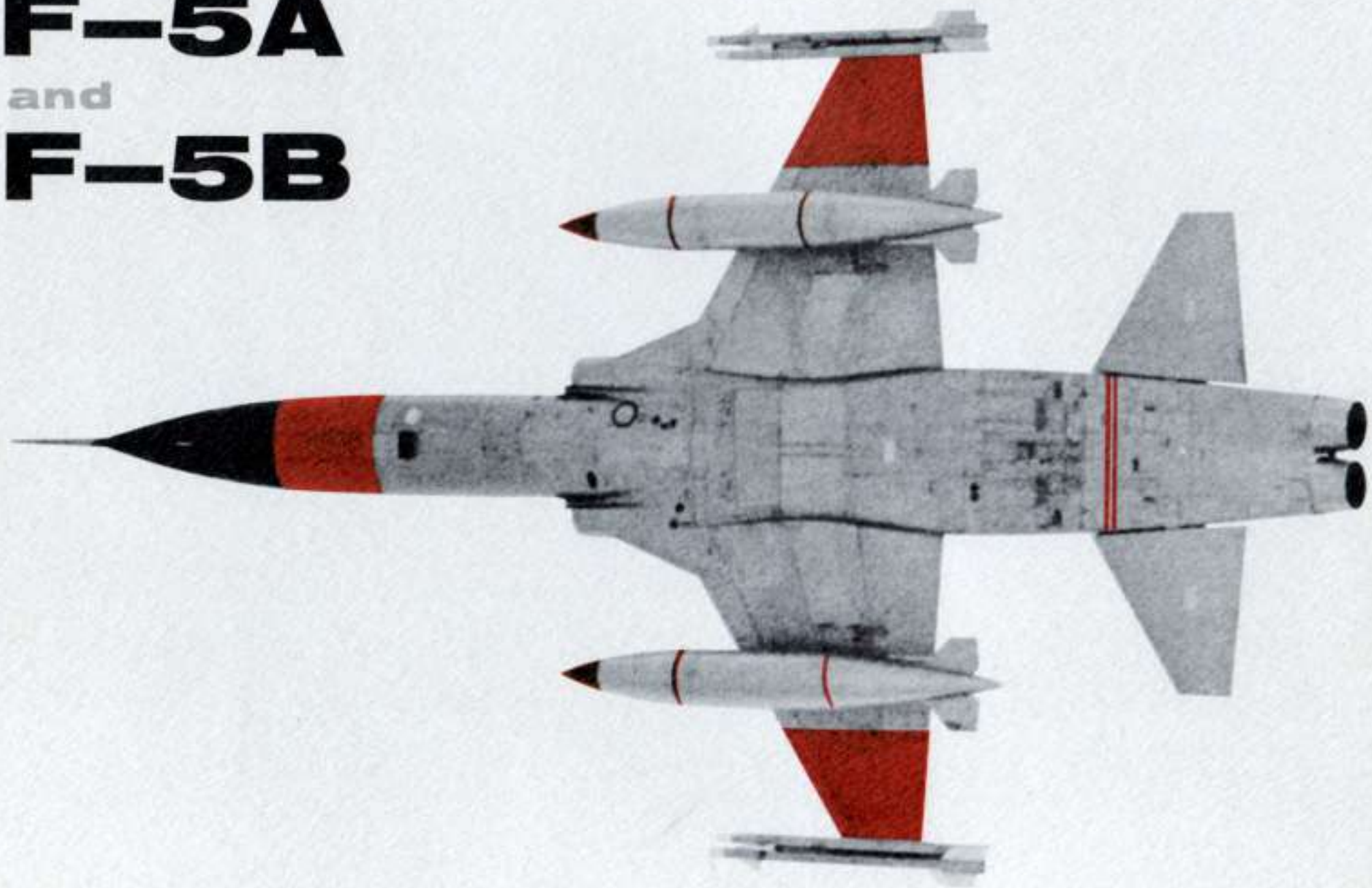
NORTHROP CORPORATION

F–5A
and
F–5B



NB 62-73
SEPTEMBER 1962

NORTHROP CORPORATION

INTRODUCTION

After an extensive evaluation of several modern fighter aircraft, the United States Air Force and Department of Defense have designated the Northrop F-5A and F-5B as the aircraft to modernize current equipment in the inventories of certain selected countries participating in the Military Assistance Program. The F-5A and F-5B supersonic fighter aircraft are the first vehicles designed and funded specifically to meet the challenging operational requirements of the recipient countries. Low procurement, maintenance, and operational costs enable these aircraft to be programmed and maintained in users' inventories with maximum effectiveness.

The F-5A and F-5B can deliver ordnance weights in excess of half their basic takeoff weights. Their supersonic performance from sea level to 50,000 feet fulfills the air superiority as well as reconnaissance, attack, and close support roles. Initial procurement is concentrated on a simple optical system for weapon delivery; however, the forty cubic feet of equipment space in the nose will accommodate the latest all weather fire control systems. Further funded development of the General Electric J85 engine ensures even better performance in the future.

Utilizing the same basic design, the two-place F-5B combines the tactical capability of the F-5A with the training capability of the highly successful United States Air Force T-38 supersonic trainer.

The purpose of this report is to show how the F-5 series aircraft will best fill the needs of many countries widely separated geographically but closely linked in their desire to preserve their individual and collective security.

