the parachute will open immediately, subjecting the pilot to serious or fatal injury.

- In the event emergency oxygen is required for any reason, disconnect the seat oxygen hose from the connector (MC-3A or CRU-8/P attached to the parachute harness) immediately after actuating the emergency bailout bottle to prevent the escape of emergency oxygen through the seat oxygen hose. This action is not necessary when using a seat survival kit with an integrated oxygen supply.

EJECTION SEAT FAILURE

In the event that the canopy has been jettisoned but the ejection seat fails, it is recommended that both crew members proceed as follows:

1. Slow airplane - 275 knots IAS (if possible)
   If time and conditions permit, reduce airspeed to approximately 275 knots IAS.
2. Safety belt and personal leads - UNFASTEN
3. Bail-out bottle - ACTUATE (if necessary)
4. Maintain altitude with full nose down trim.
5. Invert airplane and release the stick.
6. Push free of seat.
   Immediately after releasing the stick, push free of the seat.
7. Parachute - DEPLOY (below 14,000 feet)
8. Automatic parachute lanyard - PULL (above 14,000 feet)

Ejection

FORWARD COCKPIT

BEFORE EJECTION

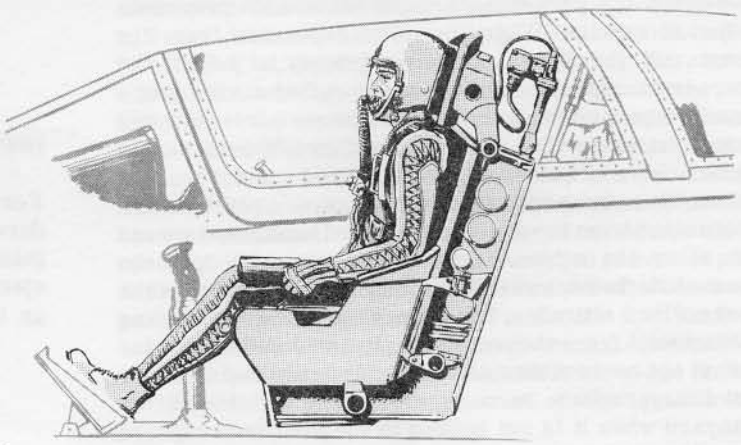
IF TIME AND CONDITIONS PERMIT...

- STOW ALL LOOSE EQUIPMENT.
- PRESSURIZATION TO RAM & DUMP (HIGH ALTITUDE).
- ACTUATE BAIL-OUT BOTTLE (HIGH ALTITUDE).

WARNING

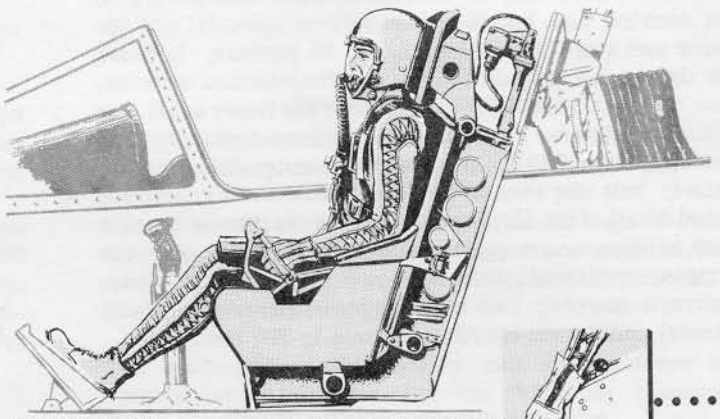
IMMEDIATELY AFTER ACTUATING THE EMERGENCY BAILOUT BOTTLE, DISCONNECT THE SEAT OXYGEN HOSE FROM THE CONNECTOR (MC-3A OR CRU-8/P ATTACHED TO THE PARACHUTE HARNESS) TO PREVENT THE ESCAPE OF EMERGENCY OXYGEN THROUGH THE SEAT OXYGEN HOSE. THIS ACTION IS NOT NECESSARY WHEN USING A SEAT SURVIVAL KIT WITH AN INTEGRATED OXYGEN SUPPLY.

- SLOW AIRPLANE (ZOOM-UP MANEUVER).



1 ASSUME PROPER POSITION

- FEET ON RUDDER PEDALS.
- THIGHS BRACED ON SEAT CUSHION.
- ARMS BRACED IN ARM RESTS.
- SIT ERECT WITH CHIN IN, HEAD HARD BACK AGAINST HEAD REST.



2 EITHER HANDGRIP—PULL UP

IF CANOPY FAILS TO JETTISON...

3 CANOPY ALTERNATE JETTISON HANDLE—PULL UP (IF REQUIRED)

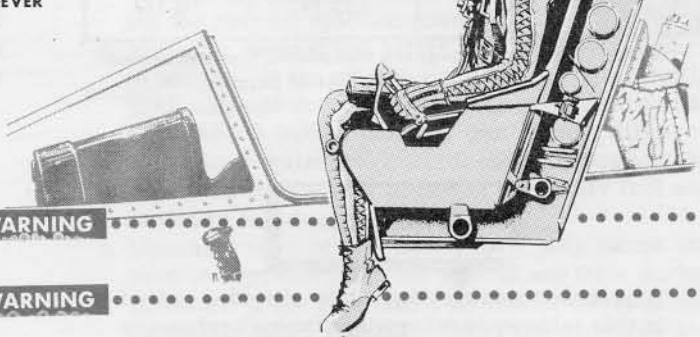
4 CANOPY SWITCH—HOLD OPEN (IF REQUIRED)

5 CANOPY MANUAL RELEASE LEVER—PULL (IF REQUIRED)

WARNING

MANUAL OPENING OF CANOPY MAY INFLICT SERIOUS INJURY WHEN LEVER IS NOT GRIPPED PROPERLY. CANOPY BREAKAWAY IS EXTREMELY RAPID. GRASP LEVER WITH RIGHT HAND OR LEFT HAND. WHEN GRASPING LEVER WITH EITHER HAND, MAKE SURE THUMB IS ON INSIDE OF LEVER.

- IF CANOPY DOES NOT RELEASE, PROCEED TO STEP 6, EJECTING THROUGH CANOPY.



6 EITHER TRIGGER—SQUEEZE

WARNING

WARNING

WARNING

AFTER EJECTION

AFTER SEAT EJECTS...

- TO ASSURE IMMEDIATE SEAT SEPARATION, ATTEMPT TO "BEAT" THE AUTOMATIC FUNCTION OF THE SAFETY BELT BY MANUALLY OPENING THE BUCKLE AND KICKING FREE OF THE SEAT.

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Figure 3-4

Procedure

AFT COCKPIT

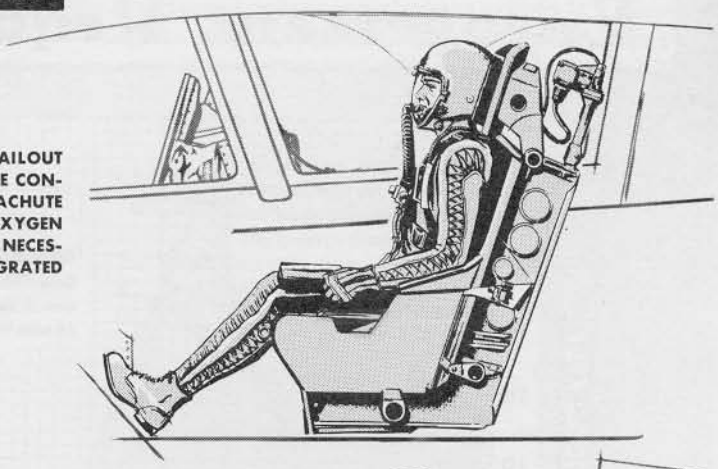
BEFORE EJECTION

IF TIME AND CONDITIONS PERMIT...

- STOW ALL LOOSE EQUIPMENT.
- ACTUATE BAIL-OUT BOTTLE (HIGH ALTITUDE).

WARNING

IMMEDIATELY AFTER ACTUATING THE EMERGENCY BAILOUT BOTTLE, DISCONNECT THE SEAT OXYGEN HOSE FROM THE CONNECTOR (MC-3A OR CRU-8/P ATTACHED TO THE PARACHUTE HARNESS) TO PREVENT THE ESCAPE OF EMERGENCY OXYGEN THROUGH THE SEAT OXYGEN HOSE. THIS ACTION IS NOT NECESSARY WHEN USING A SEAT SURVIVAL KIT WITH AN INTEGRATED OXYGEN SUPPLY.

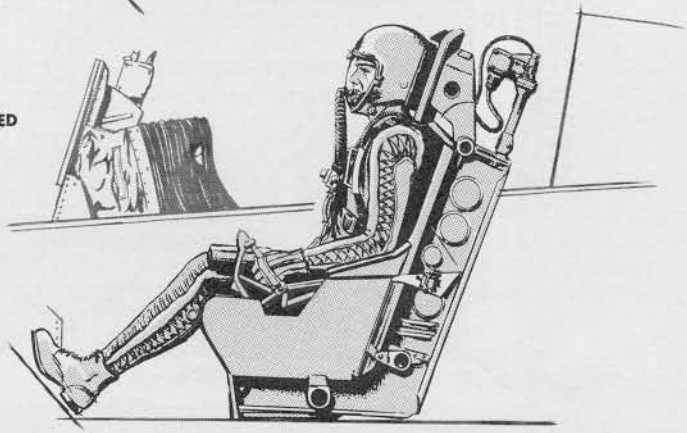


1 ASSUME PROPER POSITION

- FEET ON LOWEST PORTION OF FOOTREST.
- THIGHS BRACED FLAT ON SEAT CUSHION.
- ARMS BRACED IN ARM RESTS.
- SIT ERECT WITH CHIN IN, HEAD HARD BACK AGAINST HEAD REST.

WARNING

THE AFT COCKPIT OCCUPANT SHOULD HAVE SEAT POSITIONED AS LOW AS POSSIBLE PRIOR TO JETTISONING CANOPY.



2 EITHER HANDGRIP—PULL UP

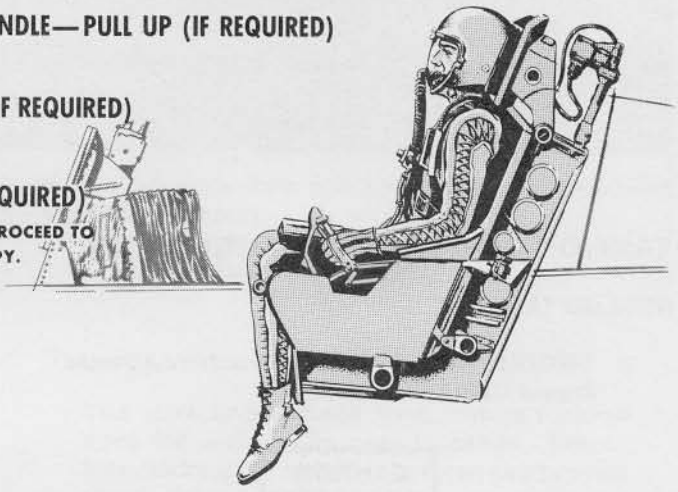
IF CANOPY FAILS TO JETTISON...

3 CANOPY ALTERNATE JETTISON HANDLE—PULL UP (IF REQUIRED)

4 CANOPY SWITCH—HOLD OPEN (IF REQUIRED)

5 NOTIFY PILOT TO PULL CANOPY MANUAL RELEASE LEVER (IF REQUIRED)

- IF CANOPY DOES NOT RELEASE, PROCEED TO STEP 6, EJECTING THROUGH CANOPY.



6 EITHER TRIGGER—SQUEEZE

AFTER EJECTION

AFTER SEAT EJECTS...

- TO ASSURE IMMEDIATE SEAT SEPARATION, ATTEMPT TO "BEAT" THE AUTOMATIC FUNCTION OF THE SAFETY BELT BY MANUALLY OPENING THE BUCKLE AND KICKING FREE OF THE SEAT.

IMMEDIATELY AFTER LEAVING SEAT, MANUALLY PULL PARACHUTE RIPCORD HANDLE FOR ALL EJECTIONS BELOW 14,000 FEET TO OPEN PARACHUTE IMMEDIATELY. THIS APPLIES REGARDLESS OF PARACHUTE TYPE TO INSURE PARACHUTE DEPLOYMENT.

DO NOT RELEASE THE SURVIVAL KIT DURING DESCENT, UNTIL THE PARACHUTE IS FULLY DEPLOYED AND STABILIZED, TO PREVENT THE SURVIVAL KIT OR ATTACHING DROP LINE FROM FOULING THE PARACHUTE.

DO NOT RELEASE THE SURVIVAL KIT UNTIL AFTER DESCENT TO A SAFE ALTITUDE FOR BREATHING WITHOUT SUPPLEMENTAL OXYGEN. THE EMERGENCY OXYGEN SUPPLY WILL BE CUT OFF WHEN THE SURVIVAL KIT IS RELEASED.

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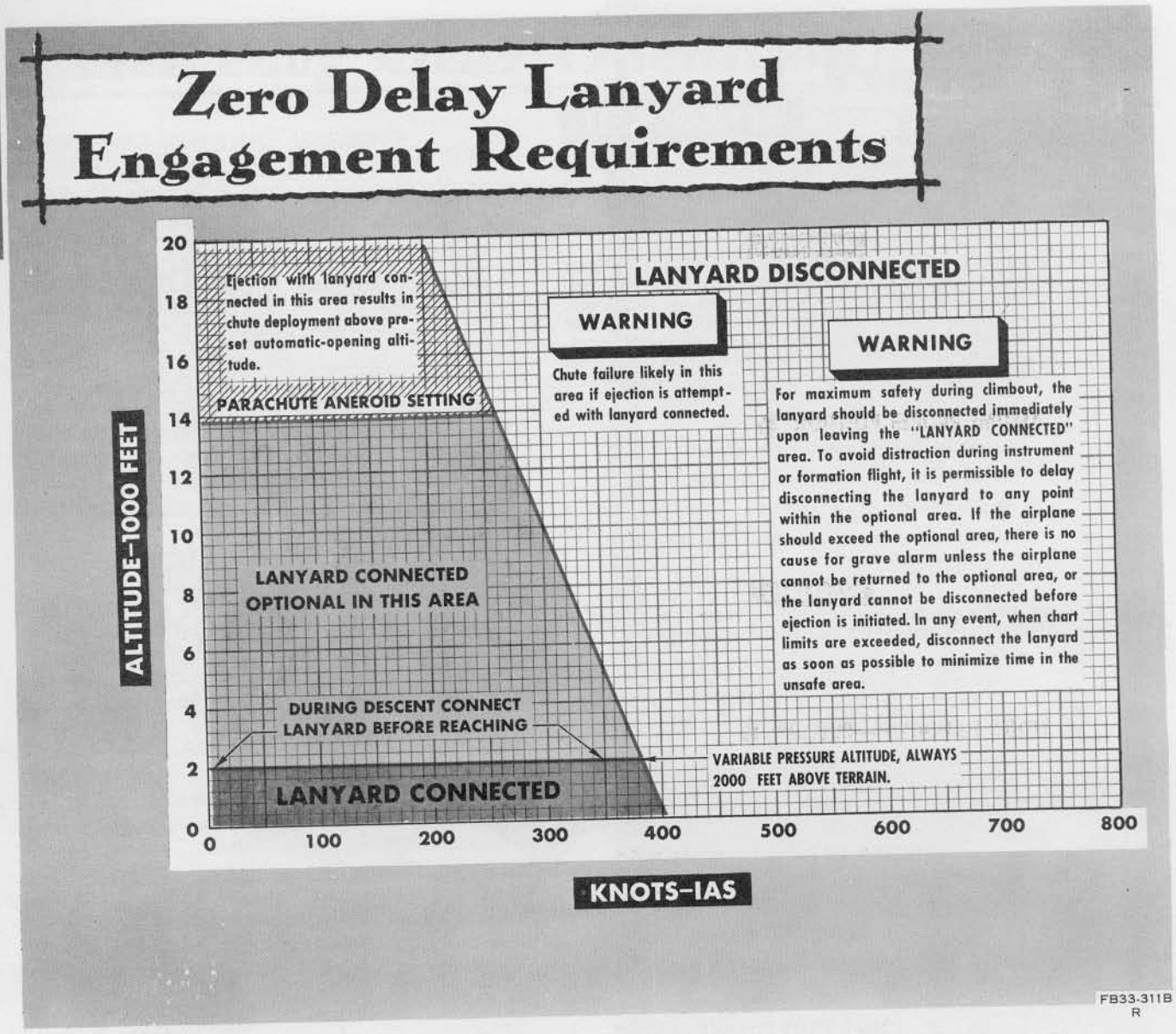


Figure 3-5

TAKE-OFF AND LANDING EMERGENCIES

ABORTED TAKE-OFF

1. **THROTTLES–IDLE** (For Fire Throttle of Affected Engine CLS'D)

CAUTION

If both throttles are placed in the CLS'D position the generators will be disconnected from the bus system at approximately 30% rpm and volumetric output of the hydraulic pumps will be greatly reduced.

2. **SPEED BRAKES–OPEN**
   Simultaneously open speed brakes while retarding throttles.
3. **DRAG CHUTE–DEPLOY**
4. Braking Action - Aerodynamic, Normal Emergency
   Use aerodynamic braking down to approximately 120 knots, lower nose gear to runway and employ normal braking technique, or emergency brake system if normal brakes are not available.

CAUTION

Care should be exercised while applying brakes to avoid blowing a tire. Fuel drained overboard after engine shutdown could contact the hot wheel causing a fire hazard.

5. Nose gear steering - ENGAGE
6. Prepare for barrier engagement
   Refer to Runway Overrun Barrier, this section.

7. Engines - SHUTDOWN (if fire exists)
   - Throttles - CLS'D
   - Engine master switches - OFF
8. Abandon airplane.

FORCED LANDING

WARNING

All forced landings shall be made with the landing gear extended regardless of terrain. A greater injury hazard is presented whenever emergency landings are made with the landing gear retracted. Increased airspeed or nose-high angle of impact during landings with gear retracted contributes greatly to pilot injury and airplane damage. The nose-high attitude causes the airplane to "slap" the ground on impact, subjecting the pilot to possible spinal injury. Less injury and less airplane damage will result with the gear extended.

It is recommended that a gear-up landing NOT be attempted with this airplane; crew should EJECT instead. However, if a gear-up landing is unavoidable, proceed with the following:

1. External tanks containing fuel - JETTISON

Note

Jettison tanks only if fuel cannot be transferred. Empty tanks should be retained to absorb the shock of landing on a prepared surface.

2. Armament - JETTISON
   If armament is carried, it must be jettisoned in an authorized jettison area.
3. Burn excess fuel to lighten airplane as much as possible.
4. Shoulder harness - LOCK

Note

The pilot is prevented from leaning forward when the shoulder harness is locked. Therefore, locking the shoulder harness may prevent some pilots from reaching the necessary controls.

5. Helmet visor - DOWN
   Lower the helmet visor for maximum protection against wind blast, flying objects and possible flame and smoke.
6. Canopy - JETTISON (if necessary)
   If it is necessary to jettison the canopy, alert RIO and pull the canopy alternate jettison handle.

WARNING

- If canopy is to be jettisoned, make sure it is jettisoned before the airplane comes to a complete stop. Otherwise, sparks from the canopy remover may cause a fire if fuel is spilled in the vicinity of the airplane, or the canopy may become jammed.

- If the canopy is not jettisoned, do not unlock the canopy until the airplane stops.

7. Make normal approach and touchdown.
8. Drag chute - DEPLOY
9. Engines - SHUTDOWN
   - Throttles - CLS'D
   - Engine master switches - OFF
10. Battery and Generators - OFF
11. Abandon airplane.

LANDING GEAR UP OR UNLOCKED

Unsafe Indication

The unsafe indication could be caused by a malfunction within the indicating system or the result of incorrect gear lowering procedure coupled with a low pressure condition of the utility hydraulic system. Upon initial detection of unsafe gear indication, proceed as follows:

1. Check utility hydraulic pressure within limits.
2. Slow airplane to airspeed below 250 knots IAS.
3. Recycle landing gear handle.
4. Cycle speed brakes and check utility hydraulic pressure indication.
5. Obtain visual check of gear position.
6. If gear still appears unsafe, utilize emergency gear lowering procedures, this section.

If gear appears down and locked with normal utility hydraulic pressure:

7. Shoulder harness - LOCK

Note

The pilot is prevented from leaning forward when the shoulder harness is locked. Therefore, locking the shoulder harness may prevent some pilot's from reaching the necessary controls.

8. Make normal approach and touchdown.
9. Throttles - IDLE
10. Drag chute - DEPLOY
11. Landing gear ground locks - INSTALL
    Install landing gear locks prior to turning off runway

Landing With Nose Gear Up or Unlocked

In the event the nose gear remains up or in an intermediate position and all procedures to extend have failed, proceed as follows:

1. Burn excess fuel, retain empty tanks.
   If time and conditions permit, lighten the airplane by burning out excess fuel load. If external tanks are carried, burn out external fuel and retain tanks to absorb initial shock.
2. Armament - JETTISON
   If armament is carried, it must be jettisoned in an authorized jettison area.
3. Shoulder harness - LOCK

Note

The pilot is prevented from leaning forward when the shoulder harness is locked. Therefore, locking the shoulder harness may prevent some pilots from reaching the necessary controls.

4. Canopy - JETTISON (if necessary)
   If it is necessary to jettison the canopy, alert RIO and pull the canopy alternate jettison handle.

WARNING

- If canopy is to be jettisoned, make sure it is jettisoned before the airplane comes to a complete stop. Otherwise, sparks from the canopy remover may cause a fire if fuel is spilled in the vicinity of the airplane or the canopy may become jammed.

- If the canopy is not jettisoned, do not unlock the canopy until the airplane stops.

5. Make normal approach and touchdown.
6. Land in center of runway.
7. Engines - SHUTDOWN (at touchdown)
8. Drag chute - DEPLOY
9. Hold nose "off" runway.
10. Ease nose to runway - 120 KNOTS IAS

Note

Very little control effectiveness of the horizontal stabilizer will be available below 120 knots IAS.

11. All electrical switches - OFF
12. Abandon airplane.

Landing With One or Both Main Gear Up or Unlocked

In the event one or both main gear remains up or in an intermediate position, after all procedures to extend have failed, the following factors should be considered before making a final decision to land:

1. Crosswind effect.
   Refer to Crosswind Landing, Section II.
2. Width and length of runway.
3. Availability of systems - NORMAL AND EMERGENCY
4. Ground condition.
5. If the above factors are not favorable - EJECT

If a decision to land is made, proceed as follows:

One Main Gear Up or Unlocked

It is preferable to land with both main gear up than with only one extended. The following procedure will retract the main gear while leaving the nose gear extended.

1. Emergency gear handle - RESET
   This will bleed emergency air from the landing gear system.

CAUTION

Failure to bleed emergency air from the system may result in rupture of the hydraulic reservoir on actuation of the normal system.

2. Landing gear circuit breaker - RESET
3. Landing gear handle - DOWN
4. Accelerate to at least 290 KIAS.

Note

The high speed required in this procedure may result in damage to the main gear doors. However, no damage to airplane structure is anticipated, and this loss should not interfere with completion of the procedure.

5. Landing gear handle - UP
   Airloads will prevent nose gear from retracting with main gear.
6. Landing gear circuit breaker - PULL
   Pull circuit breaker while airplane is at high speed quoted.
7. Proceed as with Both Main Gear Up or Unlocked.

If the above procedure fails to retract the main gear:

8. Burn excess fuel, retain empty tanks.
   If time and conditions permit, lighten the airplane by burning out excess fuel load. If external tanks are carried, burn out external fuel and retain tanks to absorb initial shock.
9. Armament - JETTISON
   If armament is carried, it must be jettisoned in an authorized jettison area.
10. Shoulder harness - LOCK

Note

The pilot is prevented from leaning forward when the shoulder harness is locked. Therefore, locking the shoulder harness may prevent some pilots from reaching the necessary controls.

11. Canopy - JETTISON (if necessary)
    If it is necessary to jettison the canopy, alert RIO, pull canopy alternate jettison handle.

WARNING

- If canopy is to be jettisoned, make sure it is jettisoned before the airplane comes to a complete stop, otherwise sparks from the canopy remover may cause a fire if fuel is spilled in the vicinity of the airplane, or the canopy may become jammed.
- If the canopy is not jettisoned, do not unlock the canopy until the airplane stops.

Note

If a BAK6 or BAK9 barrier is available and located at least 1000 feet down the runway from the approach end, the possibility of lowering the tail hook while airborne and engaging the barrier on the approach end should be considered.

12. Make normal final approach.
13. Land on side of runway opposite failed gear.
14. Engines - SHUTDOWN (at touchdown)
15. Drag chute - DEPLOY
16. Ease nose gear to runway immediately.
17. Hold unsafe gear "off" as long as possible.
18. Utilize nose gear steering for directional control.
19. All electrical switches - OFF
20. Abandon airplane.

Both Main Gear Up or Unlocked

1. Burn excess fuel, retain empty tanks.
   If time and conditions permit, lighten the airplane by burning out excess fuel load. If external tanks are carried, burn out external fuel and retain tanks to absorb initial shock.
2. Armament - JETTISON
   If armament is carried, it must be jettisoned in an authorized jettison area.
3. Shoulder harness - LOCK
4. Canopy - JETTISON (if necessary)
   If it is necessary to jettison the canopy, alert RIO and pull the canopy alternate jettison handle.

WARNING

If canopy is to be jettisoned, make sure it is jettisoned before the airplane comes to a complete stop. Otherwise, sparks from the canopy remover may cause a fire if fuel is spilled in the vicinity of the airplane, or the canopy may become jammed. If the canopy is not jettisoned, do not unlock the canopy until the airplane stops.

5. Make normal final approach.
6. Hold normal attitude for touchdown.
7. Engines - SHUTDOWN (at touchdown)
8. Drag chute - DEPLOY
9. Utilize nose gear steering for directional control.
10. All electrical switches - OFF
11. Abandon airplane.

BLOWN TIRE DURING TAKE-OFF

Prior to Reaching Go-No Go Speed

A blown tire during the take-off run presents no special problem. The decision to take-off or abort will depend on airspeed relative to Go-No Go speed and length of runway remaining. Prior to reaching Go-No Go speed, proceed as follows:

1. ABORT TAKE-OFF
2. ANTI-SKID SWITCH-OFF
   Turn anti-skid switch off to prevent loss of braking on the good tire resulting from skid indications from blown tire.

Note

Anti-skid may also be disengaged by depressing the paddle switch on the control stick.

3. Shoulder harness - LOCK
4. Use braking as required to slow airplane.

CAUTION

Avoid braking on the wheel with the blown tire. Heavy braking could cause a flat spot on the wheel which could prevent further wheel rotation and make airplane control more difficult.

Note

Directional control can be effectively maintained throughout the aborted take-off run by use of rudder and nose gear steering.

5. Fire equipment available, engines - SHUTDOWN
   If possible, do not shut down engines until adequate fire fighting equipment is available.

CAUTION

The damaged wheel may be either on fire or very hot, and fuel drained overboard after engine shutdown could contact the hot wheel, causing fire.

After Reaching Go-No Go Speed

If Go-No Go speed is reached, continue take-off and leave the landing gear extended to permit cooling of the blown tire. After reaching Go-No Go speed, proceed as follows:

1. Continue take-off.
2. Damaged tire condition - CHECK
   Check condition of blown tire, if possible, by verification from another airplane.

Note

If it can be determined that the blown tire has been torn from the wheel, the landing gear may be retracted and intended mission completed, depending on mission urgency. If the tire has remained with the wheel and is severely shredded, it is recommended that the gear remain extended so as not to foul the tire in the wheel well.

3. Speed brakes - OPEN
   Extend speed brakes to remain below maximum gear down airspeed and to rapidly reduce fuel load for lighter gross weight landing.

Note

Should conditions dictate an immediate landing, external tanks and/or armament should be jettisoned in appropriate salvo area prior to landing.

4. Do not retract landing gear.

BLOWN TIRE DURING LANDING

Landing With a Known Blown Tire

WARNING

When landing with a known blown tire, foam should not be utilized on the runway due to the possibility of loss of directional control if the good tire and nose gear contacts the foam.

A situation may occur when the pilot must land with a blown tire. In this situation the pilot should insure that the aircrew's shoulder harness is locked prior to making a normal approach and touchdown, landing on the side of the runway opposite the blown tire.

Blown Tire During Landing Roll

A blown tire at high speed will require immediate control action to keep the airplane aligned with the runway. The following procedures are applicable.

1. DRAG-CHUTE - DEPLOY
   Immediately after touchdown, deploy drag chute.
2. ANTI-SKID - OFF
   Turn anti-skid switch off to prevent loss of braking on the good tire resulting from skid indications from blown tire.
3. UTILIZE AERODYNAMIC BRAKING AND RUDDER STEERING FOR DIRECTIONAL CONTROL, AND LOWER NOSE GEAR TO RUNWAY BEFORE RUDDER CONTROL IS LOST.

WARNING

In the event the rudder fails to correct or maintain directional control, immediately lower the nose gear to the runway and hold nose gear steering button depressed. Hold the control stick forward to increase nose gear steering effectiveness.

4. Use nose gear steering for directional control.
5. Use opposite braking to slow airplane, and maintain directional control, up to and including blowing the good tire if necessary.

CAUTION

If heavy vibration or shaking of the aircraft occurs at high speeds, lock the affected brake and complete the roll out on the sliding wheel. Evidence indicates that better control and less damage may result with locked wheel than with damaged rolling wheel. If rollout is smooth to relatively low speed, however, the brakes should not be locked. Damage will probably not result from the inevitable tire vibration at low speed.

6. Fire equipment available, engines - SHUTDOWN
   If possible, do not shut down engines until adequate fire fighting equipment is available.

CAUTION

The damaged wheel may be either on fire or very hot, and fuel drained overboard after engine shutdown could contact the hot wheel, causing fire.

LANDING WITH UTILITY HYDRAULIC SYSTEM FAILURE

Landing with utility hydraulic system failure is basically the same as a normal landing (figure 2-6), except that the pattern is expanded to avoid steep turns and may be entered at any point, i.e., downwind, base, or straight in.

1. Fly a wide or straight in pattern.
2. Landing gear emergency lowering.
   Refer to Landing Gear Emergency Lowering, this section.
3. Final - 2-3 miles 2-1/2° - 3° GLIDE SLOPE
4. If flaps are retracted - HOLD 15 KNOTS FAST
5. Fly airplane down to the runway.
   Do not flare the airplane or "chop" throttles prior to crossing the end of the runway.

6. After flare-out, throttles - IDLE
7. Drag chute - DEPLOY
   Immediately after touchdown, deploy drag chute.
8. Lower nose gear - 120 KNOTS IAS.
9. Utilize nose gear steering.
10. Brake system emergency operation.
    Refer to Brake System Emergency Operation this section.

NO-FLAPS LANDING

A no-flaps landing is completed the same as a single engine landing (figure 3-2) except that flaps will not be available at touchdown; therefore, the increased final approach speed must be maintained until flare.

1. Fly a wide or straight in pattern.
2. Landing gear - DOWN
3. Flaps - RETRACT
4. Final - 2-3 miles. 2-1/2° - 3° GLIDE SLOPE
5. Hold 15 knots fast.
6. Speed brakes - AS REQUIRED
7. Fly the airplane down to the runway.
   Do not flare the airplane or retard throttles prior to crossing end of runway.
8. Make normal touchdown and roll-out.

RUNWAY OVERRUN BARRIER

The procedures listed below for engaging a runway overrun barrier installation involve only those steps necessary for actual engagement. It is assumed that those steps necessarily required (if available) for slowing the airplane prior to engagement have been performed, i.e., speed brake, drag chute, aerodynamic braking, and wheel braking. For more detailed information on the runway overrun barrier systems, refer to Runway Overrun Barrier Systems, Section VII of this manual. Any time the airplane cannot be stopped safely on the runway, attempt to engage the runway overrun barrier executing as many of the following procedures as time will permit:

1. **EXTERNAL LOAD – JETTTISON (if necessary)**
   If a tail hook arrestment is anticipated, external loads may be retained. However, if a tail hook arrestment is not possible, external loads should be jettisoned as soon as possible after the emergency is known.

WARNING

In cases of known emergency, jettison external tanks before landing. If the external tanks are jettisoned close to the barrier, they will roll into the barrier and create a fire hazard.

2. **TAIL HOOK –DOWN**
   Lower the tail hook at least 2000 feet before the barrier, but not until the nose gear has been lowered to the runway.

CAUTION

If an emergency arises whereby battery power may be lost before a landing can be made, the tail hook should be lowered in flight. If the tail hook is lowered in flight, caution must be exercised during landing to prevent the possibility of engaging the tail hook arresting gear on the approach end of the runway.

3. **CANOPY–JETTISON (if necessary)**
   If jettisoning the canopy is necessary, it should be jettisoned prior to the time the airplane comes to a stop.

WARNING

If the canopy is jettisoned after the airplane has stopped, sparks from the canopy remover may cause a fire if fuel has spilled in the vicinity of the airplane, or the canopy may become jammed.

Note

If the canopy is not jettisoned, do not unlock the canopy until the airplane has come to a complete stop.

4. Throttles - IDLE (at touchdown)
5. Shoulder harness - LOCK
6. Steer toward center of the barrier.
   Utilizing nose gear steering and/or brakes, attempt to engage the barrier in the center and at a 90° angle. This will insure a positive engagement and safe arrestment.
7. Brakes - RELEASE
   Immediately prior to arrestment, release the brakes to insure a positive barrier engagement.
8. Engines - SHUTDOWN
   After the airplane has stopped, and fire equipment is available, shutdown the engines.
   a. Throttles - CLS'D
   b. Engine master switches - OFF
9. All electrical switches - OFF
10. Abandon the airplane.

EMERGENCY ENTRANCE

Procedures and precautions to be observed by rescue personnel when assisting the pilot from the airplane following a crash landing are outlined in figure 3-6.

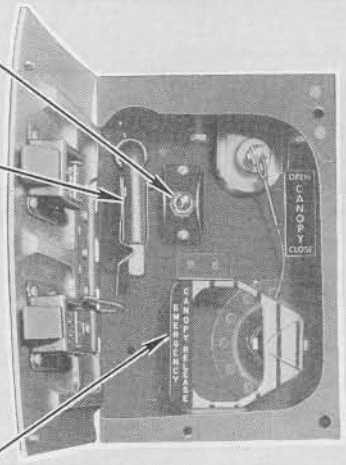
WARNING

If the canopy was jettisoned, the ejection seat handgrips may be up. With the handgrips up, the triggers will be exposed and any movement of either trigger may fire the seat and eject the pilot.

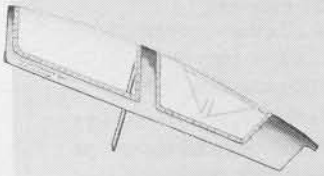
Emergency Entrance and Exit

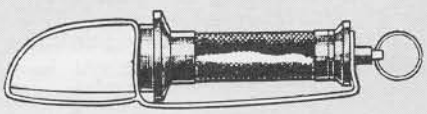
1 ACTUATE CANOPY SWITCH

2 UTILIZE CANOPY WRENCH



3 JETTISON CANOPY





CANOPY KNIFE
(BOTH COCKPITS)

LAST RESORT— BREAK THE CANOPY

IF THE CANOPY CANNOT BE OPENED, BREAK THE CANOPY WITH A SHARP POINTED INSTRUMENT SUCH AS A KNIFE OR AXE.

Note

IF THE CANOPY CANNOT BE REMOVED BY THE ABOVE PROCEDURES, THE AIRCREW CAN BREAK THROUGH THE CANOPY WITH THE CANOPY KNIFE.

FB33-304D

Figure 3-6

EMERGENCY EXIT

A canopy knife (figure 3-6) is mounted in each cockpit so the aircrew can break through the plexiglas in the canopy if it cannot be opened by normal or emergency procedures. In the event that no cockpit ladder or alternate device (access stand, etc.) is available, the shoulder harness may be used as "scaling ropes" for emergency exit from the cockpit.

DITCHING

Note

Thoroughly inspect emergency and survival equipment. Check parachute, life vest, and raft (survival kit) prior to over water flights.

Ditch the airplane when no alternative is available. All survival equipment is carried by the pilot, thus ejection is advisable. However, if altitude and situation demand ditching, observe the following:

1. Make radio distress call.
2. IFF - EMERGENCY
3. External tanks - JETTISON
   External tanks emergency jettison button - DEPRESS
4. Armament - JETTISON
   If armament is carried, it must be jettisoned in an authorized jettison area.
5. All personal leads - DISCONNECT (exept oxygen)
   Disconnect all personal leads, except oxygen hose to prevent fouling when leaving the cockpit.
6. Oxygen diluter lever - 100% O_2
7. Landing gear - UP
8. Flaps - EXTEND
9. Helmet visor - DOWN
   Lower the helmet visor for maximum protection against wind blast, flying objects and possible flame and smoke.
10. Canopy - JETTISON
    Prior to ditching, alert RIO and jettison canopy by pulling canopy alternate jettison handle. If canopy does not jettison, raise either handgrip.

WARNING

With handgrips up, seat ejection triggers are exposed and armed. Do not actuate either trigger as seat will eject.

11. Shoulder harness - LOCK

Note

The pilot is prevented from leaning forward when the shoulder harness is locked. Therefore, locking the shoulder harness may prevent some pilots from reaching the necessary controls.

12. Fly approach heading parallel to uniform swell pattern.
13. Engines - SHUTDOWN
    Prior to touchdown, shut down engines.
    - Throttles - CLS'D
    - Engine master switches - OFF
14. Make water touchdown -
    - Normal flare-out
    - Normal landing attitude
    - Touchdown along wave crest.
15. Oxygen lead - DISCONNECT
    Disconnect oxygen hose and release mask from face as cockpit is abandoned.

Note

In the event of ditching, and sinking in water when immediate escape is impossible, it is possible for the pilot to survive under water with oxygen equipment until escape can be made. The MD-1 diluter demand type oxygen regulator is a suitable underwater breathing device when the regulator is set at 100% O_2 It is essential that the mask be tightly strapped in place and the diluter lever in 100% O_2.

WARNING

Using the bailout bottle with oxygen hose disconnected will not supply sufficient oxygen for survival. The decrease of pressure within the mask hose during inhalation allows water to enter the valve at the connection fitting.

EMERGENCY JETTISONING

EXTERNAL TANKS

The procedures for external tank jettison are shown in figure 3-7.

CAUTION

- Do not jettison external tanks containing partial fuel except in an emergency. If such action is necessary, jettison tanks in a slight dive to allow fuel to drain forward. This permits a cleaner separation and reduces the possibility of further damage to the airplane.
- Jettisoned fuel tanks sometimes fly laterally and climb rather than fall as normally expected. Therefore, pilots should warn adjacent airplanes before jettisoning tanks so that they can take a position above and forward of the jettisoning airplane.
- When jettisoning tanks in formation, airplanes should line abreast at wide intervals.

Emergency Tank Jettison

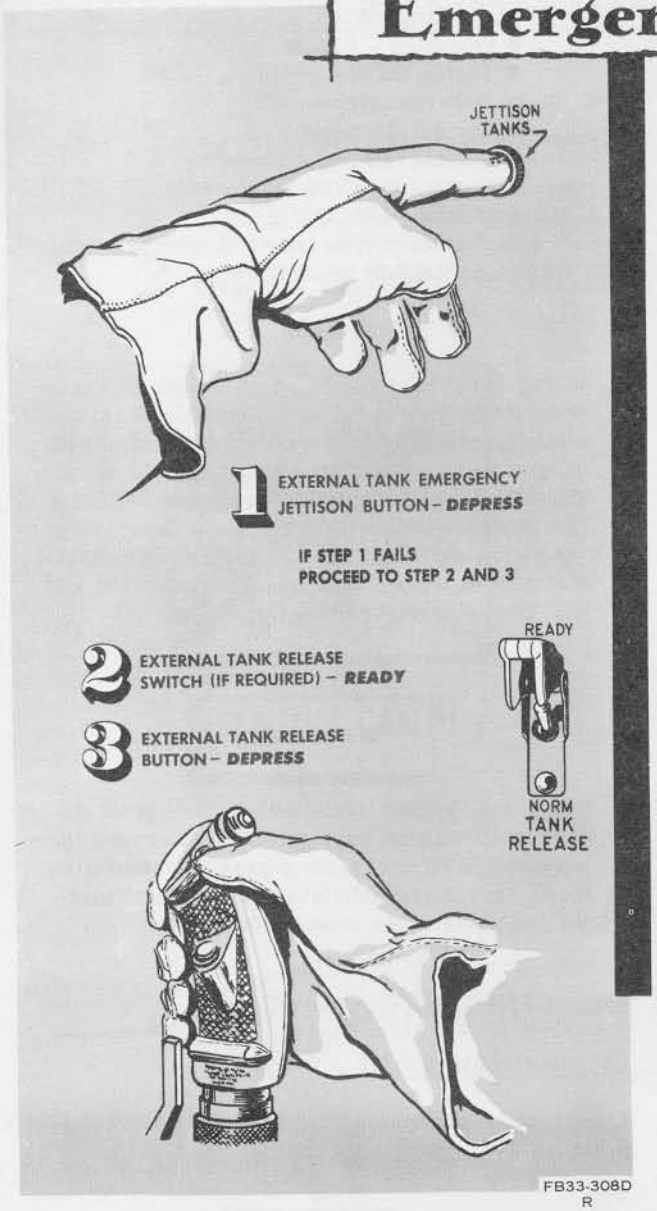


Figure 3-7

ARMAMENT

Emergency Rocket Release

To jettison the MB-1 rocket, the following procedures must be followed:

1. Master arm switch - SAFE
   Check to see if the master arm switch is in the SAFE position.
2. Armament selector knob - JETT
   Place the armament selector knob to the JETT position.

*3. MB-1 Ejector racks lock switch - UNLOCKED

4. Armament trigger - DEPRESS
   When the armament trigger switch is depressed the armament door will rotate and jettison both (unarmed) MB-1 rockets without rocket motor ignition.

CAUTION

When the first MB-1 rocket has been jettisoned, there will be a 5-second delay before the second rocket is jettisoned.

WARNING

The MB-1 rocket will not be jettisoned over friendly territory except in an authorized jettisoned area. Refer to T.O. 1F-101B-29.

Emergency Missile Release

When conditions arise that the GAR-2A missiles must be jettisoned:

1. Armament selector knob - TRIG-SALVO
2. Armament trigger switch - DEPRESS (ALL THE WAY)
   - Missile launchers extend and external missiles fire.

The missile warheads are not actuated in TRIG-SALVO therefore the missiles are unarmed and will not self-destruct. The master arm switch can be left in the SAFE position.

Missile Misfire or Hangfire

In the event of a missile misfire or hangfire indication, perform the following:

1. Armament trigger switch - RELEASE
2. Master arm switch - SAFE
3. Armament selector knob - VIS-IDENT
4. Land with launchers extended.

If the pilot elects to retract the launchers, perform the following:

5. Push-to-retract button - DEPRESS
   The launcher hot light will go out when the launchers retract.

*Some airplanes

MB-1 Rocket Ejector Rack Misfire

In the event that the launcher hot light illuminates on an MB-1 attack, proceed as follows:

1. Armament trigger switch - RELEASE
   Immediately release the armament trigger switch on the control stick to remove the fire signal from the ejector rack.
2. Master arm switch - SAFE
   Place the master arm switch to the SAFE position to disarm the warhead arm-safe switch. The attack mode and rocket armed lights go OFF.
3. Armament selector knob - VIS-IDENT
   Rotate armament selector knob to the VIS-IDENT position to de-energize the select SPL-WPN circuit.
4. Push-to-retract button - DEPRESS
   The launcher hot light will go out when the door rotates to the normal position.
5. MB-1 ejector racks lock switch - LOCKED

WARNING

The MB-1 rocket should be left in the external position for 10 minutes. The 10-minute period insures that the voltage in the thermal batteries will have dropped to a level safely below that required to ignite the rocket motor. This requirement to wait 10 minutes can be waived in event re-attack is required.

AFTERBURNER FAILURE

If the afterburner(s) fails during take-off, the exhaust nozzles will remain open until afterburner fuel flow is stopped. Until the nozzles are closed, the resultant loss of thrust is approximately 30 to 35% of Military thrust. Take-off need not be aborted if remaining runway is compatible with Military thrust requirements, refer to Appendix I charts. The failed engine afterburner throttle should be moved inboard, out of afterburner, immediately to insure exhaust nozzle closure and Military thrust availability. Relights may be attempted if normal exhaust nozzle operation was evident, when safe altitude and airspeed are reached. If abort is necessary, follow abort procedures, under "Take-Off and Landing Emergencies", this section.

AFTERBURNER NOZZLE FAILURE

Failure of the exhaust nozzle to open when initiating afterburner is recognized by higher than normal engine pressure ratio and rapid rise in exhaust gas temperature. The condition may be (but not necessarily always) accompanied by compressor stall. Engine rpm will be near normal. When these abnormal conditions occur, the throttle should be moved inboard immediately, terminating afterburner to prevent possible damage to engine and airplane structure. There is no emergency override or manual control provided for the exhaust nozzle. Exhaust nozzle failure to close when shutting down the afterburner results in lower than normal engine pressure ratio, fuel flow and exhaust gas temperature.

CAUTION

If the exhaust nozzle fails to close when the afterburner is shutdown, a loss of thrust normally available will occur. This thrust reduction will be evident throughout the entire operating range of the engine, with particular effect at the Military (OPEN) thrust setting. Nozzles can often be closed by bringing the throttle of the affected engine to IDLE and then advancing to desired thrust.

In the event the afterburner fails to shutoff when the throttle is moved out of the afterburner detent, the throttle must be retarded to a position equivalent to approximately 83% rpm in order to terminate afterburning. This action mechanically terminates afterburning by opening the afterburner emergency shutoff valve and the lack of fuel pressure at the exhaust nozzle control unit causes the exhaust nozzle to close. Subsequent advancement of the throttle past the 83% rpm position will automatically initiate afterburning providing the failed electrical switch is still on. Refer to Section I, Afterburner Emergency Shutoff Valve.

AFTERBURNER "BLOWOUT" DURING FLIGHT

In the event of afterburner "blowout" or loss of afterburning, the failed engine afterburner throttle must be moved inboard immediately. If no obvious cause (overheat) is discernible, a relight may be attempted. If cockpit indications of resumed afterburning are normal, continue afterburner operation.

Note

Allow a 3 to 5 second period between afterburner termination and relight to assure adequate fuel to igniter.

OIL SYSTEM FAILURE

An oil system failure is recognized by a decrease or a complete loss of oil pressure. If an oil system malfunction has caused prolonged oil starvation of engine bearings, the result will be a progressive bearing failure and subsequent engine seizure. This progression of bearing failure starts slowly and will normally continue at a slow rate up to a certain point at which the progression of failure accelerates rapidly to complete bearing failure. The time interval from the moment of oil starvation to complete failure depends on such factors as: Condition of bearings prior to oil starvation, operating temperatures of bearings, and bearing loads. A good possibility exists for an additional 10

to 30 minutes of engine operation after experiencing a complete loss of lubricating oil. Bearing failure due to oil starvation is generally characterized by a rapidly increasing vibration, and when the vibration becomes moderate to heavy, complete failure is only seconds away. In order to minimize engine damage and conserve remaining operating time for possible emergencies, the affected engine should be shut down upon first recognition of oil system failure.

CAUTION

Since the generator oil supply is taken from the engine supply tank, a generator warning light illumination could be an early indication of engine oil starvation even before an appreciable decrease in oil pressure is indicated on the oil pressure gage. Consequently, if a generator warning light illuminates, the oil pressure gage for that engine should be monitored.

Upon first recognition of sustained oil system failure, (above or below oil pressure limits), complete the following:

Under Critical Thrust Condition:

1. Affected engine - REDUCE THRUST
2. Avoid rapid throttle movement.
3. External tanks - JETTISON (if necessary)
4. Avoid abrupt maneuvers.
   Avoid maneuvers that require excessive "g" forces.
5. After critical thrust condition affected engine - SHUTDOWN

Under Non-Critical Thrust Condition:

1. Affected engine - SHUTDOWN

Note

If the affected engine was shut down immediately after recognition of oil system failure, it may be restarted just prior to entering the traffic pattern and operated at IDLE throughout the landing phase. This will provide additional available thrust in the event of an emergency during landing.

FUEL SYSTEM EMERGENCY OPERATION

Note

With fuel remaining only in fuselage cells 2 and 3, and throttles in afterburner it is possible that the feed tank fuel low warning light will illuminate. Illumination of this light can be expected because of the slow rate of gravity fuel flow from fuselage cells No. 3 to fuselage cell No. 2. It is therefore recommended that the throttles be retarded from the afterburner detent whenever this condition occurs.

ENGINE FUEL SYSTEM

Engine Driven Fuel Pump Failure

In the event that an engine fuel pump fails, the afterburner pump automatically assumes the full unit demands. There will be no indication to the pilot of this failure. Normal engine performance, both afterburner and normal, is available except at low altitudes where heavy fuel demands may cause partial afterburning thrust. Should the failure occur in the afterburner pump, there will be no automatic transfer and afterburning will not be available.

Engine Fuel Control System Failure

Fuilure within the engine fuel control system is evidenced by abnormal increase or reduction of engine rpm, thrust, or temperature or by the inability to reduce rpm. For such instances, transfer to the emergency fuel control system by selecting the EMERG position on the selector switch. If time and conditions permit, avoid an immediate transfer and make selection in accordance with the following:

1. Adjust throttle to match engine rpm.
   Adjust throttle to approximate rpm.

Note

If conditions permit, most satisfactory transfer will result with the throttle in IDLE.

CAUTION

If the throttle setting and engine rpm are seriously mismatched with throttle setting higher than engine rpm, flame-out, compressor stall, or overtemperature may result during transfer to emergency system. The pilot should be prepared to retard the throttle immediately if required.

2. Engine fuel control switch - EMERG
3. Slowly move throttle to desired setting.

CAUTION

- The pilot must monitor all engine instruments while utilizing the emergency system. Throttle movements must be made with caution since the emergency control cannot prevent overtemperature, stall or surge reactions.

- If the emergency system was selected because of main system failure, DO NOT transfer back to the main system. Flame-out or engine limits could be exceeded causing engine damage.

AIRPLANE FUEL SYSTEM

Boost Pump Failure

If fuel boost pumps fail, fuel will still be supplied to the engine by suction feed (below 25,000 feet). During suction feed, high fuel flow rates require by afterburning will limit afterburning operations. Prior to T.O. 1F-101B-761 there is no indication to the pilot of such a condition until engine or afterburner operation is affected. When the combined demands of engine and afterburner fuel flow cannot be met by suction feed, compressor stall, engine surge, or loss of thrust may result. In the event that abnormal engine performance is encountered during afterburning, shift throttle inboard to terminate afterburning. After T.O. 1F-101B -761 boost pump failure will be indicated in the cockpit. Pressure switches are installed upstream of the boost pump check valves, and are connected to the No. 4 and 5 telelights via the warning lights control box. The telelights are labeled FWD BOOST PUMP OUT, and AFT BOOST PUMP OUT.

CAUTION

If boost pumps fail at altitudes above 30,000 feet flame-out of both engines may occur.

Transfer Pump Failure

Normally, in (40) THRU (50) airplanes, the transfer pumps in fuselage cells 1 and 5 will operate until their respective cells are empty. Cell 5 must be empty before the pump in cell 4 will operate. Failure of the pump in cell 5 will result in the inability to transfer fuel from cells 4 and 5 except by gravity flow through the cell interconnectors. In (55) THRU (120) airplane, pump 5 will energize first, and cell 5 must empty before pumps 1 and 4 will energize. A malfunction of pump 5 before completion of transfer from cell 5 will preclude operation of pumps 1 and 4. Cells 1 and 4 will therefore feed only by gravity, or will transfer when the ALL PUMPS position is selected. Transfer pump failure is indicated by illumination of the feed tank fuel low warning light, or abnormal reduction of fuel in cell number 2 while the fuel level in cells(s) 4 and/or 5 remain full. If a transfer pump failure has been detected, proceed as follows:

1. Fuselage tank transfer switch - ALL PUMPS

Note

Selecting the ALL PUMPS position will energize all fuselage transfer pumps.

CAUTION

To prevent overheating the pump units, the transfer system should be returned to normal operation after the cell with the defective transfer pump is empty.

2. Fuel transfer - CHECK
   A decrease in individual cell (fuselage cells 1, 4 and 5) quantity will indicate transfer pump operation.
3. If defective transfer pump is still inoperative, fuselage tank transfer switch - GRAV
4. Adjust throttle to cruise setting.
5. Land as soon as practicable.
6. Before landing, fuselage tank transfer switch - ALL PUMPS

WARNING

If either cell 4 or 5 has the defective pump, maintain nose down attitudes to bring the center of gravity forward as much as possible before proceeding to land.

Note

The use of Maximum or Military thrust should be governed by the amount of fuel remaining in the number 2 cell.

ELECTRICAL SYSTEM EMERGENCY OPERATION

SINGLE GENERATOR FAILURE

Failure of one generator will be noted by illumination of one warning light. The light will indicate which generator has failed. One generator in normal operation is sufficient to support the entire electrical demand or load. In event of generator failure, the pilot should take the following action:

CAUTION

Upon illumination of the warning light, immediately check the corresponding oil gage. The generator failure could have been caused by oil starvation which will also affect the engine oil system.

1. Generator - RESET then ON
   After placing generator switch momentarily to RESET, return to ON position.
2. Generator warning light - OUT
   If generator fault has been corrected, the generator will be reconnected to the system and the warning light will go out.
3. If generator warning light remains ON, failed generator - OFF
4. Land as soon as practicable.

DOUBLE GENERATOR FAILURE

Engines Operating

When both generators fail, both warning lights will be out, and all a-c power will be lost. The battery will

provide d-c power if the battery switch is ON, for a limited time only. Attempt to reset the generators. If one generator returns to operation, the other generator light will illuminate. If the attempt to reset the generators is unsuccessful, land as soon as practicable. Keep radio transmission to a minimum and turn off all non-essential electrical equipment. See figure 1-7, Electrical System Schematic, for battery operated equipment.

CAUTION

With complete generator failure, the boost and normal transfer pump sequence is inoperative.

Immediately upon loss of a-c power, perform the following:

1. Battery - OFF
   To conserve the battery, turn battery switch OFF until non-essential electrical equipment can be turned off.
2. All electrical switches - OFF
   Turn off all electrical equipment that is not essential to flight.
3. Generators - RESET then ON.
   After placing generator switches momentarily to RESET, return to ON position.
4. Voltmeter - CHECK
   - If both generators are reconnected, voltmeter will indicate 115 volts and neither warning light will be illuminated.
   - If both generators are still inoperative, voltmeter will indicate 0 volts and neither warning light will be illuminated.
   - If one generator is reconnected, voltmeter will indicate 115 volts and the failed generator warning light will illuminate.
5. If fault has not been corrected, land as soon as practicable.

Note

Since the battery switch is not required to be ON for the generators to come back on the line, it is recommended that the generator switches be left ON. The generators may reset automatically if the undesirable condition is corrected.

CAUTION

With a double generator failure, thought must be given to conserving the battery for selective power for the gear and flaps and for vital radio transmission. With all electrical equipment off, turn battery switch ON just long enough to extend the landing gear and flaps obtaining a positive indication of gear down and locked and flap position, and to make necessary radio transmission, then turn battery switch OFF. Prior to touchdown, the battery switch may be turned ON again to select nose gear steering.

Engines Inoperative

The generators may automatically disconnect due to engine underspeed or malfunction and through no fault of the generators. A-c power will be available to boost pumps and emergency ignition as long as the engine rotates, however, the power will be low frequency and possibly low voltage. Air starts may be attempted providing engine failure is not attributed to mechanical reasons. With one engine restarted the other generator warning light will illuminate and normal operation will be resumed. D-c power is available during emergencies providing the battery switch is ON.

HYDRAULIC SYSTEM EMERGENCY OPERATION

The loss of one hydraulic pump will be noted by a warning light illumination. The loss of a pump or one entire system presents no serious flight control problem since both systems support each other through dual cylinders actuating the primary flight controls. In the event of a hydraulic pump failure, land as soon as practicable.

CAUTION

If one hydraulic pump fails, the possiblility exists that the other pump will fail due to system contamination.

PRIMARY HYDRAULIC SYSTEM FAILURE

Loss of primary hydraulic system pressure allows the utility system to assume the full demand of the flight control dual units. Also, the nose gear steering will not be available with a primary hydraulic system failure. A priority valve in the utility system denies pressure to all units except the ailerons, stabilizer, rudder, pusher actuator and brakes if the pressure in the utility system drops below 1800 psi.

1. Land as soon as practicable.

UTILITY HYDRAULIC SYSTEM FAILURE

Loss of utility hydraulic system pressure allows the primary system to assume full demand of the flight control dual units. The rudder will no longer be power operated but will be manually controlled by direct rudder pedal pressure. High fluctuations of the utility hydraulic pressure gage or loss of the utility hydraulic system, with the yaw damper of AFCS engage switches engaged, will cause yaw oscillations. Therefore, return both switches to the STANDBY position and yaw oscillations will cease. Most units lost have emergency methods of operation and are available as noted. Refer to Landing With Utility Hydraulic System Failure, this section.

Note

- The flaps will remain down or in an intermediate position if utility hydraulic pressure is lost during or after flap operation.

● The PCS pusher force will be lost in the event of a utility hydraulic system failure. The PCS horn will still be operative.

1. Speed brake retraction is available by electrical selection which causes the pressure to by-pass allowing the air stream to force the panels closed. Refer to Speed Brake System Emergency Operation, this section.
2. Gear extension is available by use of compressed air accomplished by pilot's utilization of the landing gear emergency handle to the left outboard of the console. Refer Landing Gear Emergency Lowering, this section.
3. Brake action is retained by use of compressed air system in the 40 45 airplanes or emergency hydraulic system in the 50 THRU 120 airplanes at the pilot's selection by using the emergency brake handle on the left forward console. Refer to Brake System Emergency Operation, this section.
4. Land as soon as practicable.

CAUTION

With utility hydraulic system failure, neither speed brakes or flaps will be available for landing. Approach and touchdown speeds must be higher. Refer to No-Flaps Landing, this section.

COMPLETE HYDRAULIC SYSTEM FAILURE

In the event of complete hydraulic failure the airplane will become uncontrollable. Pilot should, upon initial detection of hydraulic power loss, note trend of failure as to whether the gages show a definite, steady drop, or if the gages fluctuate. With a steady drop indication, hydraulic power will probably not recover.

1. **DECREASE AIRSPEED.**
2. **ATTAIN LEVEL FLIGHT.**
3. **EJECT.**

FLIGHT CONTROL SYSTEM EMERGENCY OPERATION

In the event of primary or utility system failure, the control forces will remain unchanged, with the exception of the rudder system. Refer to Utility Hydraulic System Failure, this section.

FLIGHT CONTROL SYSTEM FAILURE

If control system difficulties are encountered, perform the following:

Auto-Pilot Engaged:

1. AFCS - DISENGAGE
2. AFCS circuit breaker - PULL
3. Airspeed - BELOW 350 KNOTS IAS.
4. Avoid high speed maneuvers.
5. Avoid abrupt control movements.
6. Hydraulic pressure - WITHIN LIMITS.
7. Descend to lower altitude for warmer air and fly for a few minutes to see if control improves.
8. Land as soon as practicable.

Auto-Pilot Not Engaged:

1. AFCS - ENGAGE
2. If step above does not improve control, AFCS - DISENGAGE
3. AFCS circuit breaker - PULL
4. Descend to lower altitude for warmer air and fly for a few minutes to see if control improves.
5. Land as soon as practicable.

Inadvertent Pusher Engagement

1. Paddle Switch - DEPRESS
2. Pusher switch - OFF
3. AFCS engage switch - STAND-BY
4. AFCS circuit breaker - PULL
5. Decrease airspeed, cycle speed brakes and lower landing gear.

FAILURE OF STABILIZER FEEL SYSTEM BELLOWS SKIRT

Failure of the feel system bellows will result in a reduction of longitudinal control stick feel forces and a change in longitudinal trim. Depending on extent of bellows skirt damage, trim will tend to wander in pitch after each attempt to trim out stick forces. The airplane should be trimmed to obtain a minimum stick force and a firm grip retained on the control stick. High speed flight and abrupt fore and aft control stick movement should be avoided to prevent overstressing the airplane. To reduce required pitch activity and to affect a safer landing, a straight-in approach is recommended.

SPEED BRAKE SYSTEM EMERGENCY OPERATION

Should the normal operating system or the utility hydraulic system fail, and the speed brakes are extended, they may be retracted by placing the emergency speed brake switch on the engine control panel (figure 1-14), to the IN position. This allows the air loads to close the panels to a trailing position.

1. Emergency speed brake switch - IN

LANDING GEAR SYSTEM EMERGENCY OPERATION

LANDING GEAR RETRACTION

There are no provisions for emergency retraction of the landing gear inflight. In the event of an emergency where gear retraction is necessary during ground operation, the gear handle may be raised by exerting a force of approximately 35 lbs. permitting the gear to collapse, if utility hydraulic pressure is available.

Emergency Gear Operation

LANDING GEAR EMERGENCY LOWERING

If normal gear operation fails, the gear can be lowered by utilizing the procedures in figure 3-8.

Note

- The landing gear circuit breaker must be pulled and left in this position to prevent hydraulic reservoir rupture and fire hazard.
- Actuating the landing gear emergency system will cause a considerable amount of hydraulic fluid to be blown out of a fitting adjacent to the left fuel vent mast. This is normal and should not be considered as an additional malfunction by any observing airplane.

CAUTION

Retain landing gear emergency handle in the locked (out) position. Returning the handle to its normal (stowed) position allows the compressed air from the gear down side of the actuating cylinder to be vented overboard.

WHEEL BRAKE ANTI-SKID SYSTEM FAILURE

If a system malfunction is suspected or the anti-skid inoperative light illuminates, the system can be turned off by placing the anti-skid switch OFF. In an emergency, the system can be disengaged by actuating the paddle switch. This lever must be held depressed to disengage the system. The normal braking technique, a soft but steadily increasing pedal force, should be used regardless of switch position.

CAUTION

- The brakes should be released before the system is disengaged to prevent the possibility of skidding.
- Do not pump the brakes when maximum braking is required since this technique only reduces the pressure available at the brakes.

BRAKE SYSTEM EMERGENCY OPERATION

In the event of utility hydraulic system failure or loss of normal brake system, the airplane can be stopped by using the emergency brake system.

1. Allow airplane to decelerate.
   - With drag chute deployed, utilize aerodynamic braking.
   - Delay using wheel brakes as long as safety will permit, thus allowing the airplane to decelerate as much as possible.

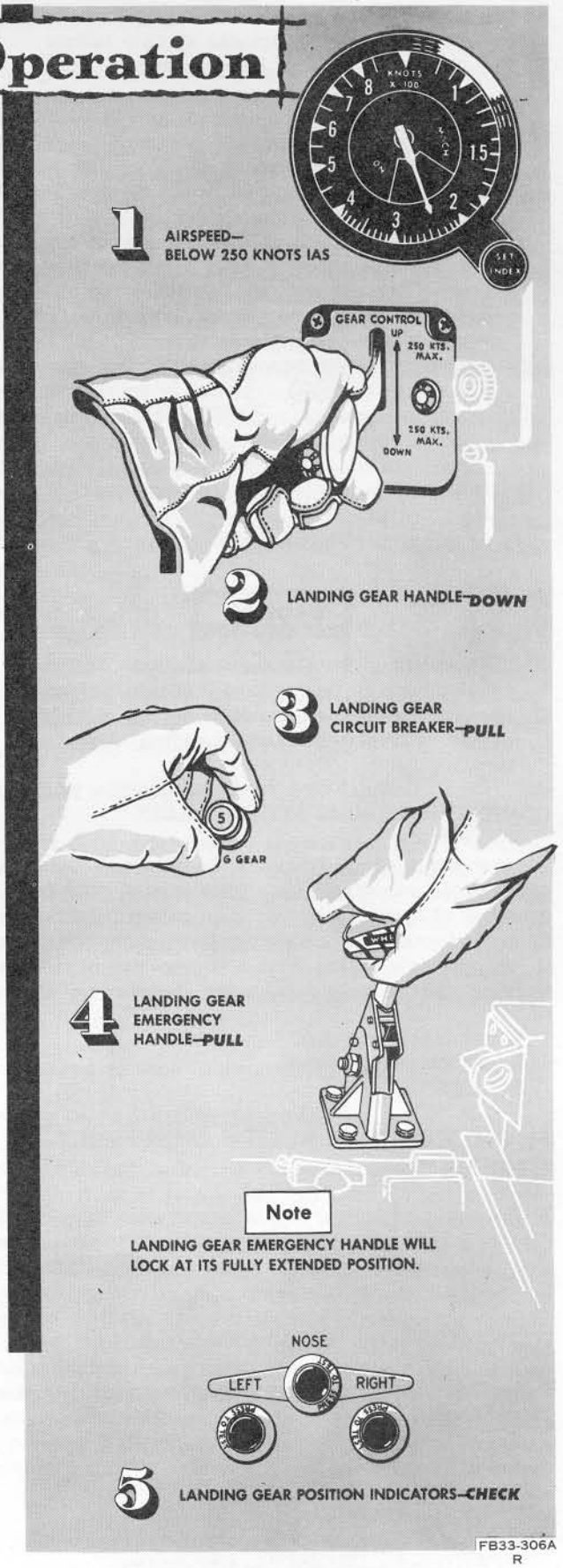


Figure 3-8

2. Emergency brake handle - PULL
   After determining that a go-around will not be made, pull the emergency brake handle.
3. Use nose gear steering for directional control.
4. Brakes - APPLY
   Apply the brakes evenly and simultaneously with a light steady pressure, gradually increasing the pressure to the maximum required (depending on the length of runway available). Hold this pressure until the airplane stops.

CAUTION

- The anti-skid feature of the brake system will not be available.

- In the 40-45 airplanes special attention must be given to maintaining directional control since there is approximately a one second delay between actuation or release of brake pedal force and brake response when compressed air is utilized for braking.

- Approximately three full brake applications will be available from the emergency brake system when the brakes are released and then reapplied. Differential braking may be accomplished for maintaining directional control by slightly reducing the pressure on one brake. Releasing the brakes "dumps" emergency brake pressure and thereby decreases the number of brake applications remaining.

Note

If emergency braking action is exhausted, the tail hook should be lowered, or the throttles may be closed to reduce forward momentum.

section IV Auxiliary Equipment

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COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM

The cockpit air conditioning and pressurization system consists of a primary heat exhanger, a secondary refrigeration package, an air pressure regulator, an air pressure safety valve, and a control panel. Through an arrangement of electrical controls the system supplies conditioned, pressurized air to the cockpit. Refer to figure 4-1.

COCKPIT AIR CONDITIONING

The cockpit is furnished with air at any desired temperature by the cockpit air conditioning system. Hot air, drawn from the last stage of each engine compressor, is slightly cooled by the primary heat exhanger. Some of this slightly cooled air is ducted to the cockpit refrigeration package where it is further cooled to sub-zero temperatures. The cold air from the cockpit refrigeration package is then mixed with by-pass air from the primary heat exchanger to produce any selected cockpit temperature. Air conditioning outlets are provided for the foot heaters, face blowers, suit vent connections and the identification light. Refer to figure 4-1.

COCKPIT PRESSURIZATION

Air from the cockpit refrigeration package pressurizes the cockpit. The amount of pressurization is controlled by the cockpit air pressure regulator which is set at a 5 psi pressure differential. The cockpit air safety valve is used for pressure relief (over-pressure), vacuum relief (underpressure), and as the cockpit dump valve. Both the air pressure regulator and the air safety valve dump into the missile bay to control the temperature of the missiles between 0° and 100°F. When the cockpit altitude reaches 28,000 feet or higher (4.76 psi or less) a pressure light on the telelight panel will illuminate. Refer to figure 4-3 for the cockpit pressure schedule.

Cabin Air Temperature Switch

This toggle switch (figure 4-2) on the air conditioning control panel has positions marked AUTO, MANUAL, HOT and COLD. AUTO position is selected to allow operation of the temperature control as selected by the cabin air temperature knob. MANUAL position is selected to provide for pilot control of the cockpit thermal by-pass valve. The switch is spring-loaded to MANUAL position when AUTO is not selected. Momentarily holding the switch to COLD or HOT position closes or opens the cockpit thermal by-pass valve accordingly to change air temperature. Cycle time from HOT to COLD of the cockpit thermal by-pass valve is approximately 15 to 20 seconds.

Cabin Air Temperature Knob

Turning the cabin air temperature knob toward HOT causes the cockpit thermal by-pass valve to be repositioned toward the open position. Turning the cabin air temperature knob toward COLD produces the opposite effect. As the cockpit thermal by-pass valve opens or closes, the amount of engine compressor bleed air by-passing the cockpit refrigeration package is varied, thus regulating the temperature of the mixed air entering the cockpit. A slight time delay can be expected when selecting a temperature change by means of the automatic temperature control.

Cabin Pressure Switch

This three-position toggle switch (figure 4-2) on the air conditioning control panel has positions marked NORM, OFF and RAM & DUMP. With this switch in the NORM position, the cockpit air shutoff valve is open and the cockpit air pressure safety valve and cockpit emergency ram air shutoff valve are closed. With the switch in the RAM & DUMP position, the cockpit air shutoff valve is closed, the cockpit emergency ram air shutoff valve opens and a solenoid opens the cockpit air pressure safety valve. This allows ambient air to flow through the cockpit. When OFF position is selected, all valves are closed, preventing air from entering the cockpit.

Cabin Pressure Altimeter

The pressure altitude of the cockpit is indicated on the cabin pressure altimeter (figure 4-2). The altimeter

Cockpit Air Conditioning and Pressurization System

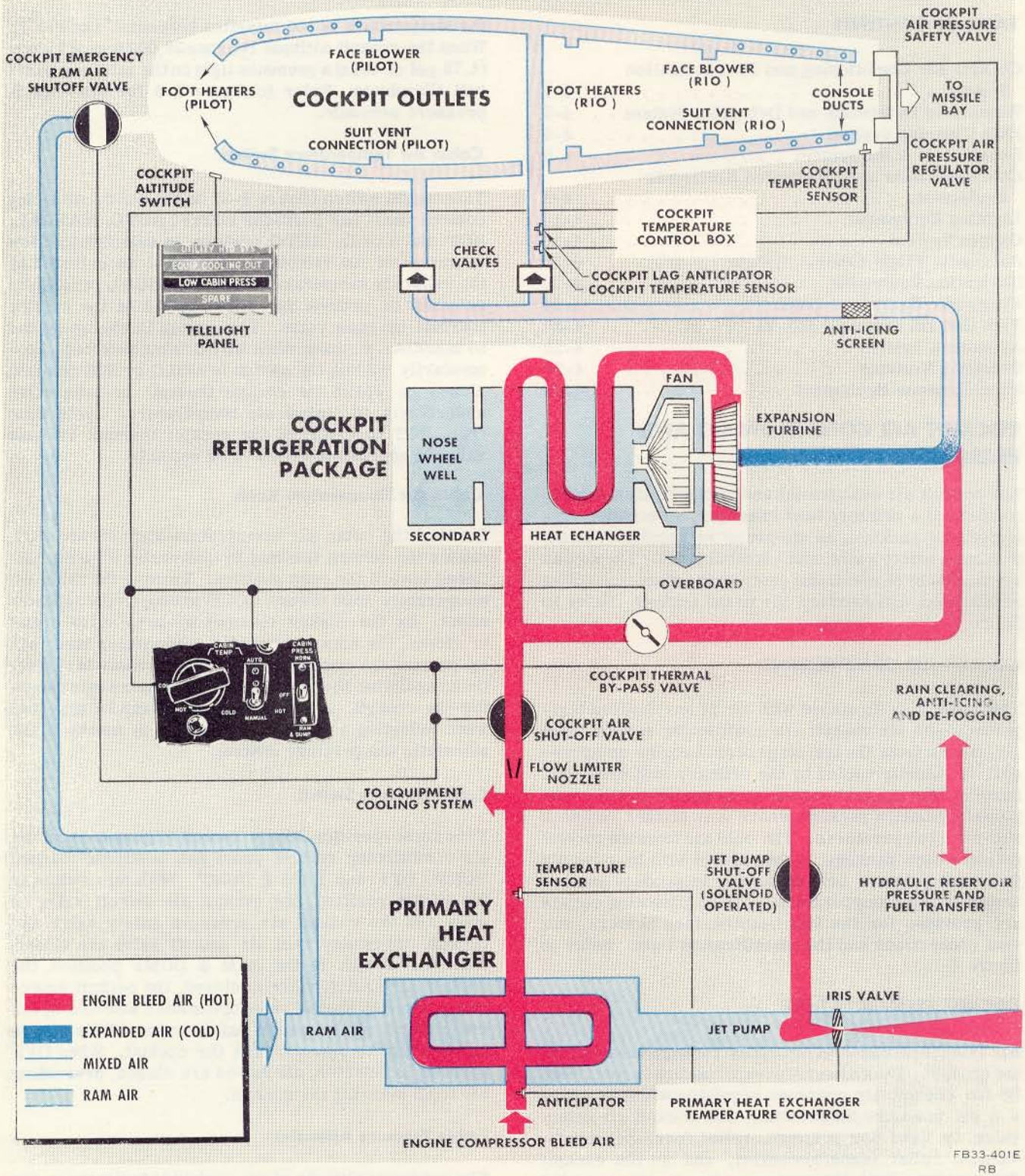

Figure 4-1

Air Conditioning Control Panel

TYPICAL

Figure 4-2

is located on the cockpit air conditioning and pressurization control panel. The meter is vented only to the pressure within the cockpit.

NORMAL OPERATION OF COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM

1. Cabin pressure switch - NORM
2. Cabin air temperature switch - AUTO
3. Cabin air temperature knob - AS DESIRED

EMERGENCY OPERATION OF COCKPIT AIR CONDITIONING AND PRESSURIZATION SYSTEM

If sudden decompression of the cockpit is necessary:

1. Turn oxygen regulator diluter lever to 100% OXYGEN.
2. Push emergency toggle lever from center to insure positive pressure to mask.
3. Move cabin pressure switch to RAM & DUMP.
4. Descend to 25,000 feet or below if circumstances permit.
5. Increase cabin temperature if atmospheric or flight conditions cause fog to be emitted from the cabin air inlets.

If cooling unit functions improperly and temperature of cockpit remains high (HOT):

1. Cabin temperature switch - MANUAL, and hold in COLD selection to readjust temperature as desired.
2. Turn cabin pressure switch to RAM & DUMP if temperature remains uncomfortably high.
3. Descend to 25,000 feet or below if circumstances permit. Ram air temperature can be controlled within limits by increasing or decreasing speed.

WINDSHIELD DEFROSTING AND DEFOGGING SYSTEM

Warm air from the primary heat exhanger is directed to the inside surface of the side windshield panels and front of canopy to prevent fog and ice formation. This air is maintained at the proper temperature by a temperature sensing device which controls a modulating valve. The modulating valve is closed if the temperature should become too high to prevent windshield overheating. The system operates on 115 volt 400 cycle a-c power. The flat area of the windshield is also defrosted by a heating element sandwiched between layers of glass. It is heated by 115 volt a-c power. The controls for the canopy defrosting and defogging system are located on the air conditioning control panel.

AIR DEFROST SWITCH

40 THRU 56-251 60

This two-position toggle switch (figure 4-2) has NORM and OFF positions. The switch should remain in NORM position at all times during normal operations. In the normal position, air is provided to the inside of the windshield and canopy at a temperature controlled by the modulating valve in the primary heat exchanger ram air circuit. The switch should be placed in the OFF position only in an emergency. Placing the switch to OFF stops air flow by closing the modulating valve. This valve is a fail-closed valve. The switch utilizes 115 volt 400 cycle a-c power.

AIR DEFROST SWITCH

56-252 60 THRU 120

This three-position toggle switch (figure 4-2) has positions marked NORM, OFF and EMERG. The switch should remain in the NORM position at all times during normal operations. In the NORM position, air is directed to the inside of the windshield and canopy at a minimum temperature, which is controlled by the position of the modulating valve in the primary heat exchanger ram air circuit. Placing the switch in the EMERG position by-passes the automatic control of the modulating valve and delivers warm air to the windshield and canopy whenever the temperature is below 102°C. Whenever the temperature is above 102°C,

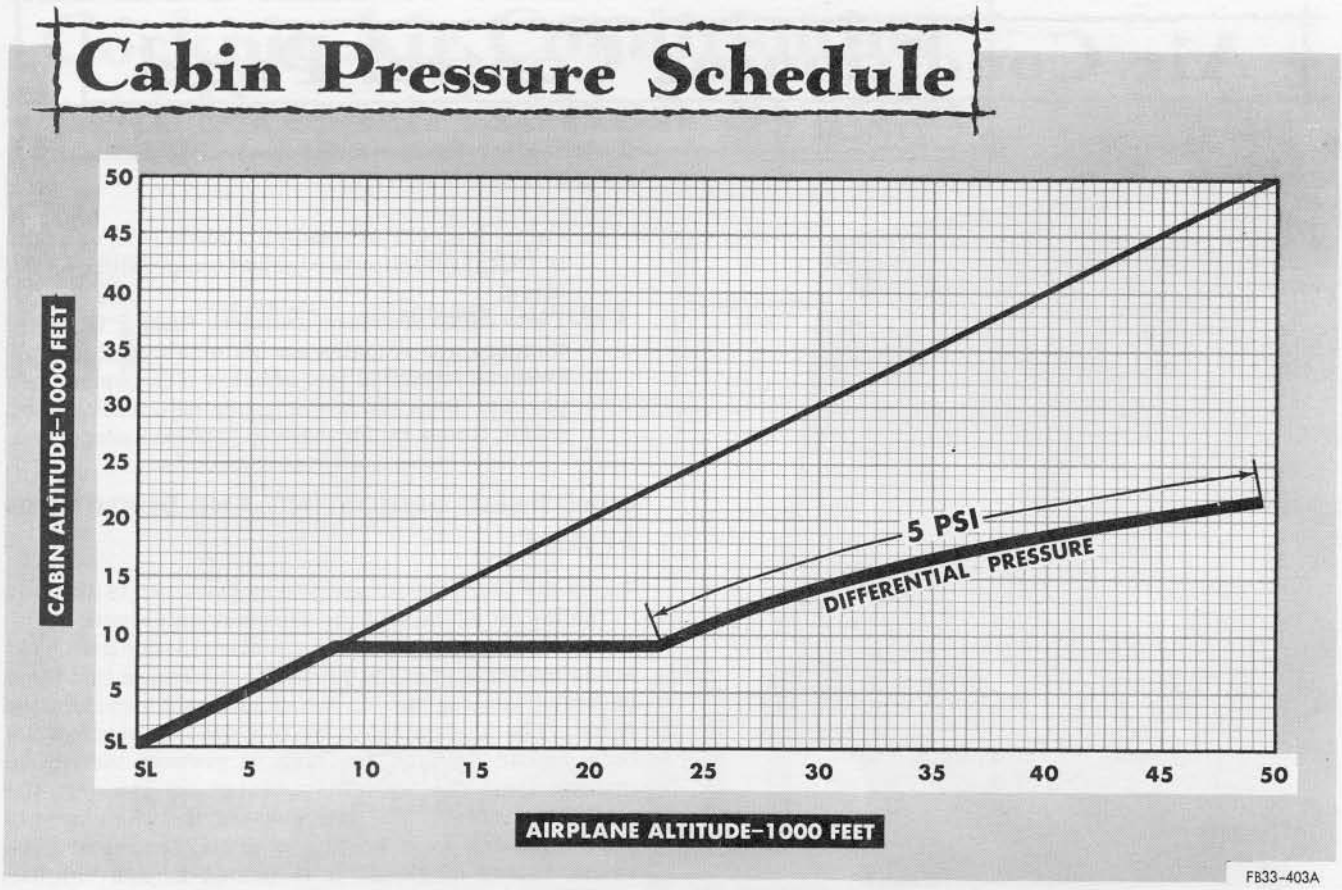

Figure 4-3

the modulating valve will automatically close regardless of switch position.

ELECTRICAL DEFROST SWITCH

The two-position switch (figure 4-2) is placed in the NORM position to supply 115 volt a-c power to the heating element to prevent the formation of ice or fog on the center windshield. In the OFF position, the circuit to the heating element is de-energized. The switch utilizes 28 volt d-c power.

NORMAL OPERATION OF WINDSHIELD DEFROSTING AND DEFOGGING SYSTEM

The following procedures should be used at all times:

1. Air defrost switch - NORM
   If the defrost switch is left in the NORM position ice or fog cannot form and a comfortable cabin temperature will be maintained.
2. Electrical defrost switch - NORM

RAIN CLEARING SYSTEM

To keep the windshield clear of rain or snow, a blast of air passes over the front and left side of the windshield. Two flush external blower nozzles receive air from the primary heat exchanger. The rain clearing system is actuated automatically when the refueling probe doors are open. The controls for the rain clearing system are located on the air conditioning control panel. The circuit utilizes 28 volt d-c power. Refer to Rain Clearing System Operating Speeds in Section V for operating limitations.

RAIN CLEARING SWITCH

The rain clearing switch (figure 4-2) controls an electrically operated valve to direct air from the primary heat exchanger to the windshield. The switch utilizes 28 volt d-c and 115 volt single phase a-c power operates the shutoff valve.

NORMAL OPERATION OF WINDSHIELD RAIN CLEARING SYSTEM

Rain clearing switch OFF unless needed to clear windshield.

CAUTION

Use of the rain removal system while the engines are operating above 90% rpm at sea level subjects the refrigeration units to excessive temperatures which decrease their reliability.

Radio Control Panels

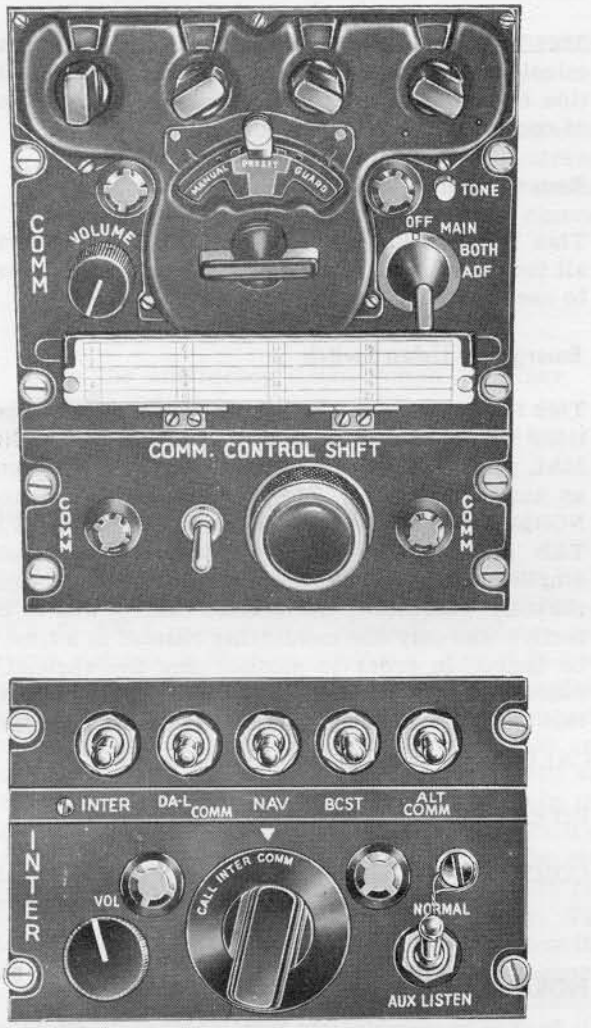

Figure 4-4

PITOT HEAT SWITCH

Prior to incorporation of T.O. 1F-101-883, the pitot heat switch (figure 4-2) is a two-position circuit breaker type switch located on the air conditioning control panel. It provides 115 volt a-c power to a conventional electrical pitot heating element. T.O. 1F-101-883 adds a conventional circuit breaker on the circuit breaker panel (left console-front cockpit), and changes the toggle circuit breaker on the air conditioning control panel to a toggle switch. This toggle switch controls pitot heat, and also controls the heater elements for the CADC and Pitch Control System vanes. The OFF position removes power from all heaters.

FACE HEAT PROVISIONS

A helmet face-plate heater is provided for use with the helmet furnished with the Partial Pressure Suit. Rotary switches control the face heat circuits. The rheostats or rotary switches are located on the pilot's right console (figure 1-16), and on the rear cockpit right vertical panel (figure 1-19). The rheostats or rotary switches are off when the circuits are not in use. Electrical leads are routed through the personal leads disconnect of the seat. This disconnect is located on the front lower section of the seat. The leads have a receptacle that mates to the pressure helmet.

CAUTION

Use the minimum amount of heat necessary to prevent or remove any accumulation of moisture on the face plate. It is not necessary that heat be felt on the face. The face plate heat rheostat should be at maximum heat just long enough to remove moisture and then return to the minimum heat required to prevent moisture accumulation.

ENGINE ANTI-ICING SYSTEM

An independent system for anti-icing the engine inlet guide vanes is provided on each engine. Hot air taken directly from the compressor is ducted to the vane area and upon automatic selection by a sensing probe in the left engine inlet duct, directed to the vanes proper. The entire selection is automatic.

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

INTERCOM SYSTEM-AN/AIC-10

The intercom system provides voice communication between cockpits while the airplane is on the ground or in flight, and between cockpit and ground during ground maintenance operations. The system also amplifies the output of the UHF, and the Pitch Control and Landing Gear Warning Systems. The system receives electrical power from the 28 volt d-c bus. A control panel (figure 4-4) is provided in each cockpit for the purpose of selecting the desired mode of operation and monitoring all audio signals from the radio receiver and intercommunication lines. Audio signals can be received individually or simultaneously with use of controls from either cockpit. The control panels are identical.

Channel Selector Knob

This three-position rotary knob (figure 4-4) has positions marked CALL, INTER and COMM. The INTER position is provided for voice communication between cockpit and ground maintenance. The COMM position is a dual purpose position which allows voice communication between cockpits (HOT MIC) without the necessity of depressing the microphone button. The other

function of the COMM position is to allow transmission and reception with the UHF command radio when utilizing the microphone button. The spring-loaded CALL position is provided to interrupt all other operations and permit urgent interphone communication.

Monitoring Switches

Three of the five toggle switches (figure 4-4) located across the top of the control panel are used to monitor the radio receivers and the interphone line. The switches are marked INTER, COMM, NAV and perform as follows:

(40 THRU 60)

INTER	For interphone reception and to monitor the interphone line when the channel selector is in COMM position.
COMM	For UHF audio reception only.
NAV	For TACAN/ILS audio reception only.
BCST	Inoperative.

(65 THRU 120)

INTER	For interphone reception and to monitor the interphone line when the channel selector is in COMM position.
DA-L/COMM	For UHF audio reception when data-link voice signals are not being received. AN/ARC-34 audio reception will terminate whenever data-link voice signals are being received.
NAV	For TACAN/ILS audio reception only.
BCST	Inoperative.
ALT COMM	For AN/ARC-34 audio reception when data-link voice signals are being received.

Volume Control Knob

The volume control knob (figure 4-4) located on the left of the control panel is turned to vary the volume of the voices or audio signals received in the headsets.

Pilot's Microphone Button

The pilot's microphone button (figure 1-4) is located on the right throttle lever grip. This push button is depressed to talk into the microphone when transmitting over the communication radio. The button is not depressed for interphone communication when the channel selector switch is in the COMM (hot mic) position. After incorporation of T.O. 1F-101-922, an alternate microphone button will also be installed on the pilot's control stick grip.

Rear Cockpit Microphone Button

This button, depressed by the left foot, permits transmission over the communication radio or communication from the rear cockpit when the "hot mic" mode of operation is not employed.

Rear Cockpit Radio Cutout Button

This button, depressed by the right foot, interrupts all incoming radio signals from the headsets in order to use the interphone system.

Emergency Listen Switch

This two-position toggle switch (figure 4-4) has positions marked NORMAL and AUX LISTEN. The NORMAL position is used at all times except in the event of an amplifier failure. The toggle switch is safetied at NORMAL (up). When the switch is moved to AUX LISTEN any incoming signals by-pass the interphone amplifier and come into the headset at line level (unamplified). Therefore, the volume control will be ineffective and only one monitoring channel at a time can be heard. In order to monitor any one channel, all other switches must be in the OFF position. Operation of the channel selector knob is as follows:

CALL	Listen only
INTER	Normal operation
COMM	Normal for (HOT MIC) operation but inoperative for transmission over UHF command radio.

NORMAL OPERATION OF INTERCOM SYSTEM

1. For communication between cockpits (HOT MIC) place both channel selector knobs on COMM.
2. With channel selector on INTER, depress mic button for communication between cockpits.
3. To transmit or receive on UHF command radio, place channel selector on COMM and press microphone button to talk.
4. For urgent interphone communication, hold channel selector knob to CALL.
5. To receive audio signals with VHF navigation receiver, use monitoring switch marked NAV. To monitor TACAN navigation and UHF communication radio receiver and use interphone simultaneously, place channel selector on COMM and use the INTER and NAV monitoring switches.
6. For communication between cockpits when the Pilot's Channel Selector knob is in COMM position with RIO in INTER, pilot must place the INTER monitoring switch on (up). This procedure will permit the pilot to transmit and receive communication with the RIO. For transmission to the pilot, the RIO must depress the foot operated microphone button.

EMERGENCY OPERATION OF INTERCOM SYSTEM

In the event of amplifier failure which is evident by silence or unintelligible signals from all receivers, the following procedure is used:

1. Place emergency listen switch to AUX LISTEN.
2. Place rotary knob to COMM (HOT MIC)
3. Any one monitoring switch - ON
   In the event that more than one monitoring switch is ON (up), the switch to the extreme left will take priority. When all monitoring switches are in the OFF position, the channel selector knob can be utilized.

Note

When the emergency listen switch on either cockpit control panel is in AUX position, no transmission over the communication radio can be accomplished from that cockpit.

UHF COMMAND RADIO-AN/ARC-34

The UHF command radio (figure 4-4) provides two-way voice communication, in the frequency range of 225.0 to 399.9 megacycles, between airplanes and ground stations or between airplanes. Any of 20 frequencies may be preset. In addition to the preset frequencies, a manual means of frequency selection is available. The set uses two receivers, a main receiver and a guard receiver. The functions of the set are selected by a four-position control switch on the right side of the control panel. The OFF position of this switch disconnects 28 volt d-c power from the set. In the MAIN position, the transmitter and main receiver are operative on the selected frequency. The BOTH position allows transmission and reception on the selected channel as well as reception on guard channel. The ADF position provides automatic direction finding as indicated by the number one bearing pointer on the bearing-distance-heading indicator. A tone button, next to the control switch, provides continuous tone transmission to aid ground stations in obtaining a direction finding bearing. A channel selector knob on the center of the control panel is turned to select the desired preset channel. Above the channel selector knob is a window marked MANUAL, PRESET and GUARD. A slide pointer over the window may be positioned over either of these three positions. With the slide in MANUAL, the frequency must be manually selected by the use of the four selecting knobs at the top of the panel. In PRESET position, the frequency is obtained by merely turning the channel selector knob. The GUARD position selects the fixed guard frequency for the main receiver and transmitter. A plastic card located on the right hand side of the canopy frame, records the frequencies that have been preset and assigned the 20 channels. There is also a card on the control box on which these frequencies may be recorded. The channels are numbered within the above mentioned window. Audio volume is adjusted by a knob on the left side of the control panel. The rear cockpit is provided with switches which allow the RIO to cut out all incoming signals or to initiate communication. The RIO can also select ADF mode by use of an override switch. An additional microphone switch and radio cutout switch is installed on the pedestal panel in dual control airplanes. For operation of the command radio in conjunction with the intercom system, refer to Intercom System of this section.

Note

- No transmission will be made on emergency (distress) frequency channels except for emergency purposes. For test, demonstration, or drill purposes the radio equipment will be operated in a shielded room to prevent transmission of messages that could be construed as actual emergency messages.
- In the 50 THRU 80 airplanes after T.O. 1F-101B-571 and 85 THRU 120 airplanes, either crewmember can take control of the UHF Command Radio by use of the control shift panel. See figure 1-24 and figure 4-19. The green light illuminates on the panel having control.

Antenna Selector Switch

The antenna selector switch is a two-position toggle switch (figure 1-14) mounted on the Engine Control Panel. It has positions marked UPPER and LOWER, and allows the pilot to select the upper or lower UHF antenna for transmission and/or reception. In the 40 THRU 90 airplanes when the antenna selector switch is placed in the UPPER position, the upper antenna is connected to the communications set, and the lower antenna is connected to the data link receiver. Placing the antenna selector switch in the LOWER position reverses this condition. In the 95 THRU 120 airplanes, whenever ADF is selected, the upper antenna is connected to the data link receiver and the lower antenna to the UHF receiver regardless of switch position. The switch utilizes 28 volt d-c electrical power.

RIO'S ADF Switch

This two-position ON-OFF toggle switch is located on the RIO's instrument panel in the 40 THRU 80 airplanes. It is marked ARA-25. Placing this switch to ON position selects the ADF mode of the UHF set by overriding the control settings in the front cockpit.

OPERATION OF COMMAND RADIO

1. Rotate control switch from OFF to MAIN. Allow approximately one minute for warm-up.
2. Rotate control switch from MAIN to BOTH. This allows monitoring of the guard frequency in addition to the selected frequency.
3. Select PRESET position on slide selector.
4. Rotate channel selector to desired channel. Reception and transmission will now be on this frequency.

5. Adjust VOLUME control to desired audio level.
6. Actuate microphone button on throttle to transmit.
7. Rotate control switch to MAIN to operate with guard receiver off. To transmit on guard frequency leave control switch on MAIN or BOTH, but position slide selector to GUARD.
8. Rotate control switch to OFF to turn radio off.

Manual Selection of Command Radio

To manually select a frequency not preset on the set perform the following:

1. Rotate control switch from OFF to MAIN. Allow approximately one minute for warm-up.
2. Select MANUAL position on slide selector.
3. Turn four knobs at top of panel to desired frequency (note reading at each knob). Reception and transmission will now be on this frequency.

Note

- The guard frequency may be received in both MANUAL and PRESET positions. However, this may be done only if the set control switch is positioned on BOTH.

- To provide for transmission from the rear cockpit, the RIO holds the foot operated microphone switch down. To cut out all incoming signals from the headsets, the RIO depresses the radio cutout switch on the right side of the floor.

ADF Selection and Function of Command Radio

To utilize the automatic direction finding feature of the set, perform the following:

1. Rotate control switch from OFF to MAIN. Allow one minute for warm-up.
2. Select desired frequency for station or air-to-air homing.
3. Rotate control switch to ADF. Observe the number one bearing pointer on the bearing-distance-heading indicator. The pilot's and RIO's bearing-distance-heading indicator should indicate the direction of arrival of the signal from a known transmitting station. A 100 cycle per second tone gradually decreasing in amplitude should be heard superimposed on the incoming signal. During communication transmissions, ADF operation will be interrupted.

Note

The RIO may override the settings on the pilot's control panel and place the UHF set in ADF mode by placing the ARA-25 switch in ON position in the 40 THRU 80 airplanes.

UHF Channel Frequency Indicator

In the 40 THRU 110 airplanes after incorporation of T.O. 1F-101B-626, and in the 115 120, the Remote Channel Indicator will be replaced with the Channel Frequency Indicator. The channel frequency indicator will be installed on the pilot's instrument panel (figure 1-15). The indicator provides three distinct features. When the control panel is set to MANUAL the indicator displays the frequency. When the PRESET position is selected, the indicator displays the channel number. When the GUARD position is selected the indicator displays GD.

NAVIGATION RADIO -AN/ARN-21 (TACAN)

TACAN is a short range navigational radio which converts radio signals into visual displays of azimuth and range. The azimuth signals are displayed as a magnetic bearing to the station on the bearing-distance heading-indicator and in terms of displacement from a selected course on the course indicator. Range from the selected station is displayed in nautical miles on the bearing-distance-heading indicator. A pulse signal from the TACAN transmitter in the airplane triggers a responding pulse from the ground station and the time lapse is translated into distance. The ground equipment can respond to distance inquiries of more than 100 airplanes without interference. The maximum range of the TACAN distance function is 195 nautical miles, however, bearing information is accurate beyond this range under most conditions. TACAN is subjected to errors in multiples of 40°. These errors are most likely to occur near maximum range and near the cone of confusion. These errors usually last less than a minute and should correct themselves if the pilot maintains his heading. An altitude limit switch cuts off power to the set at altitudes above 50,000 feet. All controls for the TACAN set, except the ILS-TACAN switch, are located on the TACAN control panel on the right console. 85 THRU 120 airplanes equipped with dual controls have TACAN control panels installed in the rear cockpit (figure 1-18). The set uses 28 volt d-c and 115 volt a-c power.

TACAN Navigation Control Shift Panel

A panel (figure 4-5) is provided in both cockpits which allows either crewmember to take control of the navigation radio. The toggle switch on the panel in either cockpit is used to take control. The green indicator light illuminates on the panel in the cockpit which has full control. The lights utilize 28 volt d-c power.

Note

In dual control airplanes, the cockpit that has control of the TACAN also controls the course set knob; therefore, course selections must be made from that cockpit.

Tacan and ILS Control Panels

ILS-TACAN Switch

The ILS-TACAN switch (figure 1-15) is located on the pedestal panel and determines which navigational system (ILS or TACAN) will furnish information to the course indicator. The ILS-TACAN switch permits the selection of individual power sources for each system, and therefore prevents ambiguous TACAN indications if the ILS system should fail during an ILS approach. The failure of either the ILS or TACAN system will be indicated by the appearance of a warning flag, and the centering of its respective indicator on the course indicator.

Channel Selector Knobs

The desired operating channel is selected by two knobs. The outer knob selects the first two digits of the desired channel and the inner knob selects the last digit. Any selection from 00 to 129 is possible but only channels 01 to 126 are operative.

CAUTION

Do not select channels above 126 or below 01 as damage to the equipment may result.

Power Switch

The power switch has three positions: OFF, REC, and T/R. In the OFF position, power to the set is shut off. In the REC position, no pulse signals are transmitted and no range information is received. Bearing data only is received and displayed. Both range and bearing signals are received when the switch is in the T/R position.

Volume Knob

This control adjusts the volume of the station identification signal in the pilot's headset.

Course Indicator (ID-387)

This indicator (figure 1-15) on the front cockpit instrument panel and (figure 1-19) on the rear cockpit instrument panel in airplanes equipped with dual controls, provides a display of ILS and TACAN information. On the face of the indicator appears a course selector knob, a course window, a TO-FROM window, a course deviation indicator (CDI), a glide slope indicator (GSI), a relative heading pointer, and a marker beacon light. The magnetic course to be flown in reference to the selected TACAN station is set in the course window by the course selector knob. The center dot represents the position of the airplane in relation to the desired course, represented by the

FB33-447B

Figure 4-5

CDI. The CDI shows direction of deviation from the course set into the indicator. Each dot deflection represents 5° that the airplane is off course. When the ILS-TACAN switch is in the ILS position, the CDI will indicate the location of the center of the localizer beam in relation to the airplane. The GSI indicates the position of the glide slope in relation to the airplane. A red warning flag appears at the end of each indicator if unreliable signals are being received, or when the ILS and TACAN are OFF.

Bearing–Distance–Heading Indicator (ID-526)

The bearing-distance-heading indicator (figure 1-15) is installed in both cockpits and provides magnetic heading under the top index, TACAN bearing information under the TACAN (#2) bearing pointer, magnetic bearing to the selected UHF transmitter (when command radio is in the ADF mode) under the UHF signal bearing (#1) pointer, and distance to the selected TACAN station. A circular reference index is provided to aid the pilot in maintaining heading. The index may be set to the desired heading by depressing and rotating the set index knob. In the 56-252 (60) THRU (120) airplanes the heading hold mode of the AFCS may be selected by pulling out the set index knob. The indicator receives heading information from the remote compass system and distance information from the TACAN transponder. Slant range distance readout is displayed on the range indicator when the TACAN set is locked on. When the heading indicator system is in the DG mode, the compass

card and the TACAN bearing pointer are referenced to the DG rather than magnetic north. A red warning flag will appear on the face of the instrument when the signal is unreliable.

Note

Normally when the compass card malfunctions, the magnetic bearing to the TACAN station may still be read under the TACAN (#2) bearing pointer. However, with failure of certain components of the remote compass system, the bearing pointer will continue to operate but will give completely erroneous information.

NORMAL OPERATION OF TACAN

1. Monitoring switches - CHECK
2. ILS-TACAN switch - TACAN
3. Power switch - REC or T/R as desired.
4. Select desired channel.
5. Volume - AS DESIRED
6. Check course indicator by rotating the course set knob until the CDI centers and TO shows in the TO-FROM window. Course window should show same course as TACAN (#2) bearing pointer.

Note

- The power switch must be in the T/R position to make range information available..
- The TACAN bearing pointer will normally search in a counterclockwise direction until a positive lock-on is acquired. If a warning flag is visible or if pointer searches continuously in either direction, signals are unreliable. In either case, pilot should check for proper station identification before suspecting instrument malfunction.
- It is possible that improperly adjusted or malfunctioning ground or airborne TACAN equipment may lock-on to false bearing. Therefore, TACAN should be cross-checked with ground radar or airborne radar as soon as possible after take-off.

EMERGENCY OPERATION OF TACAN

There is no emergency procedure as such for TACAN. If difficulty is experienced, the following checks are recommended. First, check the ILS-TACAN switch in TACAN position. Check to see if there is an obstruction between the ground station and the airplane for TACAN is subject to line-of-sight restrictions. If there are no obstructions, select a second station within range. If operation is satisfactory on the second channel, switch back to the first station to determine if the faulty operation was caused by a temporary pause in station transmission or an unknown obstruction between the station and the airplane.

GLIDE SLOPE AND LOCALIZER RECEIVER SYSTEM- AN/ARN-31 (ILS)

The glide-slope and localizer receiver system provides visual guidance signals to the pilot during instrument approaches and landings. The system is composed of two receivers and displays the guidance signals on the course indicator. The localizer receiver frequencies are spaced 0.2 mc apart from 108.1 mc through 111.9 mc and are selected on the ILS control panel. This receiver provides azimuth information during an instrument landing. The glide slope receiver frequencies are spaced 0.3 mc apart from 329.2 mc through 335.0 mc. The correct glide slope frequency will automatically be selected when the localizer frequency is set on the ILS control panel. This receiver provides elevation information during an instrument landing. The system uses 28 volt d-c and 115 volt a-c power.

ILS Control Panel

The ILS control panel (figure 4-6) is located on the pilot's right console and operates in conjunction with TACAN to form the instrument approach and landing system.

ILS-TACAN Switch

The function of this switch is covered under the discussion of TACAN.

Frequency Selector Knob

The ILS frequency is selected by the frequency selector knob located on the ILS control panel. The knob is rotated until the desired localizer frequency appears in the indicator window. The glide slope receiver is automatically tuned upon selection of a localizer frequency. The knob may be rotated in either direction.

Volume Control Knob

This knob, located on the ILS control panel, regulates the volume of the signal in the pilot's headset

Power Switch

The power switch, located on the ILS control panel has positions marked ON and OFF, and turns the system on or off.

Course Indicator (ID-387)

The operation of this instrument is covered under the discussion of TACAN. The TO-FROM indicator and the course selector knob are inoperative when using the ILS system. The course selector knob is operative when the DG-51A autopilot integrated coupler is utilized and the runway heading must be set in the course window to achieve correct operation of the Automatic Instrument Landing System.

SIF and IFF Control Panels

NORMAL OPERATION OF ILS

1. ILS-TACAN switch - ILS
2. Power switch - ON
3. Volume control - AS DESIRED
4. Observe the deflections of the CDI and glide slop indicators.

CAUTION

Check that the red warning flag for the CDI and GSI disappears. The flag must be out of sight before the indications are reliable.

EMERGENCY OPERATION OF ILS

There is no emergency operation of the ILS system. If the indications are erratic or otherwise unsatisfactory, check that the ILS-TACAN switch is in the ILS position.

MARKER BEACON RECEIVER–AN/ARN-32

The marker beacon receiver provides information of the airplane's location by producing a signal as the airplane flies through the signal cone of a 75 megacycle AM transmitter. The signal produced causes a relay to close which allows 28 volt d-c power to illuminate the amber light on the course indicator. The marker beacon receiver is energized when the 28 volt d-c bus is energized. No controls are provided.

IDENTIFICATION RADAR–AN/APX-25 (SIF/IFF)

The IFF radar identification set provides automatic selective identification of the airplane in which it is installed when properly challenged by surface or airborne radar sets. The system has provisions to identify a specific friendly airplane within a group of friendly airplanes in which the equipment is installed. Supplementary purposes are to provide momentary identification of position upon request and to transmit a specially coded response to indicate an emergency. In operation the SIF/IFF receives coded interrogation signals and transmits coded responsive signals to the source of the challenge, where this response is displayed, together with associated radar information (target, etc.) on the radar scope. Proper reply indicates the target is friendly. Three modes of operation are provided for interrogation or response to interrogation signals. These are known as mode 1, mode 2, and mode 3 , which are used for security identification, personal identification and traffic identification respectively. The radar identification set utilizes 115 volt a-c and 28 volt d-c electrical power.

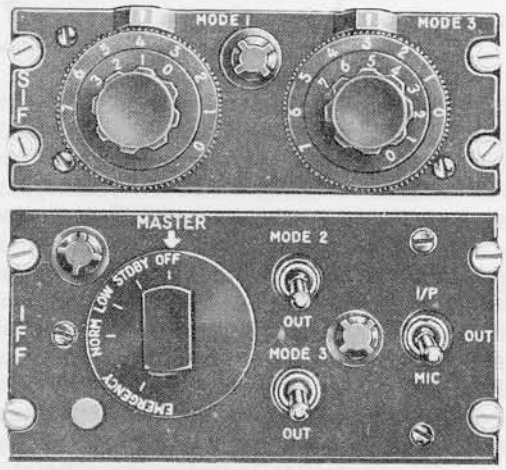

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Figure 4-6

Note

The SIF/IFF can be preset on the ground for Mark X operation. In Mark X operation the SIF (Selective Identification Feature) is eliminated rendering the code selector switches inoperative. However, the set will still operate in all three IFF modes of operation, providing limited preset interrogation and response signals.

Identification Radar Control Panels

Two control panels (figure 4-6) marked SIF and IFF on the right console contain the system master switch, two mode switches, two code selector switches and an I/P switch. The five-position master switch has positions marked OFF, STDBY, LOW, NORM, and EMERGENCY. In the STDBY position the system is inoperative but ready for instant use. In the LOW position the system operates in partial power and replies only in the presence of strong interrogations. In the NORM position the system operates in full sensitivity which provides maximum performance. In the EMERGENCY position the system replies to all modes of interrogation with a special coded signal to indicate an emergency. The mode 2 switch, marked MODE 2 and OUT, is used by the pilot for personal identification. The mode 3 switch, marked MODE 3 and OUT, is used by the pilot for traffic identification. The identification of position (I/P) switch, marked I/P, OUT and MIC, is utilized by the pilot upon request, to provide momentary identification of position when held in the UP position. When placed in the MIC position, the identification of position signals are transmitted while the microphone button is held depressed and 30 seconds after released. Two rotary code selector switches are used to select the specified code signals to be used in Mode 1 or Mode 3 operation. The specified coded signals to be used in Mode 2 are preset on the ground and cannot be changed in flight.

Operation of Identification Radar

1. Rotate master switch to STDBY to maintain equipment inoperative but ready for instant use.
2. Rotate master switch to NORM to place equipment in operation.

Note

The LOW position of the master switch should not be used except under proper authorization. Mode 1, the security identification feature, is in operation when the master switch is in NORM.

3. Set Mode 2 and Mode 3 switches OUT unless otherwise directed.
4. Set Mode 1 and Mode 3 code selectors as directed.
5. For emergency operation, press dial stop and rotate master switch to EMERGENCY and set mode 3 code selector to channel 77 so that the set will automatically transmit a special coded distress signal in response to interrogation.
6. Rotate master switch to OFF to turn set off.

ARMAMENT CONTROL SYSTEM RADAR-MG-13

Refer to Radar System, this section.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

Landing and Taxi Lights

Two 600 watt, 115 volt a-c lamps mounted on the nose gear strut and positioned when the gear is extended provide illumination during landing and taxiing. The left light is used for taxiing; the right light for landing. The lamps are set at different angles for the most effective illumination by each light.

Landing and Taxi Lights Switch

This three-position toggle switch (figure 1-14) located on the left console, controls 115 volt a-c power to the landing and taxi lights. The switch has LDG, OFF and TAXI positions. In (40) THRU 56-2399 (75) airplanes the LDG position is up and the TAXI position is down. In 56-2400 (75) THRU (120) airplanes, the TAXI position is up and the LDG position is down. LDG position is selected to provide power to the right light for landing. Placing the switch in TAXI position removes power from the right light and applies it to the taxi light. The circuit is de-energized automatically by a switch when the gear retracts.

Position and Fuselage Lights

Conventional position lights are provided on the tail and on each wing tip. A fuselage light is located aft of the canopy on the centerline, and a light is located under the fuselage just forward of the engine intakes on each side. The exterior lights each have a bright and a dim lamp. Six degrees of intensity are provided for the dim lamps. The position lights are on steady or flash, according to a switch selection. Twenty-eight volt d-c power is supplied to the dim lights and 28 volt a-c is supplied to the bright lights.

Exterior Lights Knob

A rotary knob (figure 4-7) located on the exterior lights control panel on the pilot's right console is used to control the exterior lights. One of six intensities of the light is provided by turning the knob clockwise from OFF position. Turning the knob to BRIGHT position removes d-c power from the dim lamps and applies a-c power to the bright lamps.

Exterior Lights Flasher Switch

This two-position toggle switch (figure 4-7) located on the exterior lights control panel is marked STEADY and FLASH. The position lights either flash on and off or remain steady according to selections of this switch.

Identification Light

To aid in night intercept identification, the airplane is equipped with an identification light flush mounted on the left side of the rear cockpit (figure 1-1). It is mounted to project its beam perpendicular to the vertical axis and 15° forward of the lateral axis of the airplane. This allows the identification to be made from the right rear of an object.

CAUTION

The identification light must not be operated for more than 5 seconds while the airplane is stationary as damage to the plexiglas window will occur.

On the (40) THRU (70) airplanes, the identification light switch is an integral part of the light assembly with the switch extending into the rear cockpit. In the (75) THRU (120) airplanes the light switch is located on the bulkhead at the front of the RIO's left console. The light utilizes 115 volt, single phase a-c power.

CAUTION

Care must be exercised to avoid actuation of the canopy switch when reaching for the identification light switch.

INTERIOR LIGHTING

Both cockpits are provided with a separate, complete lighting system. The systems are basically identical. The rear cockpit has two additional lights; the chartboard light and the jet computer light. The front cockpit has three thunderstorm lights compared to one for the rear cockpit, and the pilot's control panel

Lighting and Utility Panels- Front Cockpit

Figure 4-7

contains warning light test and dim buttons. Except for these provisions, the control panels are identical. The pilot's lighting control panel is on the right console; the RIO's is on his left console. Either of two separate lighting systems may be selected, each providing adequate illumination. The primary system is supplied with 115 volt single-phase a-c power, transformed to a maximum of 28 volts. Instrument panel lights, console lights, and thunderstorm lights are on this system. The secondary system is supplied with 28 volt d-c and consists of the floodlights for the instrument panel and console floodlights. The console floodlights receive power from both sources, but remain illuminated constantly at a dimmed brilliancy when on the secondary circuit. The utility light in the rear cockpit receives d-c power independent of either system. Console floodlights are on each side of the panel. The consoles and instruments panel are edge-lighted. Thunderstorm lights are provided to aid vision when exposed to lightning. One thunderstorm light is mounted above the left console in the rear cockpit, and one is mounted above the right console in the front cockpit. Two additional thunderstorm lights are located forward on either side of the front cockpit, and these can be turned off and on to permit the use of one light alone, or of all three. Spare bulbs are provided on a panel adjacent to the cockpit lights control panels in both cockpits.

Primary-Secondary Switch

The primary-secondary switch (figure 4-7) has positions marked PRIMARY-SECONDARY and is located on the pilot's lighting control panels. This switch is used to select the basic system of lighting. PRIMARY position applies 115 volt a-c power to the lights on the primary system, and SECONDARY position applies 28 volt d-c power to the secondary system.

Primary System Lighting Controls

Instrument Lights Knob

The instrument lights knob (figure 4-7) located on the cockpit lights control panel is turned clockwise from OFF position toward BRIGHT to provide illumination of the instrument panel edgelights at various intensities.

Note

This knob is also used to control instrument floodlights when the secondary system is selected.

Console Lights Knob

This knob (figure 4-7) on the pilot's lighting control panels is turned from OFF position toward BRIGHT to provide illumination of the console edgelights at various intensities.

Console Floodlights Knob

This knob (figure 4-7) on the pilot's lighting control panels provides illumination of the console floodlights at various intensities when turned from OFF position toward BRIGHT.

Note

The console floodlights remain on at a dimmed constant brilliancy when the secondary system is selected.

Thunderstorm Lights Knob

This knob (figure 4-7) on the pilot's lighting control panels is turned from OFF position toward BRIGHT to provide illumination of the thunderstorm lights at various intensities. The two forward thunderstorm lights are turned on and off by an additional switch (figure 4-7) on the pilot's utility control panel, located on the right hand console.

Secondary System Lighting Controls

Instrument Panel Lights Knob

This knob (figure 4-7) on the pilot's lighting control panels is turned from OFF position toward BRIGHT to provide illumination of the instrument panel floodlights at various intensities.

Note

This knob is also used to control the instrument edgelights in the primary system.

Console Floodlights

The console floodlights remain illuminated at a constant dimmed brilliance when the secondary system is selected.

Chartboard Light Control Knob

This knob (figure 4-14) is located only on the RIO's lighting control panel. The knob is turned from OFF toward BRIGHT to provide illumination of the chartboard light at various intensities. This light is mounted in the center of the RIO's instrument panel. The switch and light receives 28 volt d-c power independent of the PRIMARY-SECONDARY switch.

Jet Computer Light Control Knob

This knob (figure 4-14) is located only on the RIO's lighting control panel. The knob is turned from OFF position toward BRIGHT to provide illumination of the jet computer light at various intensities. This light is mounted above the right console. The switch and light receive 28 volt d-c power independent of the PRIMARY-SECONDARY switch.

Utility Light

The utility light is mounted above the right console in each cockpit. An expansion coil wire permits use of the light anywhere in the cockpit. The light is provided with an integral switch which is turned to provide illumination of the light and vary the intensity. The light receives 28 volt d-c power independent of the PRIMARY-SECONDARY switch.

Standby Compass Light

75 THRU 120 airplanes have a standby compass light installed. The light is turned on and off by a switch on the pedestal panel (figure 1-15) and the intensity is controlled by the instruments lights knob (figure 4-7).

OXYGEN SYSTEM

This airplane has a liquid oxygen system operating at a pressure of 300 psi. Liquid oxygen is vaporized and warmed to produce oxygen sutiable for breathing. A supply tank with a capacity of 10 liters is filled from an access door on the left side of the fuselage. A converter assembly, containing an evaporator coil, changes the liquid oxygen to a gaseous form. A regulator is located on the right console of both cockpits. A quantity gage is provided in the front cockpit adjacent to the regulator. Relief valves protect the system from excessive pressures, and a blow out patch in the oxygen container provides added safety if a relief valve should fail. Adjacent to the filler valve is a build-up and vent valve. This two-way manually operated valve must be placed in VENT position while filling the supply tank. The liquid is added until it flows overboard through the vent. The build-up and vent valve is then positioned to BUILD-UP position. The system is then ready for operation after a 10 minute build-up period.

WARNING

Approximately 12.5% of the system capacity is lost every 24 hour period. This is caused by the slow change of liquid oxygen to gaseous oxygen.

OXYGEN REGULATOR

The MD-1 type regulator (figure 4-8) is located on the right console of both cockpits. The regulator automatically provides for the delivery of the proper mixture of air and oxygen at lower altitudes and

Oxygen Control Panels

pressure breathing at high altitudes. It also provides for the relief of any excess mask pressures.

Note

Above 30,000 feet, a vibration or wheezing sound may sometimes be noticed in the mask. This noise is a normal characteristic of regulator operation and may be overlooked.

Supply Lever

A two-position ON-OFF supply lever (figure 4-8) located on the regulator panel in each cockpit is used to control the flow of oxygen into the regulator. In the front cockpit, this lever is safety wired ON. In the aft cockpit, the lever is left OFF when the regulator is not in use.

Diluter Lever

A two-position lever (figure 4-8) on both regulator panels has positions marked 100% O_2 and NORMAL O_2. NORMAL position provides a mixture of air and oxygen. The 100% position is selected when more oxygen than the normal scheduled amount is required.

Emergency Lever

A three-position lever (figure 4-8) is provided on both regulator panels. The spring-loaded lever can be momentarily held in TEST position to provide a steady flow of oxygen under pressure. When placed in EMERGENCY, the lever remains in position and provides continuous positive pressure to the mask. The center position provides normal system operation.

CAUTION

- The oxygen mask must be well fitted to the face whenever positive pressures are required. A leaking mask results in rapid depletion of the oxygen supply and may cause extremely cold oxygen flow to the face.
- When a partial pressure suit is being used, the emergency lever must be placed in the emergency position in order to deliver continous positive pressure to the helmet.

OXYGEN QUANTITY GAGE

A gage (figure 4-8) adjacent to the regulator panel in the front cockpit indicates the quantity of liquid oxygen in the supply tank. The gage reads 10 liters maximum. The gage utilizes 115 volt a-c electrical power.

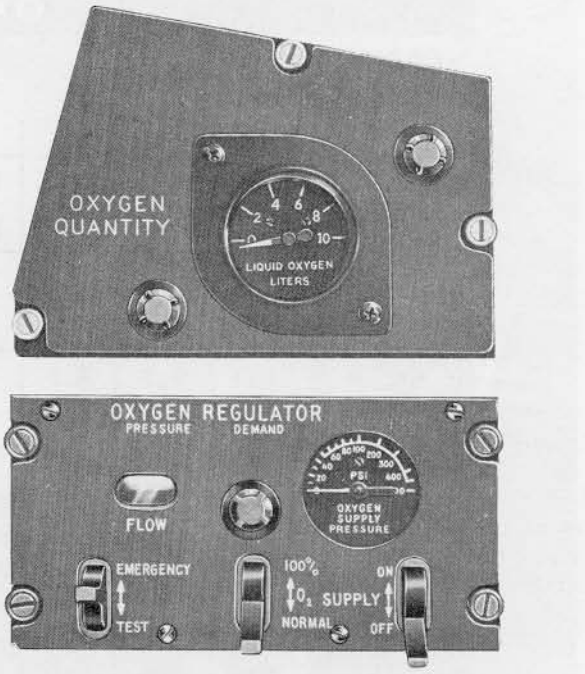

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Figure 4-8

OXYGEN SUPPLY PRESSURE GAGE

The pressure gage (figure 4-8) on the regulator control panel in each cockpit indicates system operating pressure. The maximum reading is 500 psi and the gage should read normal pressure between 300 and 360 psi.

OXYGEN FLOW INDICATOR

The flow indicator (figure 4-8) on the regulator panel is provided to indicate the normal flow of oxygen. The blinker type indicator should move freely with each breath.

OXYGEN SYSTEM PREFLIGHT CHECK

See Figure 4-10 for correct oxygen connection procedure. To assure proper operation, check the oxygen system as follows:

Note

This test procedure is applicable only for an initial preflight check of the system. In-flight tests or repeated tests made within short periods may produce false or misleading indications.