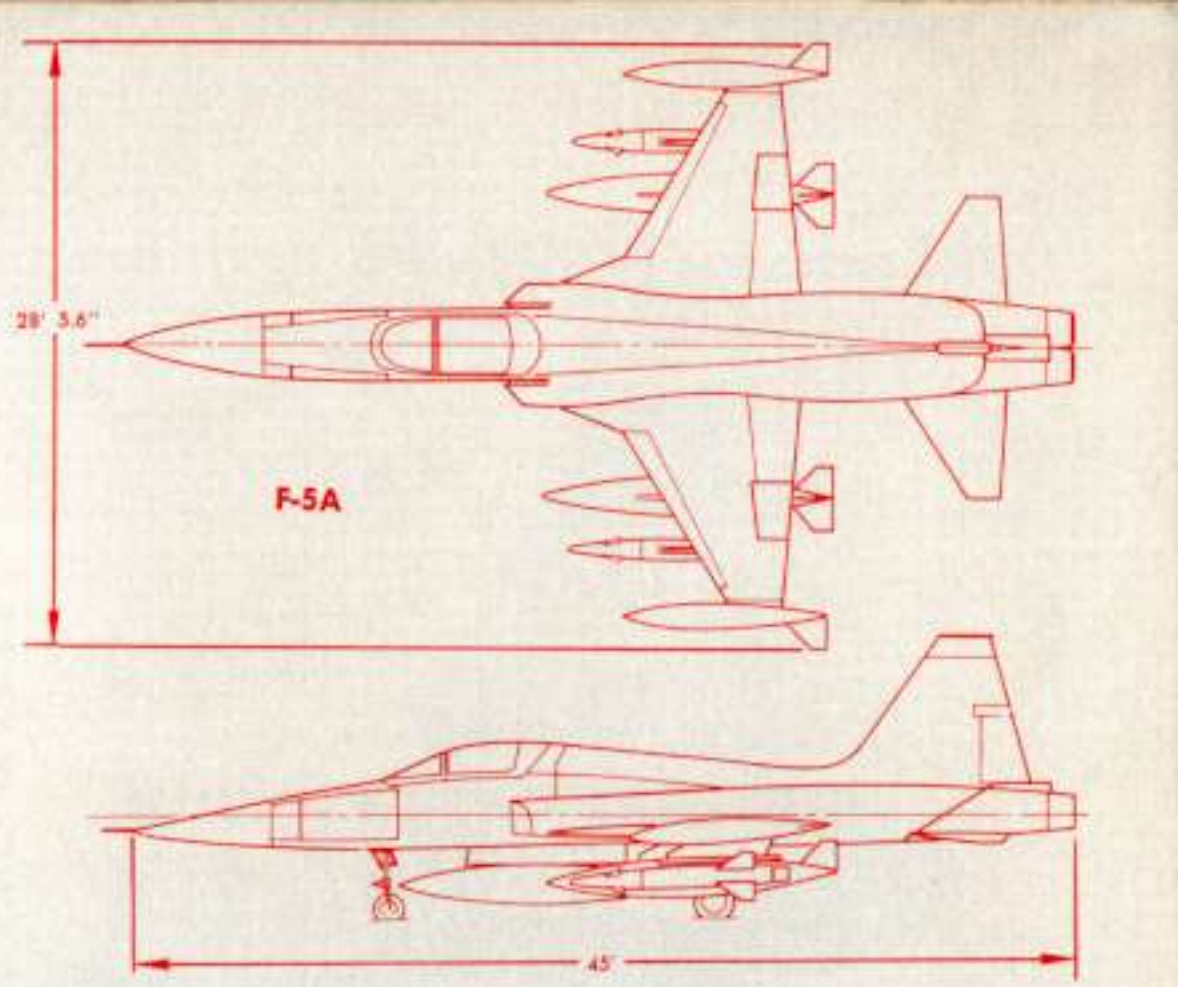
SPECIFICATIONS

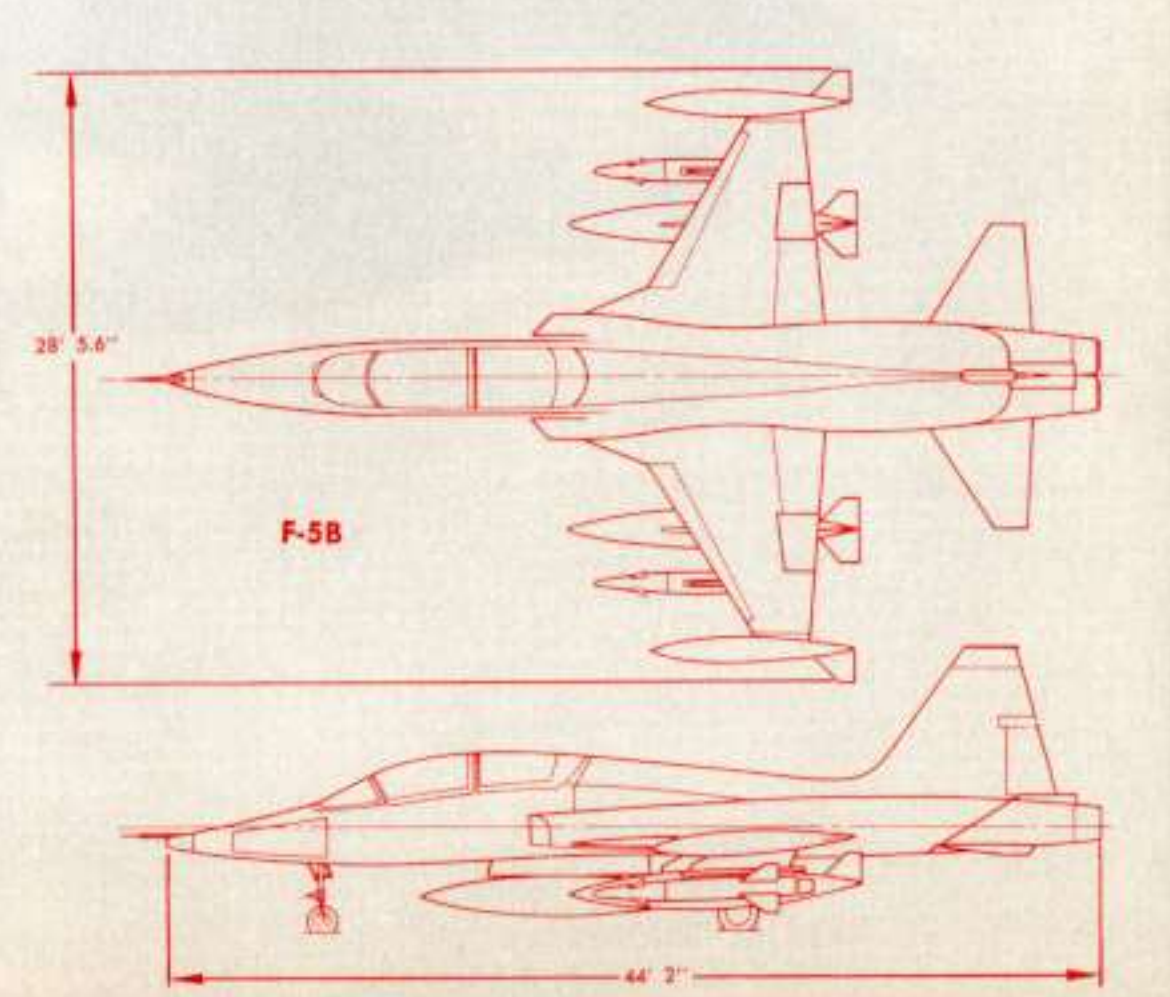
The low airframe weight of the F-5A has been combined with two high thrust-to-weight J85-GE-13 afterburning engines to form a supersonic combat aircraft which is equal in performance to many of the larger supersonic fighters now in operation.

The clean, or unarmed, weight of the F-5A is 12,240 pounds when fully loaded with 3790 pounds of internal fuel. Mission profiles shown in this brochure have been compiled on the basis of 600 pounds reserve fuel retained on landing, which is equivalent to a clean landing weight of 9050 pounds. The two-place F-5B has a gross takeoff weight of 12,530 pounds, and a landing weight of 9340 pounds.

The major dimensions shown on the three-view drawing are essentially the same for both the F-5A and F-5B with the exception of overall length. The length of the F-5B is 10 inches less than the F-5A.

Each of the J85 engines aboard the F-5A and F-5B provides a minimum guaranteed thrust of 4080 pounds in afterburning condition. The relatively light weight of the engines—570 pounds each—and the resulting thrust-to-weight ratio of 7.2 to 1—is a significant factor in the outstanding performance of the F-5A and F-5B in both the subsonic and supersonic regimes.