1. Proper security of the ejection seat and face mask disconnects - CHECK

Oxygen Duration Chart

OXYGEN DURATION–HOURS

CABIN ALTITUDE FEET	GAGE QUANTITY–LITERS										BELOW 1
	10	9	8	7	6	5	4	3	2	1	
40,000 AND ABOVE	19.4	17.4	15.5	13.5	11.6	9.7	7.7	5.8	3.9	1.9	EMERGENCY– DESCEND TO ALTITUDE NOT REQUIRING OXYGEN
	19.4	17.4	15.5	13.5	11.6	9.7	7.7	5.8	3.9	1.9	
35,000	13.9	12.4	11.1	9.7	8.3	6.9	5.5	4.2	2.8	1.4	
	13.9	12.4	11.1	9.7	8.3	6.9	5.5	4.2	2.8	1.4	
30,000	10.1	9.1	8.1	7.1	6.1	5.1	4.1	3.0	2.0	1.0	
	10.4	9.4	8.3	7.3	6.2	5.2	4.2	3.1	2.1	1.0	
25,000	7.8	7.0	6.2	5.4	4.7	3.9	3.1	2.3	1.5	.8	
	9.7	8.7	7.7	6.8	5.8	4.8	3.9	2.9	1.9	1.0	
20,000	6.0	5.4	4.8	4.2	3.6	3.0	2.4	1.8	1.2	.6	
	11.0	9.9	8.8	7.7	6.6	5.5	4.4	3.3	2.2	1.1	
15,000	4.8	4.3	3.8	3.3	2.9	2.4	1.9	1.4	.9	.5	
	11.4	10.3	9.1	8.0	6.8	5.7	4.5	3.4	2.3	1.1	
10,000	3.8	3.4	3.0	2.7	2.3	1.9	1.6	1.1	.8	.4	
	10.1	9.8	8.7	7.6	6.5	5.4	4.3	3.3	2.2	1.1	

- **UPPER FIGURES INDICATE DILUTER LEVER "100% OXYGEN"**
- **LOWER FIGURES INDICATE DILUTER LEVER "NORMAL OXYGEN"**
- **GAGE PRESSURE CONSTANT 300 PSI**
- **THE DURATION TIME IS DOUBLED WHEN ONLY ONE CREW MEMBER IS USING OXYGEN**

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Figure 4-9

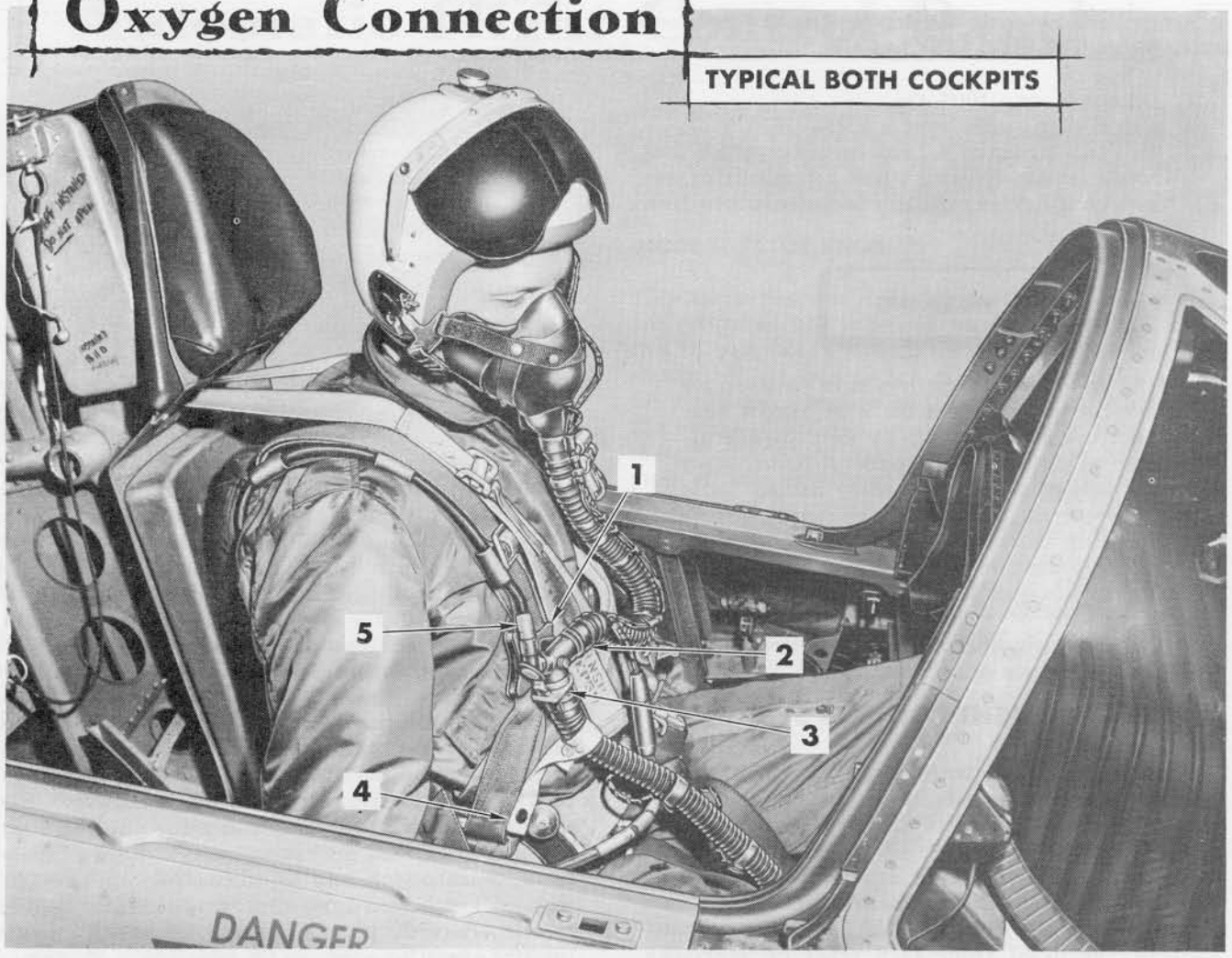
2. Oxygen quantity gage - CHECK. Oxygen pressure gage - Check 300 psi, oxygen quantity gage sufficient quantity.
3. Check oxygen regulator with the diluter valve first at NORMAL O_2 and then at 100% O_2 as follows: Blow gently into end of the oxygen regulator hose as during normal exhalation. There should be resistance to blowing. Little or no resistance to blowing indicates a leak or faulty operation.
4. Fasten oxygen hose as indicated in figure 4-10.
5. Check oxygen pressure gage at 300 psi, liquid content at sufficient quantity.
6. With regulator supply lever ON, oxygen mask connected to regulator, and diluter lever at 100% O_2, breathe normally into mask and conduct following checks:
   a. Observe blinker for proper operation.
   b. Depress emergency lever and hold on TEST. A positive pressure should result within the mask. Hold breath to determine if there is leakage around mask. Release lever, positive pressure should cease.
7. Return diluter lever to NORMAL O_2.

NORMAL OPERATION OF OXYGEN SYSTEM

1. Be sure oxygen pressure gage reads 300 psi before each flight and liquid content gage shows sufficient quantity. If content is below sufficient quantity, have oxygen system serviced before take-off.
2. Front cockpit oxygen supply lever safetied ON. Rear cockpit oxygen supply lever ON, if used.
3. Diluter lever - NORMAL O_2.

Oxygen Connection

TYPICAL BOTH COCKPITS



1. Insert connector into connector mounting plate attached to parachute harness. Check that connector is firmly attached and that lockpin is locked.
2. Insert male bayonet connector, or end of oxygen mask hose, into female receiving port of connector, and turn connector to lock its prongs into recesses in lip of receiving port.
3. Couple seat oxygen hose to lower port of connector.
4. Snap the strap attached to the seat oxygen hose to the harness assembly.
5. Attach bail-out bottle hose to swiveling port of connector by inserting male coupling of bail-out bottle hose and turning it clockwise against spring-loaded collar.

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Figure 4-10

EMERGENCY OPERATION OF OXYGEN SYSTEM

If symptoms of hypoxia develop or if smoke or fumes enter the cockpit proceed as follows:

1. Diluter lever - 100% O_2
2. Emergency toggle lever - EMERGENCY
3. Pull ball handle on H-2 emergency oxygen bailout bottle (which contains about a 6-minute oxygen supply) if oxygen regulator becomes inoperative.

WARNING

In the event emergency oxygen is required for any reason, disconnect the seat oxygen hose from the connector (MC-3A or CRU-8/P attached to the parachute harness) immediately after actuating the emergency bailout bottle to prevent the escape of emergency oxygen through the seat oxygen hose. This action is not necessary when using a seat survival kit with an integrated oxygen supply.

4. Descend to a cockpit altitude below 10,000 feet as soon as possible.

AUTOMATIC FLIGHT CONTROL SYSTEM

The automatic flight control system (AFCS) provides automatic three axis control of the airplane. Automatic turn coordination is also provided through the damper circuits. There are several different modes of operation available as shown in the table of figure 4-12. The compatibility of the various modes of operation are shown in the table. The incompatible modes are automatically excluded from each other by interlocks. Signals from the Central Air Data Computer automatically changes the system parameters to provide uniform response and stable operation at different flight conditions. These parameters are varied as a function of dynamic pressure, altitude and Mach number. Control surface deflection through the AFCS is obtained through the use of electro-hydraulic servos. The ailerons and rudder use an integrated package while the stabilizer uses a separate servo and power cylinder. In addition, the ailerons and rudder have a differential linkage which permits surface deflection by the autopilot or damper without moving the rudder pedals or the stick laterally. The stabilizer has a parallel linkage in which surface motion is reflected back to the stick. Using the manual controls, it is possible to override the system in any or all axes at any time. The AFCS function selector (figure 4-11), is located on the pilot's left hand console. The system is in a stand-by condition within approximately one and one half minutes after 28 volts d-c and 115 volts, three phase a-c power is applied. The damper or AFCS may be engaged at any altitude or attitude. However, if the AFCS is engaged outside the limits of ±65° roll or +58° pitch, it will provide pitch attitude damping and yaw damping only and will not hold the airplane at a fixed reference attitude in roll or pitch.

Note

Bank angle limits during autopilot operation should not exceed 45° for automatic ground controlled intercepts (AGCI), 20° for heading select turns, 20° for preselect headings, 20° for localizer operation, and 10° for glide slope operation.

COMMAND SIGNAL LIMITER (CSL)

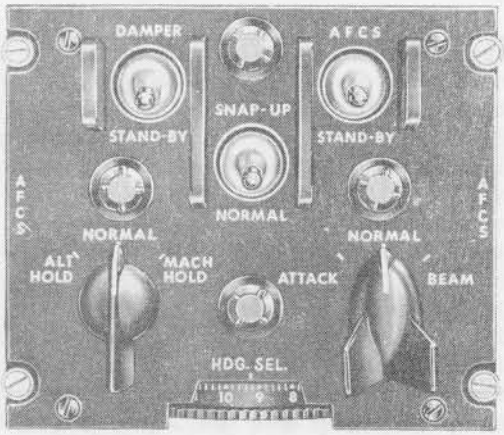
The AFCS has a Command Signal Limiting function (CSL) that limits the angle of attack and "g" loading to safe values. CSL provides this protection only when the AFCS function selector switch (Fig. 4-11) is at the AFCS position. CSL is not operative for damper only. The "g" limits are set to limit maneuvers to +4.0 g and -0.5 g for all flight conditions. These adjustments are not available to the pilot. The angle of attack limits change with Mach number. These limits are adjustable by the pilot during CSL test flights only. The angle of attack limiting curve has a shape somewhat similar to the PCS horn and pusher curves but is set lower than these curves. Because of some dissimilarity in the CSL and horn Mach scheduled angle of attack curves however, there may be times when horn sounding will be encountered while holding against the CSL limit in the transonic regions. When the stick is moved aft at a very rapid rate the CSL will limit angle of attack or "g's" early to prevent the airplane from overshooting into an unsafe region. The CSL may be overpowered by stick forces greater than 60 pounds aft or 30 pounds forward. In addition to the limiting function, the AFCS contains a disengage "g" limiter which acts as a back-up for CSL. This limiter is set to disengage the autopilot at +4.5 or -1.5 "g's". With aft stick forces greater than 28 pounds, this disengage feature is by-passed and the autopilot will not be automatically disengaged as long as this force is held even though the +4.5 "g" point has been exceeded.

STABILITY AUGMENTATION

YAW DAMPER SWITCH

This two-position toggle switch (figure 4-11) has positions marked STAND-BY and DAMPER. In some airplanes, the DAMPER position is marked STAB-AUG and held in this position by a solenoid. Placing this switch to DAMPER energizes the damper system independently from the automatic flight control system. The damper system increases stability about the yaw axis and automatically coordinates all turns. The damper system can be disengaged at any time by placing the damper switch to STAND-BY. The damper can be released by the paddle switch on the control stick but will re-energize when the lever is released.

Automatic Flight Control Panel



FB33-411B

Figure 4-11

AFCS ENGAGE SWITCH

This two-position toggle switch (figure 4-11) on the AFCS control panel has positions marked AFCS and STAND-BY. The switch is spring-loaded to the STAND-BY position and held in AFCS position by a solenoid. In STAND-BY position, the AFCS is inoperative but in a stand-by condition. In stand-by condition, the pitch, bank and heading synchronizers follow the pitch and roll inputs of the vertical gyro and the compass heading. The AFCS may be engaged at any time by placing this switch to AFCS. The AFCS maintains the attitude existing at the time of engaging, providing the pitch attitude is less than 58 degrees and the roll attitude is between 7-1/2 and 65 degrees. If the AFCS is engaged with a roll attitude of less than 7-1/2 degrees, the airplane will roll out to a wings level attitude. To use control stick steering, a fore or aft force of approximately two pounds will change the pitch attitude of the airplane by means of the AFCS. Roll attitude is changed by conventional stick movement except approximately two pounds or more left or right stick force is necessary to remove autopilot signals which would otherwise oppose the pilot's control. When the stick is stabilized at the selected bank angle, either pitch and roll attitude hold or pitch attitude hold and heading hold are re-engaged depending on whether the bank angle is between 7-1/2 and 65 degrees or less than 7-1/2 degrees respectively. The dual control stick does not have control stick steering or command signal limiting. Therefore, with AFCS engaged, control should not be attempted through the AFCS from the dual stick. Emergency stabilizer servo override may be accomplished from either stick. When on heading hold, the heading can also be changed by dialing a new heading on the HDG. SEL. (HEADING) wheel on the function selector (Fig. 4-11). When on roll attitude hold the heading can also be changed by preselecting a heading on the ID 526/ARN bearing-distance-heading indicator. The AFCS can be manually disengaged at any time by placing the AFCS switch to STAND-BY, by pressing the Paddle Switch (figure 1-10) on the control stick, or pulling the AFCS d-c circuit breaker on the pilot's left console.

MODE SELECTOR KNOB

This three-position rotary knob (figure 4-11), on the control panel has positions marked NORMAL, ALT HOLD, and MACH HOLD. With the AFCS control switch on and this switch in ALT HOLD, the AFCS maintains the airplane at the altitude existing when the switch is engaged. When the selector knob is returned to NORMAL position, the AFCS maintains the pitch attitude existing at that time unless two or more pounds stick force are being held. MACH HOLD position is selected to maintain the airplane at the desired Mach number. Signals from the AFCS control hydraulic servo cylinders to position the horizontal stabilizer. The pitch attitude is varied to maintain a constant altitude or a constant Mach if either of those two modes are selected.

Note

In the 40 THRU 100 airplanes, Mach and Altitude Hold do not maintain desired reference within limits of the AFCS Performance Specification. Normally, airplane control provided by these modes is smooth, positive and within usable limits. Under certain flight conditions the airplane may oscillate at a slow rate within 200 feet of reference altitude while on altitude hold and when on Mach hold small pitch and roll transients may be observed.

BEAM-ATTACK KNOB

This three-position rotary knob (figure 4-11) on the control panel has positions marked ATTACK, NORMAL and BEAM. BEAM position is selected to provide AILAS approaches. The pilot sets the ILS beam heading (not necessarily runway heading) on the ID-387 indicator prior to engaging the beam mode. In ILS operation, the roll angle is limited to 20 degrees before intercepting the glide path, and 10 degrees after engaging the glide path. Placing the knob on NORMAL disengages the coupler and returns the system to normal AFCS operation. The ATTACK position is used to provide operation of the AFCS in conjunction with the Data Link and MG-13 fire control system to accomplish automatic ground controlled interception (AGCI), Automatic Attack and VIS-IDENT. The data link system supplies the AFCS with ground transmitted signals to produce heading changes only. The attack mode disengages at the termination of the attack, and the switch returns to NORMAL position unless an abort condition occurs

Table of AFCS Mode Compatibility

	YAW DAMPER	ROLL ATTITUDE HOLD	PITCH ATTITUDE HOLD	PITCH CONTROL STICK STEERING	ROLL CONTROL STICK STEERING	HEADING HOLD	PRESELECT HEADING	LOCALIZER	GLIDE PATH AND LOCALIZER	AGCI	CO-ALTITUDE FIRE CONTROL	MACH HOLD	ALTITUDE HOLD	SNAP-UP PLANNED	SNAP-UP EXECUTE
YAW DAMPER		*	*	*	*	*	*	*	*	*	*	*	*	*	*
ROLL ATTITUDE HOLD	*		*	↑0	↑0	↑0	↑0	↑0	↑0	↑0	↑0	*	*	↑0	↑0
PITCH ATTITUDE HOLD	*	*		↑0	↑0	*	*	*	↑0	*	↑0	↑0	↑0	*	↑0
PITCH CONTROL STICK STEERING	*	◄0	◄0		*	◄0	*	*	↑0	*	↑0	↑0	↑0	*	↑0
ROLL CONTROL STICK STEERING	*	◄0	◄0	*		◄0	1	↑0	↑0	↑0	↑0	*	*	↑0	↑0
HEADING HOLD	*	◄0	*	↑0	↑0		↑0	↑0	↑0	↑0	↑0	*	*	↑0	↑0
PRESELECT HEADING	*	◄0	*	*	1	◄0		↑0	↑0	↑0	↑0	*	*	↑0	↑0
LOCALIZER	*	◄0	*	*	◄0	◄0	◄0		*	2	2	*	*	2	2
GLIDE PATH AND LOCALIZER	*	◄0	◄0	◄0	◄0	◄0	◄0	*		2	2	◄0	◄0	2	2
AGCI	*	◄0	*	*	◄0	◄0	◄0	2	2		↑0	*	*	↑0	↑0
CO-ALTITUDE FIRE CONTROL	*	◄0	◄0	◄0	◄0	◄0	◄0	2	2	◄0		◄0	◄0	↑0	↑0
MACH HOLD	*	*	◄0	◄0	*	*	*	*	↑0	*	↑0		2	*	↑0
ALTITUDE HOLD	*	*	◄0	◄0	*	*	*	*	↑0	*	↑0	2		*	↑0
SNAP-UP PLANNED	*	◄0	*	*	◄0	◄0	◄0	2	2	◄0	◄0	*	*		↑0
SNAP-UP EXECUTE	*	◄0	◄0	◄0	◄0	◄0	◄0	2	2	◄0	◄0	◄0	◄0	◄0	

Note : * COMPATIBLE MODES. Both can be used simultaneously.

1 After initiating a preselected heading, control stick steering is deactivated until the aircraft is within approximately 1.5 degrees of the preselected heading. At this time, control stick steering is reactivated automatically and can be used in normal manner at pilot's discretion.

2 INCOMPATIBLE MODES. The same switch is used to select both modes; consequently, they are interlocked mechanically.

0 INCOMPATIBLE MODES. Arrow indicates the mode that takes preference if selected manually or automatically.

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Figure 4-12

When the airplane is flown in the automatic attack mode, mild random roll and pitch activity resulting from steering signal noise may be encountered.

Note

- Normal yaw, roll and pitch change of the target results in random wander of the apparent source of the target echo. This causes a corresponding wander in the radar antenna during closed-loop tracking of the target that is objectionable at short ranges. If an automatic Vis-Ident pass is continued within 400 yards, antenna wander and tracking noise can cause an unsafe condition. Therefore it is recommended that during an automatic Vis-Ident pass, the BEAM-ATTACK knob be turned to the NORMAL position when a range of 600 yards or less is reached. The autopilot will then be in one of the basic modes and the remainder of the Vis-Ident run can be performed using control stick steering or manual control (AFCS switch at STAND-BY).
- The pilot should not reselect another mode of operation on the armament control panel after radar lock-on, during automatic attacks or Vis-Ident passes. Any change of mode results in a discontinuity in steering signals from the MG-13 and results in an abrupt change of flight attitude.
- If an abort signal ("A") is encountered during an automatic attack, the BEAM-ATTACK knob must be repositioned manually to the NORMAL position. The system will not automatically disengage.

SNAP-UP SWITCH

This two-position toggle switch (figure 4-11) on the AFCS control panel is marked NORMAL and SNAP-UP. SNAP-UP and ATTACK must be selected and radar lock-on obtained in order to prepare for a snap-up maneuver. Azimuth steering is automatic until the steering circle shrinks to a 1/4 inch diameter. Then elevation steering becomes operative and the snap-up maneuver is automatically accomplished. At termination of the attack, the AFCS returns to attitude hold or heading hold, depending on angle of bank, and the function selector knob returns to NORMAL. Although the snap-up mode is not engaged until lock-on, the snap-up switch can be placed at SNAP-UP any time the AFCS switch is at AFCS and a breakway signal is not present.

HEADING (HDG. SEL.) WHEEL

When the AFCS engage switch is in AFCS position, the heading "hold" mode is automatically engaged, if roll angle is 7-1/2 degrees or less. The heading is read on the heading wheel (figure 4-11) at the bottom of the control panel. A new heading may be selected by turning the wheel.

CAUTION

In some early aircraft equipped with the B-7 autopilot, an inadvertent sharp blow on the control stick during a heading select turn will release the 20 degree bank angle limit on that mode, and could result in the airplane rapidly assuming a bank angle up to 70 degrees.

AFCS RELEASE (Paddle Switch)

A release lever (figure 1-10) on the control stick, is depressed to automatically cause all switches, except the damper switch, on the control panel to return to the NORMAL or STAND-BY position. The damper switch will remain in STAB-AUG position and will re-engage upon release of the lever on the control stick.

AFCS LIMITER PANEL (COMMAND SIGNAL LIMITER)

This panel is installed in the following airplanes: 56-249 (55) THRU (120), 56-238 (45), 56-241 (50) THRU 56-243 (50), and 56-246 (55). This panel (figure 1-14) located on the pilot's left console, is used to obtain a command signal limiter boundary compatible with horn and pusher boundaries. The panel is only used for adjustment purposes and should not be utilized during normal flight.

CAUTION

Maladjustment of the limiter controls is dangerous because it may cause the airplane to be overstressed.

NORMAL OPERATION OF AFCS

1. To engage damper, place damper engage switch to STAB-AUG.
2. To engage AFCS, place AFCS engage switch to AFCS.
3. To change heading, dial new heading on heading indicator, use control stick or ID-526 indicator.
4. Use control stick to change pitch.

Note

The pitch attitude is changed by means of the AFCS. An approximate force of 2 pounds is required on the stick. If MACH HOLD or ALT HOLD is engaged, a greater force (approximately 60 pounds aft or 30 pounds forward) is required on the stick, and when the stick is released, the airplane returns abruptly to the altitude or Mach which was maintained originally.

5. To engage altitude hold, turn mode selector knob to ALT HOLD. To change reference altitude, the knob must be turned to NORMAL. After changing altitude, the knob is returned to ALT HOLD.

Note

It is recommended that the Altitude Hold mode be disengaged during acceleration or deceleration through the transonic airspeed region (Mach 0.92 to 1.05) due to the approximate ± 1.0 "g" pitch transients which will be encountered.

6. To engage Mach hold, turn mode selector knob to MACH HOLD.

Note

To change reference Mach number, the knob must be placed to NORMAL while the change is made.

7. For AILAS localizer, tune ARN-31 set to correct frequency. Turn function selector knob to BEAM.

Note

In localizer, pitch control can be maintained by control stick steering, MACH HOLD or ALT HOLD up to point of glide slope engagement.

8. For glide path beam following, ALT HOLD or MACH HOLD automatically disengages.
9. For Automatic Attack on Automatic GCI, turn function selector knob to ATTACK. Pitch control during an automatic GCI or for snap-up attack prior to the snap-up can be maintained by control stick steering, MACH HOLD, or ALT HOLD.
10. For Snap-Up Attack, place the function selector switch to SNAP-UP at or before initiation of the automatic attack.
11. To disengage AFCS, place AFCS engage switch to STAND-BY or depress release switch on control stick.

EMERGENCY OPERATION OF AFCS

In the event of AFCS malfunction, the pilot could overpower the AFCS with forces exerted on the rudder pedals or in a lateral direction on the stick. However, a pilot would have great difficulty in overpowering the AFCS in case of a stabilizer axis malfunction because of the high design servo force required for satisfactory command signal limiting. For a stabilizer axis malfunction tending to build up an excessive "g" load, or if the pilot attempts to fly the airplane to an excessive "g" loading using pitch control stick steering, the AFCS should be automatically disengaged by the "g" disconnect feature. For any AFCS malfunction, the pilot should immediately disengage the AFCS using the emergency quick release lever on the control stick. A circuit breaker is also provided as a back-up means of AFCS disengagement.

NAVIGATION EQUIPMENT

STAND-BY COMPASS

Refer to Standby Compass, Section I.

HEADING INDICATOR (SLAVED)

The heading indicator system is a light weight system which may be operated either as a directional gyro corrected for apparent drift due to earth's rotation, or as a heading indicating system slaved to the remote (magnetic) compass transmitter. The system provides an accurate directional gyro for polar navigation as well as incorporating means for magnetic slaving. The compass system is energized when external power is applied to the airplane or when the a-c generator power supply stystem is operating. Power requirements for the system are 115 volt three-phase a-c and 28 volt d-c. The system consists of a directional control gyro, vertical gyro, remote compass transmitter, servo amplifier, and a control panel. The directional control gyro is a motored gyro which stabilizes the compass system when the system is used as a magnetic compass. When the system is operated as a free directional gyro, or as a magnetic compass, the directional control gyro relates heading information to cockpit equipment. The remote compass transmitter is a magnetic sensing device that slaves the compass system to a magnetic north and controls the directional control gyro position during magnetic compass operation. The servo amplifier is the receiving and distributing center of the system. It is composed of electronic units that receive and amplify magnetic signals from the remote compass transmitter and transmits these signals to the directional control gyro. Through these signals the directional control gyro is positioned in synchronization with the remote compass transmitter. The control panels, located on the pilot's right console, provides all controls necessary for operation of the system. Instruments in the cockpit that receive heading information from the system's directional control gyro are the heading pointer of ID-387 course indicator, and the ID-526 bearing-distance-heading indicator. The autopilot system also receives course information from the system.

Function Selector Switch

The two-position function selector switch (figure 4-13), marked MAG and DG, is used to select the mode of operation of the compass system. When the switch is in the MAG (magnetic) position, the system operates as a magnetic compass with the directional control gyro slaved to the remote compass transmitter. With the switch in the DG position, the directional control gyro is no longer magnetically controlled and the system operates as a latitude corrected directional gyro. During most flight operations, the system should be operated in the MAG position. The DG function is to be used when flying in areas of magnetic interferences where remote compass transmitter may be in error. These errors may be caused by flying near large iron deposits or near the pole areas. Automatic slaving

Heading Indicator Control Panels

(directional gyro and remote compass synchronization) occurs constantly with the selector switch in the MAG position at the rate of up to 2° per minute. Automatic fast slaving can be initated by turning the selector switch from MAG to DG, then back to MAG. The fast slaving cycle is approximately 7 seconds.

CAUTION

Allow one minute to elapse between each use of the function selector switch as a means of synchronizing the system. This permits the thermal relay controlling fast synchronization to cool.

Synchronizer Knob

The synchronizer knob (figure 4-13) provides a means of synchronizing the directional control gyro and the remote compass. The synchronizer knob is marked DECR - (decrease minus) in the full left position, INCR + (increase plus) in the full right position, and SET in the center position. The knob is spring-loaded to the SET position from both left and right positions. Rotating this knob in the clockwise direction, toward the INCR + position, will cause a clockwise heading change on the cockpit indicators. The opposite will occur if the knob is moved to the DECR - position. Rate of directional gyro rotation can be governed by moving the knob either direction to the first white marker (4° per second) or to the second white marker (approximately 45° per second). With the function selector switch in the DG position, rotating the synchronizer knob will merely change heading indications on the cockpit indicators. With the function selector switch in the MAG position, rotation of the synchronizer knob in the direction indicated by the annunciator needle, will slew the system toward synchronization.

Note

Actuating the synchronizer knob with AFCS engaged will cause the airplane to turn to limits of CSL boundary in an attempt to maintain a constant heading.

Annunciator

The annunciator is a window indicator (figure 4-17) just above the function selector switch on the control panel that indicates whether or not the directional gyro and remote compass are synchronized. With the system operating in the MAG mode, the top center portion of the window is marked MAG, the left side of the window is marked + (plus) and the right side

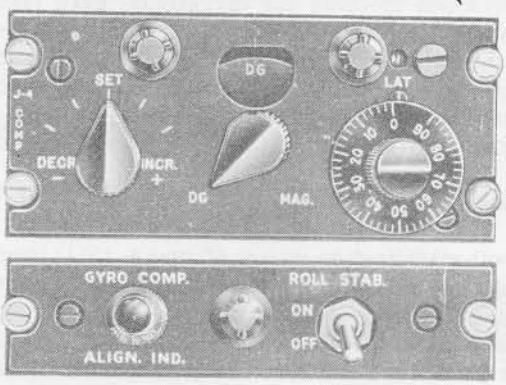

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Figure 4-13

is marked - (minus). In the center of the window is a needle that will deflect either left (+) or right (-) if the directional gyro is not synchronized with the remote compass. If the annunciator needle is deflected to the plus side of the window, the synchronizer switch must be rotated toward the INCR + mark to return the annunciator needle to center (null). With the needle centered, synchronization is complete. In the DG mode of operation, the annunciator is covered with a flag marked DG. Synchronization is not possible until mode of operation is returned to MAG.

Latitude Correction Knob

The manual controlled latitude correction knob (figure 4-13) corrects the system (when in the DG mode of operation only) for apparent gyro precession due to the earth's rotation. The knob is marked with latitudes from 0 to 90 degrees. Correction for gyro precession is clockwise in the northern hemisphere and counterclockwise in the southern hemisphere. This control knob should be preset on the ground for correct latitude that will be maintained during flight from west to east or east to west. Northerly and southerly directed flights however, will require gyro precession correction through the latitude correction knob. If the DG function is used, the latitude knob is placed on the present latitude of the airplane and replaced on new latitudes as the flight progresses.

Hemisphere Switch

The two-position hemisphere switch (figure 4-13) marked S and N is used to select the hemisphere in which the directional gyro mode of operation is operated. As a safety precaution the switch must be positioned with a coin edge or screwdriver type tool. Setting the switch in the N (northern hemisphere) position will effect a clockwise correction gyro drift, and the S (southern hemisphere) position effects a counterclockwise correction.

ROLL STABILIZATION SYSTEM-AN/AJN-3

The gyro of the AJN-3 has an additional gimbal which supports and isolates the directional gyro from the airframe. This additional roll gimbal allows the airplane to be rolled through 360 degrees without disturbing the azimuth indication. With this system, the heading indicator gives the correct heading in all attitudes and it can be read accurately in a turn.

Roll Stabilization Switch

The roll stabilization switch (figure 4-13) is located on the pilot's right console just behind the compass control panel. This two-position switch provides for ON-OFF control of the roll stabilization channel. An amber light on the panel labeled "Gyro Comp. Align. Ind." indicates any misalignment exceeding 5 degrees between the roll gimbal and the gyro case. If the angle of bank is 5 degrees or less and the light is illuminated a malfunction of the roll stabilization channel is indicated. During turns with the roll stabilization switch on, a turn cutout relay interrupts the light circuit.

OPERATION OF ROLL STABILIZATION SYSTEM

The roll stabilization switch should be ON at all times during normal operation. If the red light on the system comes on in level flight, turn roll switch OFF. The indicator system will continue to operate but without roll stabilization.

HEADING INDICATOR OPERATION-MAG

1. Place function selector switch in MAG position.
2. With external power or with generators operating, the system is operating. Allow a two-minute warm-up period.
3. The ID-526 bearing-distance-heading indicator should indicate the actual heading. (Check with standby compass or known runway heading).
4. The annunciator needle should have moved near center (null) position indicating synchronization of directional gyro control and remote compass transmitter.
5. If necessary, manual synchronization can now be accomplished by rotating the synchronizer knob in the direction indicated by the annunciator needle until needle moves to center. i.e., if annunciator needle is on the (+) side of center, rotate synchronizer knob toward INCR + mark until annunciator needle reaches center (null). The ID-526 compass card should smoothly rotate to actual airplane heading.
6. Automatic fast synchronization may be initiated by moving the function selector switch from MAG to DG then back to MAG. When function selector switch is placed to MAG, the events listed in step 5 above occur automatically.

Note

During normal or automatic synchronization, the annunciator needle may "overshoot" center (null) position. Automatic synchronization will still occur at the rate of up to 2° per minute until synchronization is complete.

HEADING INDICATOR OPERATION-DG

1. Place function selector switch in DG position.
2. Power is supplied to the system when the aircraft generators are operating. Allow a 7 to 8 minute warm-up period.
3. Set hemisphere selection switch as appropriate.
4. Set latitude correction knob to appropriate latitude.
5. With the aircraft aligned with a known heading reference use the synchronizer knob to set the BDHI to this heading.

Note

If the remote compass transmitter fails, no magnetic information will be available for the compass system. All cockpit equipment will receive heading information from the directional gyro control as before, however, cockpit heading indicators must be set and checked with a known runway heading or the standby compass.

CAUTION

During DG operation, the synchronization knob is still operative even though synchronization is not possible in the DG mode. The switch should not be operated after the servo system has been properly positioned. In polar flight, for example, the pilot would have no way to reset the servo system to an accurate position.

RADIO NAVIGATION

Refer to UHF Command Radio (ADF) (DF) and TACAN Navigation Radio, this section. Refer to Radar System - MG-13, this section.

ELECTRONIC EQUIPMENT COOLING

A refrigeration package identical to the cockpit refrigeration package receives engine bleed compressor air from the primary heat exchanger and furnishes cooled air to the electronic equipment bays. Temperature control for this system is fully automatic and is accomplished by the magnetic amplifier relays which position the thermal bypass valve. When the temperature drops below the preset value, the thermal bypass valve moves toward the open position allowing more air to bypass the refrigeration turbine and mix with the cool air. The valve moves toward closed position when the temperature arises. The air is controlled to +80°F at low altitudes and +35°F at high altitudes. A barometric switch causes this temperature switch-over at 16,000 feet in the 115 120 airplanes. 40 THRU 110 airplanes have only the +35°F temperature control. An air shutoff valve can be closed, and a ram air valve opened to cause ambient air to flow through the electronic equipment bays. Ram air cooling is inadequate

at altitudes of 35,000 feet and higher. If the equipment cooling goes out at any altitude, the radar should be turned off to provide sufficient cooling of the remaining electronic equipment. A warning light on the pilot's telelight panel marked "Equip Cooling Out" illuminates if the cooling system is not cooling the equipment properly. The electrical control system utilizes 28 volt d-c and 115 volt single-phase a-c power.

EQUIPMENT COOLING SWITCH

This two-position toggle switch (figure 4-2) on the cockpit air conditioning control panel has positions marked NORM and RAM. To supply cool air to the equipment, NORM position is used. When the switch is in RAM position, ambient air flows through the equipment bays. Ram air does not provide enough cooling air for operation of the radar. The valves are controlled by 28 volt d-c and 115 volt a-c power. The switch utilizes 28 volt d-c power.

CAUTION

If the "Equip Cooling Out" warning light comes on, put the equipment cooling switch to RAM and then back to NORM. If the light comes on again, turn off radar master switch and move switch to RAM to provide ram air for cooling of the remaining electronic equipment.

FIRE CONTROL SYSTEM-MG-13

Refer to Confidential Supplement, T.O. 1F-101B-1A.

Instrument Panel-Rear Cockpit
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-14

Left Console-Rear Cockpit
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-15 and 4-16

Right Console-Rear Cockpit
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-17

Antenna Hand Control Panel
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-18

Radar Scope Displays
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-19

ARMAMENT SYSTEM

Refer to Confidential Supplement, T.O. 1F-101B-1A.

Armament Control Panel
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-20

Armament Selection Table
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-21

Optical Sight Control Panel
Refer to Confidential Supplement T.O. 1F-101B-1A

Figure 4-22

TDU-8/B TARGET AUGMENTER

The TDU-8/B target augmenter is a passive reflector array with an active L band augmenter encapsulated in a fiberglas pod which can be installed on either external tank pylon. The target augmeter is utilized as a training aid for pilots in dry run practice and will increase the return from the small carrier airplane to give a radar return comparable to a large bomber. The target augmeter is compatible with the SAGE system. Refer to Section V for flight restrictions with the TDU-8/B target augmeter installed.

McDonnell Simulator Rocket (MSR)

The MSR simulates the MB-1 rocket and will record fire control system output indications on Polaroid film. The recordings represent the presence of proper voltages necessary for the preparation and firing of the MB-1. In addition to the recordings, arm and disarm signal voltages are returned to the FCS providing indications that the crew would see under actual MB-1 strike conditions. The MSR is capable of recording four attacks before the film in the camera must be advanced. The MSR will not be carried when GAR missiles are aboard the airplane.

Weapon System Evaluation Missile (WSEM)

The WSEM (Weapon System Evaluator Missile) simulates GAR-2A missile delivery. The WSEM is extended into the airstream like the missile, and prelaunch functions and indications are the same as those during the missile strike. Fire control system signals are recorded on an oscillograph, which when processed provides an evaluation of fire control system performance. Approximately six passes are available (depending upon the time duration of each pass) with one or two simulators installed.

REFUELING SYSTEMS

In-flight refueling is accomplished by the probe and drogue system. This method of refueling requires the pilot to maneuver the airplane in such a way that the probe enters into a funnel-shaped fitting on the end of a flexible hose extended from the tanker airplane. Ground refueling is normally accomplished by the single point pressure system.

PROBE AND DROGUE SYSTEM

The probe used for in-flight refueling is located in the upper nose area forward of the cockpit. The probe is extended to service position and the fuel system is automatically set up for refueling by placing the refuel switch to REFUEL. The airplane is then maneuvered to engage the probe with the drogue. When the connection is made fuel is transferred from the tanker to the airplane's fuel tanks through the transfer and refuel lines. Flow control valves automatically close as each tank becomes full. When the refueling operation is completed the pilot breaks contact with the drogue. The refuel switch is then placed on NORM, which retracts the probe and returns the fuel system to normal.

Refuel Switch

This three-position toggle switch (figure 1-14) is located on the fuel control panel. Placing the refuel switch on REFUEL position extends the probe, starts windshield blower operation, and interrupts the normal operation of transfer switch selections. Also, the fuel system is set up to receive fuel. The shutoff valves and fueling control valves to the tanks are opened. An air valve in the wing tanks is actuated to allow pressurized air to escape to atmosphere as fuel enters the tanks. Placing the switch on NORM retracts the probe and restores the normal operation to the transfer switches. Windshield blower operation is also stopped. In the EMERG position, the system is returned to normal, but the probe remains extended. The refuel switch utilizes 28 volt d-c power.

Note

The emergency fuselage transfer circuit will bypass the refuel switch when the quantity of fuel is reduced to 850 pounds in tank No. 2.

Auxiliary Full Fuel Indicator

Two green indicator lights (figure 1-14) on the fuel control panel are provided to indicate when the wing or external tanks become full during in-flight refueling. When the refuel switch is in NORM or EMERG position the lights will not illuminate. In this case, a tank full condition is checked by depressing the button marked "Aux Tank Full Check". The indicator lights utilize 28 volt d-c power.

REFUELING PROCEDURE--PROBE AND DROGUE JE

Note

- Do not extend the probe for extended periods of time when not actually refueling. Fuel in No. 1 cell will drain into the external tanks and wing tanks when the probe is extended.
- If practice or simulated hookups are to be made, the refueling switch should be placed in the EMERG position to prevent possible siphoning and maintain normal operation of the transfer pumps.

1. Several minutes prior to tanker rendezvous, cycle the IFR probe.

Note

Any difficulty experienced may be due to moisture freezing on the probe doors. Therefore, when difficulty is experienced, descend to a lower altitude to dissipate any ice that may have formed in the probe doors.

2. Approach the tanker from the rear and slightly below the refueling drogue.
3. Maintain a position approximately 100 feet aft and 50 feet below the drogue until the airplane is trimmed and formation speed is determined.
4. Place the refuel switch in REFUEL position.

CAUTION

If a delay is encountered in hooking up with the tanker after the probe is extended, fuel drain from No. 1 cell could fill the wing tanks. The surge created by initiating the refueling cycle could start a siphoning action which would result in a loss of wing fuel. This creates the possibility of the collapse of the wing tanks. If a long delay is encountered with the probe extended, the pilot should transfer fuel from the wing tanks to the fuselage cell. To do this, the Refuel switch is placed on EMERG and the wing transfer switch on NORM. When the empty tank light illuminates, the Refuel switch is placed on REFUEL, and the hookup is made.

5. With a rate of closure of 3 to 5 knots, fly the probe nozzle into the drogue cone.

CAUTION

Rapid rate of closure will move the drogue forward too fast for proper reel-in, causing slack in the hose. This results in a violent whipping action which may damage the probe or drogue.

6. After contact is made, slowly fly drogue forward about 10 feet. This automatically energizes tanker's fuel transfer pumps. This is indicated by the illumination of a green light on the tanker.
7. Maintain a steady position after hookup. Smooth and precise pitch and bank control is essential to safe refueling operations. Some hose slack is to be expected at times during refueling. If the amount of slack is slight, hold position and allow the reel operator to take up the slack. All corrective action should be smooth and gradual.

CAUTION

Dropping back while the reel operator is taking up slack can cause abrupt tension on the hose. This can cause the hose to whip and possibly damage the probe.

8. With the fuel quantity selector knob in TOTAL position, note refueling progress by observing the fuel quantity gage. The wing and external tanks full light will illuminate when these tanks are full.
9. Fuel flow is automatically shut off when the receiver tanks are full. When flow has stopped reduce speed slightly to disengage probe from drogue coupling.

Note

High rates of separation when breaking contact should be avoided to prevent sudden loads on the tanker hose braking assembly.

10. Place the refuel switch on NORM.

EMERGENCY OPERATION–PROBE AND DROGUE

If the probe is damaged during refueling and cannot be retracted, normal continuity is restored to the transfer pumps and the windshield blower operation is stopped by placing the refuel switch to EMERG.

SINGLE-POINT PRESSURE REFUELING SYSTEM

The single-point pressure refueling of all fuselage cells and auxiliary tanks can be accomplished in approximately six minutes. Opening the refueling doors, located forward of the engine on the right side, provides battery bus voltage to the fueling control valves, auxiliary shutoff valve, and flow control valves. These valves are automatically positioned for refueling. Fuel from the servicing unit is distributed through the airplane fuel system refueling lines to all tanks. All tanks fill simultaneously and fuel flow to each tank stops as it becomes full. The precheck switch near the single-point refueling adapter is operated after refueling has commenced. This simulates a full tank condition and stops fuel flow. Releasing this switch restores the normal refueling operation. To prevent transfer pump operation during refueling, external power should not be applied. The precheck switch utilizes 28 volt d-c power.

REFUELING PROCEDURE–SINGLE–POINT

1. Insure that all fuel caps are secure.
2. Insert nozzle grounding plug into airplane grounding jack.
3. Open filler door and attach fuel nozzle to refueling adapter.
4. Start fuel flow.
5. Operate precheck switch near refueling adapter.

Note

The maximum allowable time lapse between actuation of the check switch and all fuel flow stopping is twenty seconds.

CAUTION

The precheck operation is required to prevent excessive pressure in the fuel cell in the event of a fuel valve malfunction. If fuel continues to flow when precheck switch is ON, discontinue refueling operations until malfunction has been corrected.

6. Release precheck switch. Refueling operation resumes and fuel flow into the airplane stops upon completion of ground refueling.

EXTERNAL TANKS

The airplane may be equipped with either the production type (Fletcher or Royal Jet) 450 gallon tank or the modified F-84 450 gallon tank. The modified F-84 tank will create less drag since it is four feet longer and smaller in diameter than the production tank. This tank can be installed on one or both external tank pylons depending on the type of mission to be flown. The single tank configuration is preferrable for tactical profiles and long range cruise missions, while the dual tank configuration is preferrable for maximum range/endurance profiles. The handling qualities of the airplane with two modified F-84 tanks are the same as with the production type tanks installed. This is true in both stabilized and maneuvering flight at low and high altitudes.

MISCELLANEOUS EQUIPMENT

FLIGHT REPORT HOLDERS

Three canvas flight report holders (figures 1-14 and 1-16) are located adjacent the left and right consoles between the canopy sill and the console. A zipper provides access to the holders.

MATTS SCORING EQUIPMENT

Upon incorporation of T.O. 1F-101B-754, the airplane will have provisions for the MATTS scoring devices. This equipment will be used only at authorized Weapon Deployment Center.

RELIEF TUBE

A relief tube for the pilot is stowed on the side of the left console below the throttle quadrant. In the RIO's cockpit it is located under the instrument panel at the center.

STOWAGE CONTAINER

A cylindrical stowage container, located behind the RIO's right shoulder, is provided to stow the radar scope visor when the scope is not being used. The container has a mechanical spring latch and is readily accessible to the RIO in flight.

REAR VIEW MIRRORS

Two rear view mirrors are installed in the windshield enclosure.

SPARE LAMPS

Spare lamps for the console panels are provided in both cockpits. The spare lamps (figure 1-16) for the front cockpit are located adjacent to the cockpit lights control panels on the right console. The spare lamps for the rear cockpit are located on the right vertical console.

CHARTBOARD

A hinged chartboard, with spring-loaded clips on each side, is stowed in the map case in the rear cockpit.

section V Operating Limitations

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This section includes the aircraft and engine limitations that must be observed during normal operation. Instrument markings giving various operation limitations are shown in figure 5-1. Some markings are self evident and are not discussed in the text.

ENGINE LIMITATIONS

Engine limitations are shown in figure 5-1. Additional information is given in the following paragraphs and figure 5-2.

MAXIMUM THRUST

Maximum thrust is defined as the thrust obtained at full afterburner and is limited to 5 minutes continuous operation on the ground and 15 minutes continuous operation in flight.

CAUTION

- Periods of afterburning up to 15 minutes should be followed by a 5 minute cooling period of non-afterburning.
- Due to high fuel consumption, afterburner operation should be avoided with less than 3,000 pounds of total fuel remaining.

MILITARY THRUST

Military thrust is defined as the thrust obtained at full throttle without afterburner and is limited to 30 minutes continuous operation.

MAXIMUM CONTINUOUS THRUST

This rating is the maximum stabilized thrust which may be used continuously. The rating is obtained by adjusting the throttle to obtain a predetermined engine pressure ratio. Maximum continuous thrust and all lower flight thrust selections may be used continuously.

ENGINE OIL PRESSURE

Normal oil pressure is 40-50 psi at all power settings. Oil pressures between 35 and 40 psi are undesirable and should be tolerated only for the completion of the flight, preferably at a reduced throttle setting. Oil pressure fluctuations or abnormal pressures should be reported as a flight discrepancy. Oil pressures below 35 psi are unsafe and require that the engine be shutdown.

ENGINE OVERSPEED

Should the maximum permissible engine speed of 102% rpm be exceeded, the engine must be inspected for damage. Pilot should make Form 781 entry stating maximum rpm obtained and duration of overspeed to insure inspection.

EMERGENCY FUEL

Aviation gasoline MIL-G-5572, lowest grade available may be used for emergency fuel. Use this fuel for low altitude emergency evacuation flight.

CAUTION

Emergency fuel may be used in lieu of JP-4 fuel only in emergencies. Continuous operation should not exceed 2 to 3 hours and such operation should be subsequently followed by operation with JP-4 prior to re-exposure to emergency fuel.

COMBUSTION STARTER LIMITATIONS

To prevent the possibility of starter destruction when a combustion start has been made or aborted, a second attempt to start will not be made until engine rotation has stopped and at least one minute has elasped. A third attempt to start will not be made until a cooling period of 45 minutes has elapsed.

ENGINE STARTER AIR BOTTLES

Refer to strange field procedures Section II.

AIRSPEED LIMITATIONS

LANDING GEAR LOWERING SPEEDS

Limiting airspeed for landing gear operation is 250 knots IAS, due to possible damage to landing gear mechanism.

CAUTION

During landing gear retraction, the landing gear and gear doors should be completely up and locked before gear limit airspeed is reached, otherwise excessive air loads may damage gear mechanism and prevent subsequent operation.

Instrument Markings

BASED ON JP-4 FUEL

ENGINE: J57-P-55 **EXHAUST TEMPERATURE** **ENGINE: J57-P-53**

200°C-560°C	CONTINUOUS BELOW 30,000 FEET	200°C-580°C
560°C-580°C	CONTINUOUS ABOVE 30,000 FEET	580°C-610°C
620°C	MAXIMUM IN AFTERBURNER BELOW 30,000 FEET	640°C
640°C	MAXIMUM IN AFTERBURNER ABOVE 30,000 FEET	670°C

Note

610°C Maximum for Starting. Maximum in Military Thrust Below 30,000 Feet (30 Min.)
640°C Maximum in Military Thrust Above 30,000 Feet (30 Min.)
650°C Maximum for Acceleration (2 Min.)

Note

630°C Maximum for Starting. Minimum in Military Thrust Below 30,000 Feet (30 Min.)
660°C Maximum in Military Thrust Above 30,000 Feet (30 Min.)
680°C Maximum for Acceleration (2 Min.)

J57-P-53 or J57-P-55

TACHOMETER

102%	MAXIMUM OVERSPEED
85%-98%	CONTINUOUS

J57-P-53 or J57-P-55

OIL PRESSURE

35 PSI	MINIMUM
35-40 PSI	CAUTION
40-50 PSI	CONTINUOUS
50 PSI	MAXIMUM

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RGY

Figure 5-1

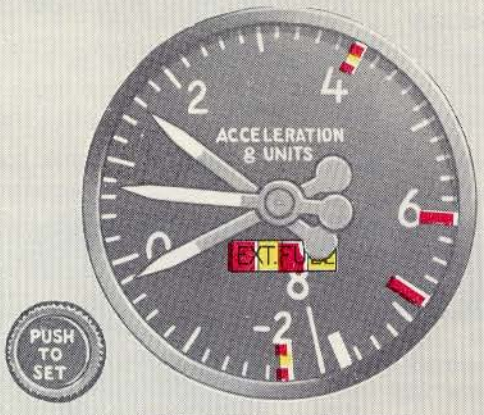
AIRSPEED AND MACH

	500 KNOTS MAXIMUM EXT TANKS
	250 KNOTS MAXIMUM LANDING GEAR AND FLAPS

HYDRAULIC PRESSURE

PRIMARY–UTILITY	
2000–2800 PSI	NORMAL WITH RAPID CONTROL MOVEMENT
	SHOWS MALFUNCTION WITH CONTROLS STATIC
2800–3200 PSI	NORMAL*
3200–3400 PSI	IF HYDRAULIC PRESSURE EXCEEDS 3200 PSI IN THE STEADY STATE AN ENTRY IN THE FORM 781 IS REQUIRED.
3400 PSI	MAXIMUM

* 2550 PSI MINIMUM AND 2950 PSI MAXIMUM WHEN LEFT ENGINE IS INOPERATIVE.



ACCELEROMETER

POSITIVE LOAD FACTORS (g) LIMITS	
6.8 g	MAXIMUM CLEAN AND 8200 LB MAXIMUM FUEL
6.0 g	MAXIMUM NO EXT TANKS
4.0 g	MAXIMUM EXT TANKS (SYMMETRICAL)
NEGATIVE LOAD FACTORS (g) LIMITS	
−2.0g	MAXIMUM EXT TANKS

STARTER AIR BOTTLE PRESSURES

3000 PSI	MAXIMUM

Note

(REFER TO AMBIENT TEMPERATURE VERSUS PRESSURE TABLE SECTION II FOR MINIMUM PRESSURES AT VARIOUS TEMPERATURES).

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RGY

FLAP OPERATING SPEEDS

Limiting speeds for lowering or raising flaps is 250 knots IAS.

MAXIMUM TIRE SPEEDS

The maximum allowable ground speed for some tires is embossed on the casing sidewall; for maximum speeds of all other tires, consult T.O. 4T-1-4.

CANOPY OPERATING SPEEDS

The canopy is not designed to be opened in flight. Any partial opening of the canopy would cause air loads to tear the canopy off the airplane. During taxiing the canopy may be opened at speeds not in excess of 75 knots IAS.

CAUTION

The pilot should consider gust or severe surface winds as a contributing factor to the 75 knot restriction.

DRAG CHUTE OPERATING SPEEDS

The drag chute is designed to be deployed after landing at speeds under 200 knots IAS. Should the drag chute door inadvertently open without actuation of the drag chute handle, the drag chute will fall free of the airplane. Actuation of the handle, however, will cause a locking mechanism to hold the chute.

CAUTION

The drag chute may be deployed in an emergency at speeds in excess of 200 knots IAS but below 215 knots IAS. In the event this is done, an entry in Form 781 must be made to insure structural inspection.

RAIN CLEARING SYSTEM OPERATING SPEEDS

The following instructions should be observed:

1. No system operation above 310 knots IAS.
2. Operation permitted only during rain and inflight refueling.

REFUELING PROBE OPERATING SPEEDS

With the refueling probe extended, maximum allowable airspeed is 310 knots IAS.

MAXIMUM ALLOWABLE AIRSPEEDS

See Figure 5-1.

Clean Airplane	
Above 25,000 ft.	1.73 indicated Mach or 700 knots IAS, whichever is lower.
Below 25,000 ft.	600 knots IAS
With External Tanks	
All altitudes	1.3 indicated Mach or 500 knots IAS, whichever is lower.
With TDU-8/B Target	
All altitudes	1.5 indicated Mach or 670 knots IAS, whichever is lower.

PITCH CONTROL SYSTEM INOPERATIVE

1. Below .9 indicated Mach number, do not exceed moderate buffet.
2. Above .9 indicated Mach number, do not exceed the following load factors:

300 Knots IAS - 1.7 g	400 Knots IAS - 3.7 g
350 Knots IAS - 2.7 g	450 Knots IAS - 4.7 g

Note

These load factors are based on 30,800 lbs. gross weight. Load factors may be adjusted in inverse proportion to gross weight, i.e. rolling pull-outs.

EXTERNAL TANKS JETTISON SPEEDS

Full or empty external tanks may be jettisoned below 300 knots IAS between +.5 "g's" and +3.5 "g's".

PROHIBITED MANEUVERS

The airplane is restricted from the following maneuvers:

1. Any snap maneuvers.
2. Rolls continued past the 360° point.
3. Intentional pitch-up and spins.
4. Negative "g" condition in excess of 15 seconds.
5. Zero "g" condition in excess of 10 seconds.

CAUTION

With external tanks, do not exceed 2/3 aileron travel above 300 knots IAS.

Engine Operating Limits

ENGINE: J57-P-55 or J57-P-53

Note

EGT MAY EXCEED NORMAL OPERATING RANGE WHILE MAINTAINING A RAPID RATE OF CLIMB.

OPERATING CONDITIONS	MAXIMUM OBSERVED EXHAUST TEMPERATURE				TIME LIMIT	
	SEA LEVEL TO 30,000 FEET		ABOVE 30,000 FEET		GROUND OPERATION	FLIGHT OPERATION
	P-55	P-53	P-55	P-53		
MAXIMUM	620	640	640	670	5 MINUTES	15 MINUTES*
MILITARY	610	630	640	660	30 MINUTES	
MAXIMUM CONTINUOUS	560	580	580	610	CONTINUOUS	
IDLE	340	340	—	—	CONTINUOUS	
STARTING	610	630	610	630	MOMENTARY	
ACCELERATION	650	680	650	680	2 MINUTES	

*REFER TO "MAXIMUM THRUST" THIS SECTION

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Figure 5-2

ACCELERATION LIMITATIONS

The following acceleration limitations are for symmetrical flight maneuvers. Unsymmetrical flight maneuvers limitations are 2/3 of the symmetrical limitations.

CONFIGURATION	"g" LIMITS	
PRIMARY ARMAMENT DOOR	ARMAMENT DOOR NORMAL POSITION	ARMAMENT DOOR ATTACK POSITION
WITH FULL INTERNAL FUEL AND NO EXTERNAL TANKS	+6.0 -2.5	+5.33 -1.0
WITH A MAXIMUM OF 8200 POUNDS INTERNAL FUEL AND NO EXTERNAL TANKS	+6.8 -2.8	+5.33 -1.0
WITH EXTERNAL TANKS OR TDU-8/B TARGET	+4.0 -2.0	+4.0 -1.0

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CENTER OF GRAVITY LIMITATIONS

MOST FORWARD C.G.

The most forward c.g. limits are 20% M.A.C. for take-off and 17% M.A.C. for in-flight and landing. The most forward c.g. occurs with full armament retained, external tanks full and retained, wing tanks empty, 6,175 pounds of fuselage fuel remaining and both crew members aboard.

MOST AFT C.G.

The most aft c.g. limits are 36% M.A.C. for take-off, and 41% M.A.C. for in-flight and landing. The most aft c.g. occurs with no fuel remaining, external tanks jettisoned, all armament expended, and the aft cockpit unoccupied.

CAUTION

Flight without armament and without armament replacement ballast may be made provided both external tanks are full at take-off. Flight without armament, without armament replacement ballast and without full external tanks may be made if the number 5 fuel cell is not filled beyond 800 pounds at take-off.

Note

The airplane has a lockout switch for the No. 5 cell. Moving the switch to the CUTOFF position prevents fuel from entering the No. 5 cell. The switch is adjacent the refueling receptacle and is kept in the NORMAL position when not required.

CENTER OF GRAVITY TRAVEL

Center of gravity locations which are beyond the recommended limits may occur unless fuel is consumed

in the following order: External fuel, wing fuel, internal fuselage (cells 1 thru 5). The pilot may also control the c.g. position by expending armament.

CAUTION

Partial fueling of the fuselage cells can result in an incorrect distribution of fuel which may cause the center of gravity to exceed the recommended limits. It is, therefore, recommended when fueling the fuselage cells, to fill them completely. The automatic operation of the pumps will then keep the fuel properly distributed among the fuselage cells.

WEIGHT LIMITATIONS

In the 001 THRU 045 airplanes the maximum allowable take-off gross weight is 51,000 pounds. This limit will be exceeded when the airplane is in the primary armament configuration with full internal load and two full external tanks. When in this configuration, it is necessary to off load the external tanks to bring the take-off gross weight within limits. In the 050 THRU 120 airplanes, the maximum allowable take-off gross weight is 52,400 pounds. Extreme care should be taken to insure that no additional items of appreciable weight are installed or removed without a weight and balance check. Refer to Weight and Balance, Section II.

Note

There is no set maximum gross weight limit for landing.

EQUIPMENT COOLING

MAGNETRON BLOWER

An automatically operated magnetron blower is installed in the airplane to aid in cooling at low engine rpm. Observe the following operating limitations during ground operation below 80% rpm.

WARM	Indefinite
STBY	8 Minutes
ON	8 Minutes

The total time in STBY and ON should not exceed 8 minutes. There is no time limit for any mode of operation when one engine is at 80% rpm or above.

Note

The FCS overheat warning light (4, figure 1-19) on the radar observer's panel will illuminate whenever the MG-13 system is receiving inadequate cooling with the radar master switch in the ON or STBY position. Operating the radar with the warning light illuminated for extended periods could effect the reliability and seriously endanger the life of the radar. The light normally would be on during the following conditions:

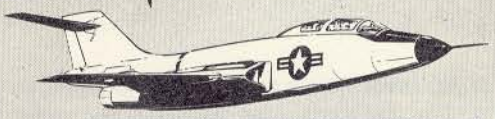
1. On the ground at engine power settings below 80% rpm.
2. In flight at any time engine power settings are below those required to maintain altitude, such as some idle letdown conditions.
3. Decelerating flight conditions using power settings close to idle.
4. During final approach just prior to touchdown.
5. At any time due to failure in the equipment cooling system.

It is permissible to operate the radar for periods up to 8 minutes with the FCS overheat light illuminated, provided the equipment cooling is NORMAL and the engines are at taxi thrust or above.

Operating Flight Limits

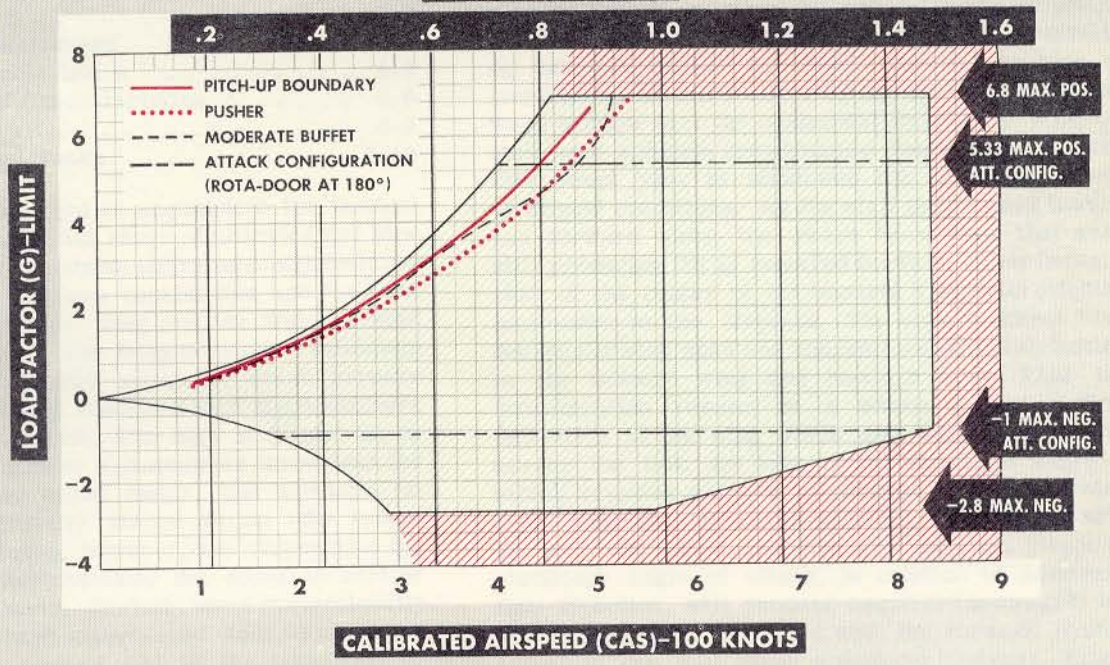
SYMMETRICAL FLIGHT MANEUVERS

GROSS WEIGHT–39,800 POUNDS



CLEAN CONFIGURATION

10,000 FEET



35,000 FEET

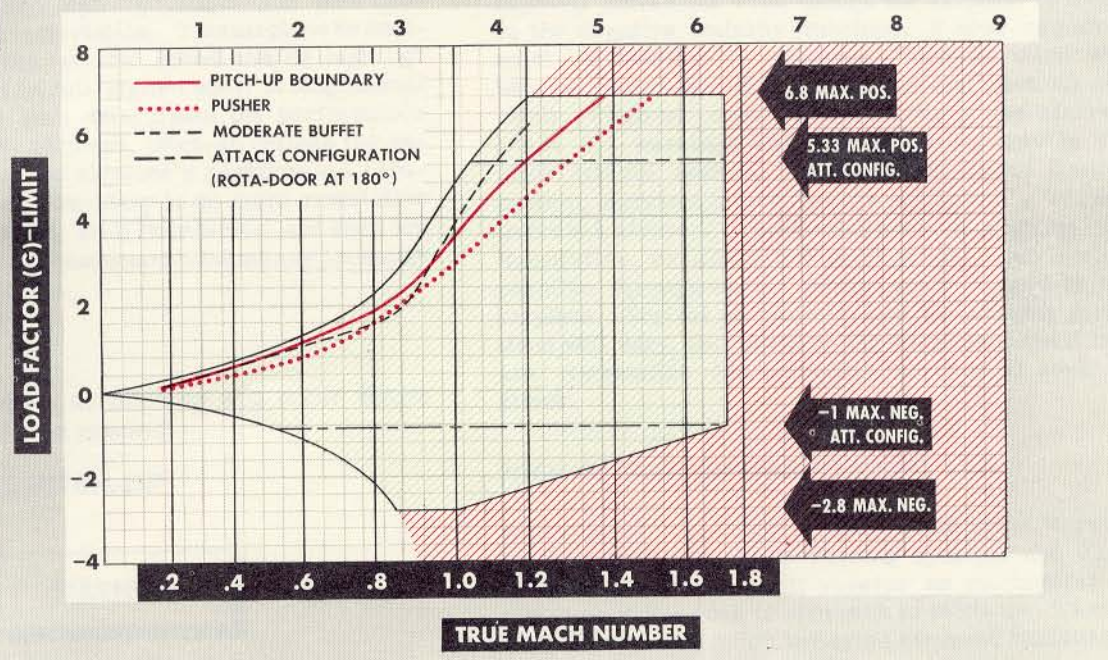


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Figure 5-3

section VI Flight Characteristics

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The airplane is designed to accomplish the tactical mission throughout a wide range of altitudes and airspeeds. The most prominent airframe design features that contribute to airplane capabilities are the thin, swept, low aspect ratio wing and the high mounted horizontal stabilizer. The wing develops a minimum of parasite drag at high airspeed, which permits rapid acceleration and sustained high Mach numbers in the supersonic region. The high stabilizer is, by position, free of airflow disturbances throughout the normal operational speed range. The airplane is, therefore, exceptionally stable within this range. These design features, however, are responsible for an undesirable characteristic not found in earlier transonic jet airplanes. Earlier, more conventionally designed fighters have experienced stability problems in the transonic regions and in the transition to supersonic flight. They were, however, relatively stable in low speed/high "g" flight and had conventional stall characteristics. This airplane by comparison destabilizes at low speed and/or high "g" loading and cannot be full-stalled short of longitudinal pitch-up. Just as stall determined the performance envelope of earlier airplane, pitch-up defines the extreme boundary of the airplane's performance capability. The pitch-up boundary is no more restrictive than previously known stall boundaries, and does not prohibit the airplane from accomplishing any presently known tactical mission.

STALLS

Stalls are prohibited, as pitch-up will occur before a full stall condition is reached.

LONGITUDINAL PITCH-UP

WARNING

Intentional pitch-ups are prohibited.

Pitch-up occurs as a result of excessive angles of attack. High angles of attack result when indicated airspeed is decreased while maintaining level flight. Conversely, when airspeed is held constant and "g" is increased, angle of attack increases proportionately. Pitch rate and rolling effect factors that may also cause an increase to critical angle of attack will be covered separately in this section. The effects of extreme angles of attack that cause loss of longitudinal stability are wing tip stall and the downwash airflow over the horizontal stabilizer. Wing tip stall is a common aerodynamic characteristic of the thin swept wing at maximum lift (maximum angle of attack) conditions. As the stall progresses inward and forward along the swept back wing, that area still producing lift is centered forward. This forward shift of the center of lift imparts a nose-up pitching movement to the airplane. Tip stall in effect also decreases wing span and concentrates lift distribution in the inboard wing and fuselage area. This lift concentration results in a sharp upward airflow deflection at the wing which then washes downward across the tail. As long as the stabilizer angle of attack remains positive in relation to the downwash flow direction, it is developing positive (upward) lift and will counteract nose-up rotation. Negative stabilizer angle of attack, in relation to downwash flow direction, will produce negative (downward) lift at the tail and, combined with the forward shifted center of lift, will cause a nose-up tendency. Slight forward stick can be used to prevent this initial nose-up movement even though the airplane is flying in the negative stability envelope. If nose-up movement is allowed to continue, forward stick will become progressively less effective and pitch-up will occur. Pitch-up should never occur if the aircrew heeds the warnings and limitations imposed by the pitch control system, the command signal limiter system, airframe buffet, and the published "g" versus indicated airspeed tables. However, if systems are inoperative, or limits are disregarded, pitch-up is possible throughout all performance ranges of the airplane. Arrival at pitch-up and the ensuing gyrations will vary, dependent on the flight conditions that are responsible for exceeding the critical angle of attack.

PITCH-UP FROM SUPERSONIC FLIGHT

Above Mach 1.0, there is little or no buffet warning prior to pitch-up. If the warning systems are inoperative, the aircrew will receive no mechanical or airframe indications of approach to pitch-up. Therefore, the following "g" indicated airspeed limitations must be strictly adhered to.

KNOTS - IAS	300	350	400	450	500
"g" LOADING	1.7	2.7	3.7	4.7	5.7

Mach Number Chart

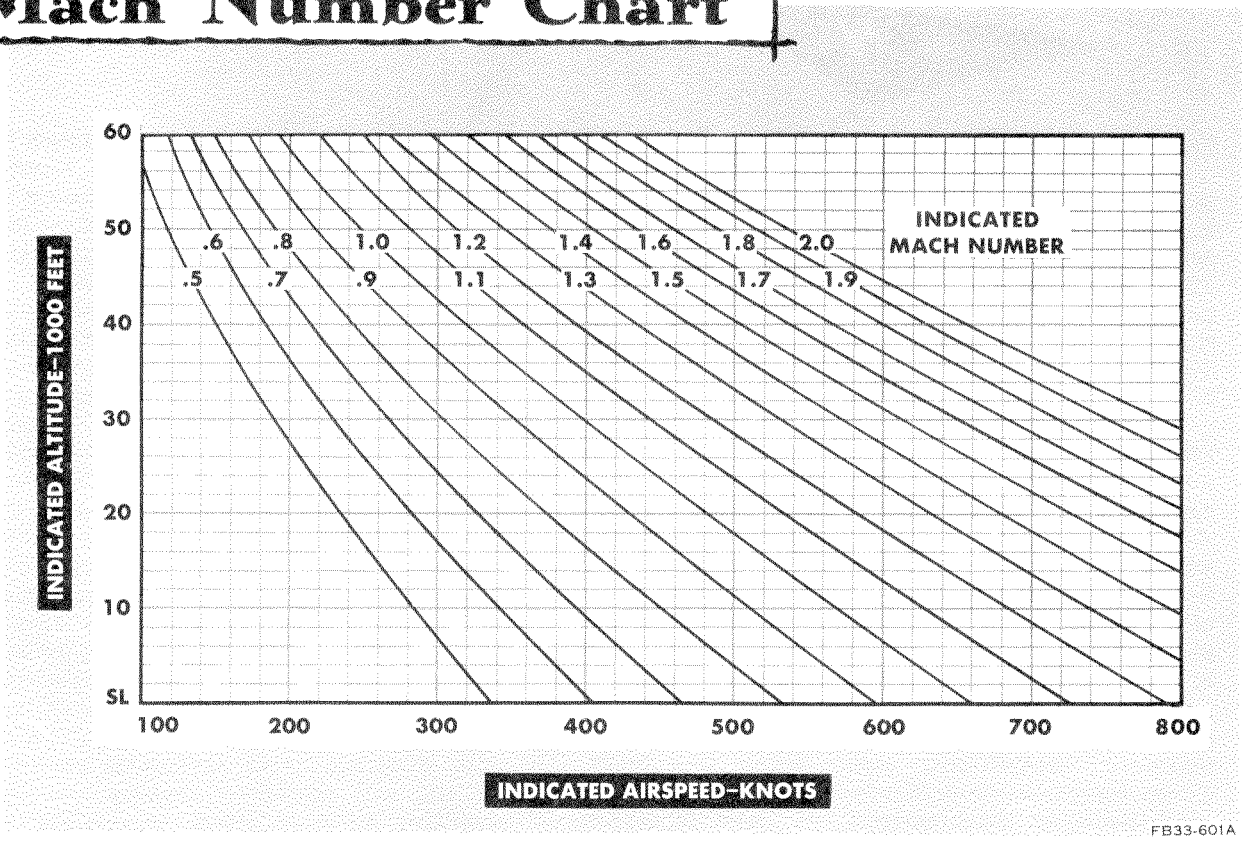


Figure 6-1

The magnitude of pitch-up maneuvering from supersonic flight is not unique, as the degree and violence of the gyration is dependent on indicated airspeed at entry.

PITCH-UP FROM 1"G" FLIGHT

If 1 "g" (level flight) is maintained as indicated airspeed is allowed to bleed off, pitch-up will be preceded by airframe buffet, which will become more pronounced as speed continues to decrease. Wing drop may be experienced prior to reaching critical angle of attack. As the airplane progresses into negative stability, forward stick movement will also be required to counteract the nose-up tendency. Pitch-up from this environment will occur when forward stick travel is insufficient to maintain positive (upward) lift on the stabilizer. Under these conditions, any radical change in pitch that cannot be stopped by nose-down control must be considered pitch-up, and recovery procedures should be immediately employed. For minimum safe level flight speeds, refer to Fig. 6-2 Recommended Minimum Flight Speeds.

PITCH-UP FROM LESS THAN 1"G" FLIGHT

Characteristics of pitch-up from less than 1 "g" flight will be generally the same as covered in the preceding paragraph. However, the warning system safety margin will be degraded for the reasons covered below. Stable flight can be maintained down to speeds in the 100 knot region, if the appropriate "g" loading is maintained. Conversely, if loading is stabilized at less than 1 "g" as in the case of a steep climb, airspeed can be decreased well below the point at which pitch-up would occur in 1 "g" flight. In this situation, airframe buffet and triggering of the PCS/CSL systems will also be delayed to lower airspeeds. This is the one extreme flight condition which may not actuate the warning systems early enough to allow sufficient airspeed margin to recover to normal flight attitudes. In high angle climbs, the minimum airspeed which will allow recovery with adequate safety margin is dependent on climb angle, gross weight, altitude, and power configuration.

PITCH-UP FROM ACCELERATED FLIGHT

Pitch-up due to excessive "g" can occur throughout the entire speed range. Although there is less tendency to exceed critical "g" at high indicated airspeeds, pitch-up under these circumstances is possible and may result in damage to airplane structure. For this reason it is extremely important to adhere to limits indicated in the "G" vs Airspeed table if warning systems are inoperative. In subsonic flight, increasing "g" loading to the critical point will be accompanied by airframe buffet, wing drop, and evidence of entry

into the negative stability region. Adequacy of these aerodynamic warnings will vary, dependent on the rate at which "g" is built up. With a slow increase in "g", the onset and buildup of the warnings will occur at a rate that can be easily interpreted and acted on by the pilot. If the "g" is increased at a rapid rate, the warnings will be compressed into short duration and may not provide warning to unload prior to exceeding critical angle of attack. Excessive aft stick rates may cause pitch-up, even though back pressure is relieved well short of the critical point. This is due to inertial overshoot. Once the airplane has developed a high pitching rate, it may continue, unless strong counter forces (stabilizer) are applied. Allowable aft stick rates will vary with angle of attack. High rates are available at low angles of attack, but must be decreased with an increase in angle of attack.

Note

The stick rate allowed by the PCS system reflects the maximum safe stick rate for existing flight conditions.

WARNING

To avoid pitch-up maneuvers, a very slow pull-in rate should be used when near or approaching the pitch-up boundary.

It is possible to stop pitch-up if the initial nose-up tendency is recognized at onset and nose-down stabilizer is applies. If, upon applying nose down stabilizer, negative "g's" are experienced, the airplane has not reached full scale pitch-up. Under these circumstances, the aircrew should relax forward stick pressure to maintain between 0 and +0.5 "g" as continued full nose-down stabilizer will result in negative "g" and possible negative stall. Pitch-ups from excessive "g" at high airspeed will produce higher pitch rates, more extreme pitch angles and greater "g" overshoot. However, the airplane will tend to recover more rapidly. This is due to the dynamic rebound, which combined with other recovery actions, will cause a more rapid realignment with the relative wind.

PITCH-UP FROM ROLL MANEUVERING

Under flight conditions where "g" loading is at maximum, introduction of high rates of roll may induce pitch-up. Angle of attack, which is stabilized near critical at maximum "g", is caused to further increase by the aerodynamic effects of rolling. These effects are inertial or roll coupling, and a magnification of the down-wash/forward movement of the center of lift. High "g" rolls may also induce snap rolls due to complete wing-stall. Snap rolls will in turn induce yaw and pitch inputs, which will in most cases result in pitch-up. Airframe buffet will provide warning in subsonic rolls; however, adequacy of warning time will depend on rate of roll. If severe airframe buffet builds up during rolling maneuvers, the "g" loading should immediately be decreased. If a snap roll does occur, the pilot should reduce "g" loading and neutralize ailerons. This action will tend to dampen out any further adverse ocillations. Control actions to counter the snap roll will only induce oscillations that may lead to pitch-up. Snap rolls, and ensuing pitch-up, may also result from negatively stalling the airplane. Negative stall limits are not published, but allowable negative "g" decreases proportionately with indicated airspeed. If airframe buffet is noted during negative "g" flight, immediately decrease the negative "g" to zero or a small positive value. If snap rolls occur as a result of negative stall, proceed with snap roll recovery actions outlined above.

Note

During high "g" rolls and/or snap rolls, the local airflow at the PCS vanes may not be representative of the total airflow affecting the airplane aerodynamically. As a result, warning systems actuation may occur too late to prevent exceeding the critical angle of attack.

PITCH CONTROL SYSTEM AND COMMAND SIGNAL LIMITER SYSTEMS

These systems will normally provide adequate warning that critical angles of attack are being approached. The pusher and CSL will prohibit further increases in stabilizer travel at their appropriate boundaries. If inflight failures or out-of-calibration conditions are discovered, the pilot should adhere strictly to the "G" Vs Indicated Airspeed Tables contained in this section. Under all conditions smooth control inputs are always recommended.

CAUTION

- During high angle climbs with airspeed decreasing, the PCS/CSL systems may not actuate early enough to make a normal recovery to level flight. Since "g" loading (angle of attack) determines warning system trigger points, the decreased "g" in a stabilized steep climb will allow lower airspeeds to be reached before the systems actuate.

- During high rates of roll, the airflow affecting the warning systems sensing vanes and the airplane as a whole may differ in direction and magnitude. As a result, PCS/CSL actuation may occur well beyond the normal boundary trigger points and may be delayed to a point which will allow the airplane to reach critical angles of attack. High roll rates should be avoided under low speed or high "g" conditions.

PITCH CONTROL SYSTEM BOUNDARIES

The speed and load factor at which the horn and pusher are actuated can be determined from the Pitch Control System Boundaries Chart, figure 6-3.

USE

To obtain the speed at which the horn and pusher are actuated while decelerating in level flight, enter the Airspeed Boundaries Chart at fuel remaining and proceed vertically to the horn or pusher reflector line. Proceed to the left edge and read IAS.

1. Fuel remaining - 5,000 lbs.
2. Pusher reflector
3. Pusher is actuated at 171 knots IAS
4. Horn reflector
5. Horn is actuated at 177 knots IAS

To determine the load factor at which the horn and pusher are actuated, enter the Load Factor Boundaries Chart at fuel remaining and proceed to the left edge and read the "g's" at which the horn or pusher will be actuated.

1. Fuel remaining - 5,000 lbs.
2. IMN 1.20 at 40,000 feet.
3. Horn reflector
4. Horn is actuated at 3.7 "g's".
5. Pusher reflector
6. Pusher is actuated at 3.9 "g's".

COMMAND SIGNAL LIMITER SYSTEM BOUNDARY

The load factor at which the command signal limiter limits AFCS commands can be determined from the Command Signal Limiter System Boundary Chart, figure 6-4.

USE

To determine the load factor at which the command signal limiter limits AFCS signals, enter the chart at fuel remaining and proceed to the left edge and read the "g's" at which command signal limiting occurs.

1. Fuel remaining 5,800 pounds
   Empty weight 32,200 pounds
   TOTAL weight 38,000 pounds
2. IMN .90 at 35,000 feet
3. Command Signal Limiter Reflector
4. Command Signal Limiting occurs at 2.3 "g's".

PITCH-UP RECOVERY

In the event pitch-up is accidentally entered, perform the following as soon as pitch-up tendency is recognized:

1. Apply full nose-down stabilizer.
2. Neutralize rudder.
3. Neutralize ailerons.
4. If pitch-up continues, deploy drag chute as soon as the peak of pitch-up is reached.

Note

Speed at peak of pitch-up will be less than 150 knots IAS. Drag chute should not be deployed in excess of 200 knots IAS.

CAUTION

Afterburner blowout and subsequent torching-off of afterburner fuel could cause loss of drag chute. Therefore, if pitch-up occurs during afterburner operation, retard throttles out of afterburner detent until pitch-up recover has been completed.

5. Return control stick to neutral as soon as negative "g" is sensed. Stabilizer position is critical during this phase of recovery, since sustained positive or negative "g's" would probably result in re-entering pitch-up.

Note

The airplane feel system will tend to hold the stick full forward until angle of attack is broken, at which time it will tend to move the stick toward neutral as the airplane recovers.

The drag chute will break the pitch-up maneuver immediately and prevent the airplane from spinning. However, the airplane may perform a roll during the recover after the angle of attack has broken. The roll, if encountered, will be fairly rapid and will stop with no action required on the part of the pilot. The airplane will be out of control during the pitch-up maneuver for approximately 4 to 8 seconds. After recovery, slowly roll wings level, while maintaining between 0 and +1 "g" to gain flying speed. Care should be used during and after the recovery to avoid rapid stick rates, which could produce excessive positive or negative load factors as the airplane will be very close to stalling speed initially. No attempt should be made to pull out of the ensuing dive until 350 knots IAS has been reached.

WARNING

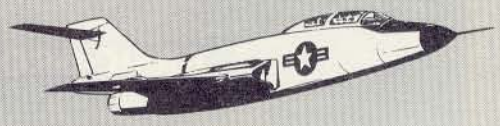
Do not jettison the drag chute during pitch-up recovery.

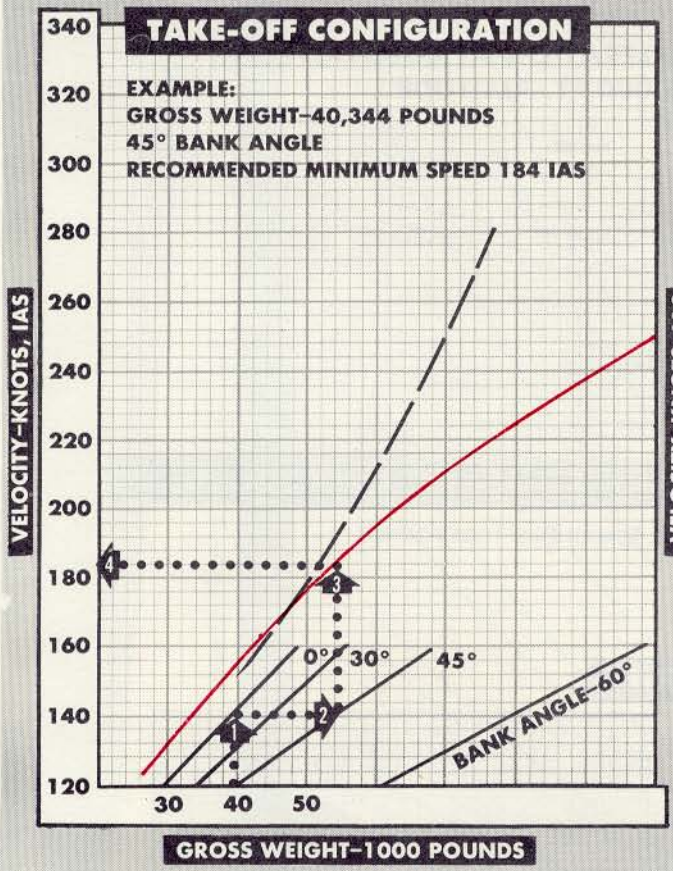
As speed increases to 230-250 knots IAS, the drag chute will fail and break away from the airplane; this is not detrimental in any way. If the drag chute fails to deploy, airplane control action remains the same, however, an incipient spin may result; refer to Spins, this section.

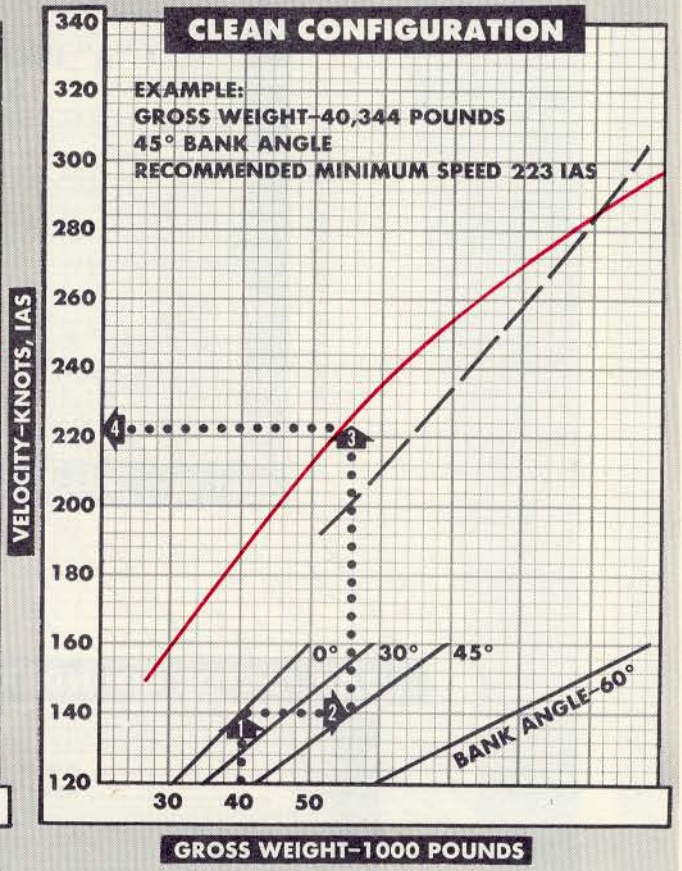
WARNING

If a fully developed pitch-up occurs below 15,000 feet terrain clearance, EJECT, as the possibility of dive recovery is highly improbable. If pitch-up is encountered and the airplane is not under control by 15,000 feet terrain clearance, EJECT.

Recommended Minimum Flight Speeds







– – –	MINIMUM LEVEL FLIGHT SPEED CAPABILITY WITH MILITARY THRUST
———	RECOMMENDED MINIMUM SPEED

BANK ANGLE	LOAD FACTOR
0°	1.0g
30°	1.2g
45°	1.4g
60°	2.0g

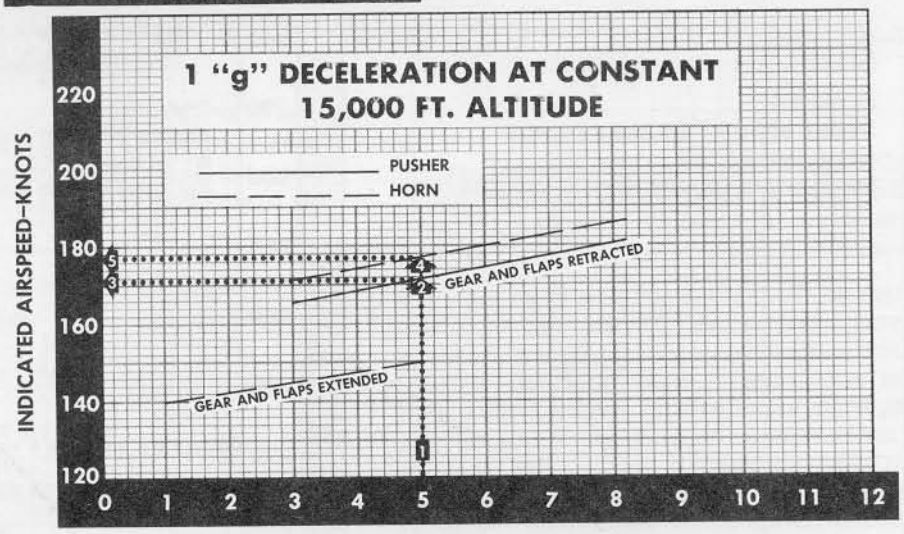
FB33-602D
R

Figure 6-2

Pitch Control System Boundaries

BASIC GROSS WEIGHT -- 31,000 POUNDS

AIRSPEED BOUNDARIES



LOAD FACTOR BOUNDARIES

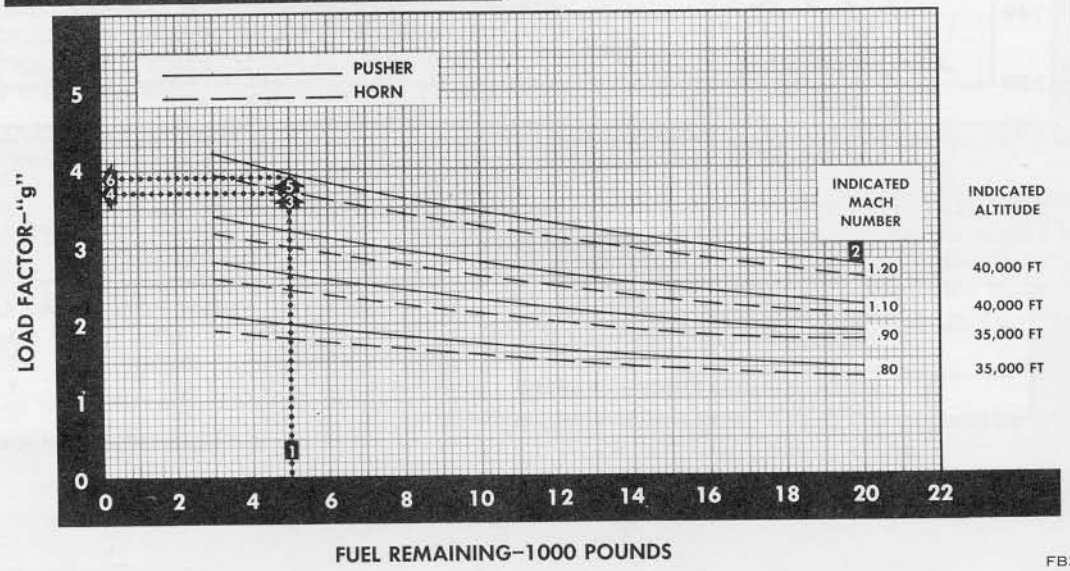


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Figure 6-3

Command Signal Limiter System Boundary

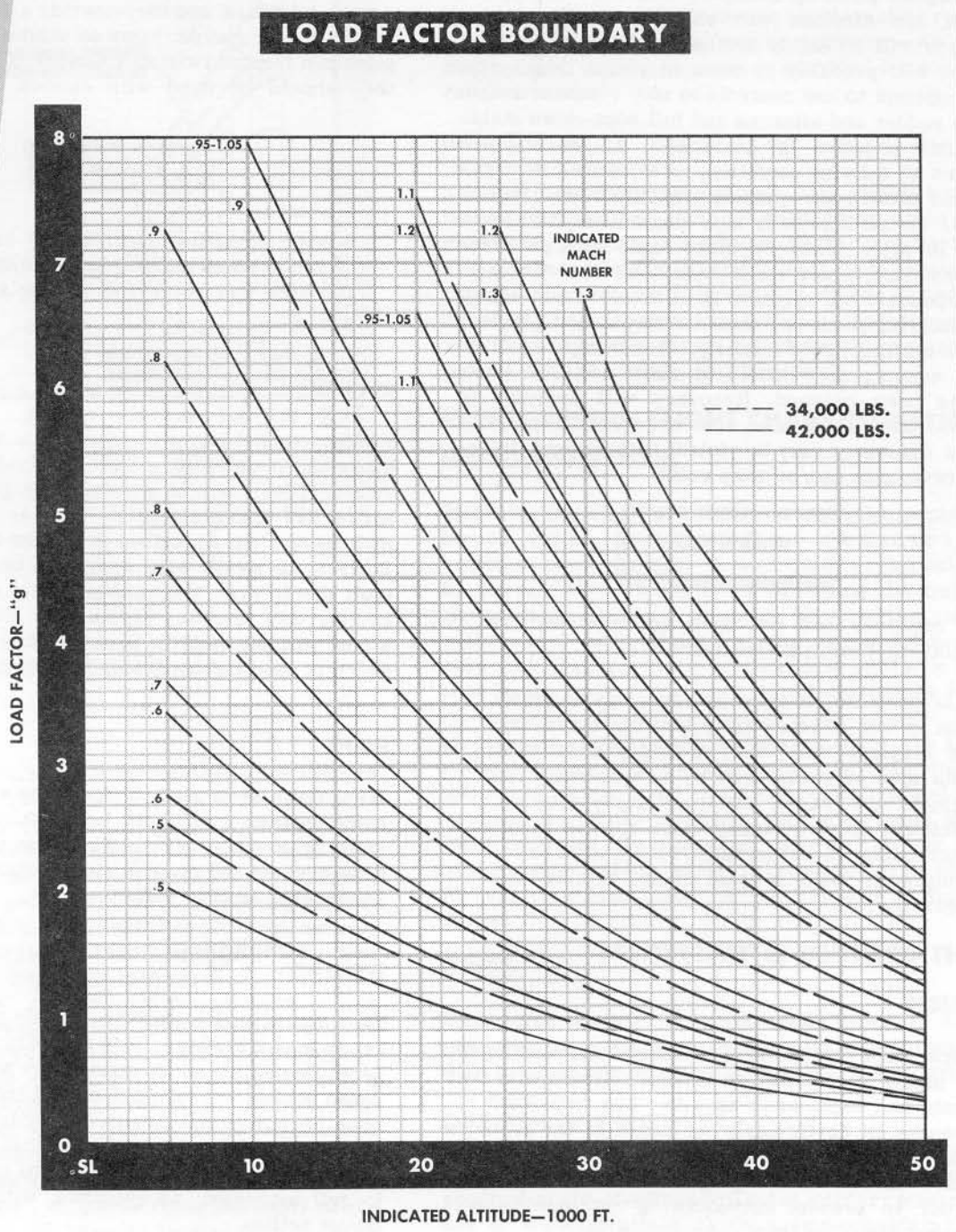

Figure 6-4

SPINS

Note

Intentionally attempting to spin the airplane is prohibited.

It is virtually impossible to spin this airplane without first entering pitch-up. Therefore, if the procedures for pitch-up recovery are performed immediately upon recognition of the onset of pitch-up, a spin will not result. If the drag chute fails to deploy during an attempted pitch-up recovery and recovery is not effected, the airplane will enter an incipient spin. This spin will be highly oscillatory in pitch, roll and yaw and will probably reverse direction frequently. Do not attempt to use controls to stop rotation; retain neutral rudder and ailerons and full nose-down stabilizer until negative "g" is sensed. As the airplane recovers to a flying condition, as evidenced by negative load factor, the stabilizer should be returned to neutral. Do not apply any high longitudinal stick force during or after recovery, since rapid stick rates for stick positions, which could produce excessive or sustained positive or negative load factor could result in re-entering pitch-up, since the airplane will be very close to stalling speed initially. No attempt to pull out of the ensuing dive should be made until 350 knots IAS has been reached. Recovery will probably be effected but will require considerable altitude loss and the maneuver may be violent with several directional reversals and/or snap rolls.

WARNING

- If recovery has not been accomplished by 15,000 feet terrain clearance, EJECT.
- It is possible, if recovery from an incipient spin is not effected after several turns, that the airplane will enter a steady state spin. This spin is recognized by its extremely flat attitude and rapid, non-oscillatory rotation. Recovery from a steady state spin is highly improbable, therefore EJECTION should be accomplished with at least 15,000 feet terrain clearance.

FLIGHT CONTROL EFFECTIVENESS

STABILIZER

A single piece controllable horizontal stabilizer provides highly responsive control effectiveness at both subsonic and supersonic speeds. The increased effectiveness is particularly noticable at low altitudes and high indicated airspeeds, therefore you should exercise caution when flying under these conditions in order to prevent excessive "g" or unintentional overshoot resulting from overcontrolling.

CAUTION

Igniting the afterburners in flight and subsequent acceleration may cause inadvertent aft stick movement. This acceleration should be anticipated and avoid unnecessary stick movement by relaxing your grip on the stick.

AILERONS

The ailerons are hydraulically powered by tandem power cylinders and they provide a good lateral control. At high speeds, rapid or extreme aileron movement can impose twisting loads to the wing. Therefore they should be used with caution at high speeds.

CAUTION

Some lateral overcontrol may occur between .7 and .9 Mach number below 10,000 feet due to the high roll rates and rolling accelerations available.

RUDDER

Rudder control becomes effective at approximately 70 knots and remains effective throughout the entire speed range. There will be a pedal force gradient increase above 290 knots airspeed. This is the feel system switch-over as described in Section I of this manual. Inherent to swept wing design is the dihedral effect (roll due to yaw), the rudder is very effective in correcting this tendency (picking up low wing). Rudder action will normally be performed by the yaw damper which is used throughout the speed range.

FLAPS

Wing flaps when used for approach and landing and in some instances in flight (air refueling) improve the stability of the airplane. The flaps act as both lift and drag devices and provide slower touchdown speeds and shorten the landing roll distances.

SPEED BRAKES

Two hydraulically extended panels on the empennage act as speed brakes. They are very effective and give rapid deceleration. A mild buffet will be noted when speed brakes are fully extended at high speeds. A mild nose-up trim change occurs with their extension. Speed brakes may be used to good advantage on final approach where airspeed and descent can be adjusted by partial to full extension, as required, without changing the thrust setting.

Stick Forces Diagram

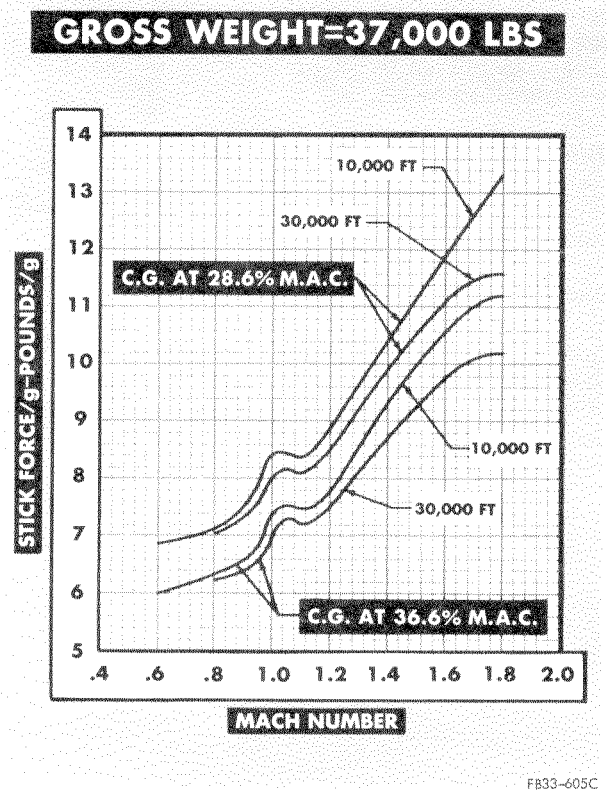

Figure 6-5

LEVEL FLIGHT CHARACTERISTICS

LOW SPEEDS

The recommended airspeeds for take-off, approach and landing and their relationship to gross weight, temperature, pressure altitude and wind effect contained in this manual are well above any dangerous flight attitude. Handling characteristics within the recommended speed ranges are good and control response positive. High angle of attack, usually associated with low speeds, can create undesirable rates of descent (sink). You should recognize any high rate of descent and add thrust to recover. Any attempt to pull back on the stick, further increasing angle of attack, can result in higher rates of descent. This attitude, further aggravated, may result in pitch-up. The recommended final approach airspeeds allow adjustments to your rate of descent well within safe operating flight speed ranges. You should plan to arrive at touchdown with the proper touchdown speed. Should the speed be reached while "high", do not increase the angle of attack to keep within the intended landing area but hold this speed, land "long" or go-around and correct your final approach on the next attempt.

CRUISE SPEEDS

Under cruise conditions recommended in Appendix I heading and altitude are easily maintained. Under high altitude and heavy gross weight cruise conditions, a slight buffet may occur but creates no control problem. Precise lateral trimming and equalized engine thrusts are essential, otherwise counteracting roll due to out of trim condition can be fatiguing. An automatic flight control system is provided for extended range missions.

HIGH SPEEDS

This airplane is capable of very high speeds with the transition from transonic to supersonic speed being completely smooth. No adverse flight characteristics are evidenced at any speeds tested. This airplane is capable of maintaining supersonic speeds during maneuvering flight at constant altitudes. Stick forces will vary with airspeed; figure 6-5 shows this variance in pounds stick force (aft) with airspeed.

MANEUVERING FLIGHT CHARACTERISTICS

MANEUVERING LOADS

Maneuvering loads are incurred when the airplane is turned, rolled, yawed, pulled out of a dive or accelerated in some manner. It is the pilot's responsibility to prevent these loads from exceeding the imposed limits of the airplane. It should be noted that the accelerometer may mislead a pilot in that (1) it reads only accelerations in the vertical axis and (2) by location in the cockpit it cannot detect empennage loads. An example will better illustrate the subject. If the airplane is yawed or skidded during flight, the accelerometer may still indicate only 1 "g". During this maneuver, fairly large loads are being imposed on the vertical fin of the airplane. Actually, these steady loads may not be excessive; however, during rapid applications and/or rapid release of large control forces, very high loads can be imposed on the airframe.

DIVES

High Mach number dives are easily entered. A slow pushover entry into a shallow dive angle (less than 40°) will develop the highest obtainable Mach number.

OPTIMUM DIVE RECOVERY

The established optimum dive recovery technique is a constant angle-of-attack pull out at military power. By use of angle-of attack as the prime consideration in dive recovery, the pilot is able to convert speed into best pull-up radius while keeping clear of the stall

region. In a wide range of speed, the maximum safe angle-of attack recovery will produce a "g" loading such that altitude loss will not vary appreciably with a wide range of entry airspeeds. This speed range includes any speed at which maximum safe angle-of-attack produces more that 1 "g", but less than 6 "g" (roughly 200 to 450 knots IAS). Maximum safe angle-of-attack can be conservatively computed per indicated as follows:

KNOTS - IAS	300	350	400	450	500
"g" LOADING	1.7	2.7	3.7	4.7	5.7

This computation conservatively defines the horn boundary. Angle-of-attack can be held by computing and scheduling "g" loading as speed changes during the recovery, or by flying against the horn boundary. Application should be by smoothly applying "g" loading to the max safe angle-of-attack, while simultaneously applying military power. Military power is used to prevent rapid speed bleed-off and consequent quicker "g" requirement. At very high speed where 6 "g" is reached before horn boundary, fly "g" limit until airspeed bleeds off enough to obtain horn boundary. If more rapid speed reduction is required, reduce throttle and/or apply speed brakes, but restore airplane to the low drag military power recovery condition as soon as possible. From very low airspeeds, recovery should not be attempted before reaching 350 knots, if altitude permits.

OPTIMUM DIVE RECOVERY CHARTS

Figures 6-6 and 6-7 show the altitude loss to be expected from an optimum dive recovery.

FLIGHT WITH EXTERNAL TANKS

Airplane flight characteristics are essentially the same with one or two 450 gallon external tanks installed except for normal higher gross weight performance limitations.

Optimum Dive Recovery

MINIMUM ALTITUDE LOSS

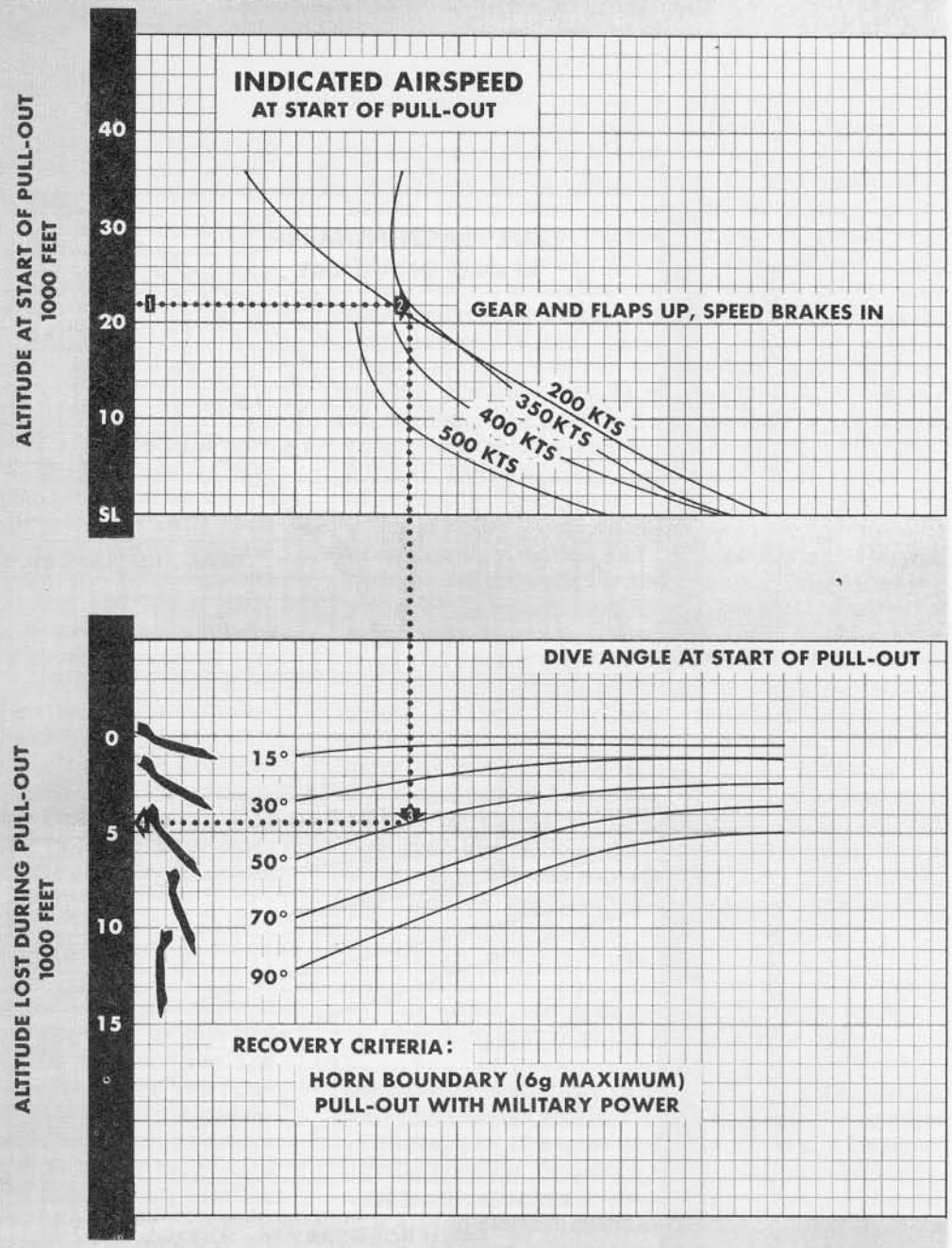

Figure 6-6

Optimum Dive Recovery

MINIMUM ALTITUDE LOSS

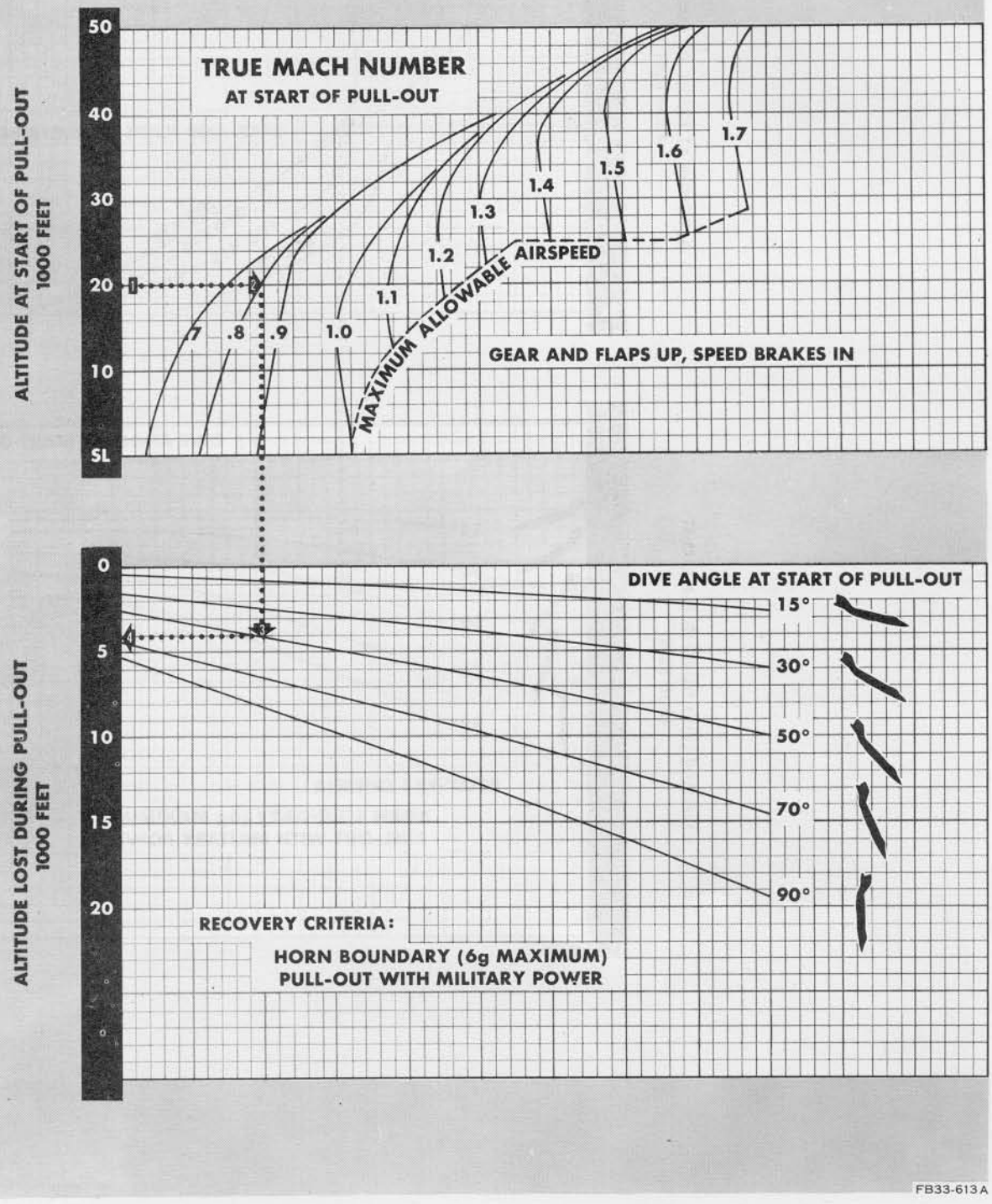

Figure 6-7

section VII Systems Operation

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Wheel Brake Operation. 7-4
Main Gear Tires 7-4
Runway Overrun Barriers 7-4

ENGINE OPERATION

THRUST–RPM RELATIONSHIP

The J57 engine employs a split, 16-stage axial-flow, compressor. The compressor section consists of a nine-stage, low-speed, low pressure rotor unit and a seven-stage, high-speed high pressure rotor unit. The two rotor assemblies are mechanically independent and revolve at different speeds. Each engine is adjusted to produce rated thrust and, since performance will deteriorate as the engine accumulates operating time, periodic adjustments to increase rpm are necessary to maintain rated thrust. Therefore each engine will vary in rpm for a given thrust. For a 1% variation in rpm, the thrust varies approximately 5% while a 1% variation in engine pressure ratio results in approximately 1.5% variation in thrust. Since rpm does not accurately indicate thrust, it is necessary to use the pressure ratio gages for more accurate thrust indications. Refer to Engine Pressure Ratio Gages, Section I.

ENGINE COMPRESSOR BLEED VALVE

A bleed valve is installed on each engine to prevent surging and stalling of the compressor by bleeding low pressure air overboard during deceleration. The speed range of compressor surges varies with temperature. An increase in compressor inlet temperature with a decrease in compressor inlet pressure requires a higher rotor speed to attain surge-free operation. The bleed valve is open during starting and idle and remains open during acceleration until the critical surge and stall region of the low pressure compressor has been passed. This critical region is determined by the bleed valve governor which receives low pressure rotor speed and compressor inlet pressure and temperature signals from the sensing units. The bleed valve is actuated pneumatically when the critical speed of the compressor is reached.

COMPRESSOR STALL

A breakdown of compressor airflow is known as a compressor stall. Compressor stall is induced by a change in the pattern of airflow being fed to the engine. The intensity of the stall is determined by the magnitude of the airflow pattern change and may affect a number, or all of the compressor blades. Stalls may be encountered at any speed. Retarding or advancing the throttle too rapidly can cause either deceleration or acceleration stalls, respectively. A malfunctioning engine compressor bleed valve, as noted in the preceding paragraph, may accentuate the characteristics of an acceleration or deceleration compressor stall. Without throttle movement, rapid changes of flight conditions which distort the inlet duct airflow pattern can induce compressor stall under certain atmospheric conditions. These compressor stalls may occur as individual loud reports or as a series of loud reports in rapid order. Compressor stalls are accompanied by airframe vibration and in some cases, emission of vapor from the engine air intake duct. Compressor stalls which result from longitudinal pitch-up can be sufficiently severe to cause flame and smoke to emerge from the engine inlet duct. While uncommon, such a condition should not, in itself, be cause for alarm. Should a stall occur as a result of longitudinal pitch-up, the aircraft should be returned to normal flight as quickly as possible, following which the recommended stall-recovery procedure outlined in Section III should be accomplished. RPM and fuel flow drop and temporary loss of EPR occurs when a series of stalls are experienced. Fuel flow and rpm will fluctuate when individual stalls are encountered.

Note

The engine can sustain numerous rapid order type compressor stalls without engine damage.

Compressor stalls may be recognized by loss of thrust reflected through engine instruments, rapid reduction or fluctuation of engine pressure ratio at a constant throttle position, or failure of rpm to increase during acceleration. A compressor stall may be accompanied by a rise in exhaust gas temperature. The possibility of encountering compressor stall is increased during high-altitude operations as the thinner air does not conform as easily to smooth airflow through the compressor section as does the heavier air at low altitude. This results in a more easily disturbed compressor airflow pattern. There are several things that can be done to avoid compressor stall or to reduce its intensity. Erratic and abrupt throttle movements should be avoided. Rapid throttle advances during periods of high distortion of the air entering the air inlet duct, such as at low airspeeds, can cause acceleration stalls. Coordinated flying increases the efficiency of the compressor inlet air duct. Airspeeds

should be maintained above the acceptable minimum. Following a single loud explosion, immediately check for signs of fire (trailing smoke or flames and fire warning system indications) to determine whether a compressor stall or engine failure has occured. Off-idle compressor stalls (sometimes referred to as "choo-choo" or acceleration stalls) may be experienced between idle and approximately 80% rpm while accelerating during engine ground runup. If a stall occurs as the throttle is being advanced in this range, momentarily stop or slow throttle advancement as required to correct the stalled conditions. Off-idle stall or "choo-choo" is of no consequence unless it is severe to the degree that more than 14 seconds are required for the engine to accelerate from 65% to MIL POWER. If more than 14 seconds are required, the engine should be shut down and the cause determined before flight.

FLAME-OUT

Rapid throttle movement, especially at high altitudes, may cause the engine to flame-out. This type of flame-out, like compressor stall, occurs when more fuel is injected into the combustion chamber than the engine can utilize for acceleration at the existing rpm. But unlike the compressor stall, this mixture is so rich that it cannot burn, so the flame goes out. Flame-out may also occur when engine is decelerated too rapidly, whenever the fuel injected into the combustion chambers is inadequate to sustain combustion at the existing rpm. Flame-outs of this nature can be avoided by slower throttle movements. Flame-outs are indicated by loss of thrust, drop in exhaust temperature and rpm. Single engine flame-out will yaw the airplane slightly.

ENGINE NOISE AND ROUGHNESS

In-flight engine noises and roughness may occur especially when engine is operating above 90% rpm. Usually a slight change in rpm will eliminate roughness. However, if roughness occurs at all altitudes and engine speeds it may indicate some mechanical failure and an immediate landing should be made.

TURBINE NOISE DURING SHUTDOWN

The light scraping or squealing noise, sometimes heard during engine shutdown, results from interference between engine rotating and stationary parts having different cooling rates. This scraping is undesirable since it may damage the engine parts. To minimize this scraping, operate the engine at idle for five minutes before shutdown. If heavy scraping should occur, no attempt should be made to restart or operate engine until exhaust temperature has dropped enough to provide adequate clearance between the affected parts.

STARTING ENGINES

56-248 (55) THRU (120)

For engine starting procedure refer to Section II.

SONIC BOOM

The sonic boom is the result of a compressibility or "shock" wave which is built up ahead of the airplane as its speed approaches the speed of sound. Sonic booms have been known to break windows and crack plaster on buildings, and to rip the fabric from the wings of light airplanes. As a measure of safety and courtesy, flight at supersonic speed should not be performed within a distance of one mile of slow flying airplanes or approaching airplanes, or within one mile of personnel and installations on the ground. Over residential areas, supersonic flight should not be made.

FUEL SYSTEM MANAGEMENT

The operation of the fuselage fuel transfer system is completely automatic when the fuselage tank transfer switch is in the NORM position. This automatic transfer pump sequencing provides continuous fuel flow from cells 1, 4 and 5 to cells 2 (engine feed tank) and 3. Placing the fuselage tanks transfer switch in GRAV interrupts the continuity of the fuselage transfer pumps and the fuselage cells transfer by gravity flow only. Since afterburning increases fuel consumption, all fuselage transfer pumps that have fuel available to them are automatically energized when either throttle is placed in the afterburner detent. These pumps will automatically shut off when their fuel supply is depleted. During wing or external fuel transfer without the fuselage transfer pumps operating (fuselage transfer switch in GRAV), wing and external fuel is directed to all cells. When the transfer pumps are operating wing and external fuel is directed to cell 2 only.

Note

To insure transfer pump operation place the fuselage tank transfer switch to ALL PUMPS whenever the "Feed Tank Fuel Low" warning light illuminates.

With External Tanks Installed —

1. During taxi, take-off and climb to altitude, transfer fuselage and external fuel.
2. At level-off, fuselage transfer switch - GRAV
3. When the external tanks are empty, external tank transfer switch to STOP and wing tank transfer switch to NORM.
4. When the wing tanks are empty, wing tank transfer switch to STOP.
5. Fuselage transfer switch - NORM

Without External Tanks Installed —

1. During taxi, take-off and climb to altitude, transfer fuselage fuel only.
2. At level-off, fuselage transfer switch - GRAV
3. Wing tank transfer switch - NORM
4. Monitor fuel transfer.
5. When the wing tanks are empty, wing tank transfer switch to STOP.
6. Fuselage transfer switch - NORM

Fuel Weight Variations

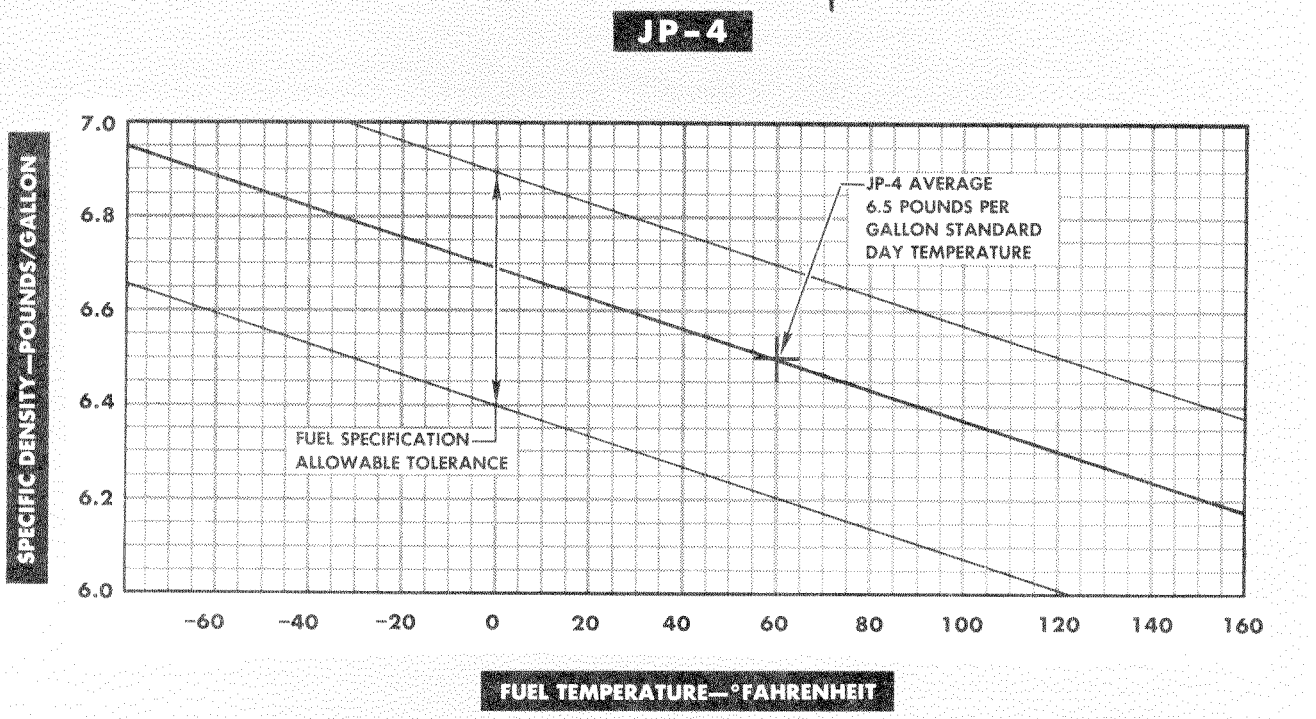

Figure 7-1

FUEL CELL MONITORING

It is recommended that the fuel quantity gage tank selector knob be utilized with the fuel quantity gage for the following fuel cell monitoring sequence.

1. During take-off, initial climb and all afterburner operation - On cell No. 2.
2. Upon leveling off and as soon as Military thrust or less is used - Check all tanks for proper feeding.
3. Throughout flight - On TOTAL
   a. If transferring wing and/or external fuel, monitor TOTAL until gage indicates decrease in total fuel.
   b. If wing and/or external fuel has been consumed. monitor TOTAL and periodically (once every fifteen minutes) check all tanks for proper feeding.
4. During descent, traffic pattern, and throughout landing phase - On cell No. 2.

Correct fuel monitoring will lead to an early detection of fuselage transfer pump failure.

Note

Monitor fuselage cell number 2 whenever the total fuel quantity drops below 3,000 pounds.

FUEL QUANTITY VARIATIONS

Variations between the quantity and weight of JP-4 are a source of considerable difficulty in the accurate determination of airplane performance. The primary purpose of the fuel quantity data table in Section I, is to list the individual fuel cell quantities in gallons. However, since the fuel quantity gage measures the fuel load in terms of pounds, the standard pound per gallon equivalent of 6.5 (standard day) is also quoted. Military specifications concerning fuel production allow a specific density variation of 6.2 to 6.7 pounds per gallon, or a maximum of one-half pound per gallon for standard day conditions. It can readily be seen that under standard day conditions, the total fuel weight (3003 gallons) can vary as much as 1502 pounds, depending on specific density alone. Added to the specific density variation is the effect of fuel temperature. For a change in temperature of -60° Fahrenheit to 120° Fahrenheit, the total fuel weight will change by 11 percent, or, for every change in the fuel temperature of one degree, the total fuel weight will change inversely by .061 percent. Therefore, with the additional changes in fuel weight caused by temperature, a wide range of fuel weights for a constant quantity can be realized. For example, if the fuselage cells (883 gallons) were filled with JP-4 manufactured at the high end of the specific density tolerance (6.7 pounds per gallon), and the fuel temperature was 15 degrees, the fuel quantity gage

would indicate 12,898 pounds. However, the same fuel quantity gage would indicate 11,392 pounds if the fuselage cells (1883 gallons) were filled with JP-4 manufactured at the low end of the specific density tolerance (6.2 pounds per gallon), and the fuel temperature was 105 degrees. While it is not expected that a clinical study of the fuel density be made prior to each flight, it should be remembered that the engine fuel control schedules fuel in pounds, not gallons. Refer to figure 7-1, Fuel Weight Variations, for the mean, minimum and maximum fuel weights in relation to specific density and temperature.