GENERAL DESCRIPTION

The F-5A is a twin turbojet powered supersonic aircraft capable of operating from unpaved runways at tactically dispersed bases. It can deliver more than 6200 pounds of ordnance payloads, fly supersonic to altitudes above 50,000 feet, and climb nearly 30,000 feet per minute at sea level. The two J85-GE-13 afterburning engines give the F-5A a maximum speed of Mach 1.44.

Seven external store stations accommodate long range air-to-air intercept and air-to-ground attack missions, or sufficient fuel to ferry the aircraft 1660 nautical miles.

Outstanding takeoff performance and a landing gear system designed to operate on sod fields allow maximum utilization of the F-5A from tactically dispersed forward areas. Leading and trailing edge wing flaps, a drag chute, and a landing weight of less than 9100 pounds, enable the F-5A to land with a ground roll of less than 1800 feet.

Minimized field maintenance and logistics requirements call for only a small lift trailer for engine, aft fuselage, and horizontal tail removal, and for external store handling. Self-contained provisions such as a solid propellant cartridge starter, a 10-liter liquid oxygen system sufficient for more than five days operations, and onboard electrical power further minimize ground support equipment needed in remote field operations. Single-point refueling of internal and external tanks allows a complete turnaround for an intercept configuration in less than eight minutes.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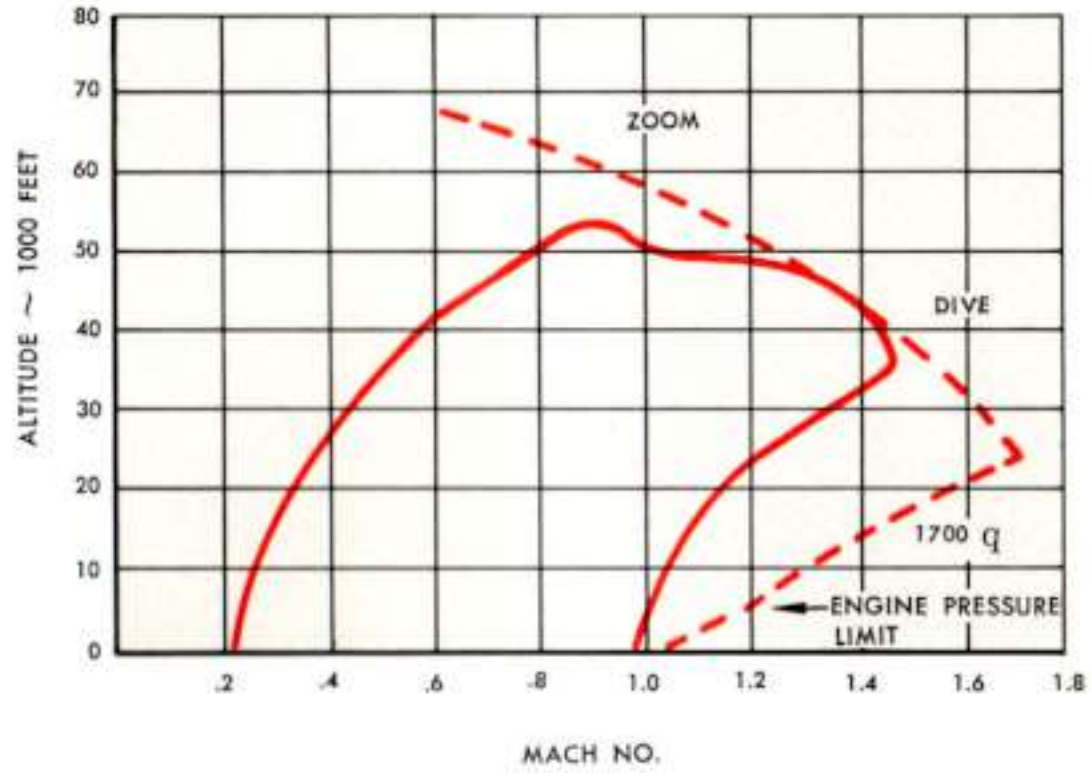
PERFORMANCE

The F-5A is a high performance tactical fighter designed for a broad spectrum of missions, including maintenance of air superiority, aerial reconnaissance and surveillance, attack, and close support of ground forces.

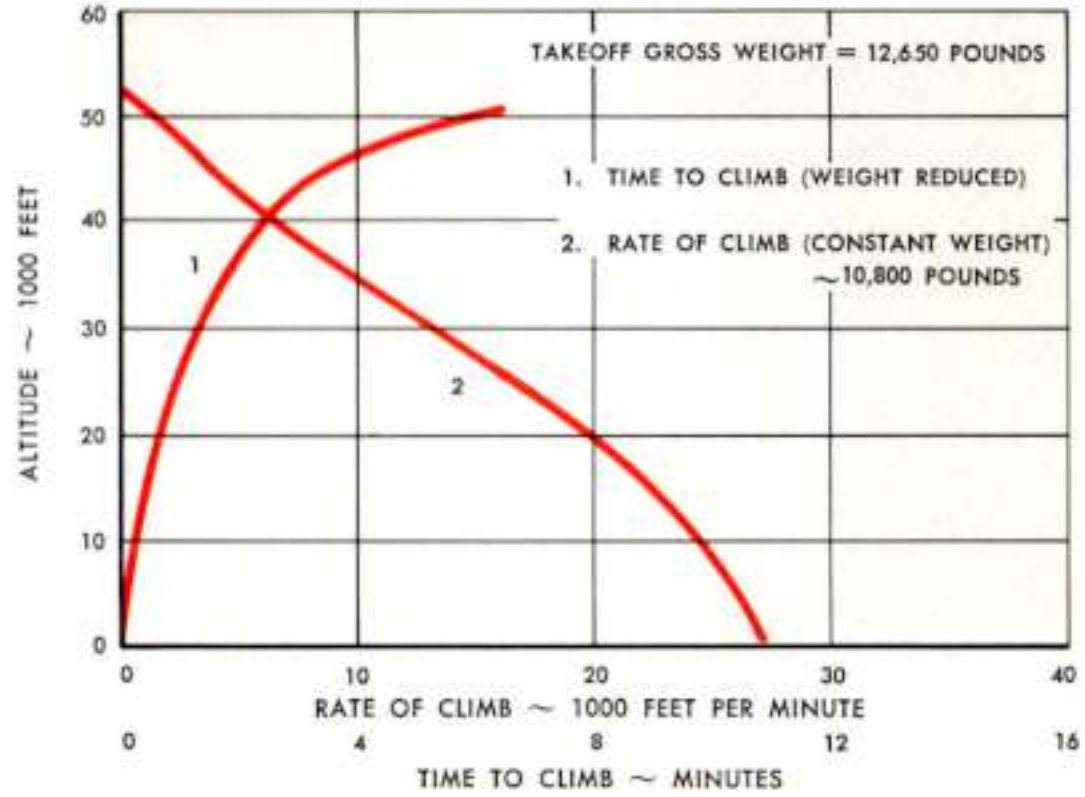
Performance data shown are representative of F-5A capabilities against enemy air forces, in support of tactical operations, and as a force for maintenance of internal security. The clean F-5A attains Mach 1.44 and can fly Mach 1.37 with wing-tip mounted GAR-8 Sidewinder missiles. Its ability to perform intercepts is comparable to the highest performance USAF interceptors, as evidenced by its outstanding rate of climb. The T-38, sister ship to the F-5A, attained the world record for time-to-climb in February 1962.

At a gross weight of 12,650 pounds with Sidewinders, the F-5A requires a takeoff ground roll of only 1940 feet. The 15-foot drag parachute and full-span leading edge wing flaps make the F-5A one of the few supersonic fighters which can land safely within its takeoff distance.

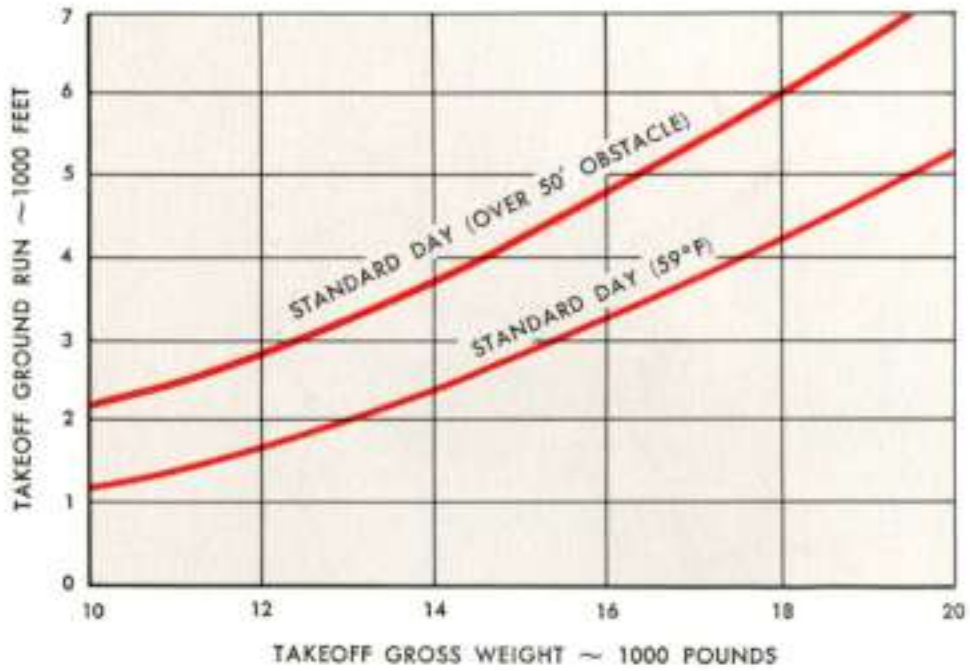
SPEED SUMMARY



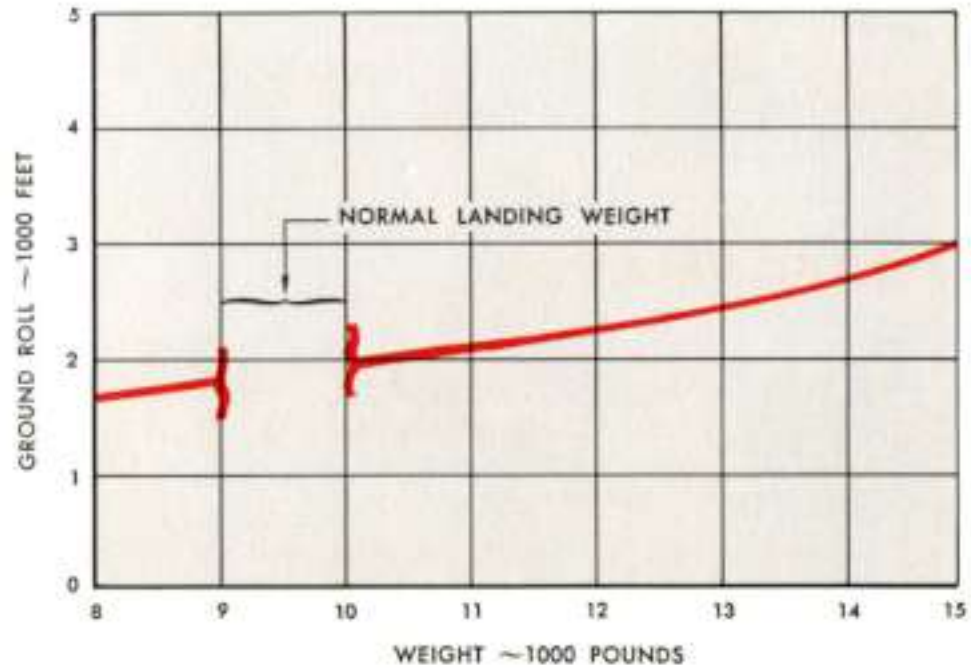
CLIMB PERFORMANCE (2) SIDEWINDERS



TAKEOFF DISTANCE SEA LEVEL

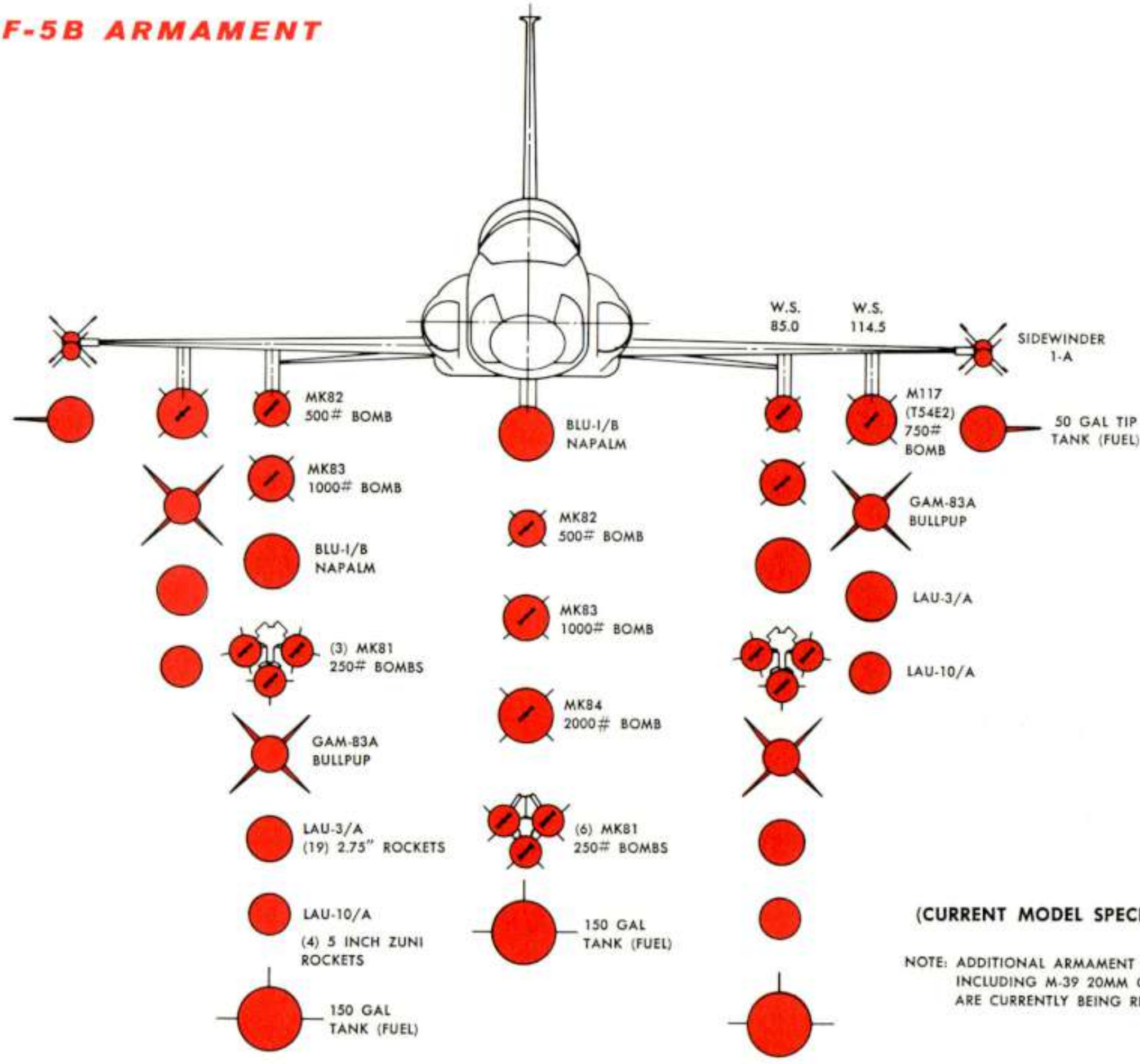


LANDING DISTANCE SEA LEVEL



SOD FIELD OPERATION

F-5A / F-5B ARMAMENT



(CURRENT MODEL SPECFICATION)

NOTE: ADDITIONAL ARMAMENT PROPOSALS, INCLUDING M-39 20MM CANNON, ARE CURRENTLY BEING REVIEWED