WHEEL BRAKE OPERATION

The brakes are conventionally operated by toe action on the rudder pedals. This action meters utility hydraulic pressure to force the brake disks together. Since the brake values are spring-loaded metering type valves, hydraulic pressure cannot be felt at the pedals. The resulting characteristic is a soft full travel brake pedal with slightly increasing pedal force as the brake valve holdback spring is compressed. This characteristic is conducive to inadvertently "riding" the brakes during taxi operation and locking the wheels during landing roll with the anti-skid system inoperative or while utilizing the emergency brake system. Obviously, the soft pedal characteristic should be cautiously considered during the above mentioned phases of operation. Additional techniques that should be used to minimize brake wear are: (a) Control taxi speed with the throttles to avoid "dragging" the brakes, (b) Use nose gear steering for directional control while taxiing and during landing roll-out, (c) Utilize all available drag devices from touchdown to completion of the landing roll, (d) Take full advantage of the high aerodynamic drag available from touchdown speeds down to approximately 120 knots IAS. For all conditions, normal and emergency, the most efficient braking technique is a single, smooth application of the brakes with a constantly increasing pedal pressure. Normally the airplane can be stopped with a minimum of wheel braking and well below anti-skid cycling. However, under slippery runway conditions or if maximum braking is required, the brakes should be applied to the point of anti-skid cycling.

Note

There may be a tendency to consider cycling as a malfunction. However, it is, in fact, an indication that the system is maintaining maximum braking efficiency. Anti-skid should never be turned off except when a system malfunction is recognized. Turning the system off will eliminate anti-skid protection which may result in blown tires or locked wheels on a slippery runway. If, during cycling, the "Brakes Off" phase exceeds 3 seconds, the system will automatically revert to manual braking and the anti-skid light will illuminate. Once the wheels regain normal speed (no skid condition) the system will revert to normal operation and the warning light will go out.

At the first indication of a brake malfunction, or if it is suspected that the brakes are in an overheated condition due to excessive use, the airplane should be maneuvered off of the active runway and stopped to allow sufficient cooling before the airplane is subsequently towed or taxied. Taxiing, even at low speeds, will not provide adequate cooling of overheated brakes and can cause additional heat build-up. Peak temperatures occur in the brake assembly from 5 to 15 minutes after maximum braking and is further transferred to the wheel and tire. In extreme cases, this heat build-up can cause brake fire and/or tire explosion. In view of the above, an airplane with overheated brakes should never be parked in a crowded area, and all personnel should be kept well clear. During a series of successive landings, it is recommended that a minimum of 15 minutes elapse between landings where the landing gear remains extended in the slip stream, and a minimum of 30 minutes between landings where the landing gear has been retracted to allow sufficient time for cooling between brake applications. Additional time should be allowed for cooling if brakes are used for steering, crosswind taxiing operation, or a series of landings.

MAIN GEAR TIRES

The main landing gear tires are not capable of withstanding the high heat conducted through the wheel from the brake during high-energy stops or successive low-energy stops. As a result of this, a tire replacement program has been initiated. This program will use point systems based on airplane gross weight at take-off. For tire points refer to Section II.

RUNWAY OVERRUN BARRIERS

MA-1A (WEB-CABLE) BARRIER

The MA-1A barrier is a web-cable type barrier which consists of two across-runway cables, a series of nylon straps, and two sets of heavy link chains. The smaller "tripping" cable is suspended approximately 3 feet above the runway surface and is directly above the larger "stopping" cable. Extending between, and connected to the cables are the nylon straps. The heavy link chains, which are attached to the larger "stopping" cable, supply the required forces to stop the airplane. See figure 7-2.

MODIFIED MA-1A (WEB-CABLE) BARRIER

The Modified MA-1A barrier is an MA-1A web-cable barrier with an additional across-runway cable. The additional across-runway cable is positioned 20 feet in front of the web-cable barrier and is supported approximately 3 inches above the runway surface. The additional across-runway cable and the larger "stopping" cable of the web-cable barrier are attached to heavy link chains which supply the required forces to stop the airplane. See Figure 7-2.

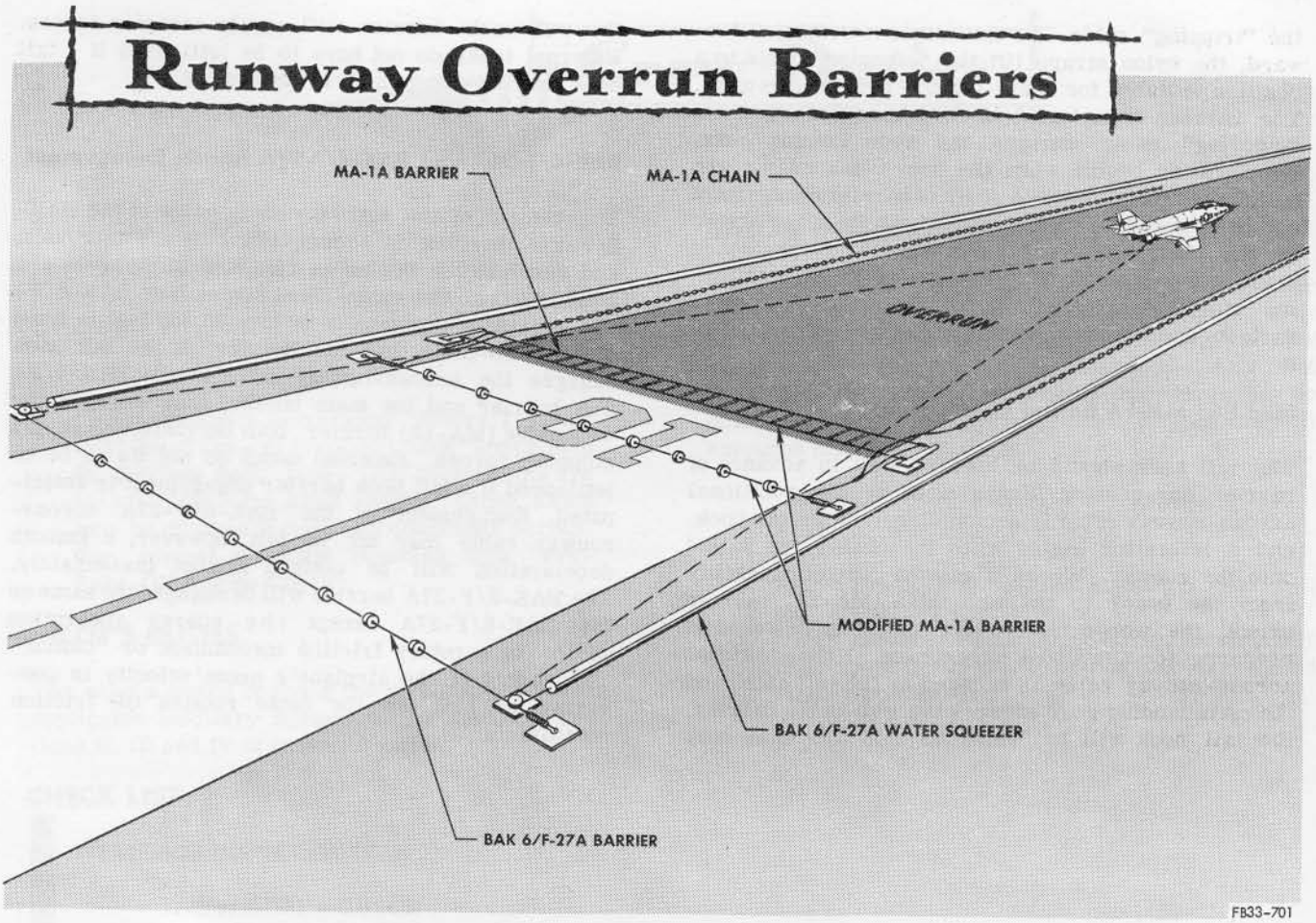

Figure 7-2

BAK-6/F-27A AND BAK-9/F-27A BARRIERS

The BAK-6 tail hook barrier consists of an across-runway cable and two water-squeezer installations. The across-runway cable is supported approximately 3 inches above the runway surface. The water-squeezer installations are long, water-filled tubes. Conical plungers, which are attached to the across-runway cable, are pulled through the tubes, and the resistance of the water against the plungers produces the required forces to stop the airplane. The BAK-9 installation utilizes the cross-runway cable, but the energy absorption device is a rotary friction mechanism or "clutch". The energy of the airplane's mass/velocity is converted to heat as the cable rotates the friction mechanism. See figure 7-2 for typical barrier illustration.

BARRIER ENGAGEMENTS

To insure a positive engagement and a safe arrestment, barrier engagements should be made perpendicular to, and in the center of the barrier. Brakes should be released just prior to engagement. After engagement, braking may be resumed to maintain directional control and to aid in stopping the airplane.

Although off-center barrier engagements produce undesirable effects, in times of emergency, a barrier engagement should be attempted regardless of airplane speed, gross weight, or position on the runway. The following barrier engagements have been successfully flight tested:

BAK-6/F-27A

160 knots	34,000 pounds	15 feet off-center
115 knots	34,000 pounds	75 feet off-center
145 knots	45,000 pounds	15 feet off-center
140 knots	52,000 pounds	15 feet off-center

Flight tests of the Modified MA-1A barrier were terminated at 90 knots, 34,000 pounds at 50 feet off-center. The MA-1A and Modified MA-1A barriers are limited by the length of chain available. Airplane damage can be expected from chain whipping action after all of the chain available has been utilized.

MA-1A Barrier Engagement

Engagement of the MA-1A web-cable barrier is accomplished when the nose gear of the airplane strikes

the "tripping" cable. As the airplane continues forward, the nylon straps lift the "stopping" cable to a position suitable for main landing gear engagement. The barrier engagement is then complete when the "stopping" cable engages the main landing gear. Deceleration begins when the heavy link chains are pulled onto the runway. A positive barrier engagement can be detected by slight fore and aft "tugs" produced by the chain. External tanks should be jettisoned prior to engagement. If the external tanks are retained, the "stopping" cable will be slapped back to the runway surface, and the main landing gear tires may roll over it.

Modified MA-1A Barrier Engagement

The tail hook should be lowered well in advance of barrier engagement. Engagement of the additional across-runway cable is accomplished by the tail hook, and deceleration begins when the chains are pulled onto the runway. Where a remote control capability from the tower to the web-cable (MA-1A) barrier exists, the web-cable barrier should be lowered if preparing for a tail hook arrestment. If the additional across-runway cable is engaged by the tail hook, and the main landing gear engages the web-cable barrier, the tail hook will be "unloaded". In this case only the web-cable barrier will supply stopping forces. External tanks do not have to be jettisoned if a tail hook barrier engagement is anticipated.

BAK-6/F-27A and BAK-9/F-27A Barrier Engagement

Engagement of the across-runway cable of the BAK-6/F-27A barrier is accomplished by the tail hook, and deceleration begins as the conical plungers are pulled through the water-filled tubes. The BAK-6/F-27A barrier will normally be located 500 feet in front of the web-cable (MA-1A) barrier. If the tail hook engages the across-runway cable of the BAK-6/F-27A barrier and the main landing gear engages the web-cable (MA-1A) barrier, both barriers will supply stopping forces. External tanks do not have to be jettisoned if a tail hook barrier engagement is anticipated. Engagement of the BAK-6/F-27A across-runway cable may not be felt, however, a smooth deceleration will be noticed almost immediately. The BAK-9/F-27A barrier will be engaged the same as the BAK-6/F-27A except the energy absorption device is a rotary friction mechanism or "clutch". The energy of the airplane's mass/velocity is converted to heat as the cable rotates the friction mechanism.

section VIII Crew Duties

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Checklist 8-1

Note

Certain items in paragraphs "Before Taxiing" and "Pre-Take-Off Airplane Check" are printed in ***Boldface Italic*** type. Only these items are MANDATORY for alert checks. Other items may be checked if time and conditions permit. The normal checklist resumes with "Pre-Take-Off Engine Check".

PILOT'S DUTIES

The pilot's duties of flying the airplane and operating applicable auxiliary equipment are discussed in Sections II, III and IV of this publication.

RADAR INTERCEPT OFFICER'S DUTIES

The primary duty of the RIO is to operate the radar equipment so that together, the pilot and RIO may seek and identify questionable airplanes and destroy hostile airplanes. Secondarily, the RIO should assist the pilot in any way possible so that lengthy procedures may be quickly and accurately accomplished resulting in a well executed mission.

1. Perform navigational duties in all types of weather.
2. Assist the pilot in preflight inspections and "call out" checklists during flight.
3. Clear the area whenever possible, particularly in areas of heavy traffic and during take-off and landing operations.

CHECK LIST

EXTERIOR INSPECTION (RIO)

1. Form 781 - CHECK
2. Nadar - CHECK
   Check NADAR for installation and operation as locally directed. 115 volt, 3 phase a-c power is required to check the operation of the NADAR.

CAUTION

On aircraft without central vertical gyro, turning radar master switch to STANDBY or ON and then returning to OFF or WARM could damage the FIRE CONTROL SYSTEM VERTICAL GYRO if the aircraft is taxied with radar in OFF or WARM.

3. Door 200R - SECURED
4. Rotary door - CHECK
   Check visually for armament configuration.

INTERIOR CHECK (RIO)

Before External Electrical Power is Connected

1. Circuit breakers - IN
   Visually inspect circuit breakers prior to entering cockpit.
2. Radar mode selector - OFF
3. Ejection seat safety pin - INSTALLED
   Check that the ejection seat hand grips are in the full down position and that the ejection seat safety pin, with red warning flag, is installed in the left hand grip.

CONTINUED ON NEXT PAGE

INTERIOR CHECK (RIO) CONTINUED

Note

The ejection seat safety pin also serves as the canopy safety pin.

4. NAV aids and letdown book - CHECK
5. Survival kit, safety belt, and shoulder harness - FASTEN
   - Attach the survival kit straps to the parachute harness.
   - Attach the shoulder harness and parachute lanyard to the safety belt.
   - Connect the zero delay lanyard to the parachute ripcord handle.
6. Identification light switch - OFF
7. Canopy switch - SAFETIED

With External Electrical Power Connected

1. Missile preparation indicator switches - EXT/AFT - DEACTIVATED
   Check that missile preparation indicator switches are in the non-activated position.
2. TACAN navigation control shift - AS BRIEFED
3. TACAN navigation power switch - ON
4. UHF control shift - AS BRIEFED
5. UHF command radio - ON
   - Control switch - BOTH
   - Frequency selector knob - AS REQUIRED
   - Volume control knob - AS DESIRED
6. Data link controls - AS DIRECTED
7. Cockpit lights - AS DESIRED
   Check all cockpit lights for proper operation and set as mission requires.
8. Rocket armed lights - TEST
9. Altimeter - SET
10. Clock - SET

*11. IR threshold video, tone, and volume - FULL COUNTERCLOCKWISE

12. 200 mi expand - IN
13. EL switch/normal/"A" scope - NORMAL

*14. Range rate - 75

15. Radar mode selector - WARM
16. Radar range - 30 MI SHORT PULSE

*17. Chaff - OFF

*18. Chaff (Nose/Tail) - TAIL

*19. Chaff (TGT HDG) - OFF

20. Search intensity - FULL COUNTERCLOCKWISE

CAUTION

If either search or attack intensity control knob is turned clockwise when radar master switch is placed ON, the radar scope may be damaged.

21. Video - FULL COUNTERCLOCKWISE
22. Scale lights - AS DESIRED
23. Attack intensity - FULL COUNTERCLOCKWISE
24. IF gain - FULL COUNTERCLOCKWISE

*25. Lobe freq. - AS DESIRED

26. Tune switch - OFF
27. Meter switch - X10
28. HOJ - OFF
29. CADJ - OFF
30. Elevation control - DETENT
31. Antenna scan - 2 BAR
32. Azimuth scan - B
33. Spare lamps - CHECK

CONTINUED ON NEXT PAGE

*Some airplanes

INTERIOR CHECK (RIO) CONTINUED

34. Intercomm control - CHECK
    - Int - ON
    - DAL/COMM - ON
    - BCST - ON (for IR tone)
    - NAV - ON
    - Volume - AS REQUIRED
    - Call/Inter/Comm - COMM
    - Aux listen - NORMAL
35. Face heat - OFF
36. Oxygen control panel - CHECK
    - Oxygen emergency lever - NEUTRAL
    - Oxygen diluter lever - NORMAL
    - Oxygen supply lever - ON
    - Oxygen supply pressure gage - CHECK
      Check oxygen pressure 300 psi.
37. Antenna hand control - CHECK
    Check for free movement and action switch not binding.
38. Elevation vernier - DETENT
    Check antenna hand control vernier knob in detent since it will be active at all times and will effect antenna elevation angle.
39. Utility light and cord - STOWED
40. Seat - ADJUST

*Block I IIP Airplanes Only.

BEFORE TAXIING

Note

All check items printed hereafter in ***Boldface Italic*** type are mandatory for alert checks. Non-boldface items may be checked if time and conditions permit. The normal checks are resumed with "Pre-Take-Off Engine Check".

1. Ejection seat safety pin - REMOVE
2. Radar master switch - STBY or ON

CAUTION

- Observe the following operating limitations during ground operation:

  WARM- - - - - - - - - - - - - - - INDEFINITE
  STANDBY- - - - - - - - - - - - - - 8 MINUTES
  ON - - - - - - - - - - - - - - - - 8 MINUTES

- There is no time limit for any mode of operation when one engine is at or above 80% PRM.

- On (40) THRU 56-246 (55) airplanes the systems are not equipped with central vertical gyros. Therefore, on these aircraft, care must be taken to prevent damage to the fire control system vertical gyro. These aircraft should be taxied in STANDBY or ON if the gyro excitation voltage has been applied in the past 30 minutes. Ground time limitations take primary consideration, however.

TAXIING

1. TACAN navigation radio - TEST
   - Monitoring switches - CHECK
   - Power switch - AS DESIRED
     Allow approximately 90 seconds warm-up.
   - Navigation control shift light - ILLUMINATED
   - Select desired channel
   - Volume - AS DESIRED
   - Observe the CDI deflection on the course indicator.
   - Observe the number two bearing indicator and the range indication on the bearing-distance-heading indicator.
2. Direction finder (ADF) - CHECK
   Check during ground transmissions to assure proper operations.

PRE-TAKE-OFF AIRPLANE CHECK (RIO TO PILOT)

1. ***Seat Safety Pin–REMOVED (Call)***
   "Call out" ejection seat safety pin removed.
2. ***Zero Delay Lanyard–HOOKED (Call)***
   "Call out" zero delay lanyard hooked.
3. ***Canopy–CLOSED, LIGHT OUT (Call)***
   "Call out" canopy closed, light out.
4. ***Take-off Trim–SET (Call)***
   "Call out" take-off trim set.
5. ***EPR Gages–SET (Call)***
   "Call out" engine pressure ratio gages set.
6. ***Battery–ON (Call)***
   "Call out" Battery switch on.
7. ***Voltmeter–115V (Call)***
   "Call out" voltmeter 115 volts.
8. ***Oxygen Flow–BLINKING (Call)***
   "Call out" oxygen flow blinker, and check for blinker operation of the oxygen system.

Note

Remain on NORMAL O_2 during take-off. If any fumes are detected during the take-off run, they should be reported immediately to the pilot so corrective action may be taken.

9. ***Pitot Heat Switch–ON (Call)***
   "Call out" pitot heat on.

AFTER TAKE-OFF- CLIMB (RIO TO PILOT)

During Climb

1. Zero delay lanyard - STOWED (Call)
   "Call out" zero delay lanyard stowed and manually unhook zero delay lanyard from parachute ripcord handle. Refer to Zero Delay Lanyard Engagement Requirements, Section III.

WARNING

It is imperative that the zero delay lanyard is not overlooked and left attached to the parachute ripcord handle. If this occurs, and high altitude ejection is necessary, serious or fatal injury may result since the parachute will open immediately upon separation from the seat.

2. Pusher switch - ON (Call)
3. Oxygen diluter lever - NORMAL O_2 (Call)
4. Cabin pressure switch - NORM (Call)
5. IFF - CHECKED (Call)
6. Altimeter - 29.92" HG OR AS REQUIRED (Call)
   Check altimeter against pilot's indication after level-off.

Note

Refer to Section II for further radar armament delivery and escape procedures.

ARMAMENT SAFETY CHECK (RIO TO PILOT)

1. Master arm switch - SAFE (Call)
   Switch should be safetied and sealed in the SAFE position when armament is aboard.
2. Armament selector knob - VIS-IDENT (Call)
   Safety detent knob should be safetied and sealed when applicable.
3. Vis-Ident Indicator light - ILLUMINATED (Call)
4. Arm select window - BLANK (Call)
5. MB-1 Ejector racks lock switch - LOCKED (Call)
   Switch should be safetied and sealed in the LOCKED position when MB-1 is aboard.
6. MB-1 ejector racks annunciators - LOCKED (Call)
7. Armament safety check - CALL COMPLETE

CAUTION

This armament safety check should be accomplished prior to all practice intercepts.

DESCENT (RIO TO PILOT)

1. IFF - CHECKED (Call)
2. Altimeter - SET STATION PRESSURE (Call)
   Check altimeter against pilot's indication after level-off.
3. Defrost switches - NORM (Call)
*4. Icing ignition - AS REQUIRED (Call)

BEFORE LANDING (RIO TO PILOT)

Prior to Entering the Traffic Pattern

1. Zero delay lanyard - HOOKED (Call)
   Check zero delay lanyard connected to parachute ripcord handle. Refer to Zero Delay Lanyard Engagement Requirements, Figure 3-5.
2. Fuel Quantity - CHECK & ON #2 (Call)
3. Master arm switch - SAFE (Call)
4. Armament selector knob - VIS-IDENT (Call)
5. MB-1 ejector racks lock switch - LOCKED (Call)
6. Hydraulic pressure - WITHIN LIMITS (Call)
7. Pusher switch - OFF (Call)
8. AFCS engage switch - STAND-BY (Call)
9. Safety belt and harness - SECURE (Call)
   Check safety belt tight and shoulder harness locked.
10. Radar master switch - AS REQUIRED

In the Pattern—

11. Landing gear - DOWN (Call)
    "Call out" landing gear down, indicators checked.
12. Flaps - EXTENDED (visually check)
    Visually check the flaps in the full down position and "call out" to pilot.

AFTER LANDING (RIO TO PILOT)

1. Flaps - RETRACT (Call)
2. Speed brakes - CLOSE (Call)
3. Ejection seat safety pin - INSTALL (Call)
4. Cockpit pressurization - RAM AND DUMP (Call)
   "Call out" to check the cabin pressure altimeter to assure that the cockpit is fully depressurized before opening the canopy.
5. All unessential electrical equipment - OFF (Call)
   "Call out" to turn off all unessential electrical equipment and check all aft cockpit electrical equipment off.

CAUTION

On aircraft not equipped with central vertical gyros, radar should remain in STBY to preclude damage to the fire control system vertical gyro. The 8 minute ground limitation must still be observed.

6. Radar intensity controls - FULL COUNTERCLOCKWISE

*Some airplanes

BEFORE LEAVING AIRPLANE

1. Radar master switch - OFF
   Turn the radar master switch off only on airplanes which are equipped with the central vertical gyro (CVG).

CAUTION

On airplanes not equipped with CVG, do not turn the radar master switch to OFF or WARM until the airplane is in the chocks.

2. Form 781 - COMPLETE
   Advise the pilot of any discrepancy so that it may be entered in the Form 781.

CAUTION

- Insure that all personal equipment and straps are free of cockpit controls so that no damage is incurred when leaving the airplane.
- Assure that the automatic-opening parachute lanyard anchor does not foul when leaving the airplane to prevent inadvertent opening of the parachute.

EMERGENCY PROCEDURES

Whenever possible, RIO should assist pilot in emergency situations by reading applicable emergency instructions from Emergency Procedures section of Aircrew's Abbreviated Checklist T.O. 1F-101B-(CL)1-1.

section IX All-Weather Operation

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Except for some repetition necessary for emphasis or continuity of thought, this section contains only those procedures which differ from, or are in addition to, the normal procedures presented in Section II.

Instrument Flight Procedures

Within the limits specified in the following paragraphs, this airplane handles well during all phases of instrument flight. Like all fighters, it requires the pilot to pay constant attention to his flight instruments. Ordinary instrument techniques must be modified somewhat because of the airplane's rapid acceleration, lateral control sensitivity and buffet regions. These modifications do not restrict the airplane's operational effectiveness, nor do they present any particular control difficulties to the pilot. Several navigational aids are furnished which facilitate instrument flight. These aids include UHF direction-findings, TACAN, and ILS. IFF is installed to facilitate positive identification of the airplane by ground radar stations during radar penetrations and radar approaches. The RIO's map and beacon mode of radar operation are effective aids to navigation. An autopilot relieves pilot fatigue on long flights and frees him for in-flight planning.

BEFORE INSTRUMENT TAKE-OFF

a. Perform all normal pre-takeoff checks and turn on pitot heat if necessary.

b. Check all flight instruments and set the attitude indicator pitch trim knob pointer to the zero bias index. (This should place the miniature airplane in approximately 4 degrees nose low position, thus providing a picture of the airplane's inflight attitude relative to level flight conditions at normal cruise airspeed.) Select appropriate navigational aids to be used for the departure and set navigational instruments and switches as required.

INSTRUMENT TAKE-OFF

Instrument take-offs can be made with Military or Maximum thrust. Maximum thrust take-offs involve rapid initial changes of attitude and steep pitch angles, and also increase the possibility of accelerating past the gear and flap down limit speeds. If preflight planning shows that a Maximum thrust take-off is required, turn off the afterburners as soon as the airplane is definitely airborne. Use of Maximum thrust, however, considerably shortens the take-off roll.

Instrument Take-Off-Military and Maximum Thrust

a. After aligning the airplane visually with the runway centerline set the heading indicator and recheck all instruments.

b. Advance throttles to 80% rpm with brake pedals depressed. Release brakes, advance throttles to full open, maintaining directional control with nose gear steering until the rudder becomes effective. (approximately 70 knots). Whenever visibility permits, runway features and lights should be used as an aid to maintain proper headings.

CAUTION

Do not use brakes to maintain heading. Doing so will lengthen the takeoff roll, reduce acceleration and increase the possibility of blowing a tire.

c. At approximately 15 knots below takeoff speed ease the nose gear off the runway and set up a take-off attitude by smoothly applying back pressure to raise the miniature airplane approximately 3 degrees above the horizon bar. The airplane will fly off at 165 to 170 knots. Due to reversal error, the altimeter and vertical velocity indicator will show a

momentary downward indication. As the airplane leaves the ground, reference should be made to the attitude indicator for both pitch and bank until a definite climb is established.

1. Military Thrust: Hold a constant attitude until both altimeter and vertical velocity indicator show a definite climb, then retract the gear. After gear retraction increase pitch attitude to +5°.
2. Maximum Thrust: As soon as definitely airborne increase the pitch attitude to +10° by placing the miniature airplane on the 10° pitch reference scale marker. When definitely airborne retract the gear.

Note

Asymmetric gear retraction can cause some yaw and roll. The lateral sensitivity of the airplane requires that corrections be made with smooth even pressures on the controls. If the yaw damper is inoperative, very careful control will be necessary, especially in turbulent air.

d. At 200 knots, wing flap lever - RETRACT.

WARNING

Do not raise the flaps at airspeeds below 200 knots.

e. Maximum thrust - For a military climb, turn off the afterburners at 230 to 250 knots depending on gross weight.

Note

Changes in attitude and trim caused by turning off the afterburners are slight.

f. Cross check the vertical velocity indicator to make certain that the rate of climb is increasing steadily.

g. Continue climbing straight ahead. Make no turns before reaching 250 knots IAS. Limit low altitude maneuvering to 30° maximum bank angle and 350 knots maximum IAS.

INSTRUMENT CLIMB

Military Thrust Climb

The optimum VFR military thrust climb schedule is suitable for instrument flight; however, steep attitude and high rates of climb require thinking well ahead of the airplane. Maintain approximately +10° to +12° indicated pitch attitude until intercepting the climb schedule between 6,000 to 10,000 feet. As soon as the climb schedule is intercepted note the attitude on the attitude indicator and maintain this attitude until readjustment is dictated by the mach indicator. If airspeed is inadvertently allowed to increase an appreciable amount (.05 mach or more) above the climb schedule, do not resort to extreme pitch attitudes in order to correct it. Instead increase pitch attitude approximately 2° and let airspeed decrease slowly. If airspeed falls below the proper schedule, a light buffet may occur at high altitude and high gross weights rendering instrument control more difficult.

Maximum Thrust Climb

Maximum thrust climbs may be made safely on instruments but they are uncomfortable because the steep pitch angles make correction of minor attitude deviations difficult. After take-off, accelerate to 250 knots IAS in take-off altitude, then establish a 10° climb on the attitude indicator. Maintain this attitude while accelerating to the best climb speed. Upon reaching the climb schedule, readjust pitch attitude not to exceed 30° climb. Refer to performance instruments to determine subsequent corrections. These corrections should not exceed 5°.

Note

Caution should be used to avoid making extreme pitch adjustments when correcting for high airspeed. Once an extreme nose-high pitch attitude is entered airspeed decreases rapidly and the airplane approaches the pitch-up boundaries.

INSTRUMENT CRUISING FLIGHT

Level Flight

After leveling off from the climb, establish cruising airspeed and use the thrust settings for recommended optimum cruise schedule. Precise lateral trimming and equalized engine thrusts are essential due to the sensitive lateral control. When the airplane is in level flight at cruising airspeed, readjust the horizon bar on the attitude indicator to indicate level flight attitude. The airplane has excellent handling characteristics throughout its normal speed range if properly trimmed and flown by reference to the flight instruments. With heavy gross weights at altitude above 35,000 feet a slight buffet may occur but creates no control problem. At airspeeds below cruise schedule, buffet at heavy gross weights may be disturbing.

Turns

A constant 30° angle of bank may be used for all turns except where rate turns are required or desired. At high gross weights, a buffet may be encountered during turns at high altitudes, but it creates no control problem as long as recommended cruise schedule airspeed is maintained.

Steep Turns

Any angle of bank exceeding 30° is considered a steep turn. The airplane is easily controlled on instruments in banks up to 60°, however a high airspeed is desirable when the angle of bank exceeds 45°.

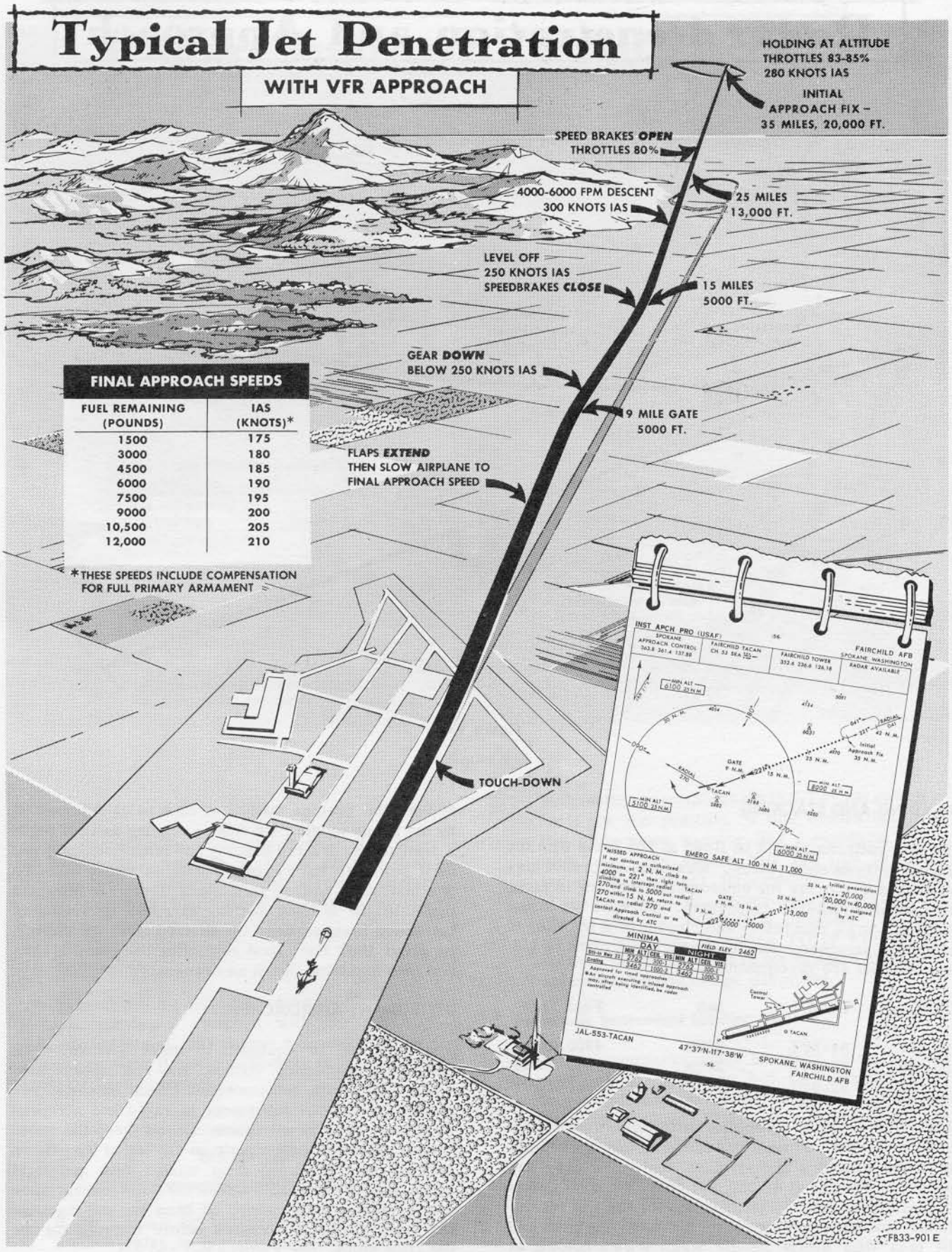

Typical Jet Penetration
WITH VFR APPROACH
HOLDING AT ALTITUDE
THROTTLES 83-85%
280 KNOTS IAS
INITIAL
APPROACH FIX –
35 MILES, 20,000 FT.
SPEED BRAKES OPEN
THROTTLES 80%
4000-6000 FPM DESCENT
300 KNOTS IAS
25 MILES
13,000 FT.
LEVEL OFF
250 KNOTS IAS
SPEEDBRAKES CLOSE
15 MILES
5000 FT.
GEAR DOWN
BELOW 250 KNOTS IAS
9 MILE GATE
5000 FT.
FLAPS EXTEND
THEN SLOW AIRPLANE TO
FINAL APPROACH SPEED
TOUCH-DOWN
FINAL APPROACH SPEEDS
FUEL REMAINING (POUNDS) | IAS (KNOTS)*
1500 | 175
3000 | 180
4500 | 185
6000 | 190
7500 | 195
9000 | 200
10,500 | 205
12,000 | 210
*THESE SPEEDS INCLUDE COMPENSATION FOR FULL PRIMARY ARMAMENT
INST APCH PRO (USAF)
FAIRCHILD AFB
SPOKANE, WASHINGTON
RADAR AVAILABLE
EMERG SAFE ALT 100 N.M. 11,000
MINIMA
DAY
NIGHT
FIELD ELEV 2462
JAL-553-TACAN
47°37'N-117°38'W
SPOKANE, WASHINGTON
FAIRCHILD AFB
FB33-901 E

Figure 9-1

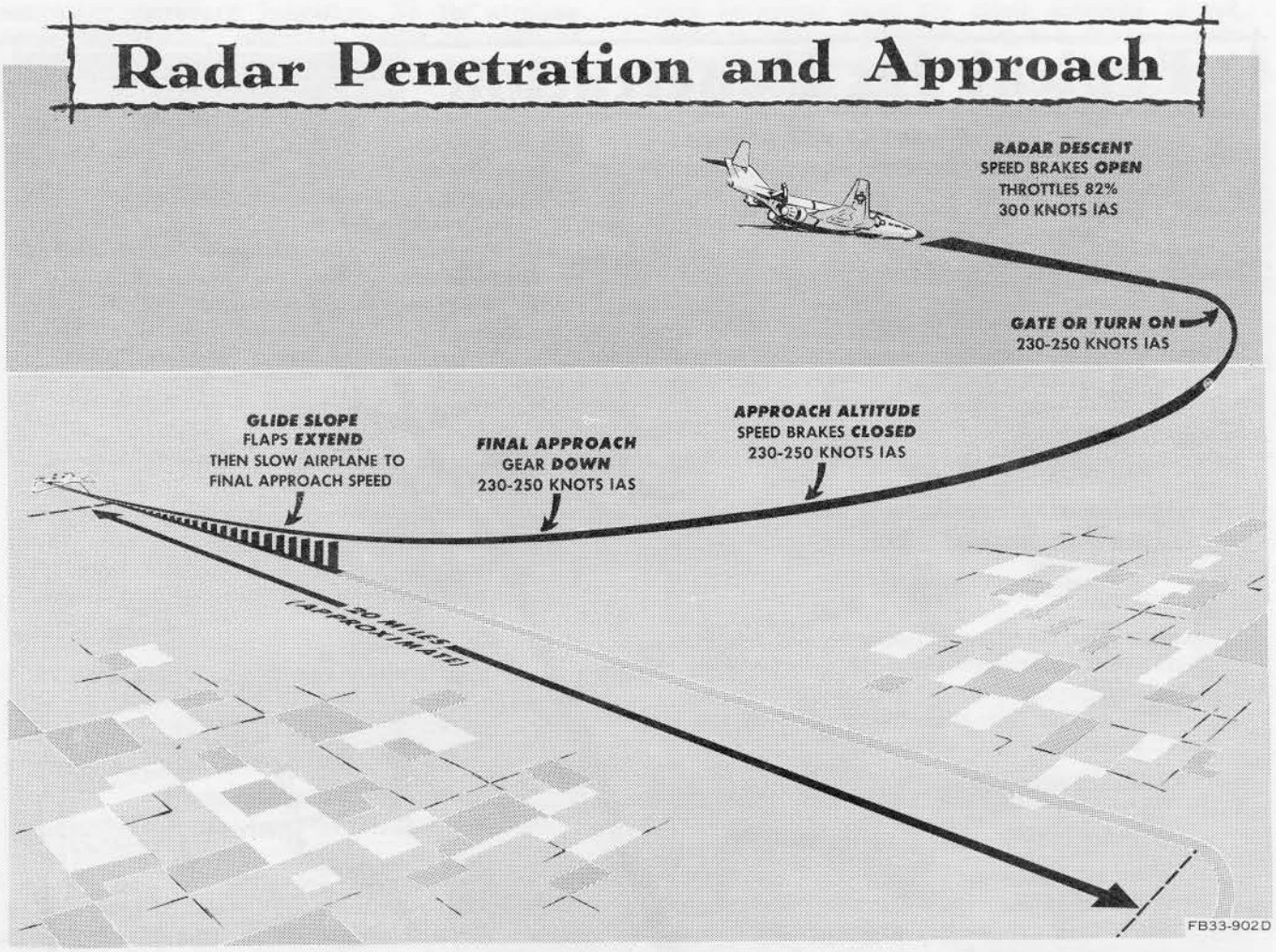


Figure 9-2

HOLDING AND STACKING

Holding patterns should be flown at 280 knots with the thrust settings shown below. Maximum endurance airspeeds are too low for comfortable handling in turns and when turbulence is present. Increase the thrust setting 1 to 2% rpm before entering the turn in order to maintain airspeed. Single needle width turns (1 1/2° per second) are recommended.

Altitude	RPM	IAS	Fuel Flow
20,000	84-86%	280K	4350 lb./hr.
30,000	85-87%	280K	3970 lb./hr.
40,000	92-94%	280K	5020 lb./hr.

Whenever possible, fly holding patterns between 20,000 and 30,000 feet. Formations can be maintained readily at these altitudes and airplane control is easy and positive. Holding at 40,000 feet provides no advantage in fuel consumption to compensate for the control difficulty and buffet present at the altitude. Turns should be less than single needle width when holding at 40,000, the precise degree of bank being determined by the gross weight. To enter a holding pattern begin a turn to the desired heading and simultaneously reduce power to the settings shown in figure 9-1. To descend when holding in a stack, lower the nose and maintain the holding pattern airspeed by extending the speed brakes. Lead the desired level-off altitude by about 1000 feet, first retracting the speed brakes and then adjusting thrust as necessary.

INSTRUMENT APPROACHES

The airplane is equipped to make TACAN, PAR (Precision Approach Radar) and ILS approaches. When flown with recommended thrust settings, response to throttle movement is rapid and airspeed control is good at all times. Do not keep the speed brakes extended continuously on any leg of the pattern because the increased drag wastes fuel and light buffet may be induced. Lower the flaps (except when one engine is inoperative) on base leg and stabilize the final approach airspeed before intercepting the the glide slope. See Figures 9-3 and 9-4.

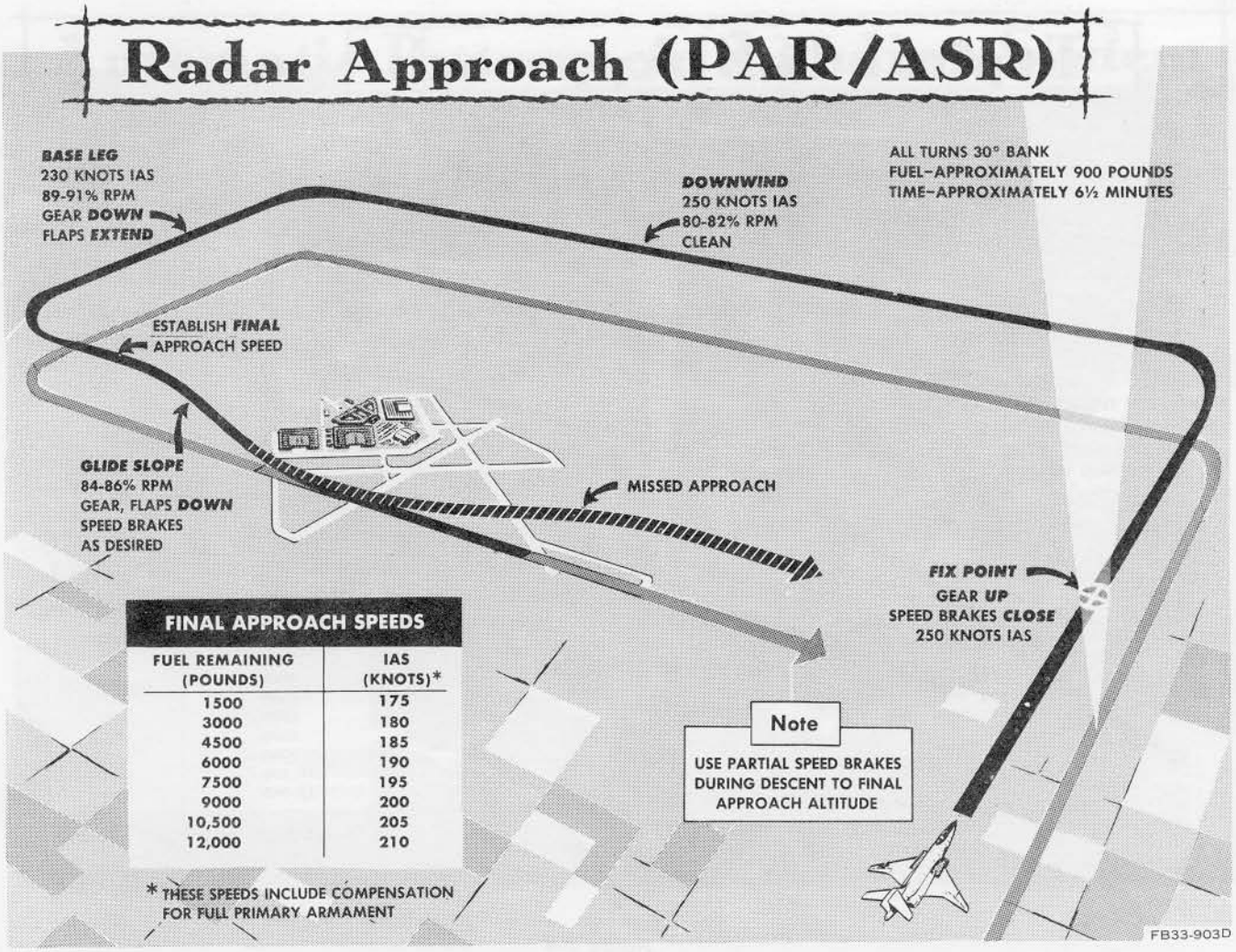


Figure 9-3

Note

At normal final approach speeds, the altimeter will indicate a lower altitude than the actual altitude of the airplane. Refer to Appendix I (figure A1-5) for altitude corrections.

ILS Approaches

The procedures for ILS approaches are shown in figure 9-4. In airplanes equipped with the AN/ARN-21 TACAN set, the ID-387 course indicator will not give ILS information if electrical power to the ILS-TACAN switch relays is lost.

WARNING

If the TACAN set is on and power to the ILS-TACAN relay is lost during an ILS approach, the ID-387 will automatically display TACAN information even though the ILS-TACAN switch is in the ILS position. If this occurs before the glide slope warning flag disappears, the pilot may not notice that the CDI is not indicating localizer information. Therefore, as soon as the airplane intercepts the localizer, check that the TO-FROM indicator on the ID-387 is blank. If either TO or FROM is visible, the ILS system is not reliable and ILS approches should not be attempted.

Automatic Instrument Landing System

Automatic approaches may be made using the AFCS and ILS. Refer to figure 9-5 for maximum entry angle vs maximum entry speed. For detailed operating instructions of the AFCS, refer to Section IV. To make an automatic approach:

a. AFCS engage switch - AFCS
b. ILS power switch - ON
c. ILS-TACAN switch - ILS
d. Select desired frequency.
e. Volume control - Identify (As desired)

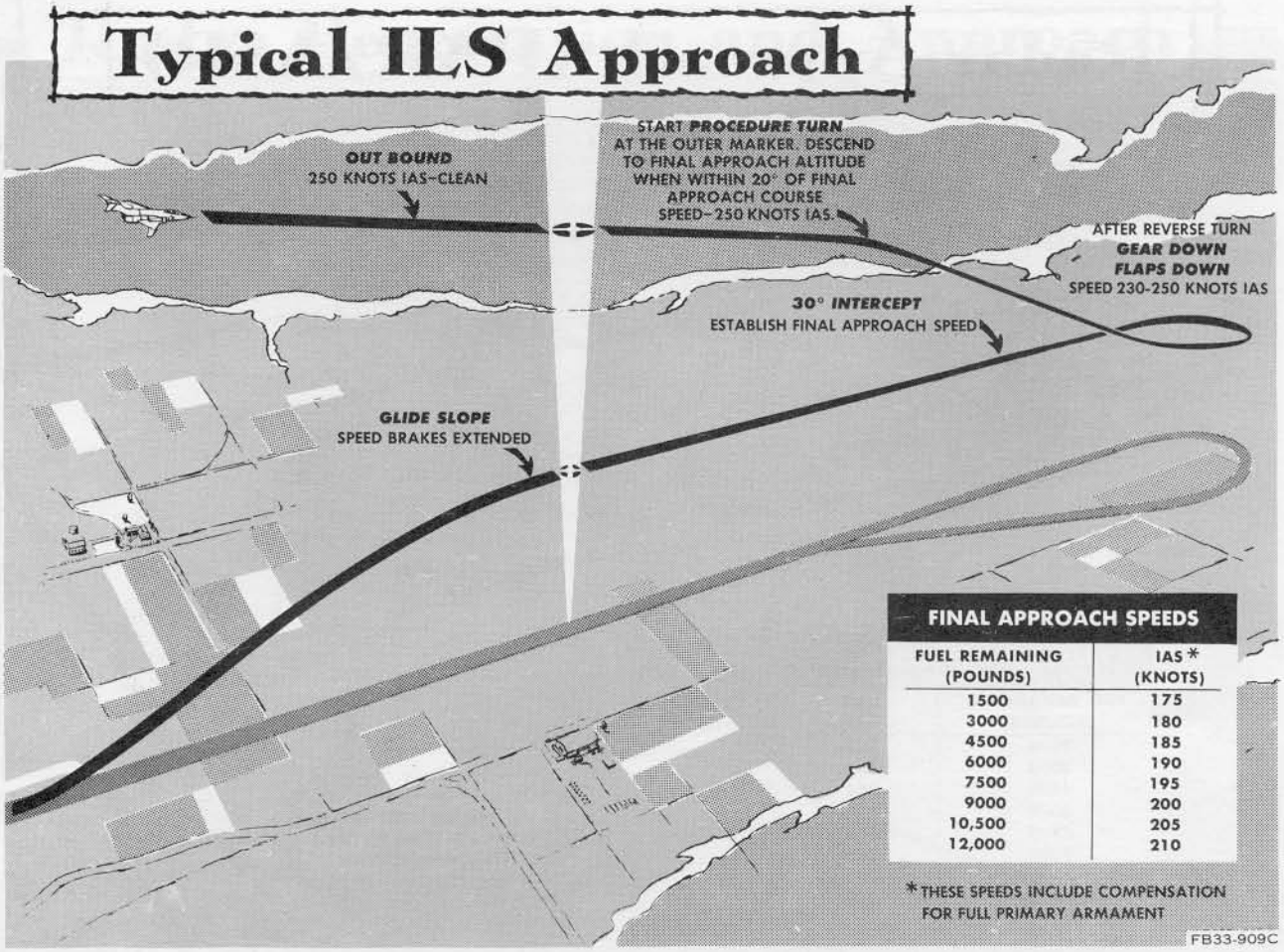


Figure 9-4

f. Mode selector knob - ALT. HOLD

After arriving at final approach altitude, place the mode selector knob to ALT. HOLD.

g. Maintain 250 knots IAS

h. Set ILS beam heading on ID-387 course indicator.

i. Check that the red OFF flags for the CDI and GSI are out of sight and that the aircraft is below the glide slope.

j. Landing gear handle - DOWN

k. Wing flap lever - EXTEND

l. Slow airplane to final approach speed.

CAUTION

The radar master switch should be in the ST BY position prior to intercepting the glide slope. The directional indicator should be operating properly, with the function selector switch in either the MAG, or DG position.

m. During procedure turn when within 150° of the beam heading and prior to intercepting beam place AFCS selector knob to BEAM. Automatic coupling to the ILS beam will occur at beam edge.

Note

- The airplane must be below the glide slope when placing the AFCS beam-attack knob in the BEAM position.

- When coupled to the ILS beam and prior to reaching the glide slope, bank angle limits are restricted to ±20°.

n. Automatic coupling to the glide slope will occur at beam center and will be accomplished by a slight nose-down step and automatic disengagement of the ALT. HOLD mode.

Note

When coupled to the glide slope beam, bank angle limits are restricted to ±10°.

o. Use speed brakes and adjust power as required to control airspeed on glide slope.

p. At ILS minimums, disengage AFCS by means of control stick disengage lever and complete landing or perform missed approach procedure.

Automatic Instrument Landing System

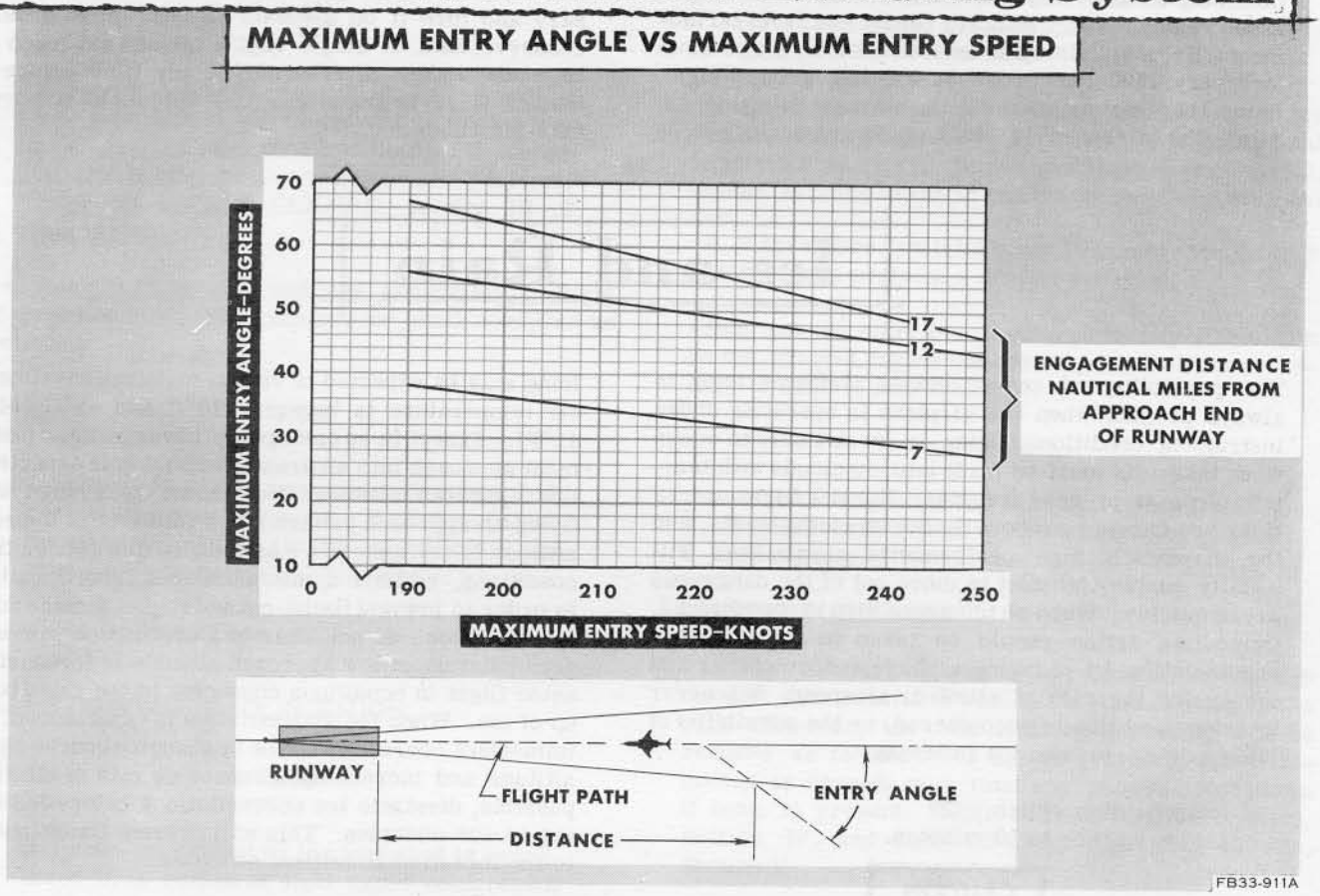


Figure 9-5

MISSED APPROACH OR GO-AROUND

As soon as it is determined that a go-around is necessary, apply Military thrust, close speed brakes and stay below the gear down limit speed. Raise the gear as soon as climb has been established, and raise the flaps at 200 knots. Climb to the missed approach altitude at an airspeed of 250 knots, reducing thrust to establish a climb of about 2000 feet per minute.

Note

After a climb has been established the Military thrust setting must be reduced without delay so that the airplane does not overshoot the missed approach altitude. The required thrust setting will vary, depending on the airplane's gross weight and the height of the local missed approach altitude. Under average conditions, however, (when the climb is 1500 feet or less) a reduction to 85% rpm will permit the airplane to climb at 250 knots at a rate which is not excessive.

Make no turns below 250 knots and limit bank angles to 30°. Missed approaches can be made from any point before the landing flare, at gross weights up to normal take-off weight, if the recommended approach speed, as shown on the appropriate diagram, is followed.

SINGLE ENGINE APPROACH

In addition to the techniques noted under Instrument Approaches, observe the following precautions: Make no large thrust reductions at any time and never reduce power below 85% rpm. Prevent high rates of descent by making all necessary corrections immediately. Maintain the recommended airspeeds and correct any loss of airspeed immediately with Military thrust. Do not lower the landing gear until the wings are level on final approach. When landing is assured, lower flaps.

SINGLE ENGINE MISSED APPROACH OR GO-AROUND

On a single engine approach, make the decision to go-around early. Apply Military thrust and level off momentarily, maintaining at least 200 knots, plus 5 knots for every 1500 lbs. above 31,000 lbs. gross weight. Raise the gear as soon as the descent has stopped. Allow the airspeed to build up to 250 knots before climbing more than 300 feet per minute and before beginning any turns. Climb to the missed approach altitude at 250 knots. Use the afterburner only if necessary and turn it off as soon as possible in order to conserve fuel. A single engine missed approach can be made without afterburner at any time before the landing flare is begun at gross weights up to normal take-off weight.

Ice and Rain

The possibility of engine and/or airframe icing is always present when the airplane is operating under instrument conditions. Icing is most likely to occur when take-offs must be made into low clouds with temperatures at or near freezing. Normal flight operations are carried on above the serious icing levels, and the airplane's high performance capabilities will usually enable the pilot to move out of the dangerous areas quickly. When an icing condition is encountered, immediate action should be taken to avoid further accumulation by changing altitude and/or course and increasing the rate of climb or airspeed. Whenever an icing condition is encountered, or the possibility of icing exists, perform the following:

a. Icing ignition switch - ON
b. Limit ignition to 10 minutes.

CAUTION

- Ignition should be limited to 10 minutes continuous operation, unless existing climatic conditions require it to be used longer.
- Indiscriminate use of the system will seriously affect the life expectancy of the system.

c. All operational time of the icing ignition system shall be entered in Form 781.

Ice accumulation can best be observed on the wing leading edges inboard of the stall fences. Inlet duct icing can be anticipated when critical quantities of ice can be seen accumulating on the airframe. If a 1/2 to 3/4 inch layer of ice gathers on the inlet duct lips, or on areas within the ducts, large pieces of it can be drawn into the engine. If this happens, compressor stall will occur and the engine will probably flame-out. The compressor may be damaged, however, there is little chance that the engine will be totally disabled. Ice ingestion and subsequent flame-out can be expected within 4 to 10 minutes after entering areas of heavy icing. Areas of icing enroute should be avoided, but since such areas cannot always be predicted, the following rules of thumb may be used. If the outside air temperature when flying in visible moisture is between 0° and 5°C (32° to 41°F), maintain an airspeed of at least 300 knots to lessen the possibility of inlet icing. Icing may be expected in visible moisture any time the air temperature is between -10°C and +5°C (14° to 41°F). Except in an emergency, never make an instrument approach into an area where icing is expected at low approach altitude. Ice cannot be evaded while flying an approach pattern and a flameout at approach altitude is critical. If a PAR must be flown under these conditions, request a minimum fuel (short) pattern. In order to prevent flame-out and engine damage due to ice ingestion, do not clear to a destination where ice accumulation at low approach altitude is forecast and avoid flight in conditions conducive to the rapid build-up of ice. When ice accumulation is experienced, take immediate corrective action by changing course and/or altitude and increasing airspeed or rate of climb. If possible, dissipate ice accumulations before descending to low altitudes. This will prevent flame-out due to ice ingestion at critical altitudes.

MINIMIZING FLAME-OUTS DUE TO ICE INGESTION

Compressor stalls caused by ingesting ice crystals may be experienced while operating at high altitudes in or around clouds or thunderstorms, or in areas where precipitation from overhanging clouds is evident. These compressor stalls are not to be confused with those occurring as a result of high altitude pitch-up or zoom maneuver, engine acceleration or deceleration, high altitude low airspeed flight, or ice ingestion. These compressor stalls will generally occur during weather operation above 30,000 feet and will be noticed by an individual loud report or as a series of report. There is no airplane ice accumulation preceding or during this type of compressor stall as there is preceding or during an ice ingestion. Intake duct ice ingestion, unlike ice crystal ingestion, is most likely to result in flame-out. The danger of a flame-out from intake duct ice ingestion or compressor stalls from ice crystal ingestion can be minimized by the following procedures:

a. Icing ignition switch - ON
b. Afterburner - OFF
   Remove the throttle from the afterburner detent of the affected engine(s).
c. Check the engine instruments for mechanical engine failure or overtemperature.

d. Do not retard the throttle(s) unless engine failure or overtemperature is evident.

Note

If an overtemperature condition exists, retard the throttle(s) slowly to prevent exceeding engine exhaust temperature limits. If engine failure exists, or overtemperature persists, refer to ENGINE FAILURE, Section III of this manual.

e. Remain in straight and level unaccelerated flight if possible until the compressor stall condition is relieved.

Note

Compressor stalls may cause an appreciable loss of thrust or flame-out. If it is not possible to maintain altitude, maintain sufficient airspeed for adequate airplane control.

f. Icing ignition switch - OFF

FLAME-OUTS DUE TO ICE INGESTION

Note

A flame-out caused by ice ingestion is recognized by a series of light rapid compressor stalls followed by a drop in rpm and exhaust temperature.

If flame-out due to ice ingestion occurs, and loss of altitude is not critical, utilize the icing ignition switch as outlined on the Ice and Rain paragraph of this section, and perform a normal air start. If loss of altitude is critical when flame-out occurs, perform the following:

a. As soon as rpm begins falling, move the throttle on the affected engine to IDLE and the remaining throttle to OPEN.

b. Alternately depress the emergency ignition buttons (one for each throttle) every 30 seconds.

Note

An automatic timer provides ignition operation for a period of 30 seconds after each emergency ignition button is released.

c. Repeated alternate actuations of the emergency ignition buttons should be limited to 20 minutes total time (this results in 10 minutes ignition per engine), unless existing climatic conditions require additional use.

d. If the engine rpm falls below 35%, move the throttle to CLS'D and perform a normal air start.

After the air start has been accomplished, maintain on the affected engine the lowest possible rpm necessary to make a safe landing.

Note

After ice ingestion has been experienced, make a notation in Form 781 to inspect the engine for damage.

LANDING IN THE RAIN

The rain clearing system will provide vision through the left side panel and windshield when landing in the rain. However, the rain clearing capability will be reduced as the throttles are retarded. A speed increase is necessary on final approach and touchdown if icing is present. Refer to Rain Clearing System, Section IV, and Rain Clearing Operating Speeds, Section V.

Note

When large puddles of water are standing on the runway, there is a possibility of flame-out on the landing roll, due to water ingestion.

Vision in Rain

If reported rain intensity is heavy rain or less, good vision should be obtained through cleared area. Cleared area will be slightly smaller in heavy rain than in moderate rain. If very heavy rain is reported, some visibility will be retained but it will be substantially impaired.

Turbulence and Thunderstorms

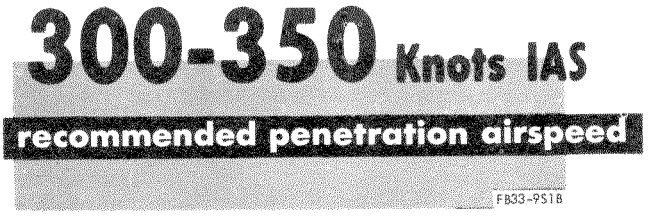
Intentional flight through thunderstorms is not recommended. This type of flight requires considerable instrument experience and may result in structural damage to the airplane. Heavy rain or hail may erode the radome, the tip of the vertical stabilizer, and other plastic parts. Heavy turbulence can be penetrated safely at all normal cruise speeds if the yaw damper is operating. However, penetration will be easier at 300 to 350 knots. Refer to Ice and Rain, this section. The following factors, singly or in combination may cause engine flame-outs:

a. Penetration of cumulus build-ups with associated high liquid content.
b. Engine inlet duct icing.
c. Turbulence associated with penetration can result in angles of attack of plus 9 degrees or more causing marginal engine performance.
d. Above 40,000 feet, the surge margin of the engine is reduced and there is poor air distribution across the face of the compressor.

CAUTION

- Flight through moderate or heavy turbulence is not recommended when the yaw damper is inoperative because excessive "g" loads may cause the airplane to be overstressed.
- Altitude hold mode should be disengaged prior to entering a thunderstorm because of the possibility of extreme pressure changes and resultant servo pitch transients.
- Flight through turbulence may increase inlet distortion. At higher altitudes this distortion can result in engine surge and possible flame-out. However, normal air starts may be accomplished.

APPROACHING THE STORM



Prepare the airplane before entering turbulent air. If the storm cannot be seen, its proximity may often be detected by the use of radar. Adjust power as necessary to obtain the recommended penetration airspeed of 300-350 knots.

Night Flying

No special procedures or precautions are required for flying this airplane at night. Interior and exterior lighting is adequate for all night flying conditions.

Cold Weather Procedures

The success of low temperature operation depends primarily upon the preparations made during the previous postflight inspection. Also, some snow or ice may have accumulated on the airplane. Depending on the weight of the snow or ice accumulated, take-off distances and climb-out performance can be seriously affected. The roughness and distribution of the snow or ice could vary stall speeds and flight characteristics to an extremely dangerous degree. Loss of an engine shortly after take-off is a serious enough problem without the added, and avoidable, hazard of snow and ice on the wings and stabilizer. In view of the unpredictable and unsafe effects of such practice, snow or ice must be removed before flight is attempted. The procedures outlined should be followed to expedite the preflight inspection and to insure satisfactory operation of the airplane and its systems during the next flight. Procedures to be followed when icing is encountered are covered elsewhere in Section IX.

BEFORE ENTERING AIRPLANE

At temperature below -26°C (-15°F) preheat the cockpit. Check that all snow, frost or ice is removed from the wings, fuselage and tail before flight is attempted.

Do not permit the ground crew to chip or scrape away ice. This may damage the airplane surface.

WARNING

Failure to remove snow, frost or ice while the airplane is on the ground can lead to serious consequences when flight is attempted. At best take-off distance and climb performance will be adversely affected, and dangerous loss of lift and treacherous stalls may result. Insure that water from melted ice is sponged so that it will not drain into some critical area and refreeze.

ON ENTERING AIRPLANE

With external electrical power connected, check fuel quantity (all positions). Make certain that low-temperature conditions did not affect the fuel system calibration so as to cause erroneous gage readings.

BEFORE STARTING ENGINES

Check that the wheels are well chocked. See that all ground equipment is located a safe distance from the airplane to prevent damage in case the airplane slips when the engines start.

STARTING ENGINES

Start the engines in the normal manner: however, exercise caution when ambient temperature is 0°C (32°F) or lower, as the engine rotor may be ice-locked by frozen condensation. At low ambient temperatures, hung starts are more prevalant. If any indication of a locked rotor, or unusual noise, or low engine speed is noted, discontinue the start. Hot air blown through the engine will free the rotor if icing is present.

CAUTION

During start, if the engine is not free to rotate, immediately move the engine start switch to STOP START and have external heat applied to the forward section of the engine. The engine should be started as soon as possible after heating to prevent moisture from refreezing.

WARM-UP AND GROUND CHECK

Note

If a start is made with an engine which has cooled to a temperature of -35°C (-31°F) the engine must be allowed to warm up at idle for two minutes before running at higher speeds. Abnormal oil pressures may be experienced during this warm-up period.

Turn on the cockpit air conditioning and windshield and canopy defrosting systems immediately after engine start. Check canopy and windshield for cracks, paying particular attention to the areas around the mounting screws. Operate all controls sufficiently to assure that speed of operation of control surfaces is adequate.

CAUTION

Make sure all instruments have warmed up sufficiently to insure normal operation.

TAXIING

Avoid taxiing in deep snow as taxiing and steering are extremely difficult and frozen brakes may result. Increase the space between airplanes while taxiing in freezing temperature to insure a safe stopping distance, and to prevent icing the airplane surfaces by melted snow and ice from the jet blast of the preceding airplane.

WARNING

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

TAKE-OFF

Start the take-off roll at 80% rpm. After the airplane is rolling and properly aligned with the runway, advance the throttles to OPEN.

Note

- Afterburner operation results in very rapid acceleration and may not allow sufficient time for the landing gear to retract before the gear down limit speed is reached.
- If an engine check is made with a relatively cold engine, the engine pressure ratio may overshoot as much as one tenth for approximately 5 minutes. However, if an overshoot condition persists, engine limits may be exceeded and thrust should be reduced to bring pressure ratio within limits.

AFTER TAKE-OFF

After take-off from a wet snow or slush-covered field, operate the brakes several times to expel wet snow or slush. Cycle the gear several times so that it does not freeze in the retracted position. Expect considerably slower landing gear operation in cold weather because the lubricants are stiffer.

CAUTION

In cold weather operation the increased thrust makes acceleration to gear limit speeds even more critical. Do not exceed landing gear and flap structural limit speed until gear and flaps are fully retracted. The nose gear may not retract, and gear doors may be damaged, at higher airspeeds.

Hot Weather and Desert Procedures

In general, hot weather procedures do not differ from normal procedures except that precautions must be observed to protect the airplane from damage due to high temperatures and blowing sand. Particular care should be taken to prevent sand from entering the various airplane components and systems.

BEFORE ENTERING AIRPLANE

Check the air intakes for accumulations of dust or sand, and be sure all protective covers are removed if used. Check the exposed portion of the shock strut pistons for accumulation of dust or sand, and have them cleaned if necessary. Inspect tires for blisters or other evidence of deterioration and for proper inflation. Check particularly for hydraulic system leaks as heat and moisture may cause valves and packings to swell.

WARNING

Be careful when removing fuel caps. Thermally expanded fuel vapor may blow the cap or fuel in your face.

ON ENTERING AIRPLANE

Do not permit foreign objects to come in contact with the canopy, since it is possible to damage the plexiglas in extremely hot weather.

STARTING ENGINES

Normal starting procedures are used in hot weather. Temperatures will probably be on the high side of operating ranges. Engine ground operation should be kept to a minimum.

TAKE-OFF

Note

- Whenever possible, avoid taking off in air contaminated with blowing sand.
- Under warm humid conditions, place cabin pressure switch to the RAM & DUMP position. When climbing through 5,000 feet, place cabin pressure switch to the NORM position.

Required take-off distances for jet aircraft are greatly increased by high temperatures. See Appendix I, Take-Off Distances at various temperatures.

LANDING

Hot weather operation requires the pilot to be more cautious of gusts and wind shifts near the ground. Landing ground rolls are only slightly longer than those which occur with normal temperatures. Refer to Appendix I. Follow normal procedures and observe the following:

a. When landing is made with the cockpit air conditioning and pressurization systems operating, select sufficient heat to prevent formation of fog in the cockpit.

b. Under warm, humid conditions, position the cabin pressure switch to RAM & DUMP prior to reaching traffic altitude. This prevents formation of fog in the cockpit.

BEFORE LEAVING AIRPLANE

Check that protective covers are immediately installed on pitot head, angle-of-attack transducer sensors, canopy and intake and exhaust ducts to prevent contamination by dust or sand. The canopy should be left open if the location is not subject to blowing sand or dust.

appendix I Performance Data

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part 1 Introduction

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Appendix I is divided into parts (1 through 9) to present performance data in proper sequence for preflight planning. Performance data, based on flight test and contractor's estimate, are presented in graphical and profile-type charts. Maximum range, endurance, and maximum continuous thrust operations are presented in profile-type charts and take-off, climb, nautical miles per pound of fuel, descents and landing data are presented in graphical type charts. Profile-type charts integrate much of the information provided in the graphical chart for ease in flight planning computations. These charts are based on the recommended climb-cruise performance shown for the specific airplane configuration. Direct interpretation of fuel and time required for any given distance, while flying the recommended schedules, is available using the profile presentation. The graphical charts should be used when other than the recommended schedules are maintained. The fuel used and subsequent decrease in gross weight is computed in the presentation. Graphical charts should be utilized where more accurate interpretations for flight planning is required. The complete operating speed range for the airplane is given on these charts. All data, profile and graphic charts, are based on ICAO standard day conditions. In some instances, temperature corrections for nonstandard atmosphere have been included. These corrections are based on maintaining the recommended Mach number or indicated airspeed (IAS). Performance charts are based on data obtained using J57-P-55 and J57-P-53 engines.

Note

The indication of the fuel quantity indicator presents the readings of actual fuel weight remaining. This is accomplished by means of a compensator capacitor located in the lower end of cell number 2 which provides accurate readings regardless of changes in the dielectric value of the fuel or variations in specific gravity due to temperature changes. Therefore, adjustment for various fuel densities is not necessary.

AIRSPEED CONVERSION

An airspeed conversion chart (figure A1-1) is provided to correct calibrated airspeed (CAS) to true airspeed (TAS), and true Mach number (M).

AIRSPEED POSITION ERROR CORRECTION

This chart (figure A1-2) is provided to obtain calibrated airspeed (CAS) from indicated airspeed (IAS) and true Mach number from indicated Mach number. Two airplane configurations are given.

Indicated Airspeed

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

Calibrated Airspeed

Calibrated airspeed (CAS) is indicated airspeed corrected for installation error. To obtain calibrated airspeed, add correction shown in figure A1-2, to indicated airspeed.

Equivalent Airspeed

Equivalent airspeed (EAS) is calibrated airspeed corrected for compressibility effect. To obtain equivalent airspeed, subtract correction shown in figure A1-4 from calibrated airspeed.

True Airspeed

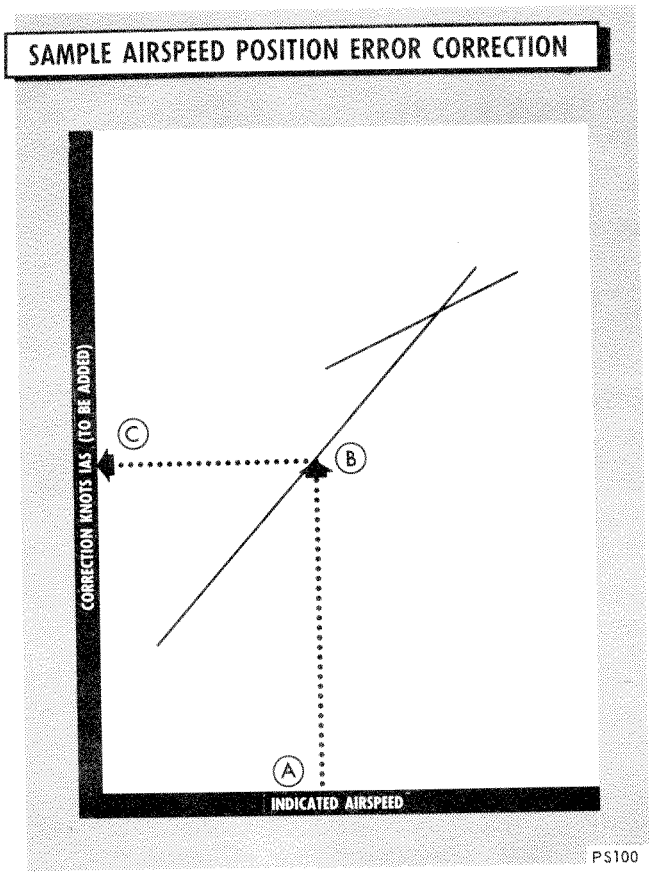
True airspeed (TAS) is equivalent airspeed corrected for atmospheric density. Refer to Airspeed Conversion, figure A1-1.

MACH NUMBER CORRECTION

Since most speeds in this section are quoted in terms of true Mach number, the Mach Number Correction chart (figure A1-3) provides a direct reading correction to obtain indicated Mach number from a recommended true Mach number. This process can be reversed, if required, to obtain true Mach number from indicated Mach number.

USE

For purpose of explaining the use of the Airspeed Position Error Correction Chart, consider the airplane flying at an indicated airspeed (IAS) of 150 knots, flaps extended and gear down. Read up the 150 knot line to where it intersects the correction



curve and from this point draw a straight line to the left margin of the chart to find the correction factor, which is +8 knots. Therefore, the CAS is 158 knots. For Mach number correction, consider the airplane flying at a true Mach number of .82 Mach, flaps and gear up. Read up the .82 (true Mach number) line to where it intersects the correction curve, and from this point draw a straight line to the left margin of the chart to find the indicated Mach number of .78.

SAMPLE PROBLEM

A. Indicated Airspeed	150 Kts.
B. Reflector Line	
C. Correction	+8 Kts.
D. Calibrated Airspeed (A. + C.)	158 Kts.

COMPRESSIBILITY CORRECTION

Calibrated airspeed (CAS) may be corrected for compressibility by using the chart presented in figure A1-4. Subtract correction from calibrated airspeed to obtain equivalent airspeed (EAS).

ALTIMETER POSITION ERROR CORRECTION

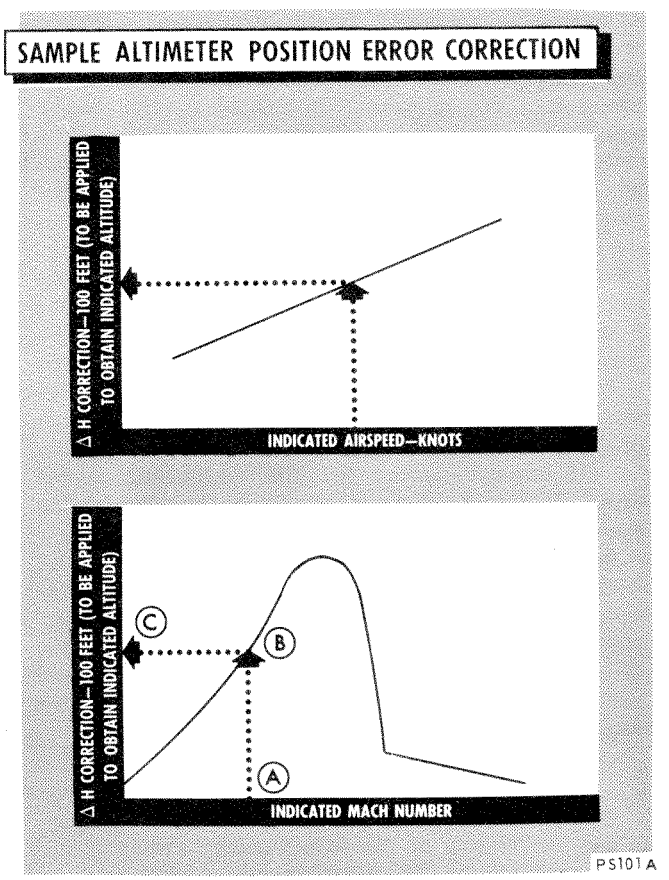
This chart (figure A1-5) is provided to give altimeter error corrections for given Mach numbers at various altitudes.

USE

For purposes of explaining the use of the Altimeter Position Error Correction Chart, consider the airplane flying at an indicated Mach number of .9 and an altitude of 36,000 feet. Read up the .9 indicated Mach number line to where it intersects the 36,000 feet correction curve, and from this point draw a straight horizontal line to the left margin of the chart. Read the correction factor which is -1500 feet. Since indicated altitude is equal to pressure altitude +(± Δ H correction), the indicated altitude can be found by substituting the 36,000 ft. altitude and the -1500 feet correction factor into the equation. Therefore, indicated altitude equals 36,000 ft. -1500 feet or 34,500 feet.

SAMPLE PROBLEM

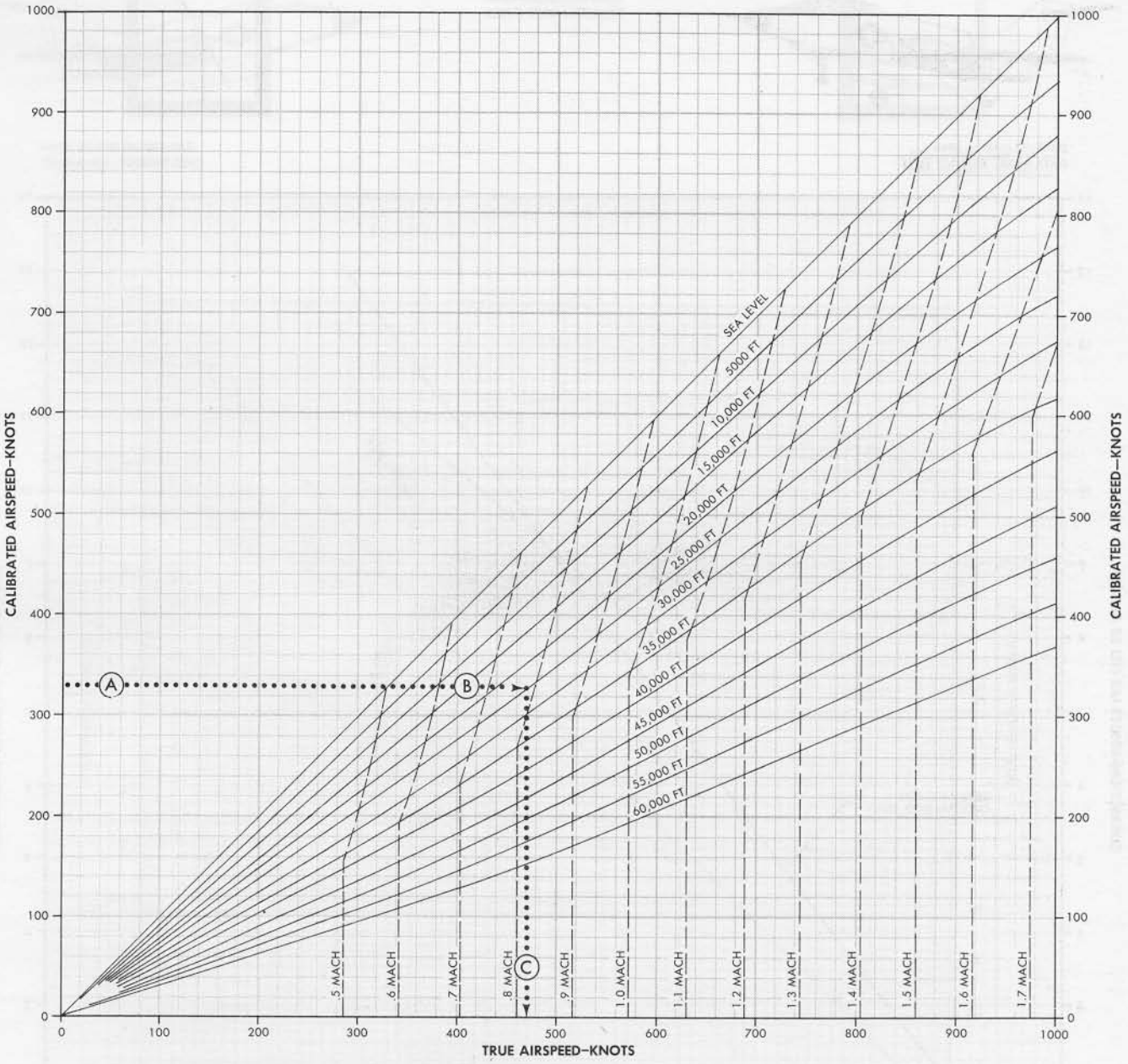
A. Indicated Mach Number	.9 Mach No.
B. Pressure Altitude	36,000 Ft.
C. Δ H Correction	-1,500 Ft.
D. Indicated Altitude (B. + C.)	34,500 Ft.



ENGINE THRUST CHECK CURVE (PRESSURE RATIO)

These charts (figures A1-6 and A1-7) are provided to give maximum and minimum acceptable limits of engine pressure ratio for the existing ambient temperature. A chart is provided for each inlet duct configuration with separate plots for right and left engine included on each chart.

AIRSPEED CONVERSION



USE OF CHART

ENTER WITH CAS "A". MOVE HORIZONTALLY TO ALTITUDE "B" TO FIND TRUE MACH NUMBER. DROP VERTICALLY TO FIND TAS "C". TAS VALUES FROM THE GRAPH ARE CORRECT ONLY ON ICAO STANDARD DAY. OTHERWISE, TAS VALUES TEND TO BE CONSERVATIVE WHEN TRUE. FREE AIR TEMPERATURE IS GREATER THAN STANDARD AND HIGHER WHEN TRUE FREE AIR TEMPERATURE IS LOWER THAN STANDARD.

EXAMPLE

A=330 KNOTS CAS
B=.78 TRUE MACH NUMBER AT 25,000 FEET
C=470 KNOTS TAS

FB33-P100

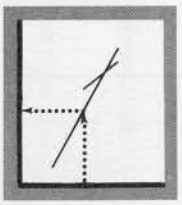
Figure A1-1

AIRSPEED POSITION ERROR CORRECTION

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN

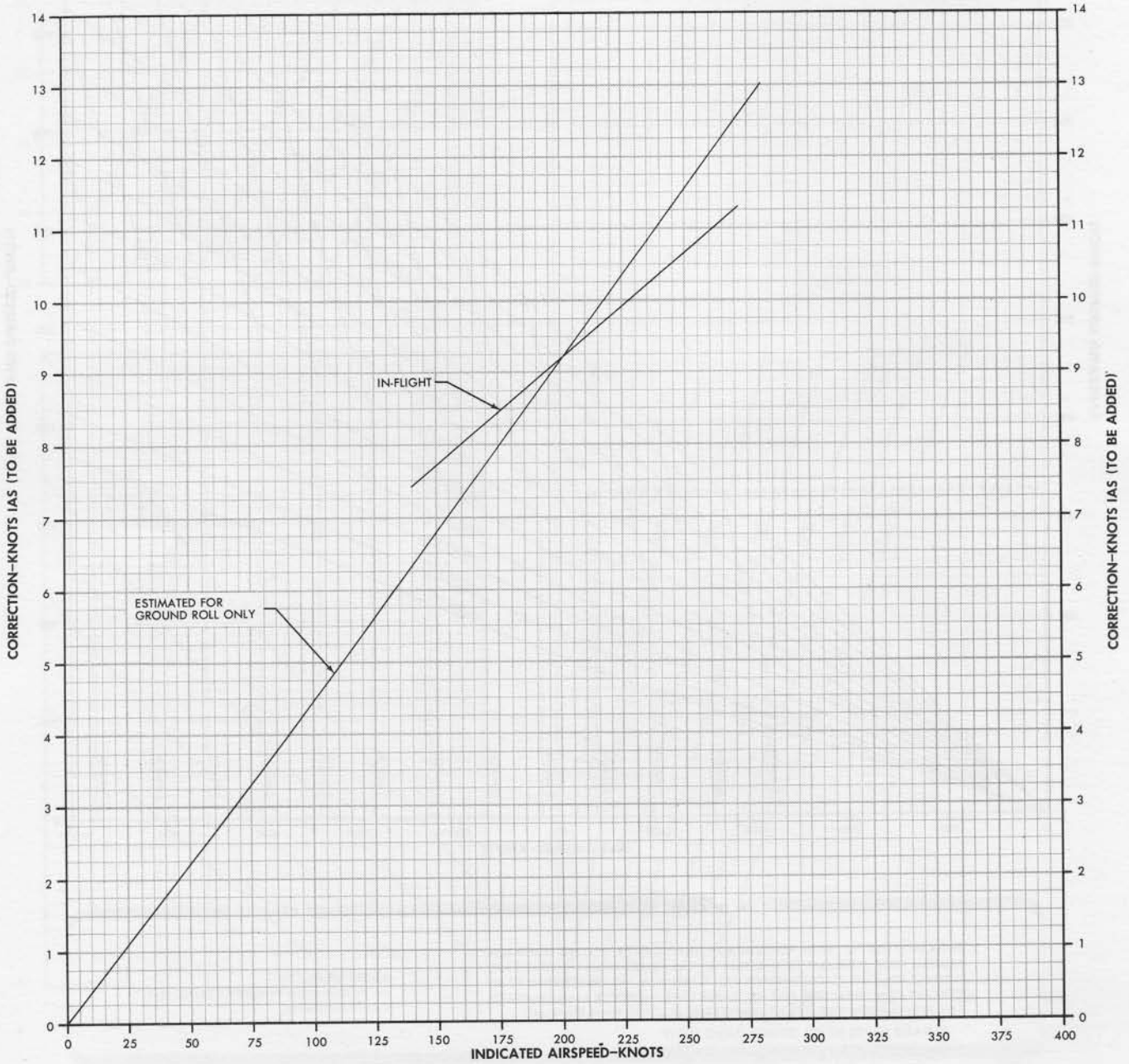
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 30 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

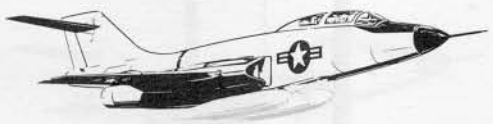


FB33-P101D

Figure A1-2

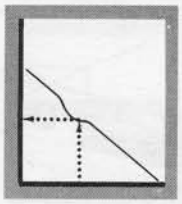
MACH NUMBER CORRECTION

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS RETRACTED, GEAR UP



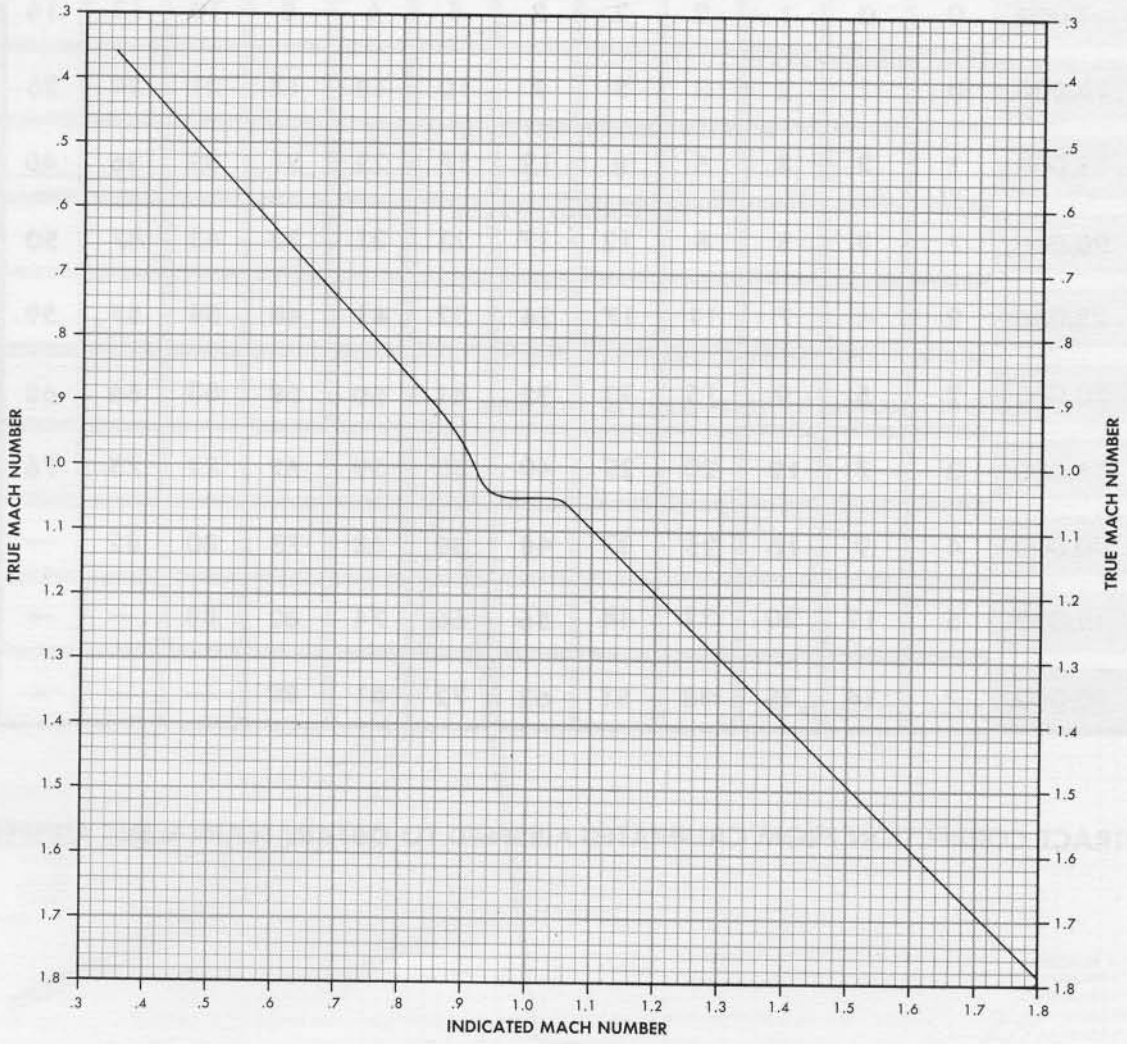
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 30 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

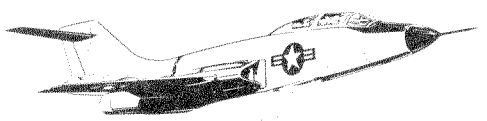


FB33-P108A

Figure A1-3

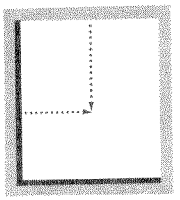
COMPRESSIBILITY CORRECTION

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS



REMARKS
ICAO STANDARD DAY

GUIDE



PRESSURE ALTITUDE–FEET	CAS–KNOTS											
	150	200	250	300	350	400	450	500	550	600	650	700
5000	0	0	1	2	2	3	5	6	8	10	12	14
10,000	0	1	2	3	5	7	10	13	17	21	24	26
15,000	1	2	3	5	8	12	17	23	31	32	36	40
20,000	1	3	5	8	12	17	23	31	37	43	47	50
25,000	2	4	7	11	17	24	32	41	48	54	57	59
30,000	2	5	9	15	23	32	41	50	58	63	66	68
35,000	3	7	12	20	29	40	50	59	67	72	75	76
40,000	4	9	16	25	37	48	59	68	75	80	82	—
45,000	5	11	20	32	44	56	66	74	82	88	—	—
50,000	7	14	25	38	51	62	72	81	89	—	—	—

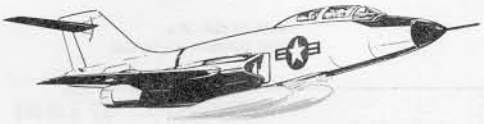
SUBTRACT CORRECTION FROM CALIBRATED AIRSPEED TO OBTAIN EQUIVALENT AIRSPEED

FB33-P102 A

Figure A1-4

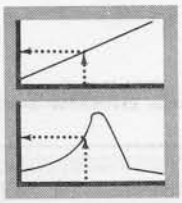
ALTIMETER POSITION ERROR CORRECTION

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS



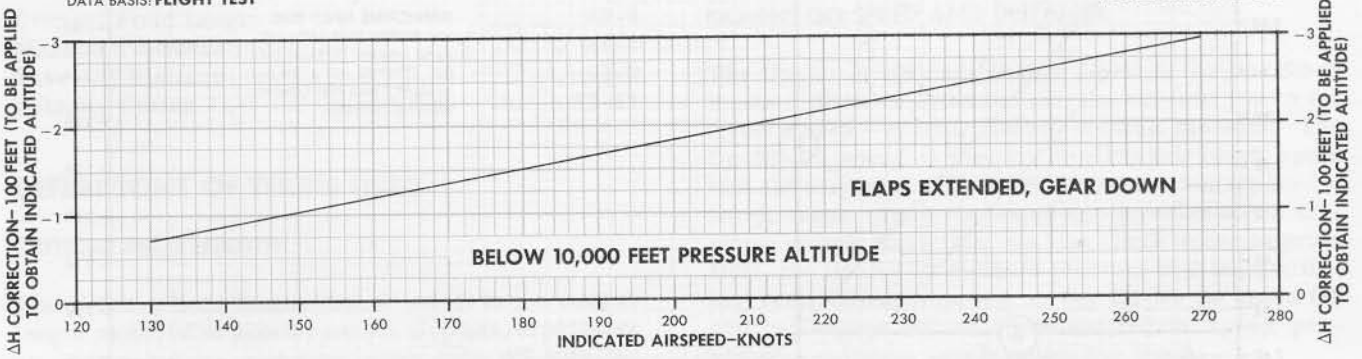
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

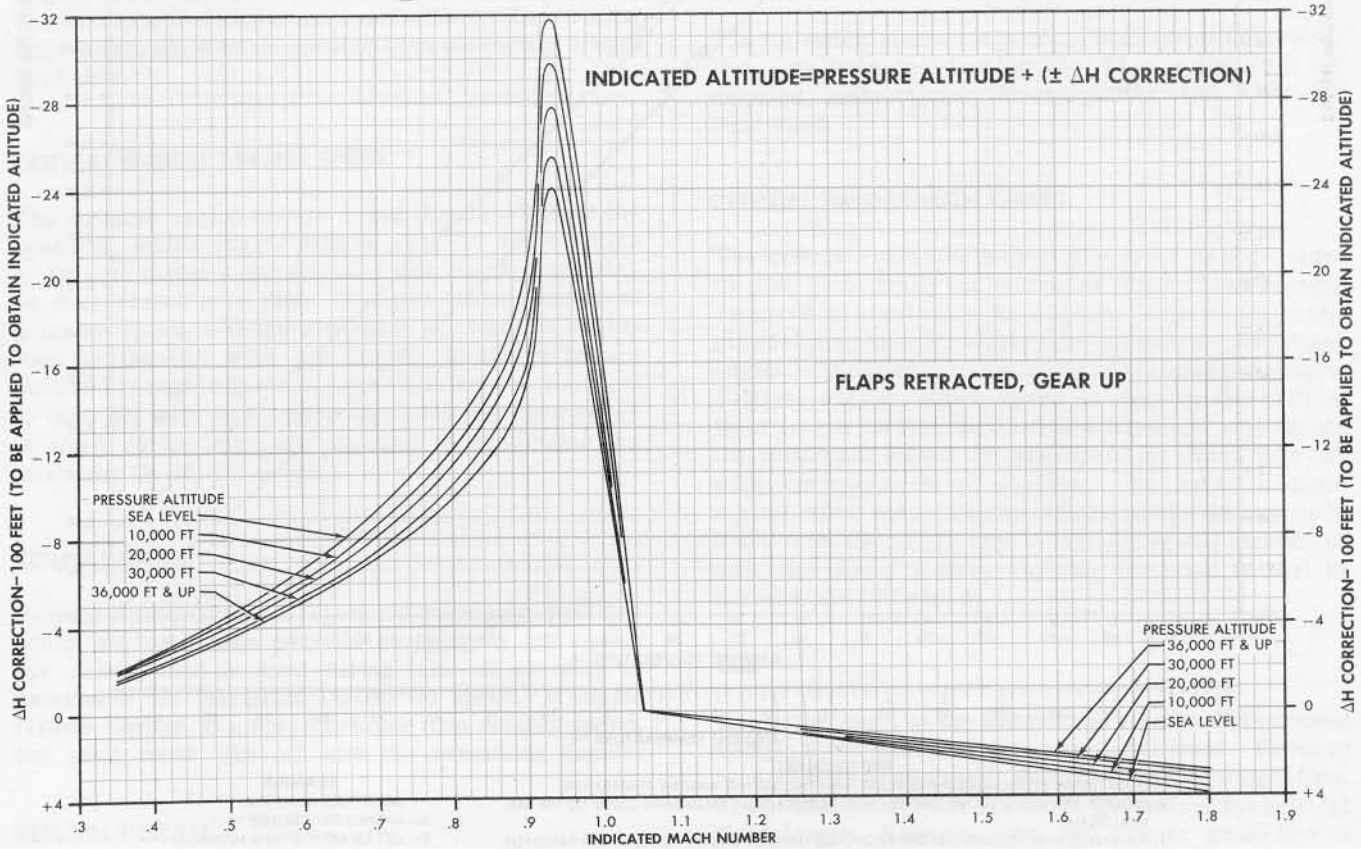
GUIDE



DATE: 30 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





FB33-P103 D

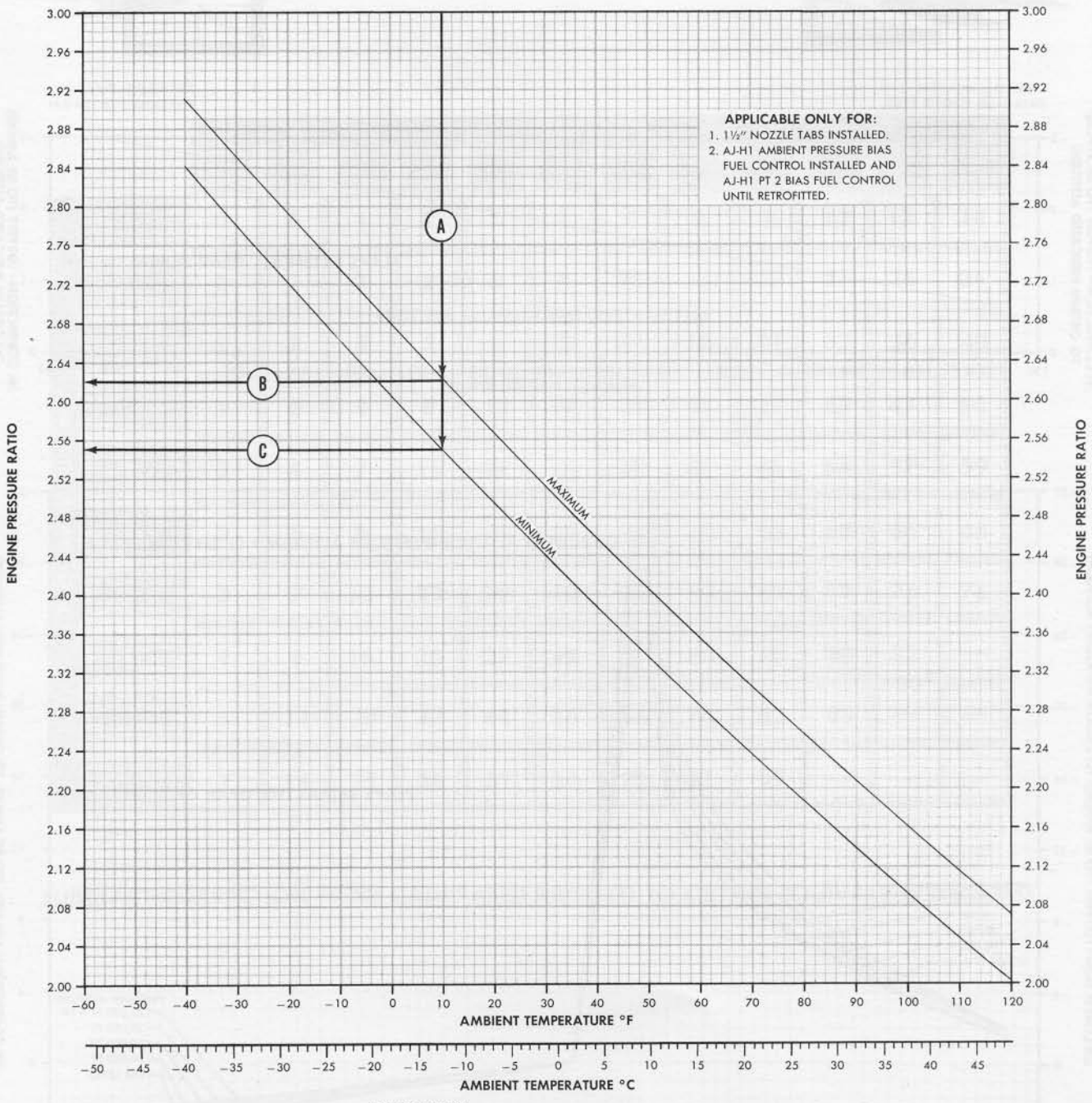
Figure A1-5

ENGINE THRUST CHECK CURVE

J57-P-55 ENGINES

DATE: 1 FEBRUARY 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



USE OF CHART

1. ENTER GRAPH AT THE HORIZONTAL SCALE WITH THE EXISTING AMBIENT TEMPERATURE.
2. PROCEED VERTICALLY TO THE CURVES, THEN HORIZONTALLY FROM EACH CURVE TO THE VERTICAL SCALE.
3. THE VALUES THUS LOCATED ARE THE ACCEPTABLE LIMITS OF ENGINE PRESSURE AND RATIO FOR THE EXISTING AMBIENT TEMPERATURE.
4. THE VALUES THUS LOCATED ARE THE MAXIMUM AND MINIMUM ACCEPTABLE LIMITS OF ENGINE PRESSURE RATIO FOR THE EXISTING AMBIENT TEMPERATURE.

EXAMPLE

ACCEPTABLE RATIO FOR:
A= AMBIENT TEMPERATURE 10°F
B= LEFT OR RIGHT ENGINE MAXIMUM ACCEPTABLE LIMIT 2.62
C= LEFT OR RIGHT ENGINE MINIMUM ACCEPTABLE LIMIT 2.55

FB33-P1068

Figure A1-6

part 2 Take-Off

TABLE OF CONTENTS

Charts

Critical Field Length A2-6
Maximum Refusal Speed A2-7
Take-Off Distance A2-9
Velocity During Take-Off Ground Run A2-11

DEFINITIONS OF TERMS USED

CRITICAL FIELD LENGTH

The critical field length (figure A2-1) is the runway length required to accelerate the airplane, experience an engine failure, and then either take-off with the remaining engine or fully stop in the same total runway distance. It is used to determine the critical engine failure speed that is used in take-off planning and incorporates climb-out restrictions. The critical field length must be no greater than the runway length available.

CRITICAL ENGINE FAILURE SPEED

The critical engine failure speed (figure A2-1) is the speed at which engine failure permits acceleration to lift-off in the same distance that the airplane may be decelerated to a stop. If engine failure occurs at a lower speed, a shorter distance is required to stop than to take-off with one engine. If engine failure occurs at a higher speed, a shorter distance is required to take-off with one engine than to stop. This speed is used during take-off planning to determine the minimum Go-No Go speed.

REFUSAL SPEED

Refusal speed (figure A2-1) is the maximum speed at which engine failure permits stopping at the end of the runway and is used during take-off planning to determine the maximum Go-No Go speed. If engine failure occurs at a speed greater than refusal speed, the pilot must take-off with the remaining engine.

REFUSAL DISTANCE

Refusal distance (figure A2-1) is the distance required to accelerate to refusal speed under normal conditions. The refusal distance, in conjunction with refusal speed, is useful only as a criterion for establishing the Go-No Go distance.

GO-NO GO SPEED AND DISTANCE

The Go-No Go distance (figure A2-1) is the line check marker distance from the start of take-off run to the first runway marker below refusal distance. The Go-No Go speed is the acceleration line check speed that the airplane will normally attain within the Go-No Go distance. Since the rapid acceleration of the airplane makes more than one line check speed impractical, the Go-No Go distance together with the qualifying restrictions imposed on the Go-No Go speed (by critical engine failure speed and refusal speed) provides an optimum acceleration line check.

TAKE-OFF PLANNING CHARTS

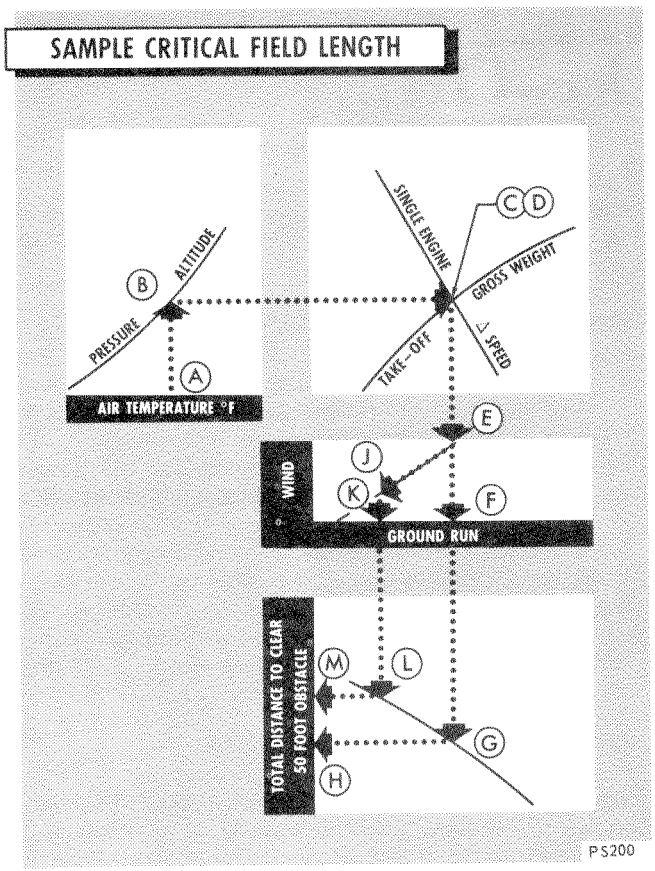
The following charts are provided for take-off planning. Refer to Mission Planning Part 11 of Appendix I, for detailed instructions in completing the Take-Off Data card.

CRITICAL FIELD LENGTH CHART

The critical field length chart (figure A2-2) is provided to give graphically an indication of the runway length required to accelerate the airplane, experience an engine failure, and then either take-off with the remaining engine or fully stop in the same total runway distance. Critical engine failure speed is read for the critical field length on figures A2-3 and A2-4 and represents the minimum engine failure speed at which take-off with one engine is advantageous. To permit a single engine climb out, when the critical field length exceeds 5,800 feet, the single engine take-off speed increment must be added (before applying the wind factor) to normal take-off speed.

USE

Enter the chart at the temperature scale and proceed vertically to intersect the pressure altitude. Proceed horizontally to intersect the take-off gross weight line. From this point, descend to the ground run for critical field length. Proceed along the proper guide line to adjust for wind effects and vertically downward to the reflector line for distance required to clear a 50 foot obstacle.



SAMPLE PROBLEM

Configuration: Gear Down, Flaps Extended; Maximum Thrust

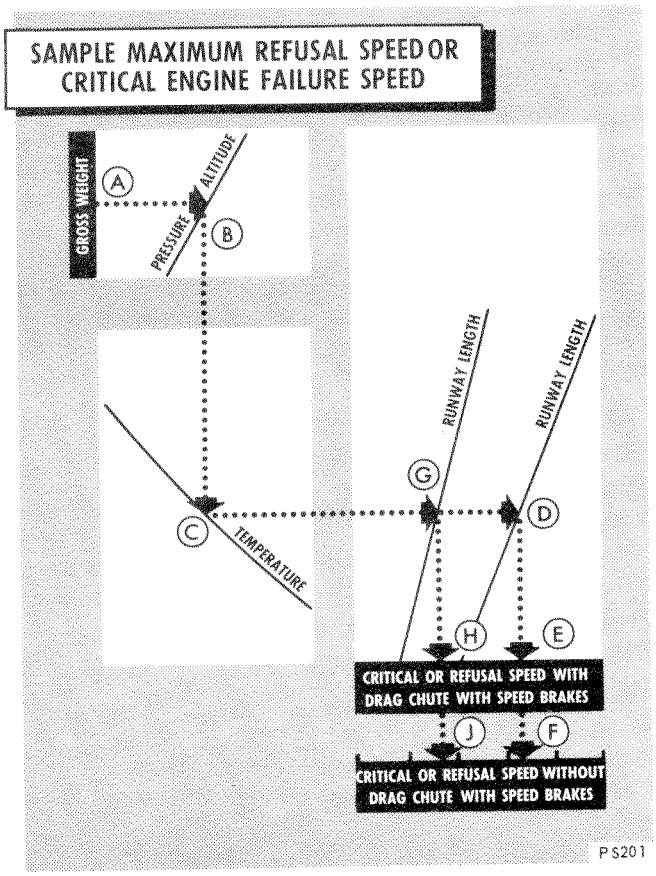
A. Air Temperature	80°F
B. Pressure Altitude	Sea Level
C. Take-Off Gross Weight	50,000 Lbs.
D. Single Engine "Δ" Take-Off Speed	+2 Kts.
E. Wind Base Line	
F. Critical Field Length Ground Run (no wind)	6,800 Ft.
G. Reflector Line	
H. Distance Required to Clear 50-Foot Obstacle (no wind)	15,500 Ft.
J. Effective Headwind	20 Kts.
K. Critical Field Length Ground Run (with wind)	5,700 Ft.
L. Reflector Line	
M. Distance Required to Clear 50-Foot Obstacle (with wind)	11,000 Ft.
N. Normal Take-Off Speed (Velocity During Take-Off Ground Run Chart)	181 Kts.
P. Single Engine Take-Off Speed (D + N.)	183 Kts.

MAXIMUM REFUSAL SPEED OR CRITICAL ENGINE FAILURE SPEED CHARTS

These charts, for hard dry runway (figure A2-3 and A2-4), and for wet runway (figure A2-5 and A2-6), present both the maximum refusal speeds and the critical engine failure speeds. The maximum refusal speed is read for the total runway length and represents the maximum speed at which a single engine failure may occur and successful stopping accomplished within the runway length. The critical engine failure speed is read for the critical field length and represents the minimum engine failure speed at which take-off with one engine is advantageous, provided that the normal take-off speeds are increased as noted on the Critical Field Length Chart (figure A2-2) to realize 100 ft./min. rate of climb at lift-off if the critical length exceeds 5,800 feet. Stopping distance is based on using flaps and speed brakes and with or without the drag chute as noted on separate scales.

USE

Enter the chart at the airplane gross weight and proceed horizontally to the intersection of the pressure altitude. Descend to intersect the temperature scale and proceed horizontally to intersect the critical field length and total runway length. From the total runway length intersection, descend to the base of the chart to read maximum refusal speed with drag chute and further to the read scale to read maximum refusal speed without the drag chute. From the critical field length intersection, descend to the base of the chart to read critical engine failure speed with drag chute and further to the read scale to read critical engine failure speed without the drag chute.



SAMPLE PROBLEM

Configuration: Gear Down, Flaps Extended; Maximum Thrust

A. Take-Off Gross Weight	50,000 Lbs.
B. Pressure Altitude	Sea Level
C. Temperature	80°F
D. Length of Actual Runway	9,000 Ft.
E. Refusal Speed (with drag chute)	167 Kts.
F. Refusal Speed (without drag chute)	156 Kts.
G. Critical Field Length Ground Run (critical field length chart)	6,800 Ft.
H. Critical Engine Failure Speed (with drag chute)	136 Kts.
J. Critical Engine Failure Speed (without drag chute)	126 Kts.

TAKE-OFF DISTANCE CHARTS

Ground roll distances and distance required to clear a 50-foot obstacle using Maximum and Military thrust are shown in the Take-Off Distance charts, (figures A2-7 thru A2-10). All distances computed are for normal technique on a dry, hard surface runway. Temperature, pressure altitude, gross weight, head and tail winds are variables plotted on this graph. The graphs may be used for any configuration, considering gross weight. Airspeeds given (IAS) for take-offs are shown on the gross weight lines.

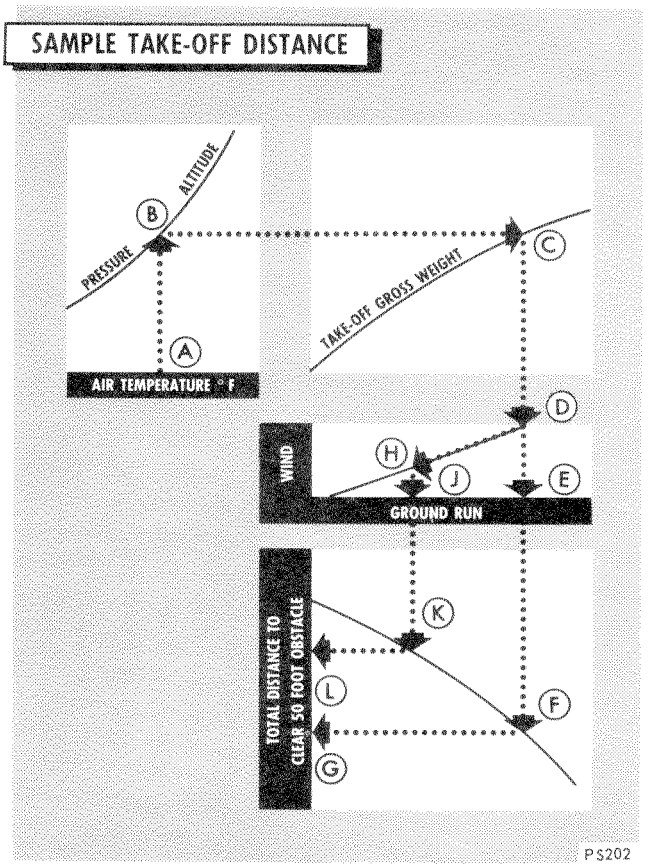
USE

The example shown assumes 644 pounds of fuel used for start and taxiing to take-off position. Pressure altitude may be obtained by setting the cockpit altimeter to 29.92" Hg and reading indicated altitude. Temperatures given on the surface are usually given in degrees Fahrenheit. Enter the chart at the temperature scale, proceeding vertically to intersect the pressure altitude. Proceed horizontally to the take-off gross weight and read airspeed for take-off. Descend to the base line for wind effect and apply effective wind. Descend to the ground run scale reading ground run distance and further to the reflector for reading total distance required to clear a 50-foot obstacle.

SAMPLE PROBLEM

Configuration: Gear Down, Flaps Extended; Maximum Thrust, J57-P-55 Engines

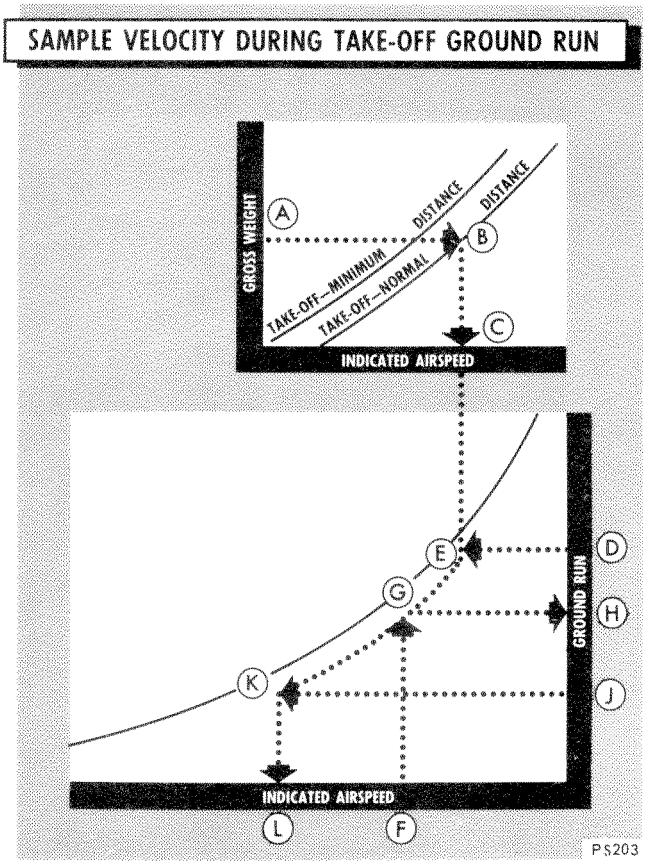
A. Temperature	60°F
B. Pressure Altitude	Sea Level
C. Take-Off Gross Weight	50,000 Lbs.
Take-Off Airspeed	181 Kts.
D. Wind Base Line	No Wind
E. Ground Run (no wind)	3,180 Ft.
F. Reflector Line	
G. Distance Required to clear a 50-Foot Obstacle (no wind)	4,300 Ft.
H. Effective Headwind	20 Kts.



J. Ground Run (with wind)	2,550 Ft.
K. Reflector Line	
L. Distance Required to clear a 50-Foot Obstacle (with wind)	3,400 Ft.

VELOCITY DURING TAKE-OFF GROUND RUN CHARTS (GO–NO GO LINE CHECK)

These charts (figures A2-11 and A2-12) provide the normal take-off speed, with both engines operating, for the various take-off gross weights of the airplane and a means of obtaining a Go-No Go line check. The Go-No Go line check distance marker speed is the 1000 ft. marker speed below refusal speed. The charts can be used to obtain any line distance and speed relationship such as: Line distance at critical engine failure speed, line distance at refusal speed, speed at any runway marker or take-off ground run for other than normal take-off speed. However, it is recommended that the Go-No Go line check distance marker, as defined above, be used as the criterion for decision to abort or take-off after engine failure. If a definite failure occurs prior to reaching the Go-No Go distance marker, the airplane should be stopped. If the marker is reached and partial failure is indicated by the fact that the airplane speed is less than that predicted for that marker, the airplane should be stopped, if the Go-No Go line check distance marker failure occurs thereafter or not. If failure occurs, the pilot must not attempt to rotate the airplane to lift-off attitude until



single engine take-off speed is attained. If critical field length exceeds the total runway length or 10,000 feet for any take-off gross weight, temperature and altitude combination, climb-out capabilities with one engine are insufficient.

USE

Enter the chart at the airplane gross weight and read airspeed determined by the intersection of the take-off normal distance reflector line. The take-off-minimum distance reflector line is used only where field length is a critical factor. Re-enter the chart at the ground run scale for the previously computed take-off distance and proceed horizontally to intersect the line projected down from the take-off-normal distance reflector line. From this intersection (E) project a line, to the left, parallel to the nearest acceleration guide line. Re-enter the chart at the indicated airspeed scale with the previously computed refusal speed, and project up to intersect the newly plotted acceleration guide line (G). From this point, project horizontally to the ground run scale and read refusal distance. Re-enter the ground run scale at the Go-No Go distance marker (the first 1000 ft. marker below refusal distance; i.e., Go-No Go distance marker would be 2000 feet if refusal distance fell between the 2000 ft. and 3000 ft. markers), proceed horizontally to intersect the newly plotted acceleration guide line (K) then vertically to the indicated airspeed scale to read Go-No Go line check speed.