ATTACK AND CLOSE SUPPORT CAPABILITIES

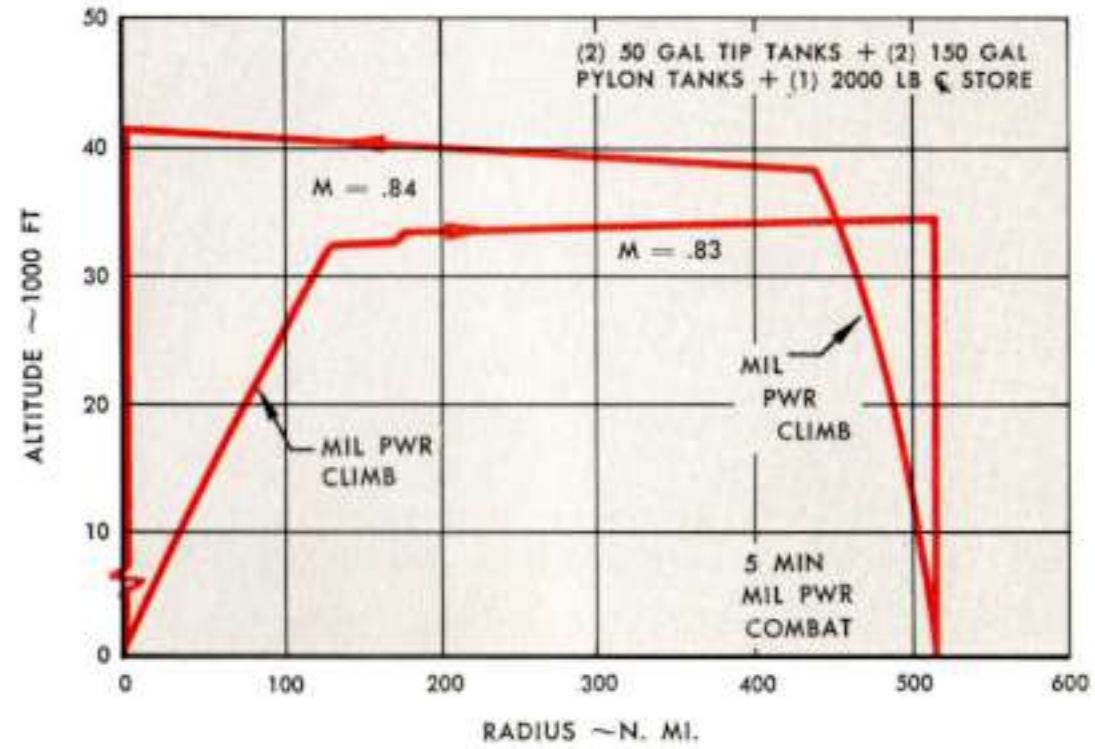
For air-to-ground employment, ordnance delivery is enhanced by the outstanding flight characteristics and maneuverability of the F-5A at low altitude. The seven pylon stations accommodate virtually any combination of ordnance and fuel — totalling more than 6200 pounds — for either high altitude combat missions or close support of troops.

F-5A ability to operate from relatively unimproved airfields close to combat zones, low maintenance requirements and a turnaround time of less than eight minutes permit a maximum number of effective missions to be flown in any operational environment.