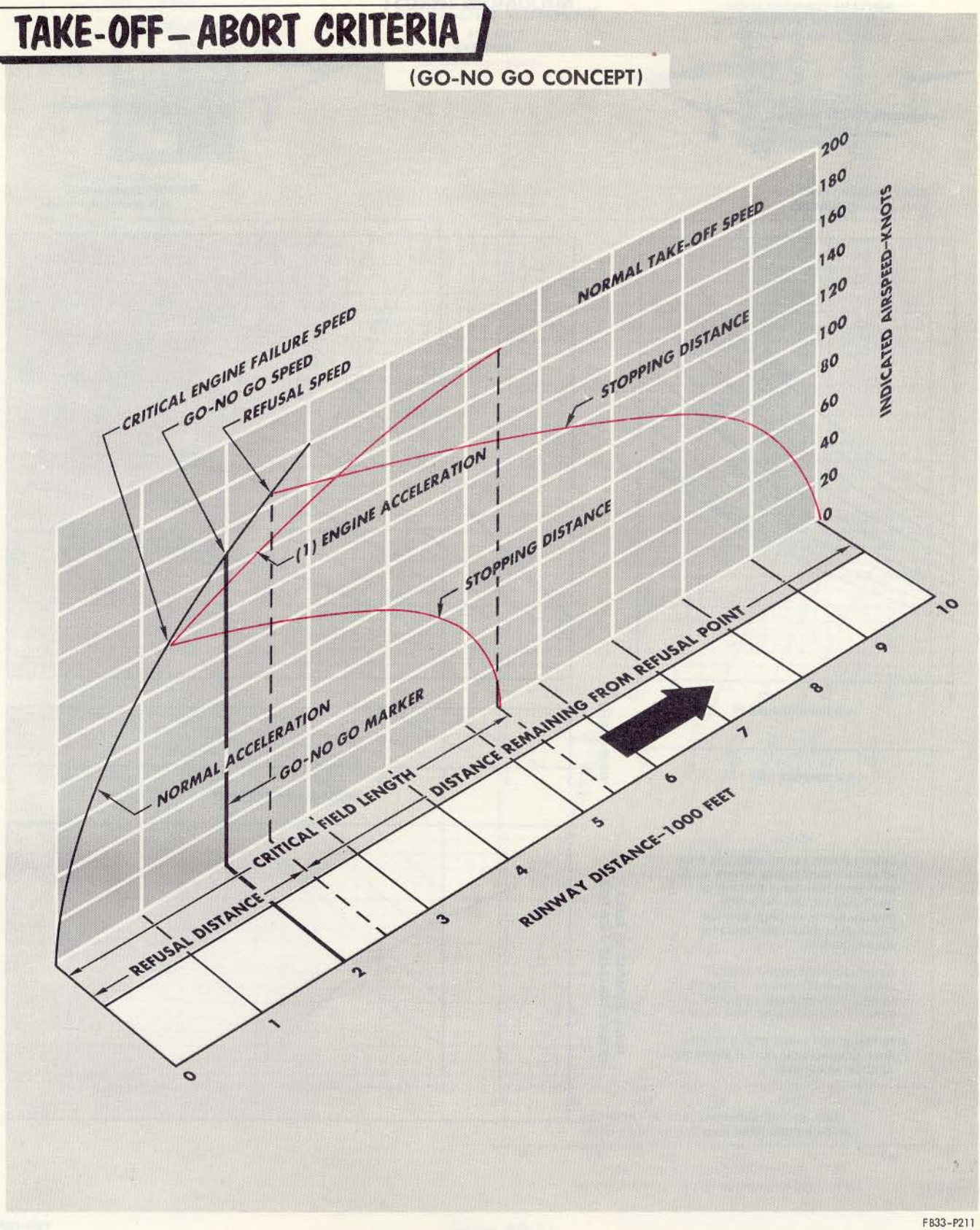
SAMPLE PROBLEM

Configuration: Gear Down, Flaps Extended; Maximum Thrust

A. Take-Off Gross Weight	50,000 Lbs.
B. Take-Off Normal Distance Intersection	
C. Normal Take-Off Speed	181 Kts.
D. Normal Take-Off Ground Run (Take-Off Distance Chart)	3,100 Ft.
E. Intersection of C. and D.	
F. Refusal Speed (without drag chute) (Maximum Refusal Speed or Critical Engine Failure Speed Chart)	156 Kts.
G. Intersection of E. and F.	
H. Refusal Distance	2,200 Ft.
J. Go-No Go Distance (First Runway Marker Before Refusal Distance)	2,000 Ft.
K. Intersection of E. and J.	
L. Go-No Go Speed	149 Kts.

TAKE-OFF – ABORT CRITERIA

(GO-NO GO CONCEPT)



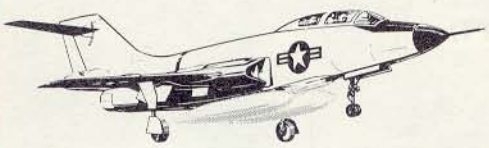
FB33-P211
R

Figure A2-1

CRITICAL FIELD LENGTH

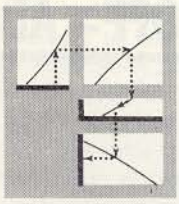
MAXIMUM THRUST

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



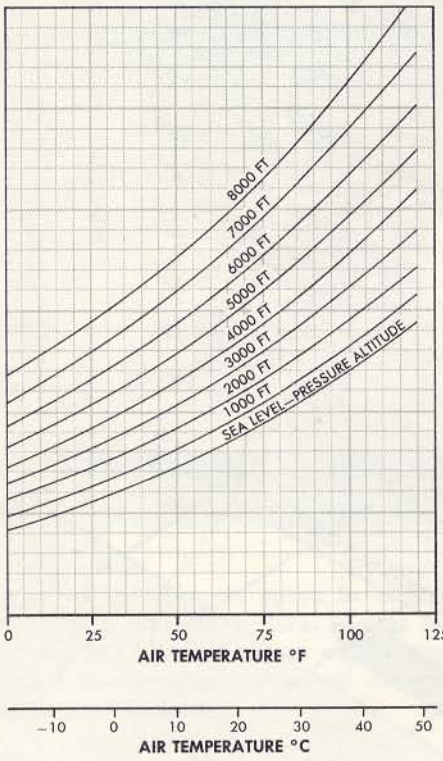
REMARKS
SINGLE ENGINE FAILURE

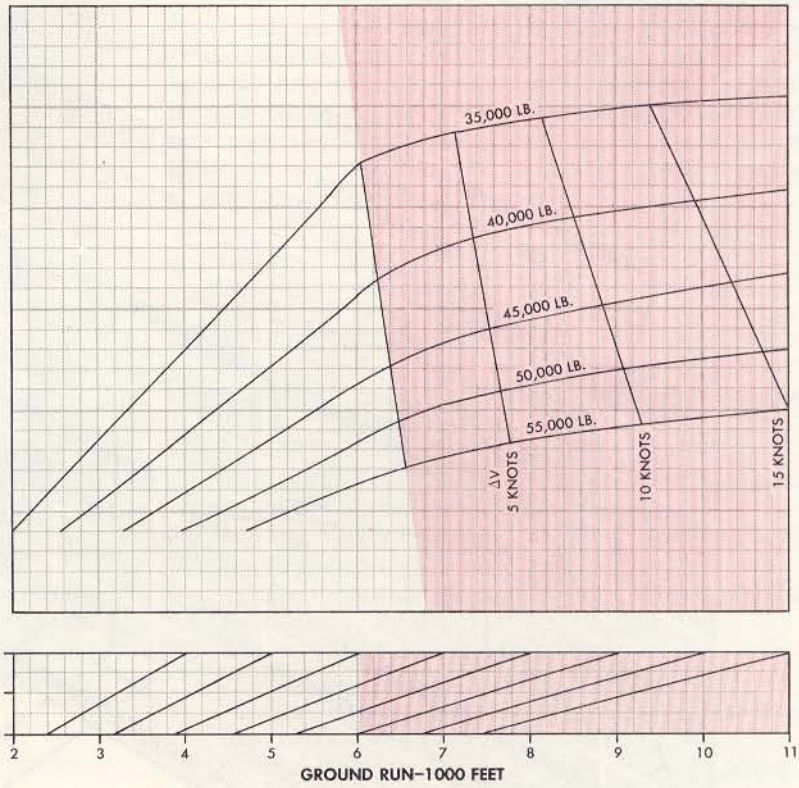
GUIDE

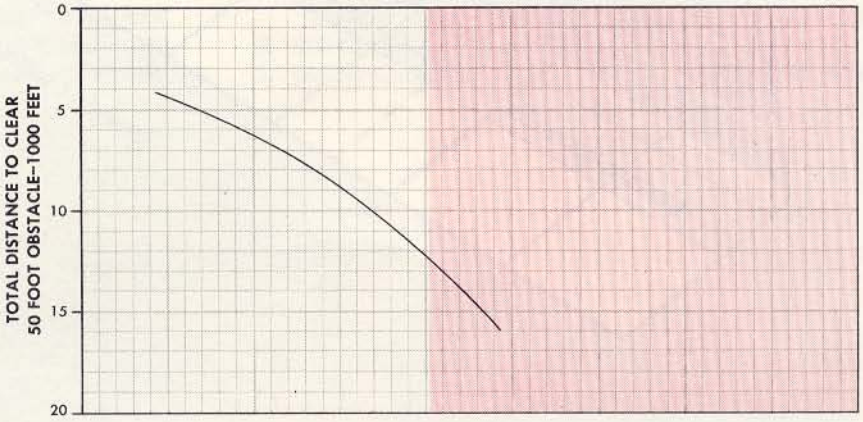


DATE: 1 MARCH 1960
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL







NOTES

1. CRITICAL ENGINE FAILURE SPEED (THE SPEED AT WHICH ENGINE FAILURE PERMITS ACCELERATION TO TAKE-OFF IN THE SAME DISTANCE THAT THE AIRPLANE MAY BE DECELERATED TO A STOP) IS READ FOR CRITICAL FIELD LENGTH ON "MAXIMUM REFUSAL" CHARTS.
2. TO OBTAIN SINGLE ENGINE TAKE-OFF SPEED, ADD SINGLE ENGINE Δ SPEED TO NORMAL TAKE-OFF SPEED. ("VELOCITY DURING TAKE-OFF GROUND RUN" CHART.)
3. TO REALIZE BEST SINGLE ENGINE PERFORMANCE, LANDING GEAR MUST BE RETRACTED AS SOON AS POSSIBLE.

FB33-P200 B
R

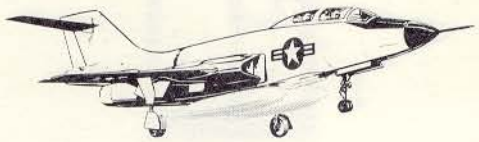
Figure A2-2

MAXIMUM REFUSAL SPEEDS OR CRITICAL ENGINE FAILURE SPEEDS

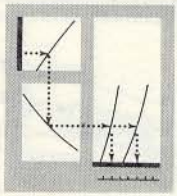
AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN

MAXIMUM THRUST
HARD DRY RUNWAY

REMARKS
SINGLE ENGINE FAILURE

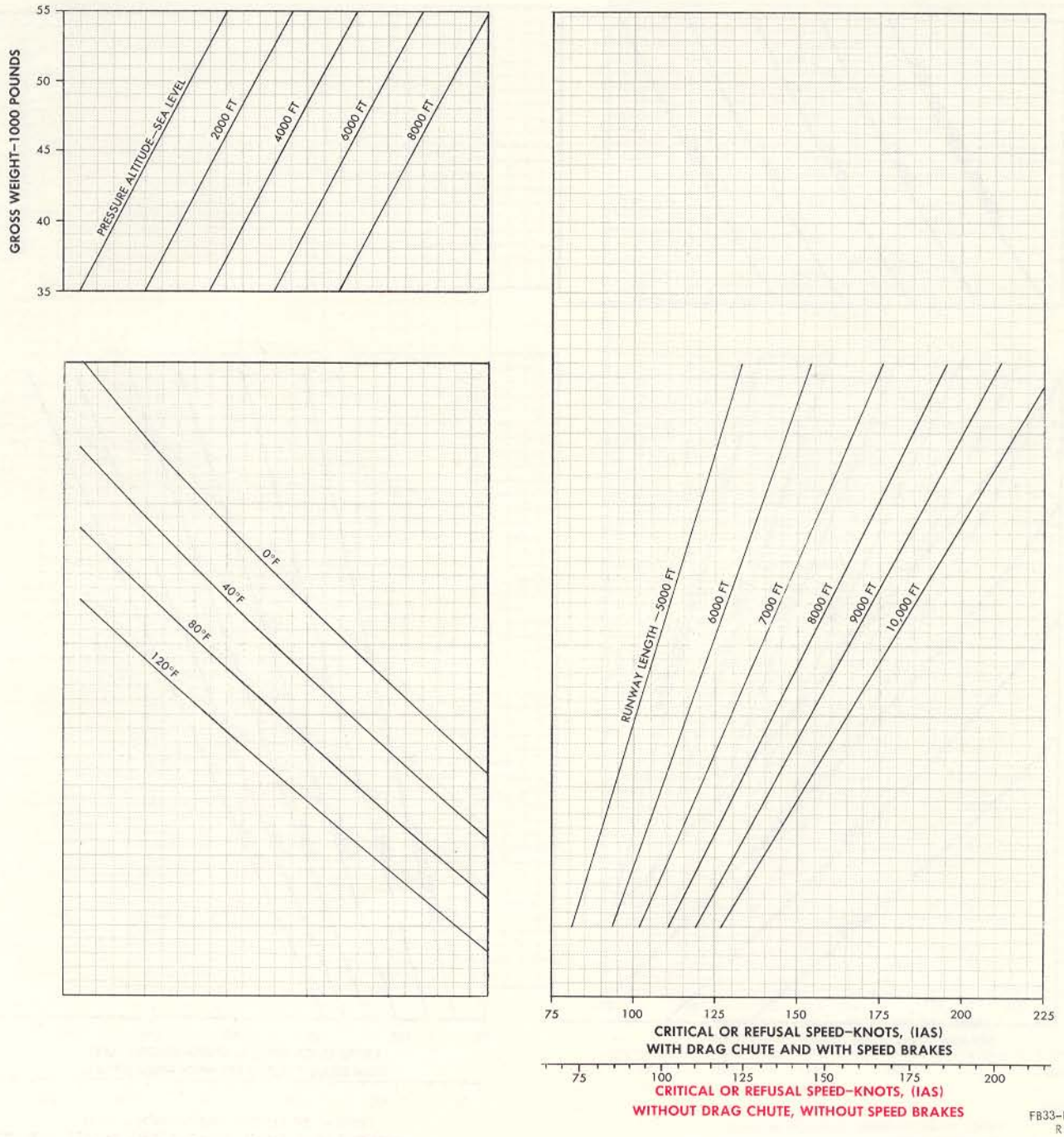


GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

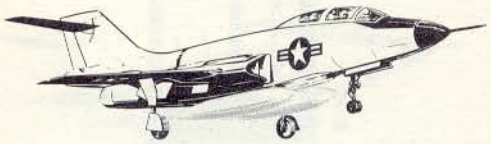


FB33-P201C
R

Figure A2-3

MAXIMUM REFUSAL SPEEDS OR CRITICAL ENGINE FAILURE SPEEDS

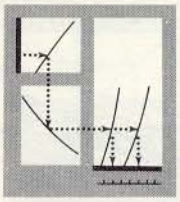
AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



MILITARY THRUST
HARD DRY RUNWAY

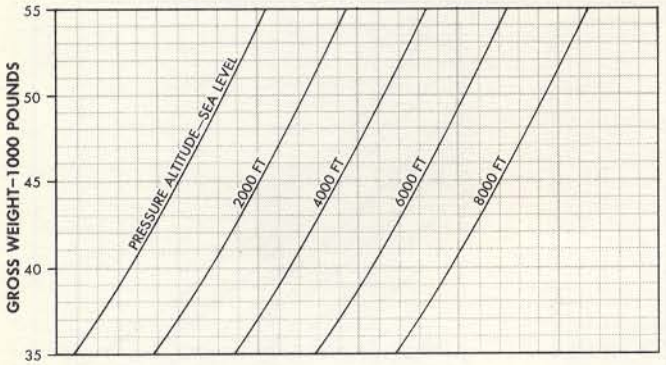
REMARKS
SINGLE ENGINE FAILURE

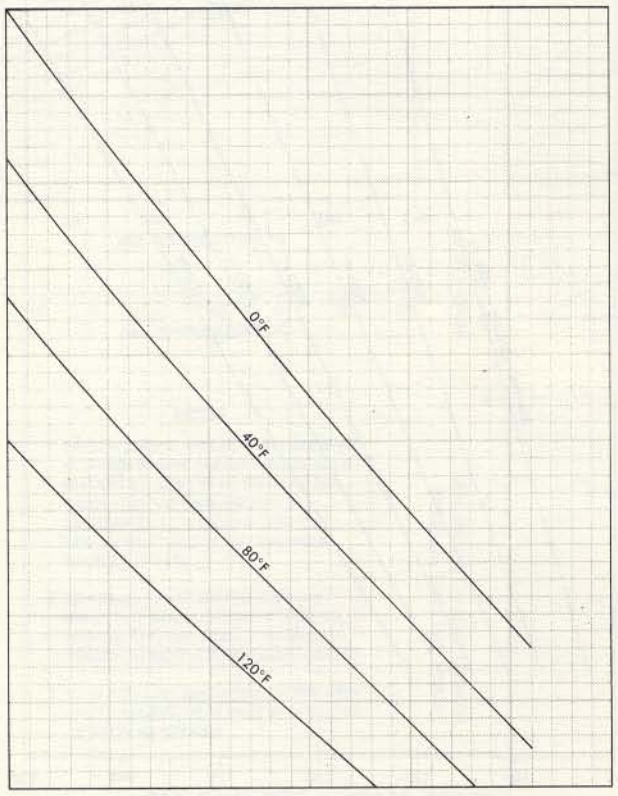
GUIDE

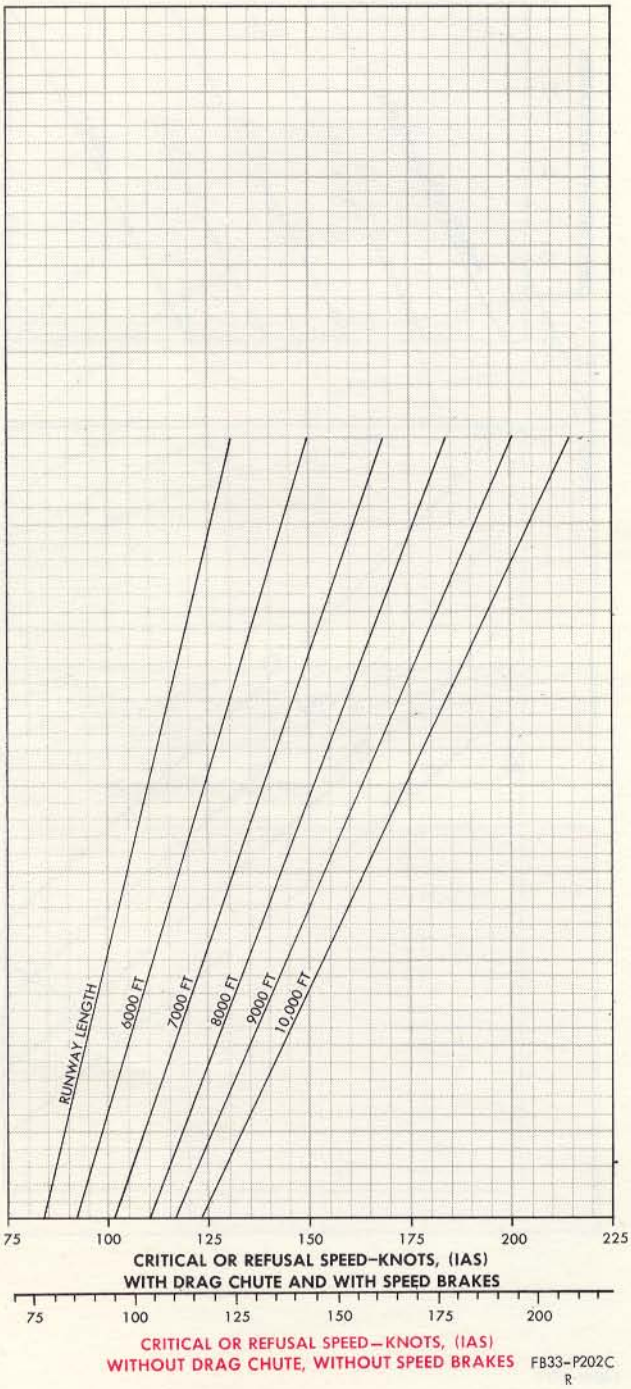


DATE: 1 MARCH 1960
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL







FB33-P202C
R

Figure A2-4

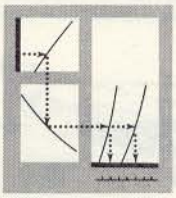
MAXIMUM REFUSAL SPEEDS OR CRITICAL ENGINE FAILURE SPEEDS

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN

MAXIMUM THRUST
WET RUNWAY
REMARKS

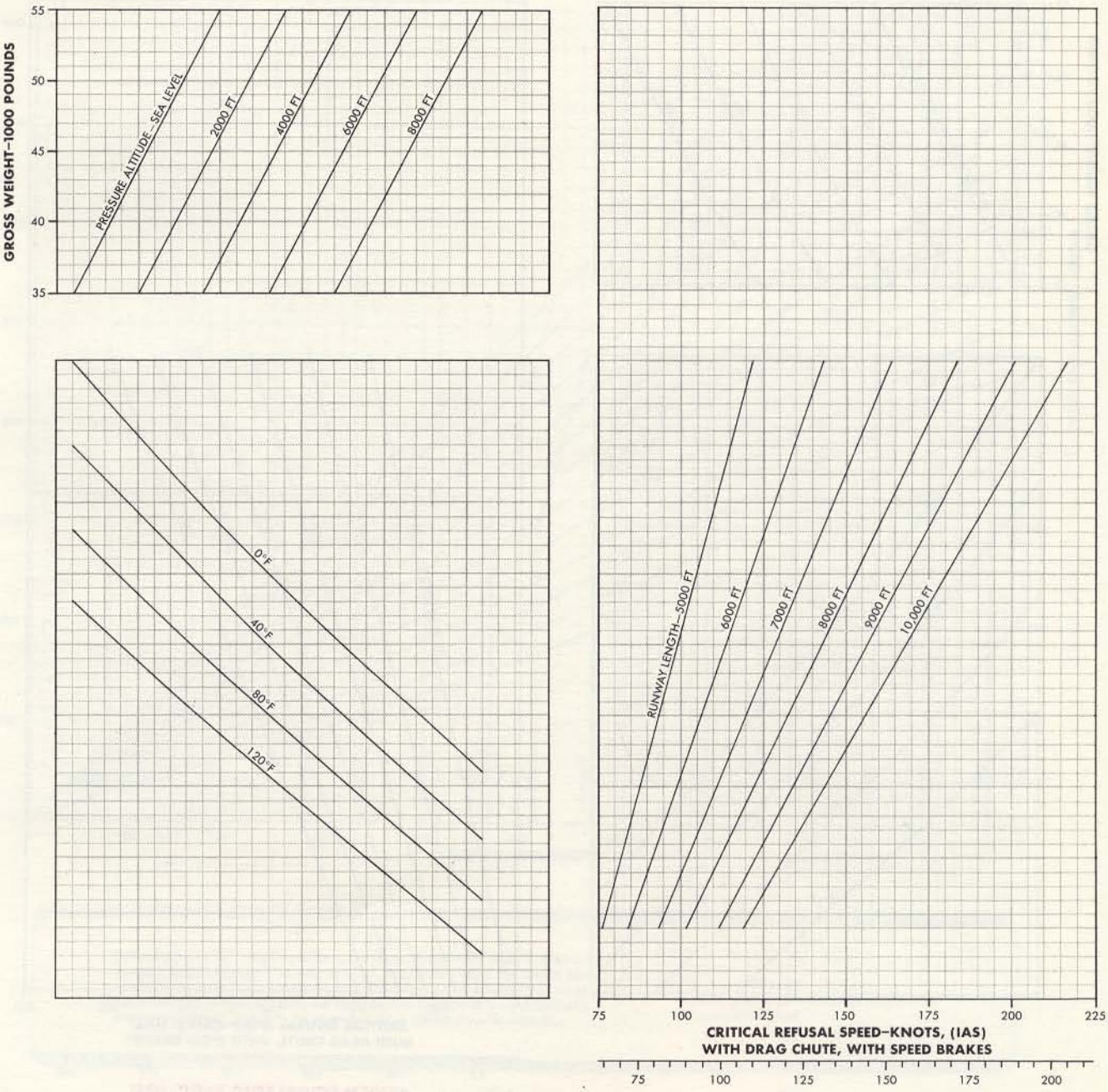
SINGLE ENGINE FAILURE

GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33–P212
R

CRITICAL REFUSAL SPEED–KNOTS, (IAS)
WITHOUT DRAG CHUTE, WITHOUT SPEED BRAKES

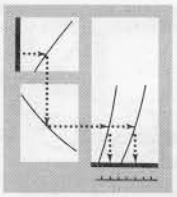
Figure A2-5

MAXIMUM REFUSAL SPEEDS OR CRITICAL ENGINE FAILURE SPEEDS

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN

MILITARY THRUST
WET RUNWAY
REMARKS
SINGLE ENGINE FAILURE

GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

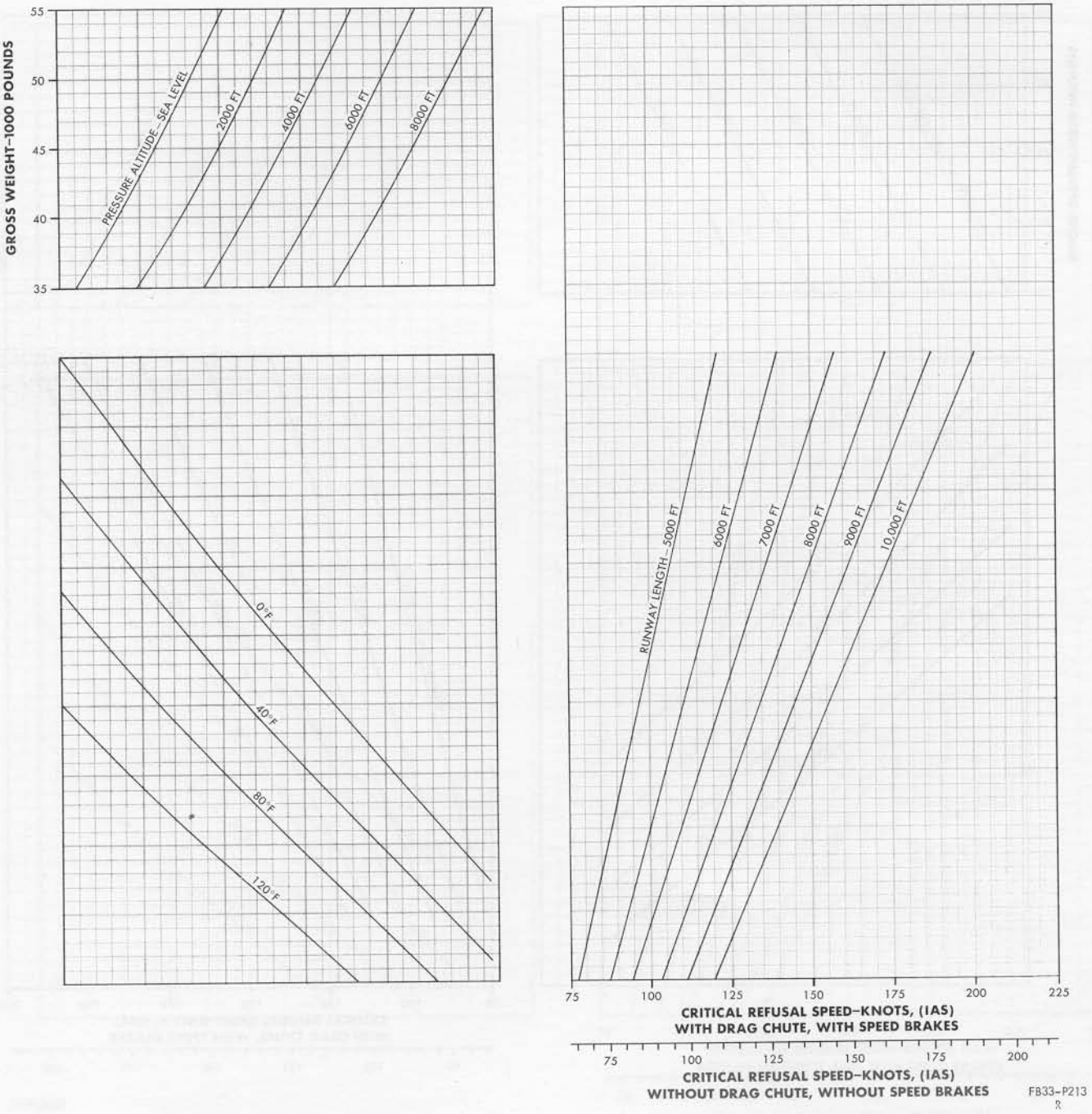
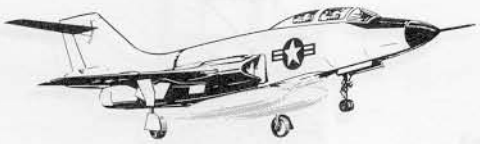


Figure A2-6

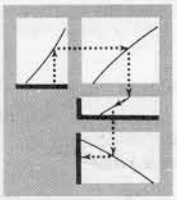
TAKE-OFF DISTANCE
MAXIMUM THRUST
HARD DRY RUNWAY

REMARKS
ENGINE(S): (2) J57-P-55

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN

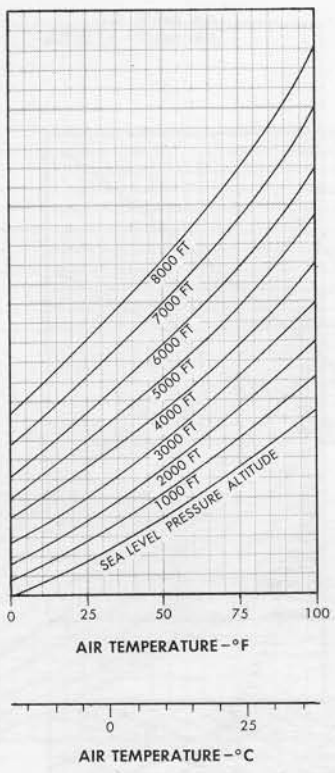


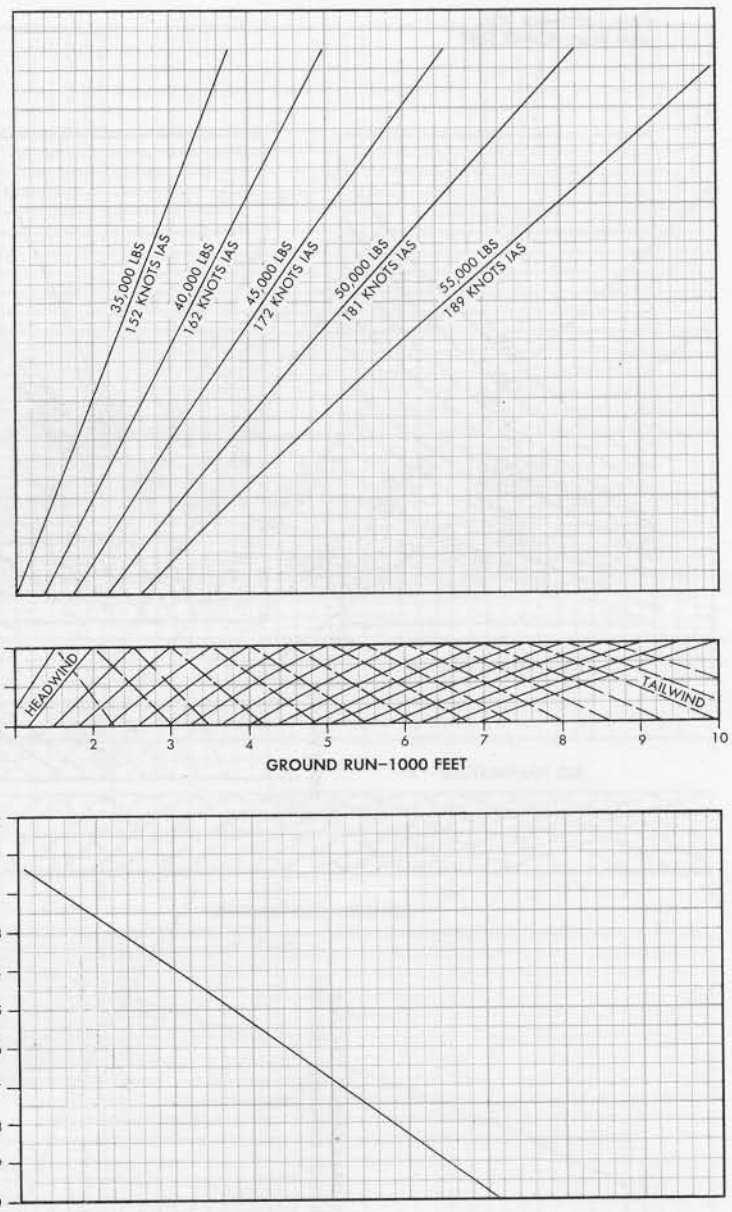
GUIDE

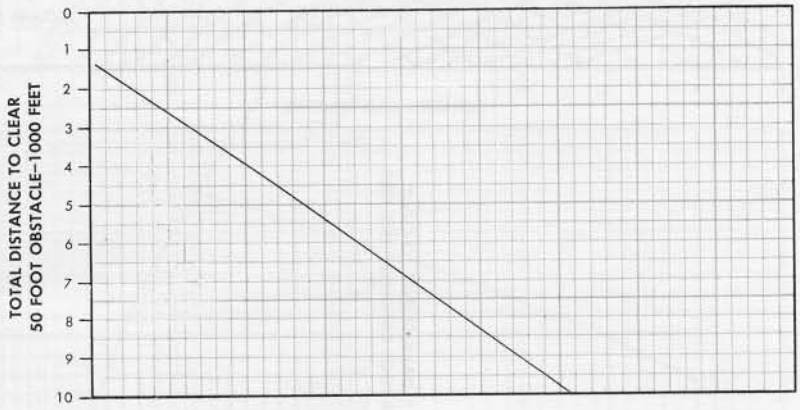


DATE: 1 DECEMBER 1957
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





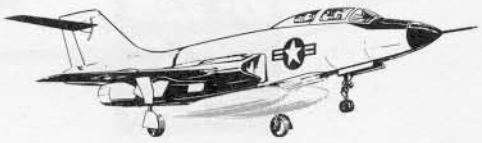


F833-P205C

Figure A2-7

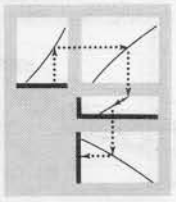
TAKE-OFF DISTANCE
MILITARY THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



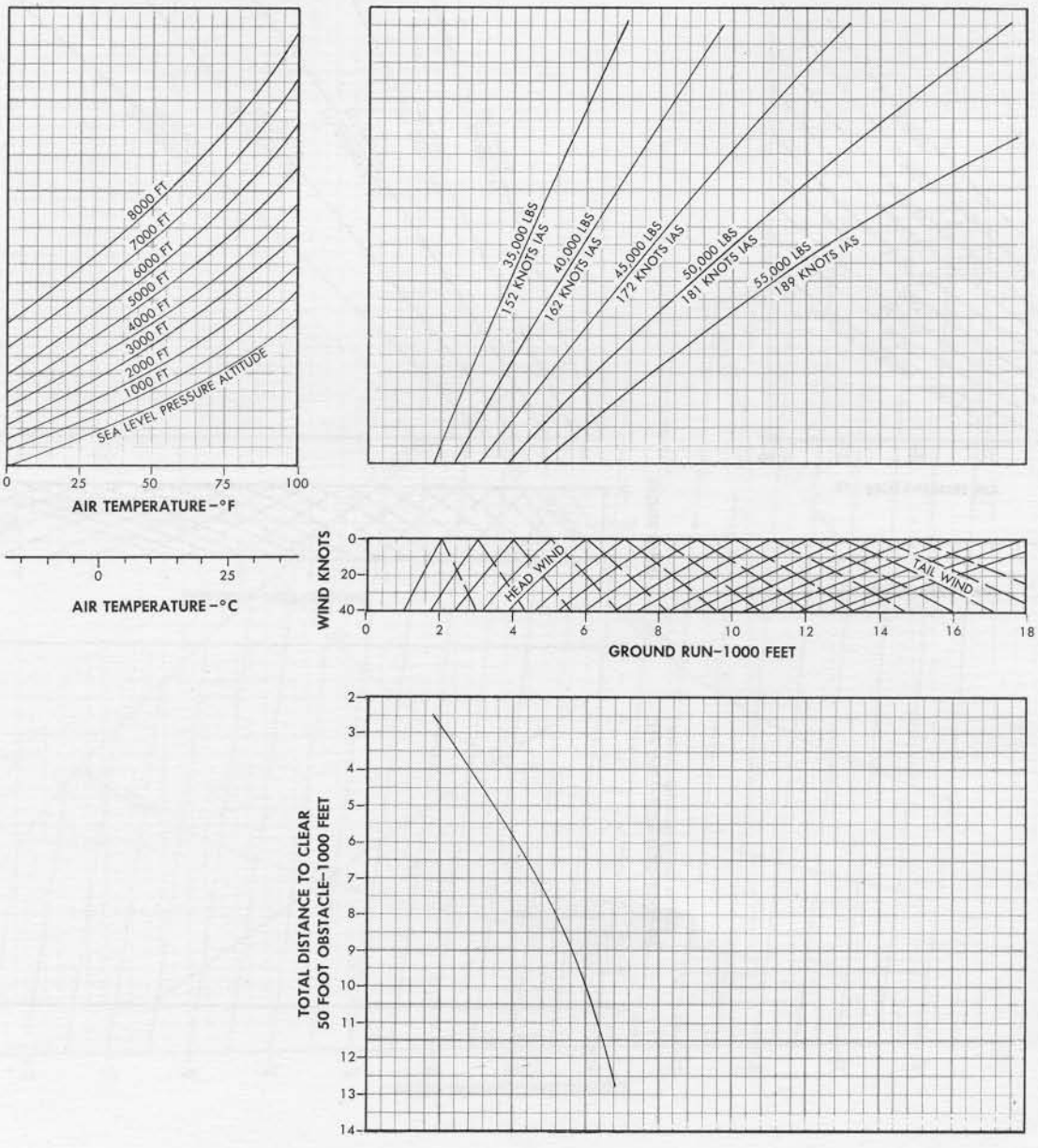
REMARKS
ENGINE(S): (2) J57-P-55

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

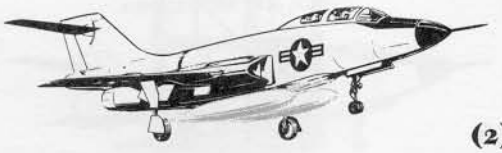


FB33-P206 A

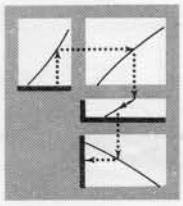
Figure A2-8

TAKE-OFF DISTANCE
MAXIMUM THRUST
HARD DRY RUNWAY
REMARKS

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



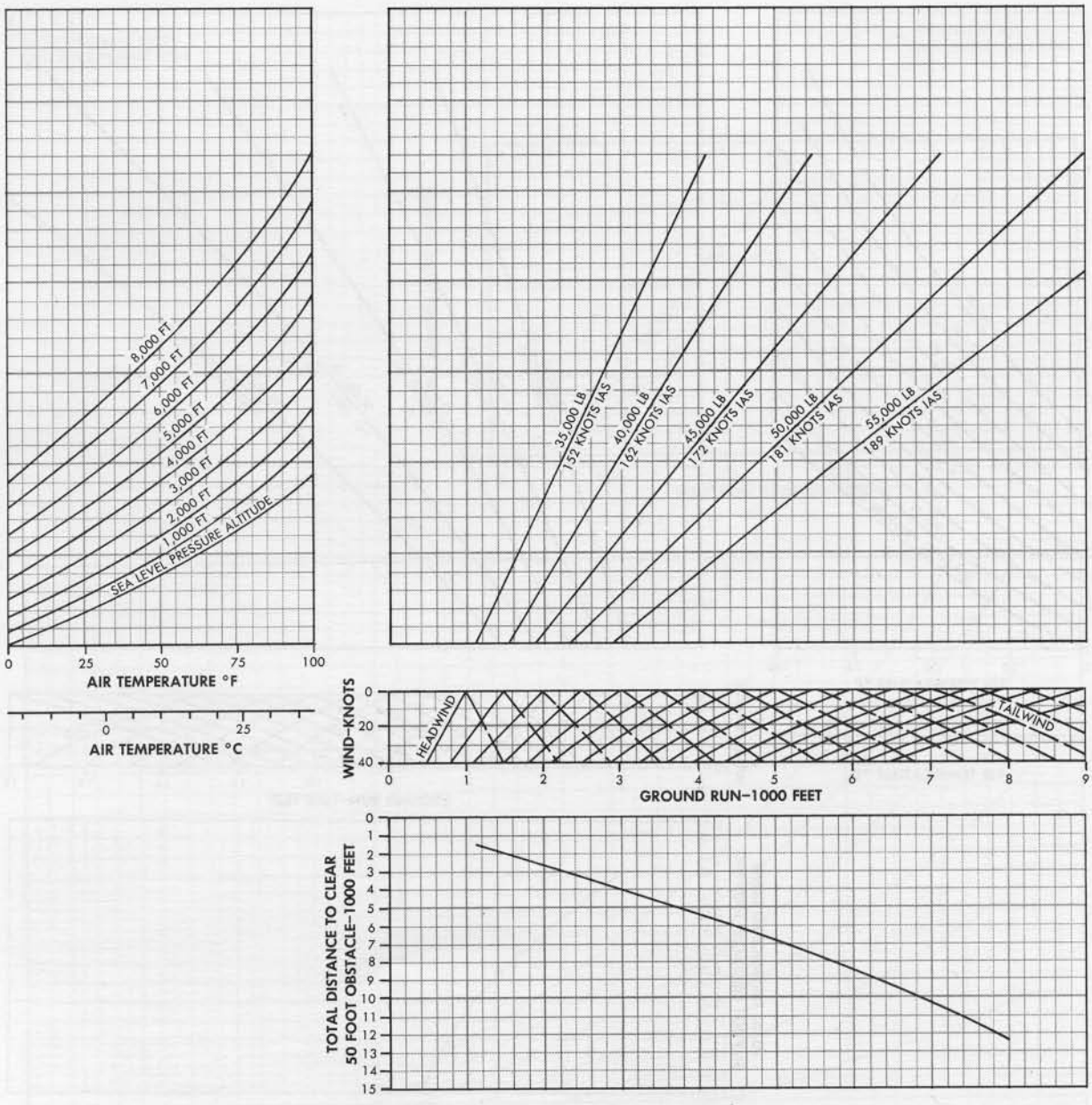
GUIDE



(2) J57–P-53 ENGINES

DATE: 17 AUGUST 1962
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

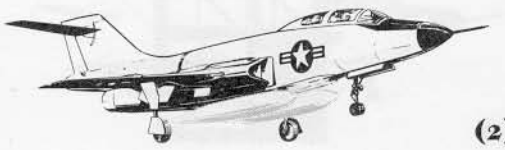


FB33-P203A

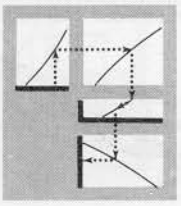
Figure A2-9

TAKE-OFF DISTANCE
MILITARY THRUST
HARD DRY RUNWAY
REMARKS

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



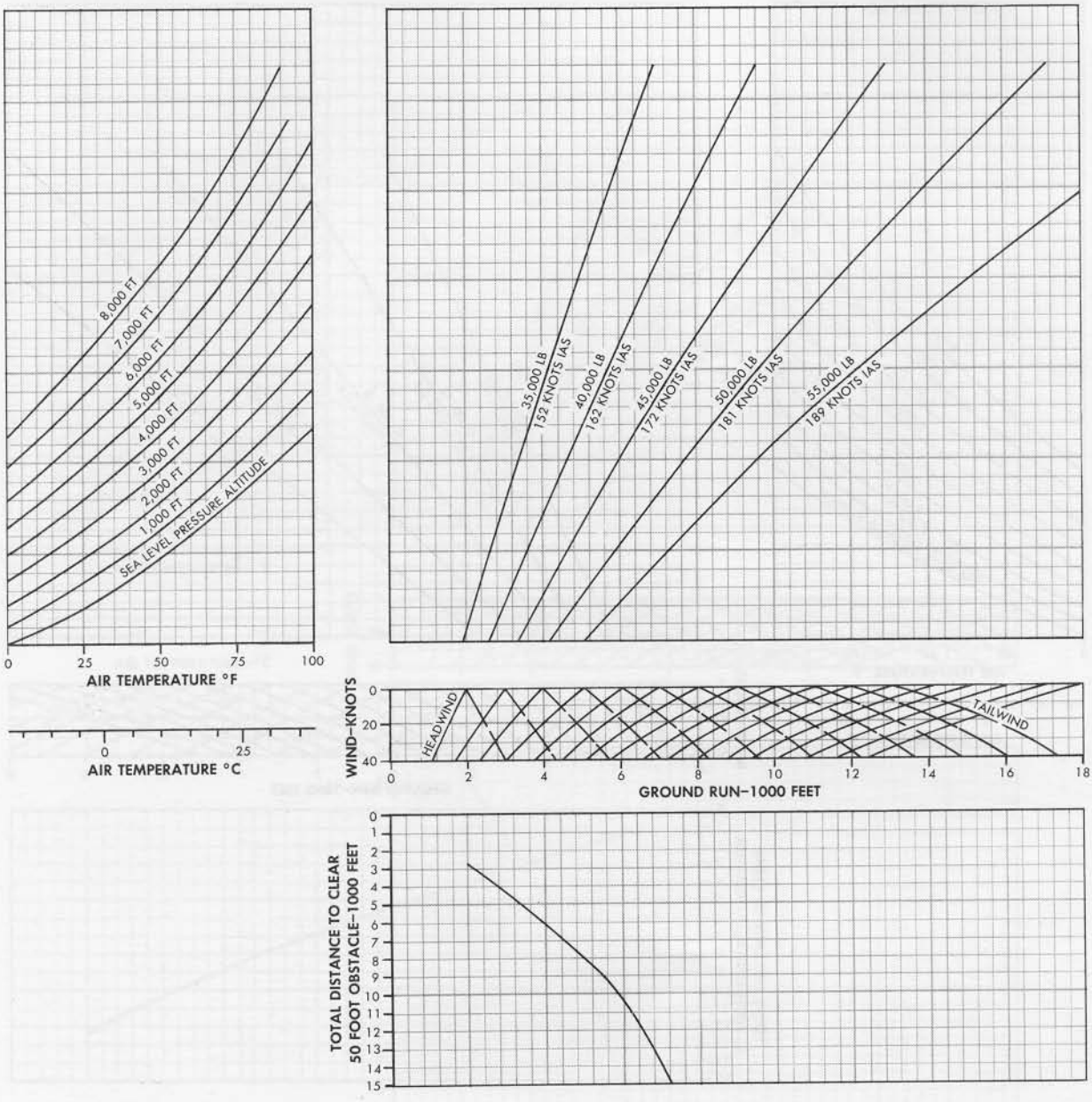
GUIDE



(2) J57–P-53 ENGINES

DATE: 17 AUGUST 1962
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



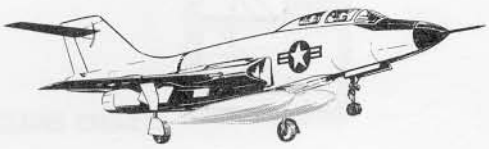
FB33–P204A

Figure A2-10

VELOCITY DURING TAKE-OFF GROUND RUN

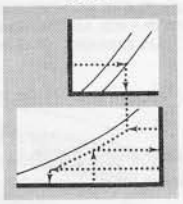
(GO-NO GO LINE CHECK)
MAXIMUM THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



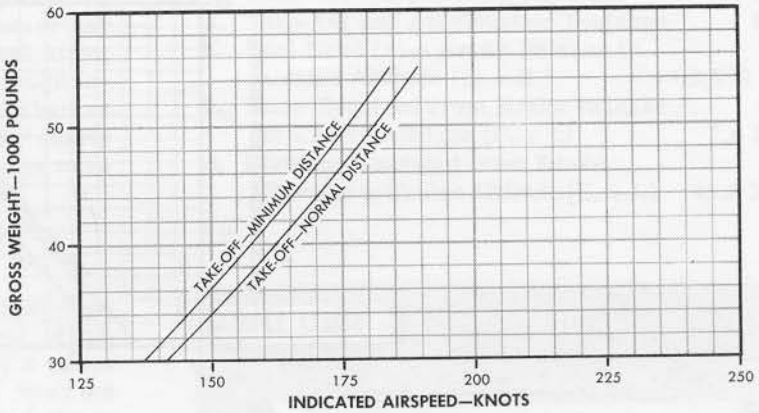
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

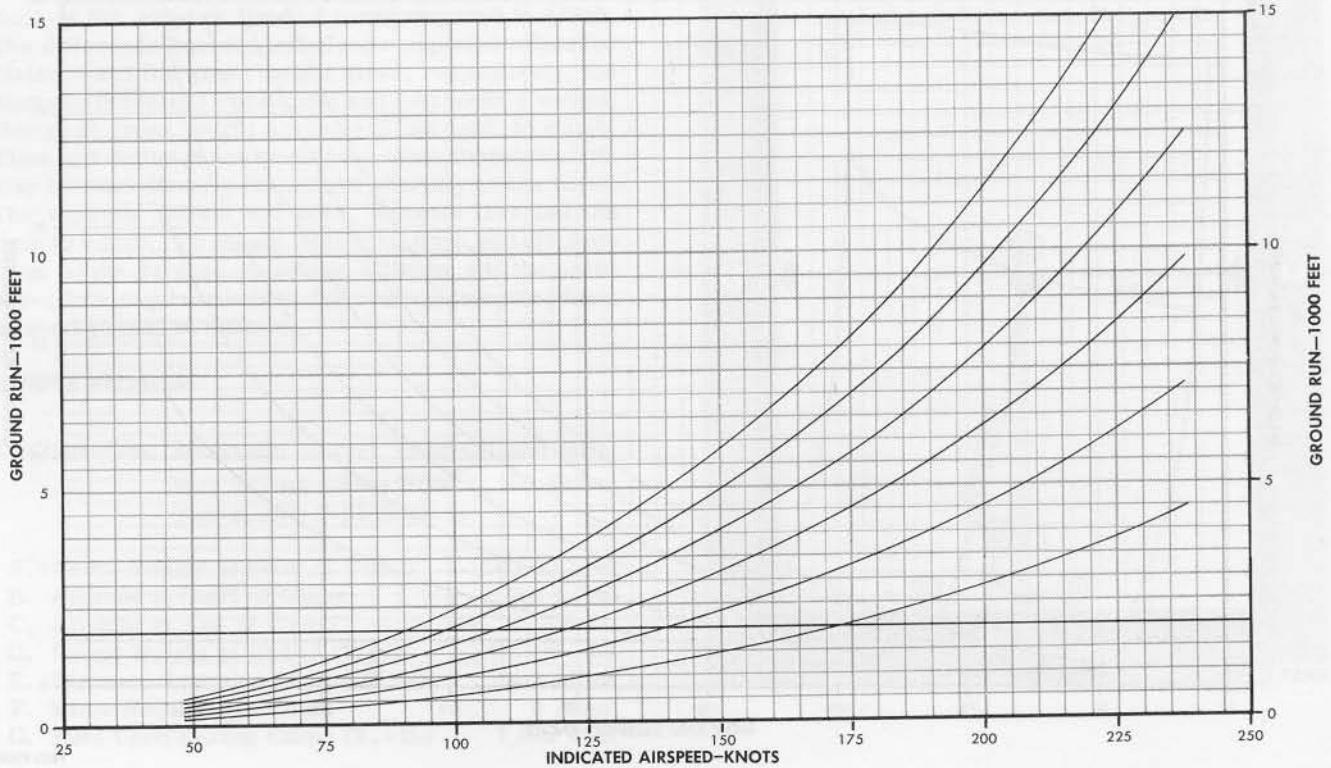
GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





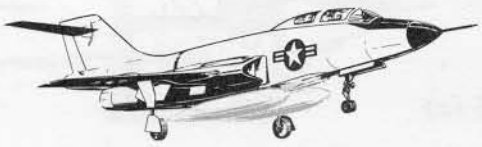
FB33-P2078

Figure A2-11

VELOCITY DURING TAKE-OFF GROUND RUN

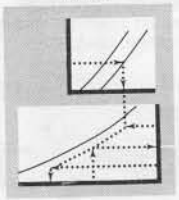
(GO-NO GO LINE CHECK)
MILITARY THRUST
HARD DRY RUNWAY

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



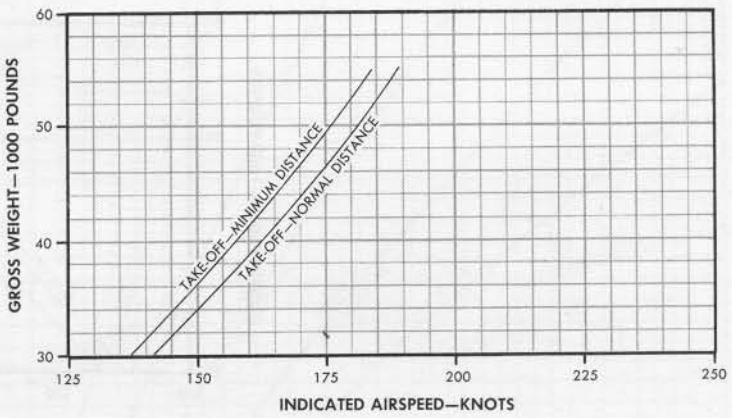
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



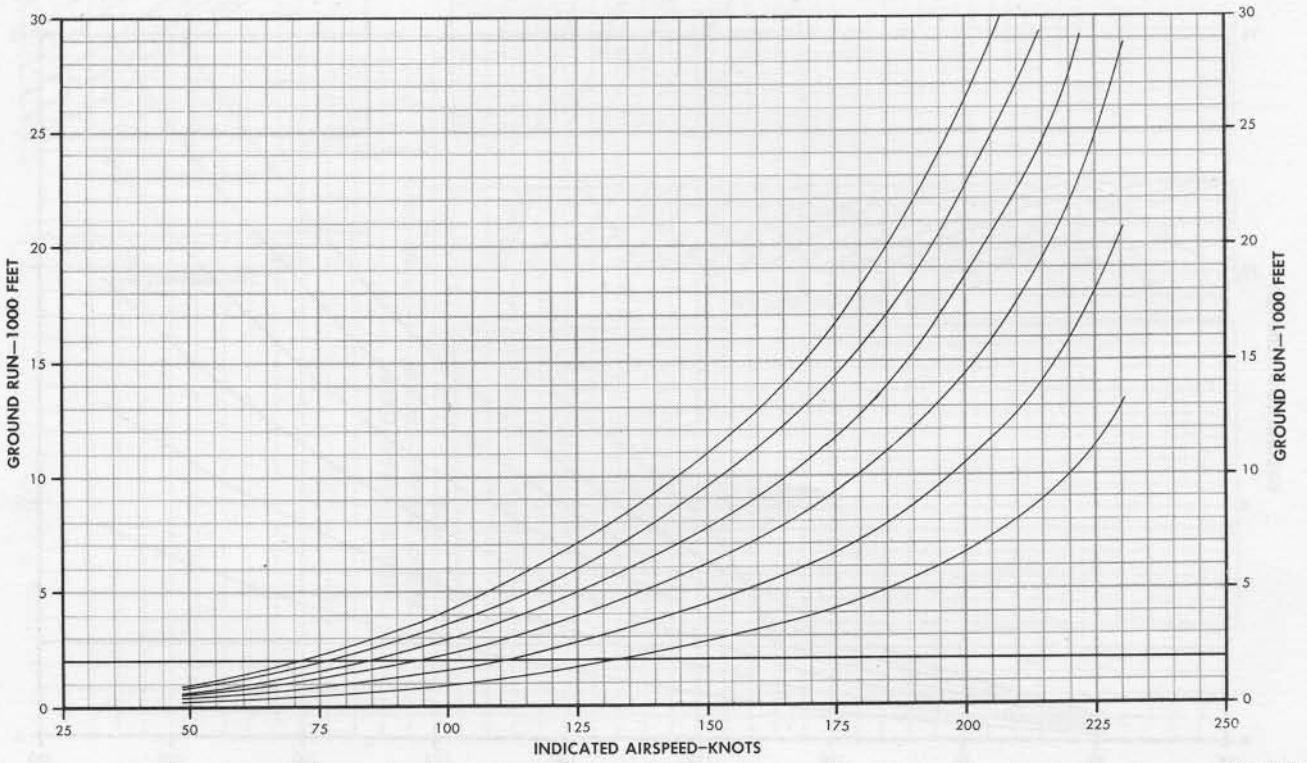


Figure A2-12

part 3 Climb

CLIMB CHARTS

Climb charts (figures A3-1 through A3-13) are provided for both emergency single-engine and normal two-engine operation. These charts, based on recommended climb speeds, are plotted for Maximum and Military thrust and present two airplane configurations. Time and distance are plotted vs. gross weight with guide lines to show the reduction in gross weight during climb as fuel is consumed. Ceilings and optimum cruise altitude are superimposed on the graph. Fuel, time, and distance required from brake release through acceleration to best climb speed is noted on each chart as "Pre-Climb Requirements". The "With Tanks" charts denote a method of adjusting the existing data to be compatible with the "One-Tank" configuration.

USE

To obtain the climb data, enter the proper climb chart at gross weight and altitude at start of climb. From initial altitude, parallel a guide curve until it intersects the desired altitude at the end of climb. Read the time (right scale), distance (left scale), and gross weight. The difference between initial and completed time is the elapsed time (Δ time) required to climb. The difference between initial and completed values for distance and for gross weight gives, respectively, the distance traveled (Δ distance) and fuel used (Δ weight, change in gross weight = pounds of fuel used) to climb. Time and distance are zero at sea level, therefore both may be read directly for climbs starting at sea level. The example shows fuel used, distance traveled and time to climb. To obtain total fuel, time, and distance from brake release to cruise altitude, add the noted pre-climb requirements to chart values computed from take-off pressure altitude.

SAMPLE PROBLEM

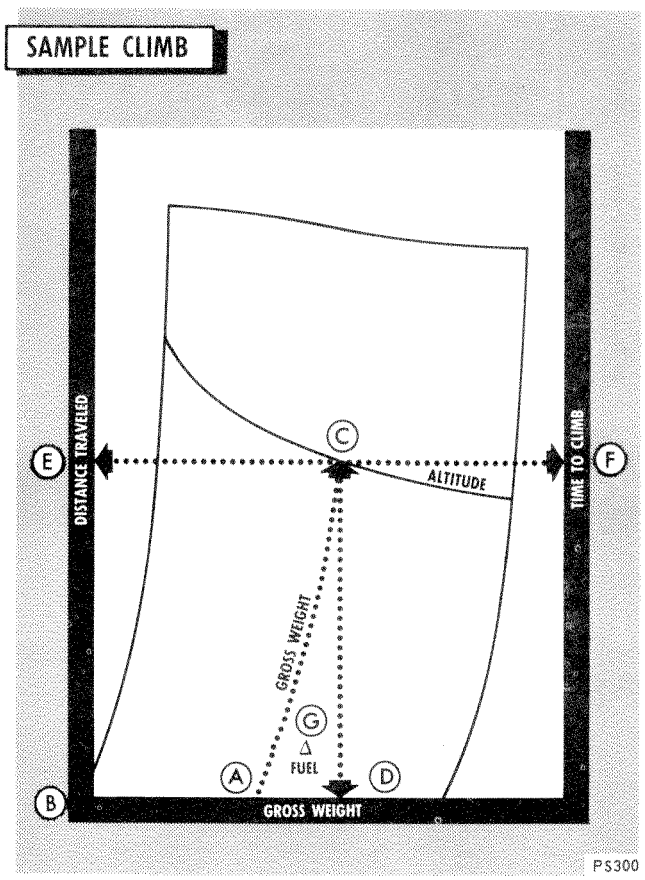
Configuration: Maximum Thrust Take-Off and Military Thrust Climb With (2) 450 Gallon Tanks, J57-P-55 Engines

A.	Gross Weight at Start of Climb	50,000 Lbs.
B.	Altitude at Start of Climb	Sea Level
C.	Altitude at End of Climb	30,000 Ft.
D.	Gross Weight at End of Climb	48,100 Lbs.
E.	Distance Traveled During Climb	44.3 Miles
F.	Time Required to Climb	6 Mins.
G.	Fuel Used During Climb (A. - D.)	1,900 Lbs.

Note

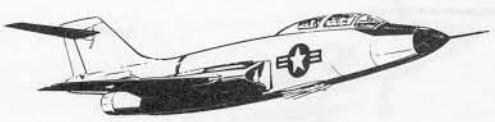
To obtain fuel, time, and distance from brake release to cruise altitude, apply pre-climb requirements noted for Maximum Thrust take-off and acceleration to best climb speed.

H.	Take-Off and Acceleration Fuel	770 Lbs.
I.	Take-Off and Acceleration Time	1.4 Mins.
J.	Take-Off and Acceleration Distance	4 Miles
K.	Fuel Used from Brake Release to Cruise Altitude (G. + H.)	2,670 Lbs.
L.	Time Required from Brake Release to Cruise Altitude (F. + I.)	7.4 Mins.
M.	Distance Traveled from Brake Release to Cruise Altitude (E. + J.)	48.3 Miles



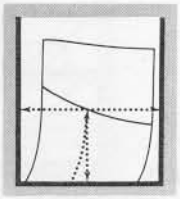
MAXIMUM THRUST SUPERSONIC CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE 1 JUNE 1959
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

NOTES
1. SUBSONIC CLIMB TO 25,000 FT.
2. .7g PUSHOVER TO LEVEL FLIGHT, ACCELERATE, 1.3g PULL-UP TO SUPERSONIC CLIMB SPEED.
3. SUPERSONIC CLIMB TO COMBAT CEILING.

SUPERSONIC COMBAT CEILING

TRUE MACH NUMBER

M=1.23 54,000 FT
M=1.23 53,000 FT
M=1.23 52,000 FT
M=1.24 51,000 FT
M=1.24 50,000 FT
M=1.25 49,000 FT
M=1.26 47,000 FT
M=1.27 46,000 FT
M=1.28 45,000 FT
M=1.29 44,000 FT
M=1.30 43,000 FT
M=1.30 42,000 FT
M=1.30 41,000 FT
M=1.31

M=1.31 29,000 FT
M=1.30 30,000 FT
M=1.30 31,000 FT
M=1.29 32,000 FT
M=1.29 33,000 FT
M=1.28 34,000 FT
M=1.27 35,000 FT
M=1.26 36,000 FT
37,000 FT
38,000 FT
39,000 FT
40,000 FT

M=.89 25,000 FT
20,000 FT
15,000 FT
10,000 FT
5,000 FT
SEA LEVEL

M=.88
M=.89
M=.89
M=.89
M=.88
M=.88
M=.87
M=.86

DISTANCE TRAVELED–NAUTICAL MILES

TIME TO CLIMB–MINUTES

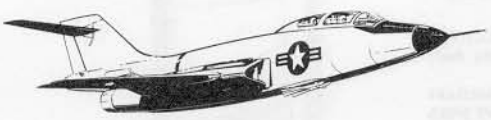
GROSS WEIGHT–1000 POUNDS

FB33-P328 A

Figure A3-1

MAXIMUM THRUST CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
MINIMUM CLIMB SPEED = 275 KNOTS CAS

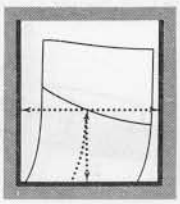
PRE-CLIMB REQUIREMENTS:

1. MAXIMUM THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED = 1220 LBS. FUEL; 0.9 MINUTES; 3 MILES.

NOTE

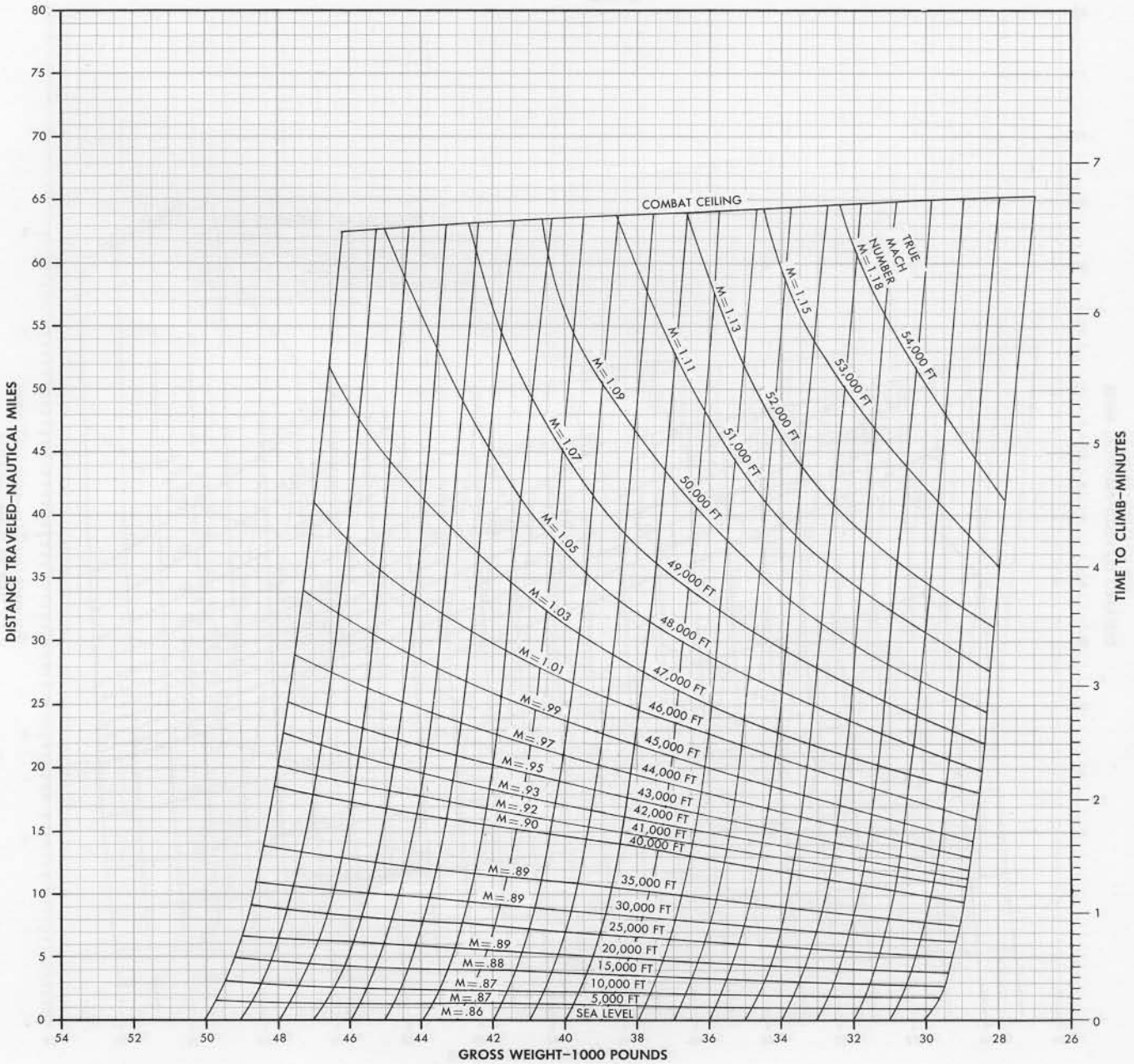
TO OBTAIN TOTAL FUEL, TIME, AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

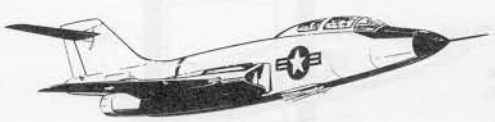


FB33-P300C

Figure A3-2

MILITARY THRUST CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

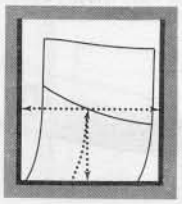
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
MINIMUM CLIMB SPEED = 275 KNOTS CAS

PRE-CLIMB REQUIREMENTS:

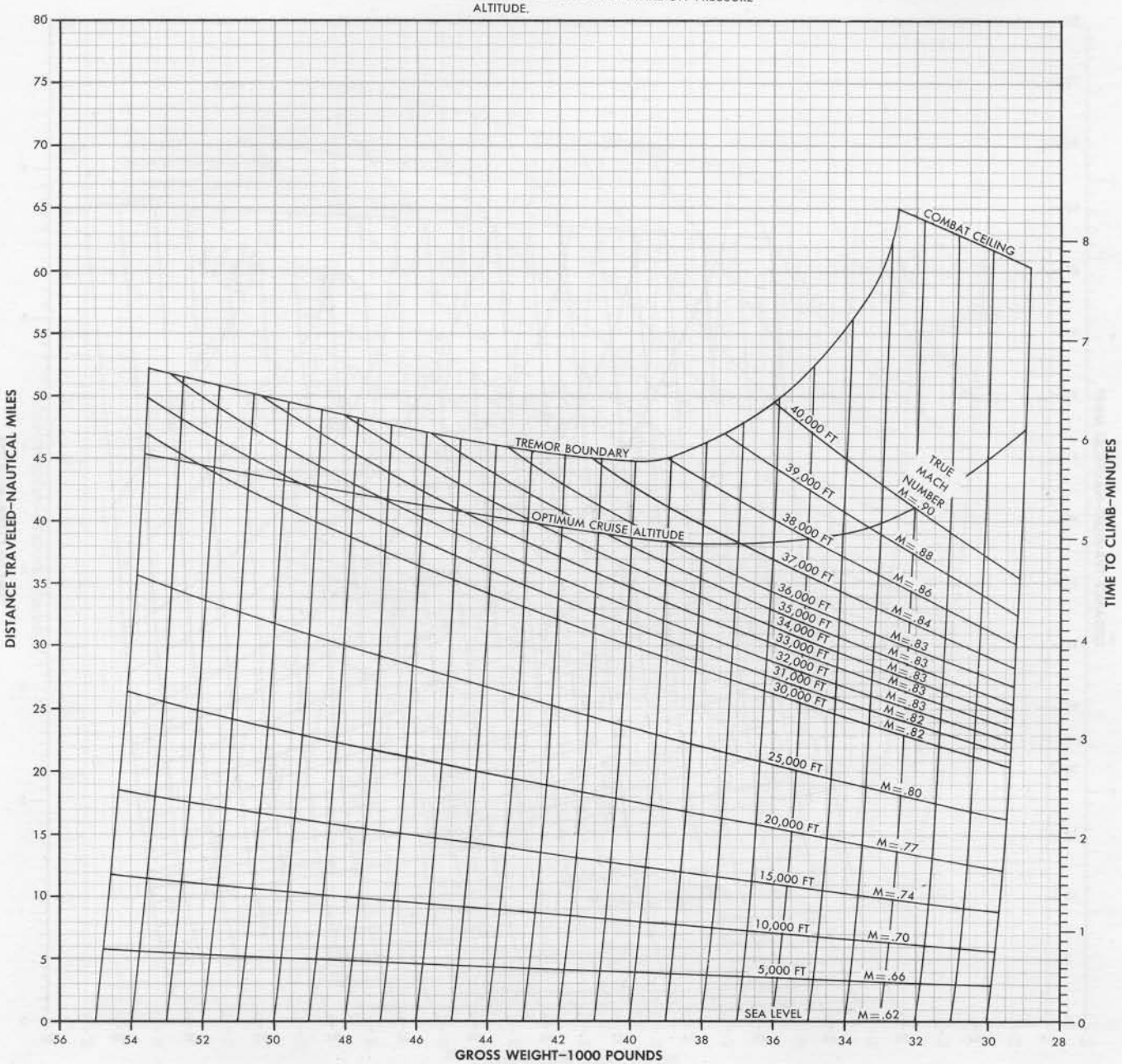
1. MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED = 460 LBS. FUEL; 1.7 MINUTES, 4 MILES.
2. MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED = 700 LBS. FUEL; 1.3 MINUTES; 4 MILES.

NOTE
TO OBTAIN TOTAL FUEL, TIME, AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

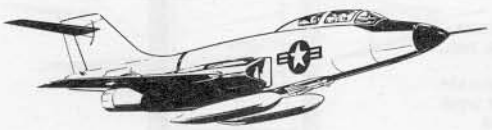


FB33-P301E

Figure A3-3

MAXIMUM THRUST CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

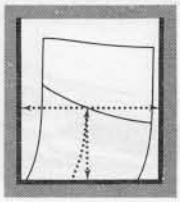


REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
MINIMUM CLIMB SPEED = 275 KNOTS CAS

PRE-CLIMB REQUIREMENTS:
1. MAXIMUM THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED = 1315 LBS. FUEL; 1.0 MINUTES; 3 MILES.

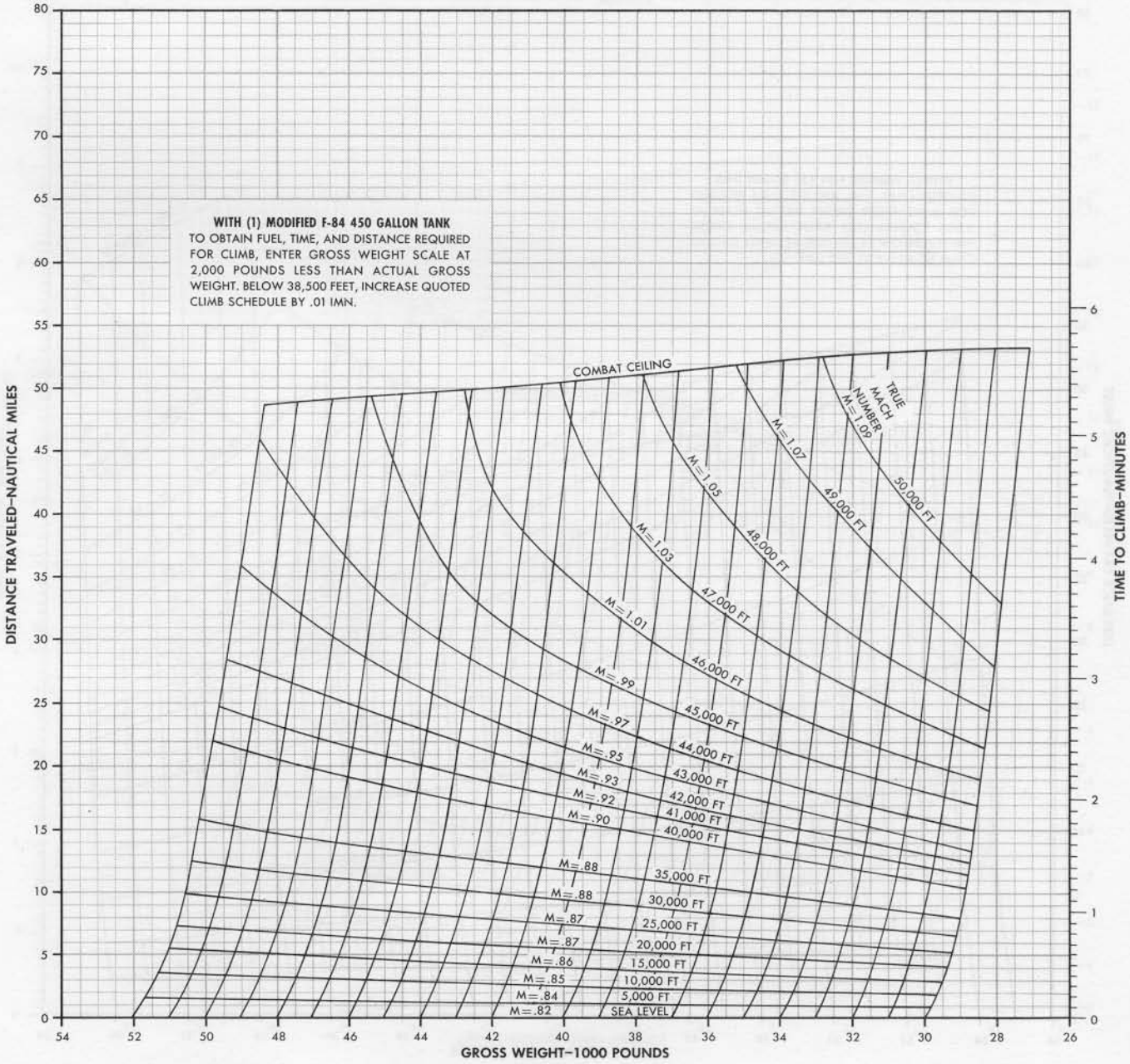
NOTE
TO OBTAIN TOTAL FUEL, TIME, AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

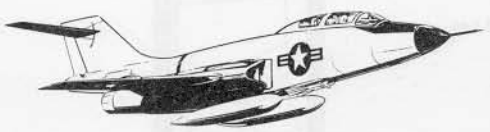


FB33-P302C

Figure A3-4

MILITARY THRUST CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
MINIMUM CLIMB SPEED = 275 KNOTS CAS

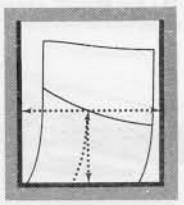
PRE-CLIMB REQUIREMENTS:

1. MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED = 550 LBS. FUEL; 2.0 MINUTES, 4 MILES.
2. MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED = 770 LBS. FUEL; 1.4 MINUTES; 4 MILES.

NOTE

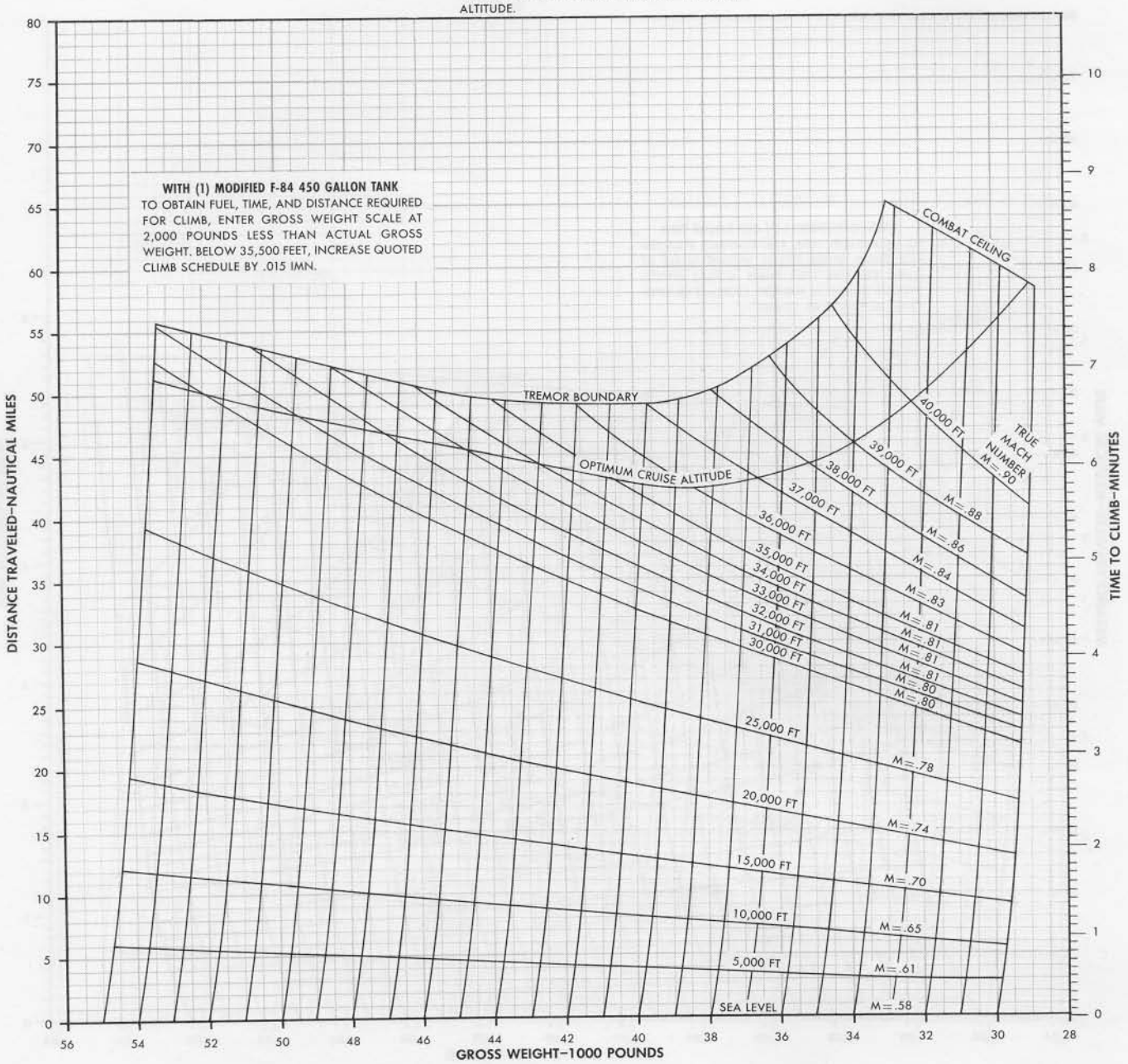
TO OBTAIN TOTAL FUEL, TIME, AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

WITH (1) MODIFIED F-84 450 GALLON TANK
TO OBTAIN FUEL, TIME, AND DISTANCE REQUIRED FOR CLIMB, ENTER GROSS WEIGHT SCALE AT 2,000 POUNDS LESS THAN ACTUAL GROSS WEIGHT. BELOW 35,500 FEET, INCREASE QUOTED CLIMB SCHEDULE BY .015 IMN.



FB33-303 E

Figure A3-5

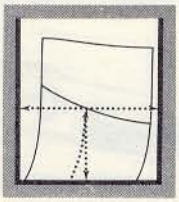
MAXIMUM THRUST CLIMB

ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT

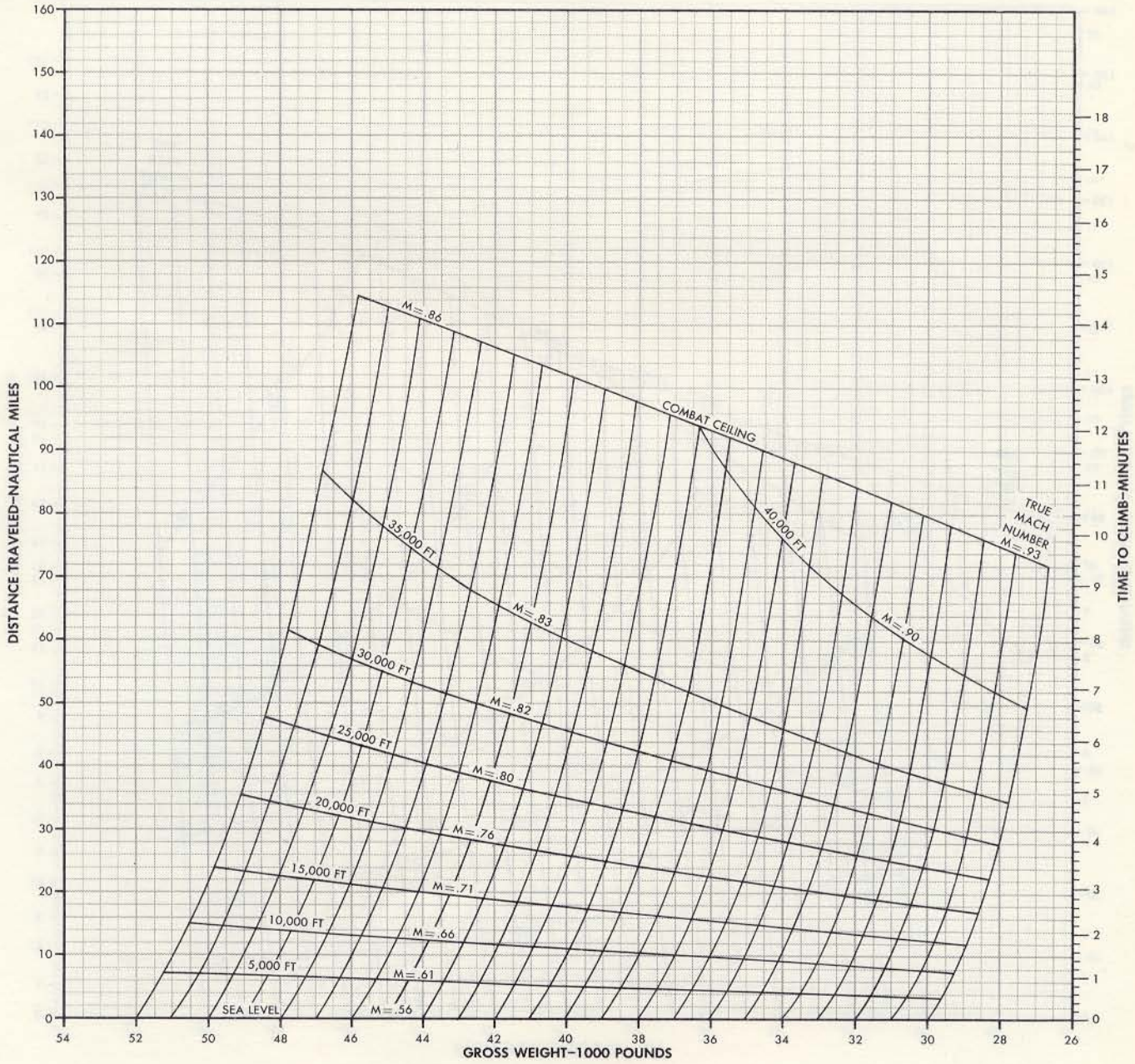
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
MINIMUM CLIMB SPEED=275 KNOTS CAS

GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



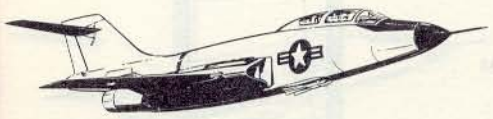
FB33-P322B
R

Figure A3-6

MILITARY THRUST CLIMB

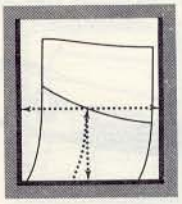
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



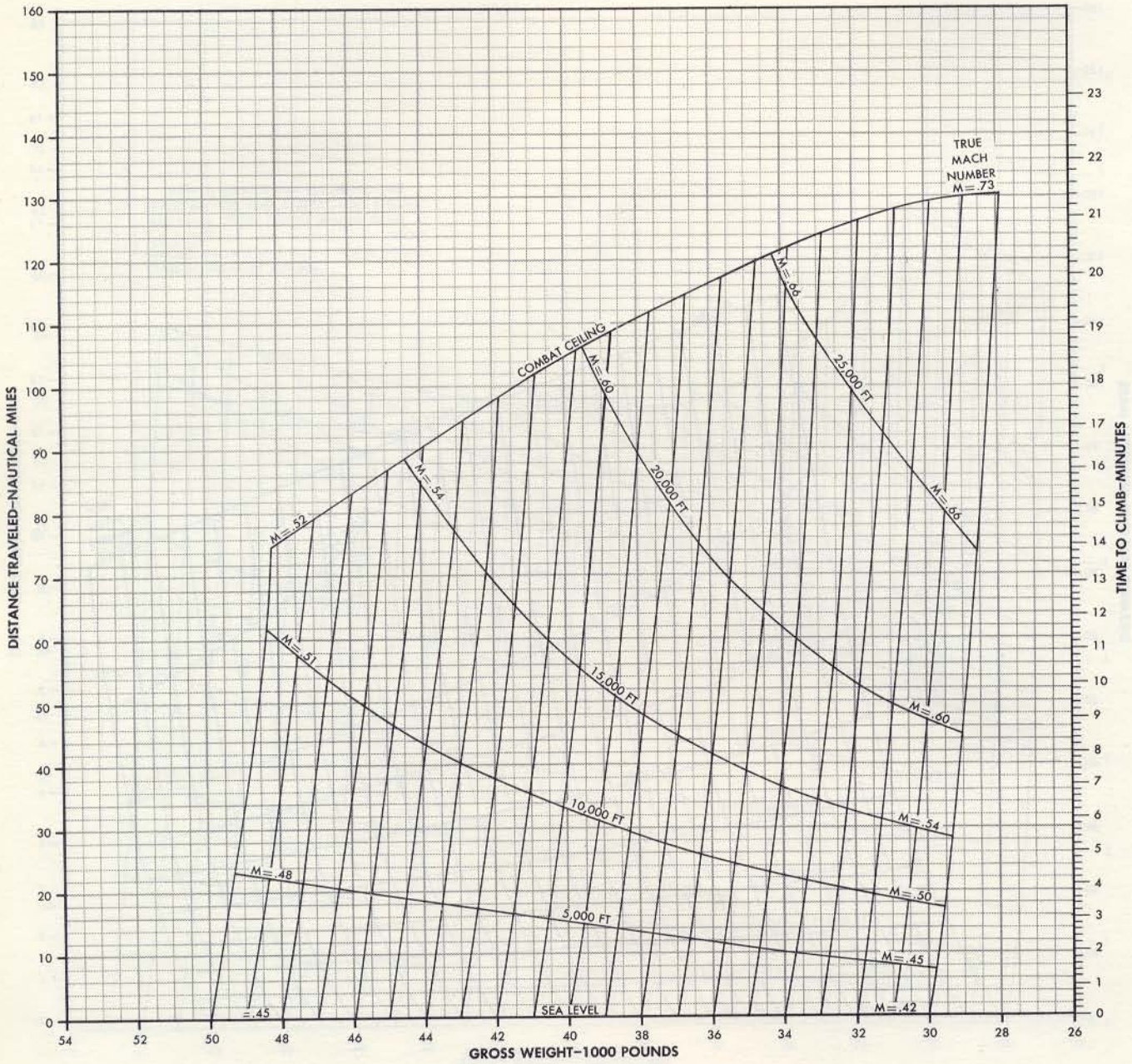
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
MINIMUM CLIMB SPEED = 275 KNOTS CAS

GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P323D
R

Figure A3-7

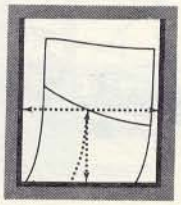
MAXIMUM THRUST CLIMB

ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

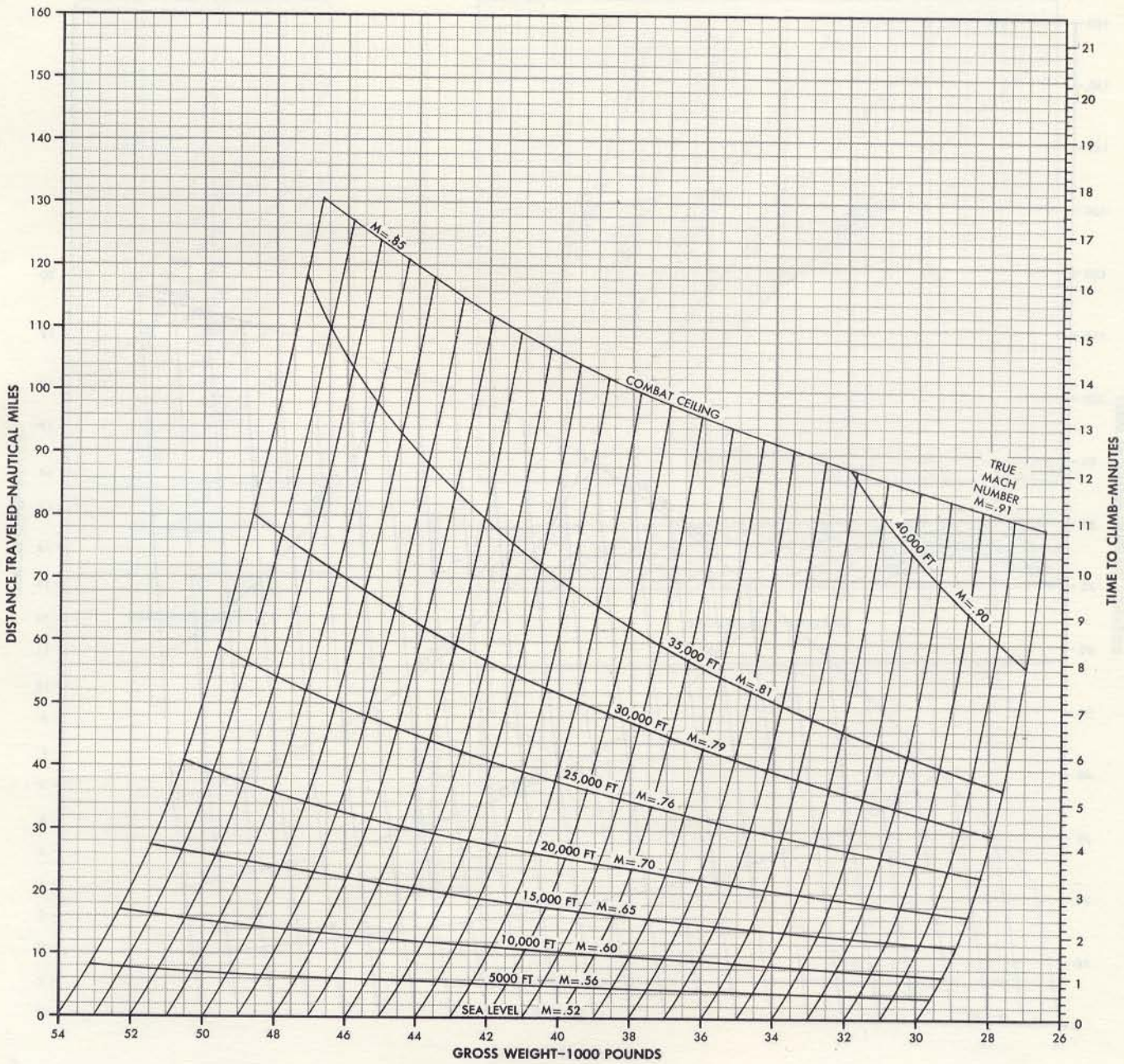
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
MINIMUM CLIMB SPEED=275 KTS. CA S

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P329A
R

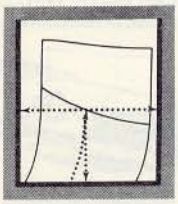
Figure A3-8

MILITARY THRUST CLIMB
ONE ENGINE OPERATING

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

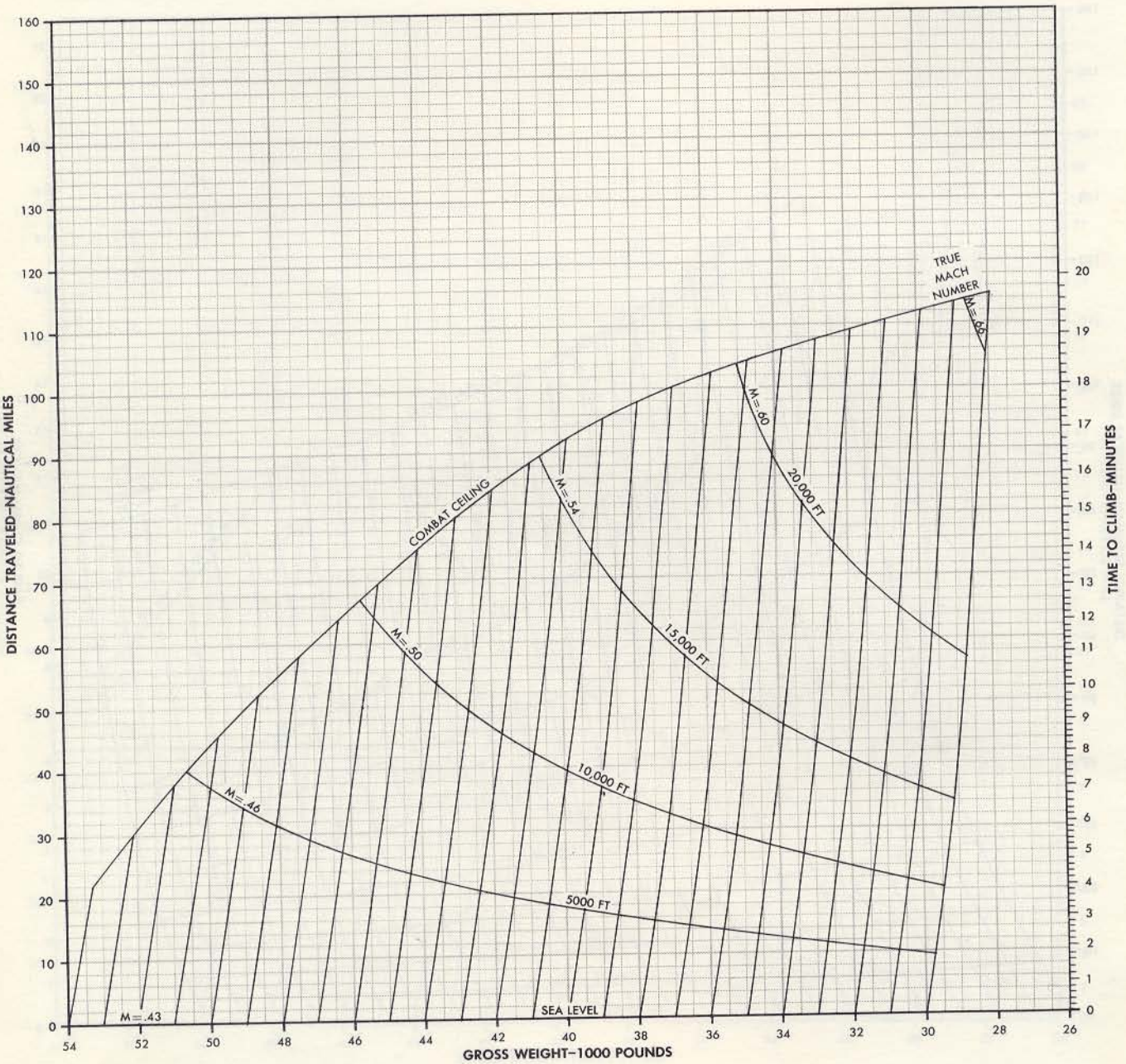
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
MINIMUM CLIMB SPEED=275 KTS. CAS

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

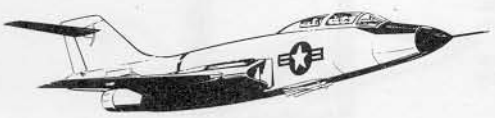


FB33-P330 A
R

Figure A3-9

MAXIMUM THRUST CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



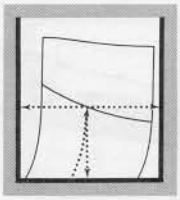
DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

REMARKS
ICAO STANDARD DAY
MINIMUM CLIMB SPEED=275 KNOTS CAS

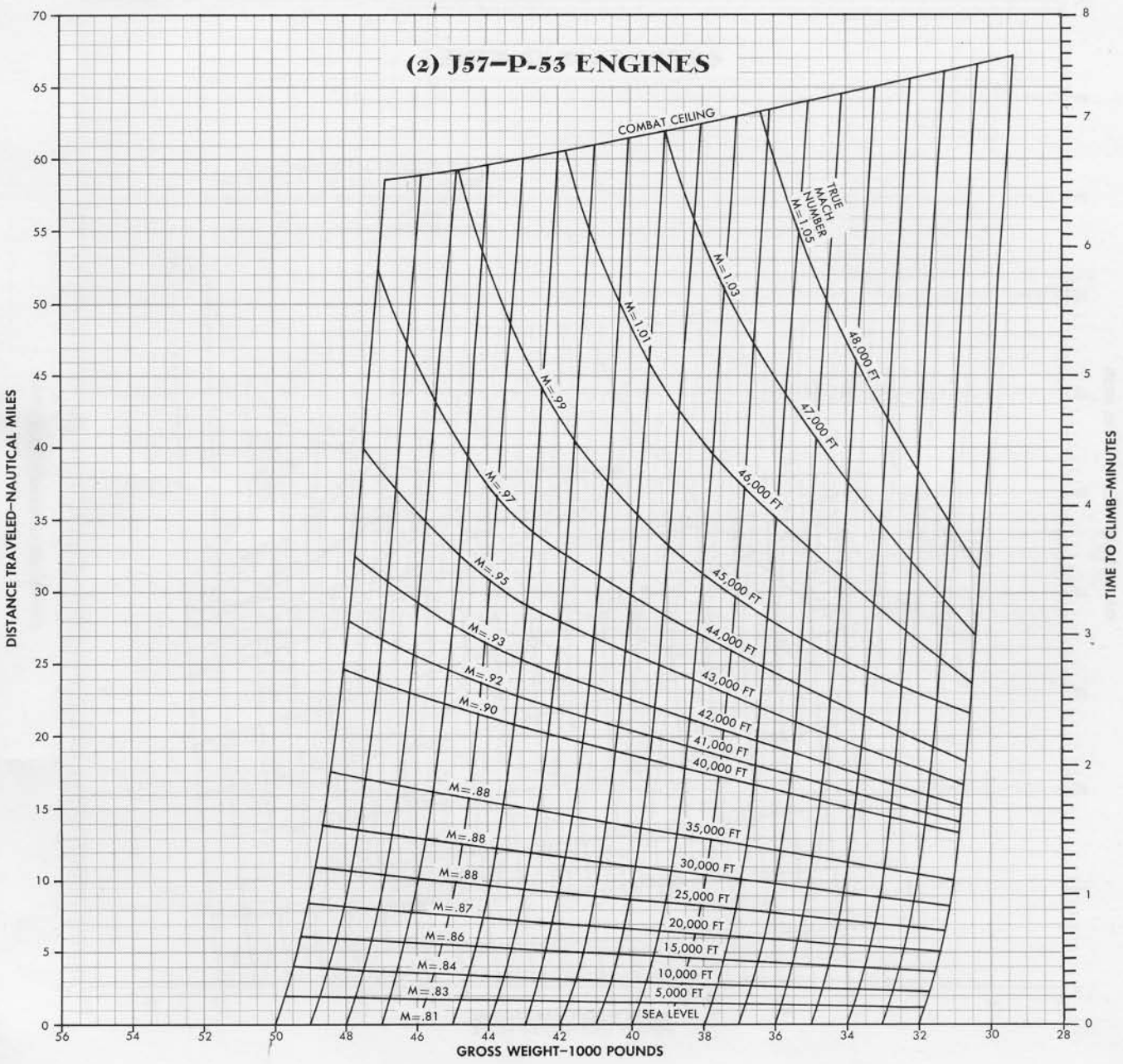
PRE-CLIMB REQUIREMENTS:
1. MAXIMUM THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED=1320 LBS. FUEL; 1.0 MINUTES; 4 MILES.

NOTE
TO OBTAIN TOTAL FUEL, TIME AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

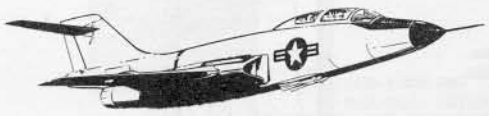


FB33-P304A

Figure A3-10

MILITARY THRUST CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F; PRIMARY ARMAMENT



DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

REMARKS

ICAO STANDARD DAY
MINIMUM CLIMB SPEED=275 KNOTS CAS

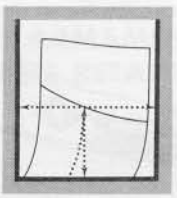
PRE-CLIMB REQUIREMENTS:

1. MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED=460 LBS. FUEL; 1.7 MINUTES; 4 MILES.
2. MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED =800 LBS. FUEL; 1.4 MINUTES; 5 MILES.

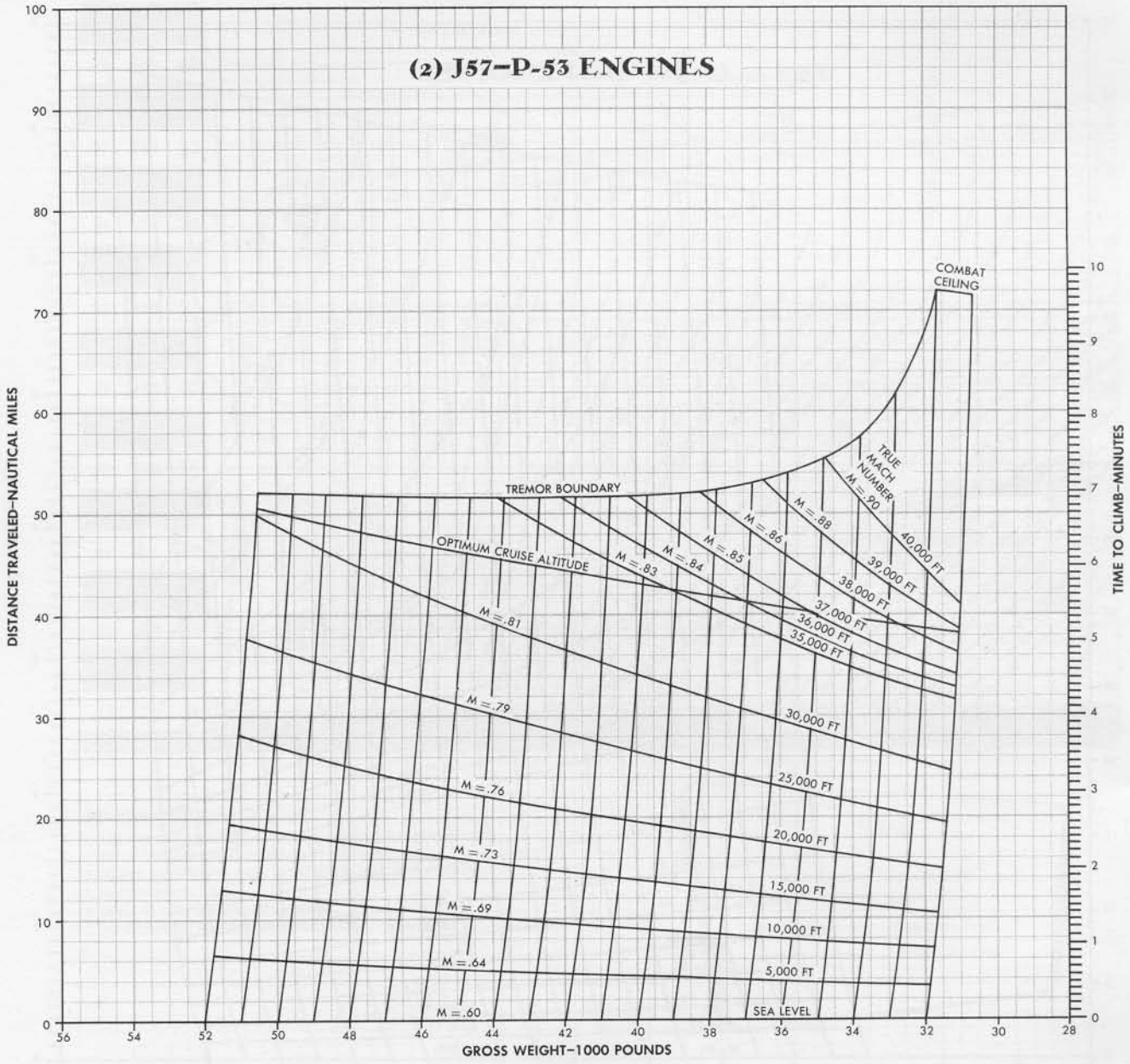
NOTE

TO OBTAIN TOTAL FUEL, TIME AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



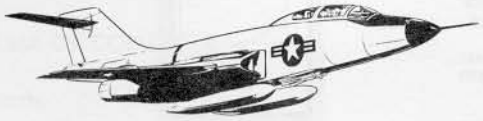
FB33-P305A

Figure A3-11

MAXIMUM THRUST CLIMB

AIRPLANE CONFIGURATION

F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS

ICAO STANDARD DAY
MINIMUM CLIMB SPEED = 275 KNOTS CAS

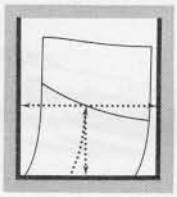
PRE-CLIMB REQUIREMENTS:

1. MAXIMUM THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED = 1415 LBS. FUEL; 1.1 MINUTES; 4 MILES.

NOTE

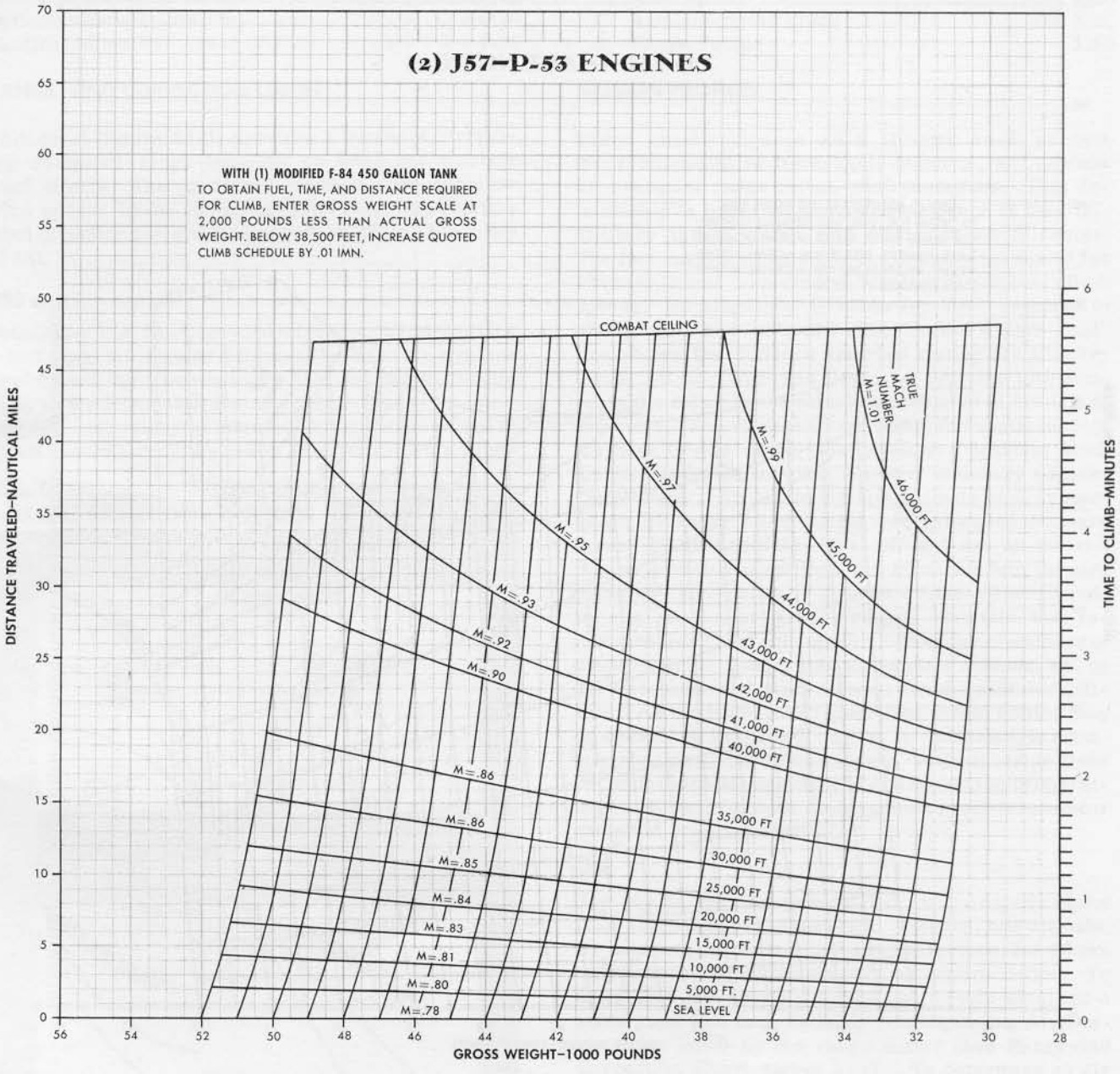
TO OBTAIN TOTAL FUEL, TIME AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P306A

Figure A3-12

MILITARY THRUST CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

REMARKS

ICAO STANDARD DAY
MINIMUM CLIMB SPEED=275 KNOTS CAS

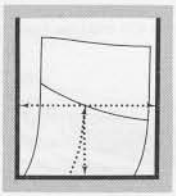
PRE-CLIMB REQUIREMENTS:

1. MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED = 550 LBS. FUEL; 2.0 MINUTES; 4 MILES.
2. MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED =870 LBS. FUEL; 1.5 MINUTES; 5 MILES.

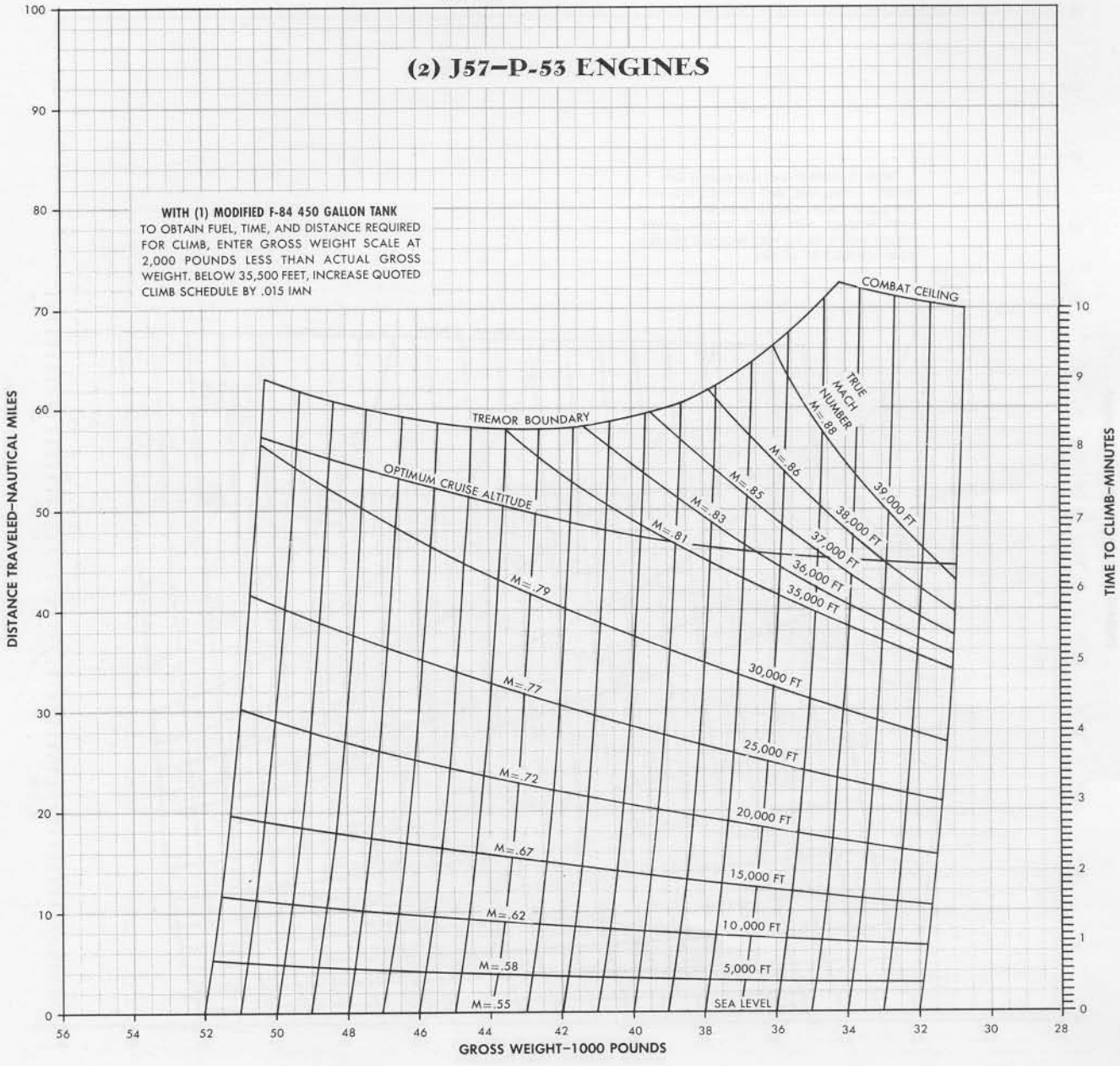
NOTE

TO OBTAIN TOTAL FUEL, TIME AND DISTANCE FROM BRAKE RELEASE TO CRUISE ALTITUDE, ADD RESPECTIVE PRE-CLIMB REQUIREMENTS TO CHART VALUES COMPUTED FROM TAKE-OFF PRESSURE ALTITUDE.

GUIDE



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P307A

Figure A3-13

Part 4 Range

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Charts

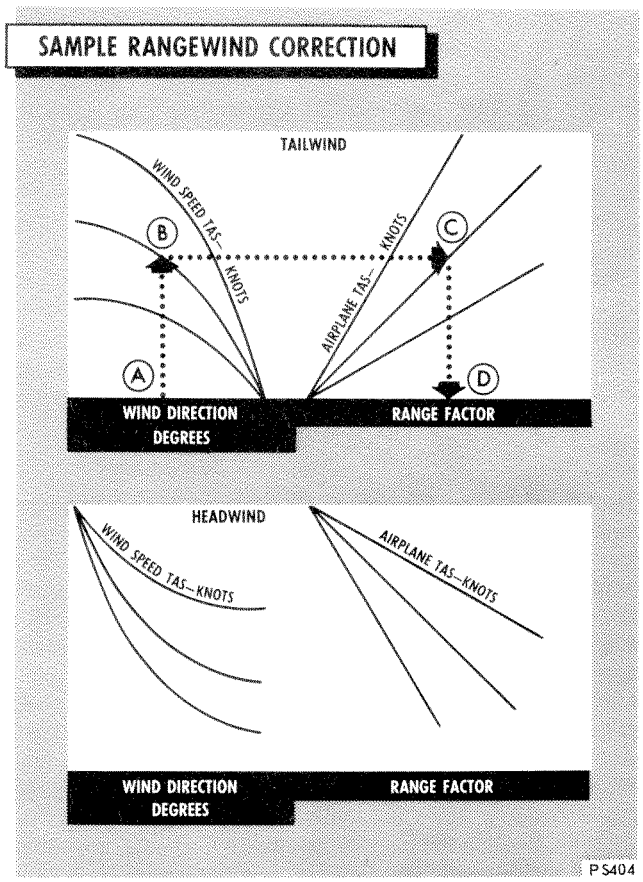
Rangewind Correction. A4-7
Mission Profiles A4-8
Intercept Mission Profiles A4-14
Optimum Return Profiles A4-20
Nautical Miles Per Pound of Fuel A4-26

RANGEWIND CORRECTION CHART

This chart (figure A4-1) provides a means of correcting computed range (specific or total) for existing wind effects. The presented range factors consider wind speeds up to 150 knots (TAS) from any relative wind direction for airplane speeds of 200 to 1300 knots (TAS).

USE

Determine the relative wind direction by measuring (clockwise) the angular difference between the airplane heading and the true wind direction and proceed vertically to the interpolated wind speed. From this point, project horizontally to intersect the airplane true airspeed and reflect to the lower scale to read the range factor. Multiply computed range by this range factor to find range as effected by wind.



SAMPLE PROBLEM

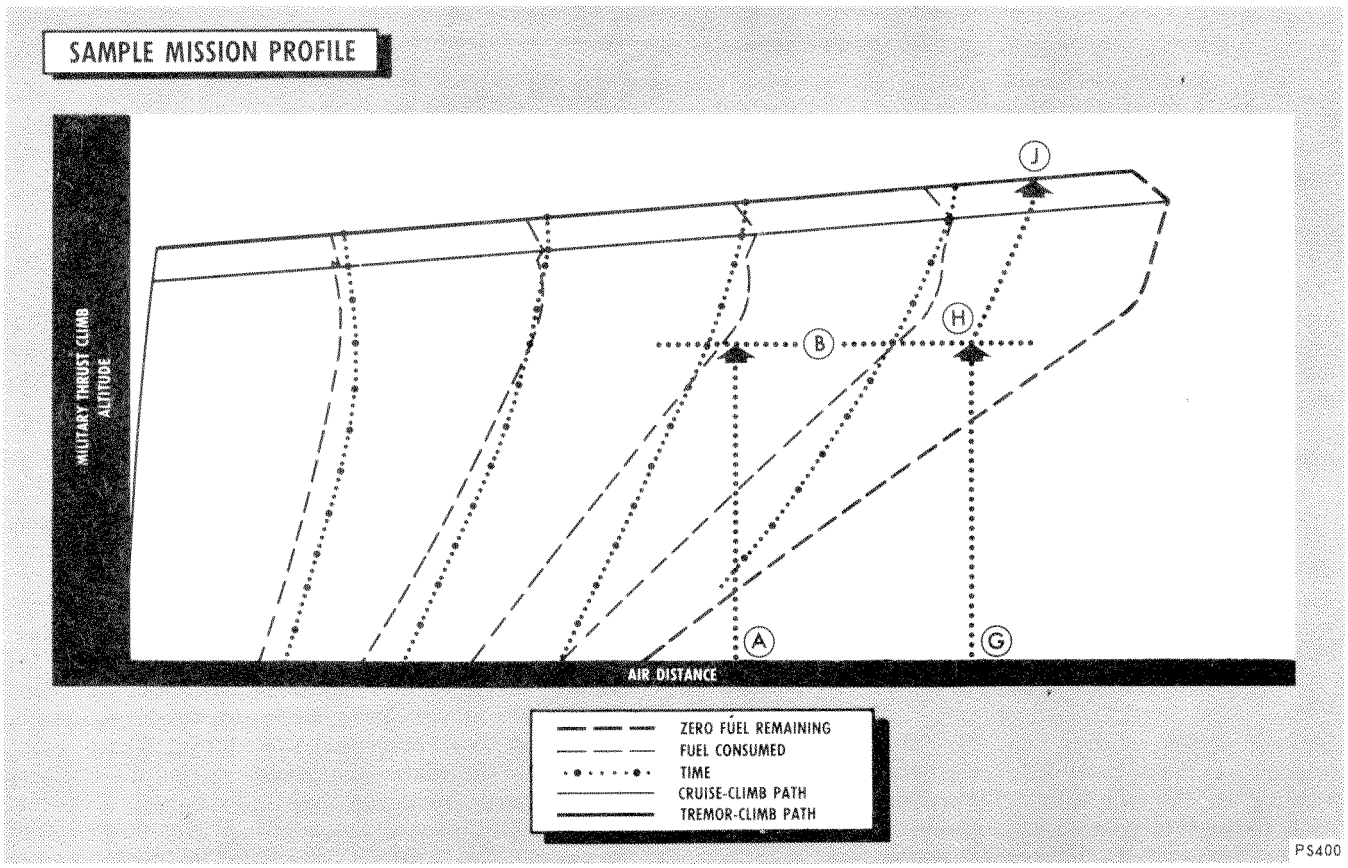
A.	Relative Wind Direction	150°
B.	Wind Speed (TAS)	125 Kts.
C.	Airplane Speed (TAS)	400 Kts.
D.	Range Factor	1.25

MISSION PROFILES

These charts (figures A4-2 through A4-6) present the relationship of time, fuel, distance, and altitude to maximum range for no-wind conditions. This relationship is based on a mission sequence of take-off, Military thrust climb, and maximum range cruise. The fuel curves include a fuel allowance (as noted) for Military thrust take-off and acceleration to best climb speeds. No allowance is made for time required to start, taxi, and take-off. The "Initial Climb Path" line shows the distance traveled during the Military thrust climb from sea level to cruising altitudes, using the climb speed schedule tabulated at the left of the chart. The "Initial Climb Path" line continues into the best cruise-climb path based on a constant Mach number and also into the "Tremor Boundary Cruise-Climb Path". To obtain the approximate best cruise-climb altitude, climb at the recommended Military thrust climb schedule, level off and set up the recommended thrust settings and Mach number; the airplane will automatically seek the cruise-climb altitude for its particular gross weight. Maintain the recommended thrust settings throughout the remainder of cruise-climb. For cruise at constant altitude, set up the recommended Mach number for the selected altitude. As the flight progresses, the thrust setting may be decreased gradually, as fuel is consumed, to maintain recommended Mach number. A Cruise table gives recommended Mach numbers and approximate operating conditions for both cruise-climb procedure and for cruise at constant altitude.