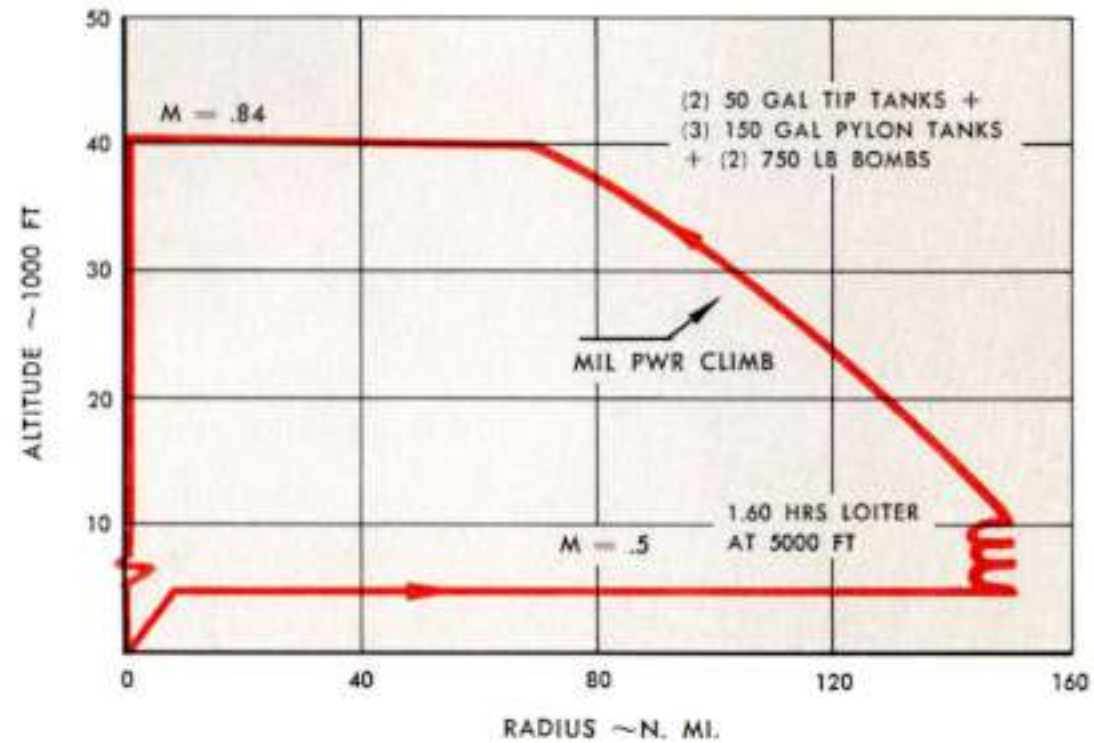
The high-low-high attack mission illustrates F-5A ability to perform attack missions against targets in excess of 500 nautical miles from base. The close support mission shown is indicative of the F-5A and F-5B loiter capability in support of ground troops, with two 750 pound bombs. Substitution of two GAM-83A Bullpup missiles will result in slightly increased loiter time. An additional benefit of the twin-engined configuration is the potential employment of single engine loiter, which increases loiter time twelve minutes.

All performance on this and subsequent pages, including mission profile data, has been computed by using five minutes normal power and one minute maximum power on takeoff, and 600 pounds reserve fuel on landing, unless otherwise noted.

HI — LO — HI ATTACK



CLOSE SUPPORT MISSION



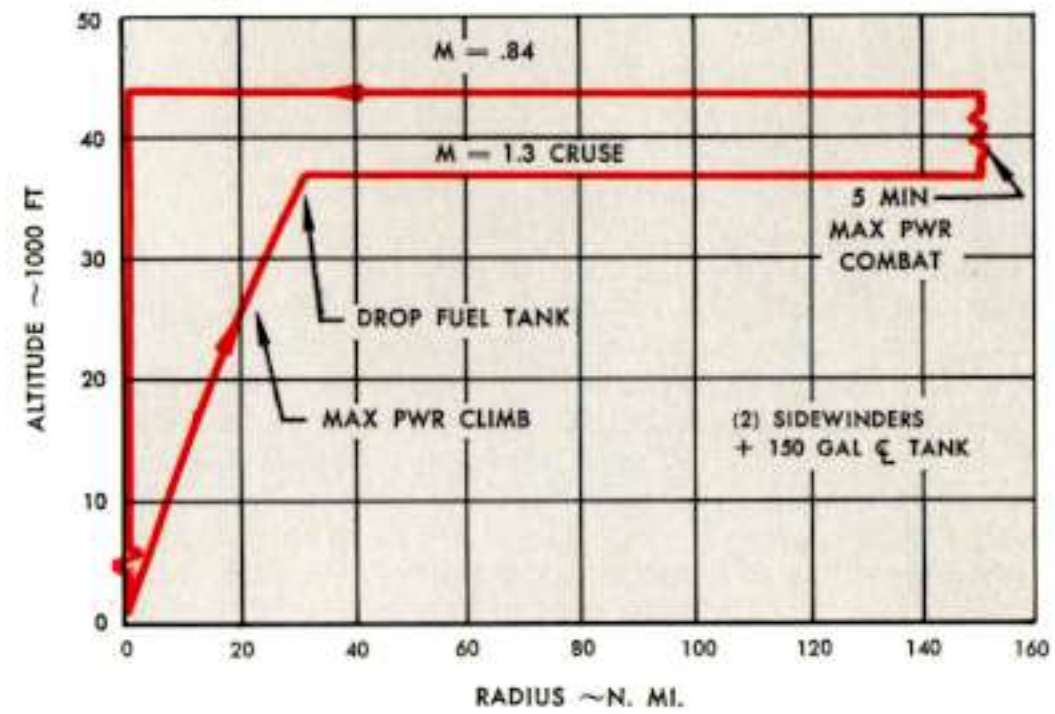
INTERCEPT

Air Force Flight Test Center Report No. FTC-TDR-62-5, "Limited Performance Evaluation of the Norair F-5A With J85-GE-5 Engines," contains the following:

"The performance of the F-5A is impressive. The aircraft has ample thrust subsonically, and can maintain over 3g's at 20,000 feet in military power for over 360 degrees of turn at constant IAS. The aircraft has climb performance comparable with Century Series aircraft such as the F-106A. With maximum power and no external stores, the F-5A can take off and climb to 40,000 feet in 3.5 minutes. The maximum level flight speed attained during the test was 1.43 Mach number at 36,865 feet on a one degree C colder than standard day. The combat ceiling of the aircraft at a gross weight of 9,970 pounds operating on one engine at maximum power was found to be above 42,600 feet on a standard day. Maneuvering and handling qualities of the aircraft are excellent . . ."

Performance depicted is based on standard allowances for intercept missions, and includes takeoff power at normal thrust for two minutes and maximum thrust for one minute. Six hundred pounds of reserve fuel is retained on landing.