USE

The charts may be entered with one or more of the four range factors; time, fuel, distance, and altitude. By entering the chart with the known factors, the others may readily be determined for a no-wind condition. To determine the actual distance flown (with wind) for a given time and fuel, multiply corresponding Air Distance (no wind) by the range factor (see Rangewind Correction Chart, figure A4-1). To determine an air distance (without wind) equivalent to desired distance (with wind) and the corresponding time and fuel required, divide the desired distance (with wind) by the range factor. Fuel and time relationships, as read on the profile for Air Distance (no wind), are applicable to any wind condition.



SAMPLE PROBLEM

Configuration: Primary Armament +(2) 450 Gallon Tanks Retained; J57-P-55 Engines

A.	Desired Distance (Nautical Miles)	1200 Miles
B.	Cruise Altitude	30,000 Ft.
C.	Tabular Cruise Speed	460 Kts.
D.	Relative Wind Direction	40°
E.	Wind Speed	50 Kts.
F.	Range Factor (Rangewind Correction Chart)	.915
G.	Equivalent Air Distance Without Wind (A. ÷ F.)	1,311 Miles
H.	Fuel Required	16,600 Lbs.
J.	Time Required	2 Hrs. 52 Mins.
K.	Cruise Mach Number	.78
L.	Cruise EPR (Initial - Final)	2.20 - 1.87

Note

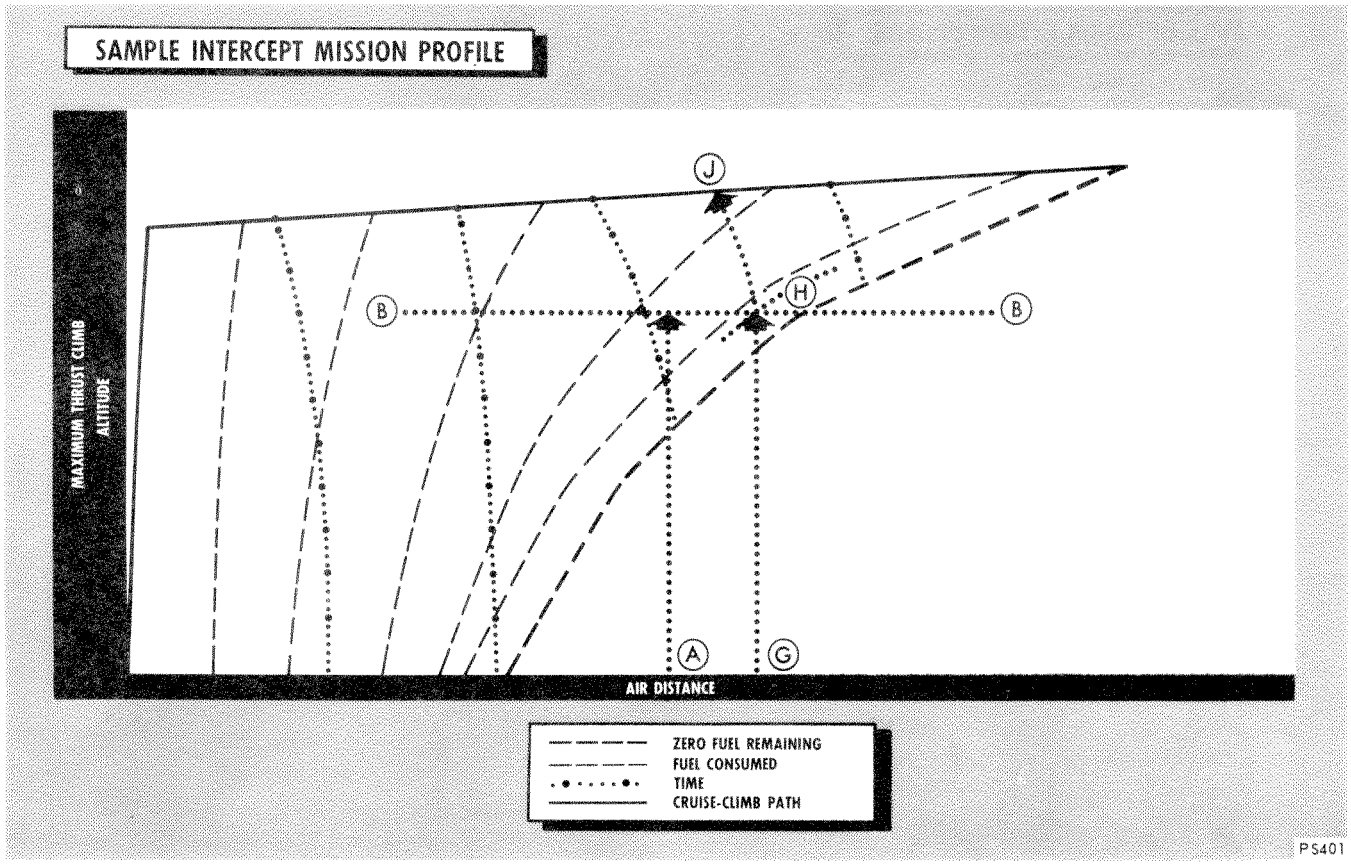
- When tanks are dropped when empty, it is advisable to apply wind corrections to the two legs of the mission separately.
- Steps C., K., and L. are found on the Cruise Table.

INTERCEPT MISSION PROFILES

These charts (figures A4-7 through A4-9) present the relationship of the minimum time to distance, fuel and altitude considering no-wind effects. This relationship is based on a mission sequence of Maximum thrust take-off, Maximum thrust climb, and full normal thrust cruise. The fuel curves include a fuel allowance of 1558 lbs. for start, taxi, Maximum thrust take-off, and acceleration to climb speeds. The "Initial Climb Path" line shows the distance traveled during the Maximum thrust climb from sea level to cruising altitude, using the climb speed schedule tabulated at the left of the chart. The continuation of the initial climb path is the cruise-climb path based on full normal thrust Mach number at absolute ceiling. A cruise table gives Mach numbers and approximate operating conditions for both cruise-climb procedure and for cruise at constant altitude.

USE

The charts may be entered with one or more of the four range factors; time, fuel, distance, and altitude. By entering the chart with the known factors, the others may readily be determined for a no-wind condition. To determine the actual distance flown (with wind) for a given time and fuel, multiply corresponding Air Distance (no wind) by the range factor (see Rangewind Correction Chart, figure A4-1). To determine an air distance (without wind) equivalent to desired distance (with wind) and the corresponding time and fuel required, divide the desired distance (with wind) by the range factor. Fuel and time relationships, as read on the profile for Air Distance (no wind), are applicable to any wind condition.



SAMPLE PROBLEM

Configuration: Primary Armament +(2) 450 Gallon Tanks Retained.

A.	Desired Distance (Nautical Miles)	800 Miles
B.	Cruise Altitude	35,000 Ft.
C.	Tabular Cruise Speed (TAS)	519 Kts.
D.	Relative Wind Direction	40°
E.	Wind Speed	50 Kts.
F.	Range Factor (Rangewind Correction Chart)	.925
G.	Equivalent Air Distance Without Wind (A. ÷ F.)	865 Miles
H.	Fuel Required	15,820 Lbs.
J.	Time Required	1 Hr. 39 Mins.
K.	Cruise Mach Number	.90
L.	Cruise EPR (Initial - Final)	2.62 - 2.57

Note

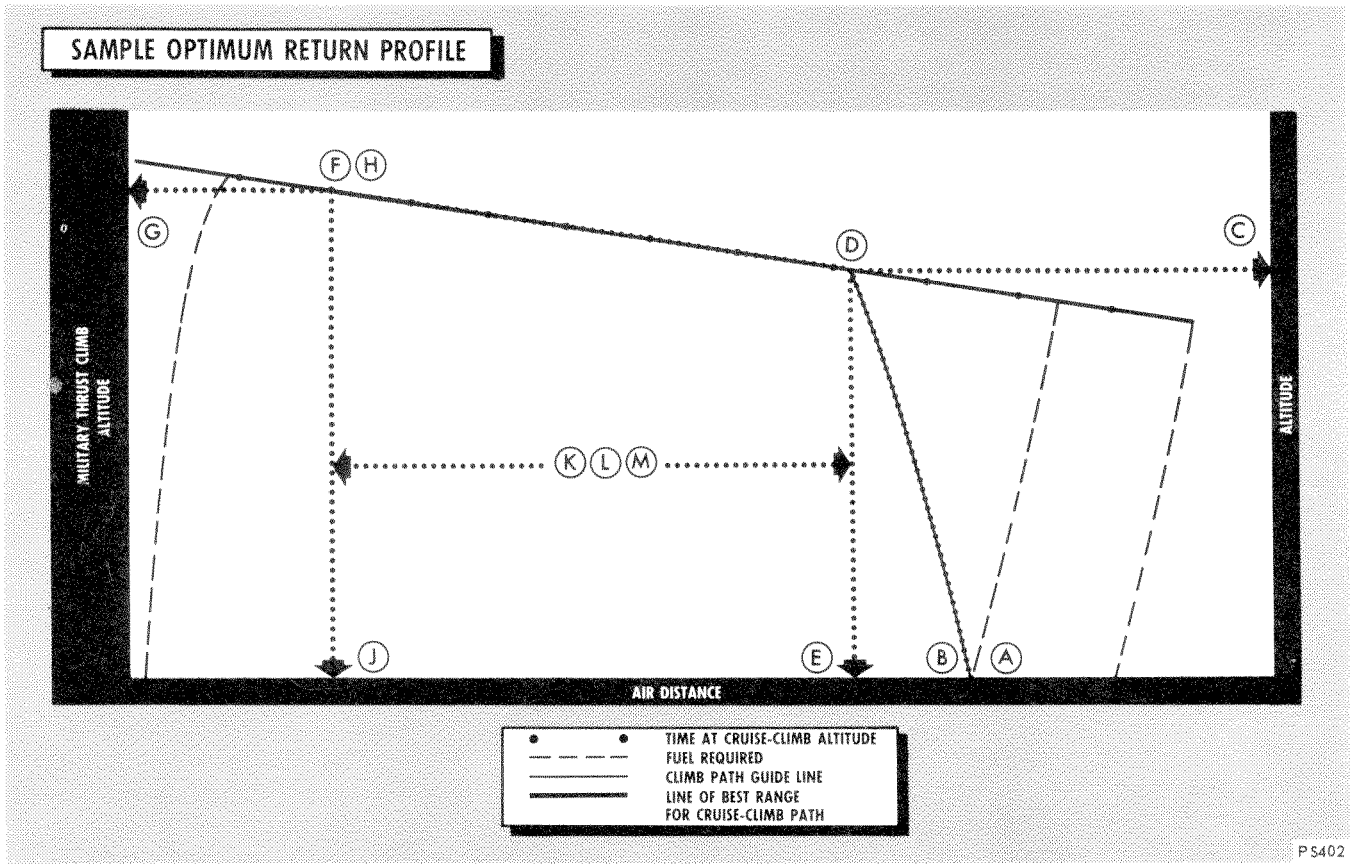
- When empty tanks are dropped, it is advisable to apply wind corrections to the two legs of the mission separately.
- Steps C., K., and L. are found on the Cruise Table of the applicable profile.

OPTIMUM RETURN PROFILES

These profiles (figures A4-10 and A4-13) show the minimum fuel required for maximum distance (no wind) based on an optimum flight path from any starting point within the range of the airplane configuration. The flight path required is indicated by different shaded areas and their related notes. The fuel curves are based on a Military thrust climb to, and recommended cruise at, the optimum altitude. The Military thrust climb speed schedule and recommended cruise thrust settings are tabulated on each chart. No reserve for descent and landing has been included. The time shown at the optimum altitude is cruise time only; it does not include the time required for the climb to optimum altitude or any allowance for descent, loiter, and landing.

USE

Enter the chart at the initial (recovery) altitude with either the fuel remaining (to determine the distance available) or with the distance to be flown (to determine the fuel required). From the initial point of recovery, parallel the climb path guide line to the intersection of the cruise-climb path. Follow the cruise-climb path to a point corresponding to desired distance or fuel reserve required. For recoveries with low fuel loads (within the shaded area), parallel the climb path guide line to the intersection of the constant altitude cruise line and maintain that altitude. The time required to fly the distance is the time at cruise altitude (obtained from graphical Military thrust climb chart). To obtain wind effect on range, refer to Rangewind Correction (figure A4-1).



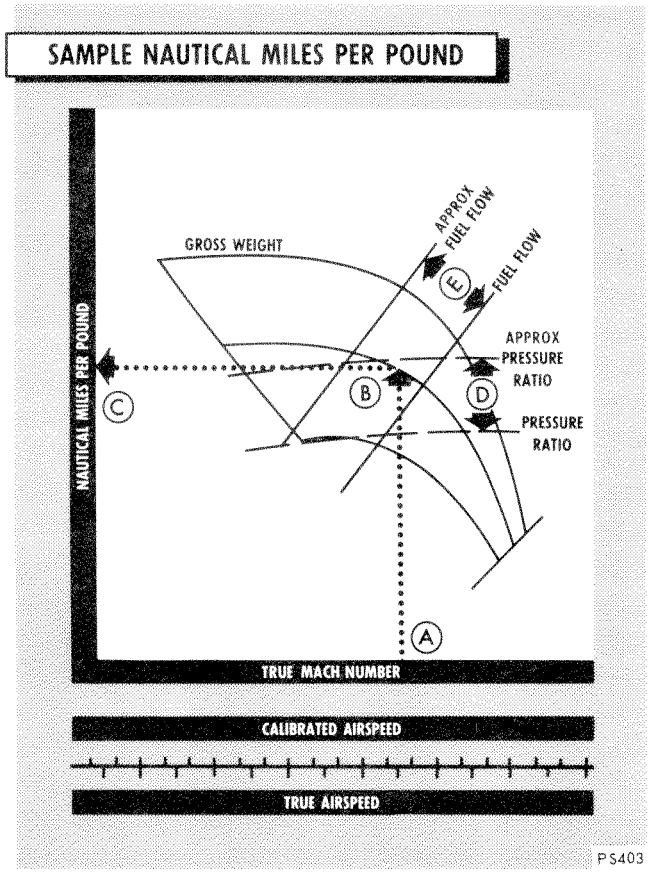
SAMPLE PROBLEM

Configuration: Primary Armament +(2) 450 Gallon Tanks

A.	Initial Fuel (At Sea Level)	16,000 Lbs.
B.	Maximum Range (Including Climb)	1,450 Miles
C.	Parallel Climb Guide Line to Cruise-Climb Path	32,300 Ft.
D.	Maximum Cruise Time at Optimum Altitude	3 Hrs. 0 Mins.
E.	Distance Corresponding to Cruise Time	1,400 Miles
F.	Follow Cruise-Climb Path Until Reserve Fuel Remaining is	2,000 Lbs.
G.	Altitude at End of Cruise	38,400 Ft.
H.	Time Corresponding to Fuel Reserve	29 Mins.
J.	Distance Corresponding to Fuel Reserve	225 Miles
K.	Net Optimum Cruise Time (D. - H.)	2 Hrs. 31 Mins.
L.	Net Optimum Cruise Distance (E. - J.)	1,175 Miles
M.	Net Optimum Range (Including Climb Distance) (B. - J.)	1,225 Miles
N.	Average TAS (L. ÷ K.)	470 Kts.
P.	Relative Wind Direction	O°
Q.	Wind Speed	60 Kts.
R.	Range Factor (Rangewind Correction Chart)	.86
S.	Total Net Range with Headwind (Including Climb) (R. x M.)	1,054 Miles

NAUTICAL MILES PER POUND OF FUEL GRAPHS

The Nautical Miles per Pound of Fuel charts (figures A4-14 through A4-37) graphically present cruise data throughout the speed range from maximum endurance to Military thrust. Several weights for each configuration and operating condition (emergency single-engine and normal two-engine operation) are given at altitudes of sea level, 5,000, 15,000, 25,000, 30,000, 35,000, 40,000 and 45,000 feet. Each chart includes specific range (nautical miles per pound), fuel flow, and thrust settings (pressure ratio). Also included are curves of recommended cruise Mach number, maximum endurance, and Military thrust. Specific range is plotted vs. Mach number, with subscales of calibrated airspeed (CAS) and true airspeed (TAS). The "With Tanks" charts denote a method of adjusting the existing data to be compatible with the "One-Tank" configuration.



USE

Enter the chart at the desired Mach number and proceed vertically to the gross weight curve. Proceed to the left scale and read the nautical miles per pound. At the intersection of Mach number and gross weight, interpolate thrust setting and fuel flow.

SAMPLE PROBLEM

Configuration: Primary Armament +(2) 450 Gallon Tanks (35,000 Feet)

A. Mach Number	.80
B. Gross Weight	40,000 Lbs.
C. Nautical Miles Per Pound (Specific Range)	.093
D. Thrust Setting	2.23 P.R.
E. Fuel Flow	2,475 PPH

SPECIFIC RANGE

The number of nautical miles per pound of fuel does not vary with ambient temperature for a given Mach number, pressure altitude and engine pressure ratio. As can be seen from the table below, for a change in ambient temperature, the true airspeed and fuel flow increase or decrease proportionately. Since specific range is the ratio of true airspeed to fuel flow, the specific range remains constant.

PRIMARY ARMAMENT + (2) 450 GALLON TANKS
GROSS WEIGHT = 40,000 POUNDS

	MACH NUMBER	ALTITUDE	PRESSURE RATIO	TRUE AIRSPEED KNOTS	FUEL FLOW LB/HR	SPECIFIC RANGE
ICAO STANDARD DAY −66°F	.80	35,000 FT	2.23	459	4950	.093
ANA HOT DAY −37°F	.80	35,000 FT	2.23	479	5140	.093
ANA COLD DAY −85°F	.80	35,000 FT	2.23	451	4850	.093
ICAO STANDARD DAY −66°F	.90	35,000 FT	2.56	518	7000	.074
ANA HOT DAY −37°F	.90	35,000 FT	2.56	538	7280	.074
ANA COLD DAY −85°F	.90	35,000 FT	2.56	507	6850	.074

FB33-P4118

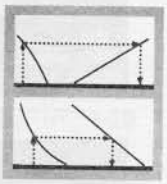
RANGEWIND CORRECTION

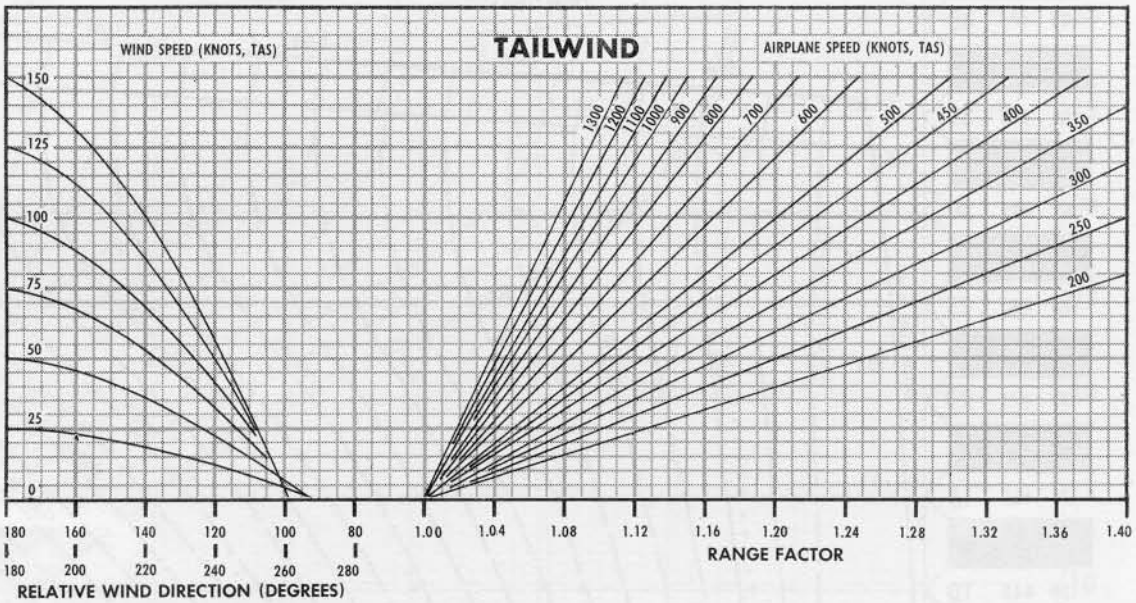
AIRPLANE CONFIGURATION

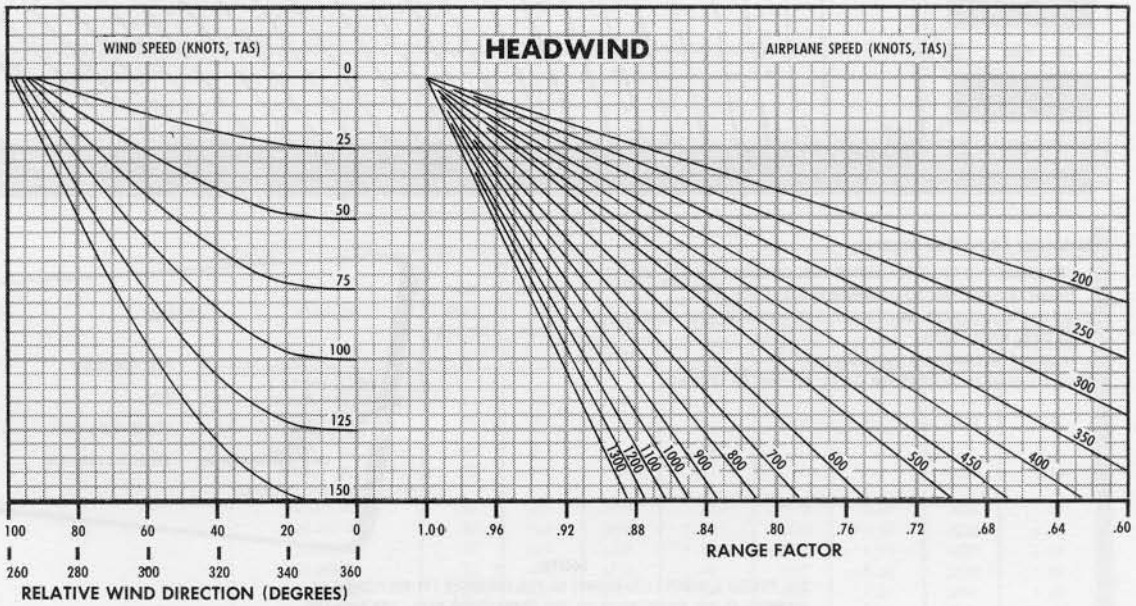
F-101B OR F-101F: ALL CONFIGURATIONS

NOTE: RELATIVE WIND DIRECTION = ANGULAR DIFFERENCE, MEASURED CLOCKWISE, BETWEEN AIRPLANE HEADING AND TRUE WIND DIRECTION

GUIDE





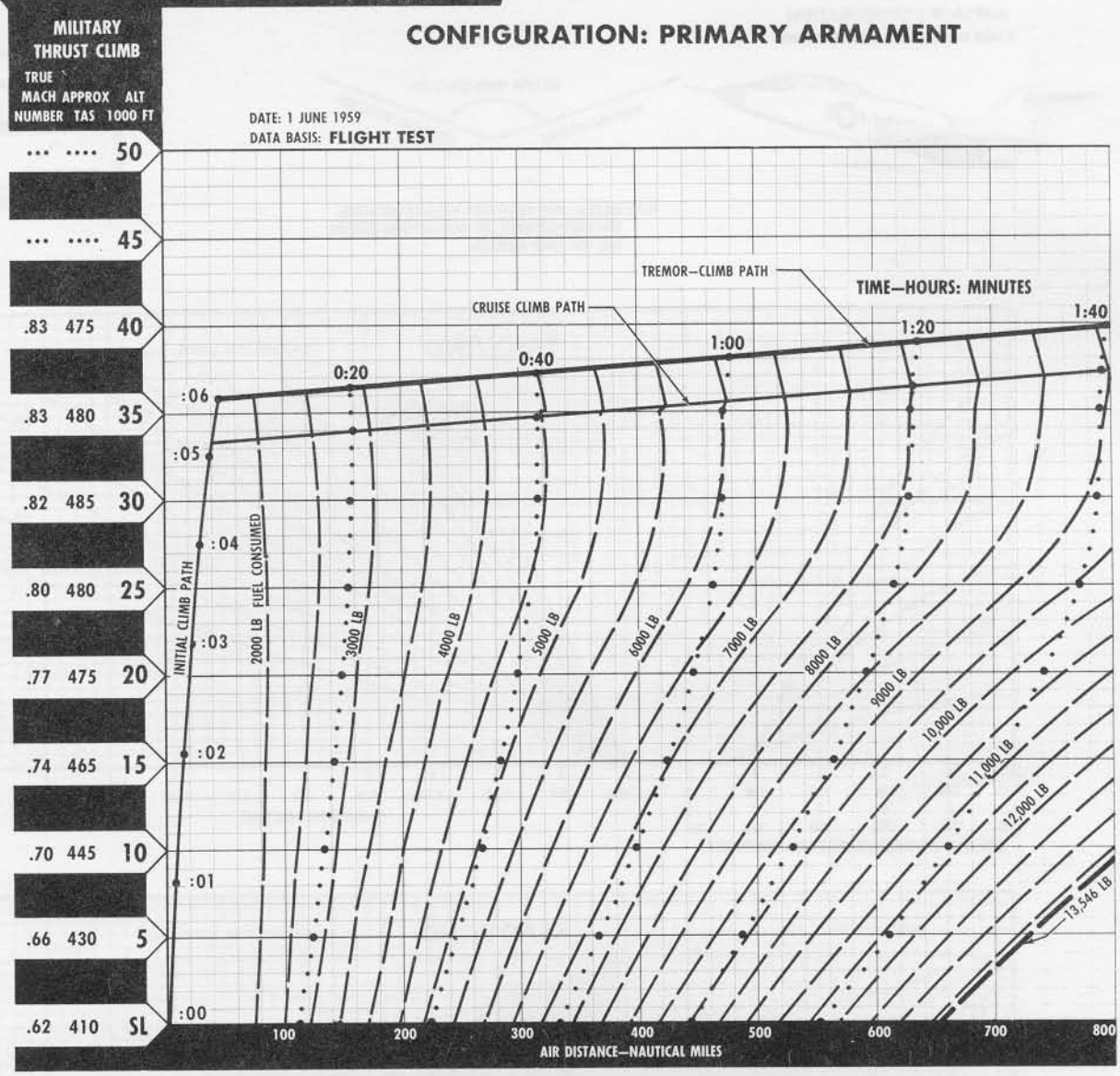


FB33-P4124

Figure 4-1

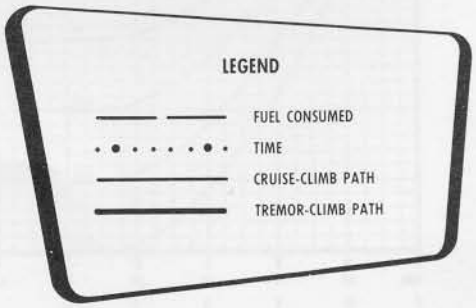
MISSION PROFILE

CONFIGURATION: PRIMARY ARMAMENT



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED– 460 POUNDS CONSUMED DURING MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED.
2. NO TIME ALLOWANCE INCLUDED PRIOR TO ATTAINING BEST CLIMB SPEED.
3. MILITARY THRUST CLIMB.
4. CRUISE AT RECOMMENDED MACH NUMBER.
5. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.



NOTE:

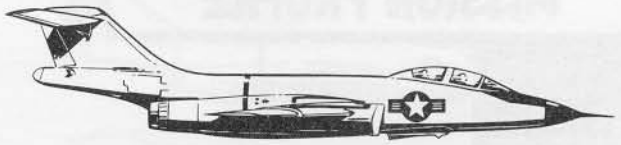
THIS PROFILE ASSUMES 1570 POUNDS OF FUEL CONSUMED (11,976 POUNDS REMAINING) AT THE INTERCEPTION OF THE CRUISE-CLIMB PATH. FOR EACH 100 POUND DEVIATION AT THIS POINT, THE CORRESPONDING EFFECT ON RANGE (NO WIND) IS APPROXIMATELY 9 NAUTICAL MILES.
SEE RANGEWIND CORRECTION CHART FOR WIND EFFECTS ON RANGE.

FB33-P400C-1

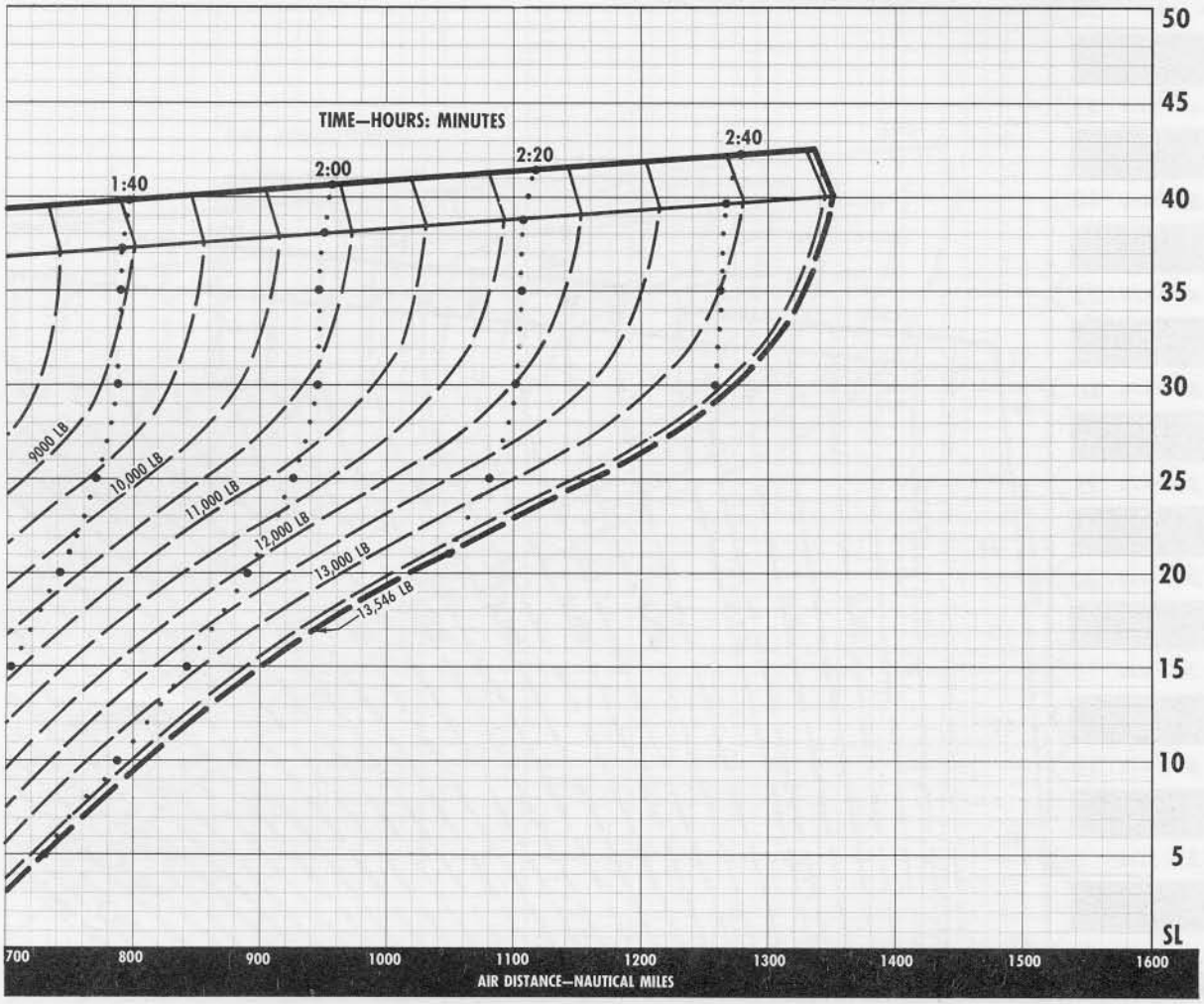
Figure A4-2

MODEL: F-101B OR F-101F

ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 45,461 LB



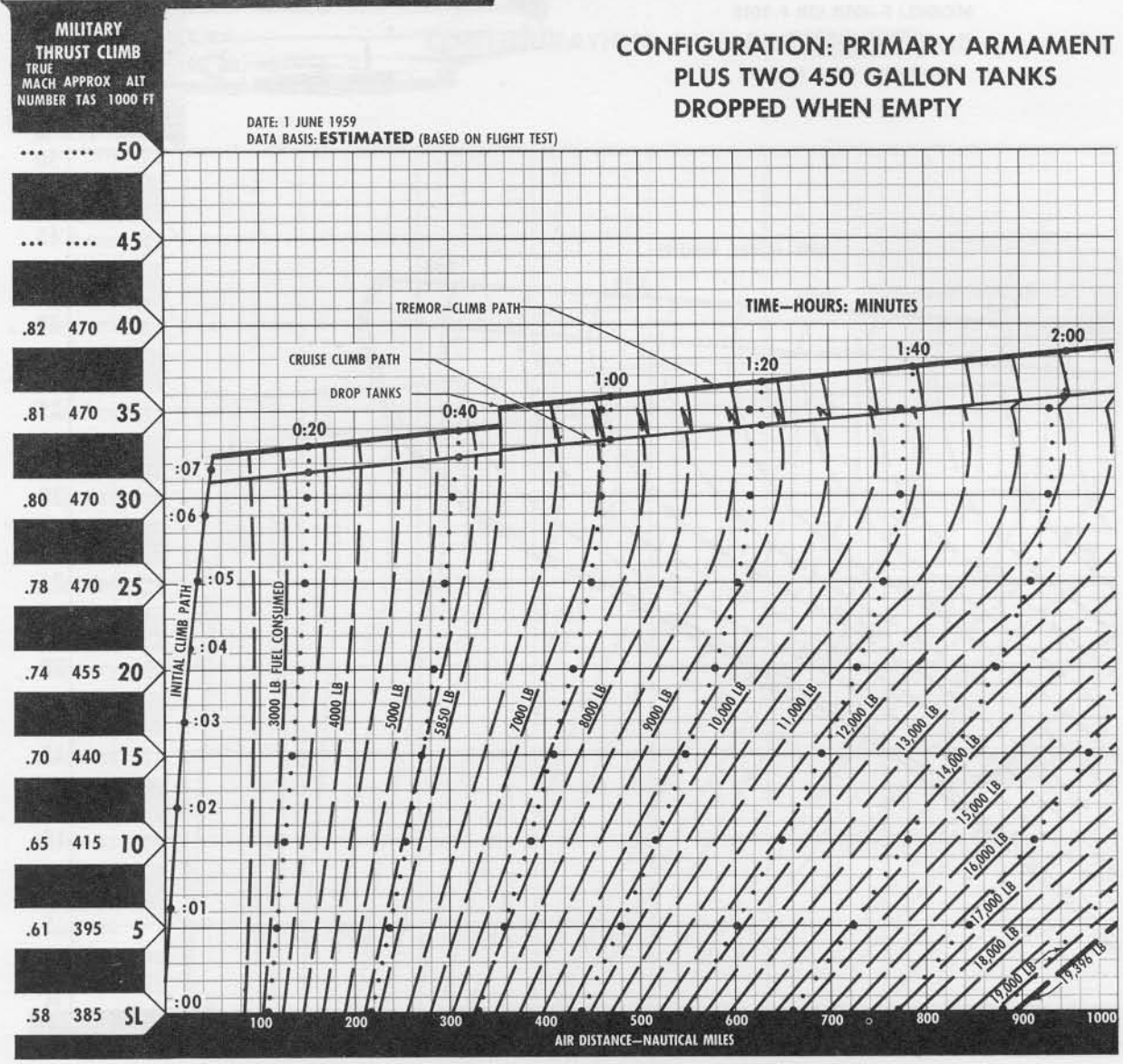
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.



CRUISE—PRIMARY ARMAMENT								
ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB		ONE-HALF FUEL LOAD 6773 LB		EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
TREMOR—CLIMB								
INITIAL— 35,850 FT.	.84	482	5183	2.31	-	-	-	-
FINAL— 42,600 FT.	.84	482	-	-	-	-	3763	2.31
CRUISE-CLIMB								
INITIAL— 33,400 FT.	.83	482	5150	2.15	-	-	-	-
FINAL— 40,100 FT.	.83	476	-	-	-	-	3679	2.14
CONSTANT ALTITUDE CRUISE								
35,000 FT	.82	473	5070	2.21	4475	2.09	3855	1.92
30,000 FT	.80	473	5091	1.97	4660	1.87	4223	1.77
25,000 FT	.77	463	5409	1.80	5055	1.73	4729	1.67
20,000 FT	.72	444	5873	1.70	5557	1.65	5248	1.59
15,000 FT	.67	422	6317	1.59	6029	1.55	5741	1.50
10,000 FT	.62	396	6622	1.49	6346	1.46	6074	1.42
5,000 FT	.56	365	6900	1.41	6588	1.37	6271	1.34
SEA LEVEL	.50	332	7064	1.33	6734	1.30	6409	1.27

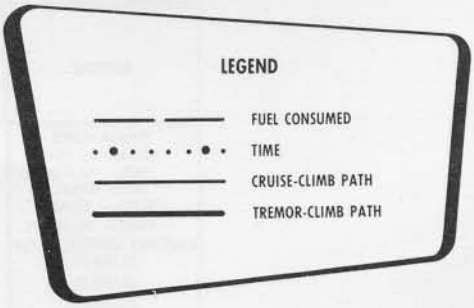
FB33-P400C-2

MISSION PROFILE



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED– 550 POUNDS CONSUMED DURING MILITARY THRUST TAKE- OFF AND ACCELERATION TO BEST CLIMB SPEED.
2. NO TIME ALLOWANCE INCLUDED PRIOR TO ATTAINING BEST CLIMB SPEED.
3. MILITARY THRUST CLIMB.
4. CRUISE AT RECOMMENDED MACH NUMBER.
5. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.



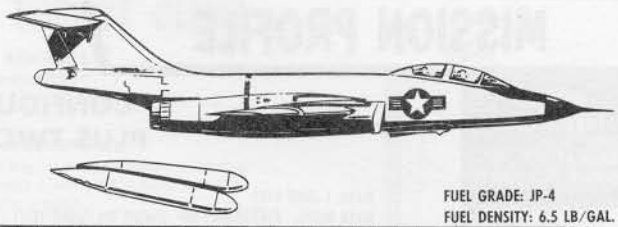
NOTE:

THIS PROFILE ASSUMES 1910 POUNDS OF FUEL CONSUMED (17,486 POUNDS REMAINING) AT THE INTERCEPTION OF THE CRUISE-CLIMB PATH. FOR EACH 100 POUND DEVIATION AT THIS POINT, THE CORRESPONDING EFFECT ON RANGE (NO WIND) IS APPROXIMATELY 7 NAUTICAL MILES.
SEE RANGEWIND CORRECTION CHART FOR WIND EFFECTS ON RANGE.

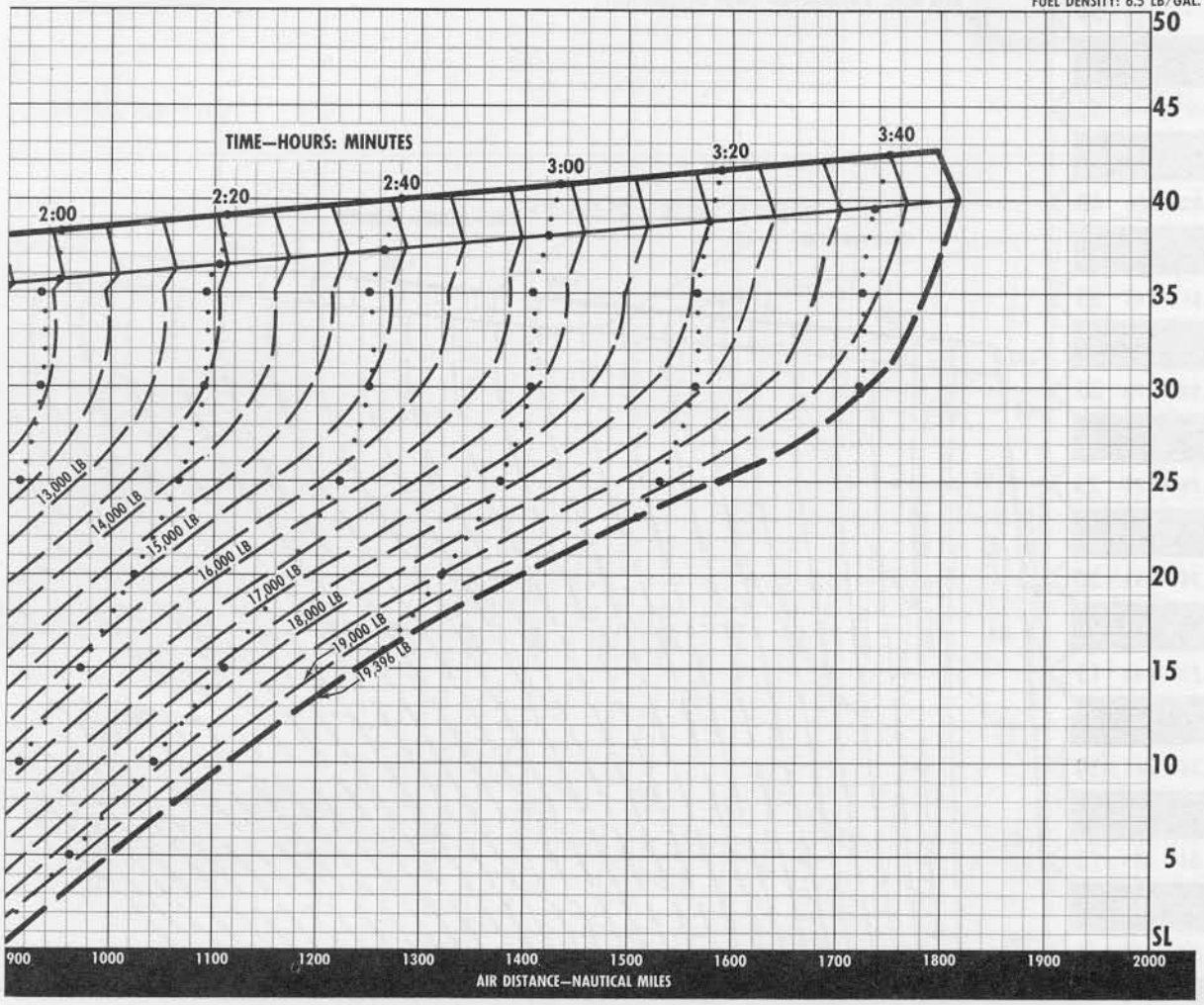
FB33-P401C -1

Figure A4-3

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB



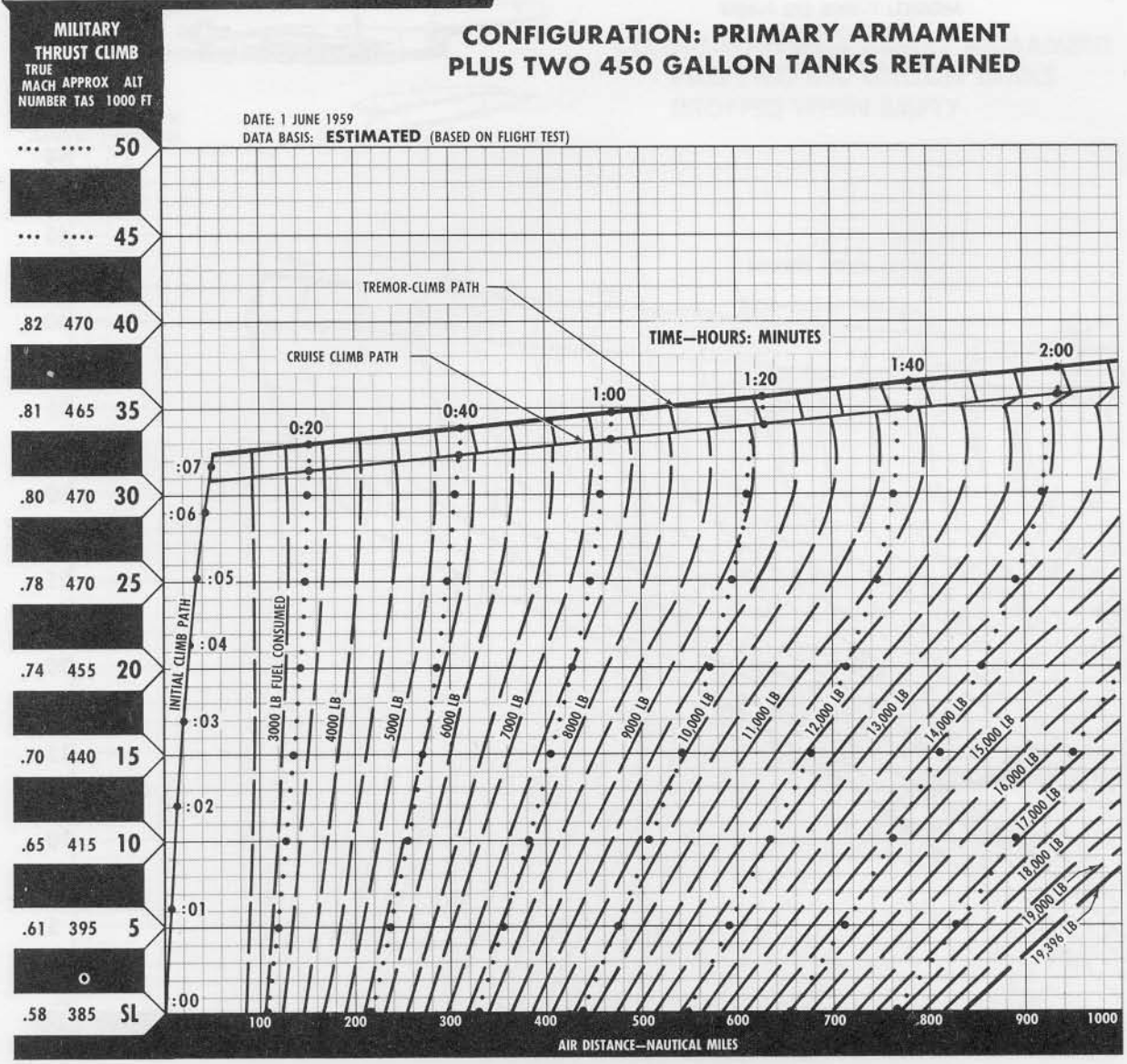
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.



CRUISE—(2) 450 GALLON TANKS					CRUISE—PRIMARY ARMAMENT					
ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB		TRUE MACH NUMBER	APPROX TAS KNOTS	MAXIMUM INTERNAL FUEL LOAD 13,546 LB		EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
TREMOR—CLIMB										
INITIAL— 32,500 FT.	.82	475	6258	2.36	.84	482	-	-	-	-
FINAL— 42,600 FT.	.82	467	-	-	.84	482	-	-	3763	2.31
CRUISE-CLIMB										
INITIAL— 30,900 FT.	.81	474	6237	2.26	.83	482	-	-	-	-
FINAL— 40,100 FT.	.81	463	-	-	.83	476	-	-	3679	2.14
CONSTANT ALTITUDE CRUISE										
35,000 FT	.80	460	-	-	.82	473	5291	2.29	3855	1.92
30,000 FT	.78	460	6133	2.20	.80	473	5244	2.01	4223	1.77
25,000 FT	.74	447	6340	2.00	.77	463	5512	1.82	4729	1.67
20,000 FT	.70	429	6724	1.84	.72	444	5936	1.71	5248	1.59
15,000 FT	.65	406	7098	1.72	.67	422	6384	1.60	5741	1.50
10,000 FT	.60	381	7398	1.61	.62	396	6689	1.50	6074	1.42
5,000 FT	.55	355	7717	1.52	.56	365	6926	1.41	6271	1.34
SEA LEVEL	.50	327	7976	1.44	.50	332	7079	1.33	6409	1.27

FB33-P401C-2

MISSION PROFILE



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED— 550 POUNDS CONSUMED DURING MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED.
2. NO TIME ALLOWANCE INCLUDED PRIOR TO ATTAINING BEST CLIMB SPEED.
3. MILITARY THRUST CLIMB.
4. CRUISE AT RECOMMENDED MACH NUMBER.
5. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.

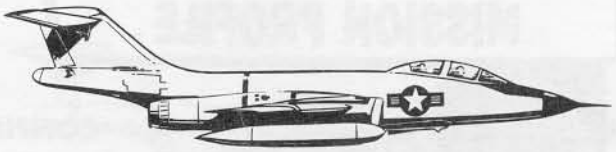
NOTE:

THIS PROFILE ASSUMES 1910 POUNDS OF FUEL CONSUMED (17,486 POUNDS REMAINING) AT THE INTERCEPTION OF THE CRUISE-CLIMB PATH. FOR EACH 100 POUND DEVIATION AT THIS POINT, THE CORRESPONDING EFFECT ON RANGE (NO WIND) IS APPROXIMATELY 7 NAUTICAL MILES.
SEE RANGEWIND CORRECTION CHART FOR WIND EFFECTS ON RANGE.

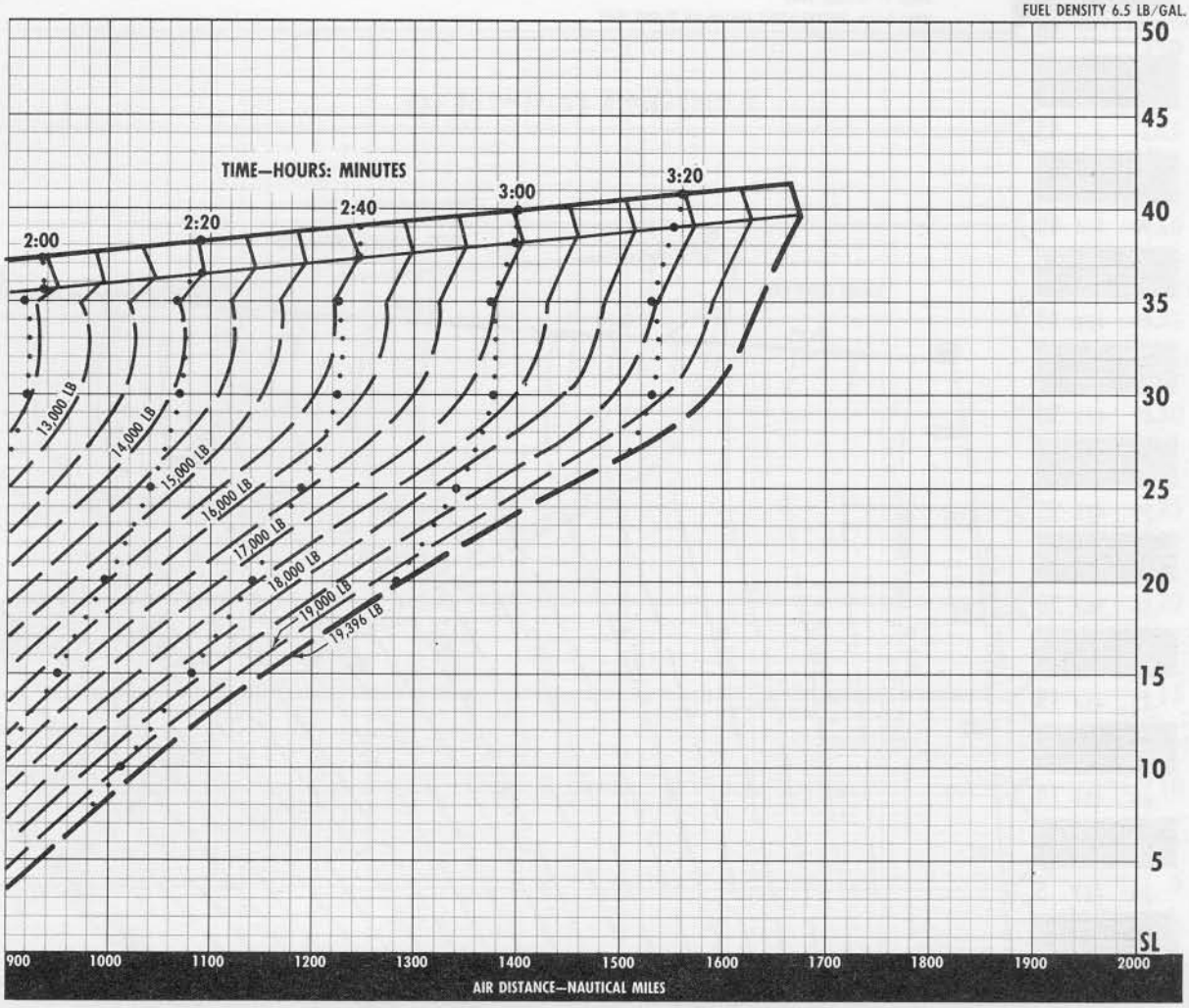
FB33-P402C-1

Figure A4-4

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB



FUEL GRADE: JP-4
FUEL DENSITY 6.5 LB/GAL.

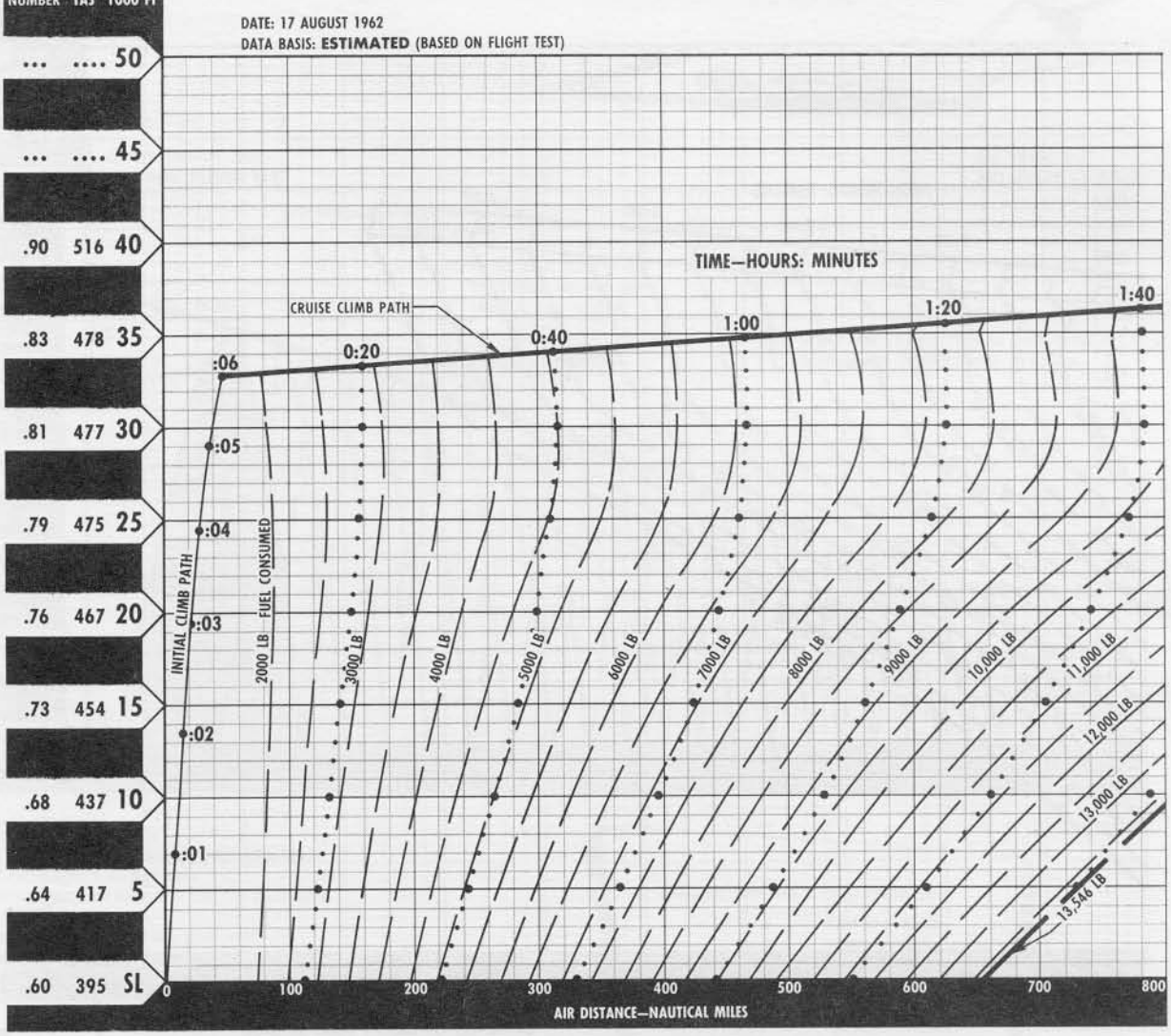


CRUISE—(2) 450 GALLON TANKS RETAINED								
ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB		ONE-HALF FUEL LOAD 9698 LB		EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUELFLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
TREMOR—CLIMB								
INITIAL— 32,500 FT.	.82	475	6258	2.36	-	-	-	-
FINAL— 41,300 FT.	.82	467	-	-	-	-	4047	2.35
CRUISE-CLIMB								
INITIAL— 30,900 FT.	.81	474	6237	2.26	-	-	-	-
FINAL— 39,800 FT.	.81	463	-	-	-	-	3998	2.25
CONSTANT ALTITUDE CRUISE								
35,000 FT	.80	460	-	-	5157	2.30	4148	2.03
30,000 FT	.78	460	6133	2.20	5287	2.04	4536	1.87
25,000 FT	.74	447	6340	2.00	5665	1.87	5126	1.77
20,000 FT	.70	429	6724	1.84	6129	1.74	5586	1.66
15,000 FT	.65	406	7098	1.72	6548	1.64	6060	1.57
10,000 FT	.60	381	7398	1.61	6865	1.54	6393	1.48
5,000 FT	.55	355	7717	1.52	7172	1.46	6673	1.40
SEA LEVEL	.50	327	7976	1.44	7415	1.38	6928	1.33

FB33-P402 C-2

MISSION PROFILE

CONFIGURATION: PRIMARY ARMAMENT



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED– 550 POUNDS CONSUMED DURING MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED.
2. NO TIME ALLOWANCE INCLUDED PRIOR TO ATTAINING BEST CLIMB SPEED.
3. MILITARY THRUST CLIMB.
4. CRUISE AT RECOMMENDED MACH NUMBER.
5. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.

LEGEND

FUEL CONSUMED

TIME

CRUISE CLIMB PATH

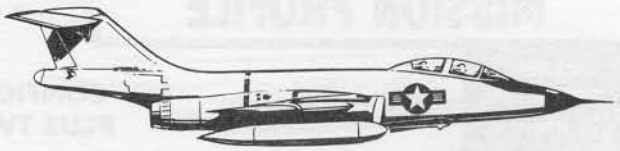
NOTE:

THIS PROFILE ASSUMES 1673 POUNDS OF FUEL CONSUMED (11,873 POUNDS REMAINING) AT THE INTERCEPTION OF THE CRUISE-CLIMB PATH. FOR EACH 100 POUND DEVIATION AT THIS POINT THE CORRESPONDING EFFECT ON RANGE (NO WIND) IS APPROXIMATELY 7 NAUTICAL MILES.
SEE RANGEWIND CORRECTION CHART FOR WIND EFFECTS ON RANGE.

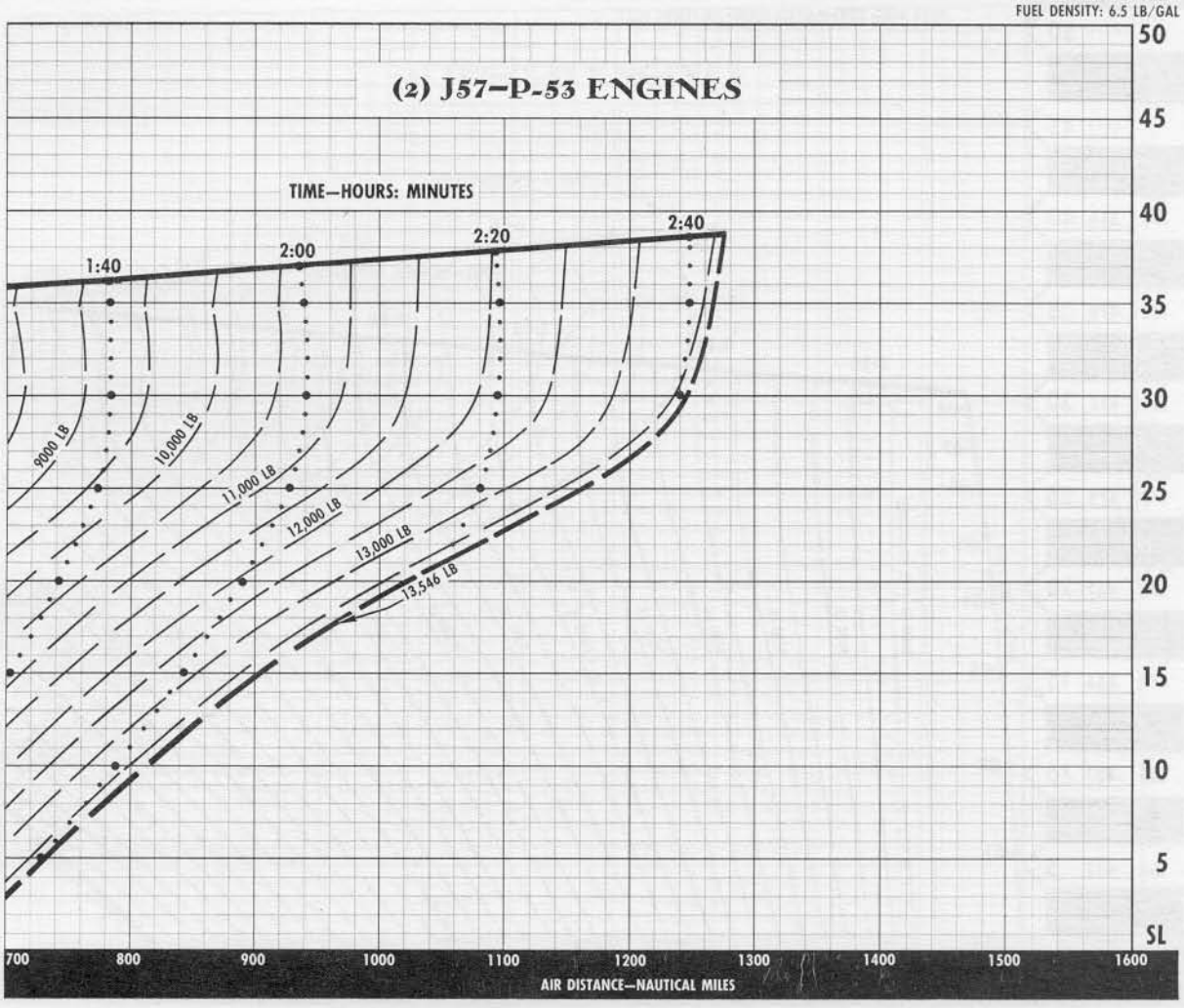
FB33-P4126-1

Figure A4-5

MODEL: F-101B OR F-101F
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT = 45,461 LB.



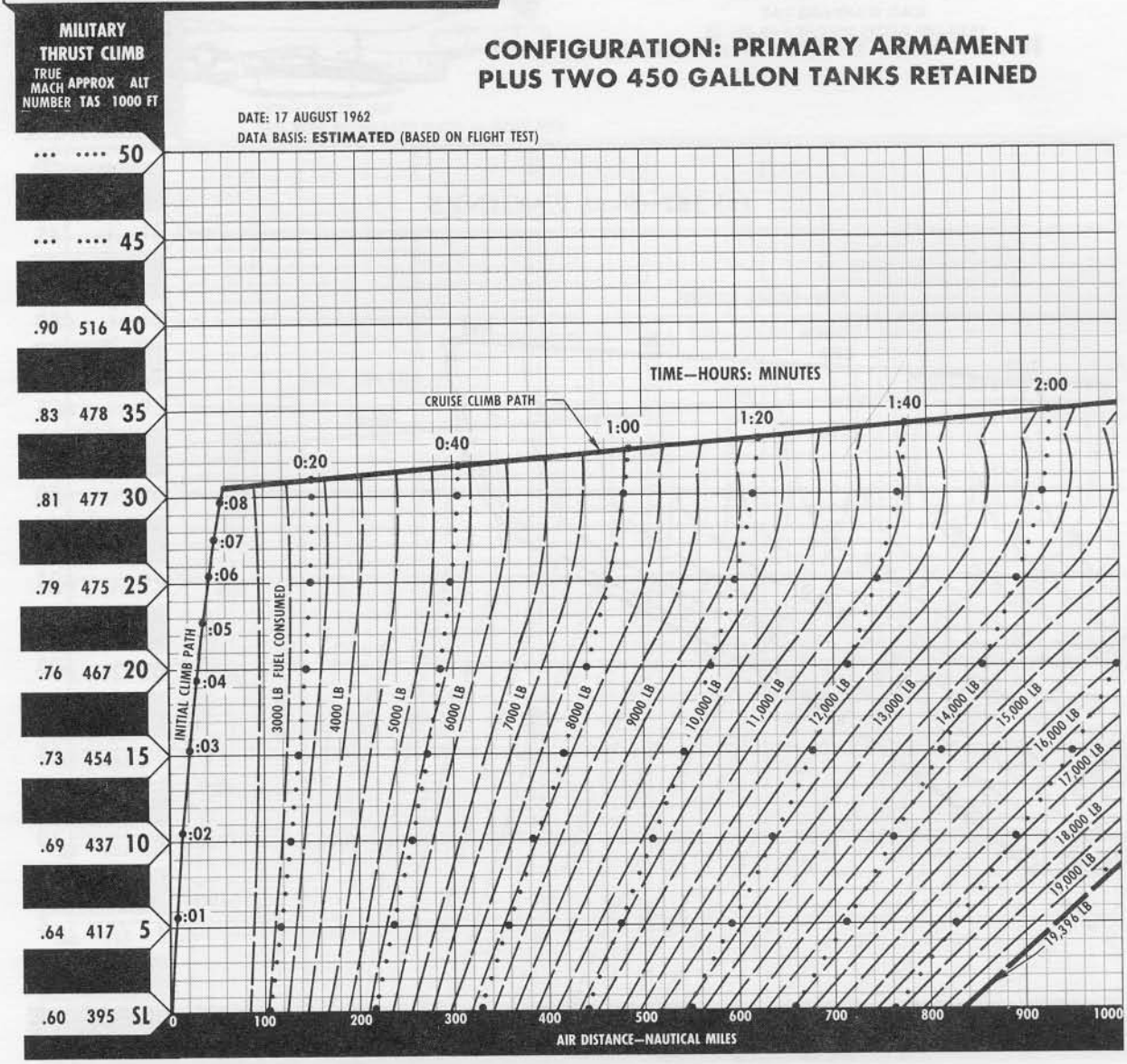
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



CRUISE–PRIMARY ARMAMENT								
ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB		ONE-HALF FUEL LOAD 6773 LB		EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUELFLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
CRUISE-CLIMB								
INITIAL– 32,800 FT.	.81	474	4946	2.17	-	-	-	-
FINAL– 38,700 FT.	.81	468	-	-	-	-	3437	2.04
CONSTANT ALTITUDE CRUISE								
35,000 FT	.81	465	-	-	4267	2.11	3676	1.91
30,000 FT	.79	465	4989	2.02	4567	1.90	4139	1.77
25,000 FT	.77	463	5409	1.82	5055	1.75	4729	1.66
20,000 FT	.72	444	5873	1.69	5557	1.63	5248	1.55
15,000 FT	.67	442	6317	1.58	6029	1.53	5741	1.46
10,000 FT	.62	396	6622	1.48	6346	1.44	6074	1.38
5,000 FT	.56	365	6900	1.40	6588	1.36	6271	1.30
SEA LEVEL	.50	332	7064	1.32	6734	1.28	6409	1.23

FB33-P4126-2A

MISSION PROFILE



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED—550 POUNDS CONSUMED DURING MILITARY THRUST TAKE-OFF AND ACCELERATION TO BEST CLIMB SPEED.
2. NO TIME ALLOWANCE INCLUDED PRIOR TO ATTAINING BEST CLIMB SPEED.
3. MILITARY THRUST CLIMB.
4. CRUISE AT RECOMMENDED MACH NUMBER.
5. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.

LEGEND

FUEL CONSUMED

TIME

CRUISE CLIMB PATH

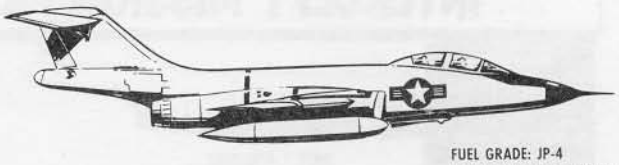
NOTE:

THIS PROFILE ASSUMES 2165 POUNDS OF FUEL CONSUMED (17,231 POUNDS REMAINING) AT THE INTERCEPTION OF THE CRUISE-CLIMB PATH. FOR EACH 100 POUND DEVIATION AT THIS POINT THE CORRESPONDING EFFECT ON RANGE (NO WIND) IS APPROXIMATELY 7 NAUTICAL MILES.
SEE RANGEWIND CORRECTION CHART FOR WIND EFFECTS ON RANGE.

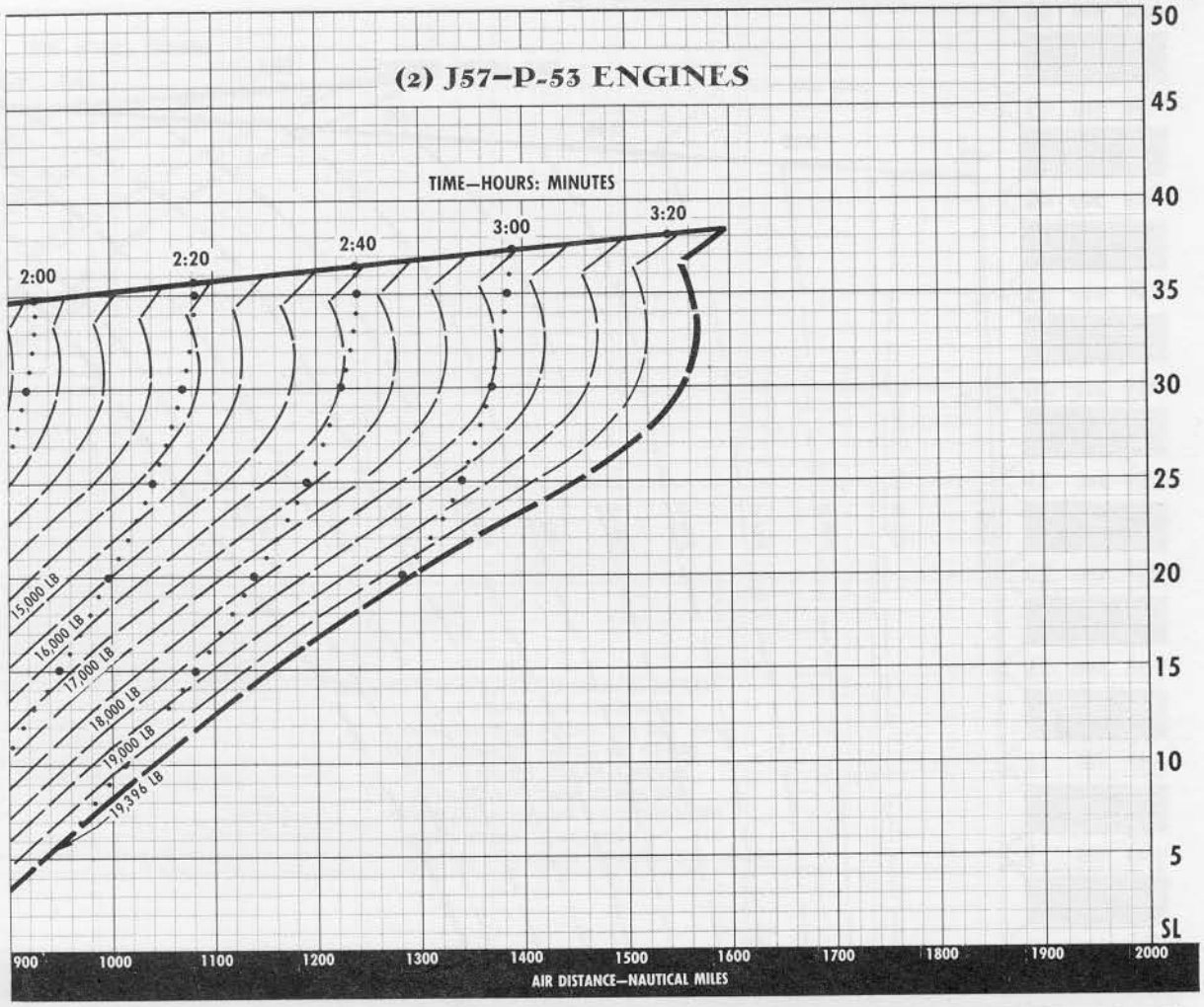
FB33-P4127-1

Figure A4-6

MODEL: F-101B OR F-101F
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT = 45,461 LB.



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

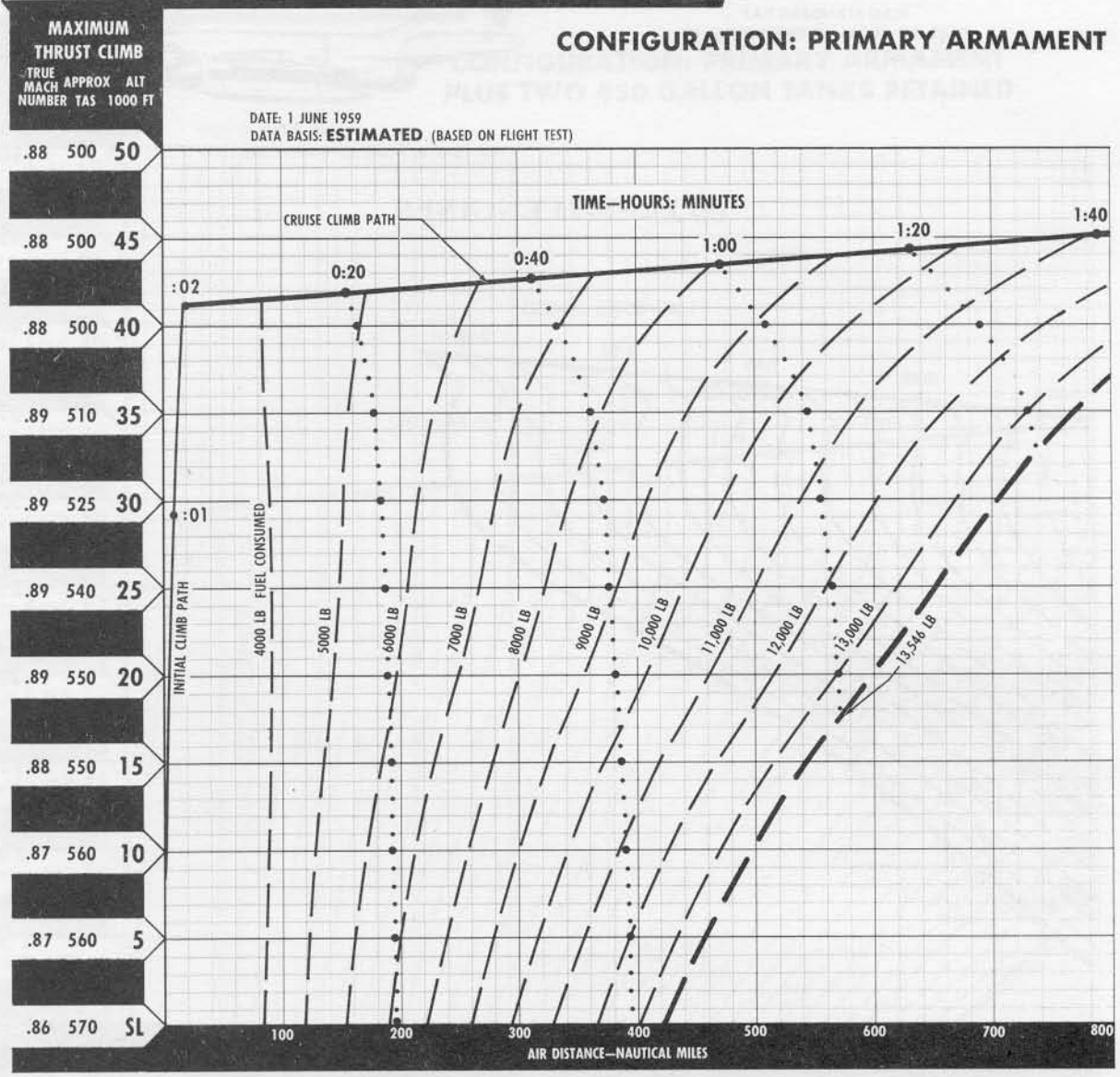


CRUISE—(2) 450 GALLON TANKS RETAINED

ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB		ONE-HALF FUEL LOAD 9698 LB		EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUELFLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
CRUISE-CLIMB								
INITIAL— 30,500 FT.	.81	475	6044	2.30	-	-	-	-
FINAL— 38,400 FT.	.81	463	-	-	-	-	3724	2.22
CONSTANT ALTITUDE CRUISE								
35,000 FT	.80	460	-	-	4917	2.35	3955	2.06
30,000 FT	.78	460	6010	2.26	5181	2.09	4445	1.88
25,000 FT	.74	447	6340	2.03	5665	1.90	5126	1.75
20,000 FT	.70	429	6724	1.86	6129	1.76	5586	1.63
15,000 FT	.65	406	7098	1.72	6548	1.63	6060	1.52
10,000 FT	.60	381	7398	1.61	6865	1.53	6393	1.43
5,000 FT	.55	355	7717	1.51	7172	1.43	6673	1.34
SEA LEVEL	.50	327	7976	1.42	7415	1.35	6928	1.26

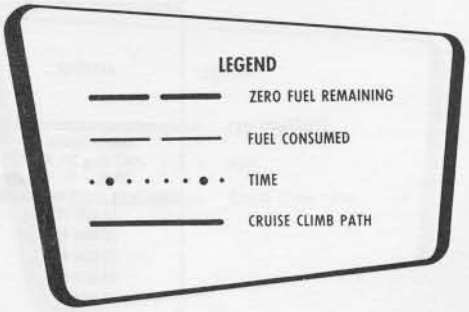
FB33-P4127-2A

INTERCEPT MISSION PROFILE



MISSION CONSIDERATIONS:

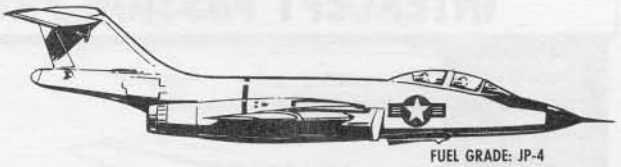
1. FUEL ALLOWANCE FOR START, TAXI, AND TAKE-OFF (1558 LB) INCLUDES 1220 LB OF FUEL REQUIRED TO ACCELERATE FROM BRAKE RELEASE TO BEST CLIMB SPEED.
2. USE MAXIMUM THRUST FOR CLIMB. (SEE MAXIMUM THRUST CLIMB CHART FOR DETAILED INFORMATION) CLIMB FUEL FROM SEA LEVEL MUST BE ADDED TO FUEL ALLOWANCE FOR START, TAXI, AND TAKE-OFF. THIS TOTAL FUEL VALUE IS VALID PROVIDED ACCELERATION TO CLIMB SPEED IS ACCOMPLISHED BELOW 8000 FEET.
3. NO ALLOWANCE OR RESERVE MADE FOR LOITER, DESCENT, OR LANDING.
4. CRUISE AT FULL MAXIMUM CONTINUOUS THRUST RECOMMENDED MACH NUMBER.



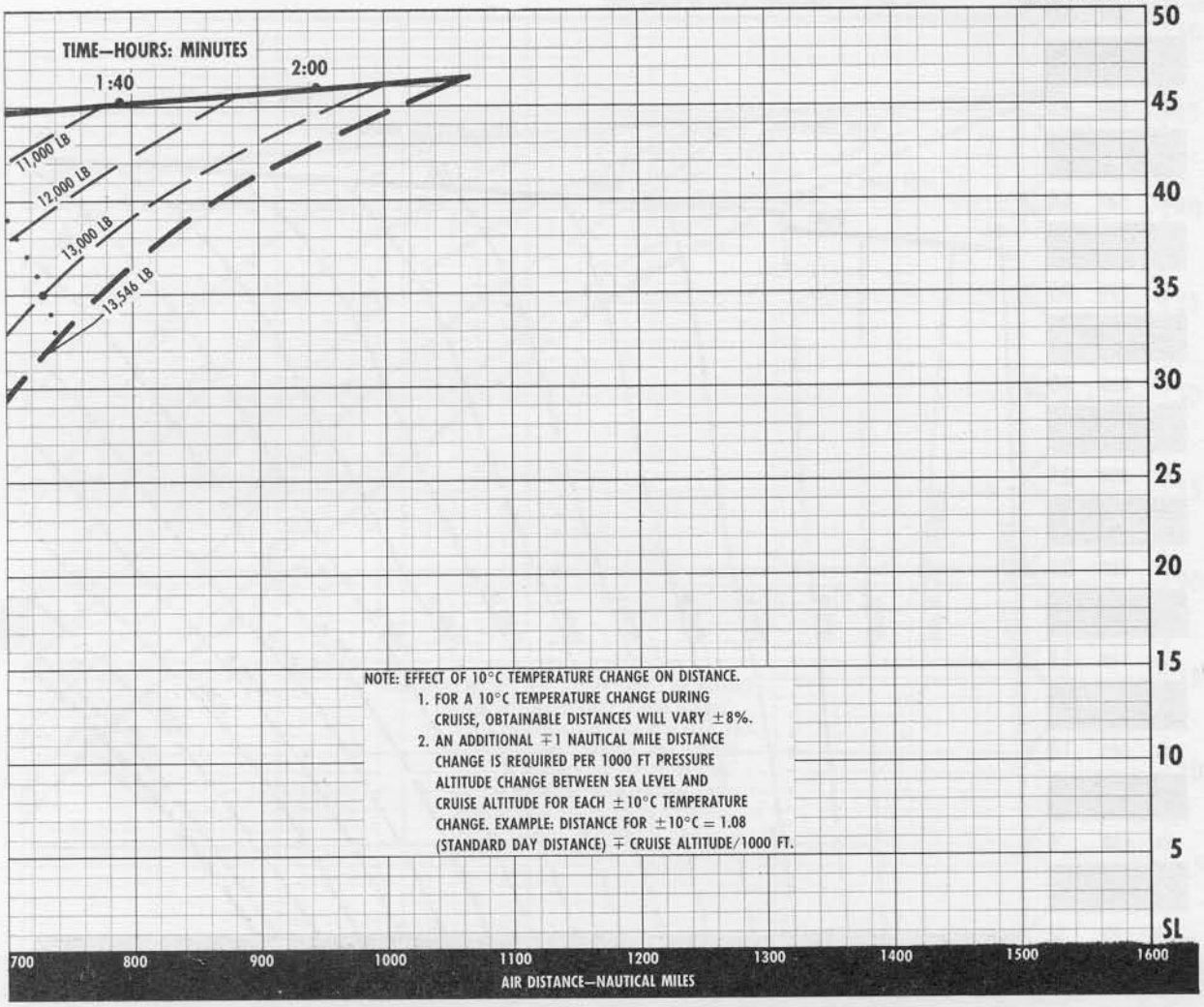
FB33-P421C-1

Figure A4-7

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 45,461 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.



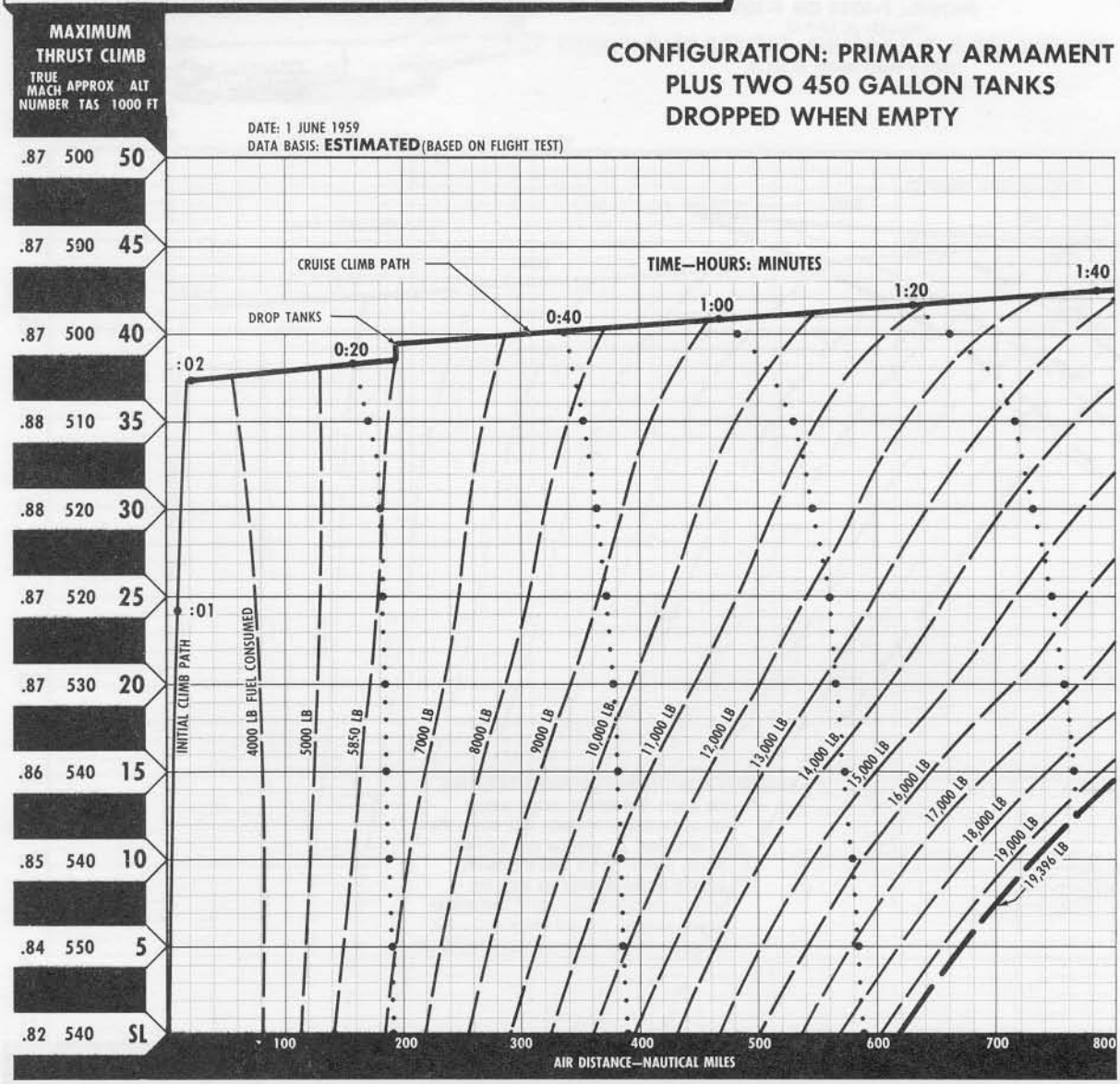
NOTE: EFFECT OF 10°C TEMPERATURE CHANGE ON DISTANCE.
1. FOR A 10°C TEMPERATURE CHANGE DURING CRUISE, OBTAINABLE DISTANCES WILL VARY ±8%.
2. AN ADDITIONAL ∓1 NAUTICAL MILE DISTANCE CHANGE IS REQUIRED PER 1000 FT PRESSURE ALTITUDE CHANGE BETWEEN SEA LEVEL AND CRUISE ALTITUDE FOR EACH ±10°C TEMPERATURE CHANGE. EXAMPLE: DISTANCE FOR ±10°C = 1.08 (STANDARD DAY DISTANCE) ∓ CRUISE ALTITUDE/1000 FT.

STANDARD DAY CRUISE—PRIMARY ARMAMENT

ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB		TRUE MACH NUMBER	APPROX TAS KNOTS	ONE-HALF FUEL LOAD 6773 LB		TRUE MACH NUMBER	APPROX TAS KNOTS	EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
CRUISE-CLIMB												
INITIAL— 41,050	.83	473	5360	2.70	-	-	-	-	-	-	-	-
FINAL— 46,450	-	-	-	-	-	-	-	-	.83	473	4040	2.66
CONSTANT ALTITUDE CRUISE												
35,000 FT	.93	537	7580	2.56	.94	543	7600	2.55	.95	550	7660	2.54
30,000 FT	.94	551	8560	2.42	.94	554	8580	2.42	.95	558	8590	2.41
25,000 FT	.93	560	9520	2.23	.93	562	9530	2.22	.94	564	9540	2.22
20,000 FT	.92	566	10710	2.10	.92	568	10720	2.10	.93	569	10720	2.10
15,000 FT	.91	571	12010	2.00	.91	572	12020	2.00	.92	574	12020	1.99
10,000 FT	.90	574	13410	1.90	.90	575	13420	1.90	.90	577	13430	1.90
5,000 FT	.89	576	14910	1.81	.89	577	14920	1.80	.89	579	14930	1.80
SEA LEVEL	.87	577	16440	1.72	.87	578	16450	1.72	.88	580	16460	1.72

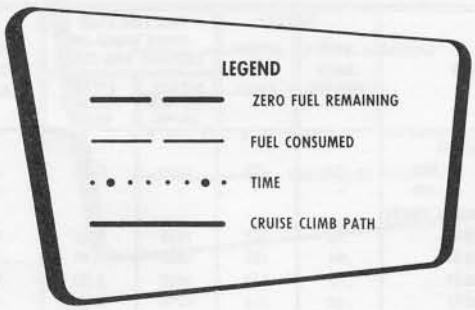
FB33-P421C-2

INTERCEPT MISSION PROFILE



MISSION CONSIDERATIONS:

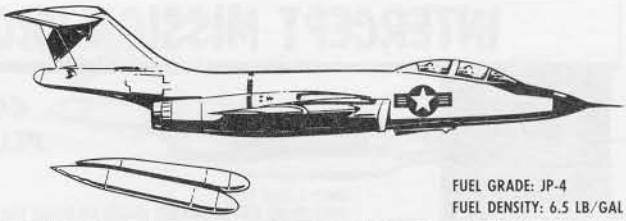
1. FUEL ALLOWANCE FOR START, TAXI, AND TAKE-OFF (1558 LB) INCLUDES 1315 LB OF FUEL REQUIRED TO ACCELERATE FROM BRAKE RELEASE TO BEST CLIMB SPEED.
2. USE MAXIMUM THRUST FOR CLIMB. (SEE MAXIMUM THRUST CLIMB CHART FOR DETAILED INFORMATION) CLIMB FUEL FROM SEA LEVEL MUST BE ADDED TO FUEL ALLOWANCE FOR START, TAXI, AND TAKE-OFF. THIS TOTAL FUEL VALUE IS VALID PROVIDED ACCELERATION TO CLIMB SPEED IS ACCOMPLISHED BELOW 8000 FEET.
3. NO ALLOWANCE OR RESERVE MADE FOR LOITER, DESCENT, OR LANDING.
4. CRUISE AT FULL MAXIMUM CONTINUOUS THRUST RECOMMENDED MACH NUMBER.



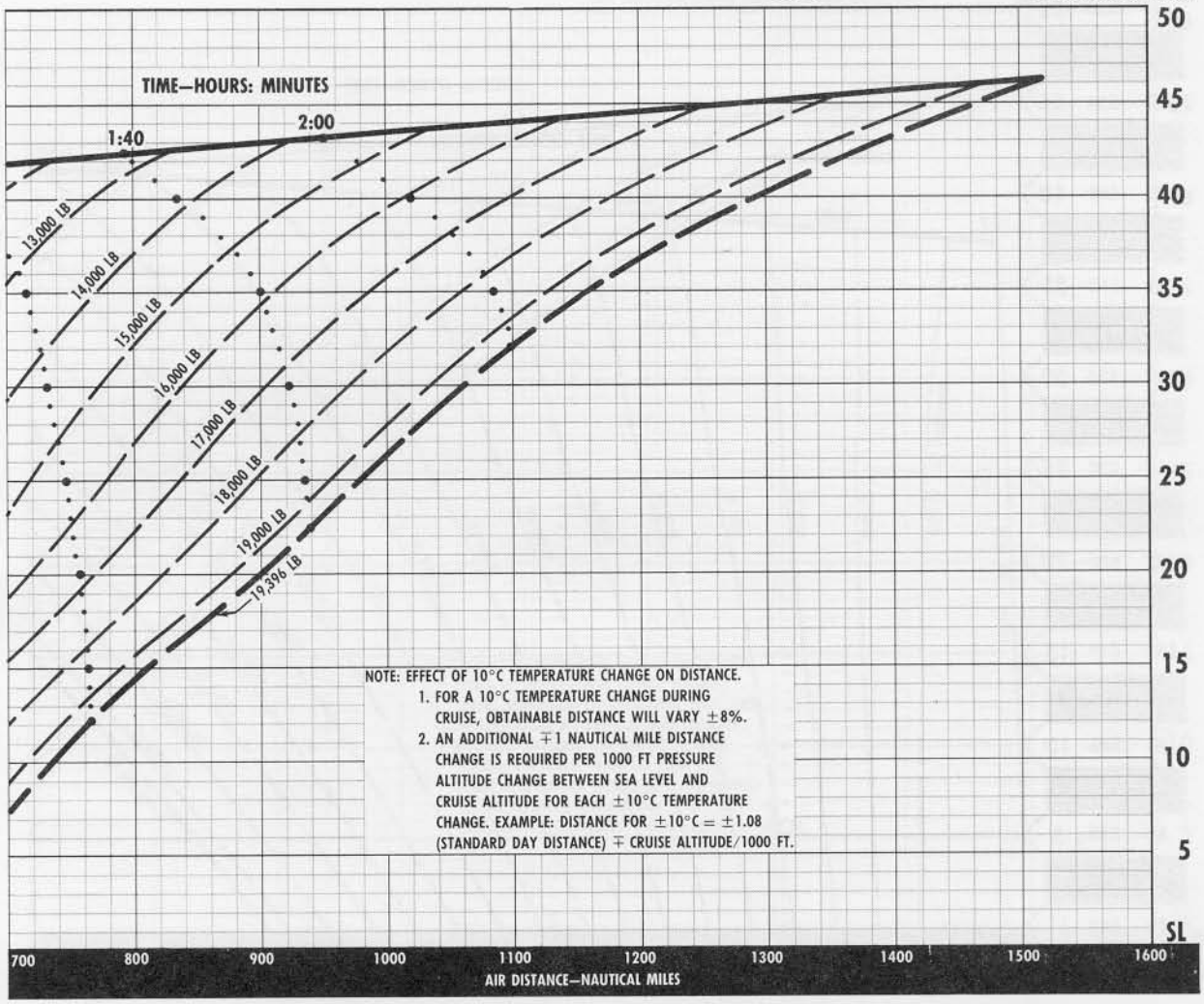
FB33-P422C-1

Figure A4-8

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB



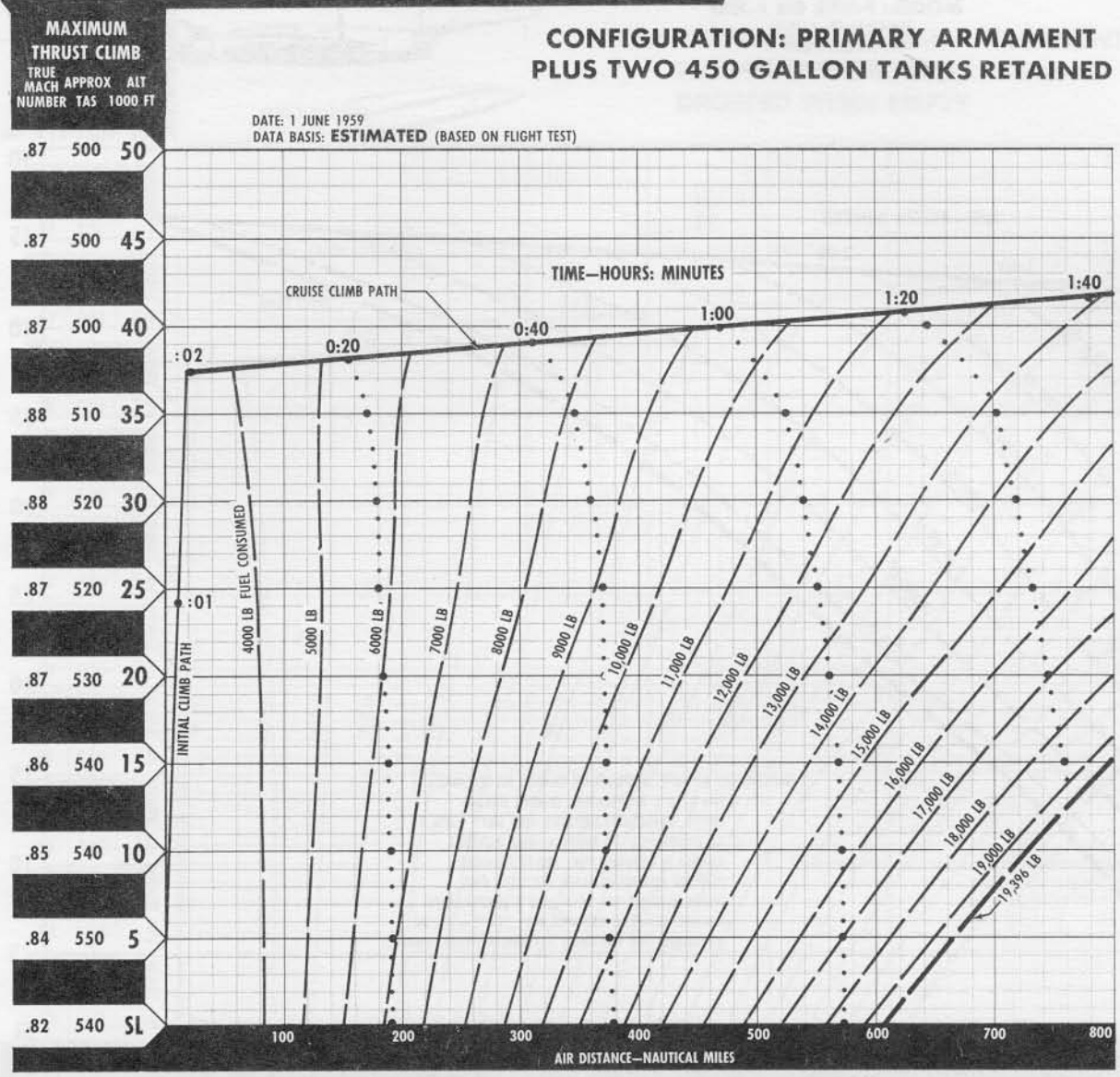
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



STANDARD DAY CRUISE—(2) 450 GALLON TANKS					STANDARD DAY CRUISE—PRIMARY ARMAMENT							
ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB		TRUE MACH NUMBER	APPROX TAS KNOTS	MAXIMUM INTERNAL FUEL LOAD 13,546 LB		TRUE MACH NUMBER	APPROX TAS KNOTS	EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
CRUISE-CLIMB												
INITIAL— 37,450	.82	467	6400	2.71	–	–	–	–	–	–	–	–
FINAL— 46,450	–	–	–	–	–	–	–	–	.83	473	4040	2.66
CONSTANT ALTITUDE CRUISE												
35,000 FT	.88	507	7420	2.62	.92	532	7560	2.57	.95	550	7660	2.54
30,000 FT	.90	528	8450	2.47	.93	548	8540	2.43	.95	558	8590	2.41
25,000 FT	.90	539	9440	2.27	.93	558	9510	2.23	.94	564	9540	2.22
20,000 FT	.89	545	10640	2.15	.92	564	10700	2.11	.93	569	10720	2.10
15,000 FT	.88	551	11940	2.03	.91	571	12010	2.00	.92	574	12020	1.99
10,000 FT	.86	551	13330	1.94	.90	573	13410	1.90	.90	577	13430	1.90
5,000 FT	.85	549	14780	1.85	.89	576	14910	1.81	.89	579	14930	1.80
SEA LEVEL	.83	546	16240	1.76	.87	577	16440	1.72	.88	580	16460	1.72

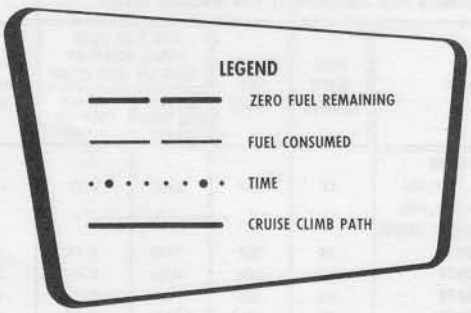
FB33-P422C-2

INTERCEPT MISSION PROFILE



MISSION CONSIDERATIONS:

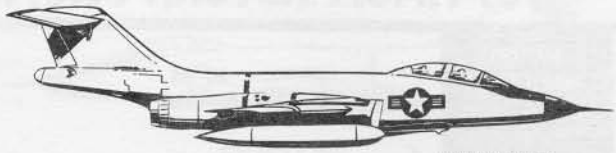
1. FUEL ALLOWANCE FOR START, TAXI, AND TAKE-OFF (1558 LB) INCLUDES 1315 LB OF FUEL REQUIRED TO ACCELERATE FROM BRAKE RELEASE TO BEST CLIMB SPEED.
2. USE MAXIMUM THRUST FOR CLIMB. (SEE MAXIMUM THRUST CLIMB CHART FOR DETAILED INFORMATION) CLIMB FUEL FROM SEA LEVEL MUST BE ADDED TO FUEL ALLOWANCE FOR START, TAXI, AND TAKE-OFF. THIS TOTAL FUEL VALUE IS VALID PROVIDED ACCELERATION TO CLIMB SPEED IS ACCOMPLISHED BELOW 8000 FEET.
3. NO ALLOWANCE OR RESERVE MADE FOR LOITER, DESCENT, OR LANDING.
4. CRUISE AT FULL MAXIMUM CONTINUOUS THRUST RECOMMENDED MACH NUMBER.



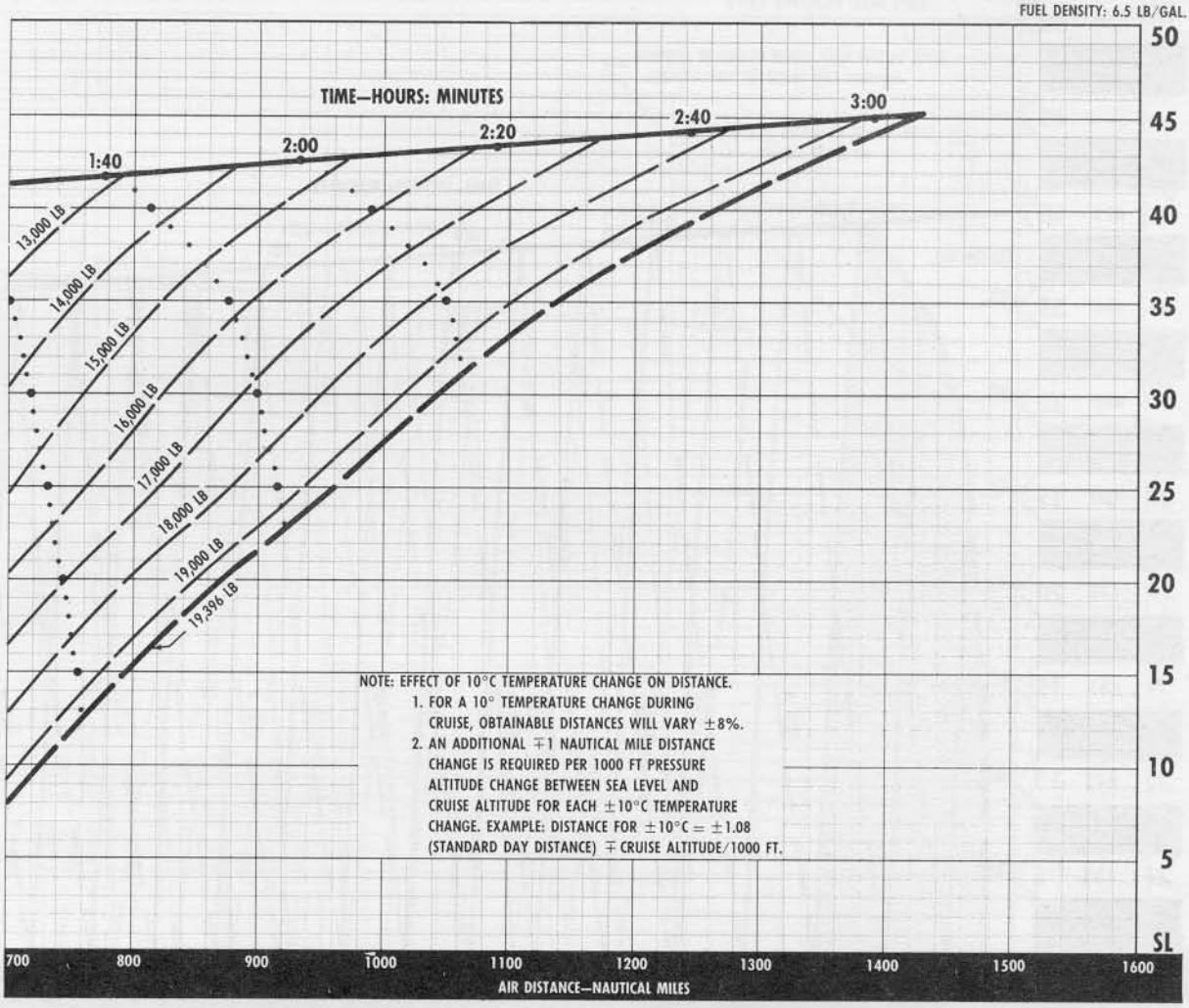
FB33-P423C-1

Figure A4-9

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

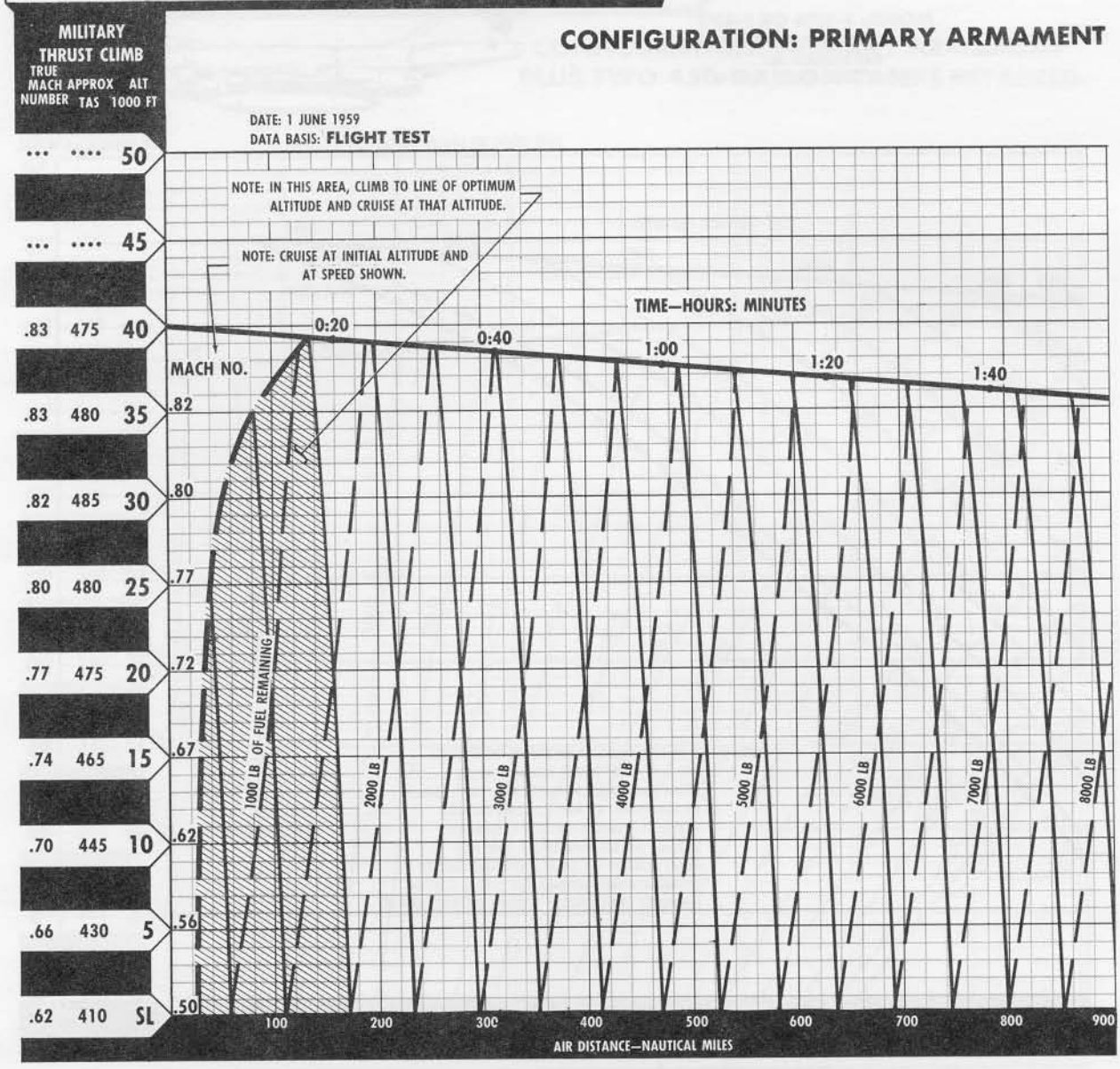


STANDARD DAY CRUISE—PRIMARY ARMAMENT PLUS (2) 450 GALLON TANKS RETAINED

ALTITUDE	FULL FUEL LOAD MINUS WARM-UP TAKE-OFF AND CLIMB				ONE-HALF FUEL LOAD 9698 LB				EMPTY FUEL LOAD ZERO LB FUEL			
	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
CRUISE-CLIMB												
INITIAL— 37,450	.82	467	6400	2.71	-	-	-	-	-	-	-	-
FINAL— 45,200	-	-	-	-	-	-	-	-	.82	467	4280	2.68
CONSTANT ALTITUDE CRUISE												
35,000 FT	.88	507	7420	2.62	.90	521	7500	2.59	.92	532	7560	2.57
30,000 FT	.90	528	8450	2.47	.91	535	8490	2.46	.92	541	8510	2.44
25,000 FT	.90	539	9440	2.27	.90	544	9470	2.26	.91	549	9490	2.25
20,000 FT	.89	545	10640	2.15	.90	550	10650	2.14	.90	554	10670	2.13
15,000 FT	.88	551	11940	2.03	.88	554	11960	2.03	.89	557	11970	2.01
10,000 FT	.86	551	13330	1.94	.87	554	13340	1.93	.87	558	13360	1.92
5,000 FT	.85	549	14780	1.85	.85	552	14800	1.84	.86	556	14820	1.83
SEA LEVEL	.83	546	16240	1.76	.83	550	16270	1.76	.84	554	16290	1.75

FB33-P423C-2

OPTIMUM RETURN PROFILE

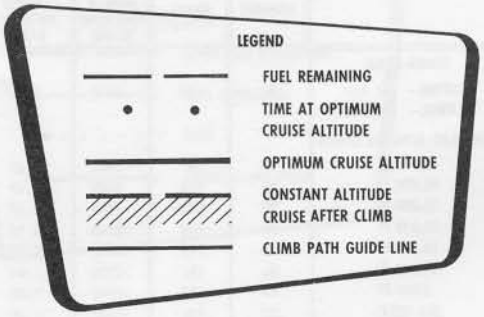


MISSION CONSIDERATIONS:

1. MILITARY THRUST CLIMB TO RECOMMENDED RETURN ALTITUDE.
2. CRUISE AT RECOMMENDED MACH NUMBER.
3. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.

NOTE:

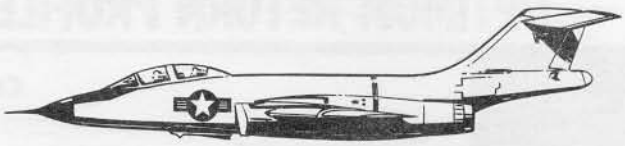
SEE RANGEWIND CORRECTION CHART FOR WIND EFFECT ON RANGE.



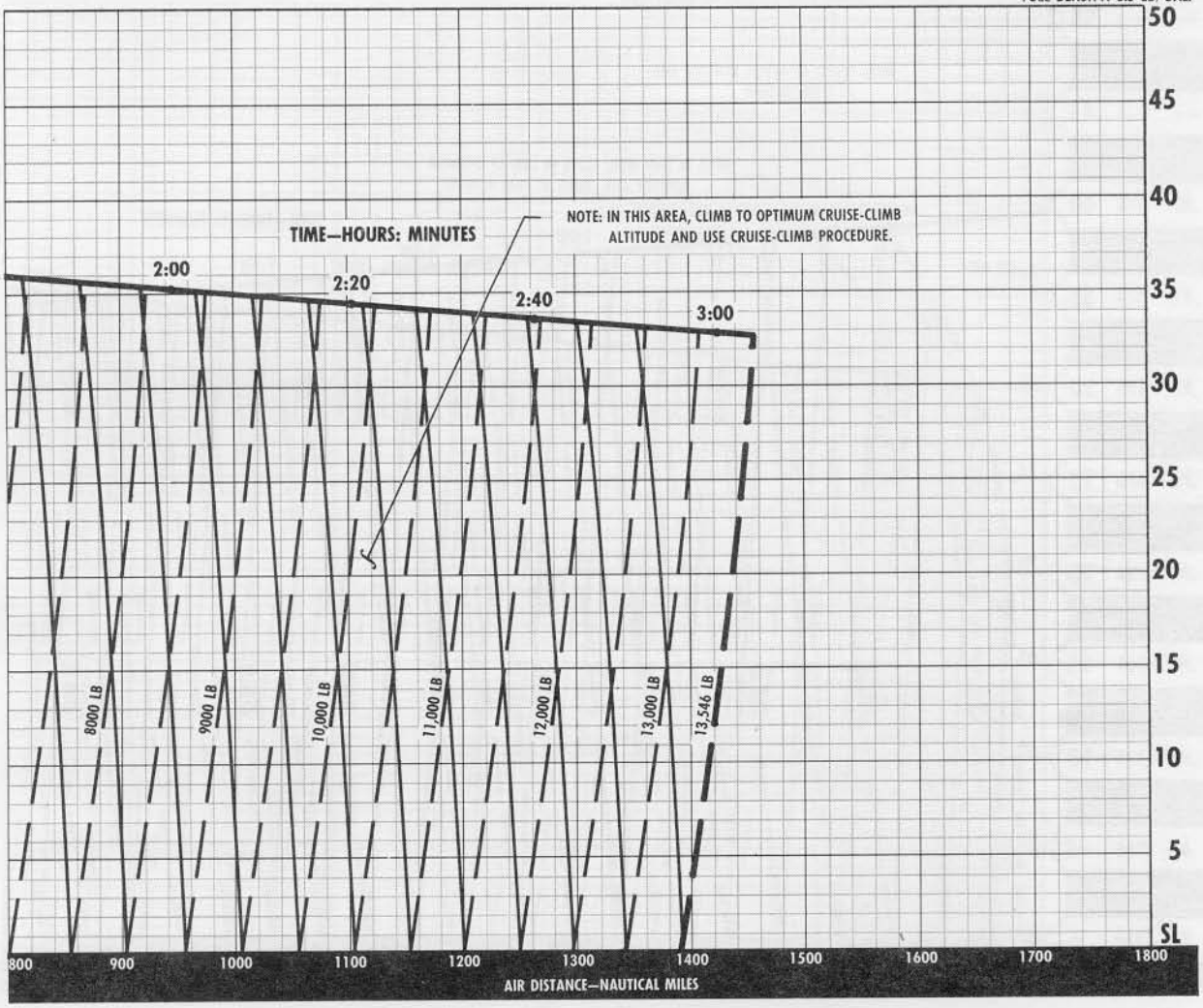
FB33-P403C-1

Figure A4-10

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 45,461 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

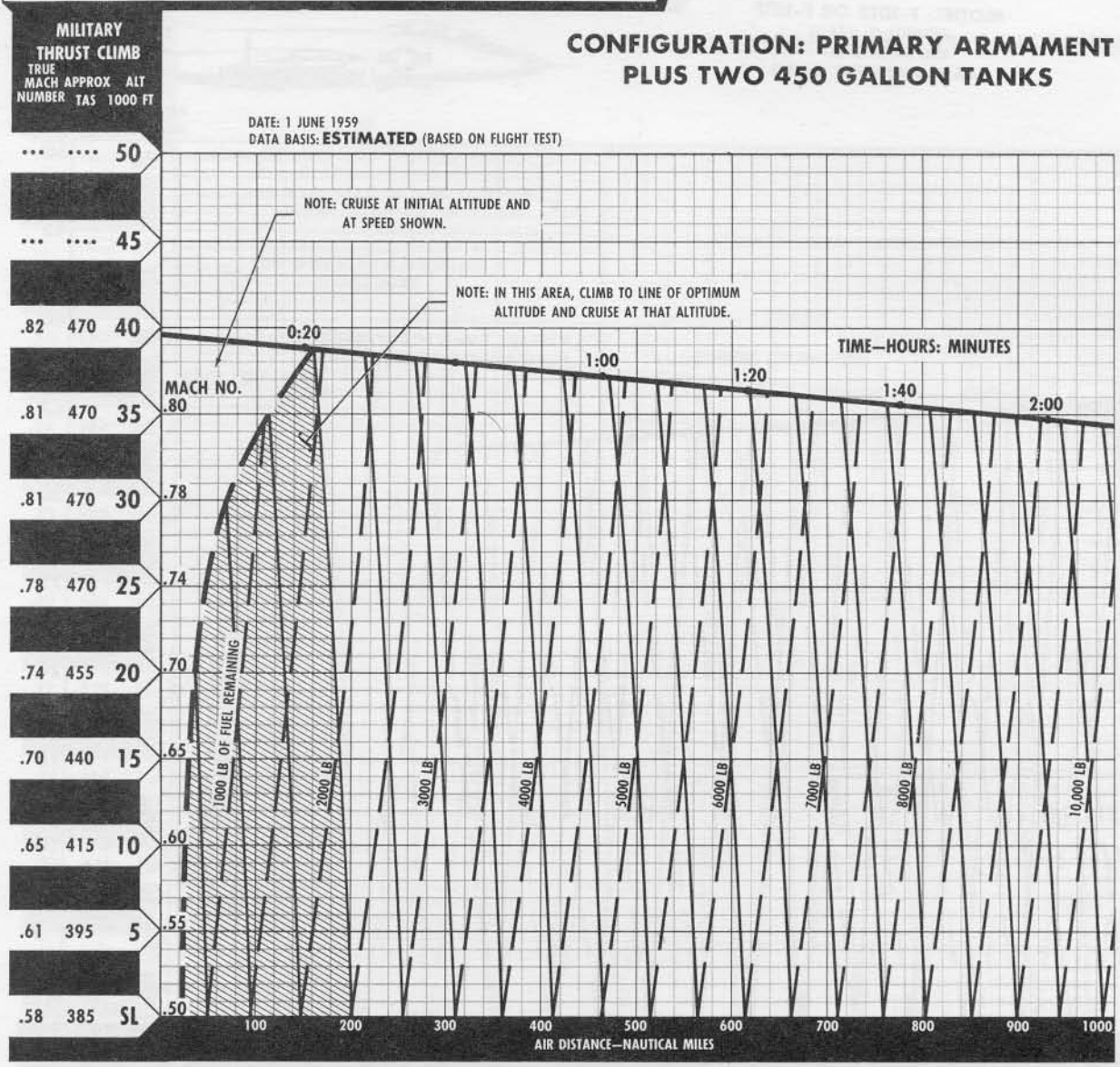


OPTIMUM CRUISE—PRIMARY ARMAMENT

FUEL LOAD	ALTITUDE FEET	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
FULL FUEL LOAD 13,546 LB	CRUISE-CLIMB INITIAL- 32,750	.83	482	5150	2.15
ONE-HALF FUEL LOAD 6773 LB	36,000	.83	476	4482	2.14
EMPTY FUEL LOAD ZERO LB FUEL	FINAL- 40,100	.83	476	3679	2.14

FB33-P403C-2

OPTIMUM RETURN PROFILE

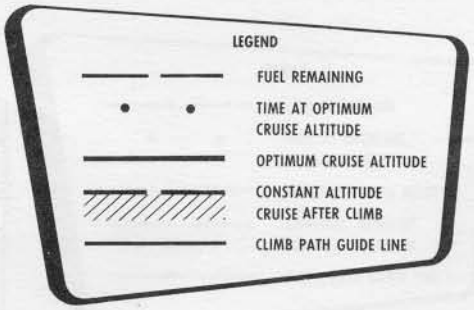


MISSION CONSIDERATIONS:

1. MILITARY THRUST CLIMB TO RECOMMENDED RETURN ALTITUDE.
2. CRUISE AT RECOMMENDED MACH NUMBER.
3. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.