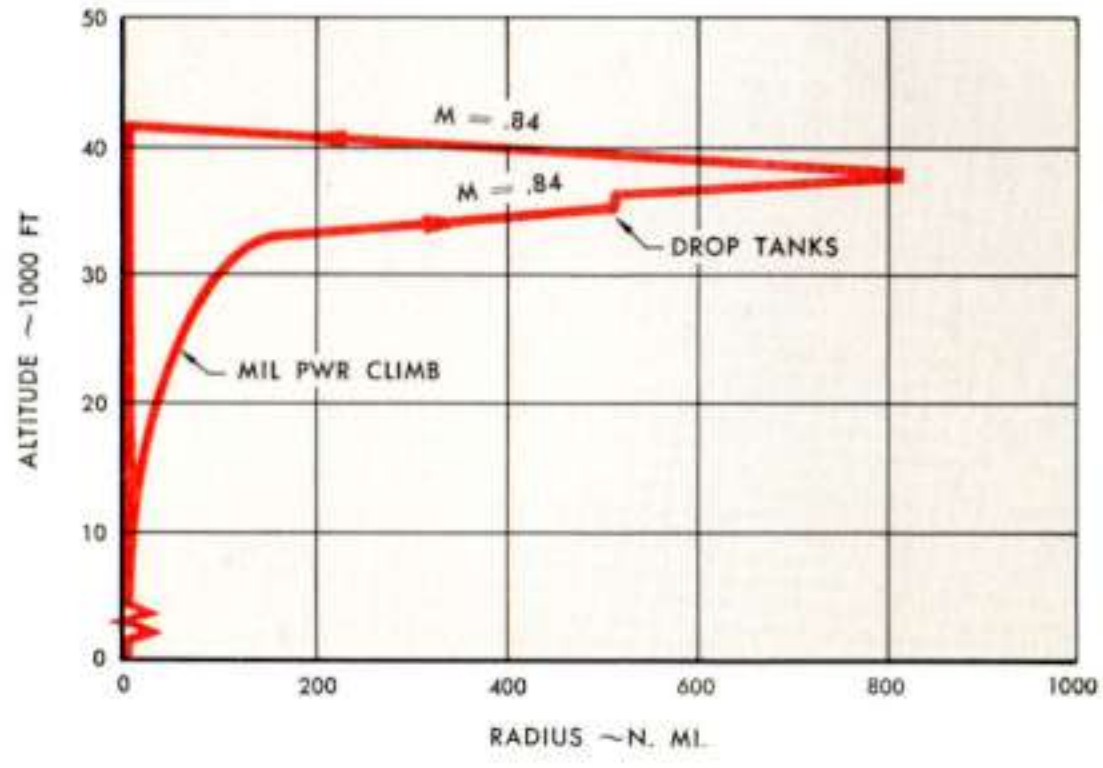
SUPERSONIC INTERCEPT MISSION



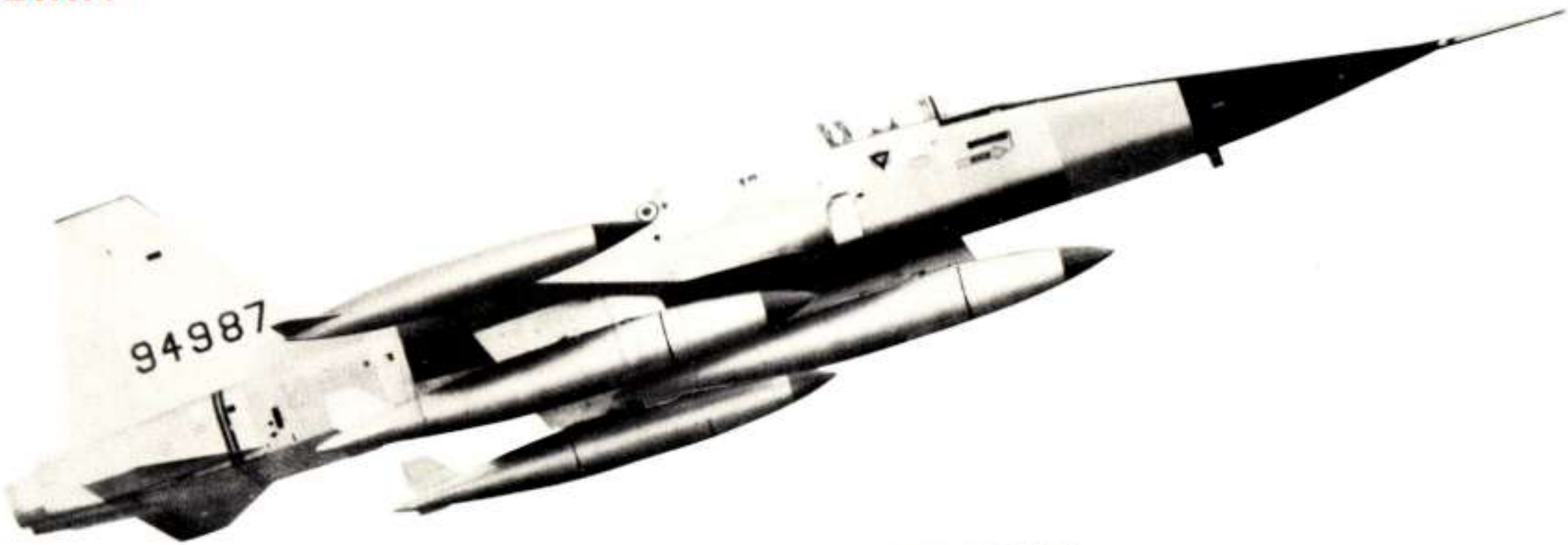
RECONNAISSANCE

Successful long range reconnaissance and surveillance missions require the outstanding low altitude maneuverability and high altitude cruising range of the F-5A. Supersonic performance at sea level is combined with a sea level rate of climb of nearly 30,000 feet per minute to enable the F-5A and F-5B to perform low level reconnaissance passes and then rapidly gain safe altitudes beyond enemy ground fire. The two-place F-5B, with its outstanding visibility from both cockpits is well suited to the task of low altitude combat surveillance. The mission profile depicts a typical high altitude reconnaissance mission of more than 800 nautical miles radius.

RECONNAISSANCE MISSION—HIGH ALTITUDE

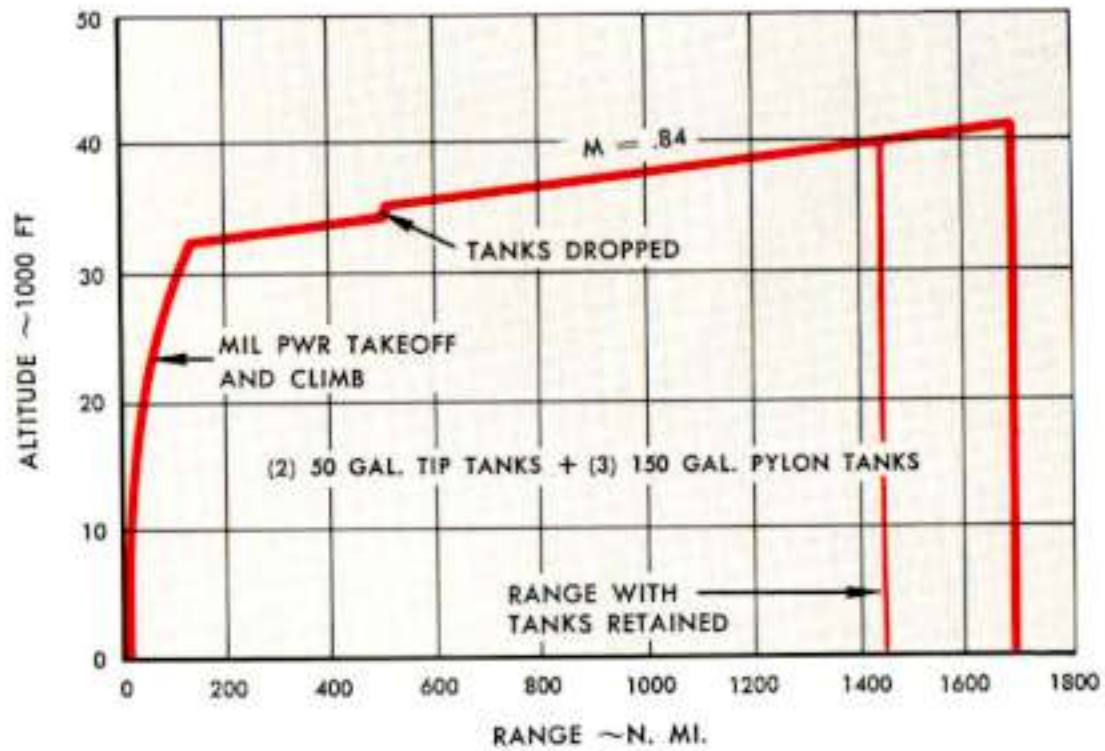


FERRY



Rapid, long range deployment features have been incorporated in the F-5A. The aircraft can be readily transferred into areas of conflict or deployed at international boundaries for unified defense. With full internal fuel, two 50-gallon wing-tip tanks, and three 150-gallon pylon tanks, the F-5A can be ferried 1660 nautical miles in less than 3.5 hours. The takeoff fuel allowance for this mission is five minutes normal power only.