NOTE:

SEE RANGEWIND CORRECTION CHART FOR WIND EFFECT ON RANGE.

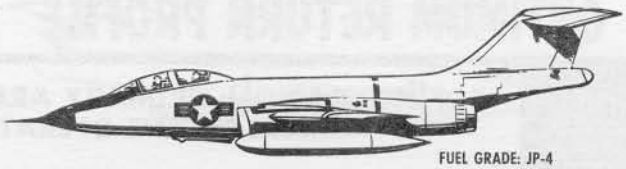


FB33-P404C-1

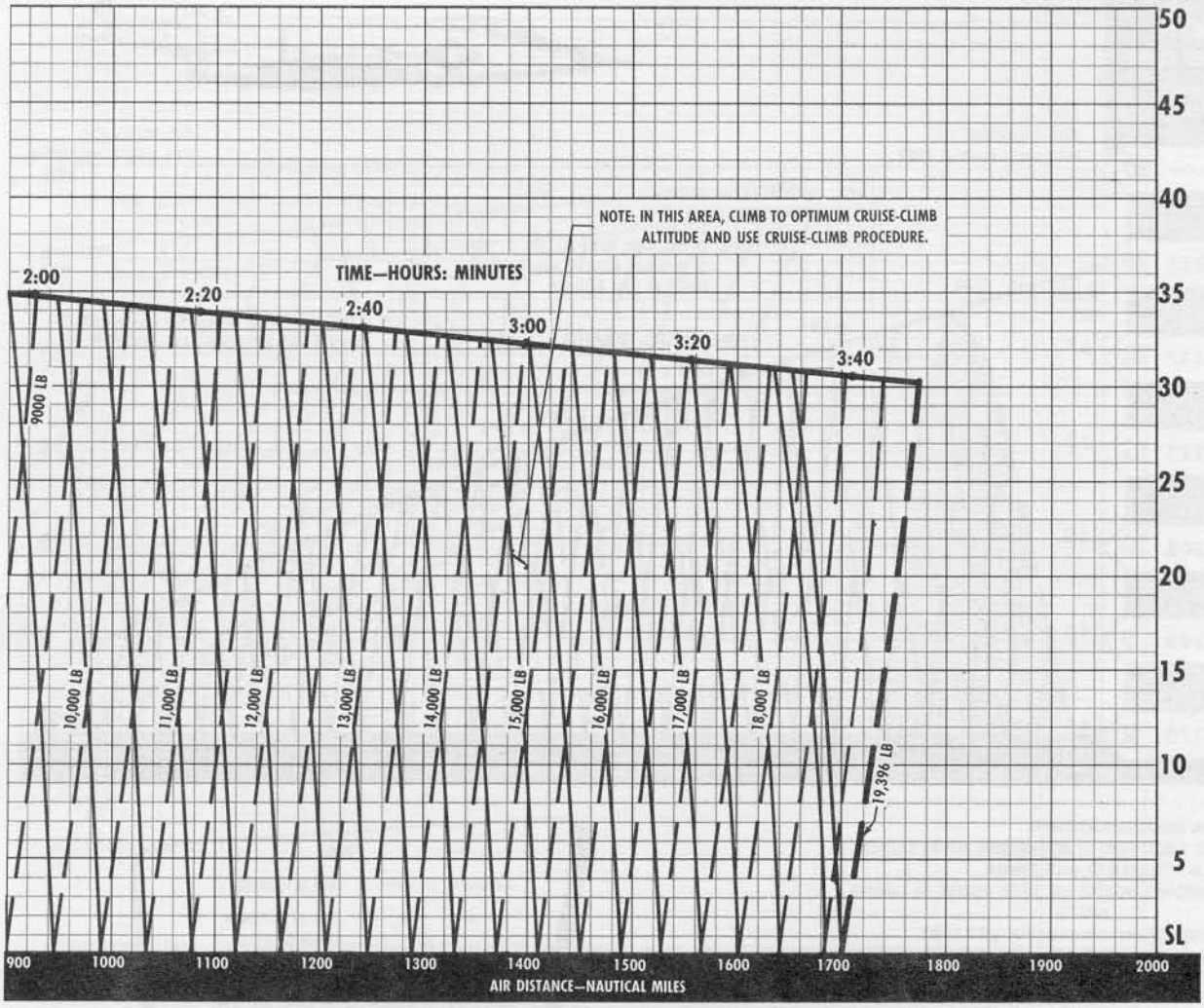
Figure A4-11

MODEL: F-101B OR F-101F

ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.



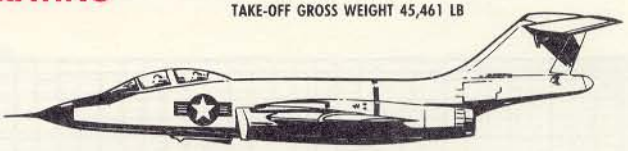
OPTIMUM CRUISE—(2) 450 GALLON TANKS					
FUEL LOAD	ALTITUDE FEET	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
FULL FUEL LOAD 19,396 LB.	CRUISE-CLIMB INITIAL- 30,200	.81	476	6512	2.26
ONE-HALF FUEL LOAD 9,968 LB.	34,250	.81	467	5235	2.25
EMPTY FUEL LOAD ZERO LB FUEL	FINAL-39,800	.81	463	3998	2.25

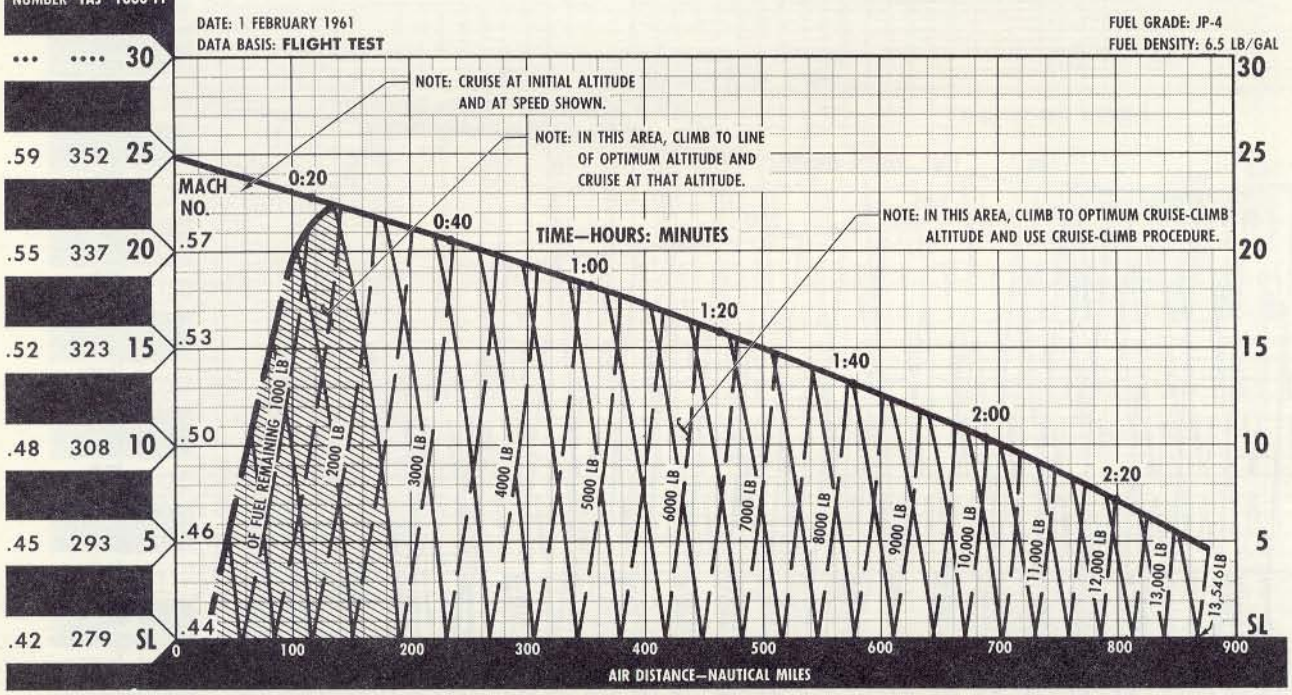
FB33-P404C-2

OPTIMUM RETURN PROFILE

CONFIGURATION: PRIMARY ARMAMENT
ONE ENGINE OPERATING

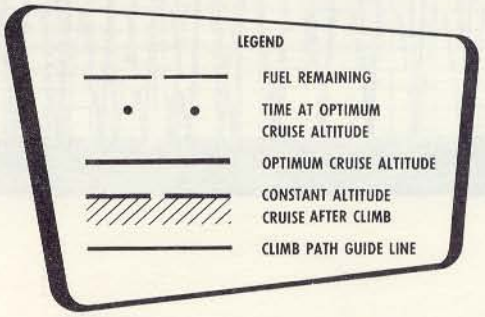
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 45,461 LB





MISSION CONSIDERATIONS:
1. MILITARY THRUST CLIMB TO RECOMMENDED RETURN ALTITUDE.
2. CRUISE AT RECOMMENDED MACH NUMBER.
3. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.

NOTE:
SEE RANGEWIND CORRECTION CHART FOR WIND EFFECT ON RANGE.



OPTIMUM CRUISE— PRIMARY ARMAMENT

FUEL LOAD	ALTITUDE FEET	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
FULL FUEL LOAD	CRUISE-CLIMB				
13,546 LB	INITIAL— 4600	.51	332	6776	2.08
ONE-HALF FUEL LOAD					
6773	14,900	.54	338	5306	2.27
EMPTY FUEL LOAD ZERO LB FUEL	FINAL— 24,800	.59	355	4241	2.54

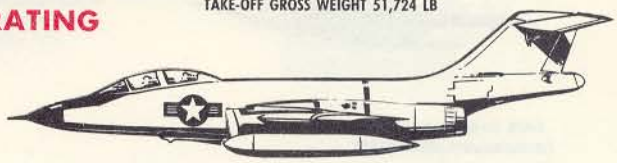
FB33-P4122B R

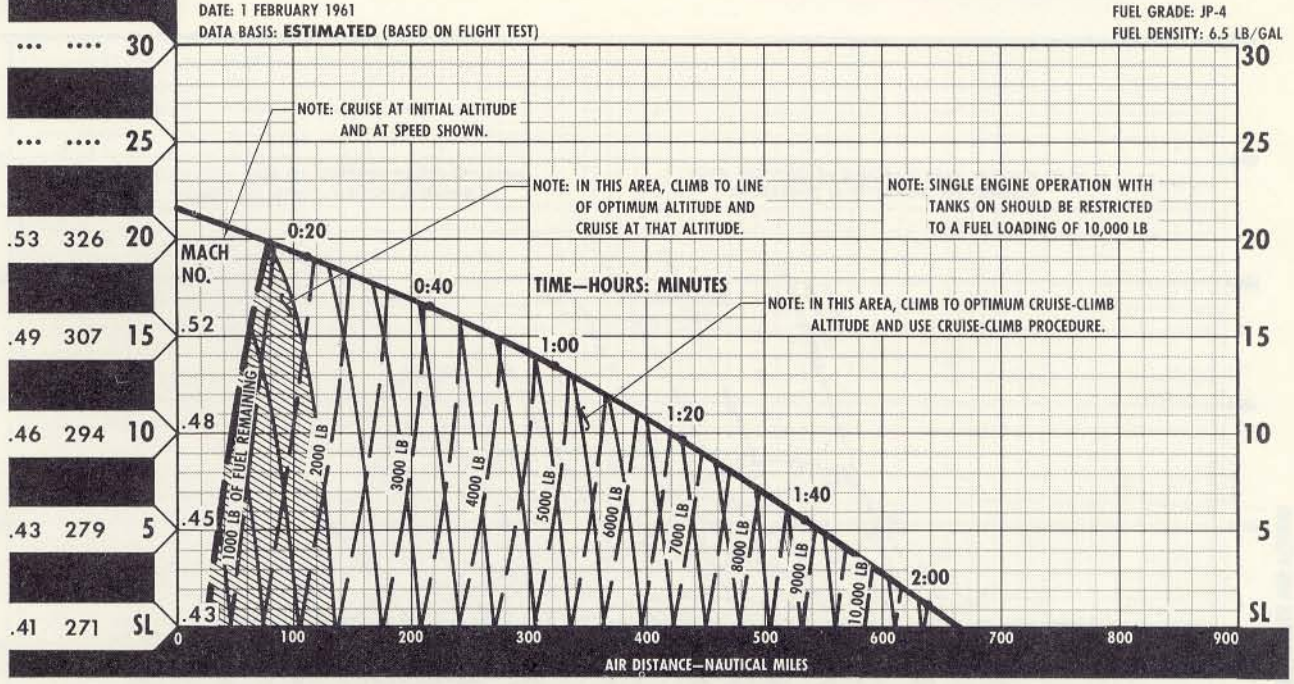
Figure A4-12

OPTIMUM RETURN PROFILE

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
INOPERATIVE ENGINE WINDMILLING
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB

CONFIGURATION: PRIMARY ARMAMENT PLUS TWO 450 GALLON TANKS
ONE ENGINE OPERATING



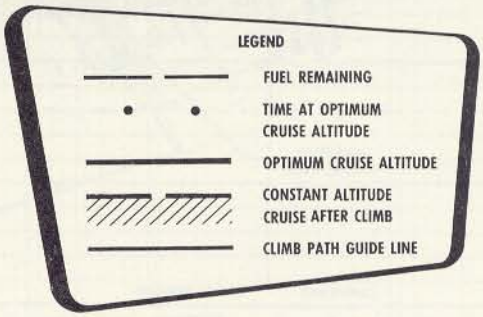


MISSION CONSIDERATIONS:

1. MILITARY THRUST CLIMB TO RECOMMENDED RETURN ALTITUDE.
2. CRUISE AT RECOMMENDED MACH NUMBER.
3. NO ALLOWANCES INCLUDED FOR LOITER, DESCENT, OR LANDING.

NOTE:

SEE RANGEWIND CORRECTION CHART FOR WIND EFFECT ON RANGE.



OPTIMUM CRUISE— (2) 450 GALLON TANKS

FUEL LOAD	ALTITUDE FEET	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
MAXIMUM USEABLE FUEL LOAD 10,000 LB	CRUISE-CLIMB INITIAL— 3200	.48	314	6695	2.02
ONE-HALF FUEL LOAD 5000 LB	13,100	.50	315	5385	2.25
EMPTY FUEL LOAD ZERO LB FUEL	FINAL— 21,500	.54	330	4502	2.46

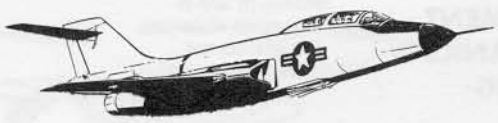
FB33-P4123 A
R

Figure A4-13

NAUTICAL MILES PER POUND

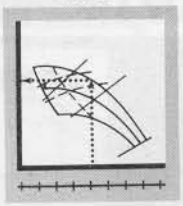
SEA LEVEL

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 13%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

NOTE: NAUTICAL MILES PER POUND AT CONSTANT MACH NUMBERS ARE UNAFFECTED BY TEMPERATURE.

MACH NO. RECOMMENDED FOR MAXIMUM RANGE

APPROX FUEL FLOW 2500 LB/HR/ENG
3000 LB/HR/ENG
3500 LB/HR/ENG
4000 LB/HR/ENG
4500 LB/HR/ENG
5000 LB/HR/ENG
5500 LB/HR/ENG
6000 LB/HR/ENG
6500 LB/HR/ENG
7000 LB/HR/ENG
7500 LB/HR/ENG
8000 LB/HR/ENG
8500 LB/HR/ENG
9000 LB/HR/ENG
9500 LB/HR/ENG
10,000 LB/HR/ENG

APPROX PRESSURE RATIO
1.2
1.3
1.4
1.5
1.6
1.7
1.8

MAXIMUM ENDURANCE

MILITARY THRUST

CURVE NO	GROSS WEIGHT
1	30,000 LB
2	35,000 LB
3	40,000 LB
4	45,000 LB
5	50,000 LB
6	55,000 LB

NAUTICAL MILES PER POUND: .070, .065, .060, .055, .050, .045, .040, .035, .030, .025, .020

TRUE MACH NUMBER: .10, .20, .30, .40, .50, .60, .70, .80, .90, 1.00, 1.10

CALIBRATED AIR SPEED–KNOTS: 200, 300, 400, 500, 600, 700

TRUE AIR SPEED–KNOTS: 200, 300, 400, 500, 600, 700

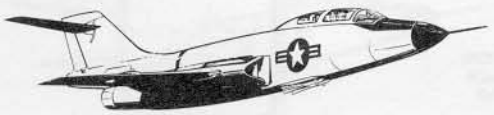
FB33-P405C

Figure A4-14

NAUTICAL MILES PER POUND

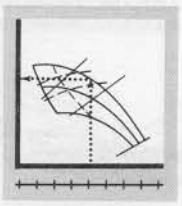
5000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 12%.

GUIDE



DATE 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

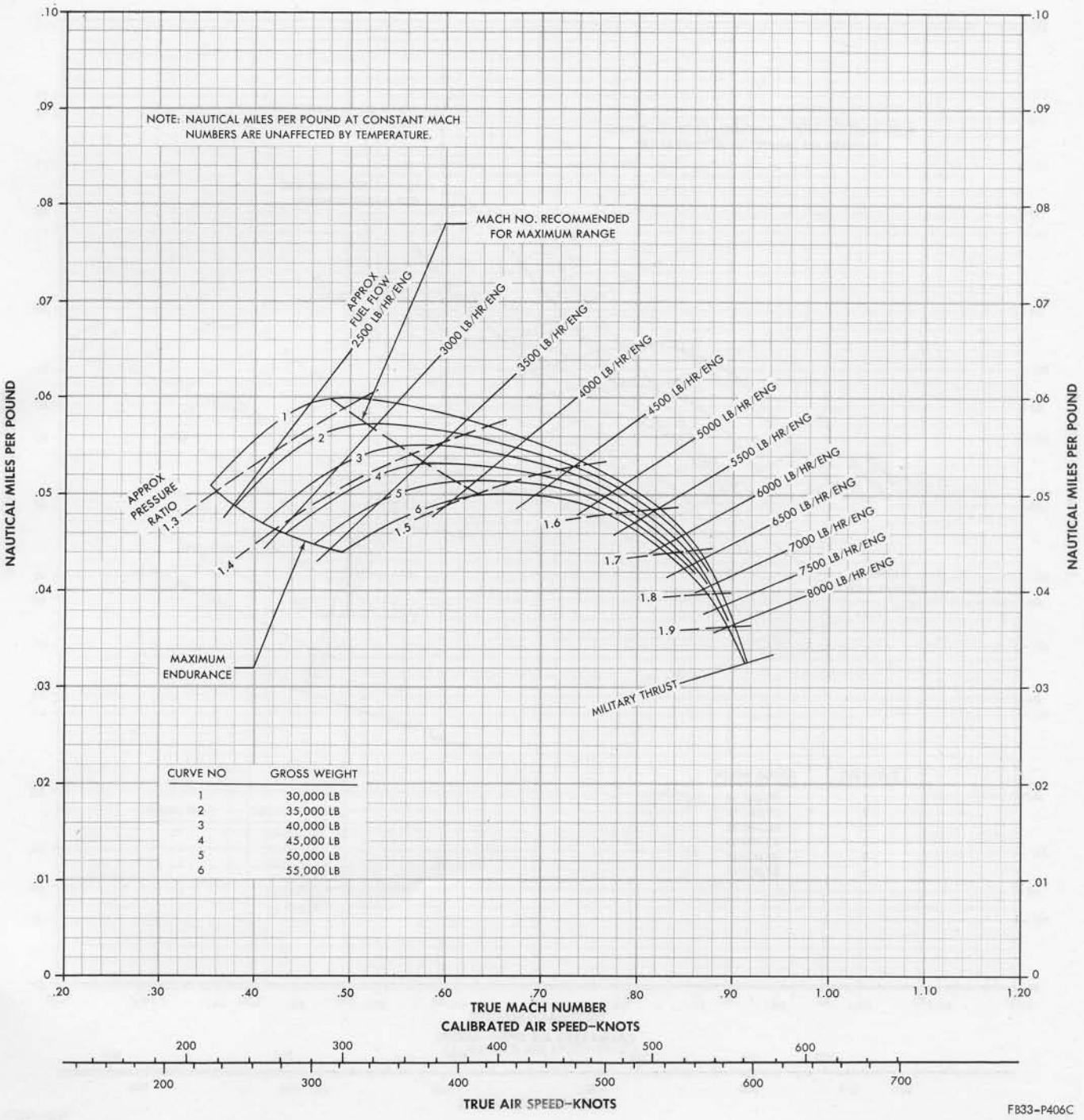
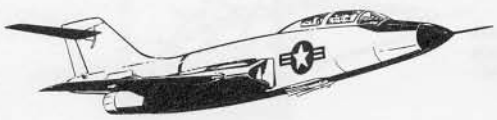


Figure A4-15

NAUTICAL MILES PER POUND

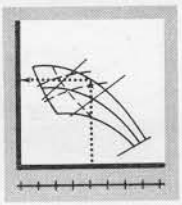
15,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 11%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

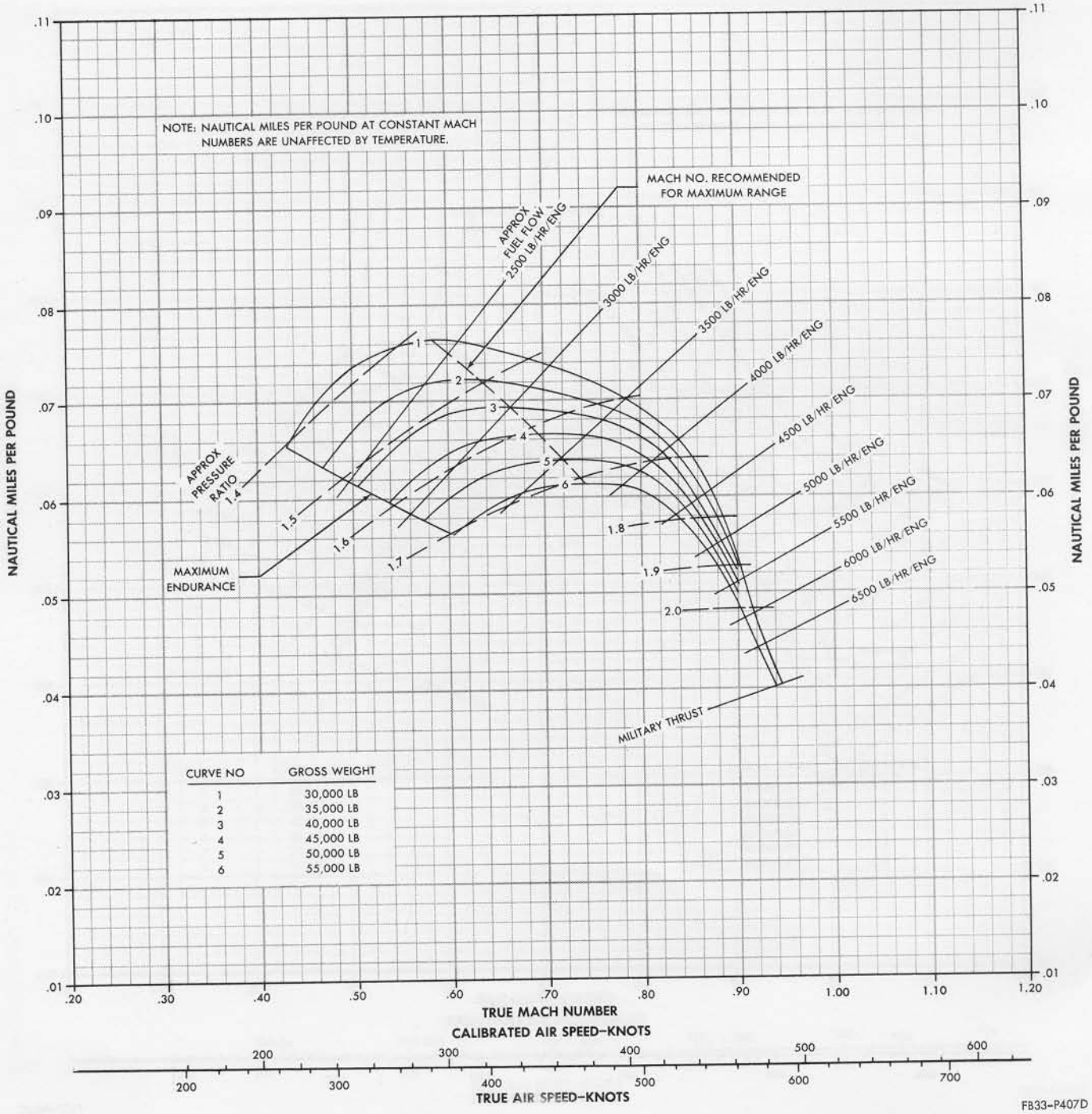


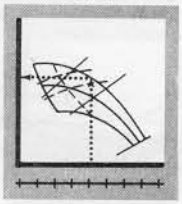
Figure A4-16

NAUTICAL MILES PER POUND
25,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT

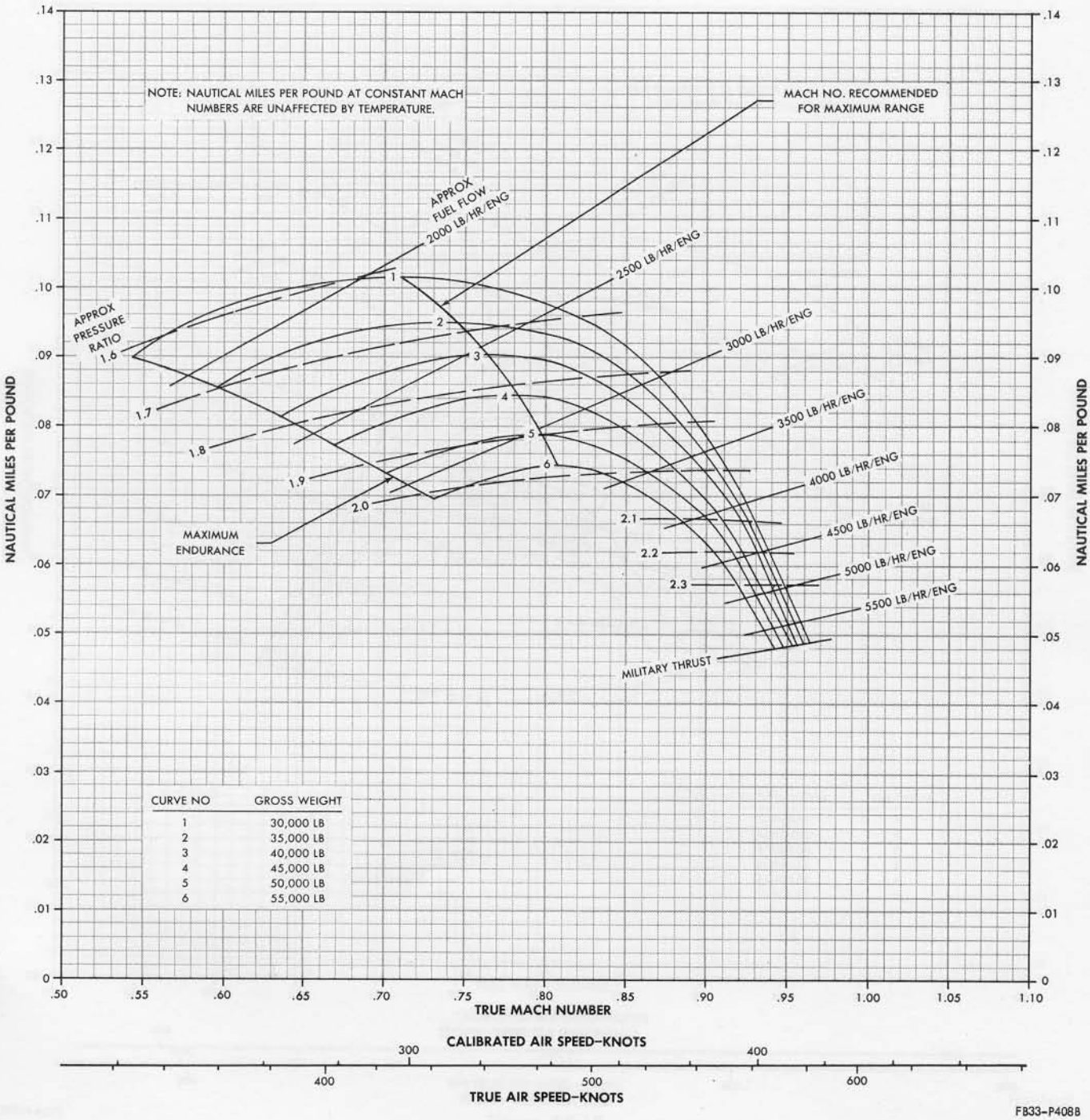
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 10%.

GUIDE



DATE 1 JUNE 1959
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



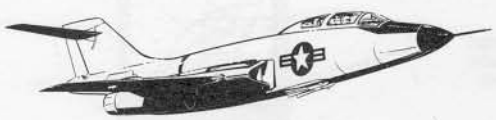
FB33-P4088

Figure A4-17

NAUTICAL MILES PER POUND

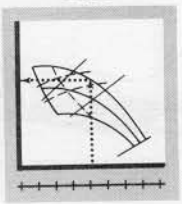
30,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 10%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

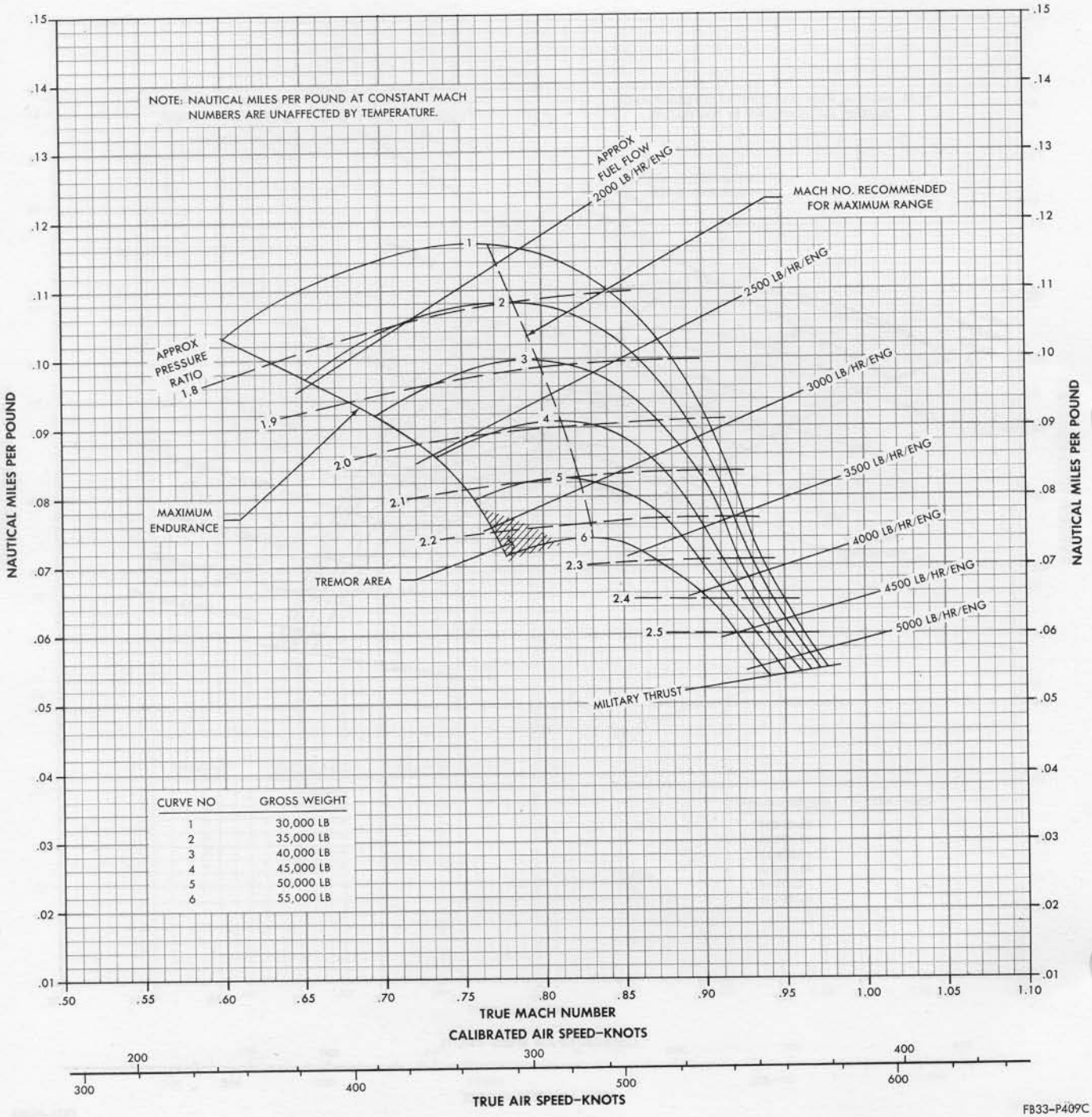
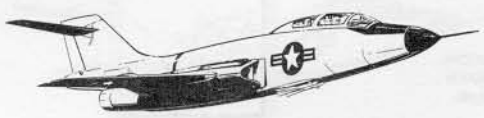


Figure A4-18

NAUTICAL MILES PER POUND

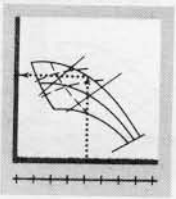
35,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



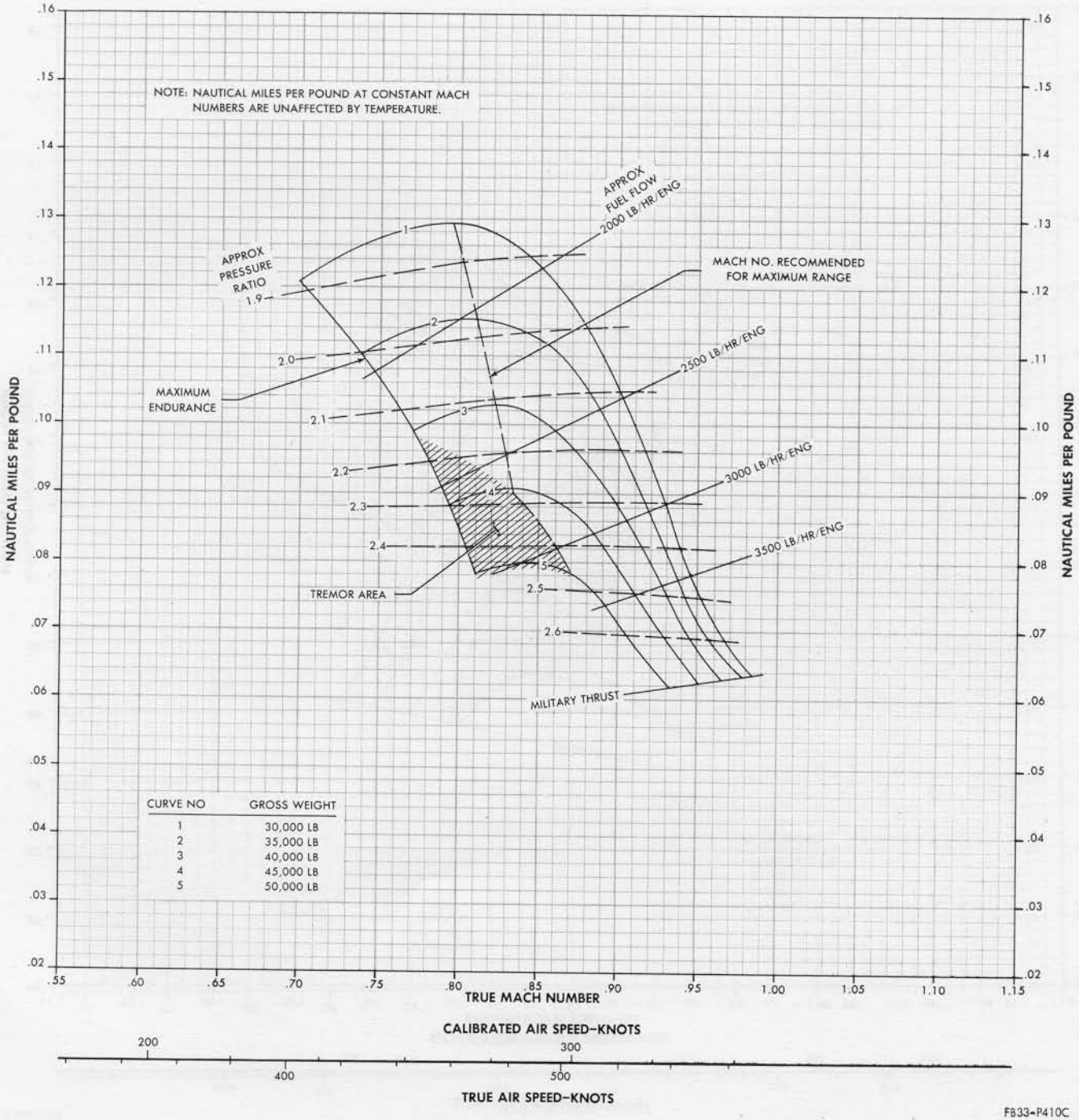
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 10%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



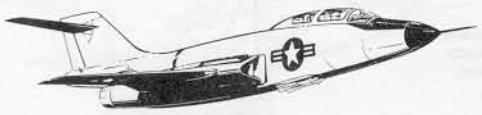
FB33-P410C

Figure A4-19

NAUTICAL MILES PER POUND

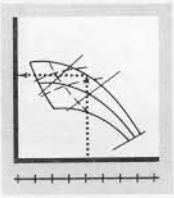
40,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 9%

GUIDE



DATE 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

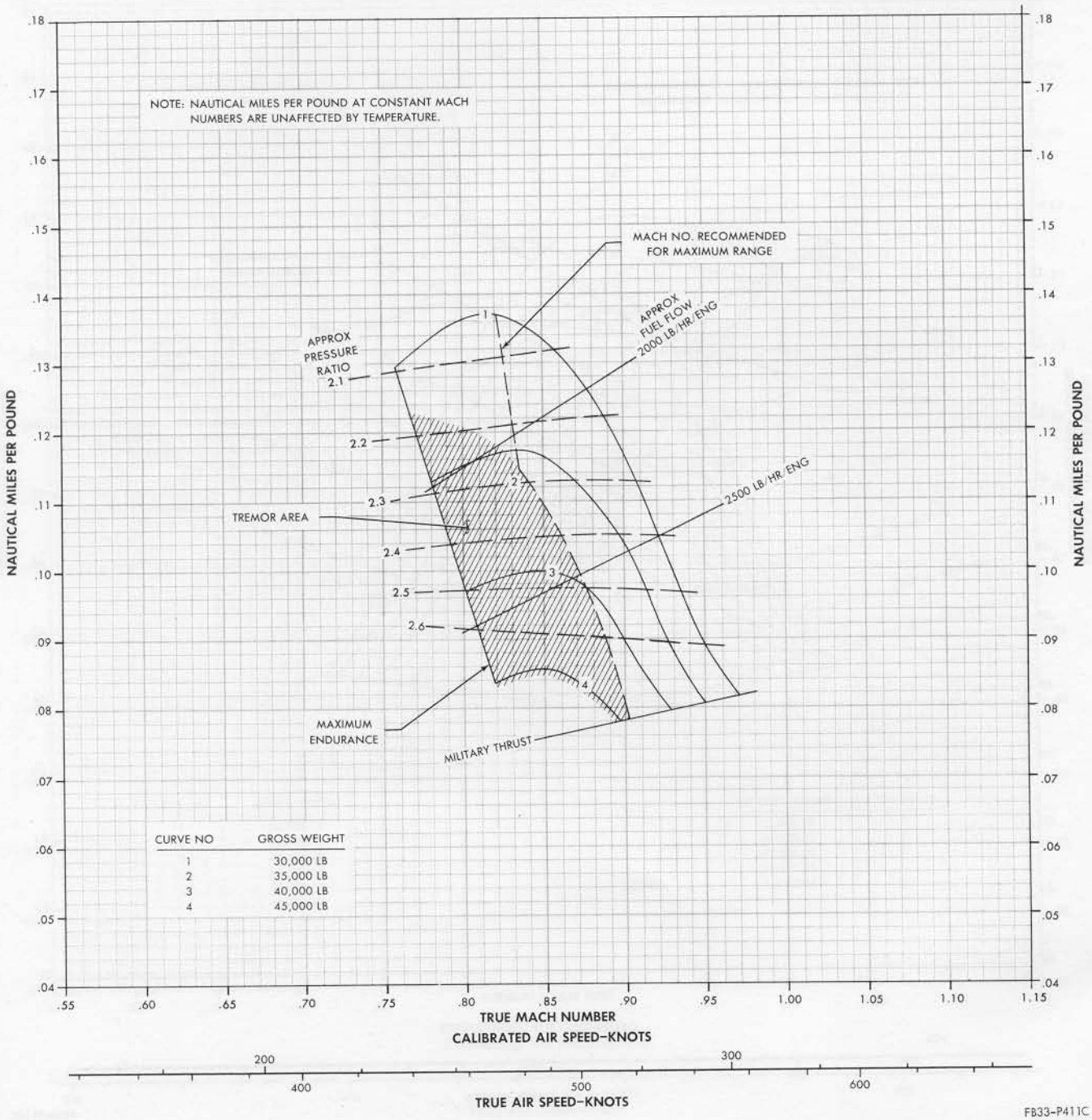


Figure A4-20

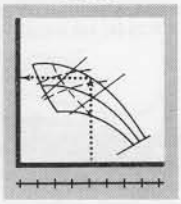
NAUTICAL MILES PER POUND

45,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT

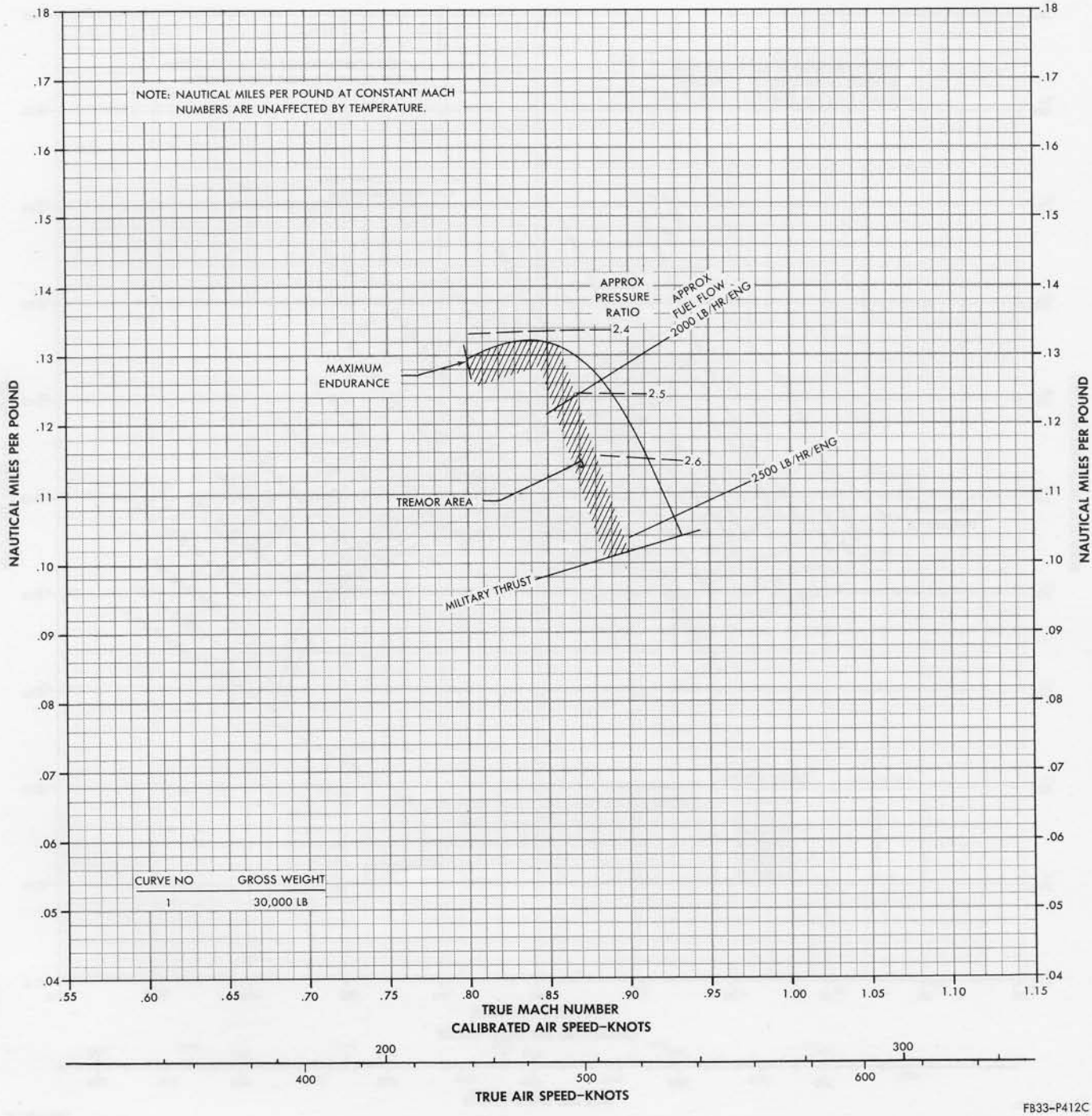
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 9%

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

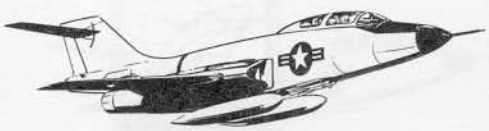


FB33-P412C

Figure A4-21

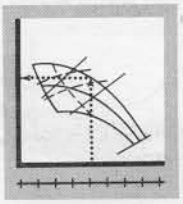
NAUTICAL MILES PER POUND
SEA LEVEL

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 13%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

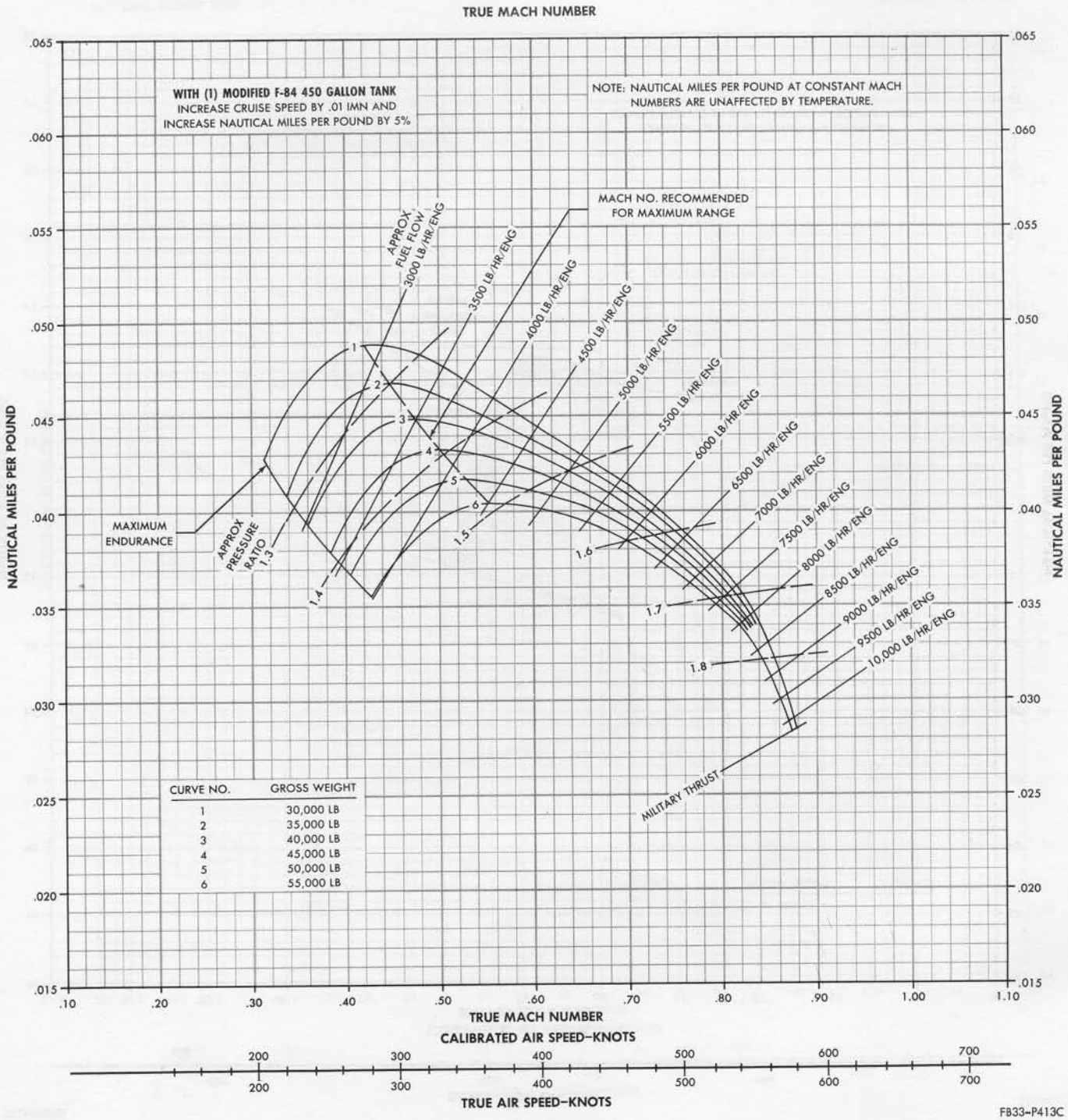
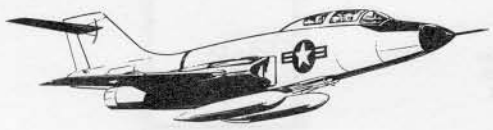


Figure A4-22

NAUTICAL MILES PER POUND

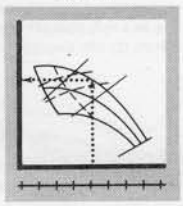
5000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



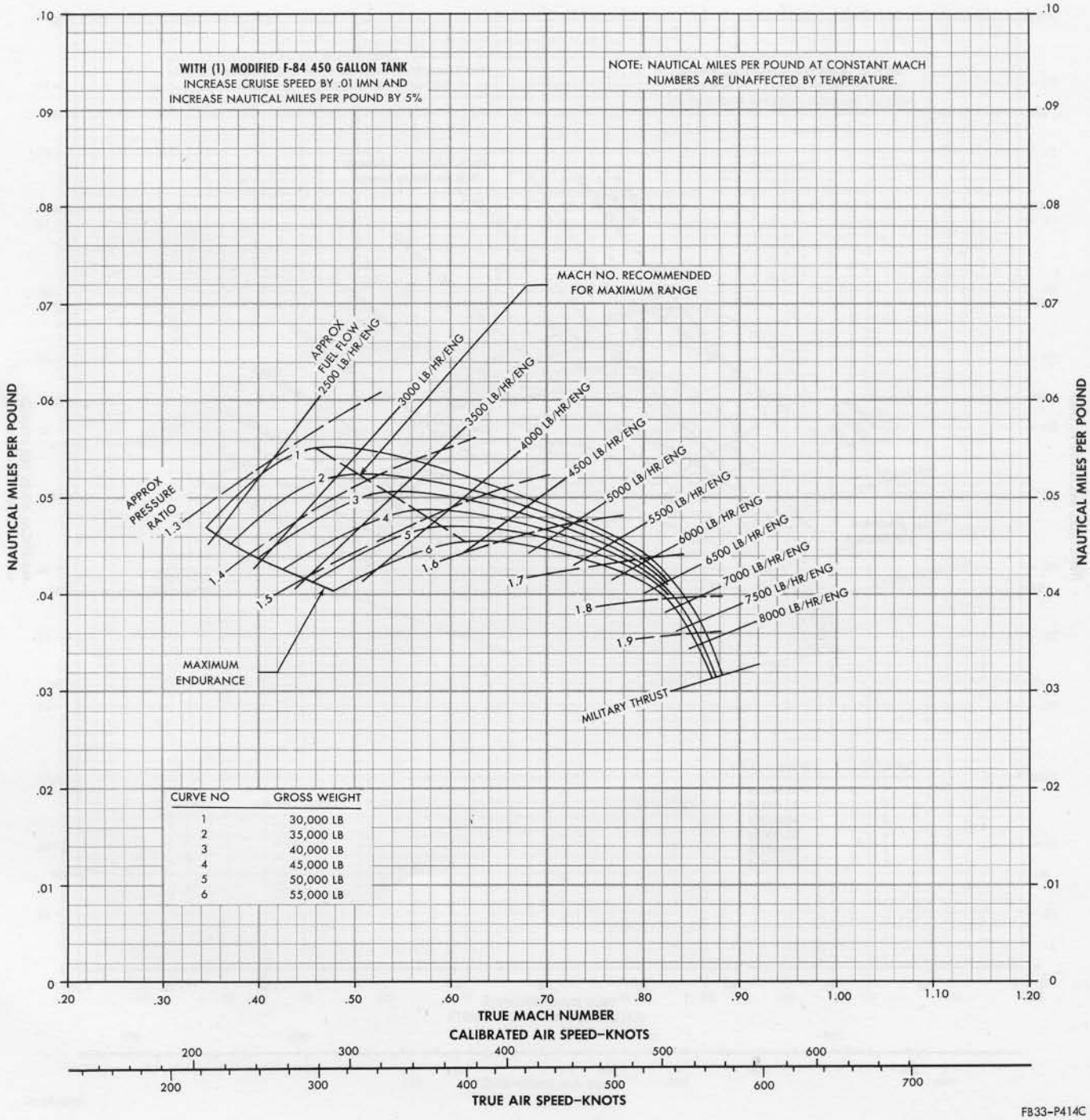
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 12%

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



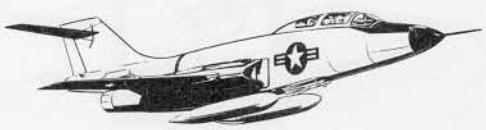
FB33-P414C

Figure A4-23

NAUTICAL MILES PER POUND

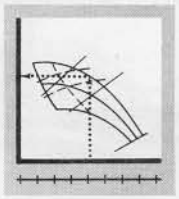
15,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 11%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

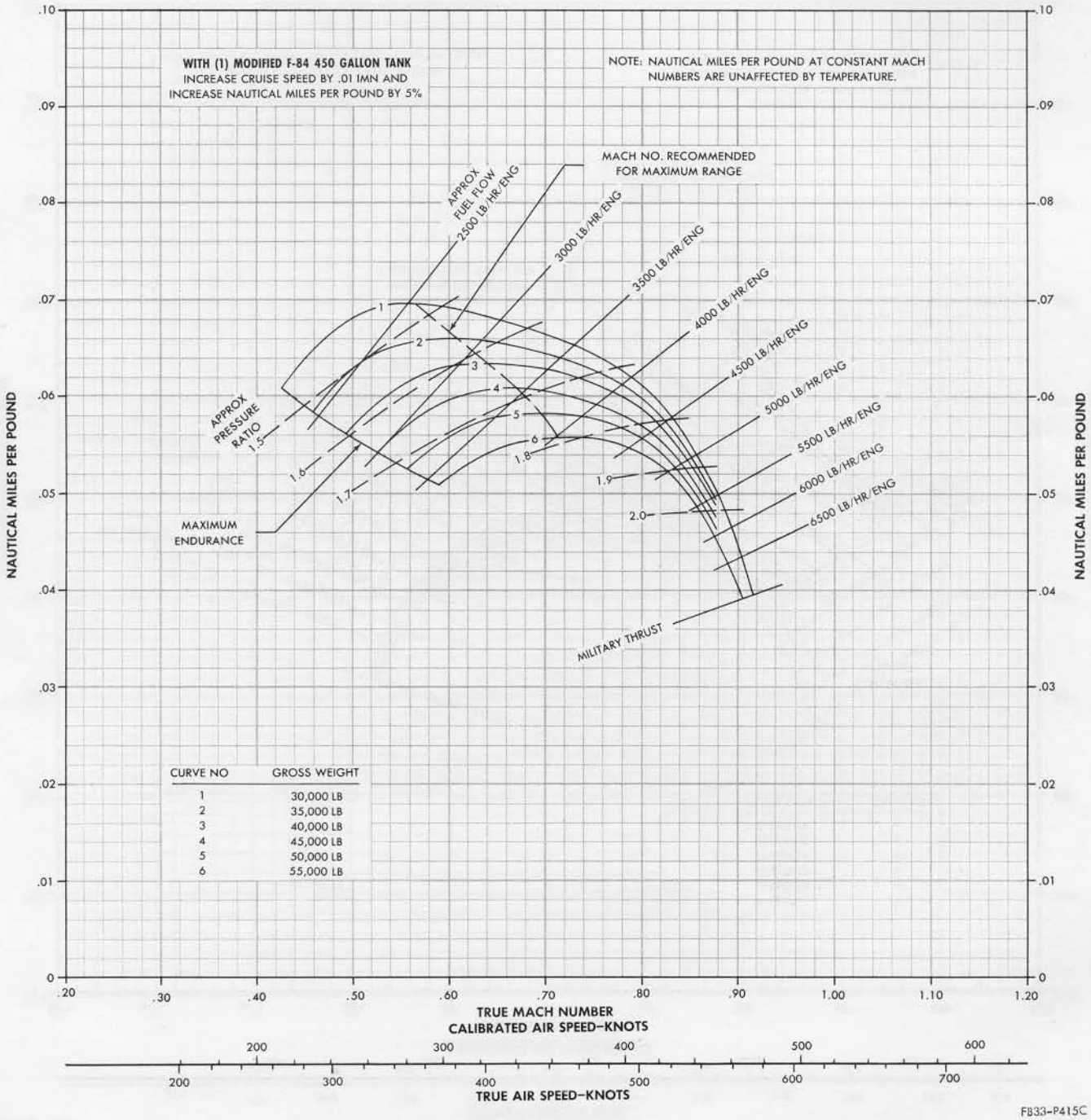
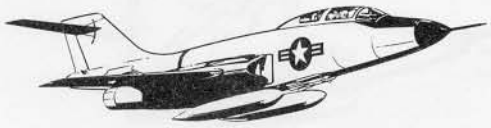


Figure A4-24

NAUTICAL MILES PER POUND

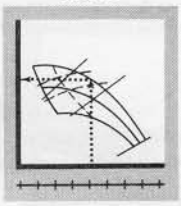
25,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 10%.

GUIDE



DATE: 1 JUNE 1959
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

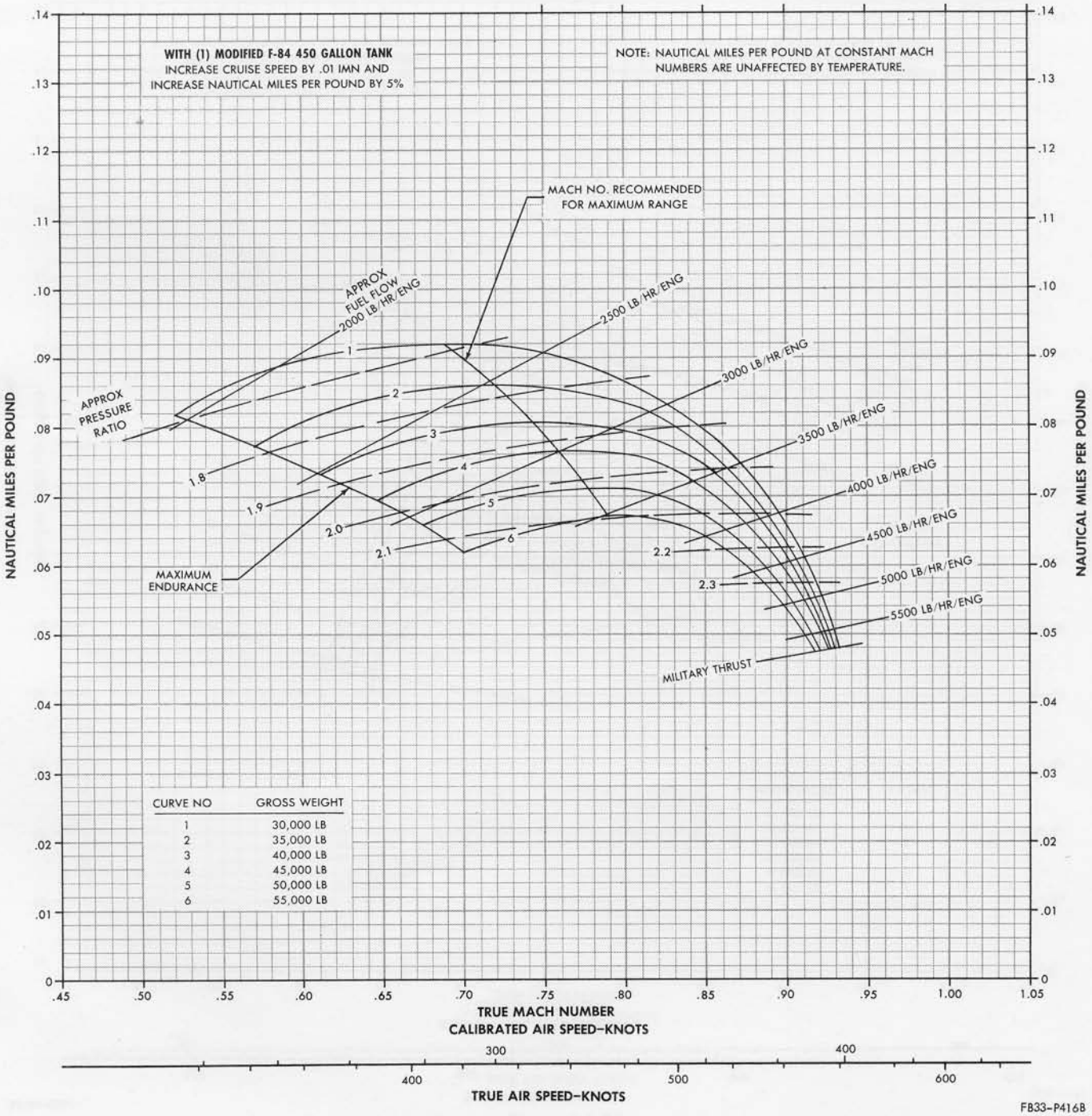
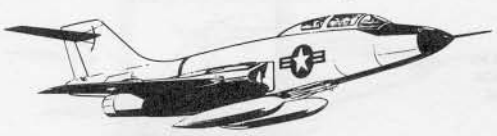


Figure A4-25

NAUTICAL MILES PER POUND

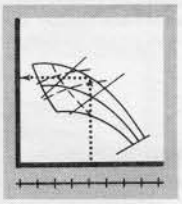
30,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME. RANGE DECREASES 10%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

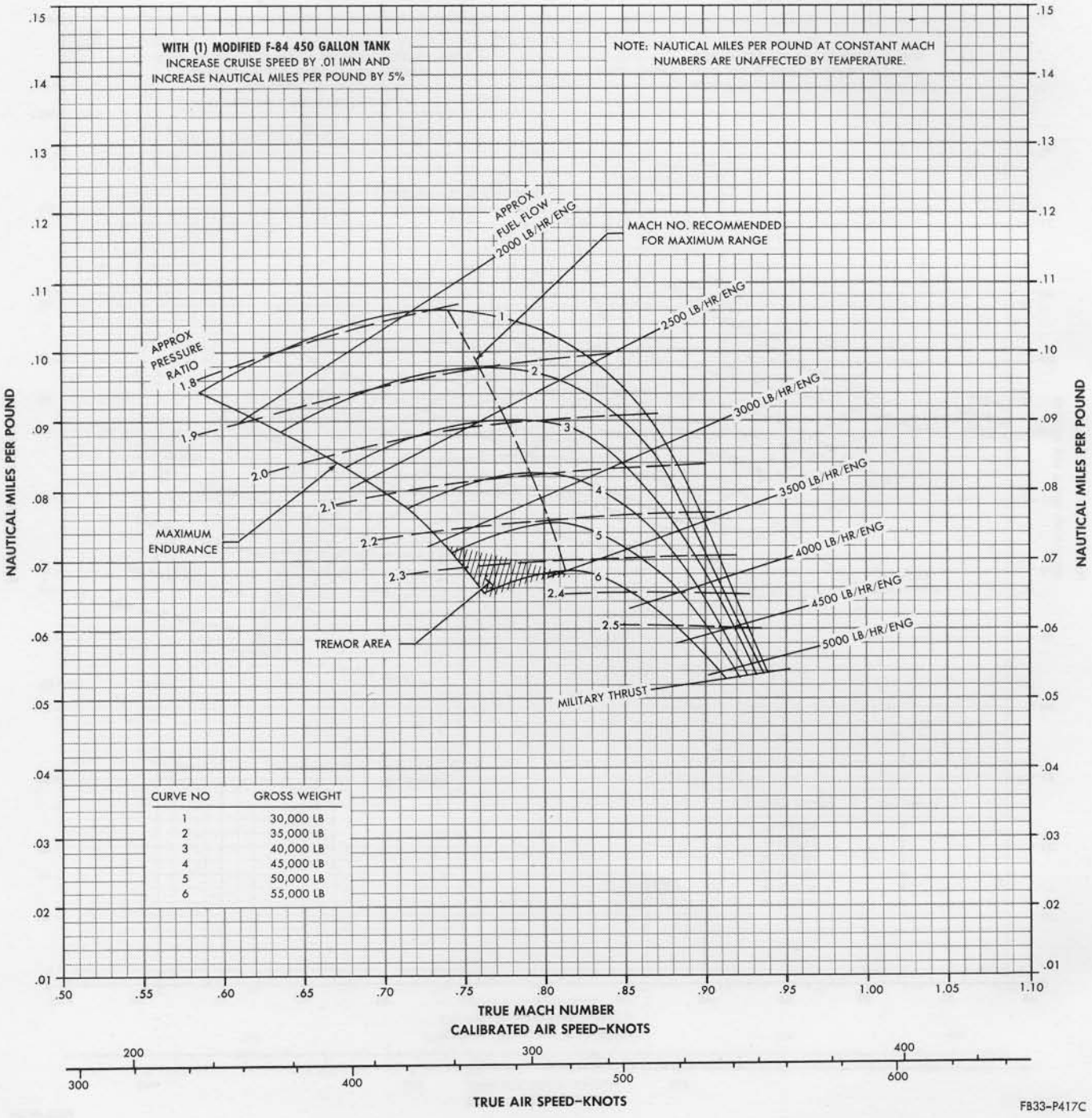
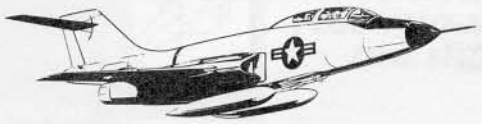


Figure A4-26

NAUTICAL MILES PER POUND

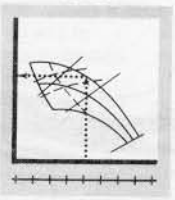
35,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



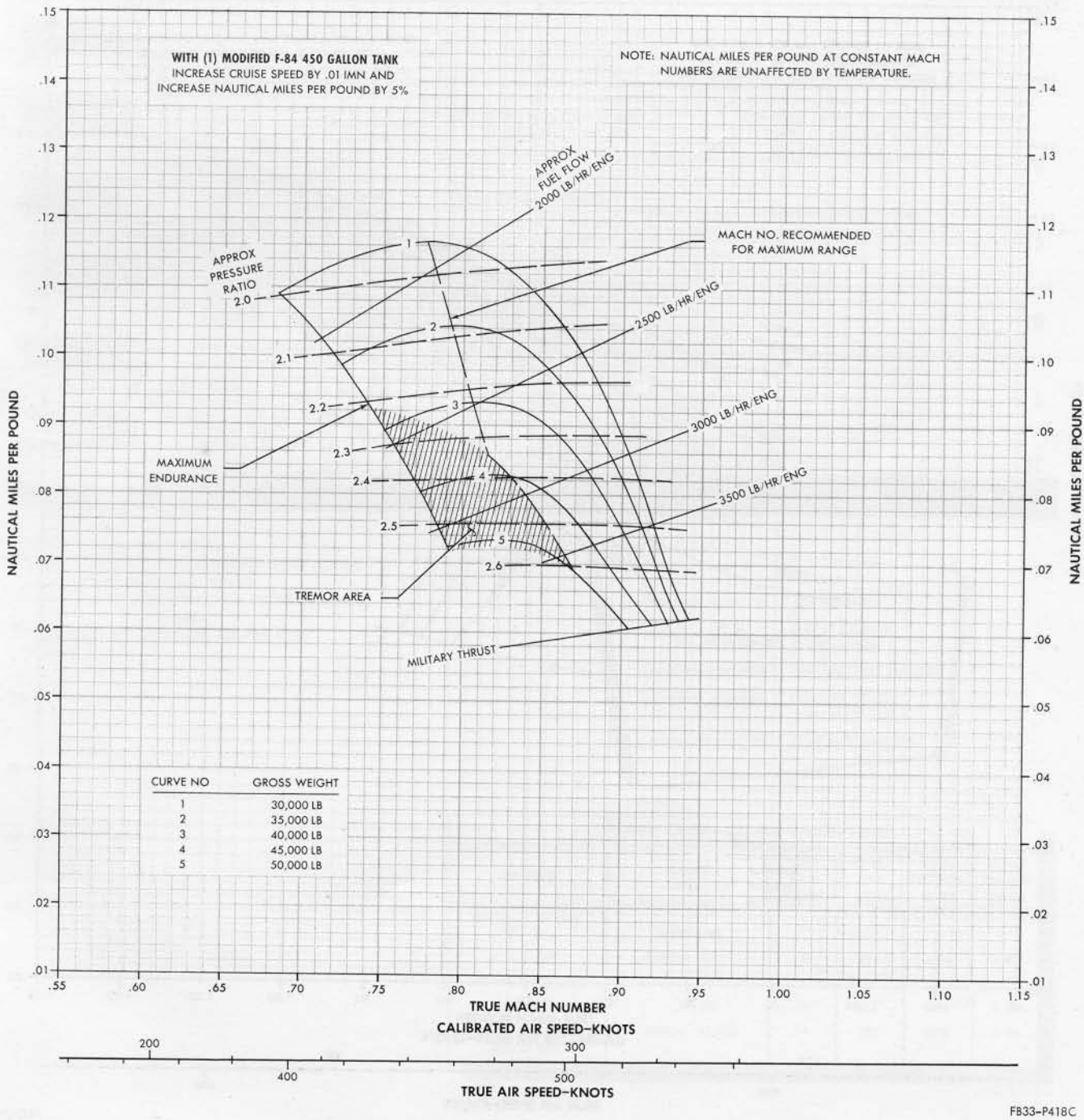
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 10%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



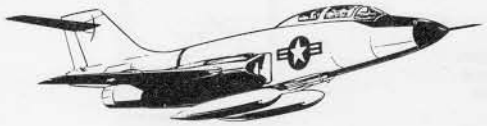
FB33-P418C

Figure A4-27

NAUTICAL MILES PER POUND

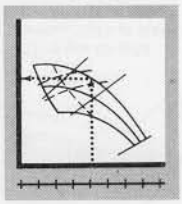
40,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 10%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

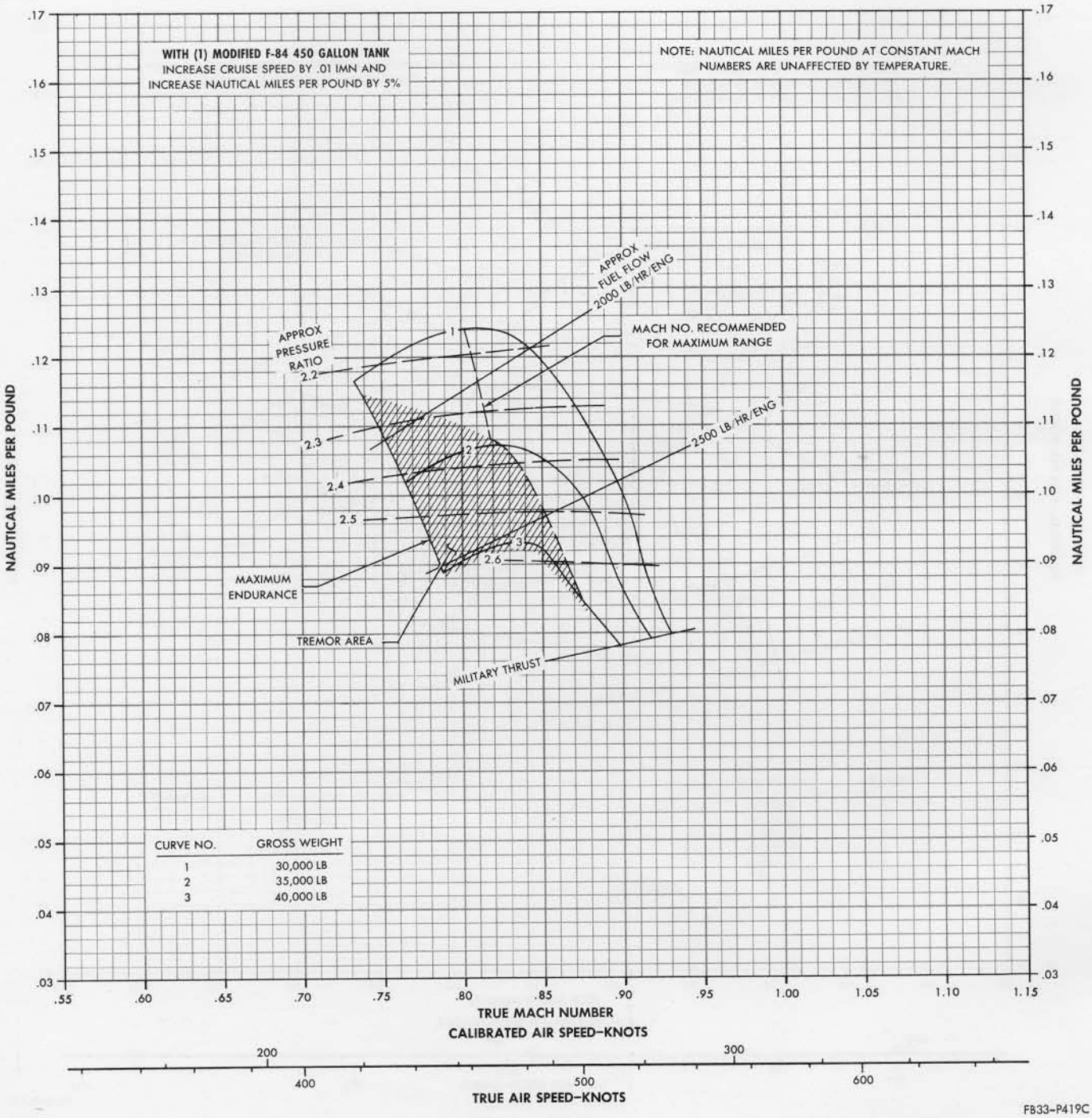


Figure A4-28

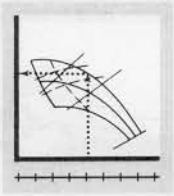
NAUTICAL MILES PER POUND

45,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 10%.

GUIDE



DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

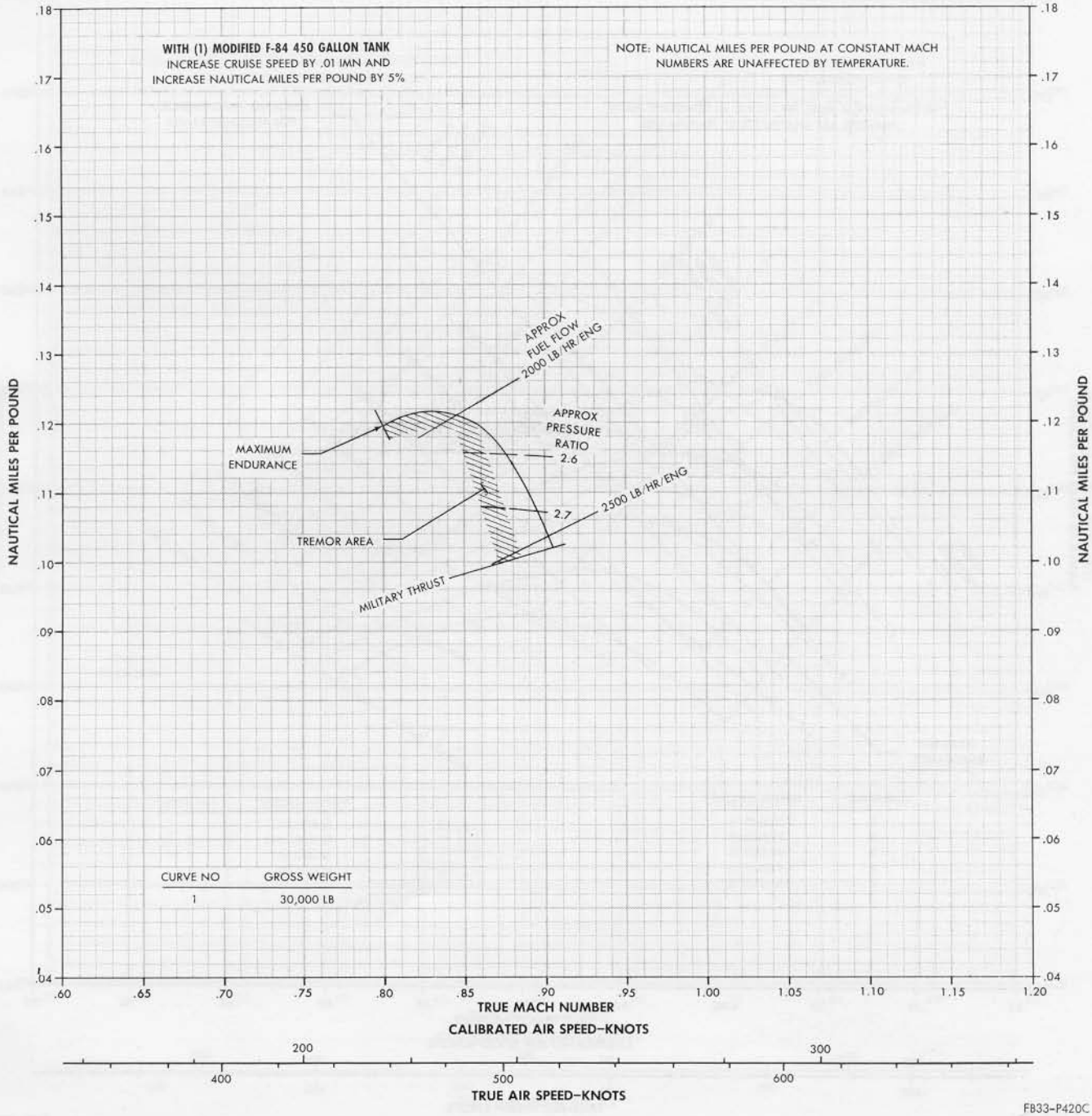


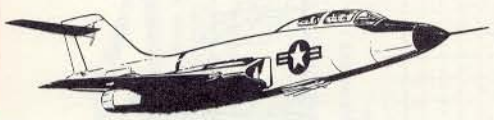
Figure A4-29

NAUTICAL MILES PER POUND

ONE ENGINE OPERATING

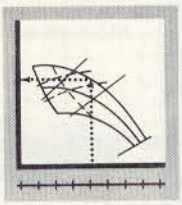
SEA LEVEL

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 14%.

GUIDE



DATE 1 JUNE 1959
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

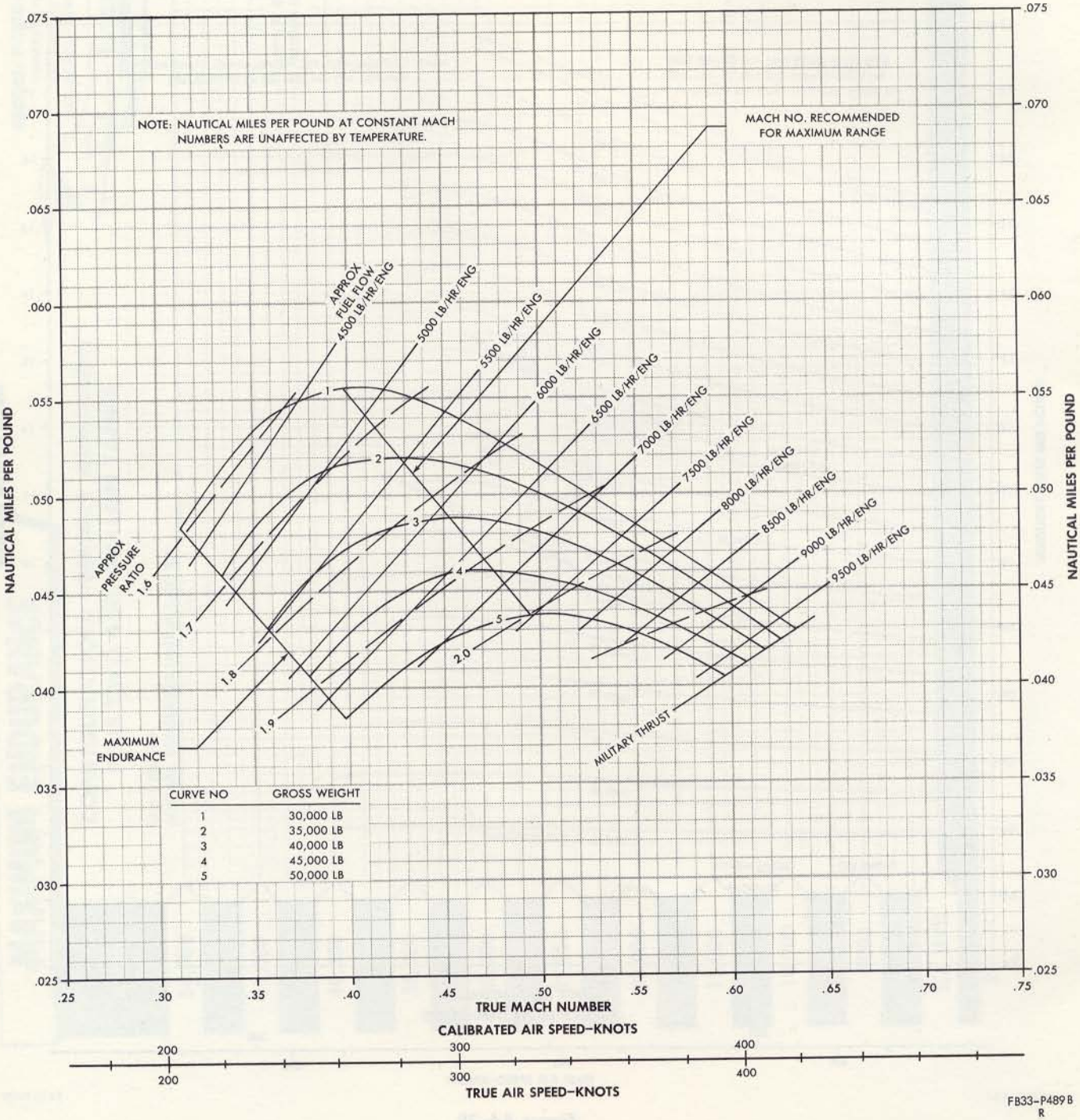


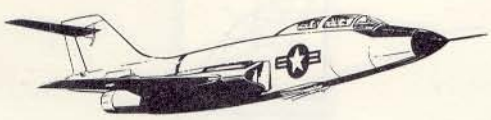
Figure A4-30

NAUTICAL MILES PER POUND

ONE ENGINE OPERATING

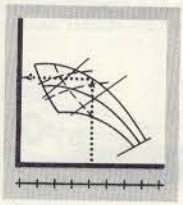
5000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



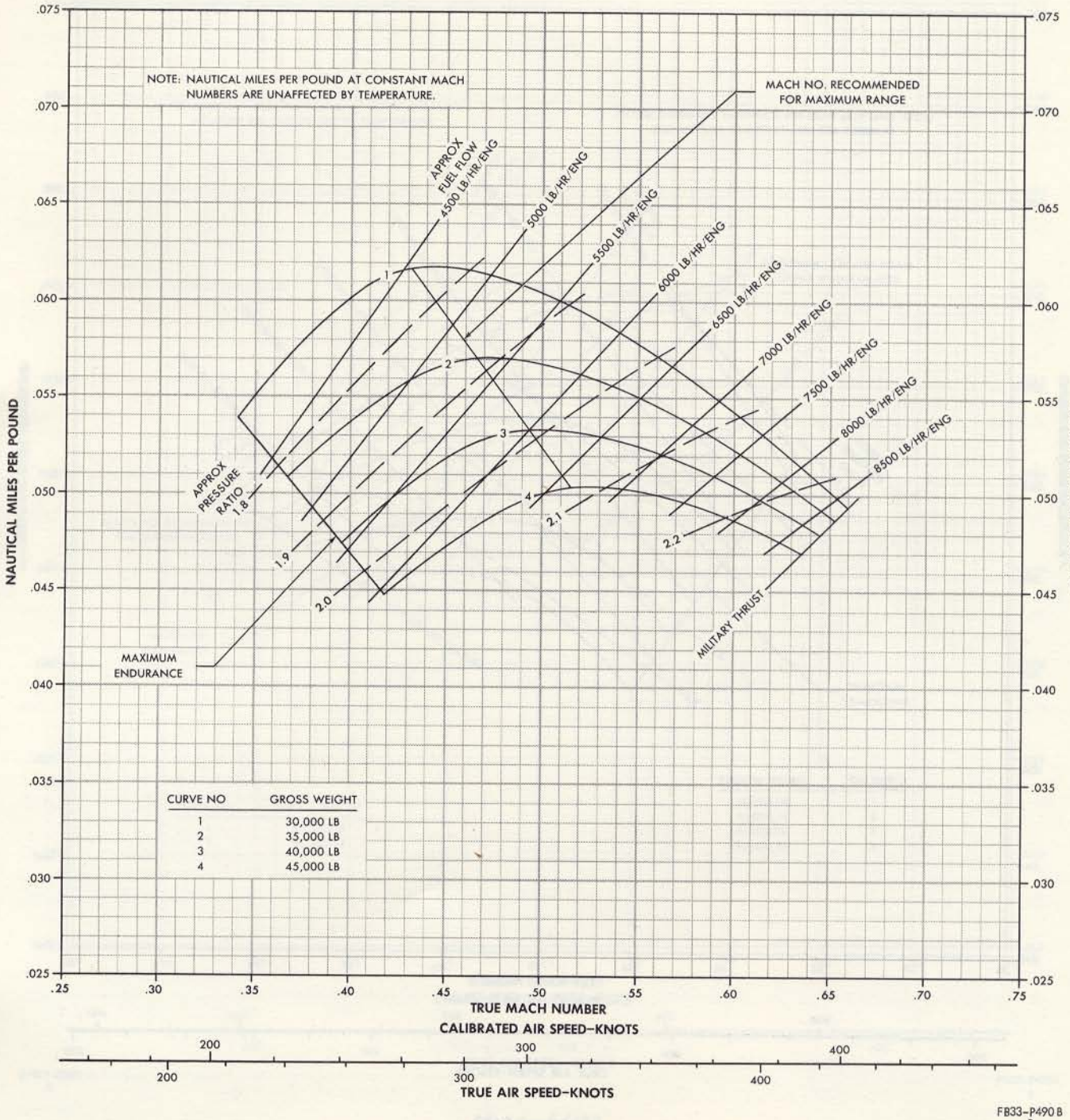
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 13%.

GUIDE



DATE 1 JUNE 1959
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P490 B
R

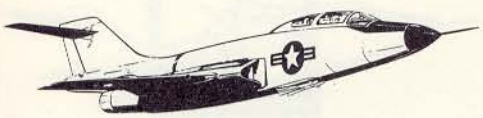
Figure A4-31

NAUTICAL MILES PER POUND

ONE ENGINE OPERATING

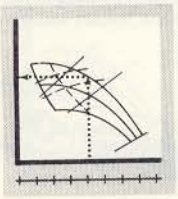
15,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 12%.

GUIDE



DATE 1 JUNE 1959
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

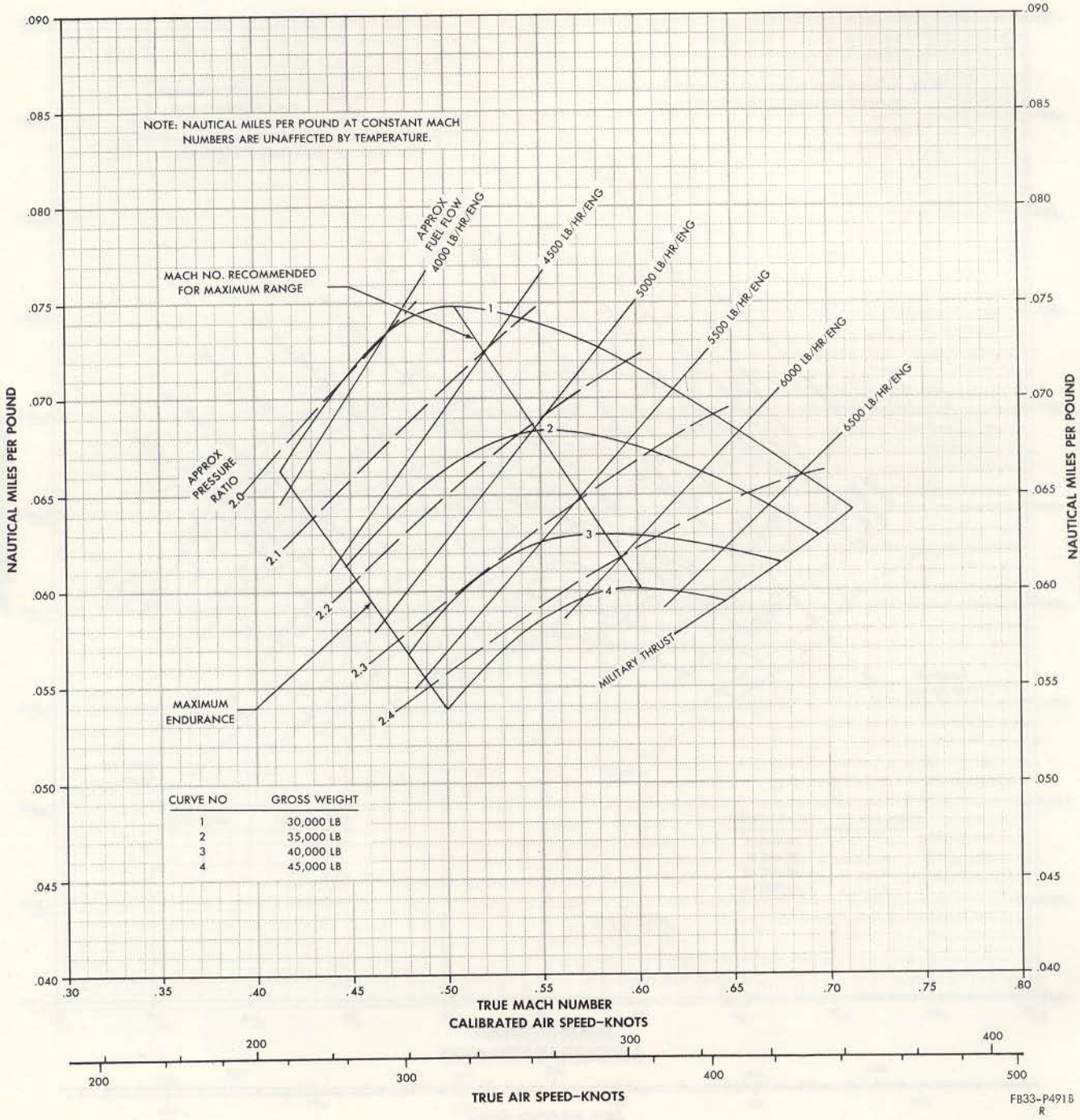


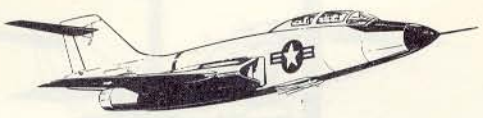
Figure A4-32

NAUTICAL MILES PER POUND

ONE ENGINE OPERATING

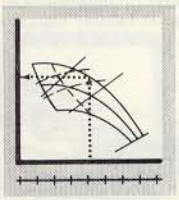
25,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME.
RANGE DECREASES 11%.

GUIDE



DATE 1 JUNE 1959
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

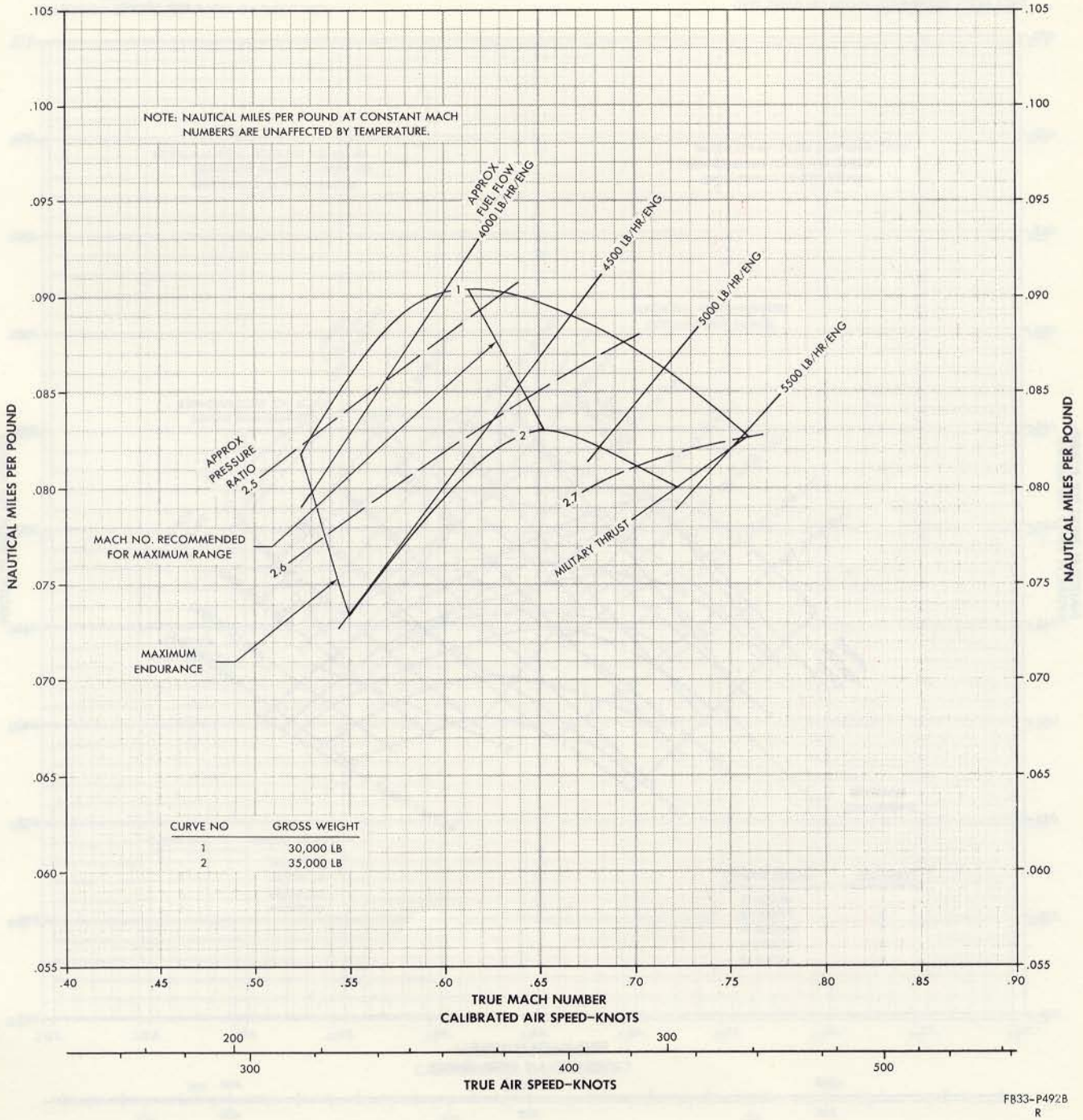


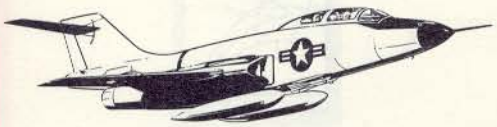
Figure A4-33

NAUTICAL MILES PER POUND

ONE ENGINE OPERATING

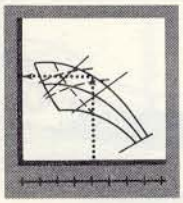
SEA LEVEL

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME
RANGE DECREASES APPROXIMATELY 15%

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

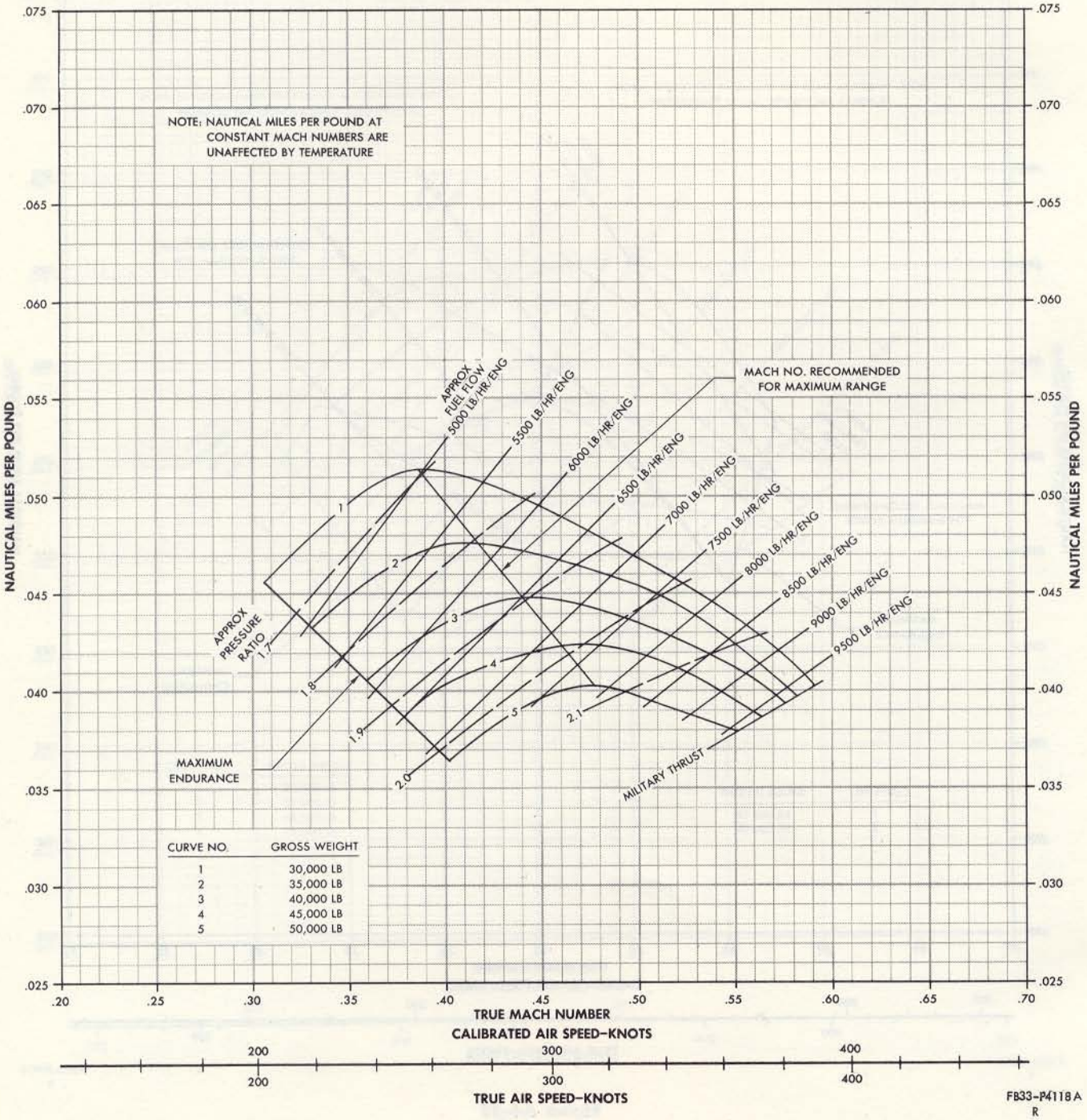
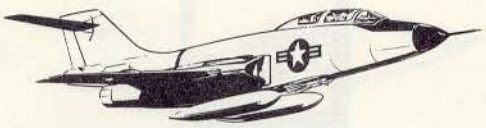


Figure **A4-34**

NAUTICAL MILES PER POUND

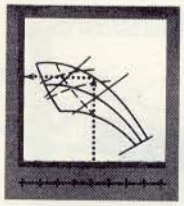
ONE ENGINE OPERATING
5000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME
RANGE DECREASES APPROXIMATELY 14%.

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

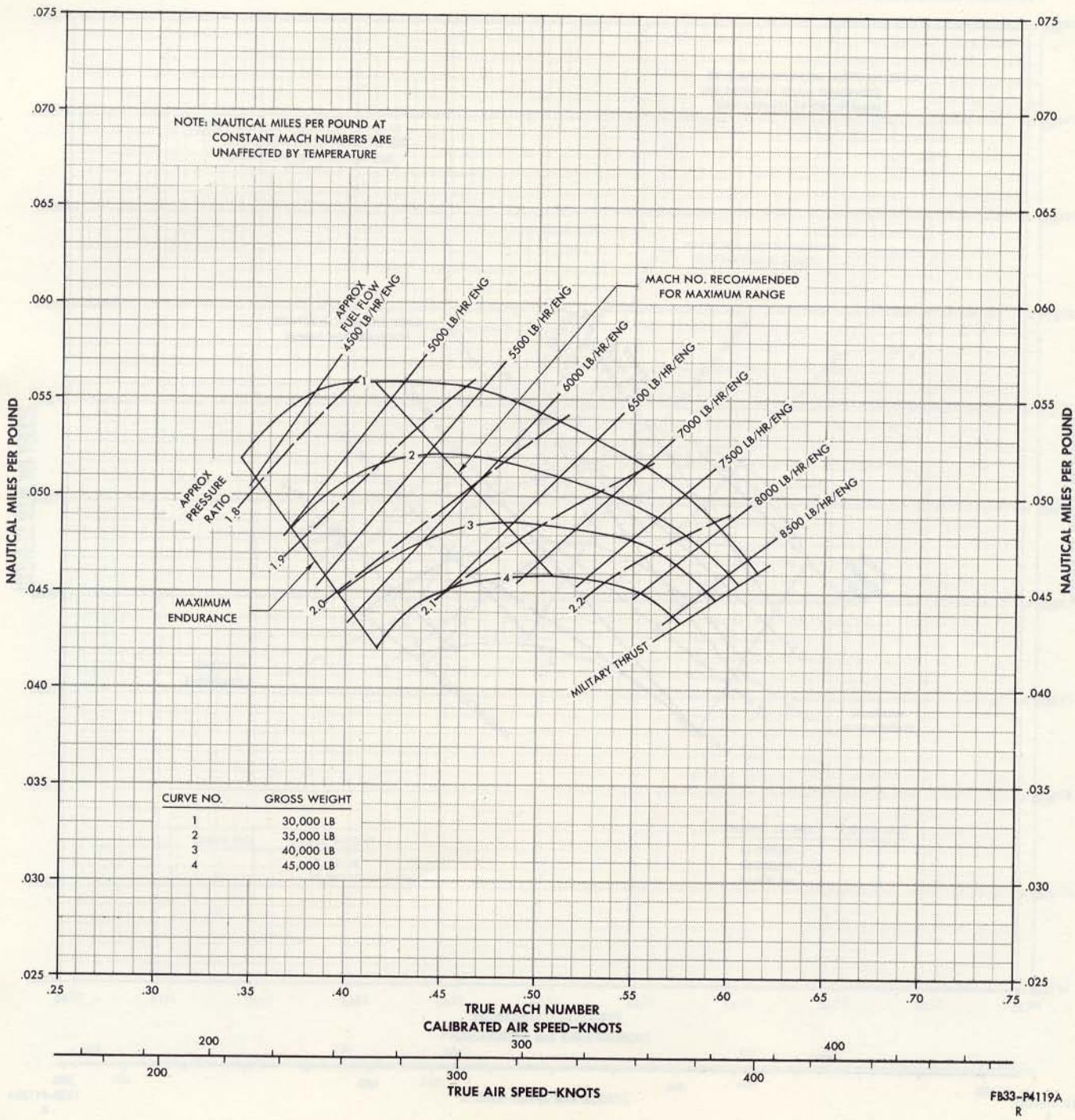


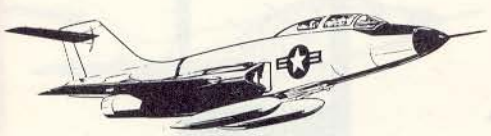
Figure **A4-35**

NAUTICAL MILES PER POUND

ONE ENGINE OPERATING

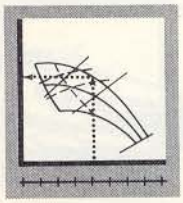
15,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME
RANGE DECREASES APPROXIMATELY 13%.

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

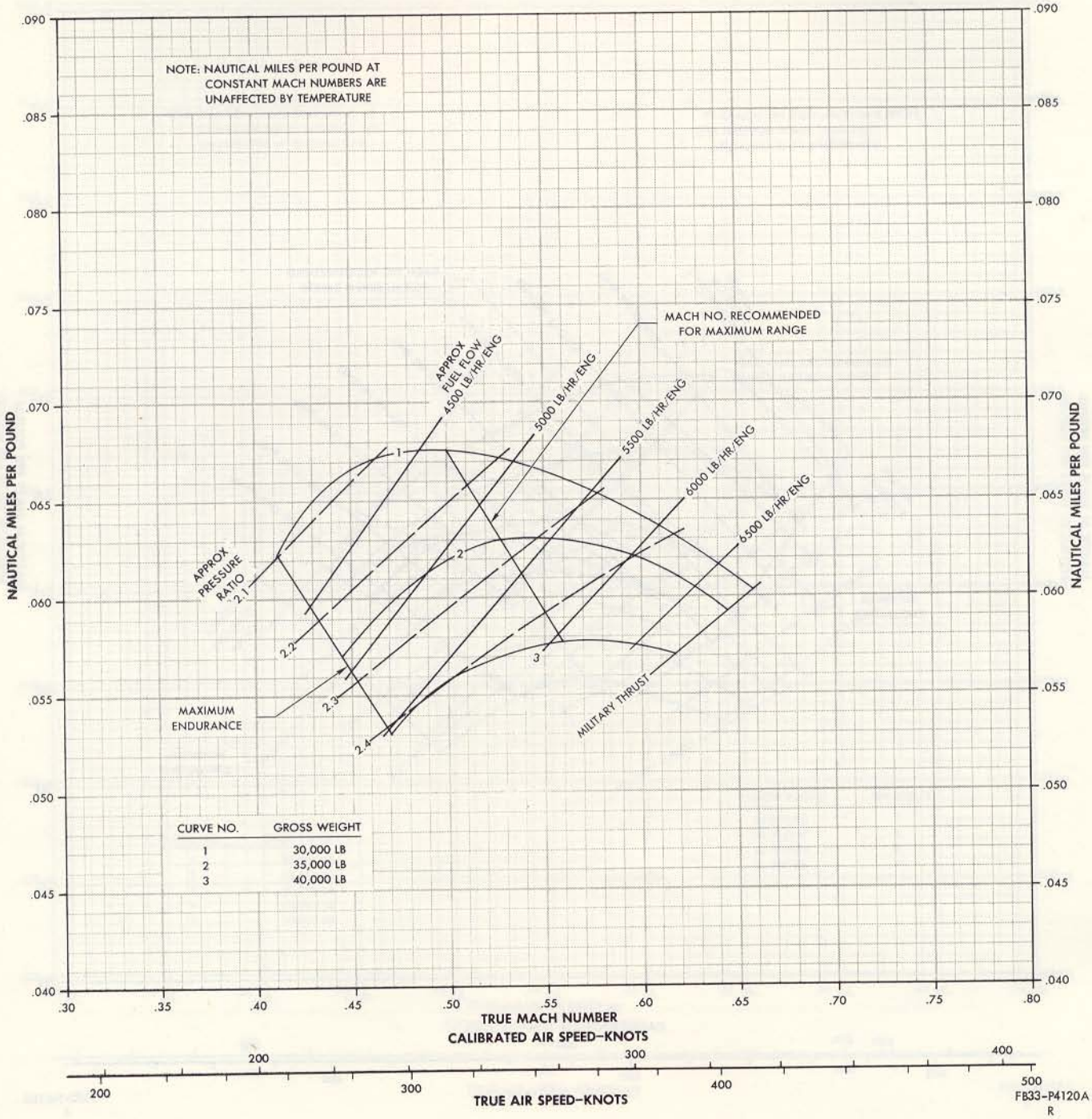


Figure A4-36

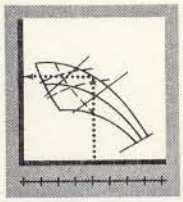
NAUTICAL MILES PER POUND

ONE ENGINE OPERATING
20,000 FEET

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
INOPERATIVE ENGINE WINDMILLING
50 KNOT HEADWIND CONDITION:
RECOMMENDED CRUISE MACH NUMBER REMAINS THE SAME
RANGE DECREASES APPROXIMATELY 12%.

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

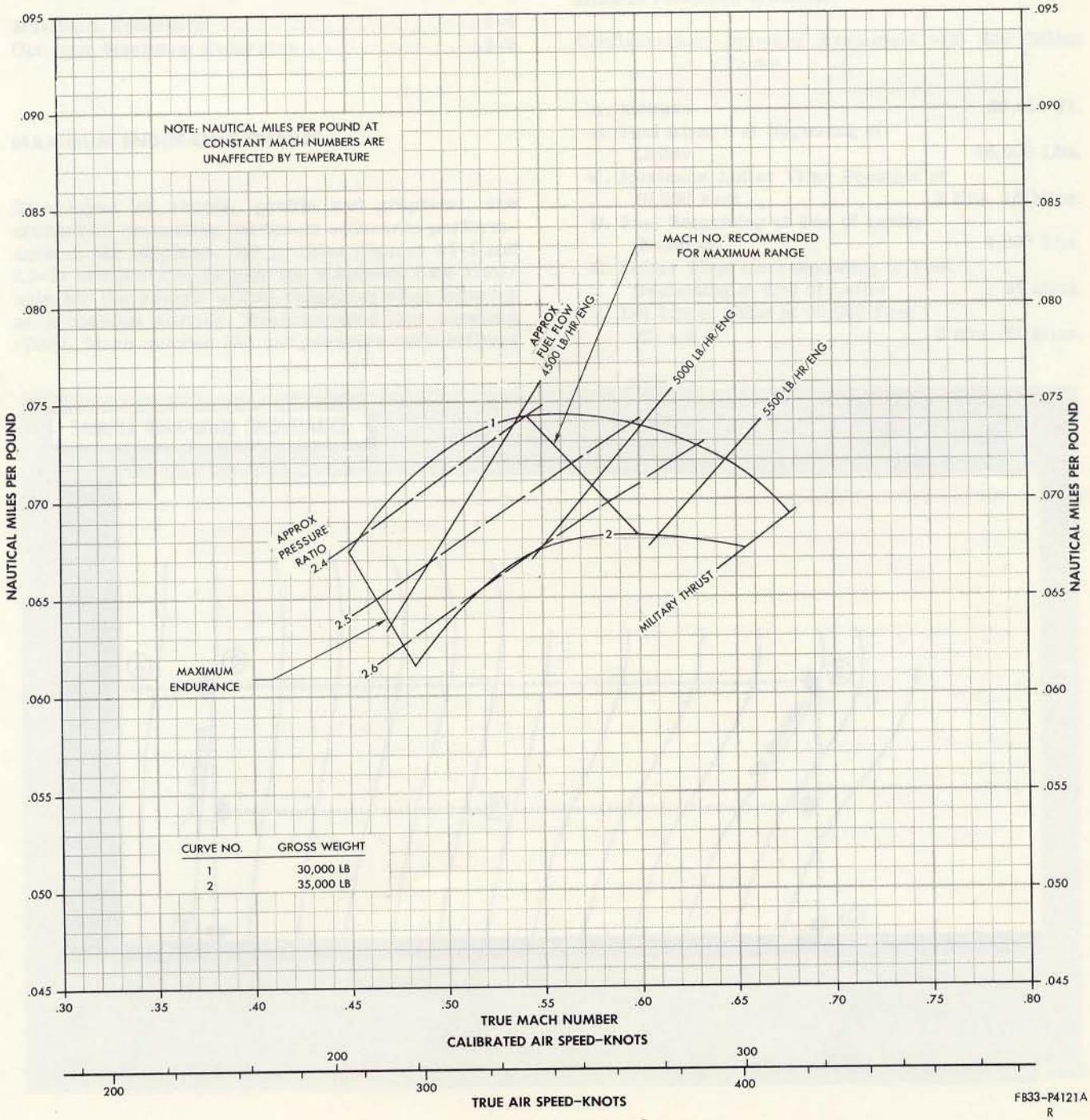


Figure A4-37

part 5 Endurance

TABLE OF CONTENTS

Charts

Maximum Endurance A5-4
Optimum Maximum Endurance A5-8

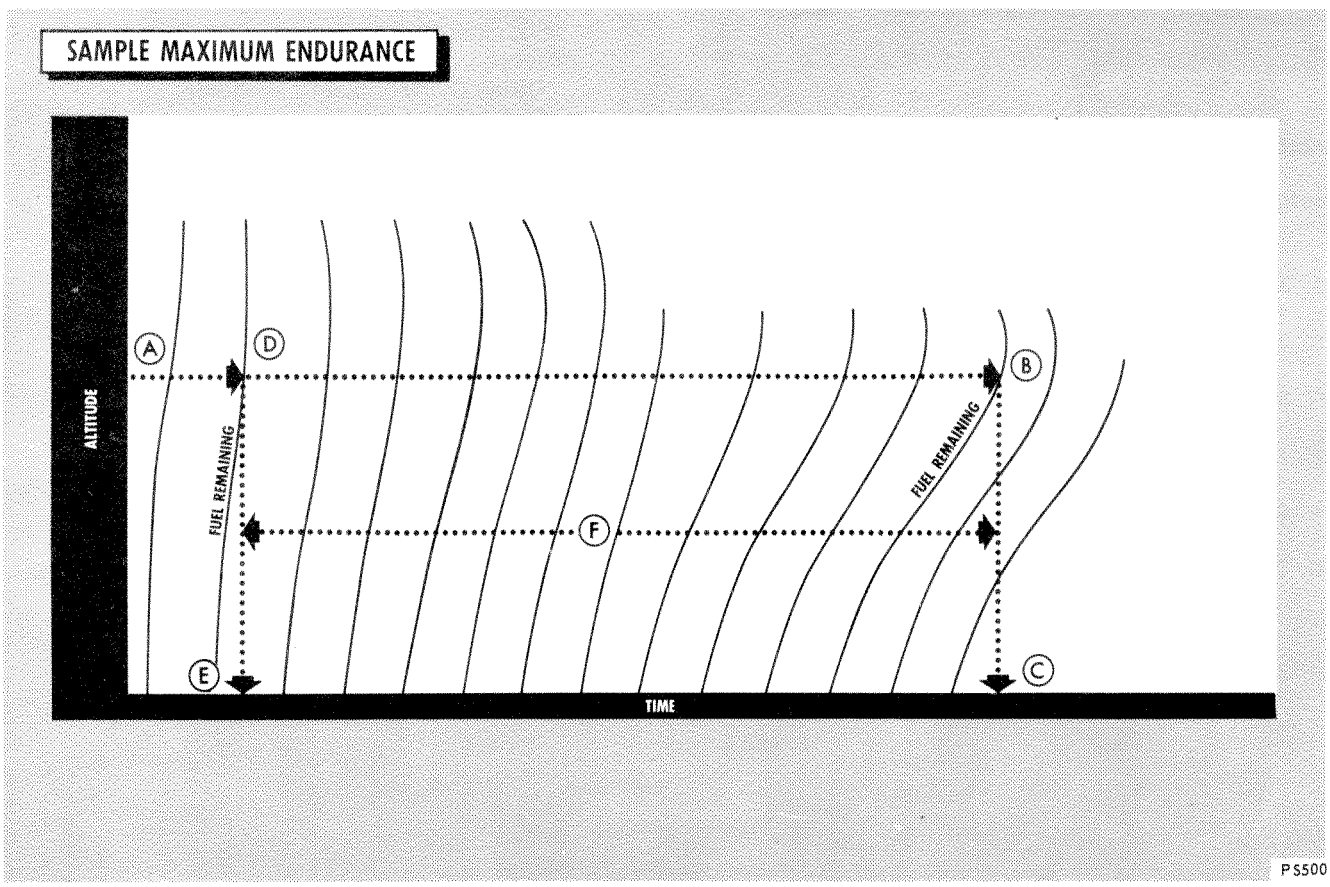
MAXIMUM ENDURANCE CHARTS

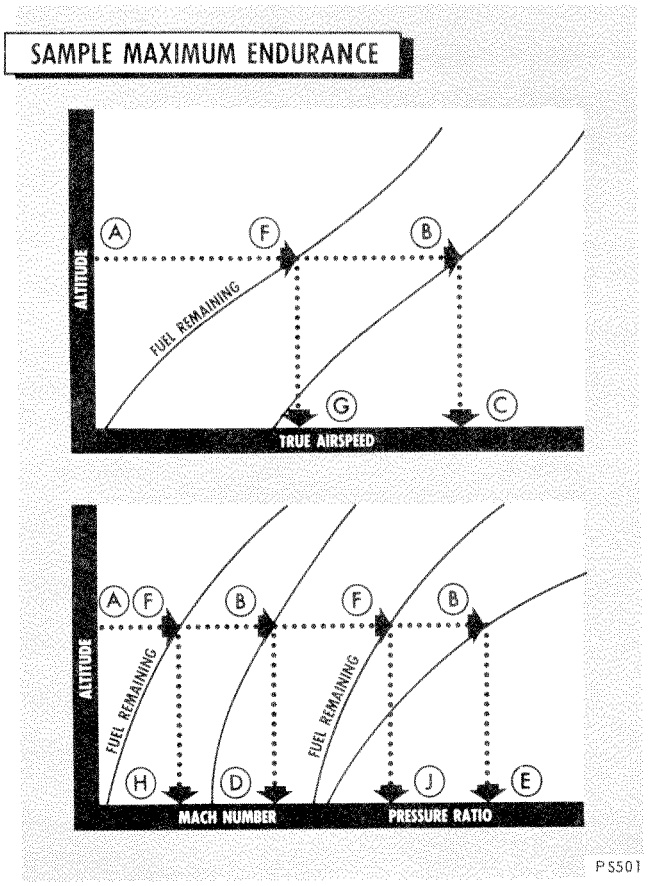
Two types of charts, profile and graphical, are utilized in presenting maximum endurance performance of the airplane. The profiles (figures A5-1 and A5-3) are provided to show the maximum time available for the amount of fuel remaining when loitering at a constant altitude. Recommended true airspeed (TAS), Mach number (M) and pressure ratio settings necessary to realize the maximum time available, are shown graphically in figures A5-2 and A5-4.

SAMPLE PROBLEM (PROFILE)

Configuration: Primary Armament +(2) 450 Gallon Tanks

A. Altitude	30,000 Ft.
B. Fuel Aboard at Beginning of Loiter	16,000 Lbs.
C. Maximum Loiter Time Possible at 30,000 Feet	3 Hrs. 18 Mins.
D. Fuel Remaining at End of Loiter (Reserve)	4,000 Lbs.
E. Loiter Time Corresponding to Fuel Remaining at End of Loiter	57 Mins.
F. Net Loiter Time at 30,000 Feet (C. - E.)	2 Hrs. 21 Mins.





SAMPLE PROBLEM (GRAPHICAL)

Configuration: Primary Armament +(2) 450 Gallon Tanks

A. Altitude	30,000 Ft.
B. Fuel Aboard at Beginning of Loiter	16,000 Lbs.
C. True Airspeed (TAS) at Beginning of Loiter	433 Kts.
D. Mach Number at Beginning of Loiter	.73
E. Pressure Ratio at Beginning of Loiter	2.21
F. Fuel Aboard at End of Loiter (Reserve)	4,000 Lbs.
G. True Airspeed (TAS) at End of Loiter	381 Kts.
H. Mach Number at End of Loiter	.65
J. Pressure Ratio at End of Loiter	1.96

OPTIMUM MAXIMUM ENDURANCE PROFILES

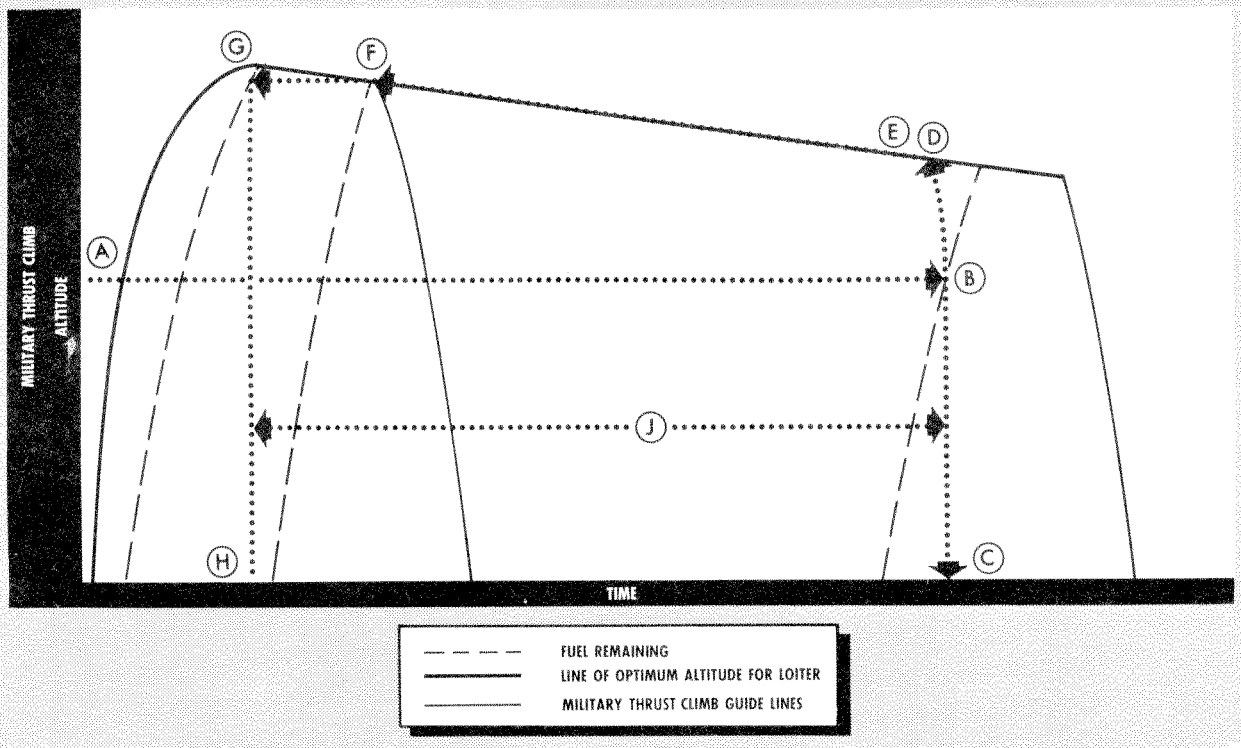
These profiles (figures A5-5 and A5-6) give the maximum time in the air for fuel remaining, based on an optimum flight path, from any starting altitude. The flight path required is indicated by the different shaded areas and their related notes. Time and fuel lines shown are based on a Military thrust climb to best endurance altitude, loiter at that altitude, and a maximum-range descent to sea level (no reserve for landing). The climb speed schedule is tabulated at the left of the chart.

SAMPLE PROBLEM

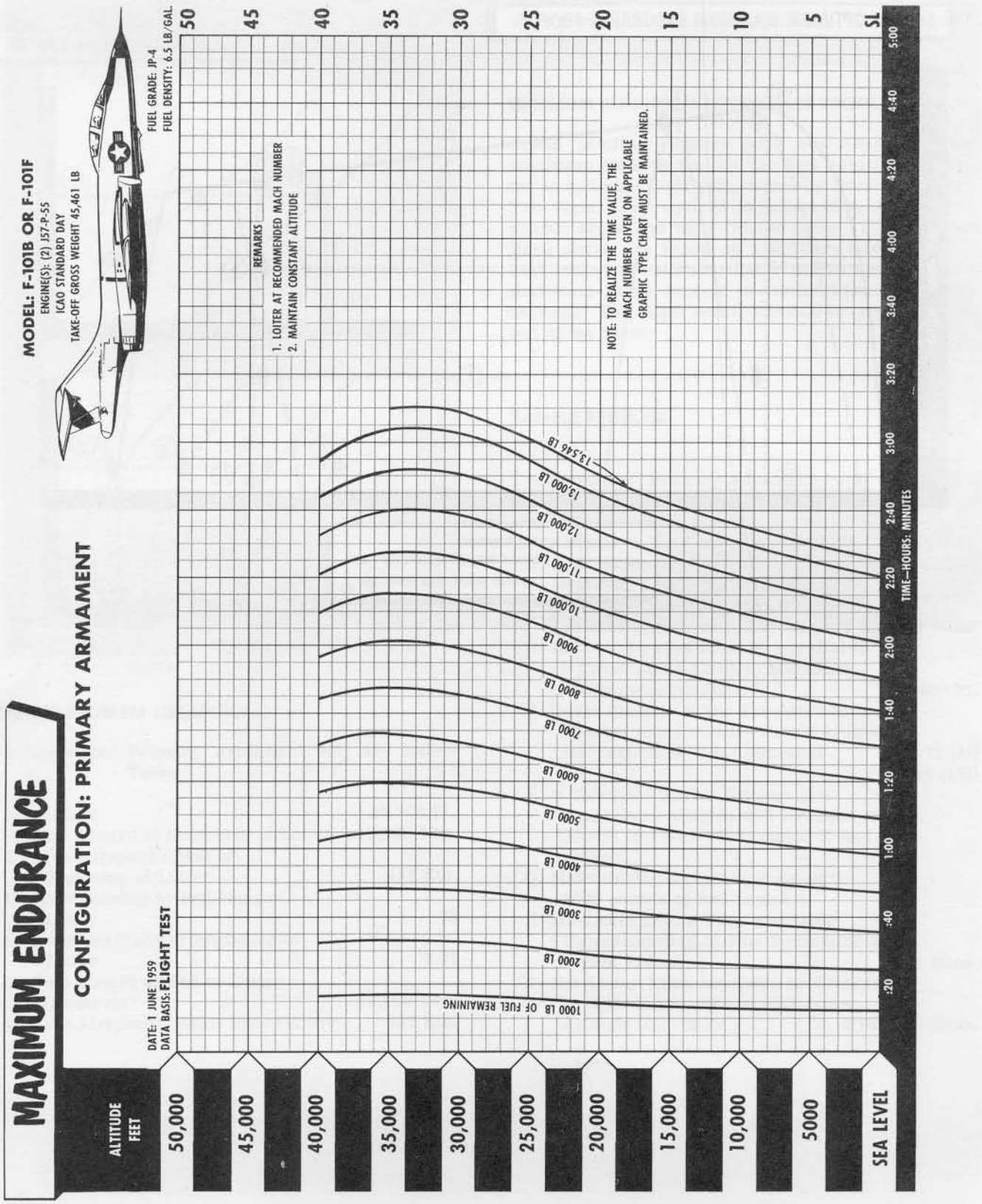
Configuration: Primary Armament +(2) 450 Gallon Tanks

A. Altitude	25,000 Ft.
B. Fuel Aboard	16,000 Lbs.
C. Maximum Loiter Time Available (Including Military Thrust Climb to Maximum Endurance Altitude)	3 Hrs. 24 Mins.
D. Proceed Upward from B. Parallel to Climb Guide Lines to Maximum Endurance Altitude	29,200 Ft.
E. Reset Throttle to the Tabulated Mach Number and Pressure Ratios to Realize the Endurance Time Indicated	.72 (M) 2.18 (PR)
F. If Tabulated Thrust Settings are maintained, altitude will increase to 34,000 feet with 3000 pounds of fuel aboard.	
G. Maintain 34,000 feet altitude until 2000 pounds of fuel remains.	
H. Maximum Loiter Time Available (Corresponding to Fuel Remaining at End of Loiter)	34 Mins.
J. Net Loiter Time Available by Climbing to Optimum Maximum Endurance Altitude (C. - H.)	2 Hrs. 50 Mins.

SAMPLE OPTIMUM MAXIMUM ENDURANCE PROFILE



PS502

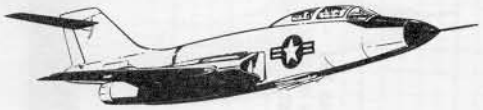


FB33-P5008

Figure A5-1

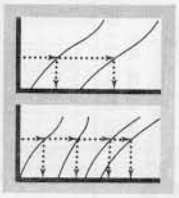
MAXIMUM ENDURANCE

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



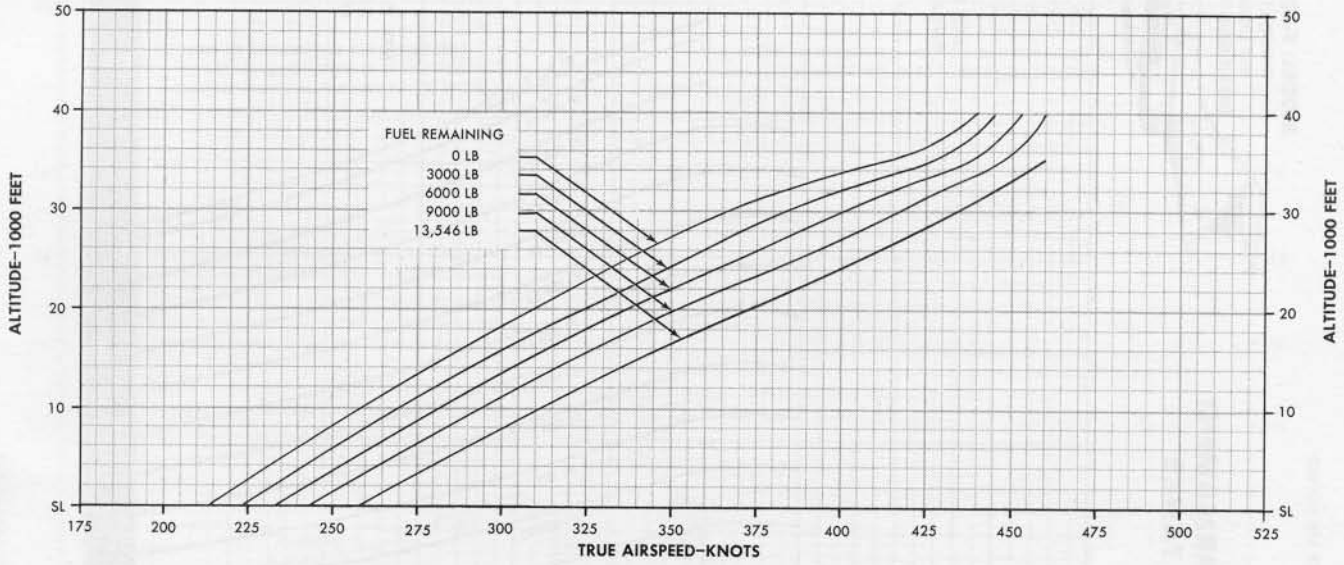
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

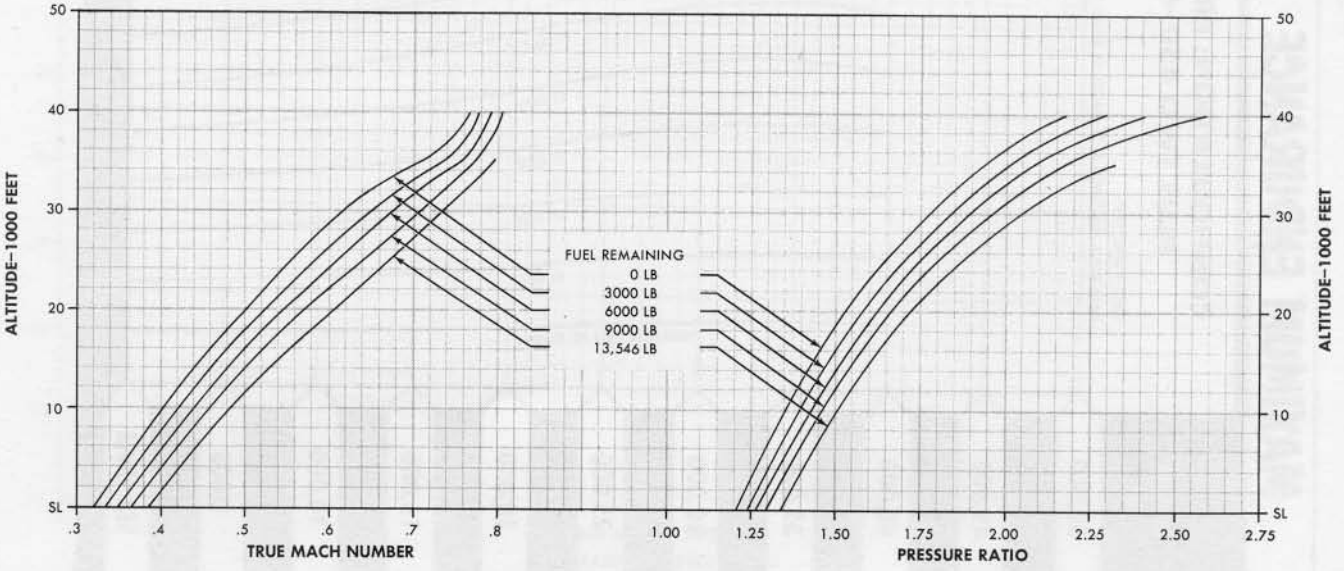
GUIDE



DATE 1 JUNE 1959
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





FB33-P501B

Figure A5-2

MAXIMUM ENDURANCE

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

CONFIGURATION: PRIMARY ARMAMENT PLUS TWO 450-GALLON TANKS

DATE: 1 JUNE 1959
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

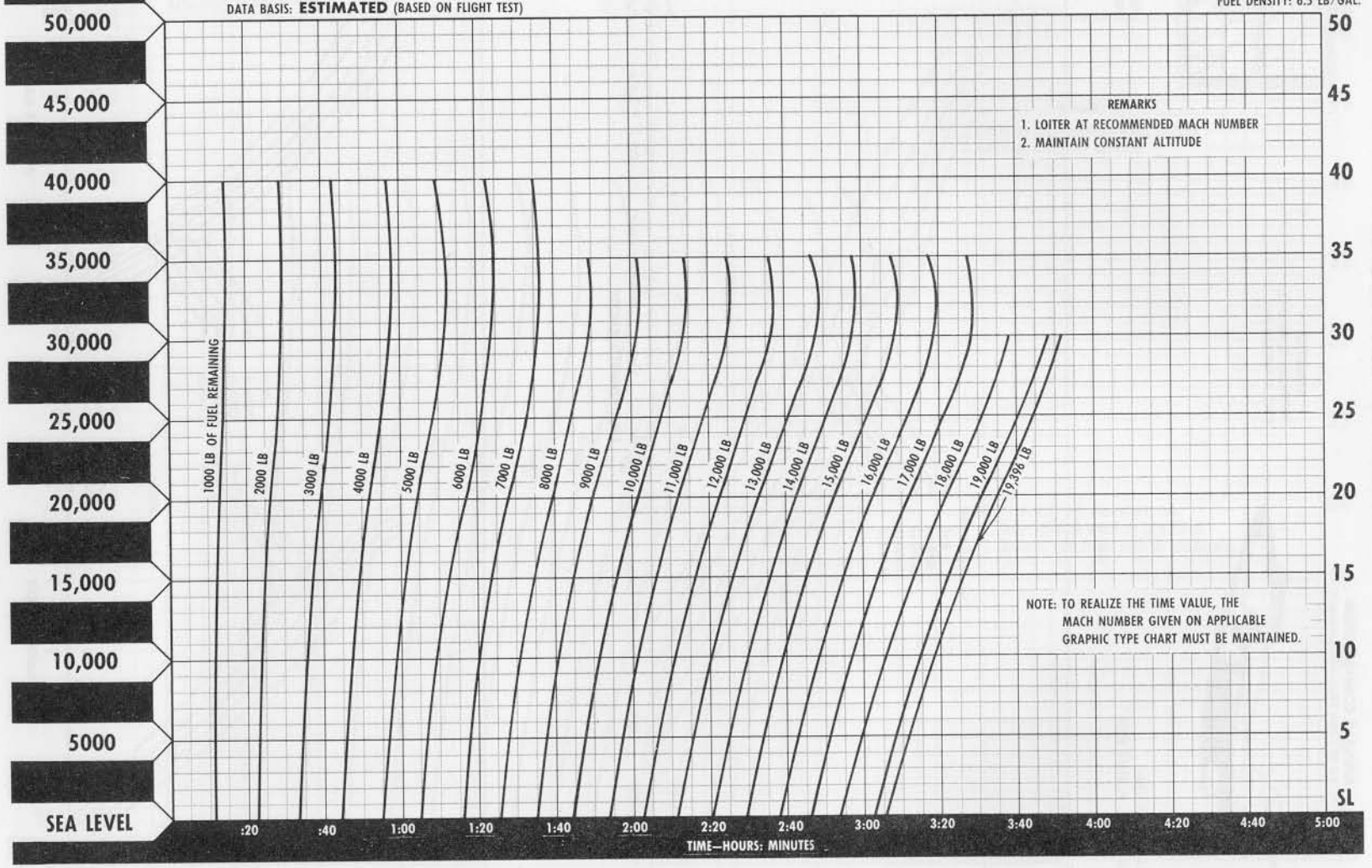
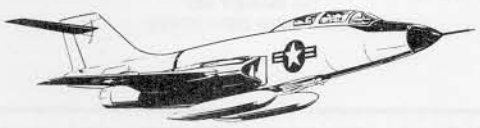


Figure A5-3

FB33-P5028

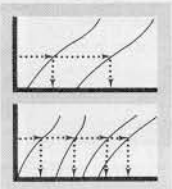
MAXIMUM ENDURANCE

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



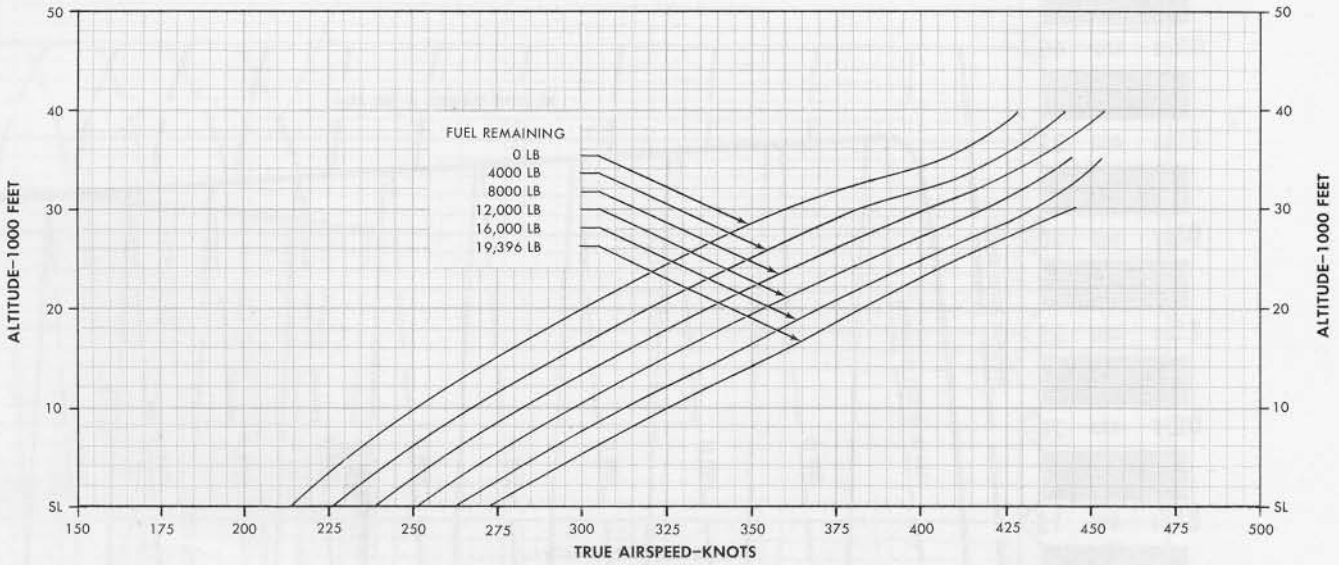
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

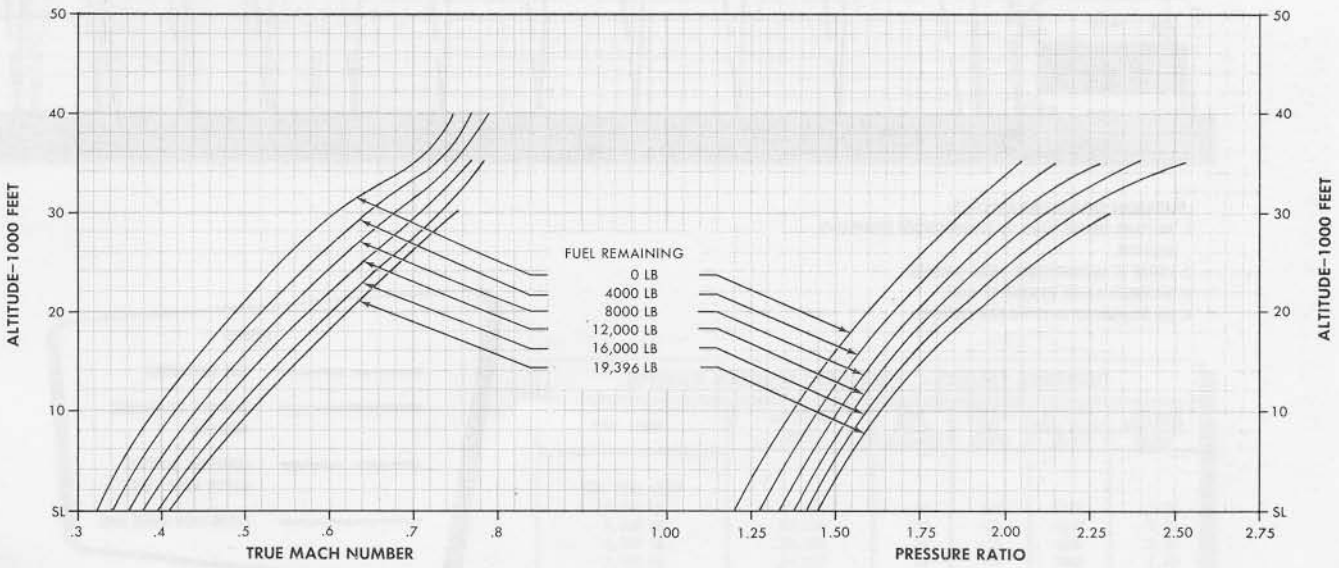
GUIDE



DATE: 1 JUNE 1959
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

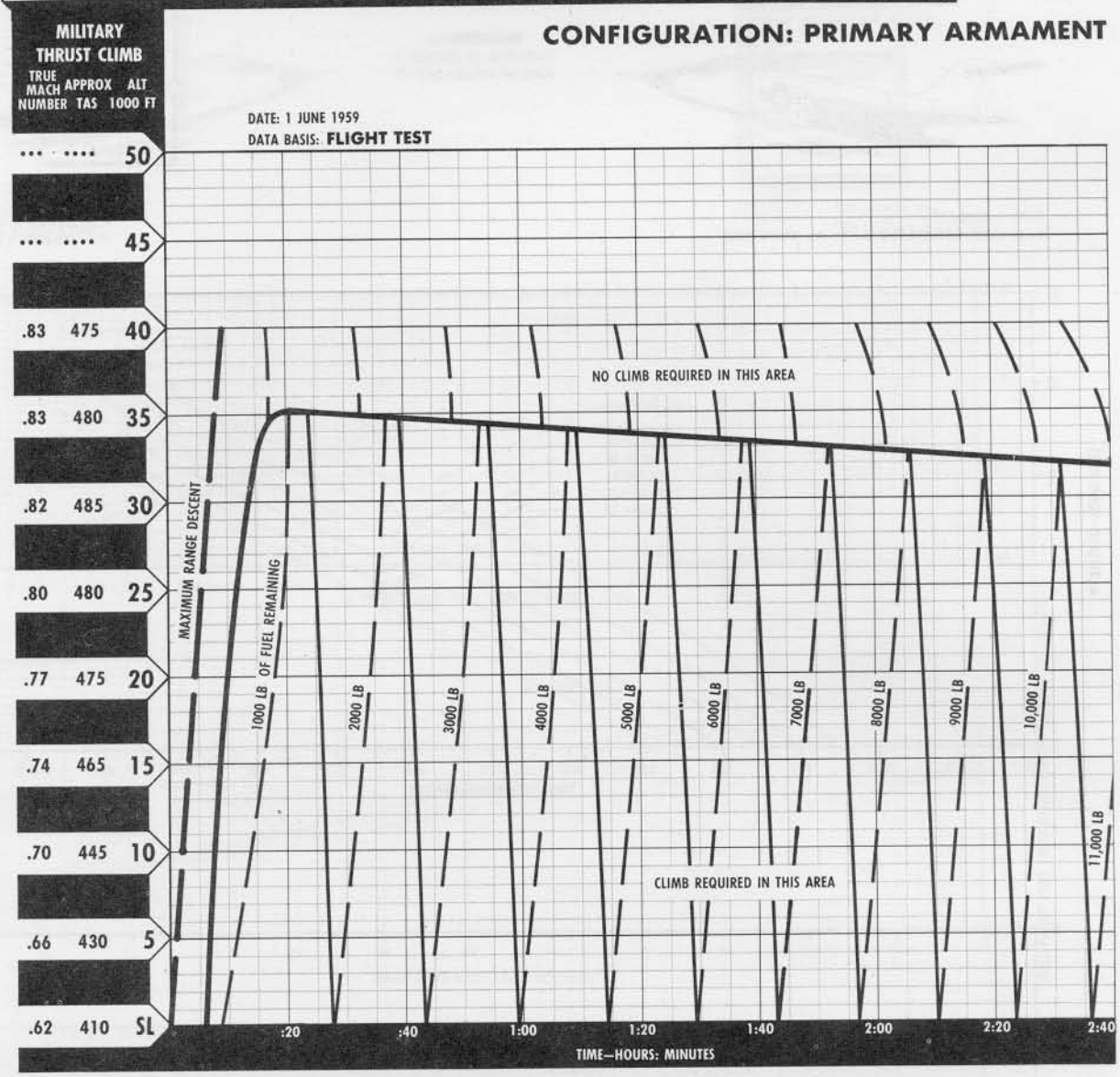




FB33-P503B

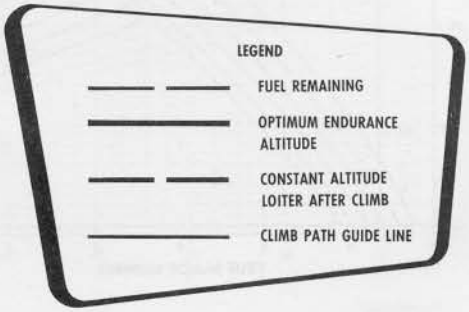
Figure A5-4

OPTIMUM MAXIMUM ENDURANCE PROFILE



MISSION CONSIDERATIONS:

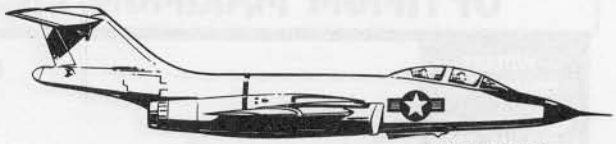
1. MILITARY THRUST CLIMB TO RECOMMENDED ENDURANCE ALTITUDE.
2. LOITER AT RECOMMENDED MACH NUMBER.
3. MAXIMUM RANGE DESCENT TO BASE.
4. NO ALLOWANCE INCLUDED FOR LANDING.



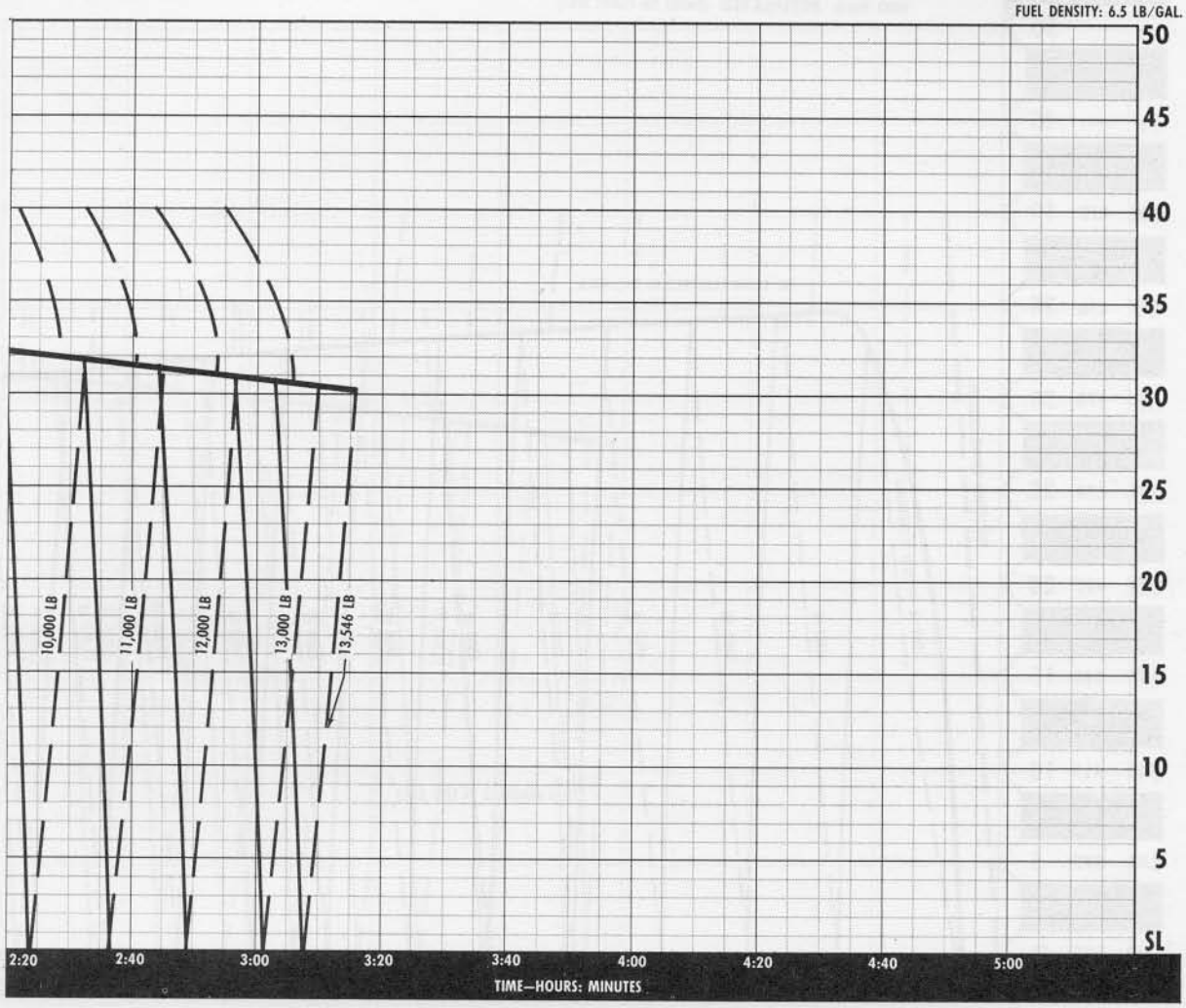
FB33-P504B-1

Figure A5-5

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 45,461 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

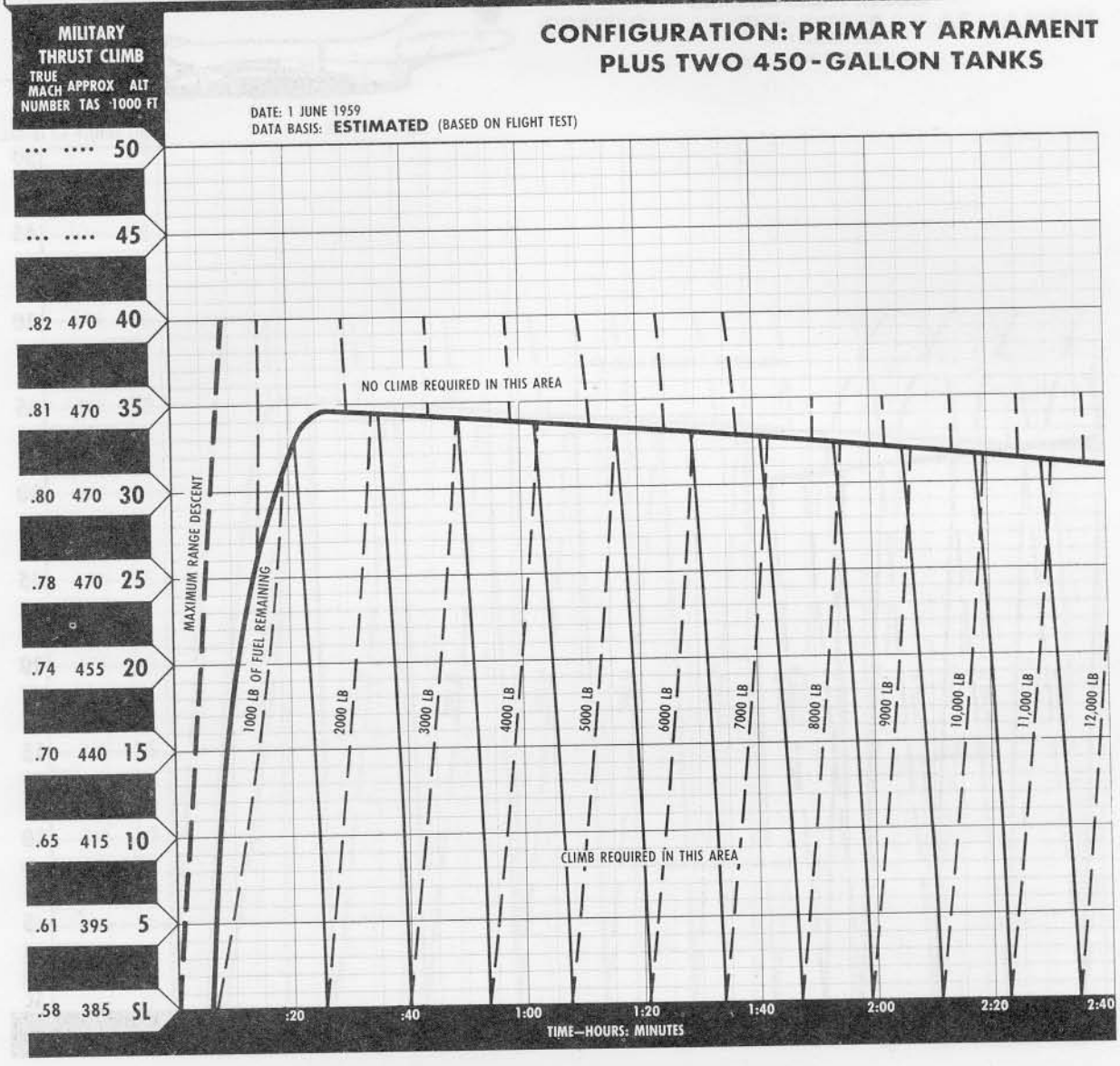


OPTIMUM MAXIMUM ENDURANCE —PRIMARY ARMAMENT

FUEL LOAD	ALTITUDE FEET	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
FULL FUEL LOAD					
13,546 LB	30,300	.74	437	5090	2.05
9,000 LB	32,050	.74	431	4560	2.03
6,000 LB	33,200	.73	426	4200	2.00
3,000 LB	34,350	.73	420	3860	1.98
ZERO LB	35,500	.72	418	3520	1.94

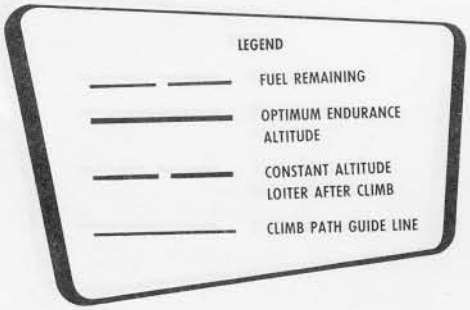
FB33-P504B-2

OPTIMUM MAXIMUM ENDURANCE PROFILE



MISSION CONSIDERATIONS:

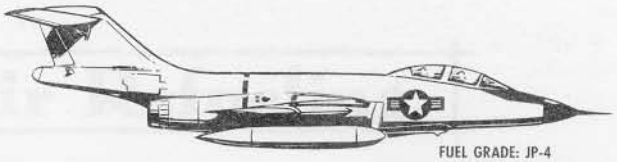
1. MILITARY THRUST CLIMB TO RECOMMENDED ENDURANCE ALTITUDE.
2. LOITER AT RECOMMENDED MACH NUMBER.
3. MAXIMUM RANGE DESCENT TO BASE.
4. NO ALLOWANCE INCLUDED FOR LANDING.



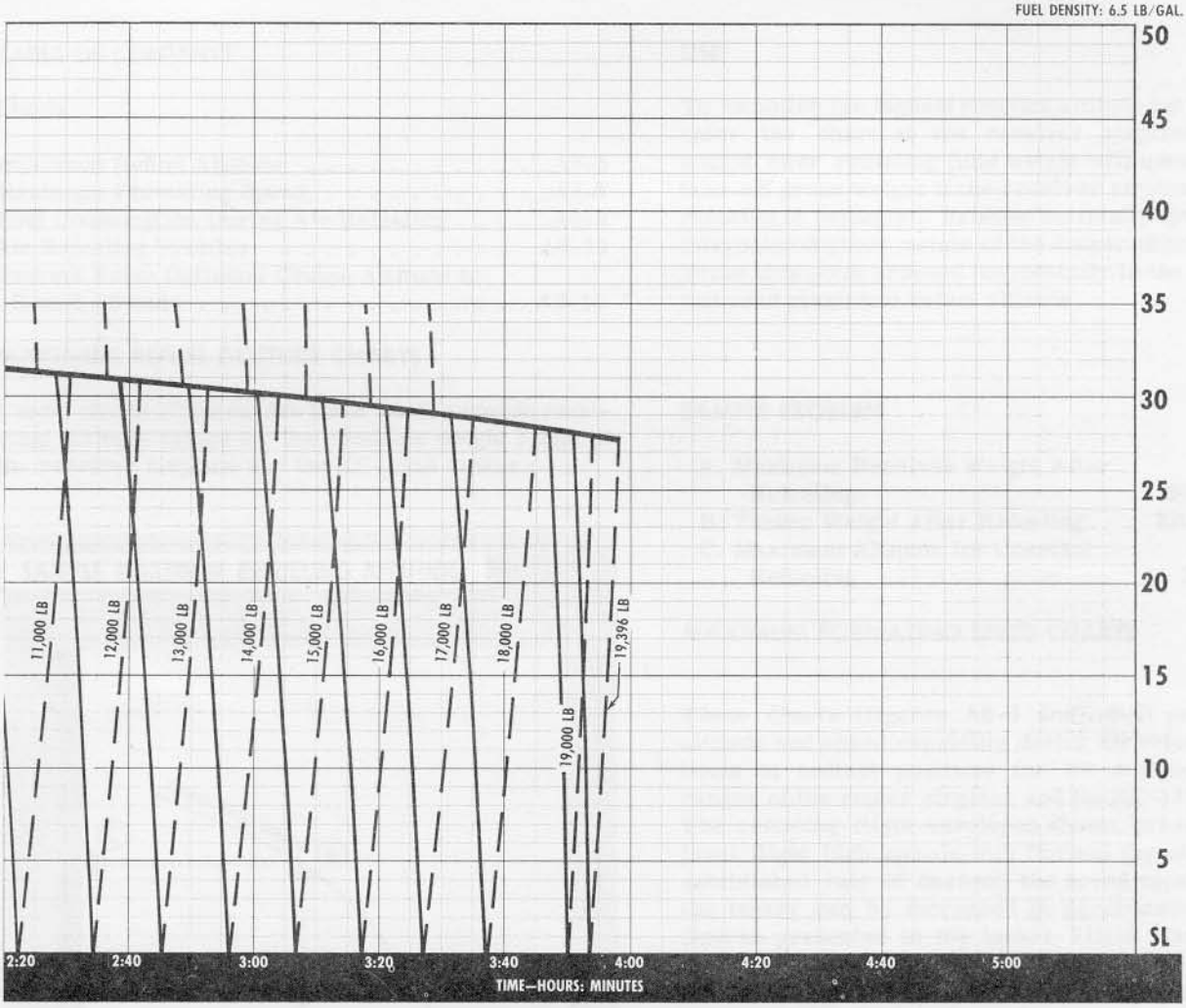
FB33-P505B-1

Figure A5-6

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.



OPTIMUM MAXIMUM ENDURANCE —(2) 450 GALLON TANKS

FUEL LOAD	ALTITUDE FEET	TRUE MACH NUMBER	APPROX TAS KNOTS	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
FULL FUEL LOAD					
19,396 LB	27,900	.72	429	6360	2.20
16,000 LB	29,200	.72	426	5900	2.18
12,000 LB	30,700	.72	422	5360	2.16
8,000 LB	32,300	.72	418	4810	2.13
4,000 LB	33,800	.71	413	4350	2.10
ZERO LB	35,350	.71	406	3860	2.06

FB33-P505B-2

part 6 Air Refueling

TABLE OF CONTENTS

Charts

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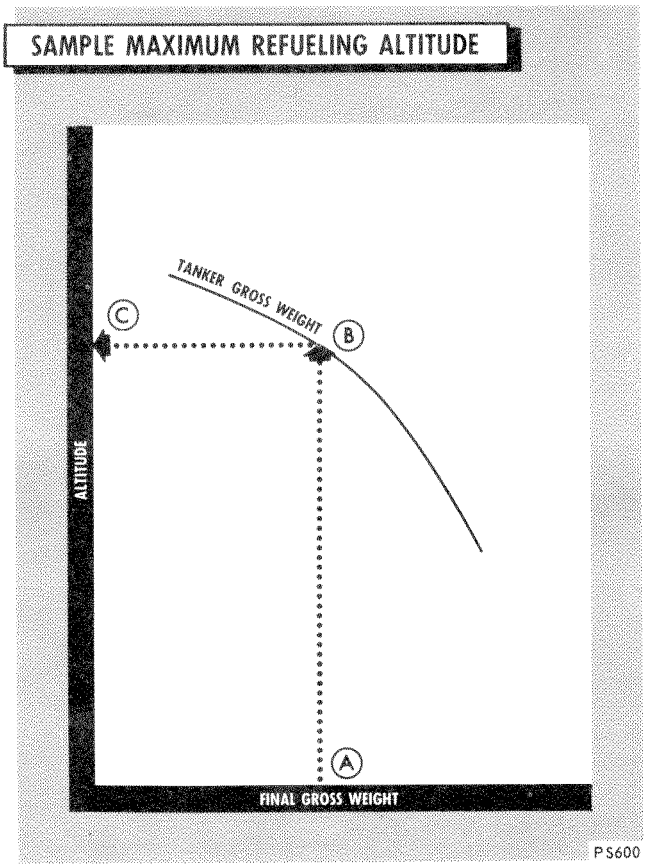
Maximum Formating Speed. A6-7
Fuel Consumption During Air Refueling A6-9
Air Refueling Profiles A6-12
Descent From Optimum Cruise Altitude to Refuel Altitude A6-16

MAXIMUM REFUEL ALTITUDE CHARTS

These charts (figures A6-1 and A6-2) provide maximum altitude values for the complete weight range of the receiver airplane and the KC-135A tanker.



USE

To establish the highest constant altitude for refueling, enter the chart at the receiver airplane's gross weight after refueling (this weight will usually be the take-off gross weight if the receiver airplane is to be refueled to capacity). Proceed vertically upward to the interpolated gross weight of the tanker after refueling. From this point proceed horizontally to the left scale and read maximum refuel altitude.

SAMPLE PROBLEM

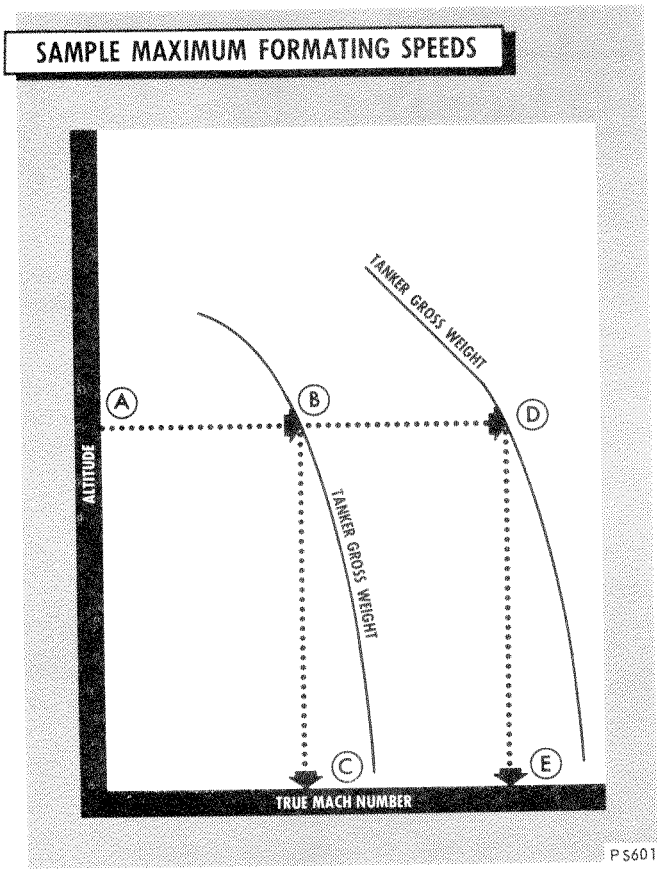
A. Maximum Receiver Weight After Refueling	50,000 Lbs.
B. Tanker Weight After Refueling	220,000 Lbs.
C. Maximum Altitude for Constant Refueling	35,200 Ft.

MAXIMUM FORMATING SPEED CHARTS

These charts (figures A6-3 and A6-4) present the altitude and speed capability during air refueling (with boom in contact position) for the complete weight ranges of the center airplane and the KC-135A tanker. The refueling flight envelopes shown, present tanker level flight high speeds with Normal thrust. With an established rate of descent, the speed capabilities of the tanker can be increased in accordance with the figures presented in the tanker Flight Manual. The speed at the beginning of refueling can be read for a constant refuel altitude from the interpolated initial refuel weight of the tanker. The final refueling speed can be read for the post refuel weight of the tanker.

USE

Enter the chart at the established refueling altitude and proceed horizontally to the weights of the tanker at the beginning and at the end of refueling. Descend to the base of the chart and read the speeds (Mach number) at beginning and end of refueling for the corresponding tanker weights.



SAMPLE PROBLEM

A. Formating Altitude	36,000 Ft.
B. Initial Tanker Weight	240,000 Lbs.
C. Initial Refueling Mach Number	.73
D. Final Tanker Weight	220,000 Lbs.
E. Final Refueling Mach Number	.81
F. Average Refueling Mach Number (C. + E.) / 2	.77

FUEL CONSUMPTION DURING AIR REFUELING CHARTS

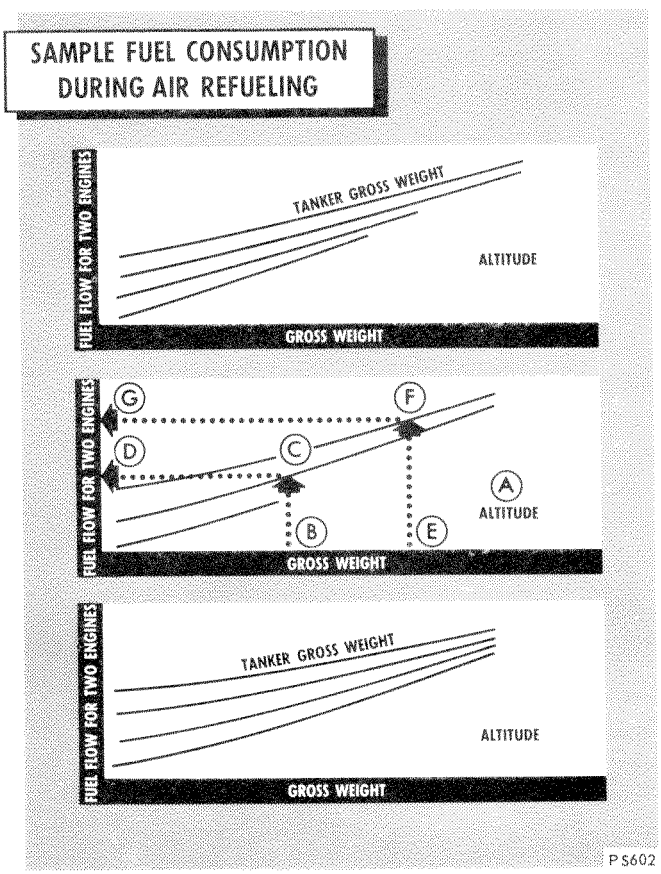
These charts (figures A6-5 and A6-6) present the fuel flow of the receiver airplane for the tanker's Normal thrust high speeds for the complete weight range of the KC-135A tanker and the receiver airplane. Three formating altitude graphs are given for each airplane configuration.

USE

Enter the base of the chart at initial receiver airplane weight and proceed vertically to intersect the initial tanker weight on the applicable formating altitude graph. Proceed horizontally to the left scale and read the initial fuel flow. Re-enter the base of the chart at the final receiver airplane's weight and proceed vertically to intersect the final tanker's weight on the applicable formating altitude graph. Proceed horizontally to the left scale and read the final fuel flow during refueling.

SAMPLE PROBLEM

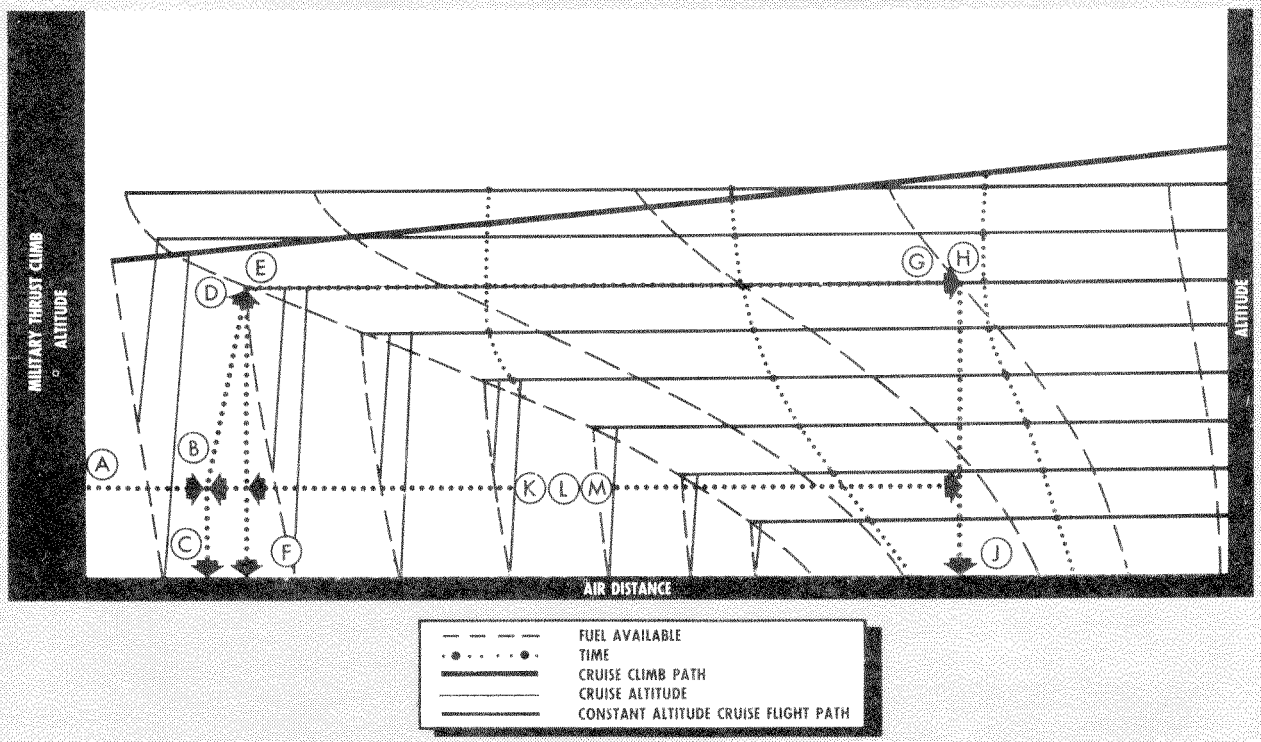
A. Formating Altitude	35,000 Ft.
B. Initial Receiver Weight	38,000 Lbs.
C. Initial Tanker Weight	220,000 Lbs.
D. Initial Fuel Flow During Refueling	87 Lbs./Min.
E. Final Receiver Weight	48,000 Lbs.
F. Final Tanker Weight	200,000 Lbs.
G. Final Fuel Flow During Refueling	113 Lbs./Min.
H. Average Fuel Flow During Refueling	100 Lbs./Min.



AIR REFUELING PROFILES

These charts (figures A6-8 and A6-9) present the relationship of time, fuel and altitude for maximum range with various fuel loads within the weight range of the airplane configuration after refueling. The climb path guide lines show the distance traveled from refuel altitude to cruise altitude using Military thrust climb speed schedule at the left of the chart.

SAMPLE AIR REFUELING PROFILE



PS603

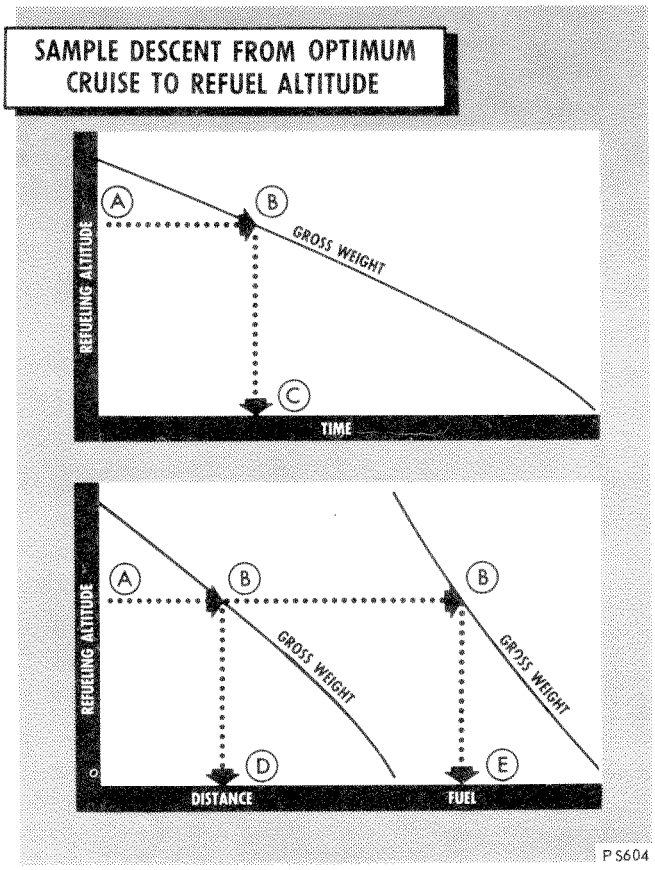
A cruise table gives recommended Mach numbers and approximate operating conditions for both cruise-climb procedure and for cruise at constant altitude. No reserve for descent and landing has been included.

USE

Establish the cruise altitude, the refuel altitude and the amount of fuel required to perform Military operations and subsequent cruise. This fuel will be referred to hereafter as fuel remaining. Enter the chart on the left side at the estimated refuel altitude and proceed to the right to intersect the proper cruise altitude climb path guide lines. Read the corresponding range figure. Enter the chart at the cruise altitude and proceed to the right to intersect the established fuel remaining line. Read the corresponding range. The distance covered during the post refuel cruise leg will be the difference between the two range values.

SAMPLE PROBLEM

A. Refueling Altitude — 20,000 Ft.
B. Climb - Cruise Guide Line
C. Total Range Including Climb to Cruise Altitude — 1660 Nautical Miles
D. Follow Climb Path Guide Line to Cruise Altitude — 30,000 Ft.
E. Cruise Time — 3 hours and 35 minutes
F. Distance Corresponding to Cruise Time — 1645 Nautical Miles
G. Follow Line of Constant Cruise to Fuel Remaining Line — 2,000 Lbs.
H. Time — 26 minutes
J. Distance — 198 Nautical Miles
K. Net Cruise Time E. - H. (3 hours, 35 minutes - 26 minutes) - 3 hours and 9 minutes
L. Net Cruise Distance F. - J. 1645 Nautical Miles - 198 Miles — 1447 Nautical Miles
M. Net Cruise Distance Including Climb C. - J. (1660 Miles - 198 Miles) - 1462 Nautical Miles



DESCENT FROM OPTIMUM CRUISE ALTITUDE TO REFUEL ALTITUDE CHART

These charts (figures A6-10 and A6-11) present the receiver airplane time, fuel and distance required to descend from optimum cruise altitude to the established refueling altitude.

USE

Enter each graph at the established refueling altitude and proceed horizontally to the interpolated weight of the receiver airplane at the beginning of refueling. Read time required to descend on the upper graph, distance traveled and fuel consumed during descent.

SAMPLE PROBLEM

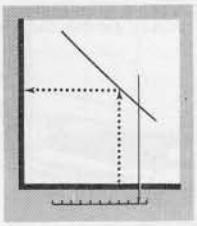
A. Refueling Altitude	30,000 Ft.
B. Receiver Weight at Start of Refuel	40,000 Lbs.
C. Time	1.2 Min.
D. Distance	8.2 Miles
E. Fuel	25 Lbs.

MAXIMUM REFUELING ALTITUDE
KC-135A TANKER

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT

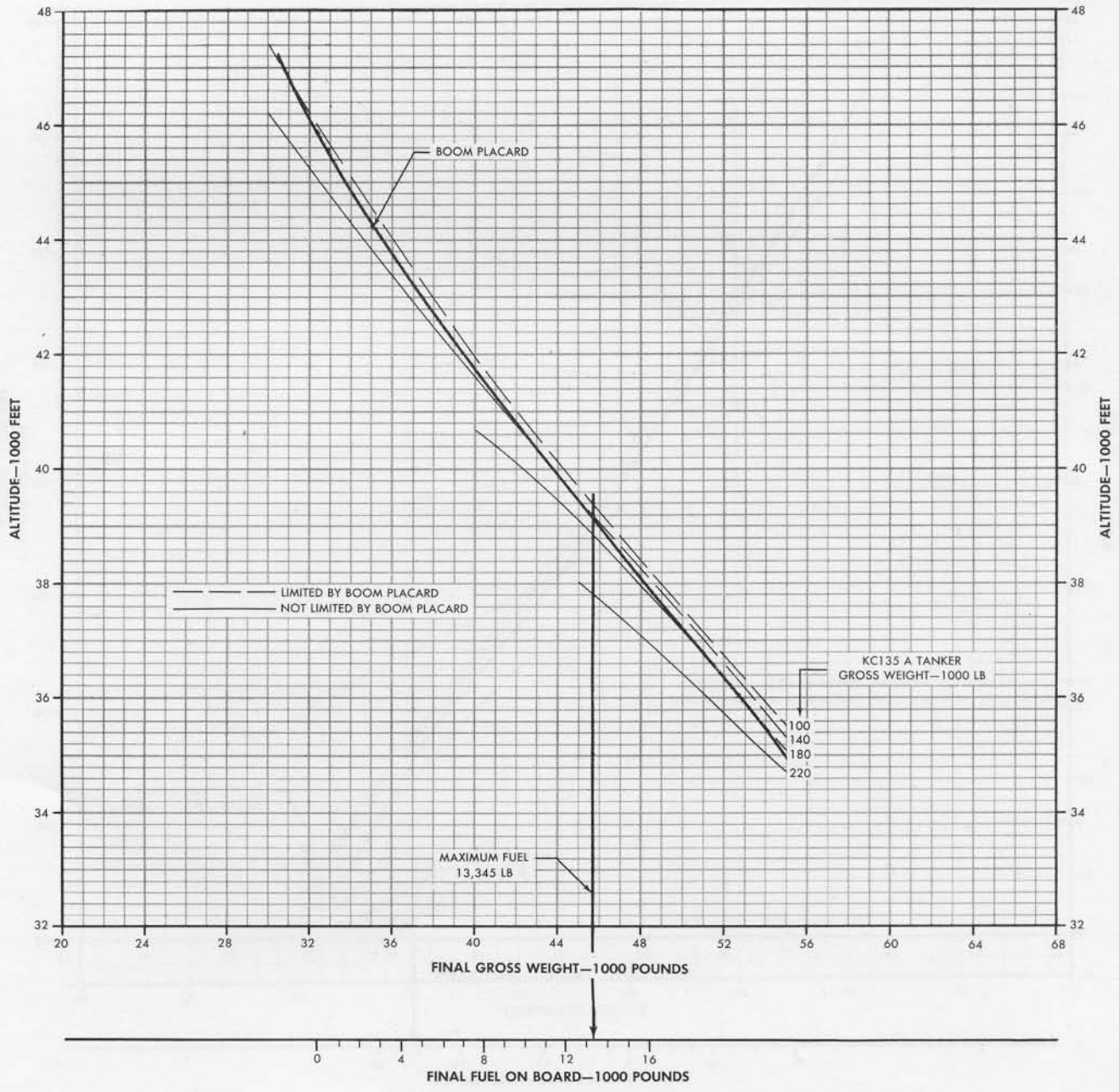
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
REFUEL FLIGHT SPEED IS MAXIMUM CONTINUOUS THRUST HIGH SPEED OF THE TANKER WITH THE BOOM IN CONTACT POSITION.

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P600 A

Figure A6-1

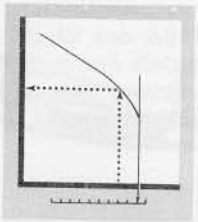
MAXIMUM REFUELING ALTITUDE

KC-135A TANKER

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
REFUEL FLIGHT SPEED IS MAXIMUM CONTINUOUS THRUST HIGH SPEED OF THE TANKER WITH THE BOOM IN CONTACT POSITION.

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

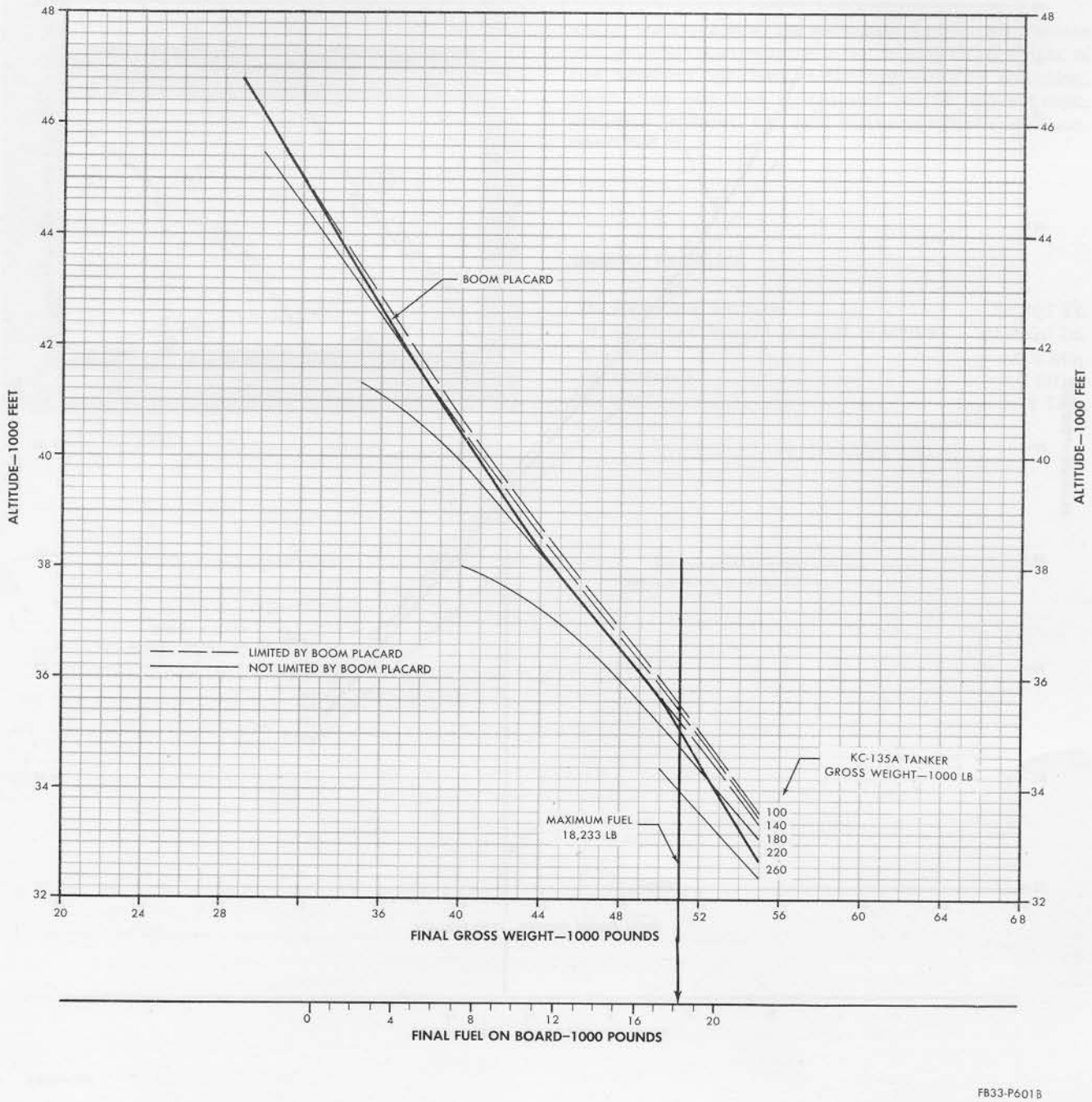
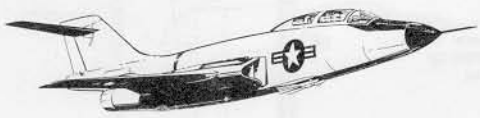


Figure A6-2

MAXIMUM FORMATING SPEEDS

KC-135A TANKER

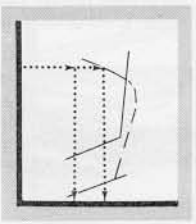
AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



REMARKS

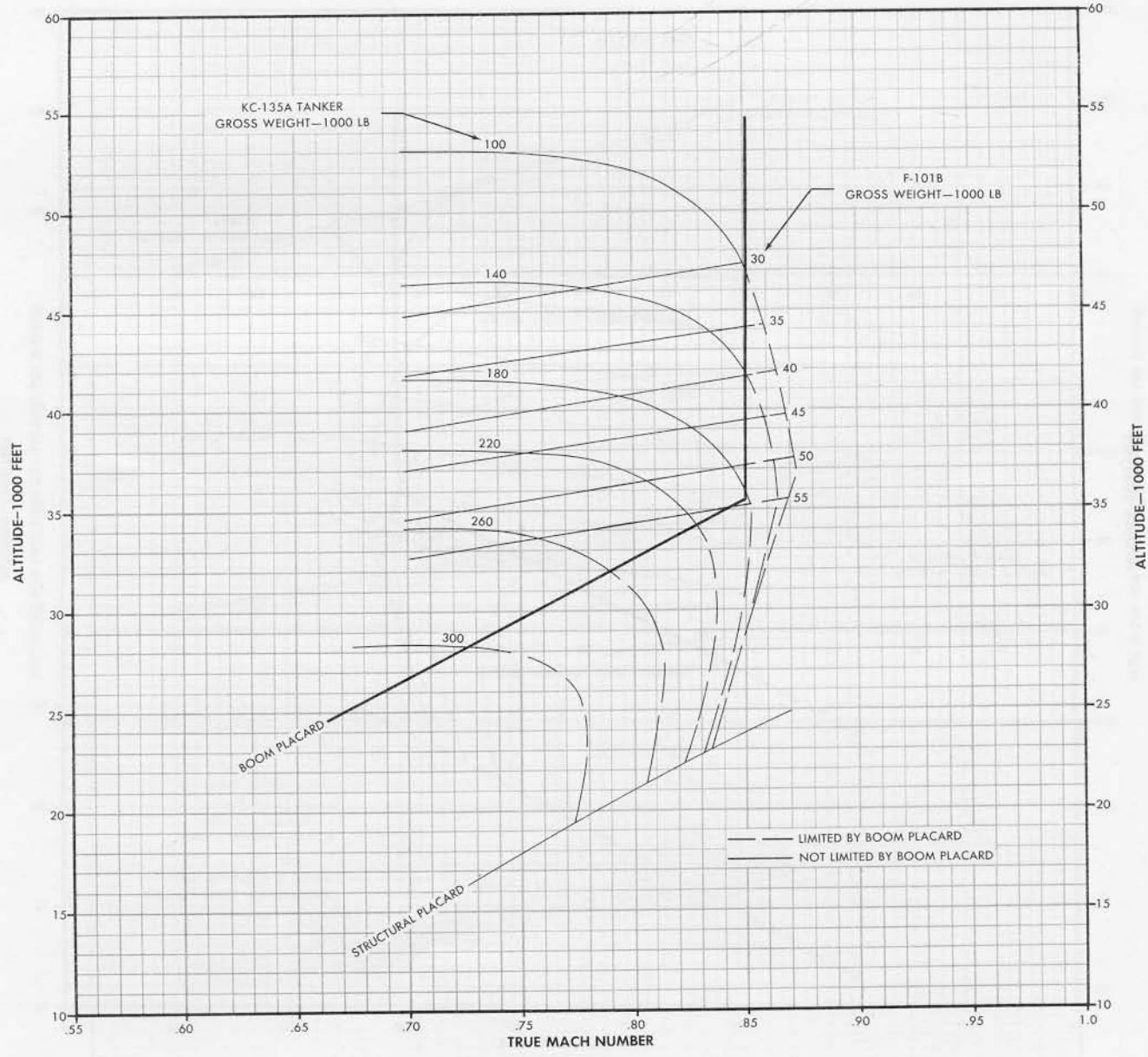
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
REFUEL FLIGHT SPEED IS MAXIMUM CONTINUOUS THRUST HIGH SPEED OF THE TANKER WITH THE BOOM IN CONTACT POSITION.

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



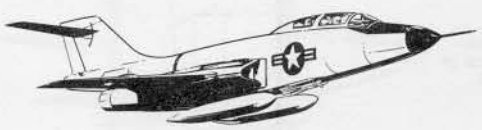
FB33-P602A

Figure A6-3

MAXIMUM FORMATING SPEEDS

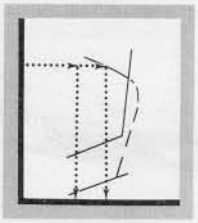
KC-135A TANKER

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



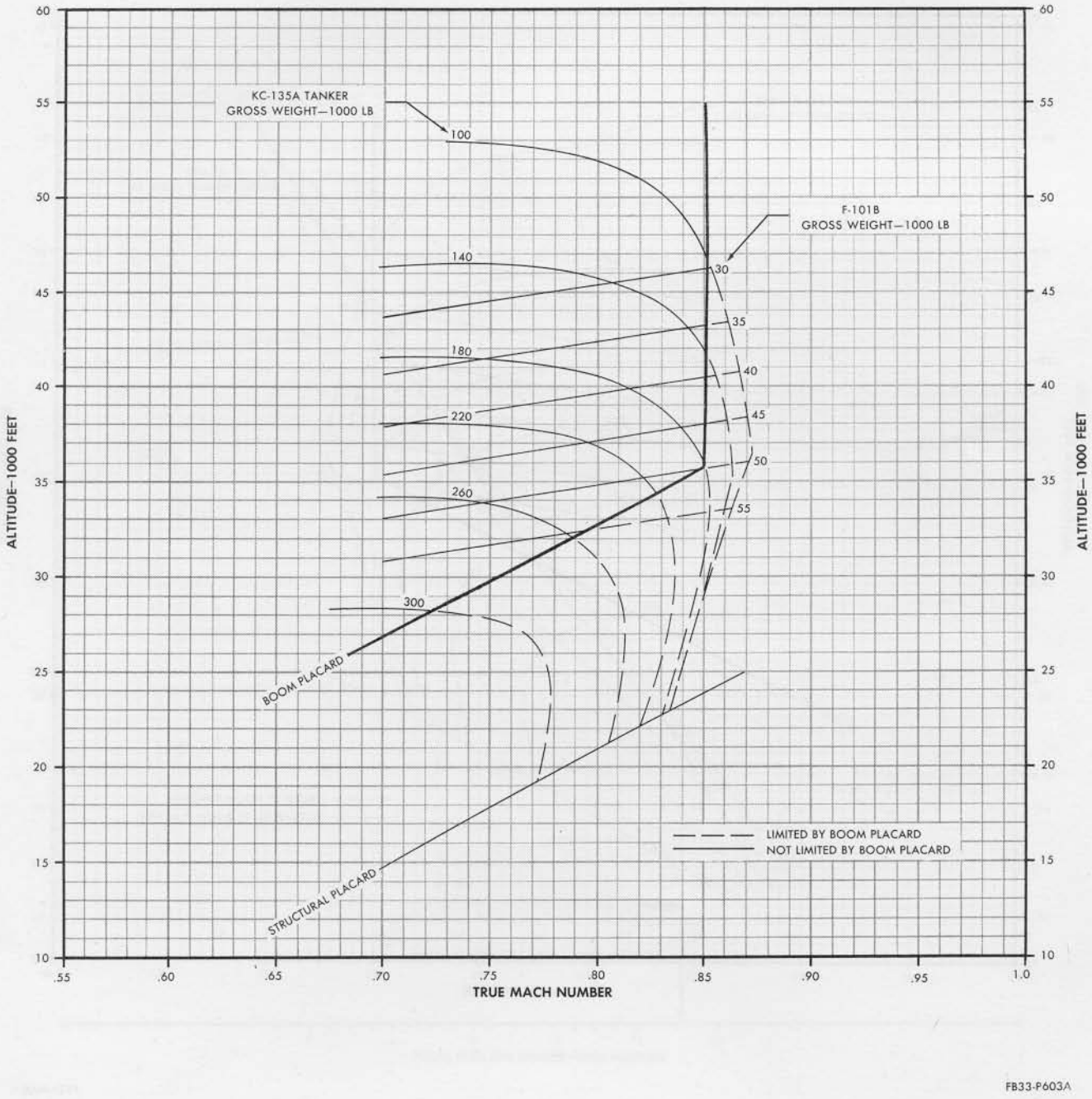
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
REFUEL FLIGHT SPEED IS MAXIMUM CONTINUOUS THRUST HIGH SPEED OF THE TANKER WITH THE BOOM IN CONTACT POSITION.

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P603A

Figure A6-4

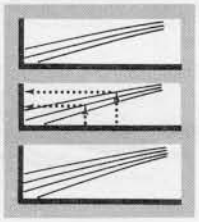
FUEL CONSUMPTION DURING AIR REFUELING

KC-135A TANKER

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT

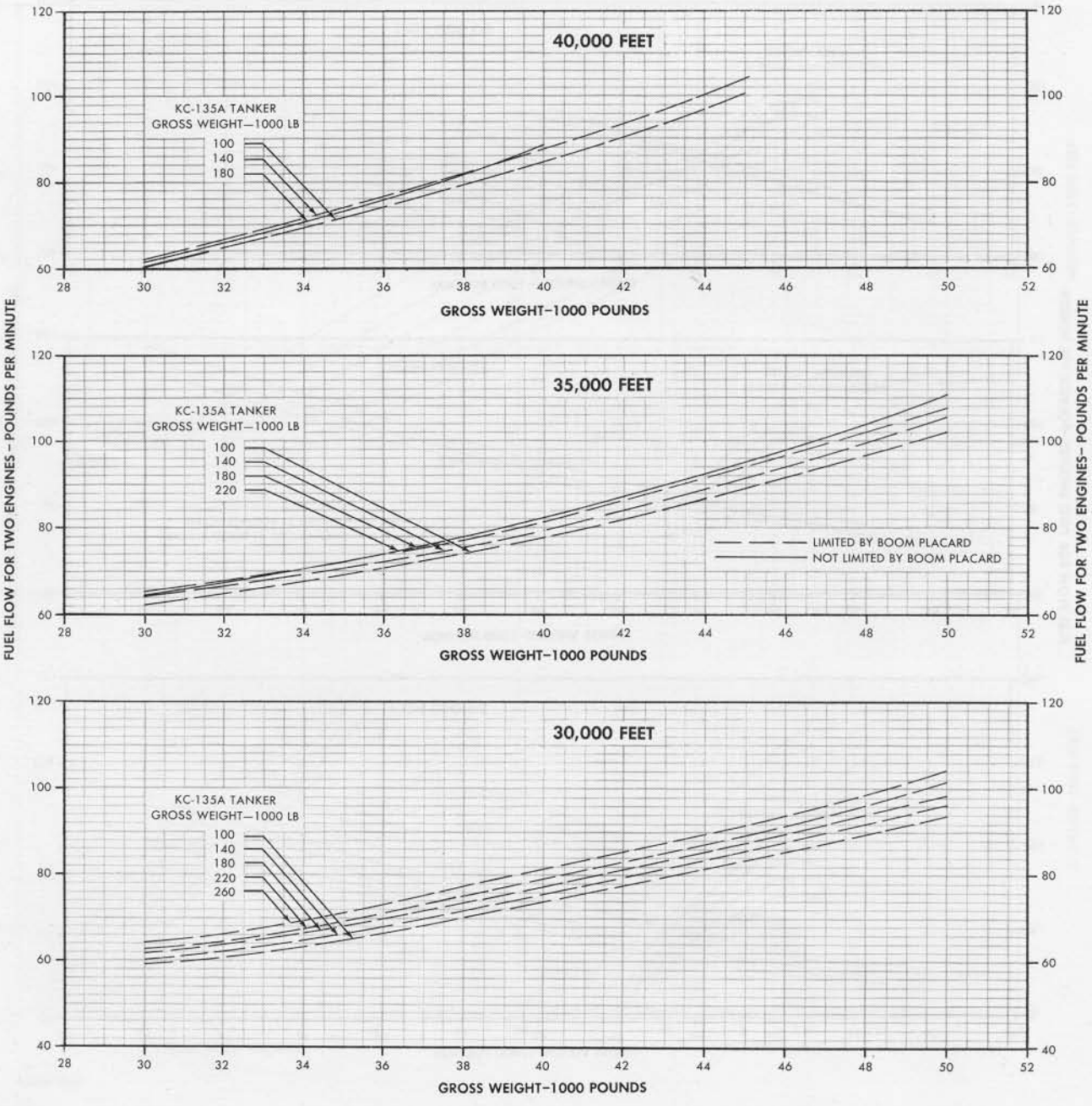
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P 604B

Figure A6-5

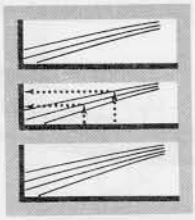
FUEL CONSUMPTION DURING AIR REFUELING

KC-135A TANKER

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS

REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 1 DECEMBER 1957
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

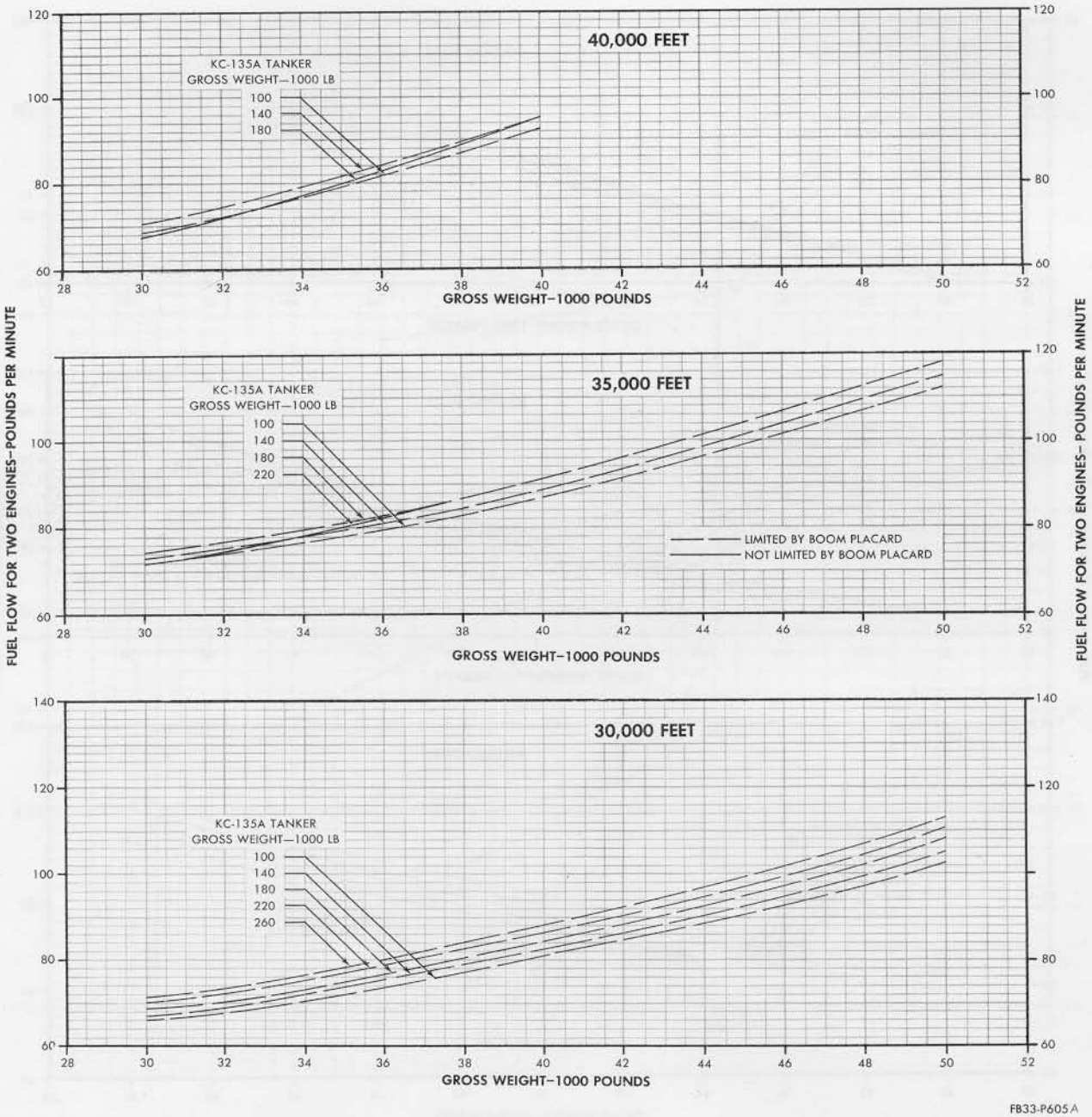


Figure A6-6

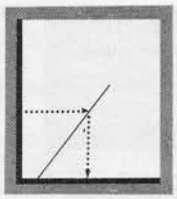
AIR REFUELING TRANSFER TIME

KC-135A TANKERS

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS

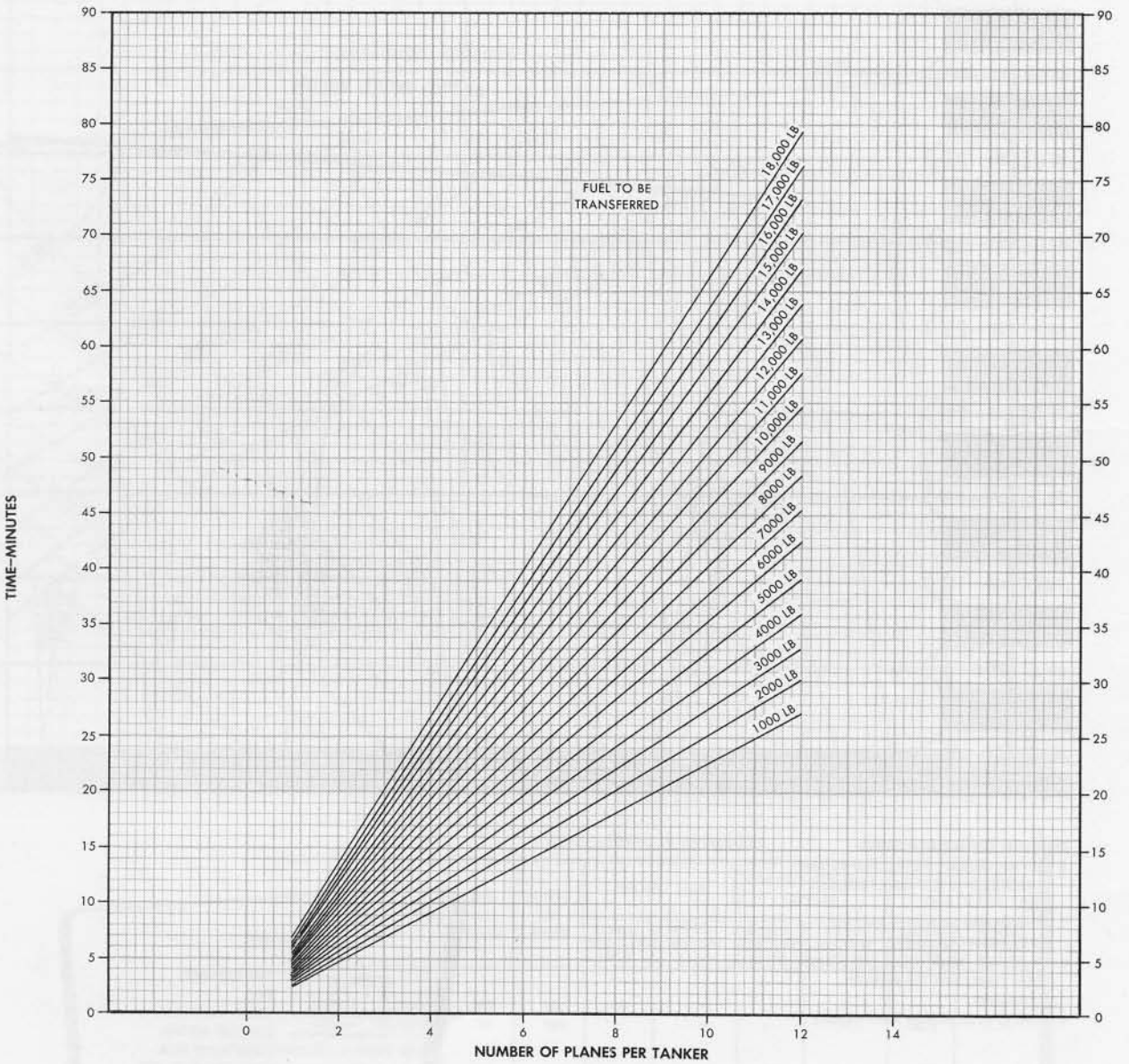
REMARKS
ENGINE(S): (2) J57-P-13
ICAO STANDARD DAY
RATE OF TRANSFER IS
600 GALLONS PER MINUTE

GUIDE



DATE: 1 JULY 1957
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

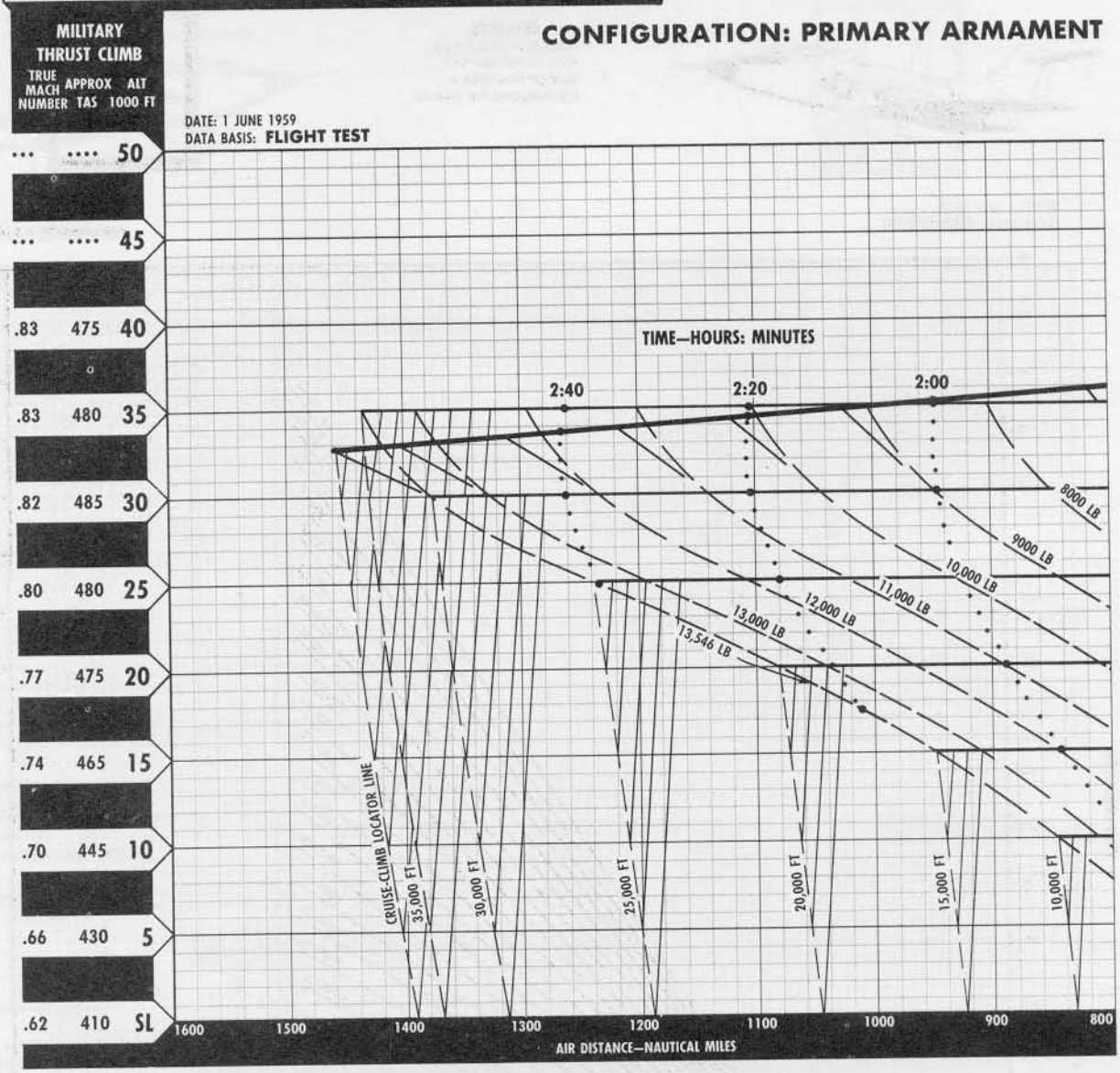


FB33-P638A

Figure A6-7

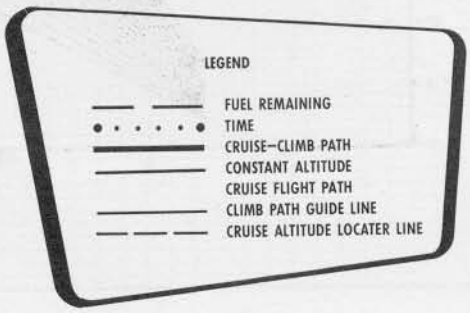
AIR REFUELING PROFILE

CONFIGURATION: PRIMARY ARMAMENT



MISSION CONSIDERATIONS:

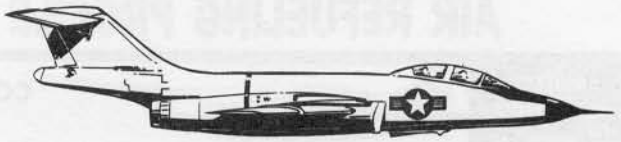
1. DOES NOT INCLUDE FUEL, TIME, AND DISTANCE TO ACCELERATE TO BEST CLIMB FORMATING SPEED.
2. NO ALLOWANCE OR RESERVE MADE FOR LOITER, DESCENT OR LANDING.
3. USE MILITARY THRUST CLIMBS. (SEE MILITARY THRUST CLIMB CHART FOR DETAILED INFORMATION.)
4. CRUISE AT RECOMMENDED MACH NUMBER.



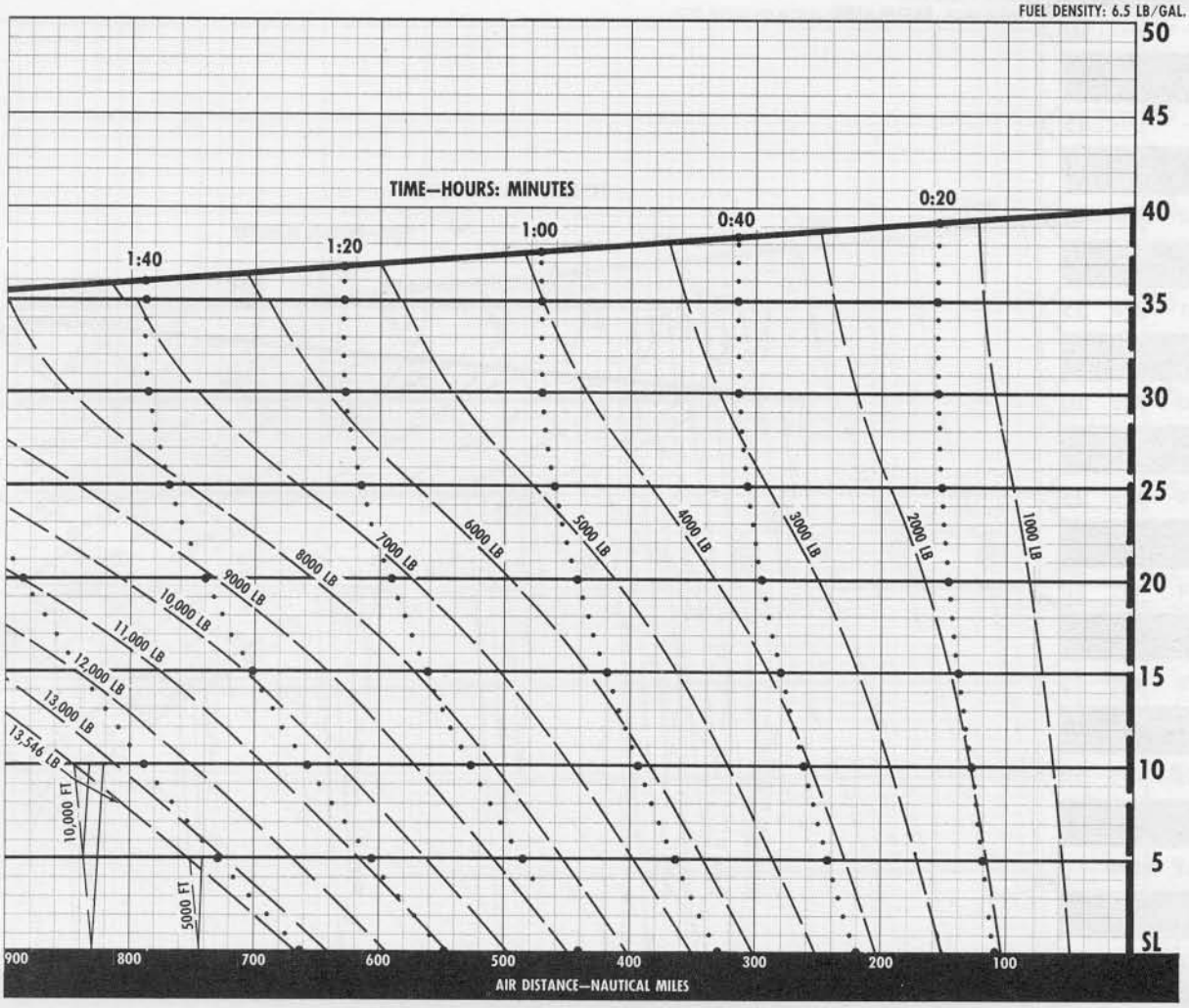
FB33-P607A-1

Figure A6-8

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
POST REFUELING GROSS WEIGHT 45,461 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

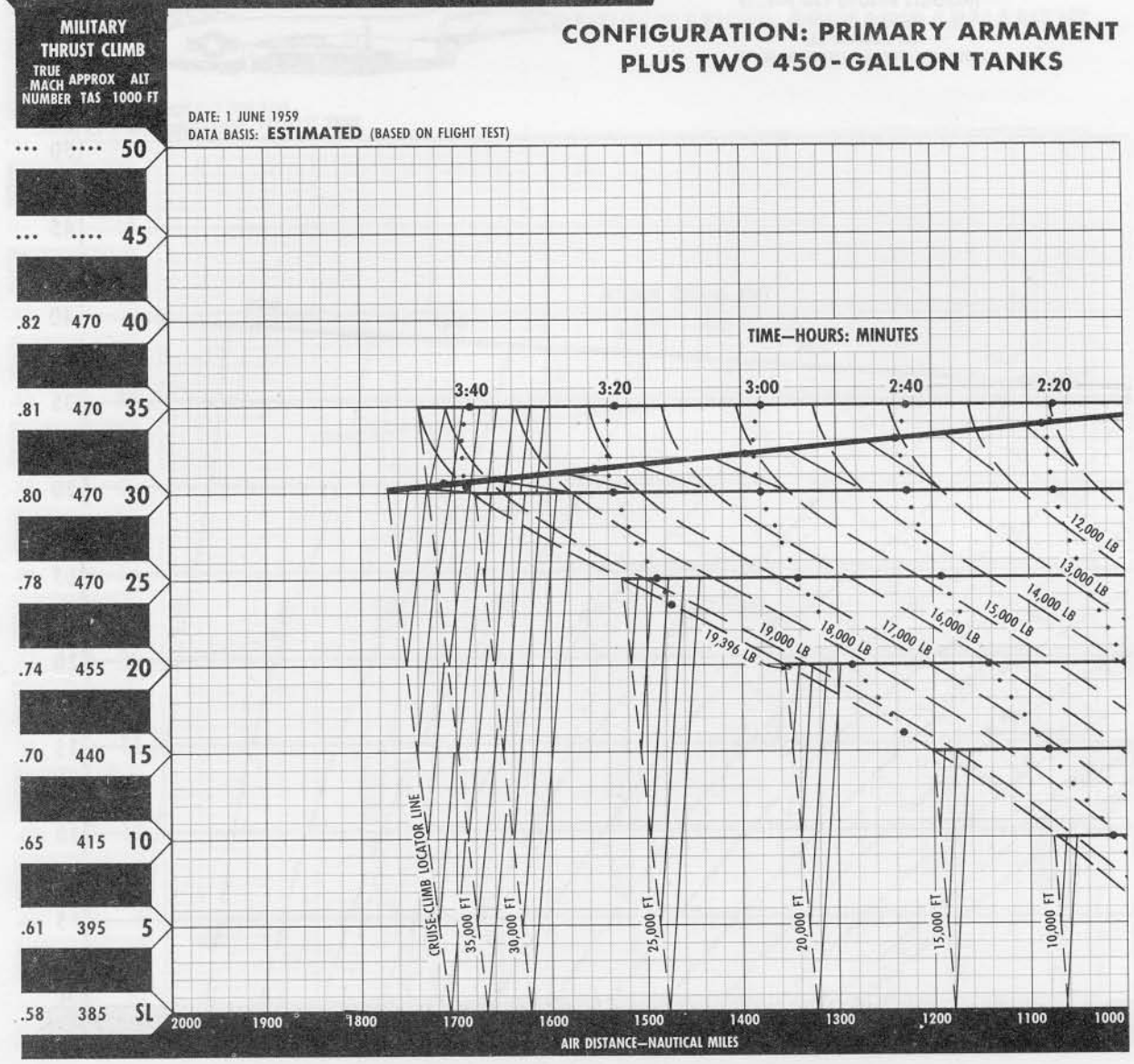


CRUISE—PRIMARY ARMAMENT

ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD		ONE-HALF FUEL LOAD 6773 LB		EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
CRUISE-CLIMB								
INITIAL— 32,750 FT	.83	482	5150	2.15	-	-	-	-
FINAL— 40,100 FT	.83	476	-	-	-	-	3679	2.14
CONSTANT ALTITUDE CRUISE								
35,000 FT	.82	473	5291	2.29	4475	2.09	3855	1.92
30,000 FT	.80	473	5244	2.01	4660	1.87	4223	1.77
25,000 FT	.77	463	5512	1.82	5055	1.73	4729	1.67
20,000 FT	.72	444	5936	1.71	5557	1.65	5248	1.59
15,000 FT	.67	422	6384	1.60	6029	1.55	5741	1.50
10,000 FT	.62	396	6689	1.50	6346	1.46	6074	1.42
5,000 FT	.56	365	6926	1.41	6588	1.37	6271	1.34
SEA LEVEL	.50	332	7079	1.33	6734	1.30	6409	1.27

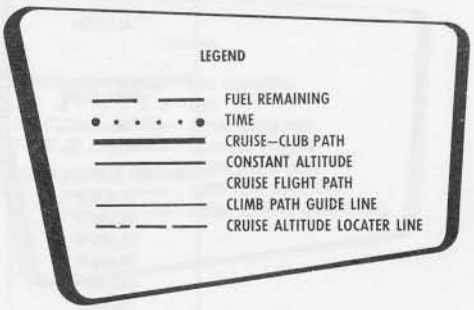
FB33-P607B -2

AIR REFUELING PROFILE



MISSION CONSIDERATIONS:

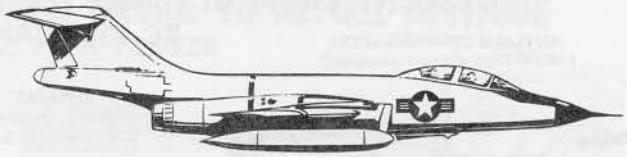
1. DOES NOT INCLUDE FUEL, TIME, AND DISTANCE TO ACCELERATE TO BEST CLIMB FORMATING SPEED.
2. NO ALLOWANCE OR RESERVE MADE FOR LOITER, DESCENT OR LANDING.
3. USE MILITARY THRUST CLIMBS. (SEE MILITARY THRUST CLIMB CHART FOR DETAILED INFORMATION.)
4. CRUISE AT RECOMMENDED MACH NUMBER.



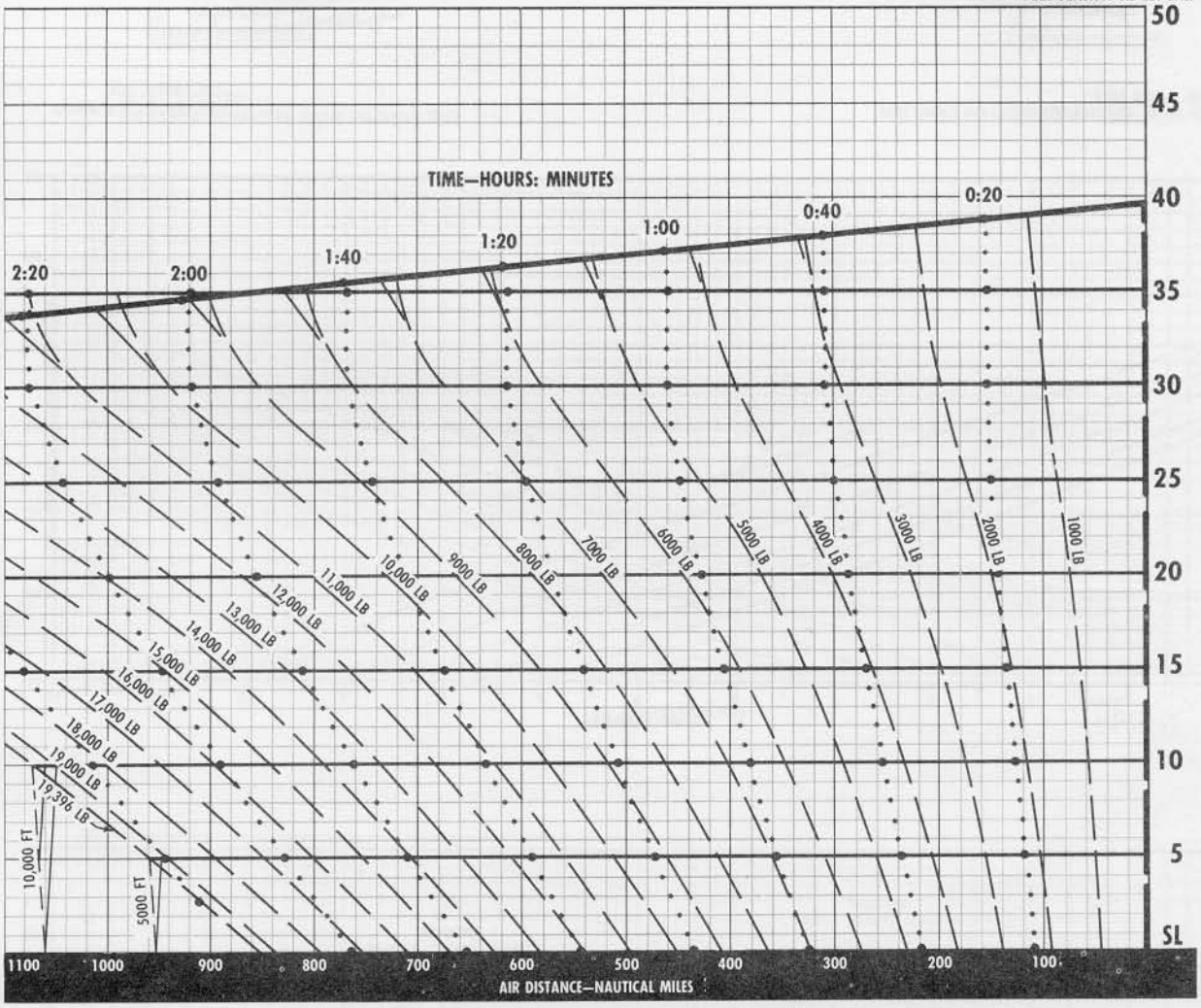
FB33-P608B -1

Figure A6-9

MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
POST REFUELING GROSS WEIGHT 51,724 LB



FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.



CRUISE—(2) 450 GALLON TANKS RETAINED

ALTITUDE	TRUE MACH NUMBER	APPROX TAS KNOTS	FULL FUEL LOAD		ONE-HALF FUEL LOAD 9698 LB		EMPTY FUEL LOAD ZERO LB FUEL	
			APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO	APPROX FUEL FLOW LB/HR	APPROX PRESSURE RATIO
CRUISE-CLIMB								
INITIAL— 30,200 FT	.81	476	6512	2.26	–	–	–	–
FINAL— 39,800 FT	.81	463	–	–	–	–	3998	2.25
CONSTANT ALTITUDE CRUISE								
35,000 FT	.80	460	–	–	5157	2.30	4148	2.03
30,000 FT	.78	460	6389	2.26	5287	2.04	4536	1.87
25,000 FT	.74	447	6497	2.04	5665	1.87	5126	1.77
20,000 FT	.70	429	6842	1.87	6129	1.74	5586	1.66
15,000 FT	.65	406	7173	1.73	6548	1.64	6060	1.57
10,000 FT	.60	381	7456	1.62	6865	1.54	6393	1.48
5,000 FT	.55	355	7751	1.52	7172	1.46	6673	1.40
SEA LEVEL	.50	327	8034	1.44	7415	1.38	6928	1.33

FB33-P608B-2

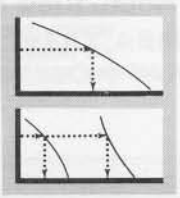
DESCENT FROM OPTIMUM CRUISE TO REFUEL ALTITUDE

KC-135A TANKER

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT

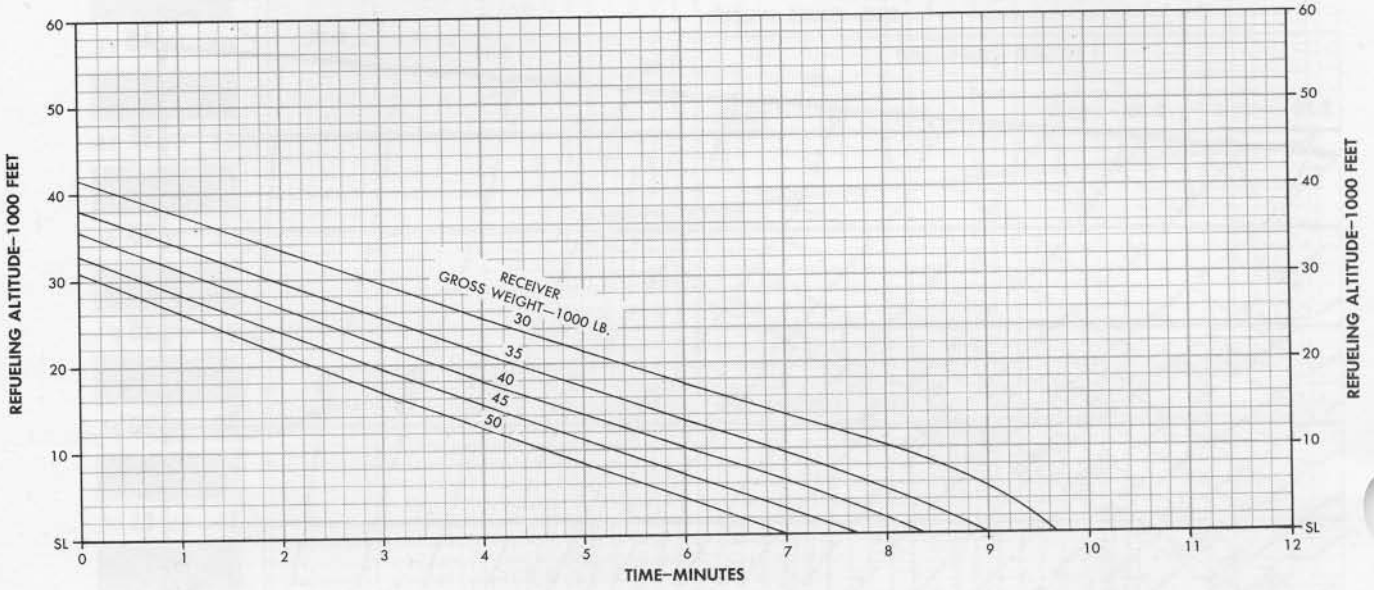
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

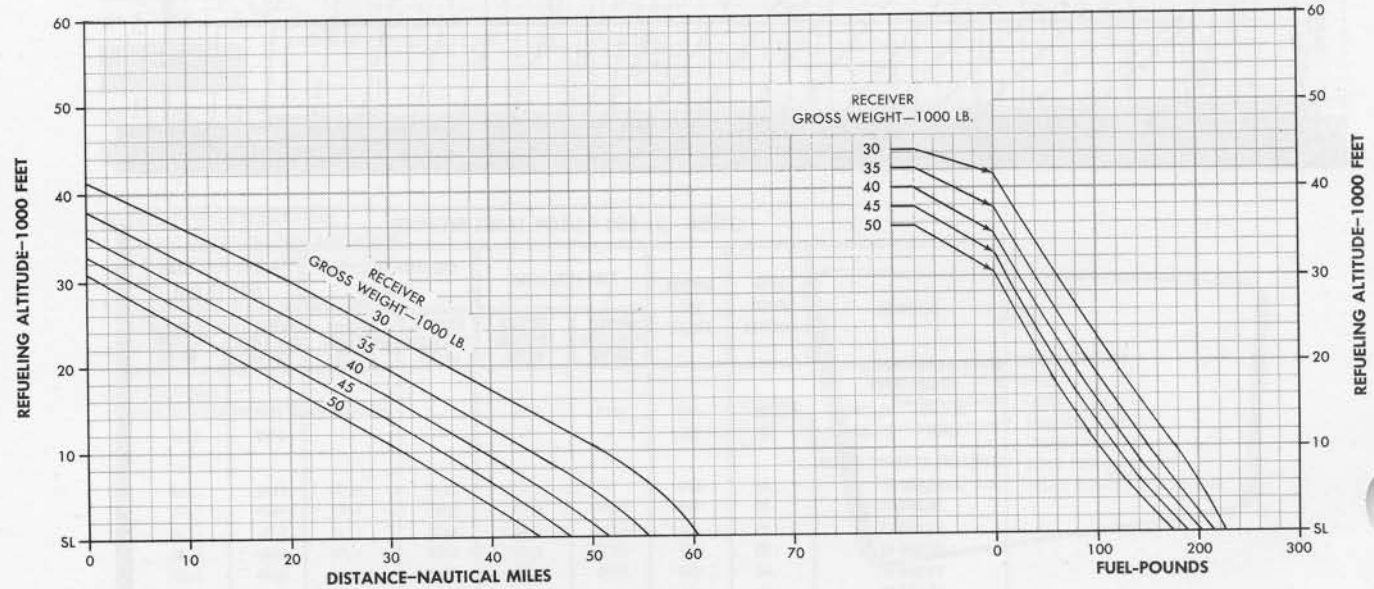
GUIDE



DATE: 1 JUNE 1959
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





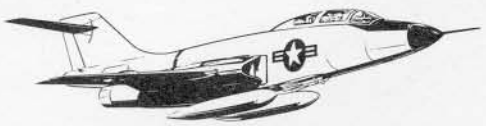
FB33-P609B

Figure A6-10

DESCENT FROM OPTIMUM CRUISE TO REFUEL ALTITUDE

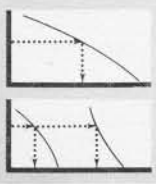
KC-135A TANKER

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



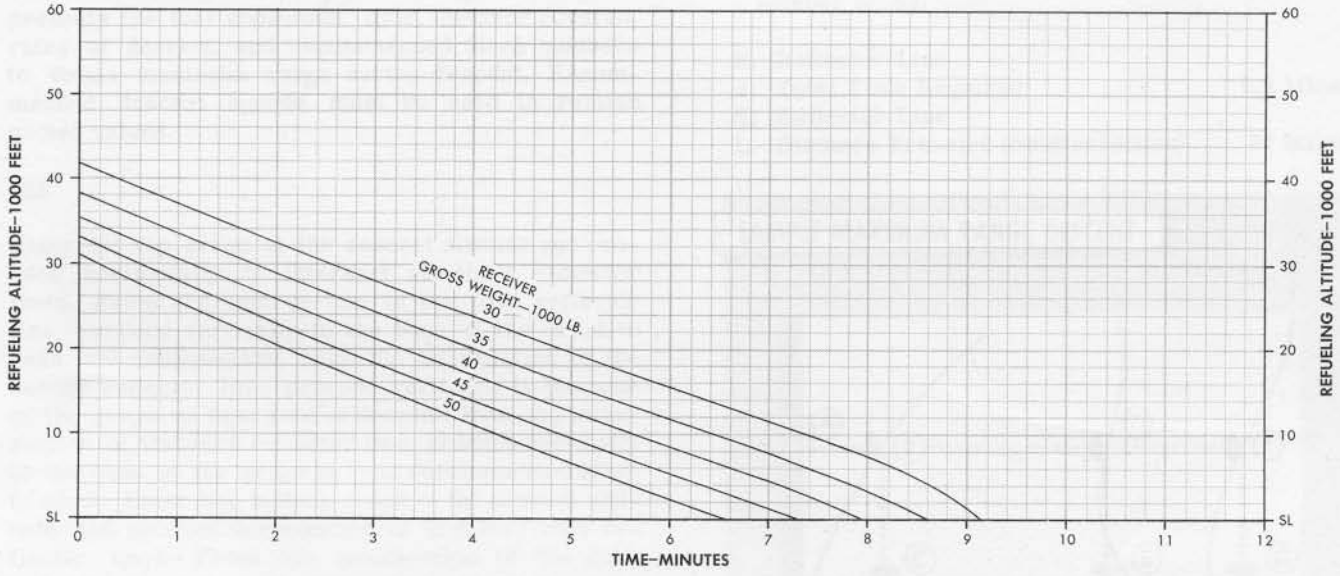
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

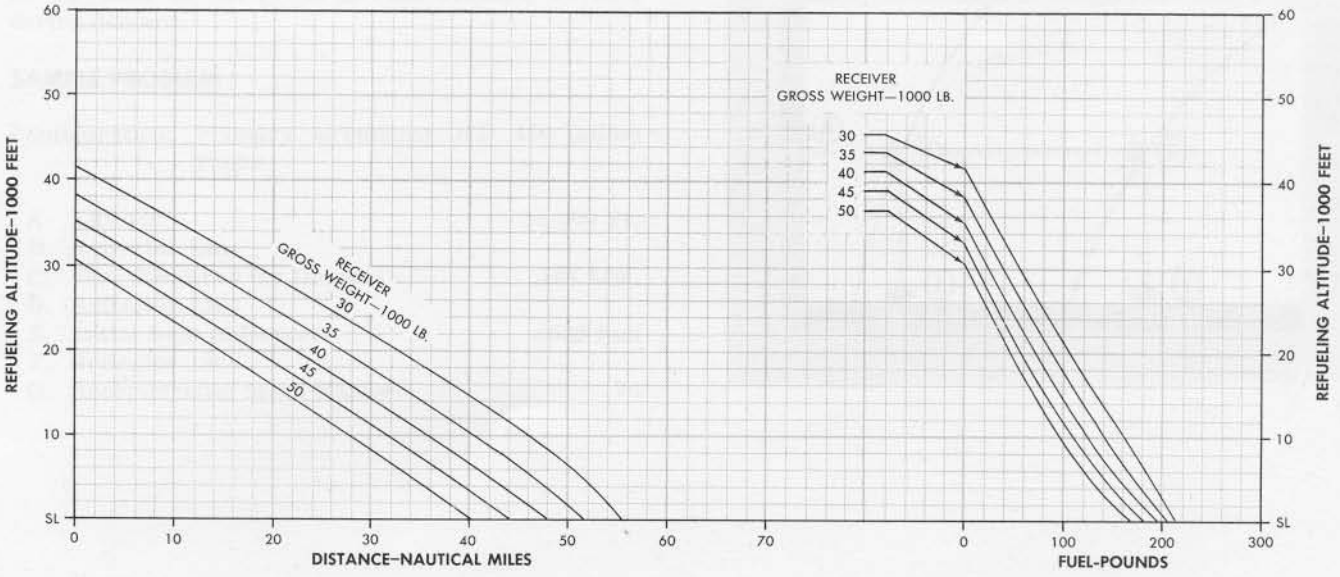
GUIDE



DATE: 1 JUNE 1959
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL





FB33-P6108

Figure A6-11

part 7 Descent

MAXIMUM RANGE DESCENT CHARTS

The descent schedules presented in figures A7-1 and A7-2 do not correspond to maximum glide angle with idle thrust, but coupled with optimum cruise presents the fuel consumed, time, distance covered, rates of descent, and recommended Mach numbers to obtain maximum range during descent. Recommended descent speeds must be used to realize quoted values.

USE

Enter the top graph at the descent altitude and proceed horizontally to intersect all three reflector lines. From the intersection of the first reflector line, proceed vertically to the base of the graph to read fuel consumption; from the intersection of the second reflector line, proceed vertically to the base of the graph to read rate of descent; from the intersection of the third reflector line, proceed vertically to the base of the graph to read recommended Mach number. Enter the bottom graph at the descent altitude and proceed horizontally to intersect both reflector lines. From the intersection of the first reflector line, proceed vertically to the base of the graph to read time to descend; from the intersection of the second reflector line, proceed vertically to the base of the graph to read distance traveled during descent.

SAMPLE PROBLEM

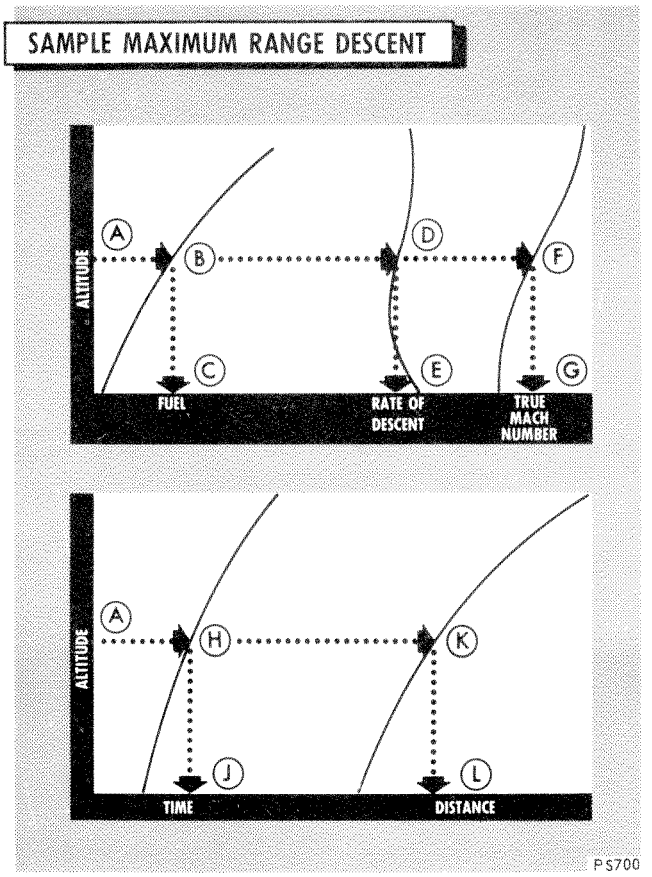
Configuration: Primary Armament +(2) 450 Gallon Tanks

A.	Altitude	30,000 Ft.
B.	Reflector Line	
C.	Fuel Required for Descent	164 Lbs.
D.	Reflector Line	
E.	Initial Rate of Descent	4600 fpm
F.	Reflector Line	
G.	Recommended Mach Number	.70

Note

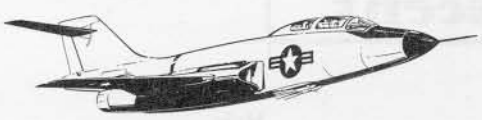
For maximum range descent, decrease Mach number .01 per 1000 feet until attaining 15,000 feet. Then maintain a constant Mach number of .52.

H.	Reflector Line	
J.	Total Time Required	6.8 Mins.
K.	Reflector Line	
L.	Distance Traveled (Nautical Miles)	39 Miles



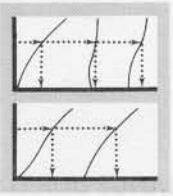
IDLE THRUST DESCENT
FUEL REMAINING–3000 POUNDS

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



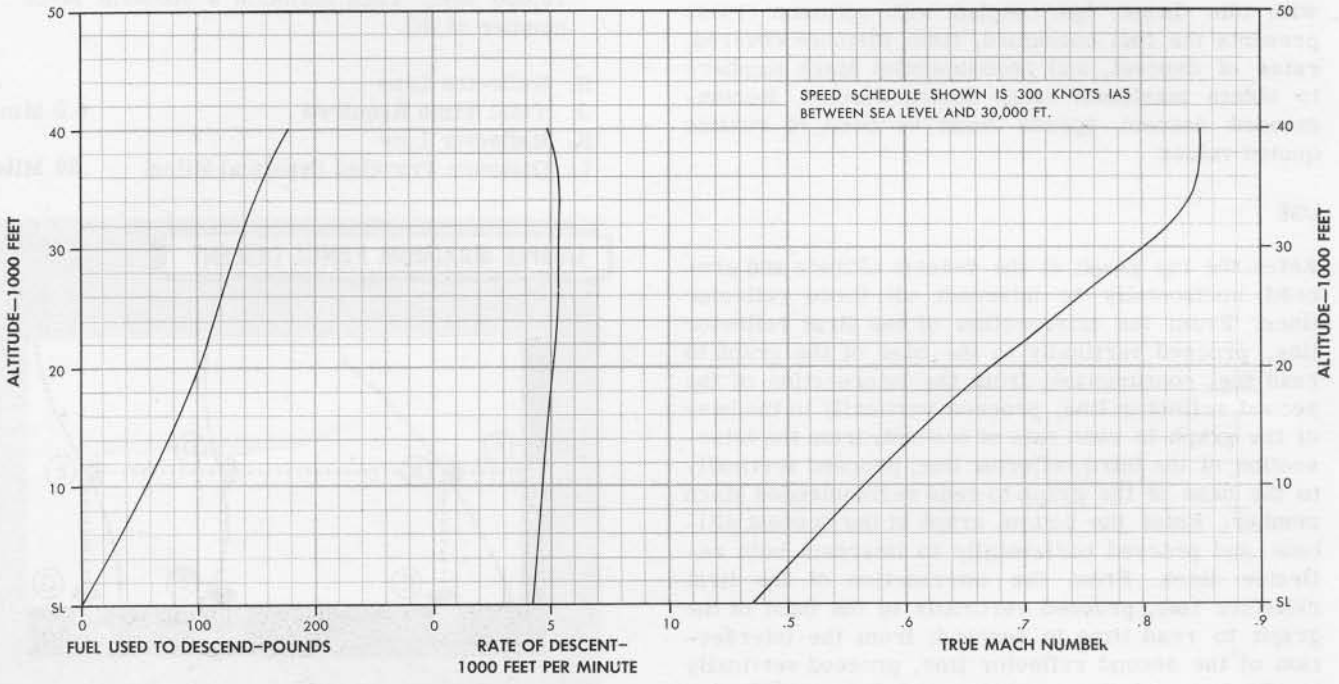
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

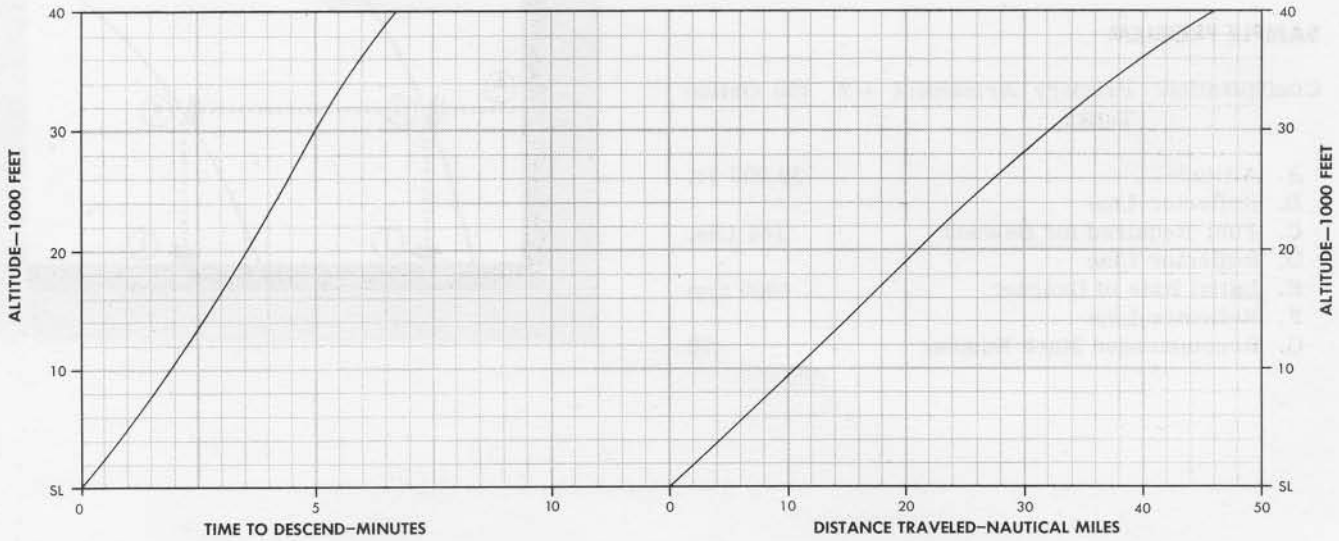
GUIDE



DATE: 9 MARCH 1962
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



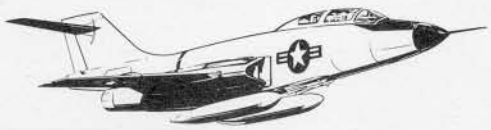


FB33-P700C

Figure A7-1

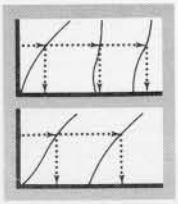
IDLE THRUST DESCENT
FUEL REMAINING–3000 POUNDS

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT
PLUS (2) 450 GALLON TANKS



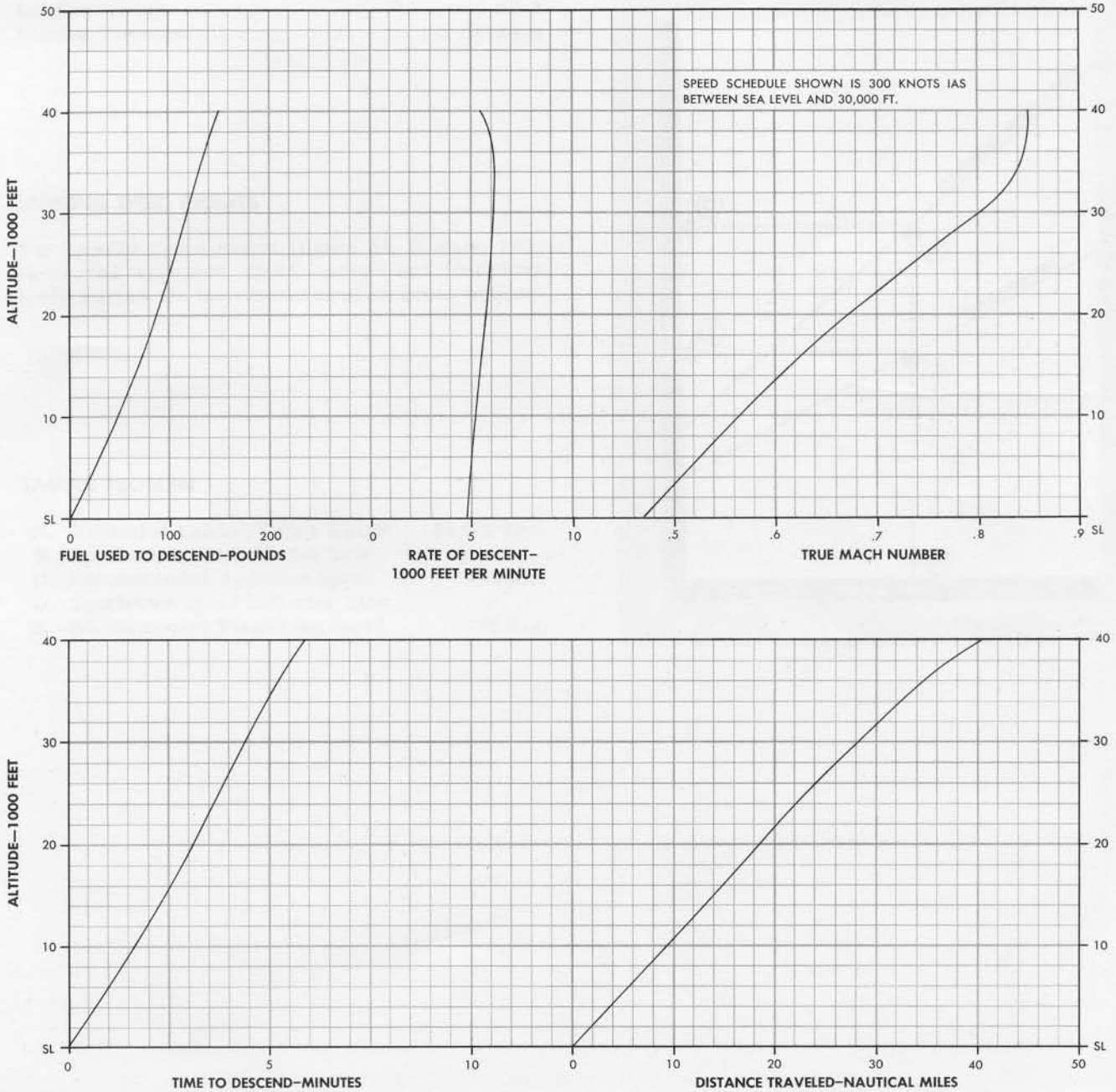
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 9 MARCH 1962
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P701C

Figure A7-2

part 8 Landing

TABLE OF CONTENTS

Charts

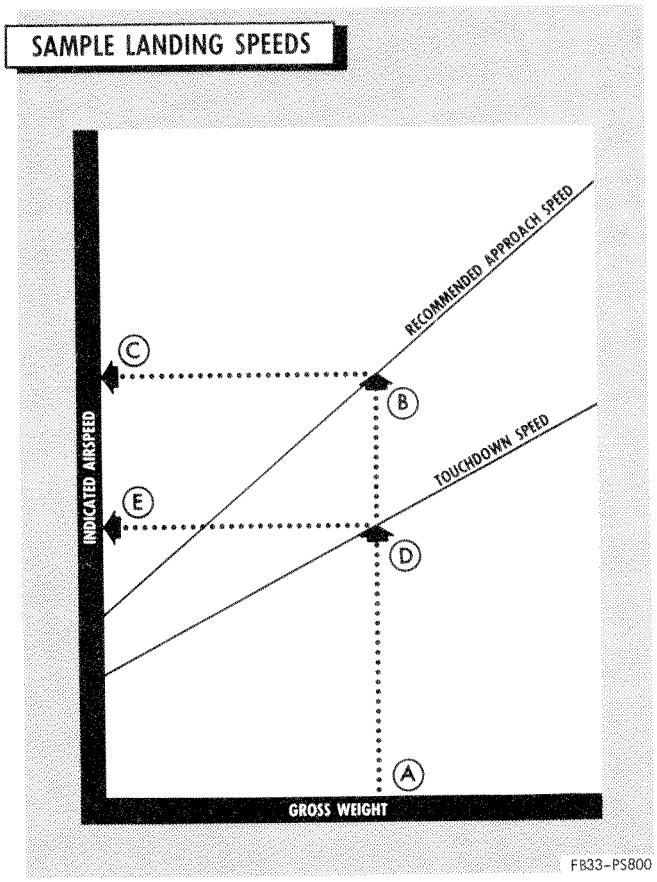
Landing Speeds. A8-3
Landing Distance. A8-4

LANDING SPEED CHARTS

The Landing Speed charts (figure A8-1) shows recommended approach speed curves and touchdown speed curves for the various airplane gross weights.

SAMPLE PROBLEM

A.	Estimated Landing Gross Weight	35,000 Lbs.
B.	Approach Speed Reflector Line	
C.	Recommended Approach Speed	178 Kts.
D.	Touchdown Speed Reflector Line	
E.	Recommended Touchdown Speed	165 Kts.



LANDING DISTANCE CHARTS

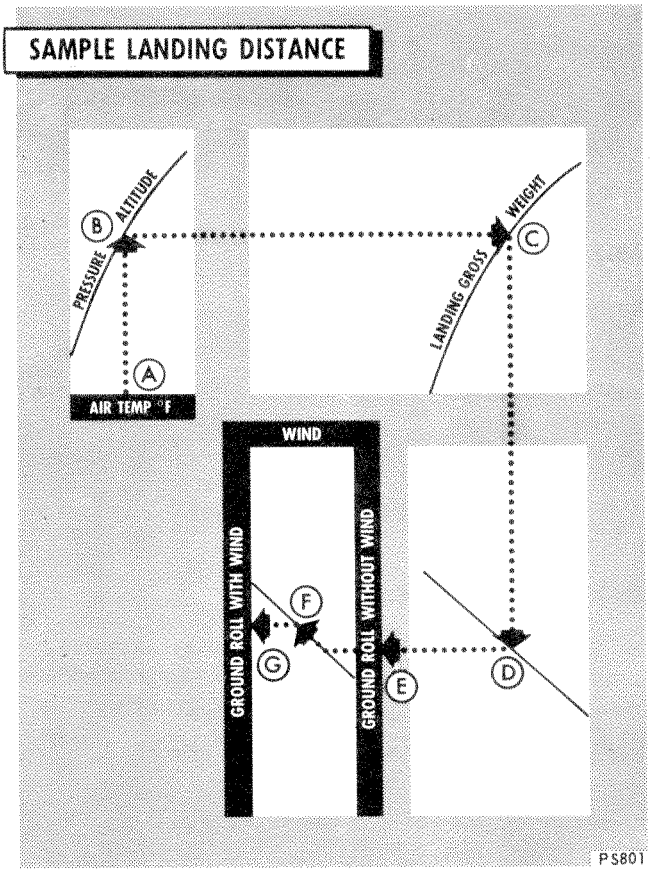
Landing and ground roll distance, with or without use of the drag chute, speed brakes and flaps, are shown in figure A8-2. The following conditions are considered: temperature (°F); pressure altitude, sea level through 8000 feet; gross weight, 25,000 through 50,000 pounds; head and/or tailwinds, 0 to 50 knots; runway condition reading, dry (RCR 23) and wet (RCR 12). The speeds given are for touchdown speeds. Refer to Landing Speeds (figure A8-1) for approach and touchdown speeds.

USE

Enter the chart at given surface temperature, proceeding vertically to intersect station pressure altitude. Proceed horizontally to the estimated landing gross weight, read touchdown airspeed. Descend directly to the RCR reflector line corresponding to existing runway condition. Read ground roll distance without wind on the left hand scale. For ground roll distance corrected for head or tailwind, move parallel to wind guide lines to effective wind. Read ground roll with wind on the extreme left hand scale.

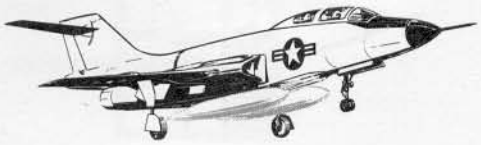
SAMPLE PROBLEM

A.	Temperature	60°F
B.	Pressure Altitude	Sea Level
C.	Estimated Landing Gross Weight	35,000 Lbs.
D.	Wet Runway Reflector Line (RCR=12)	
E.	Ground Roll (no wind)	4,950 Ft.
F.	Effective Headwind Applied	20 Kts.
G.	Ground Roll with wind	4,000 Ft.



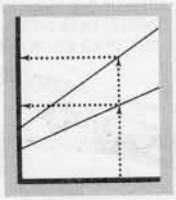
LANDING SPEEDS

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN



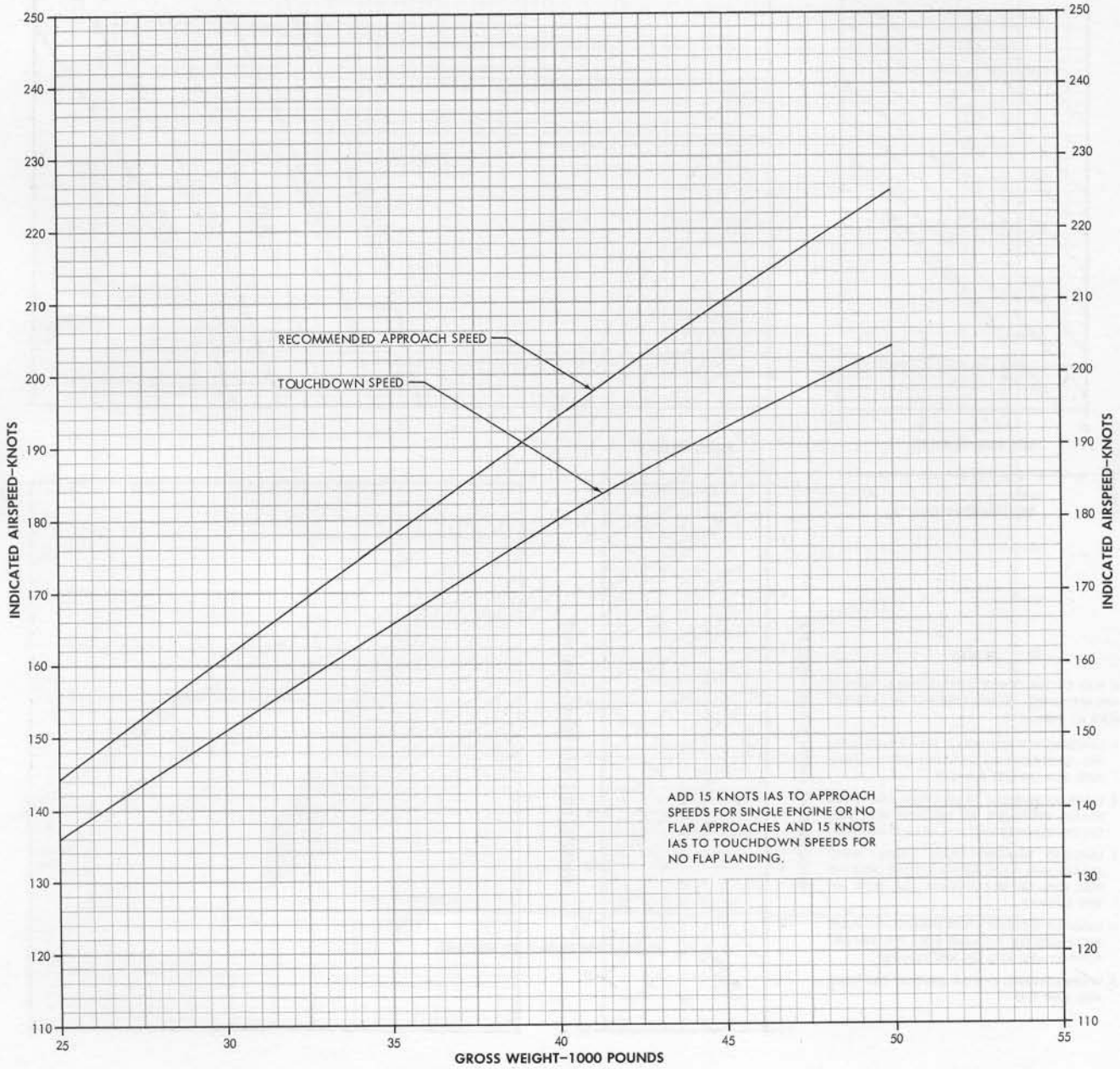
REMARKS
ENGINE(S): (2) J57-P-55

GUIDE



DATE: 30 MARCH 1959
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

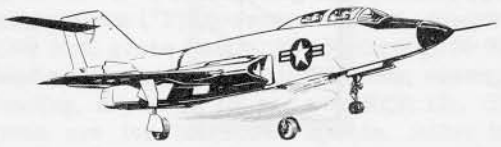


FB33-P800B

Figure A8-1

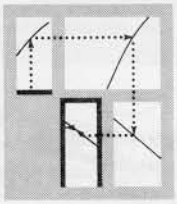
LANDING DISTANCE
WET AND DRY RUNWAY

AIRPLANE CONFIGURATION
F-101B OR F-101F: ALL CONFIGURATIONS
FLAPS EXTENDED, GEAR DOWN
SPEED BRAKES OPEN, DRAG CHUTE DEPLOYED



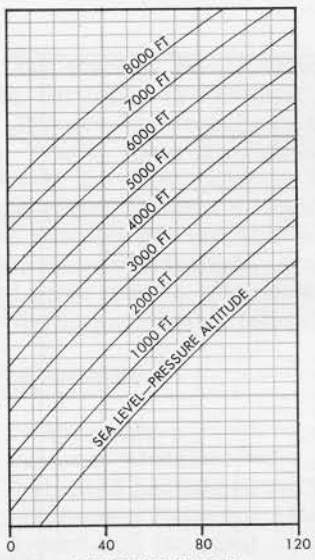
REMARKS
ENGINE(S): (2) J57-P-55

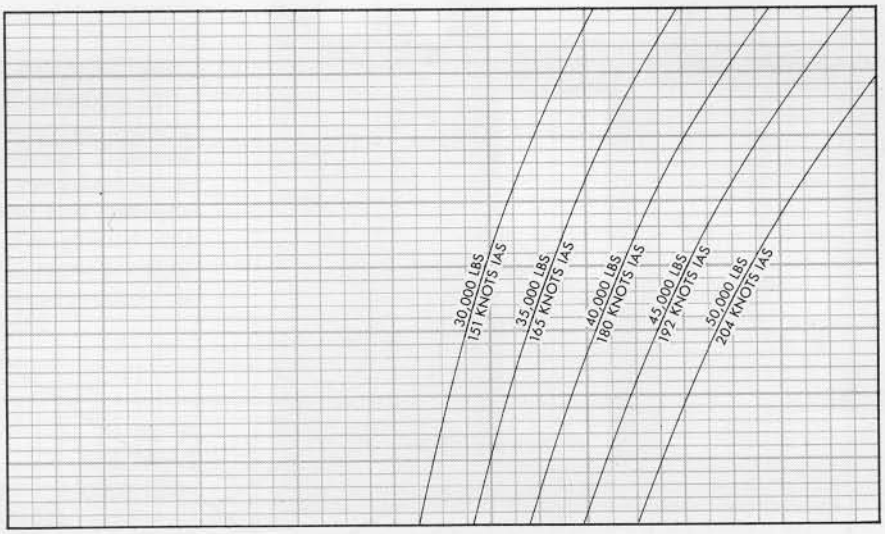
GUIDE

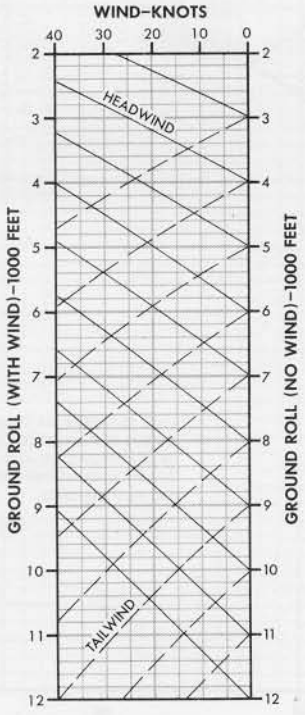


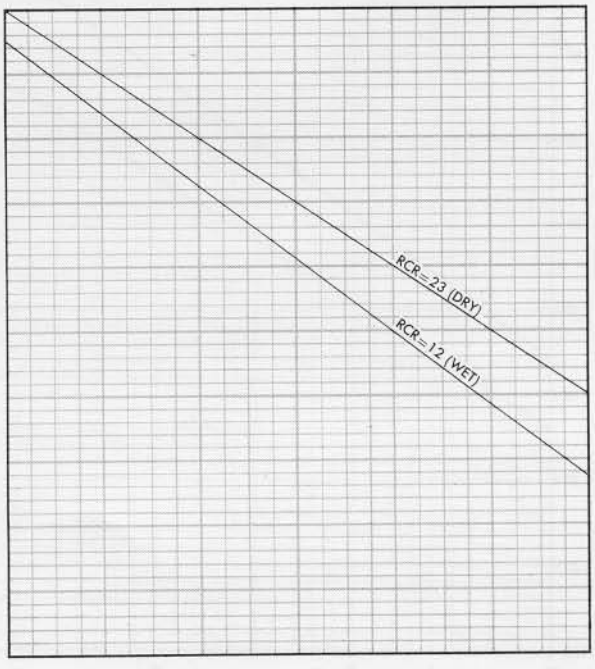
DATE: 1 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL









NOTES

IF ANY OF THE CONDITIONS GIVEN (1 THRU 5) ARE APPLICABLE, INCREASE THE ACTUAL LANDING ROLL AS INDICATED.

1. LANDING WITHOUT DRAG CHUTE INCREASES THE GROUND ROLL 53% ON DRY RUNWAY AND 60% ON WET RUNWAY.
2. LANDING WITHOUT DRAG CHUTE AND SPEED BRAKES INCREASES THE GROUND ROLL 70% ON DRY RUNWAY AND 81% ON WET RUNWAY.
3. LANDING WITHOUT DRAG CHUTE, SPEED BRAKES AND FLAPS INCREASES THE GROUND ROLL 101% ON DRY RUNWAY AND 143% ON WET RUNWAY.
4. LANDING WITHOUT SPEED BRAKES AND FLAPS INCREASES THE GROUND ROLL 19% ON DRY RUNWAY AND 23% ON WET RUNWAY.
5. WHEN LANDING OVER A 50-FOOT OBSTACLE, ADD 1000 FEET.

FB33-P801E

Figure A8-2

part 9

Combat Performance

TABLE OF CONTENTS

Charts

Supersonic Climb. A9-7
Maximum Thrust Acceleration A9-8
Maximum Thrust Turns A9-9
Military Thrust Acceleration or Turn. A9-10
Constant Altitude Turn Capability A9-11
Combat Fuel Flow A9-12
Nautical Miles Per Pound (Combat) A9-13
Level Flight Envelope A9-14
Intercept Combat Radius Profiles A9-15

SUPERSONIC CLIMB

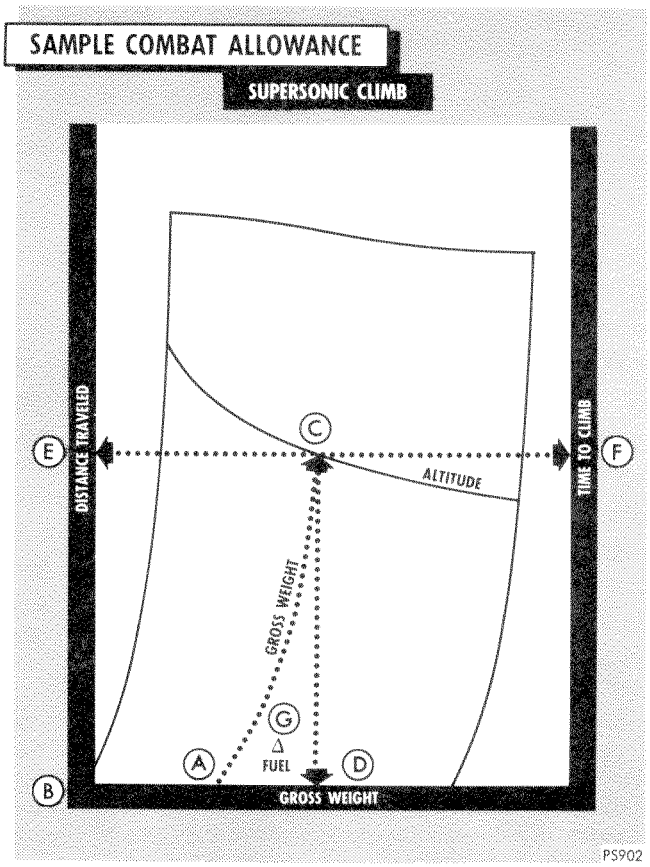
The Supersonic Climb chart (figure A9-1) presents only the supersonic portion of the Maximum Thrust Supersonic Climb Chart (figure A3-1). This chart differs from the climb data on figure 3-1 in that subsonic climb and acceleration values are omitted. Time and distance are plotted vs. gross weight with guide lines to show the reduction in gross weight during climb as fuel is consumed. Combat ceiling is superimposed on the graph.

USE

Detailed description of the proper use of this chart is presented in Part 3.

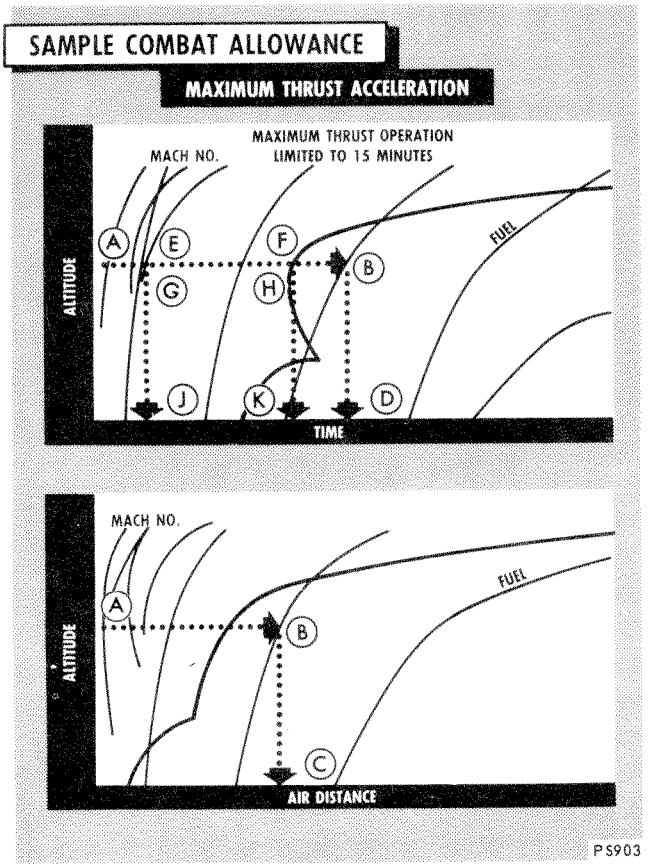
SAMPLE PROBLEM

A. Gross Weight at Start of Climb	44,000 Lbs.
B. Altitude at Start of Climb	35,000 Ft.
C. Time at Initial Altitude	.02 Min.
D. Distance at Initial Altitude (Nautical Miles)	.3 Miles
E. Altitude at End of Climb	50,000 Ft.
F. Gross Weight at End of Climb	42,700 Lbs.
G. Time at End of Climb	2.30 Mins.
H. Distance at End of Climb (Nautical Miles)	28.3 Miles
I. Time Required (G. - C.)	2.27 Mins.
J. Distance Traveled (Nautical Miles) (H. - D.)	28.0 Miles
K. Fuel Used During Climb (A. - F.)	1,300 Lbs.



MAXIMUM THRUST ACCELERATION

This chart (figure A9-2) shows the relationship between time, fuel, and distance at various altitudes during Maximum thrust operation. Lines of constant Mach number, from Maximum Endurance Speed to M_{max}, provide a capability of determining (incrementally) the time, fuel, and distance required for level flight accelerations within the airplane's speed envelope.



USE

To determine corresponding time and distance for combat fuel allowance, enter the graphs at combat altitude and project horizontally to the allotted fuel curve; from this point, descend to the base scales to read related time and distance. To determine fuel required for combat time allowance, enter the base scale with time allotted for combat and project vertically to intersect the combat altitude; at this point, read the interpolated fuel required. To determine time-fuel-distance required for acceleration, intersect the combat altitude line with initial and final Mach number; between these points, read Δ time-fuel-distance required for acceleration.

SAMPLE PROBLEM

A. Combat Altitude	25,000 Ft.
B. Combat Fuel Allowance	5,000 Lbs.
C. Combat Distance (Nautical Miles)	53 Miles
D. Combat Time	4.3 Minutes
E. Initial Mach Number	.85
F. Desired Final Mach Number	M_{max}.
G. Fuel Corresponding to Initial Mach No.	400 Lbs.
H. Fuel Corresponding to Final Mach No.	4,200 Lbs.
I. Fuel Required to Accelerate from .85 Mach to M_{max} (H. - G.)	3,800 Lbs.
J. Time Corresponding to Initial Mach No.	.3 Min.
K. Time Corresponding to Final Mach No.	3.65 Min.
L. Time Required to Accelerate from .85 Mach No. to M_{max} (K. - J.)	3.35 Min.

MAXIMUM THRUST TURNS

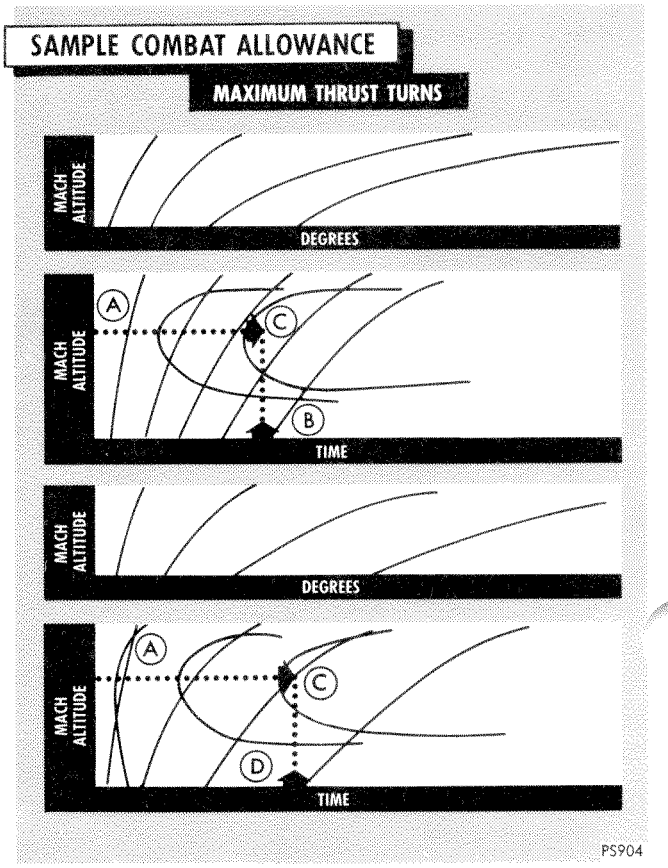
The Maximum Thrust Turns Chart (figure A9-3) shows the relationship between time, fuel and degrees turned at various altitudes with Maximum thrust setting. Time and degrees turned or fuel required during an accelerating or decelerating 45° banked turn may be determined from this chart. Mach Number attained during an accelerating turn may be determined from this chart. The time limitation for Maximum Thrust is included on the chart.

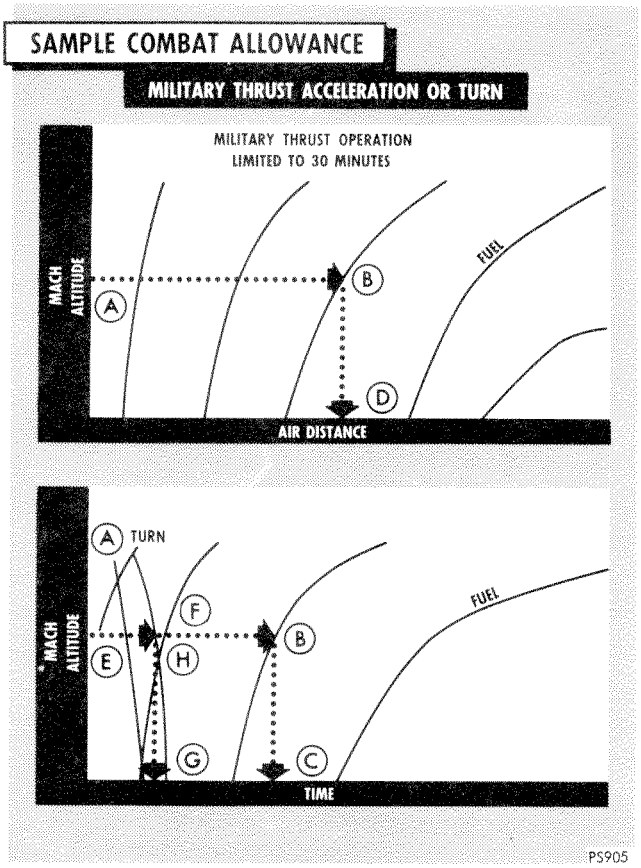
USE

Enter the chart at the combat altitude and proceed horizontally to intersect the allotted fuel, descend to the time or degrees turned scale and read the time and degrees turned available. Enter at combat altitude and time or degrees turned needed for combat and read fuel required.

SAMPLE PROBLEM

A. Altitude	30,000 Ft.
B. Degrees Turned	180 Deg.
C. Combat Fuel	1,900 Lbs.
D. Combat Time	122 Sec.





MILITARY THRUST ACCELERATION OR TURN

The Military Thrust Acceleration or Turn chart (figure A9-4) shows the relationship between time, fuel and distance during acceleration or time, fuel and degrees turned for a 45° banked turn at various altitudes with Military thrust setting. Time and distance or fuel required during a 45° banked turn may be determined from this chart. The time limitation for Military thrust is included on the chart.

USE

Enter the chart at the combat altitude and proceed horizontally to intersect the allotted fuel, descend to the time or distance scale and read the time and distance available. Enter at combat altitude and degrees turned and read time and fuel required.

SAMPLE PROBLEM

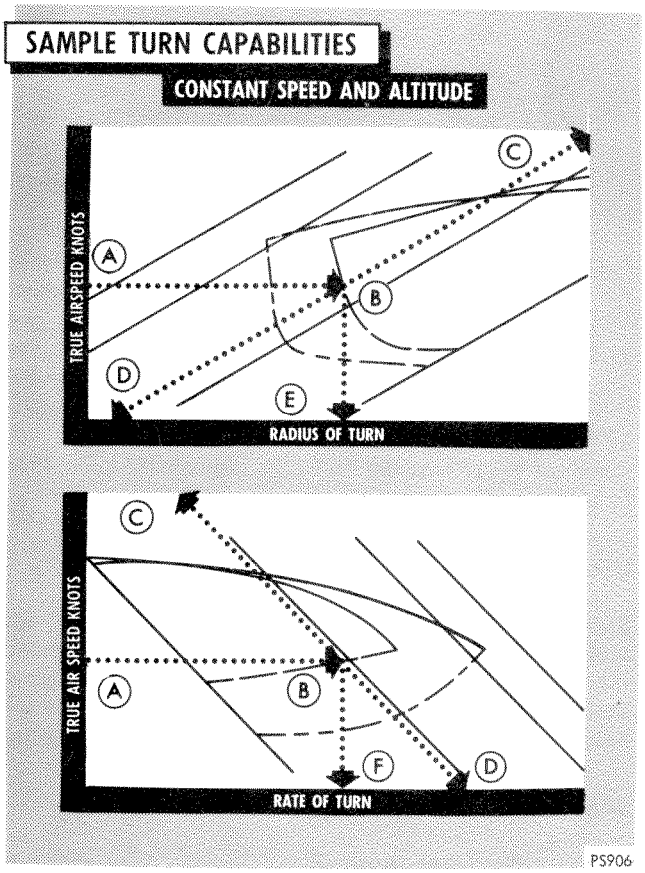
A. Altitude	30,000 Ft.
B. Combat Fuel	2,000 Lbs.
C. Combat Time	11.6 Min.
D. Combat Distance (Nautical Miles)	114 Miles
E. Altitude	30,000 Ft.
F. Degrees Turned	360 Deg.
G. Time	3.2 Min.
H. Fuel Required	570 Lbs.

TURN CAPABILITIES

The Turn Capabilities chart (figure A9-5) presents the minimum turn radius at various constant airspeeds at 10, 20, 30 and 40,000 feet, as limited by thrust or pitch-up warning system, whichever is applicable. The low speed limitations correspond to horn boundary, and the high speed limitations correspond to Maximum thrust. The chart also presents the maximum rate of turn, and maximum performance based on load factors and bank angles for constant speed and constant altitude.

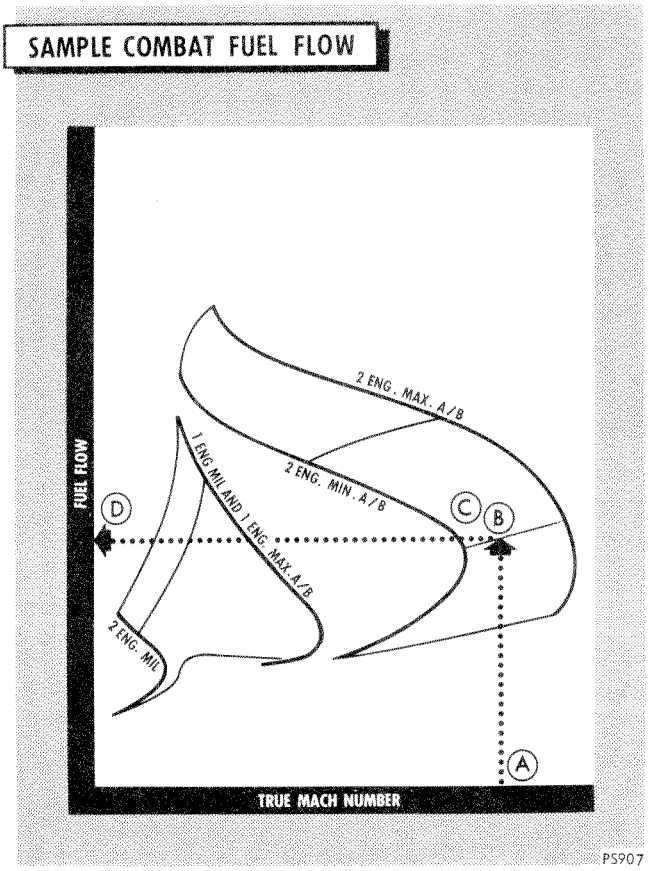
USE

Enter the chart at the airspeed and proceed horizontally to the desired altitude and descend to read the minimum radius or maximum rate of turn. Interpolate for the bank angle and load factor. For any lower bank angle or load factor the radius of turn may be read.



SAMPLE PROBLEM

A. True Airspeed	500 Kts.
B. Altitude	40,000 Ft.
C. Bank Angle	46°
D. Load Factor	1.4 "g's"
E. Radius of Turn	22,000 Ft.
F. Rate of Turn	2.25°/sec.



COMBAT FUEL FLOW CHART

This chart (figure A9-6) presents the specific fuel flow and general thrust setting required to maintain a constant Mach number for all interpolated altitudes from Sea Level to 45,000 feet. The fuel flow values are based on a stabilized level flight condition, and does not represent the fuel flow required to accelerate to a given Mach number.

USE

Enter the chart with the Mach number desired for stabilized level flight. Proceed vertically to intersect the interpolated altitude and note the general thrust setting required. From this point, project to the left scale to read the corresponding fuel flow relationship.

SAMPLE PROBLEM

A. Desired Mach Number	1.52
B. Altitude	35,000 Ft.
C. Thrust Setting Required	(Modulated Afterburners)
D. Fuel Flow (Pounds Per Minute)	850

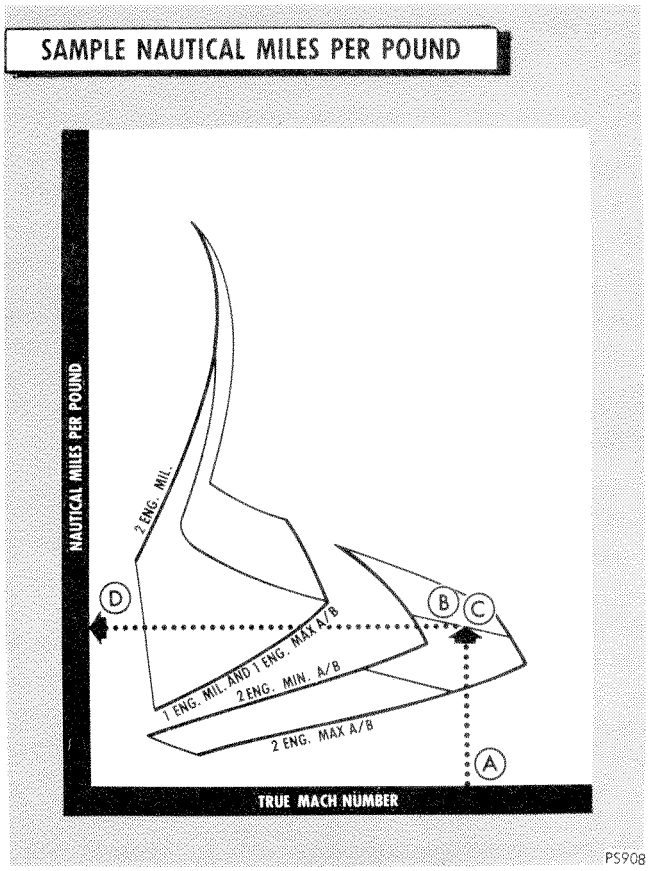
This chart (figure A9-7) presents specific range (nautical miles per 100 pounds of fuel), and the general thrust setting required, while maintaining a constant Mach number at any interpolated altitude from Sea Level to 45,000 feet. The specific range values are based on a stabilized level flight condition, and does not represent specific range associated with acceleration.

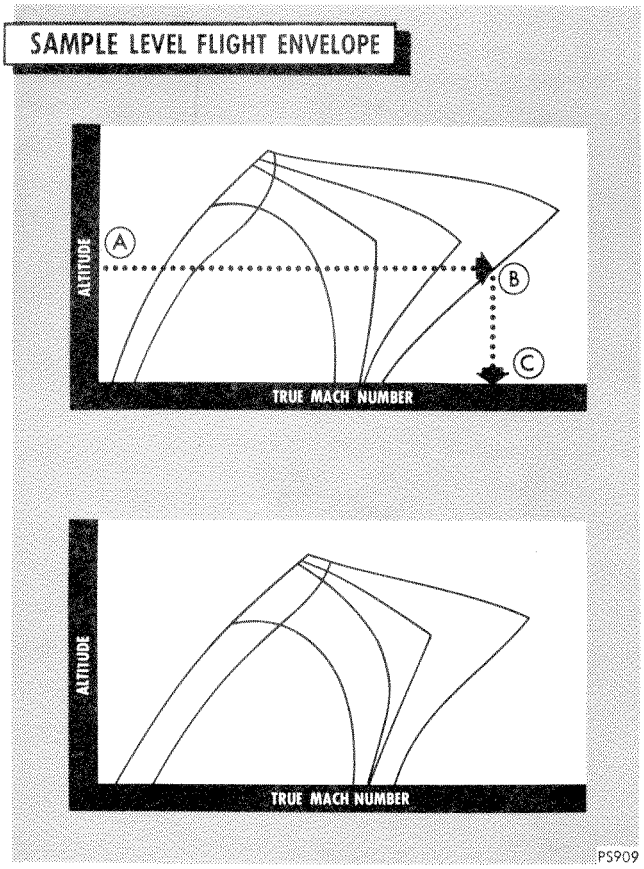
USE

Enter the chart with the Mach number desired for stabilized level flight. Proceed vertically to intersect the interpolated altitude and note the general thrust setting required. From this point, project to the left scale to read the corresponding specific range.

SAMPLE PROBLEM

A. Desired Mach Number	1.54
B. Altitude	40,000 Ft.
C. Thrust Setting Required	(Modulated Afterburners)
D. Specific Range (Nautical Miles Per 100 Pounds)	2.2 Miles





LEVEL FLIGHT ENVELOPE

This chart (figure A9-8) presents the airplane's level-flight envelope for each configuration and average combat gross weight. Parameters of the envelopes extend from the "Warning Horn Boundary" to the airplane's M_{max} throughout the altitude range. Maximum Mach number curves for the other definable "Combat Thrust Settings" are plotted within the envelopes.

USE

Enter the appropriate graph at combat altitude and project horizontally to intersect the desired combat thrust setting curve. From this point, descend to the base scale to read maximum attainable Mach number in level flight.

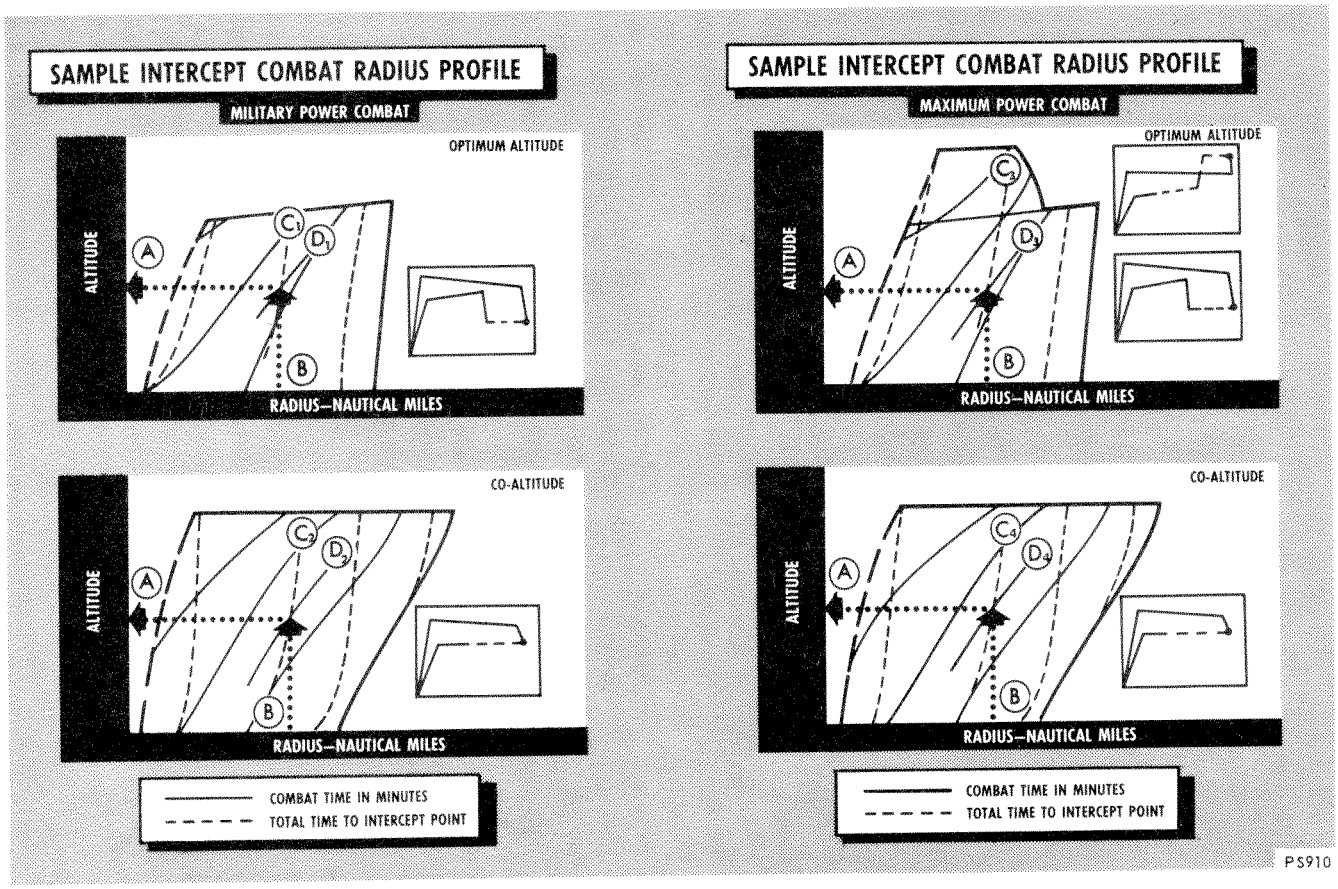
SAMPLE PROBLEM

Configuration: Primary Armament

A. Combat Altitude	32,000 Ft.
B. Combat Thrust Setting	Maximum Afterburners
C. Maximum Attainable Mach Number (M_{max})	1.6

INTERCEPT COMBAT RADIUS PROFILES

These charts (figures A9-9 through A9-12), based on a specified intercept criteria, present the intercept radius (no wind) of the airplane for various combat time - altitude combinations. These radii are consistent with an assumed mission sequence of: Maximum thrust take-off; Military thrust climb; outbound cruise at target (Co-Altitude or Optimum Altitude); intercept the target altitude (Maximum Range Descent or Supersonic Climb if outbound cruise was at Optimum Altitude); accelerate to intercept-point (target) with a constant throttle setting (Maximum or Military thrust); terminate combat at point of intercept; Military thrust climb, or Maximum Range Descent, to optimum altitude; inbound cruise at optimum altitude and Mach number; and Maximum Range Descent to base. Fuel allowance included in each profile is listed under "Mission Considerations". The interpolation of "Time to Intercept" represents the total time from brake release to termination of combat. From these plots can be determined an optimum "canned" intercept mission based on known mission requirements and/or limitations.



USE

With known target data, plot the required intercept-point on each profile. The intercept-point can be determined by combinations of: target altitude and intercept radius; target altitude and total time to intercept; or, if intercept speed is a requirement, target altitude and required combat time. After the intercept-point has been established, read the corresponding relationships to determine (by comparison) the optimum "canned" mission for the existing requirements and/or restrictions.

SAMPLE PROBLEM

Configuration: Primary Armament +(2) 450 Gallon Tanks

A. Target Altitude 20,000 Ft.
B. Intercept Radius 650 Miles
C. Total Time to Intercept
   (1) Outbound cruise at optimum altitude with Military thrust combat. . . 1 Hr. 21 Mins.
   (2) Outbound cruise at co-altitude with Military thrust combat. . . . . 1 Hr. 28 Mins.
   (3) Outbound cruise at optimum altitude with Maximum thrust combat. . 1 Hr. 24 Mins.
   (4) Outbound cruise at co-altitude with Maximum thrust combat . . . 1 Hr. 29 Mins.
D. Combat Time Required
   (1) Outbound cruise at optimum altitude with Military thrust combat. . . . 15.5 Mins.
   (2) Outbound cruise at co-altitude with Military thrust combat . . . . . 5.5 Mins.
   (3) Outbound cruise at optimum altitude with Maximum thrust combat . . . 1.8 Mins.
   (4) Outbound cruise at co-altitude with Maximum thrust combat. . . . . .5 Min.

Based on the above sample problem, if the mission requirement is a MINIMUM TIME intercept of a target at 20,000 feet and 650 miles from base, the optimum "canned" mission would consist of: an outbound cruise at optimum altitude; a maximum range descent to intercept target altitude 15.5 minutes prior to target intercept-point; accelerate to target using Military thrust for 15.5 minutes. The total elapsed time is 1 hour and 21 minutes from brake release to intercept-point.

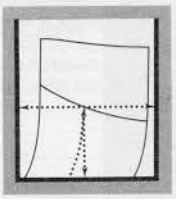
COMBAT ALLOWANCE

MAXIMUM THRUST SUPERSONIC CLIMB

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT

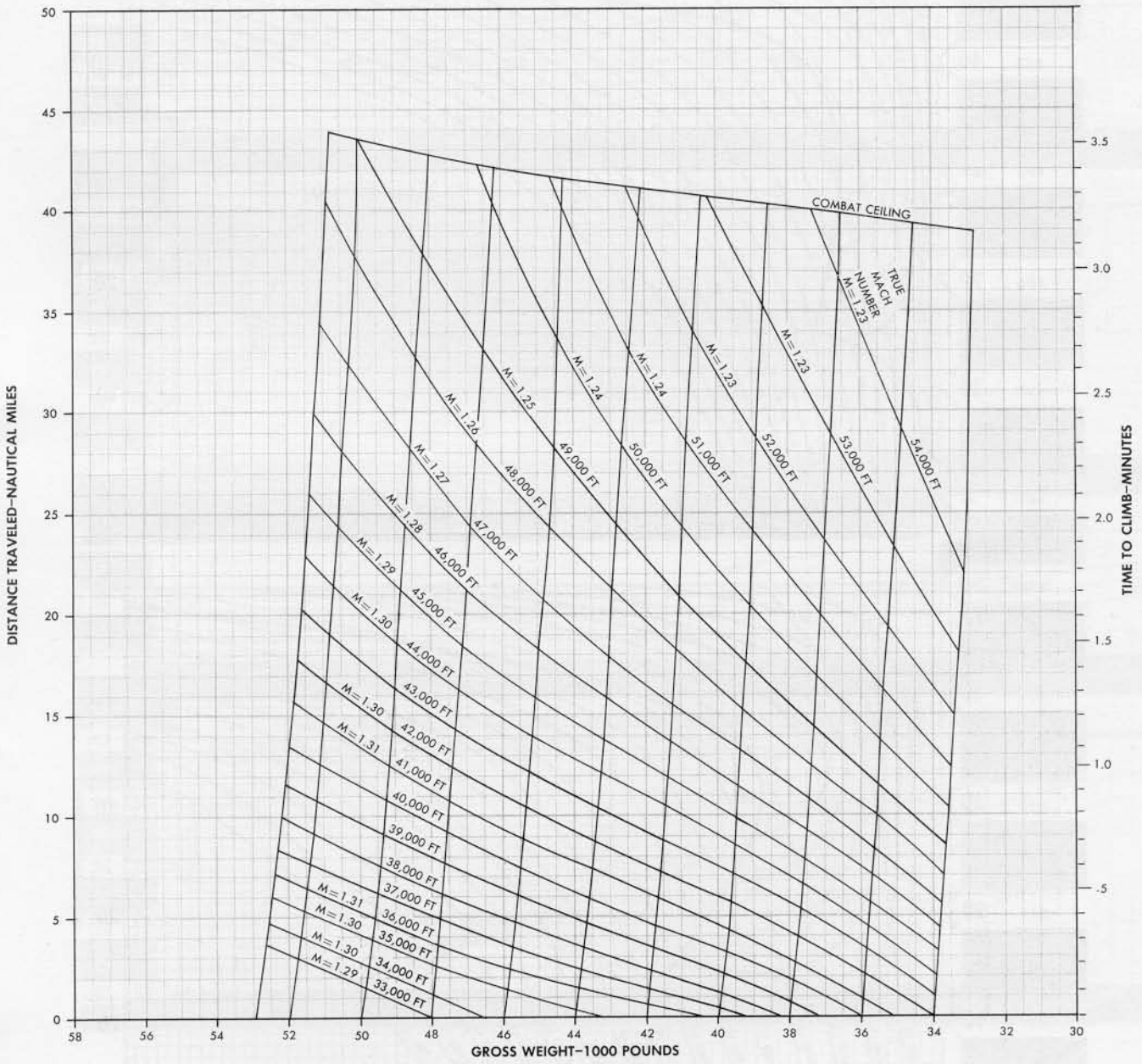
REMARKS
ENGINE(S): J57-P-55
ICAO STANDARD DAY ONLY

GUIDE



DATE: 30 MARCH 1960
DATA BASIS: **ESTIMATED**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P902A

Figure A9-1

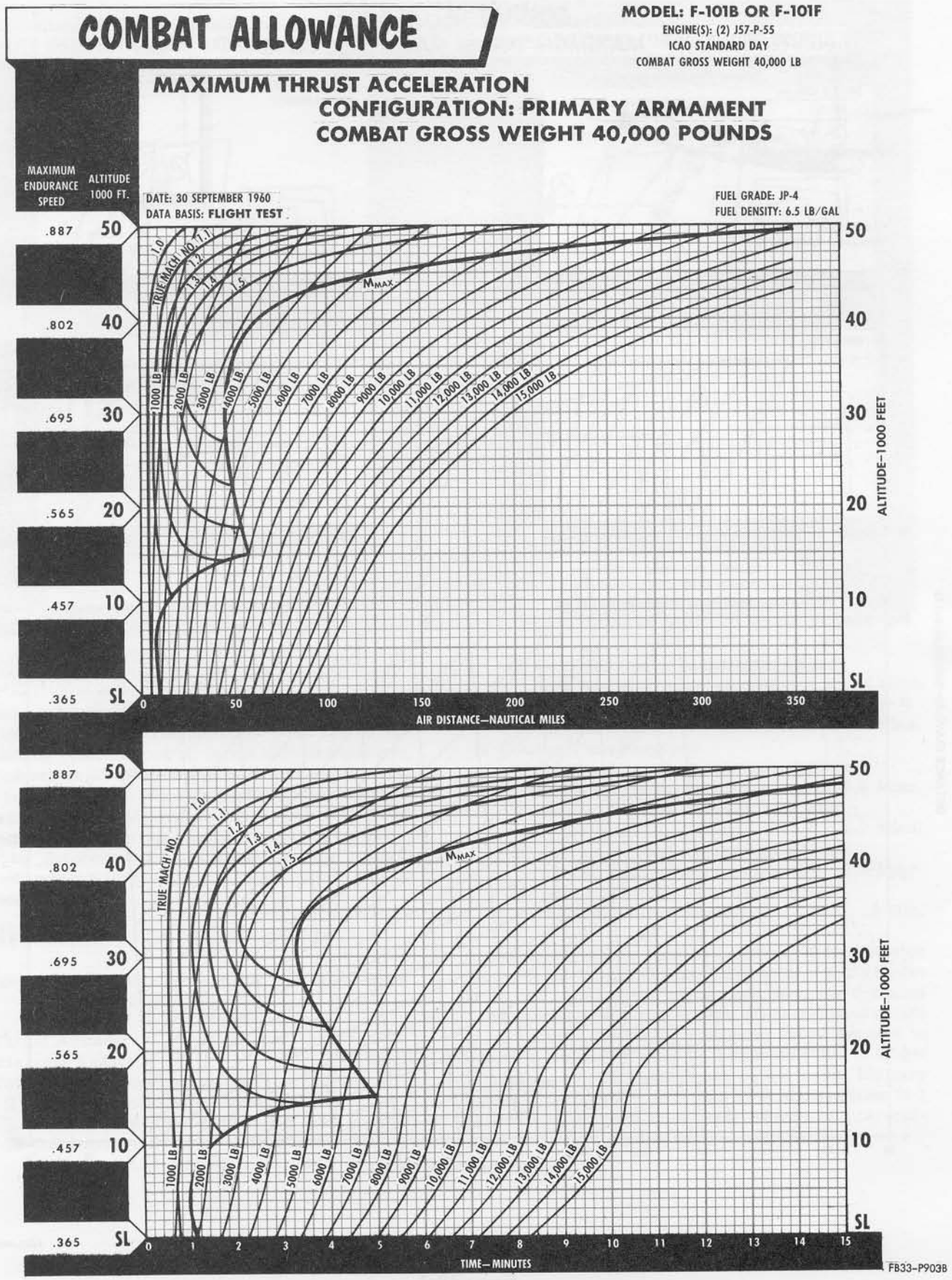
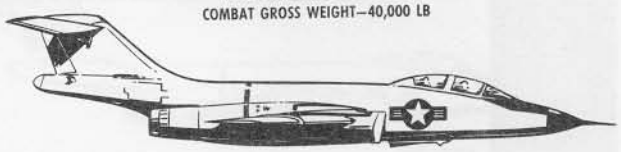

COMBAT ALLOWANCE
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
COMBAT GROSS WEIGHT 40,000 LB
MAXIMUM THRUST ACCELERATION
CONFIGURATION: PRIMARY ARMAMENT
COMBAT GROSS WEIGHT 40,000 POUNDS
MAXIMUM ENDURANCE SPEED
ALTITUDE 1000 FT.
DATE: 30 SEPTEMBER 1960
DATA BASIS: FLIGHT TEST
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL
.887 50
.802 40
.695 30
.565 20
.457 10
.365 SL
TRUE MACH NO.
1.0
1.1
1.2
1.3
1.4
1.5
MMAX
1000 LB
2000 LB
3000 LB
4000 LB
5000 LB
6000 LB
7000 LB
8000 LB
9000 LB
10,000 LB
11,000 LB
12,000 LB
13,000 LB
14,000 LB
15,000 LB
0 50 100 150 200 250 300 350
AIR DISTANCE—NAUTICAL MILES
ALTITUDE—1000 FEET
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
TIME—MINUTES
FB33-P903B

Figure A9-2

COMBAT ALLOWANCE

MAXIMUM THRUST TURNS
CONFIGURATION: PRIMARY ARMAMENT

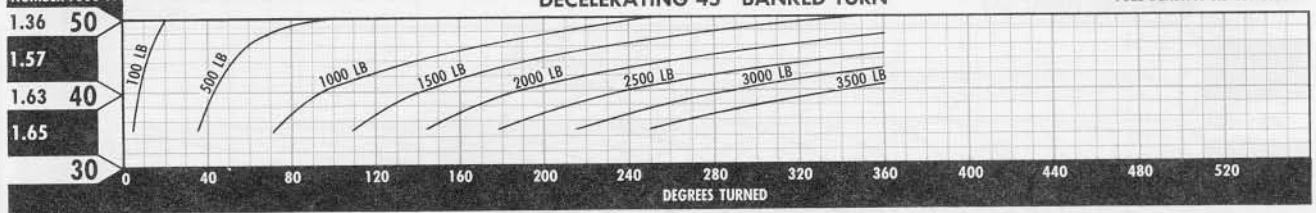
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY ONLY
COMBAT GROSS WEIGHT—40,000 LB



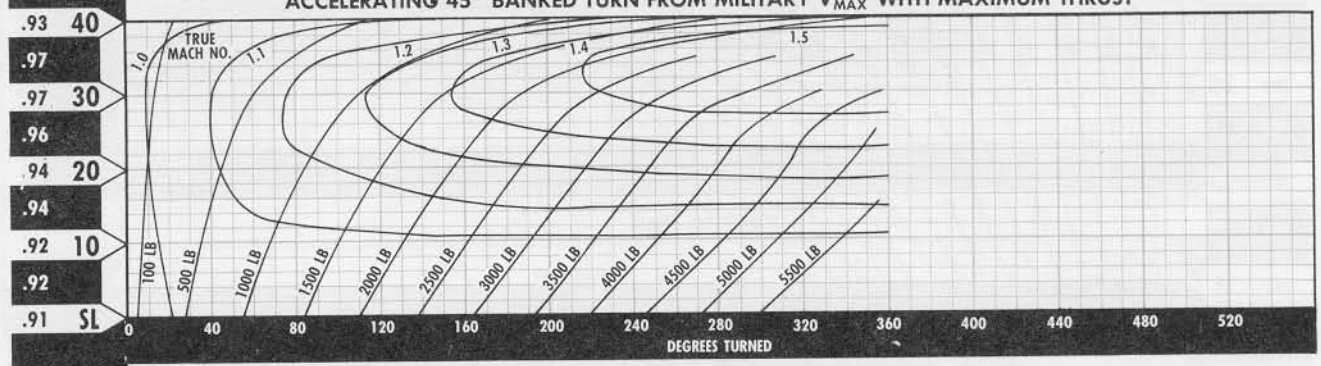
DATE: 30 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

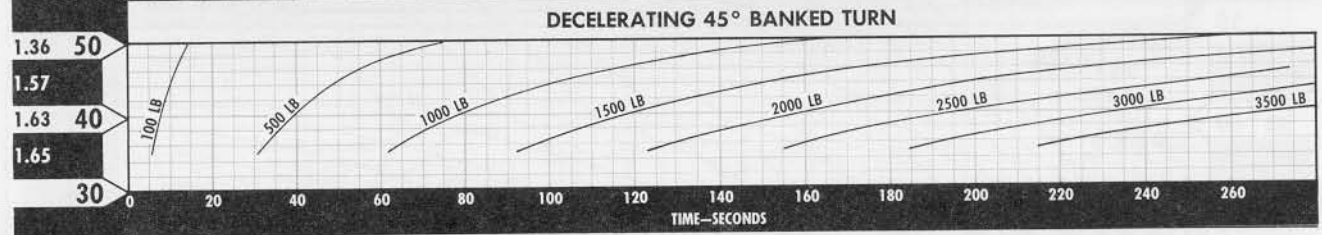
DECELERATING 45° BANKED TURN



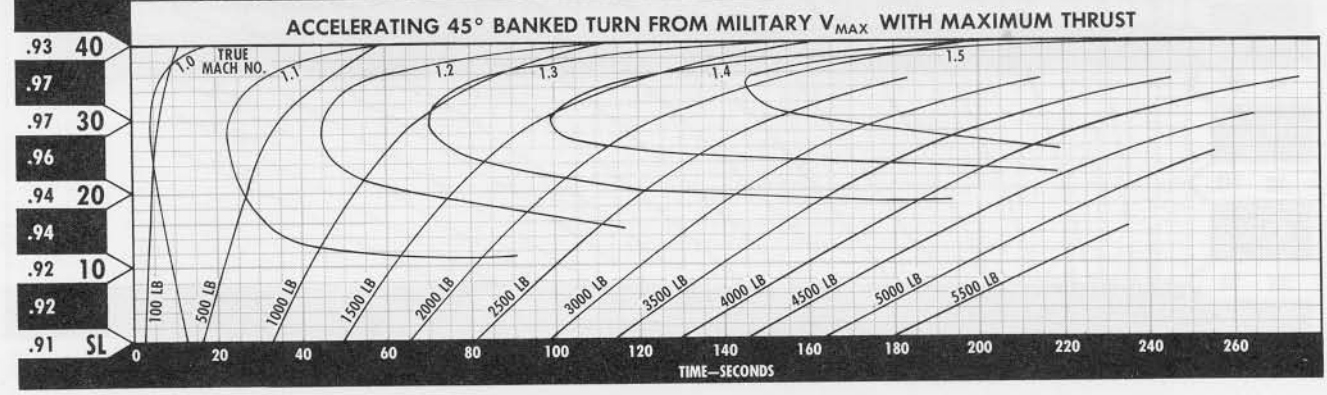
ACCELERATING 45° BANKED TURN FROM MILITARY V_{MAX} WITH MAXIMUM THRUST



DECELERATING 45° BANKED TURN



ACCELERATING 45° BANKED TURN FROM MILITARY V_{MAX} WITH MAXIMUM THRUST



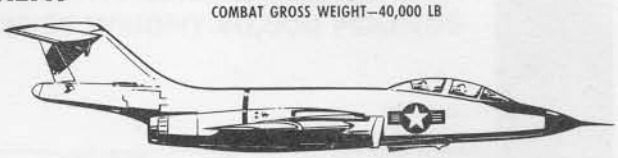
FB33-P904B

Figure A9-3

COMBAT ALLOWANCE

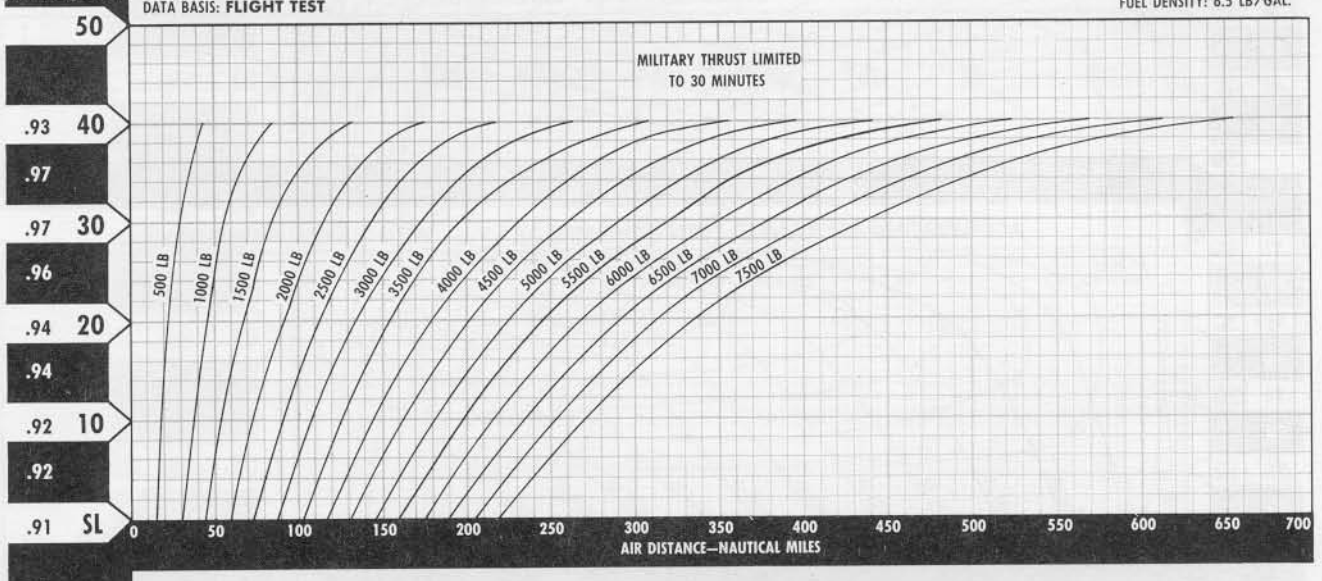
MILITARY THRUST ACCELERATION OR TURN
CONFIGURATION: PRIMARY ARMAMENT

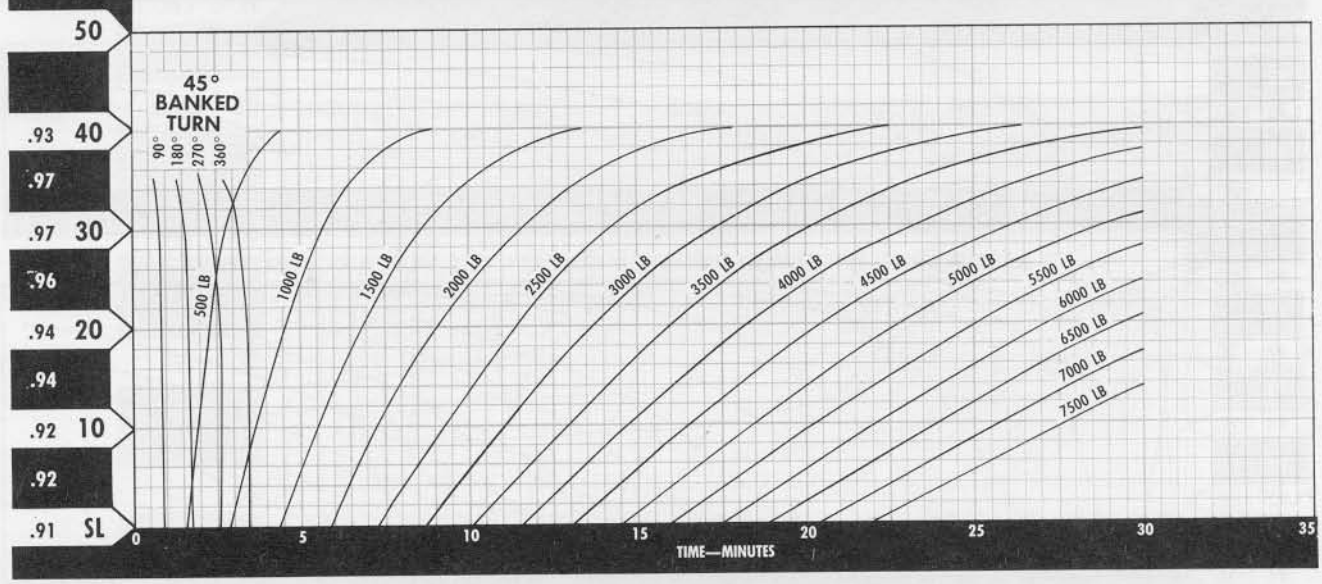
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY ONLY
COMBAT GROSS WEIGHT—40,000 LB



DATE: 30 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.





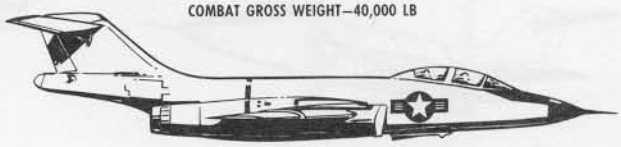
FB33-P905 A

Figure A9-4

TURN CAPABILITIES

CONSTANT SPEED AND ALTITUDE
CONFIGURATION: PRIMARY ARMAMENT

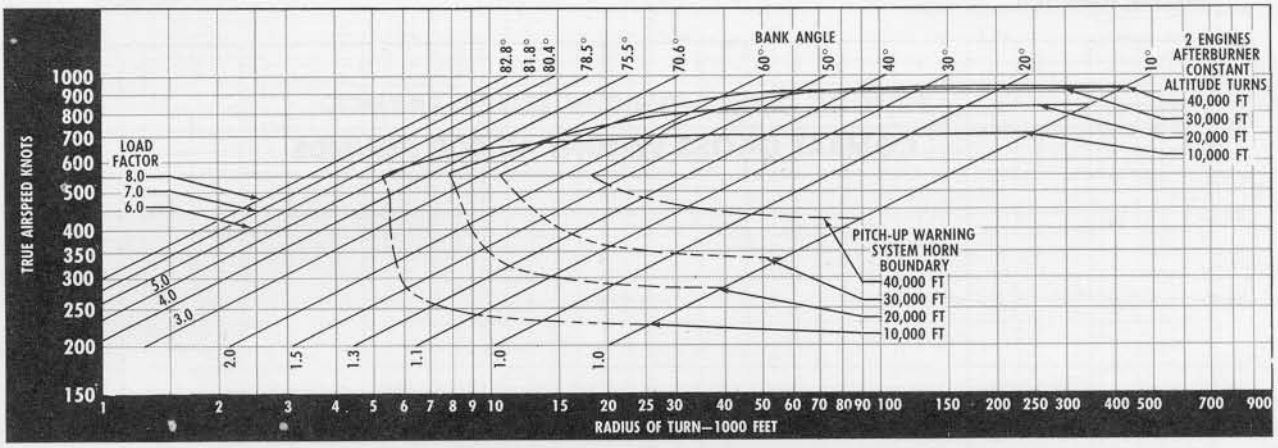
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY ONLY
COMBAT GROSS WEIGHT—40,000 LB



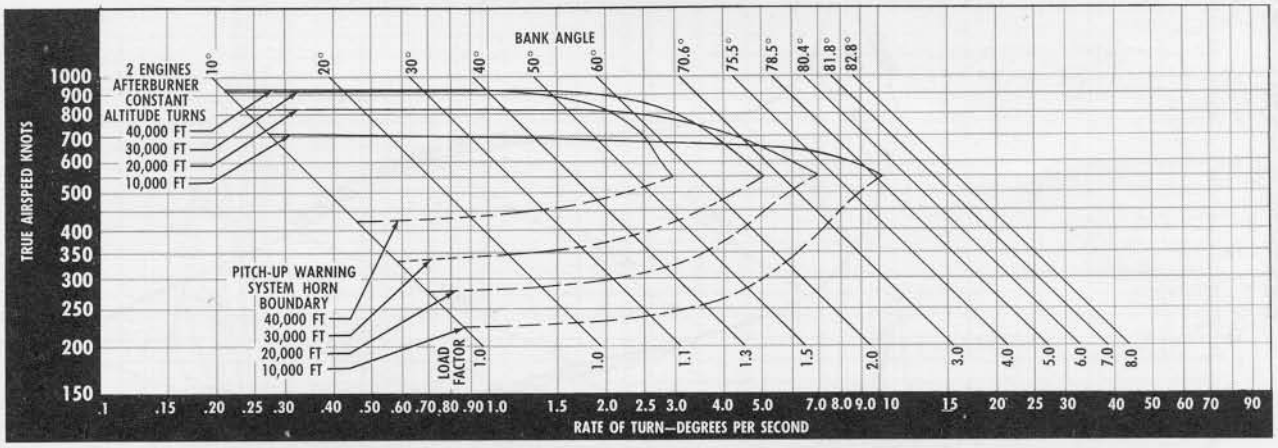
DATE: 30 MARCH 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL.

RADIUS OF TURN



RATE OF TURN

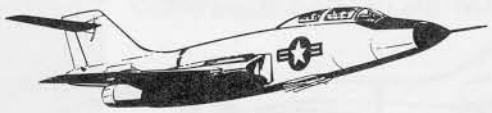


FB33-P906B

Figure A9-5

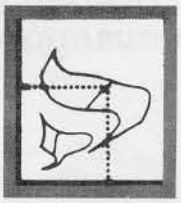
COMBAT FUEL FLOW
STABILIZED LEVEL FLIGHT

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



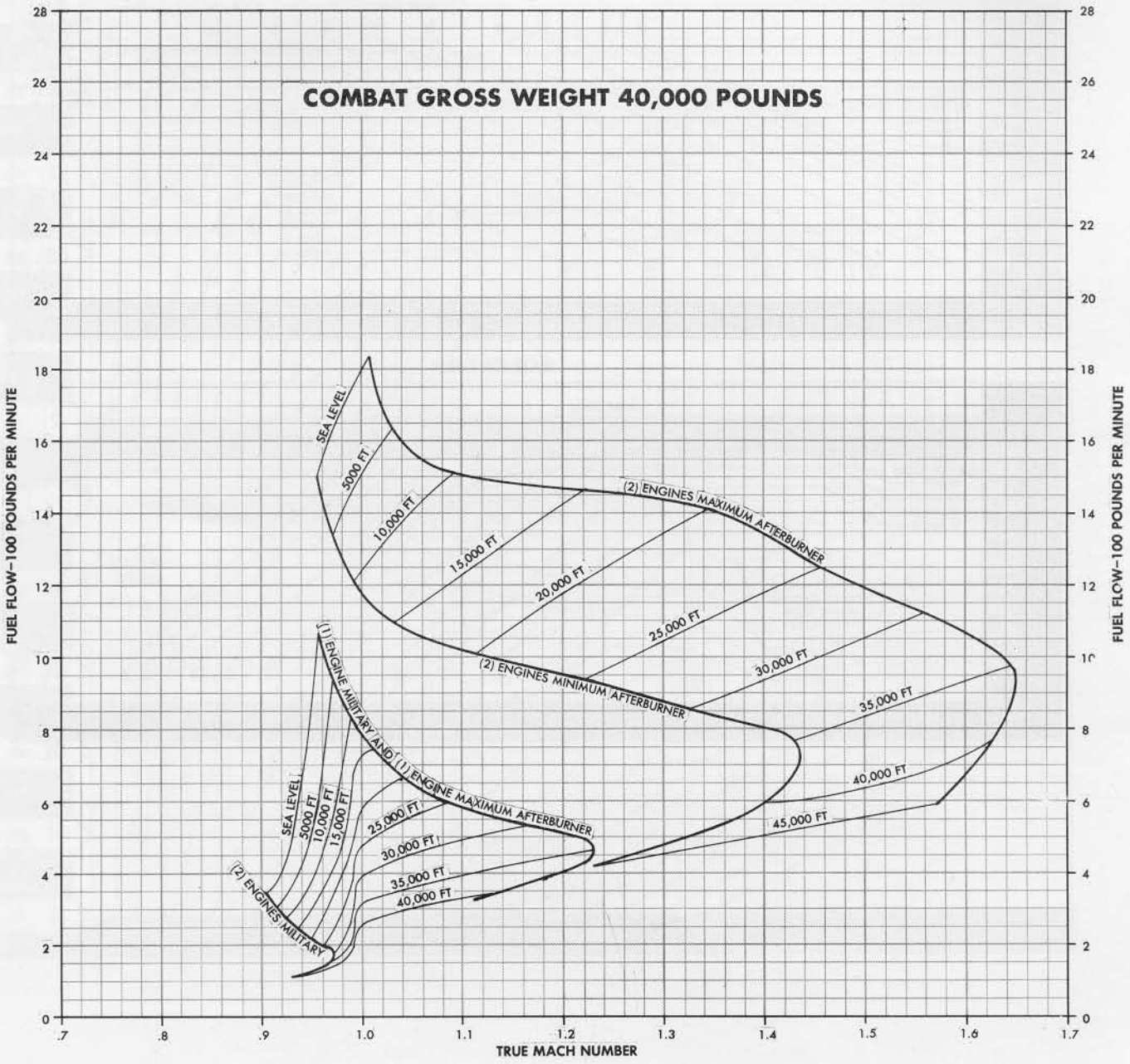
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

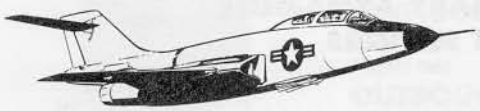


FB33-P911A

Figure A9-6

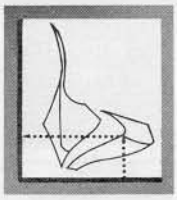
NAUTICAL MILES PER POUND
COMBAT THRUST SETTINGS

AIRPLANE CONFIGURATION
F-101B OR F-101F: PRIMARY ARMAMENT



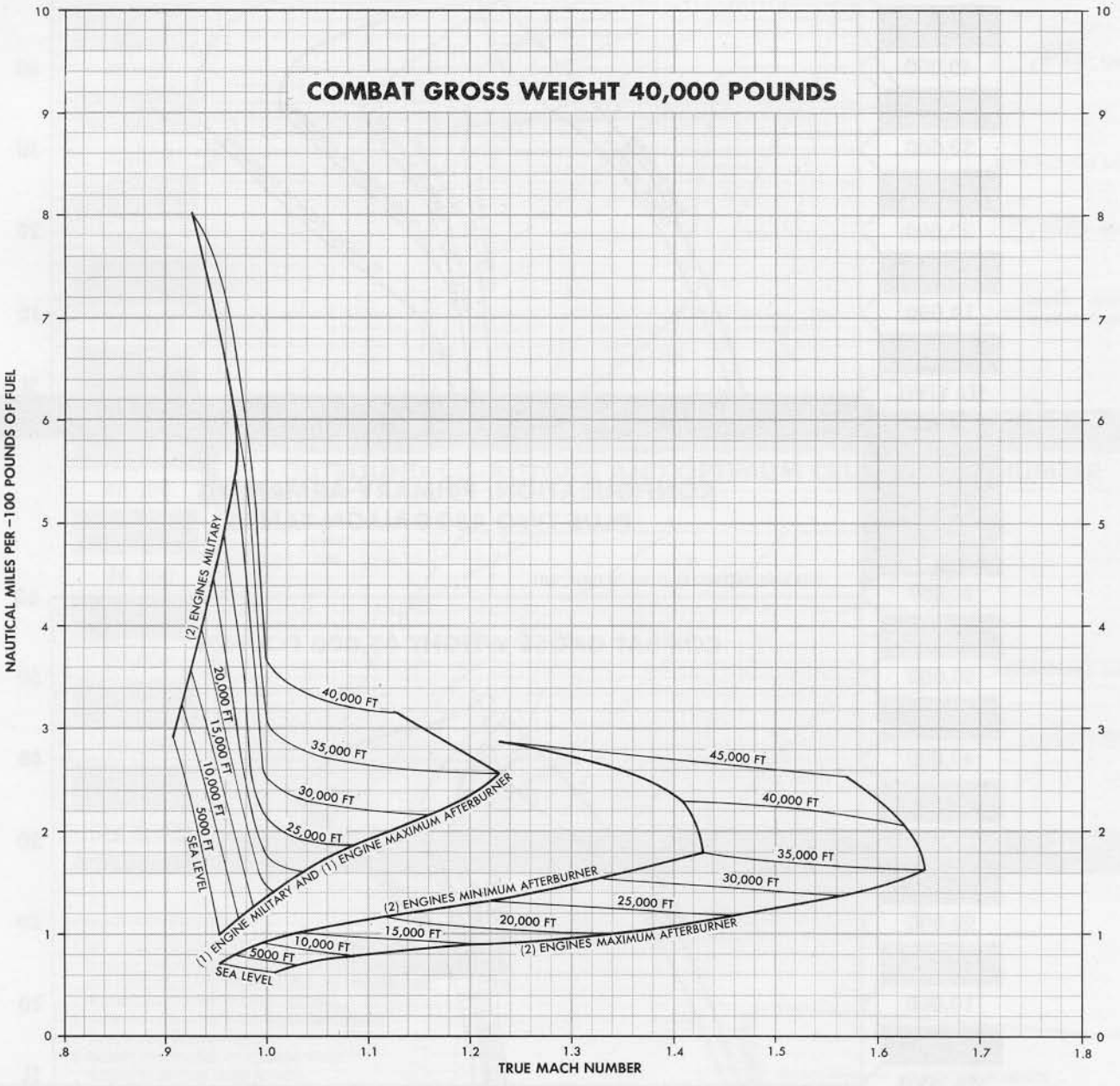
REMARKS
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY

GUIDE



DATE: 1 FEBRUARY 1961
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL



FB33-P913 A

Figure A9-7

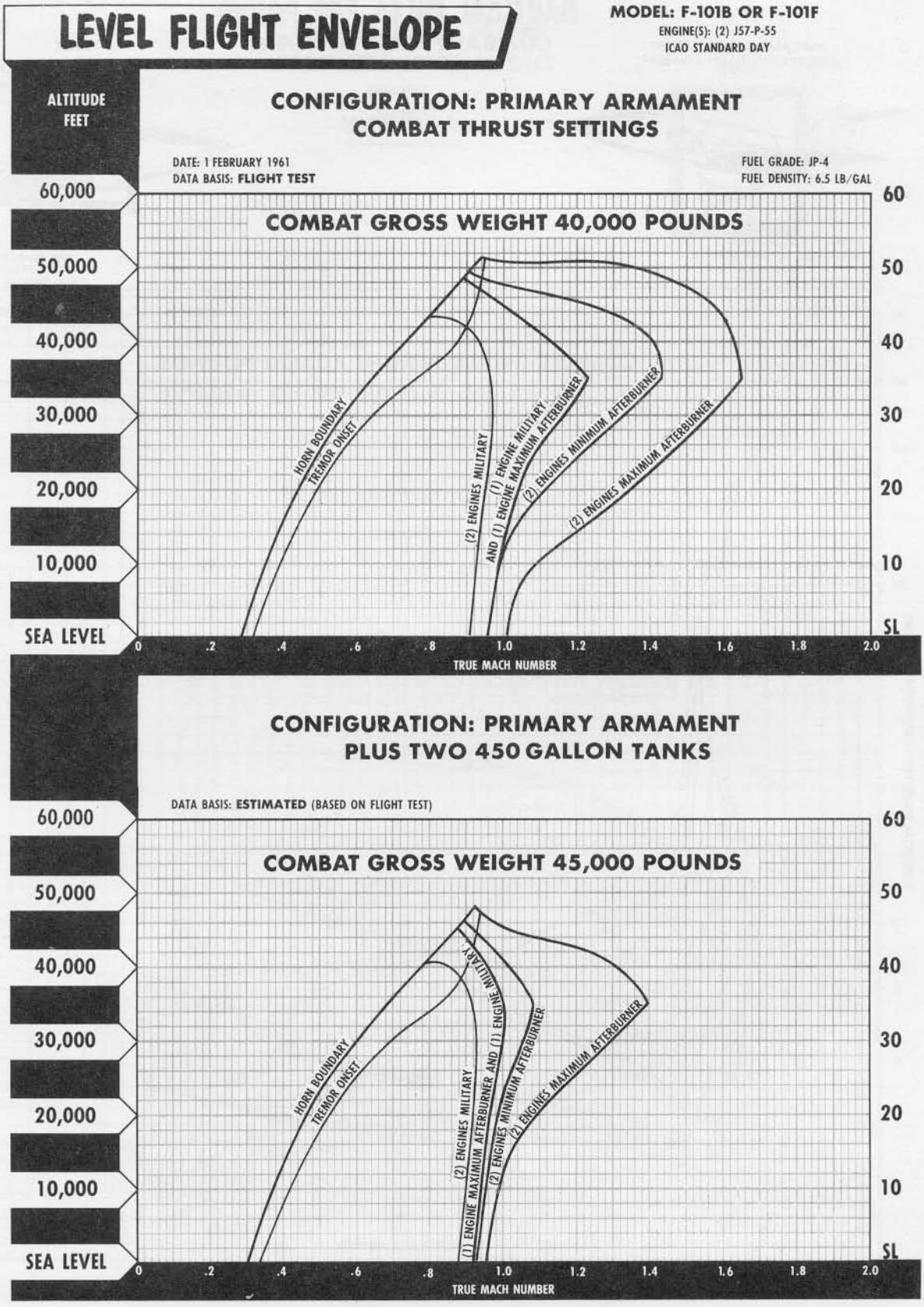

LEVEL FLIGHT ENVELOPE
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
ALTITUDE FEET
CONFIGURATION: PRIMARY ARMAMENT
COMBAT THRUST SETTINGS
DATE: 1 FEBRUARY 1961
DATA BASIS: FLIGHT TEST
FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL
COMBAT GROSS WEIGHT 40,000 POUNDS
60,000
50,000
40,000
30,000
20,000
10,000
SEA LEVEL
HORN BOUNDARY
TREMOR ONSET
(2) ENGINES MILITARY
(1) ENGINE MILITARY AND (1) ENGINE MAXIMUM AFTERBURNER
(2) ENGINES MINIMUM AFTERBURNER
(2) ENGINES MAXIMUM AFTERBURNER
0 .2 .4 .6 .8 1.0 1.2 1.4 1.6 1.8 2.0
TRUE MACH NUMBER
60 50 40 30 20 10 SL
CONFIGURATION: PRIMARY ARMAMENT
PLUS TWO 450 GALLON TANKS
DATA BASIS: ESTIMATED (BASED ON FLIGHT TEST)
COMBAT GROSS WEIGHT 45,000 POUNDS
60,000
50,000
40,000
30,000
20,000
10,000
SEA LEVEL
HORN BOUNDARY
TREMOR ONSET
(2) ENGINES MILITARY
(1) ENGINE MAXIMUM AFTERBURNER AND (1) ENGINE MILITARY
(2) ENGINES MINIMUM AFTERBURNER
(2) ENGINES MAXIMUM AFTERBURNER
0 .2 .4 .6 .8 1.0 1.2 1.4 1.6 1.8 2.0
TRUE MACH NUMBER
60 50 40 30 20 10 SL
FB33-P914 A

Figure A9-8

INTERCEPT COMBAT RADIUS PROFILE

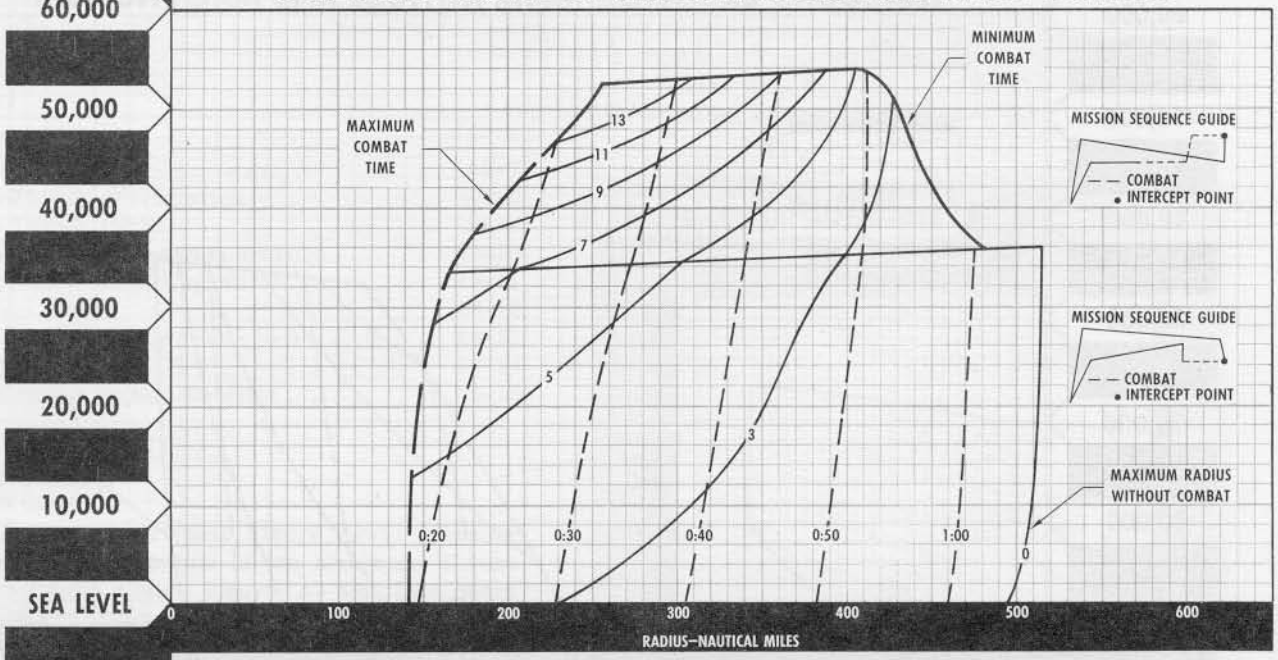
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 45,461 LB

MAXIMUM THRUST COMBAT
CONFIGURATION: PRIMARY ARMAMENT

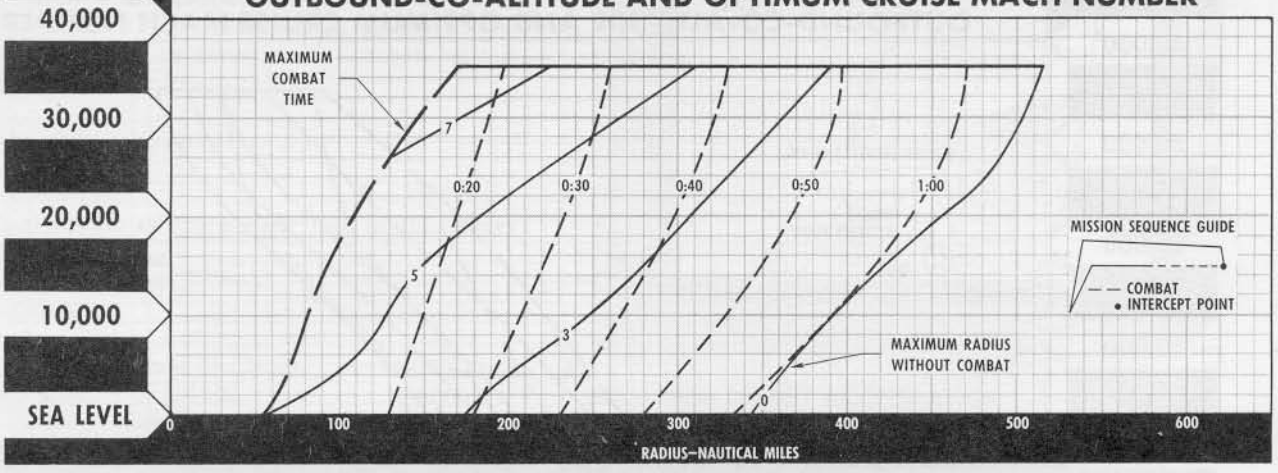
DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

OUTBOUND CRUISE-OPTIMUM ALTITUDE AND MACH NUMBER

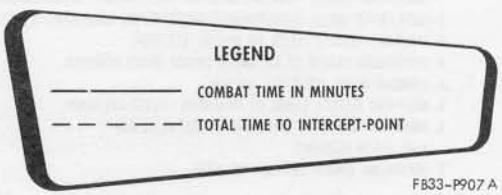


OUTBOUND-CO-ALTITUDE AND OPTIMUM CRUISE MACH NUMBER



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED–700 POUNDS CONSUMED DURING MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED. 2600 POUNDS RESERVE FOR LANDING.
2. MILITARY THRUST CLIMB TO INITIAL ALTITUDE.
3. OUTBOUND CRUISE AT OPTIMUM CRUISE MACH NUMBER.
4. COMBAT WITH MAXIMUM THRUST.
5. MILITARY THRUST CLIMB, OR MAXIMUM RANGE DESCENT, TO OPTIMUM CRUISE ALTITUDE.
6. INBOUND CRUISE AT OPTIMUM CRUISE ALTITUDE AND MACH NUMBER.
7. MAXIMUM RANGE DESCENT TO BASE.



FB33-P907 A

Figure A9-9

INTERCEPT COMBAT RADIUS PROFILE

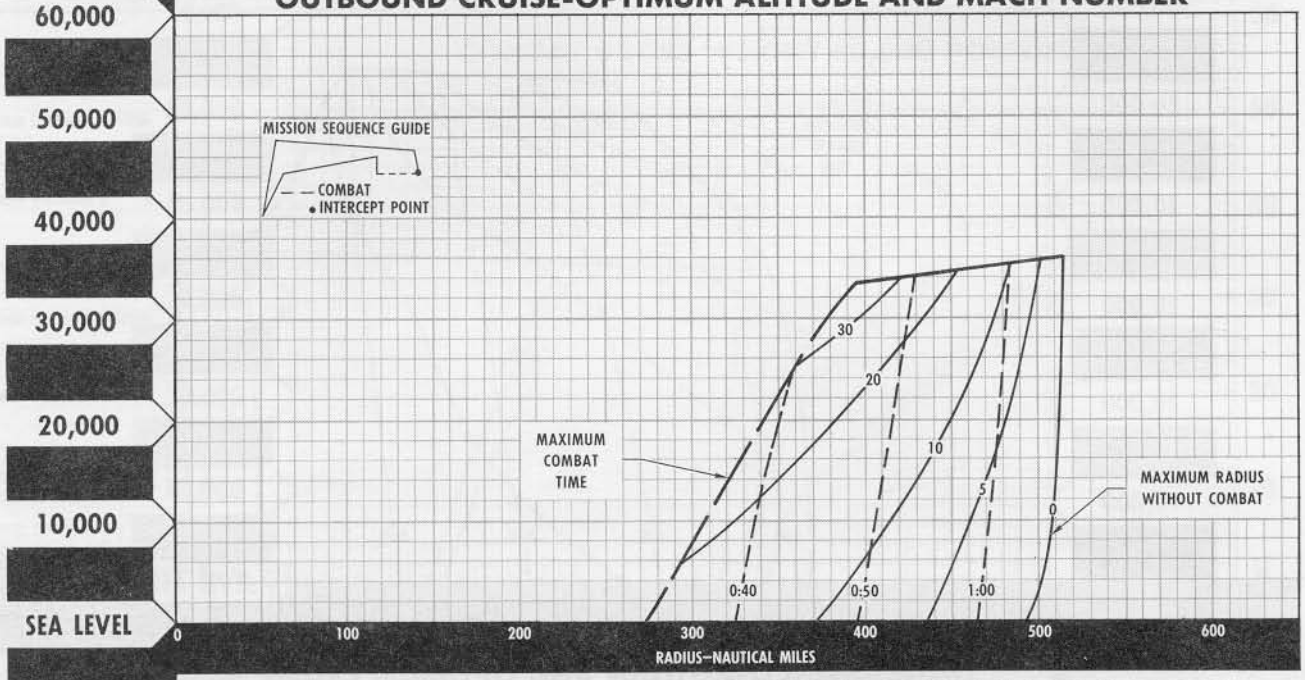
MODEL: F-101B OR F-101F
ENGINE(S): (2) J57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 45,461 LB.

MILITARY THRUST COMBAT
CONFIGURATION: PRIMARY ARMAMENT

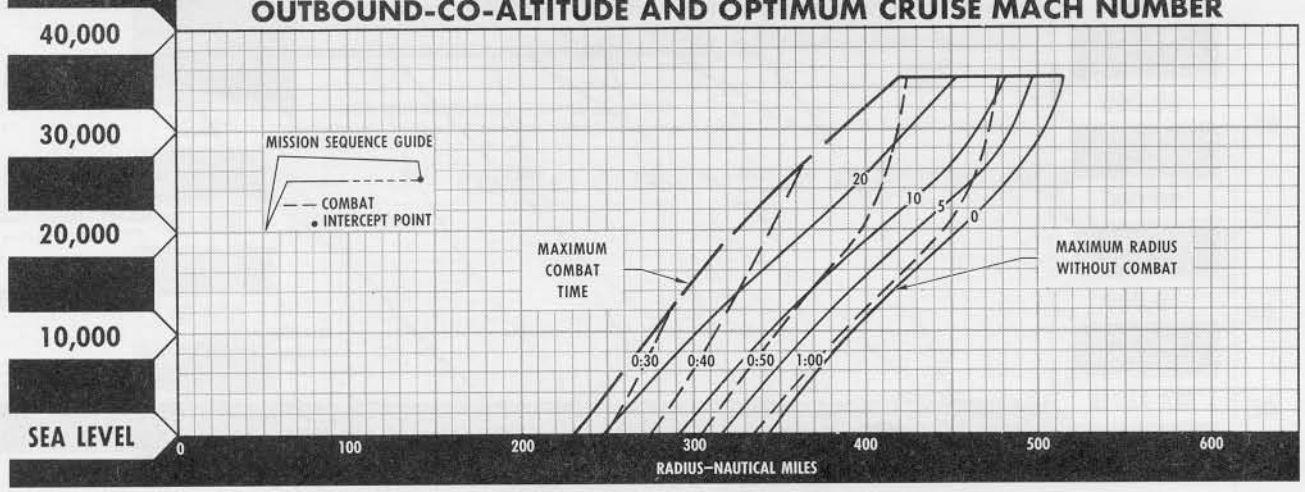
DATE: 30 SEPTEMBER 1960
DATA BASIS: **FLIGHT TEST**

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

OUTBOUND CRUISE-OPTIMUM ALTITUDE AND MACH NUMBER

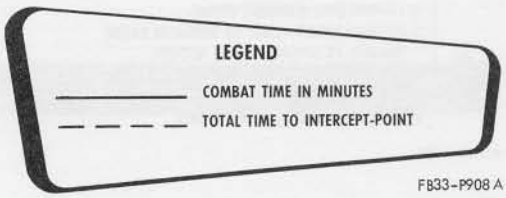


OUTBOUND-CO-ALTITUDE AND OPTIMUM CRUISE MACH NUMBER



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED–700 POUNDS CONSUMED DURING MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED. 2600 POUNDS RESERVE FOR LANDING.
2. MILITARY THRUST CLIMB TO INITIAL ALTITUDE.
3. OUTBOUND CRUISE AT OPTIMUM CRUISE MACH NUMBER.
4. COMBAT WITH MILITARY THRUST.
5. MILITARY THRUST CLIMB TO OPTIMUM CRUISE ALTITUDE.
6. INBOUND CRUISE AT OPTIMUM CRUISE ALTITUDE AND MACH NUMBER.
7. MAXIMUM RANGE DESCENT TO BASE.



FB33-P908 A

Figure A9-10

INTERCEPT COMBAT RADIUS PROFILE

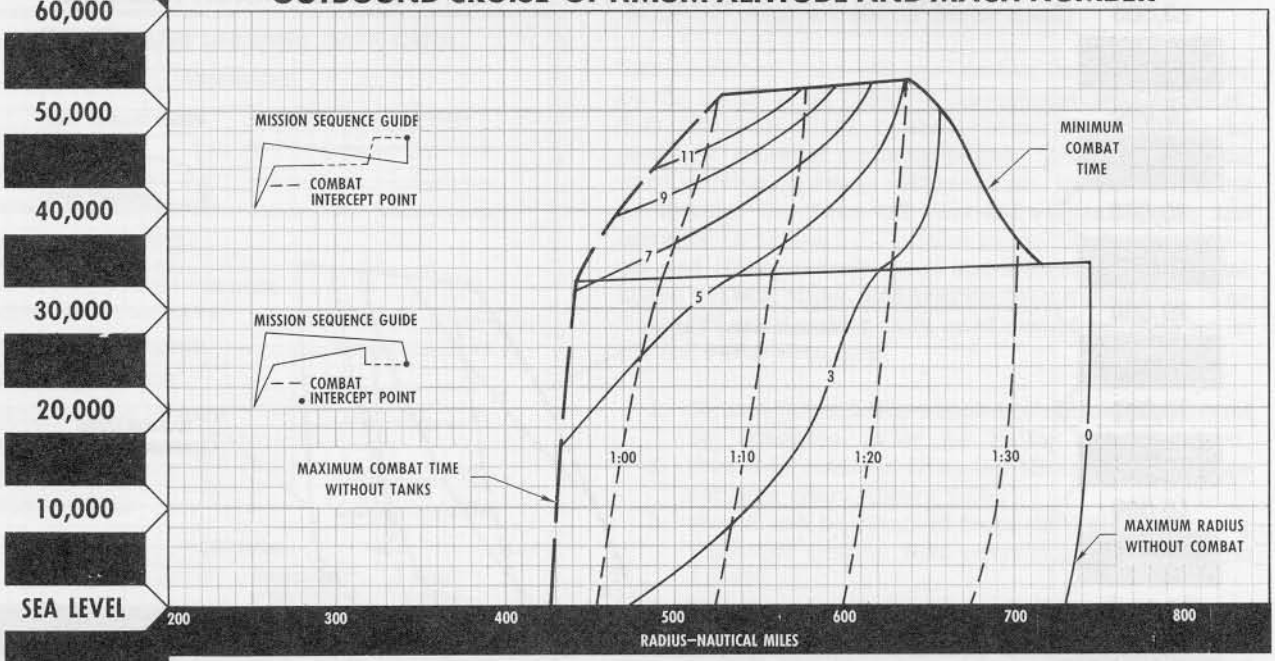
MODEL: F-101B OR F-101F
ENGINE(S): (2) 57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724

MAXIMUM THRUST COMBAT
CONFIGURATION: PRIMARY ARMAMENT PLUS TWO 450 GALLON TANKS DROPPED WHEN EMPTY

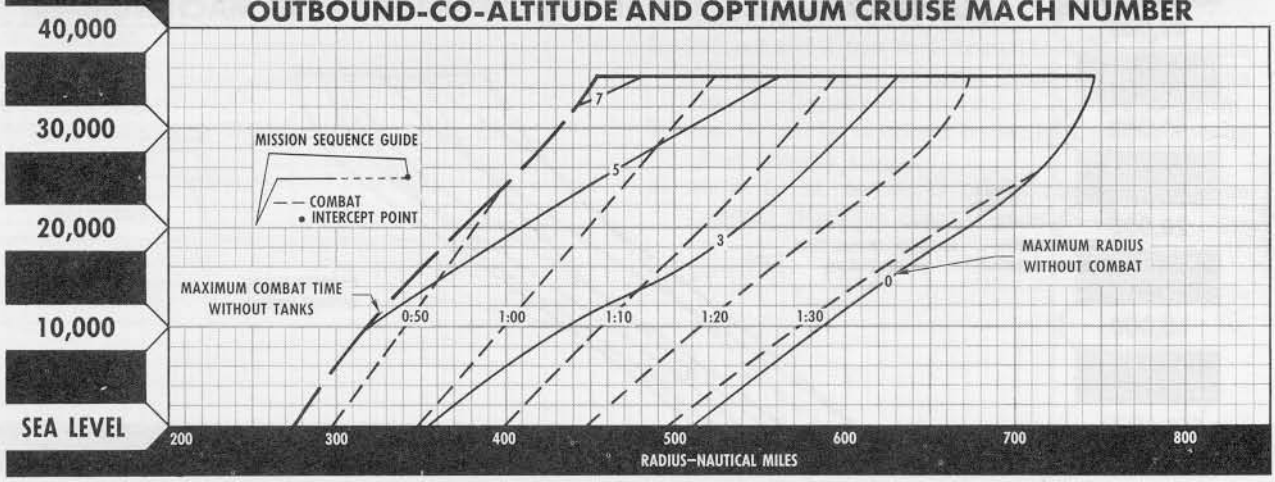
DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

OUTBOUND CRUISE-OPTIMUM ALTITUDE AND MACH NUMBER

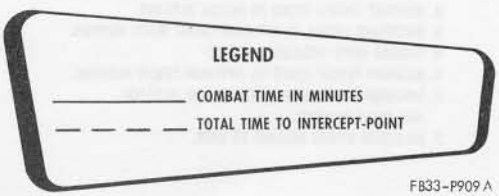


OUTBOUND-CO-ALTITUDE AND OPTIMUM CRUISE MACH NUMBER



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED—770 POUNDS CONSUMED DURING MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED. 2600 POUNDS RESERVE FOR LANDING.
2. MILITARY THRUST CLIMB TO INITIAL ALTITUDE.
3. OUTBOUND CRUISE AT OPTIMUM CRUISE MACH NUMBER.
4. COMBAT WITH MAXIMUM THRUST.
5. MILITARY THRUST CLIMB, OR MAXIMUM RANGE DESCENT, TO OPTIMUM CRUISE ALTITUDE.
6. INBOUND CRUISE AT OPTIMUM CRUISE ALTITUDE AND MACH NUMBER.
7. MAXIMUM RANGE DESCENT TO BASE.



FB33-P909 A

Figure A9-11

INTERCEPT COMBAT RADIUS PROFILE

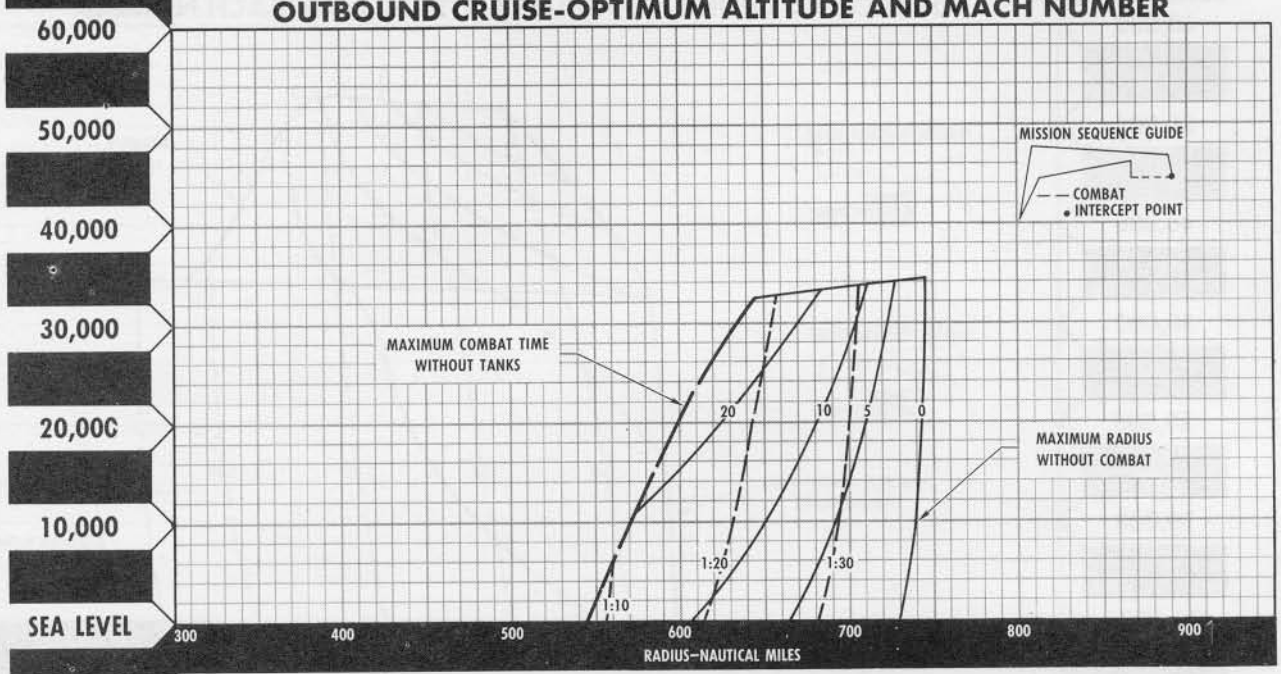
MODEL: F-101B OR F-101F
ENGINE(S): (2) 57-P-55
ICAO STANDARD DAY
TAKE-OFF GROSS WEIGHT 51,724

MILITARY THRUST COMBAT
CONFIGURATION: PRIMARY ARMAMENT PLUS TWO 450 GALLON TANKS DROPPED WHEN EMPTY

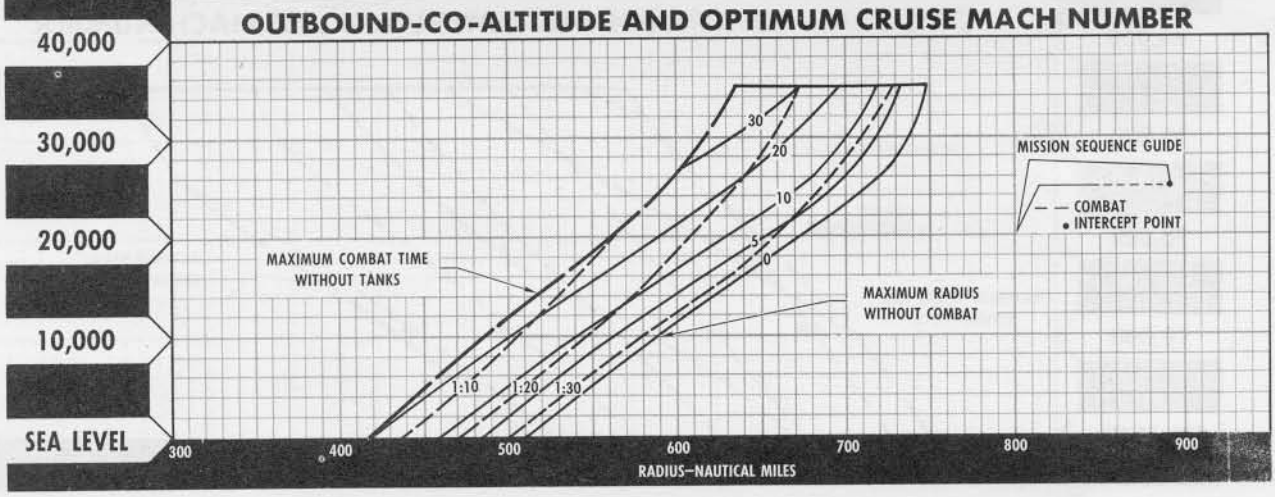
DATE: 30 SEPTEMBER 1960
DATA BASIS: **ESTIMATED** (BASED ON FLIGHT TEST)

FUEL GRADE: JP-4
FUEL DENSITY: 6.5 LB/GAL

OUTBOUND CRUISE-OPTIMUM ALTITUDE AND MACH NUMBER



OUTBOUND-CO-ALTITUDE AND OPTIMUM CRUISE MACH NUMBER



MISSION CONSIDERATIONS:

1. FUEL ALLOWANCE INCLUDED–700 POUNDS CONSUMED DURING MAXIMUM THRUST TAKE-OFF AND MILITARY THRUST ACCELERATION TO BEST CLIMB SPEED. 2600 POUNDS RESERVE FOR LANDING.
2. MILITARY THRUST CLIMB TO INITIAL ALTITUDE.
3. OUTBOUND CRUISE AT OPTIMUM CRUISE MACH NUMBER.
4. COMBAT WITH MILITARY THRUST.
5. MILITARY THRUST CLIMB TO OPTIMUM CRUISE ALTITUDE.
6. INBOUND CRUISE AT OPTIMUM CRUISE ALTITUDE AND MACH NUMBER.
7. MAXIMUM RANGE DESCENT TO BASE.

LEGEND

——— COMBAT TIME IN MINUTES

– – – – TOTAL TIME TO INTERCEPT-POINT

FB33-P910 A

Figure A9-12

part 10 Mission Planning

TAKEOFF AND LANDING DATA CARD

CONDITIONS

	TAKEOFF	LANDING
(A) RUNWAY LENGTH		
(B) WIND		
(C) RUNWAY TEMPERATURE		
(D) PRESSURE ALTITUDE		

TAKEOFF

(E) ENGINE PRESSURE RATIO	
(F) ACCELERATION CHECK	Kts. at Ft.
(G) TAKEOFF DISTANCE	Ft.
(H) CRITICAL FIELD LENGTH	Ft.
(I) CRITICAL ENG FAILURE SPEED	Kts.
(J) REFUSAL SPEED	Kts.

LANDING

	IMMEDIATELY AFTER TAKEOFF	FINAL LANDING
(K) FINAL APPROACH SPEED		
(L) LANDING ROLL		
(M) NO FLAPS OR SPEED BRAKES		
(N) NO DRAG CHUTE		
(O) NO FLAPS, SPEED BRAKES OR DRAG CHUTE		

Use Grease Pencil

FB33-P1001B

TAKE-OFF AND LANDING DATA CARD

The combined Take-Off and Landing Data card, located on the inside front cover of the Abbreviated Checklist, T.O. 1F-101B-(CL)1-1, should be completed during the preflight mission planning phase. The format of the card provides a ready reference of: Known conditions (A through D); Take-Off data and refusal speeds and distance (E through J); landing immediately after take-off and final landing speed and distance with/without speed brakes, flaps, and drag chute (K through O). The Take-Off and Landing Data card should be filled out in the following sequence:

1. Steps A through D are known conditions and should be compiled prior to filling out the card.
2. Step E is obtained from the Minimum EPR Gage Settings chart (figure 2-3).
3. Step F can be obtained from the Velocity During Take-Off Ground Run chart (figures A2-11 and A2-12).
4. Step G can be obtained from the Take-Off Distance charts (figure A2-7 and A2-8).
5. Step H can be obtained from the Critical Field Length chart (figure A2-2).
6. Steps I and J can be obtained from the Maximum Refusal Speed or Critical Engine Failure Speeds charts (figures A2-3, A2-4, A2-5 and A2-6).
7. Step K can be obtained from the Landing Speeds chart (figure A8-1).
8. Steps L, M, N and O can be obtained from the Landing Distance chart (figure A8-2).

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