FERRY MISSION




RESCUE
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MAINTENANCE FEATURES

Simplicity of design and placement of components and subsystems for ease of access in both the F-5A and F-5B reduce the manpower requirements and turnaround time significantly below that of any supersonic fighter now in service, as shown by the accompanying diagram. During wartime operations and periods of accelerated use, only fuel and ordnance are required after each flight, with all other inspection or replenishment normally being done on a once-daily basis. All systems and components are easily accessible from ground level without special workstands or ladders, and engines can be removed and replaced without disturbing the engine-driven accessories and accessory drives in the engine bay.

Approximately one-fourth of the fuselage area is composed of access doors and panels which permit rapid access to all internal components. Both single point and individual manual refueling capability are incorporated for all internal and external fuel tanks. Liquid oxygen is replenished through an external filler. Pylon attach points on the fuselage and wing are at waist level, facilitating the manual attachment of pylons and stores.

Engine accessibility is simplified by the detachable tailcone, which can be removed without disturbing the vertical stabilizer or its controls. The lightweight engines are mounted on built-in tracks, and are removed easily after disconnecting the drive shaft to the accessory power package.

OPERATIONAL FEATURES

SOD FIELD CAPABILITY

Light airframe weight, powerful twin turbojet engines, leading and trailing edge flaps, a parachute-assisted braking system, landing gear specifically designed for sod field runways, and minimum ground support requirements contribute to practical operation from tactically dispersed operational bases.

Maximum tactical effectiveness is achieved by the aircraft's ability to land, take on fuel and ordnance, and take off for another combat sortie in less than eight minutes.

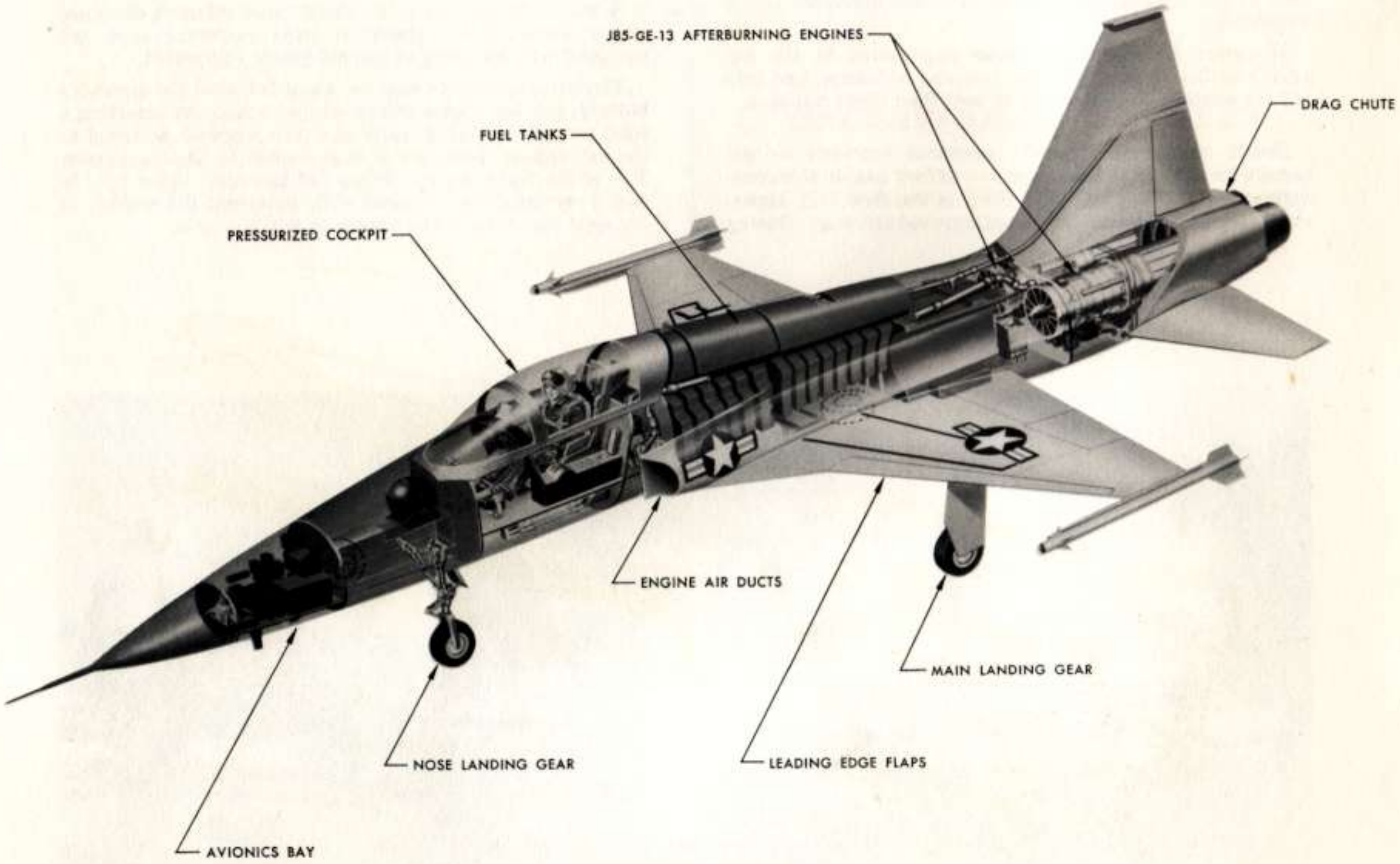
Short, unimproved, rapidly prepared runways — not usually considered prime targets — afford usable accommodations for F-5 aircraft. The F-5A is the first U.S. supersonic aircraft to operate from unimproved runways. During extensive sod field trials on relatively soft ground, the F-5A experienced a maximum of 25 percent increase in takeoff distance and a similar reduction in landing distance.

MINIMUM SUPPORT EQUIPMENT

A self-contained cartridge starter and onboard electrical power permit F-5A operation from dispersed sites not equipped with handling or ground power equipment.

Electrical checkouts may be conducted with the aircraft's battery, and the engine can be started quickly by inserting a solid propellant starter cartridge into a breech attached to the left engine; bleed air is then ducted to the compressor face of the right engine. Either J85 turbojet engine may be easily removed and replaced with universal lift trailer, or changed manually if the trailer is not available.

SUBSYSTEMS

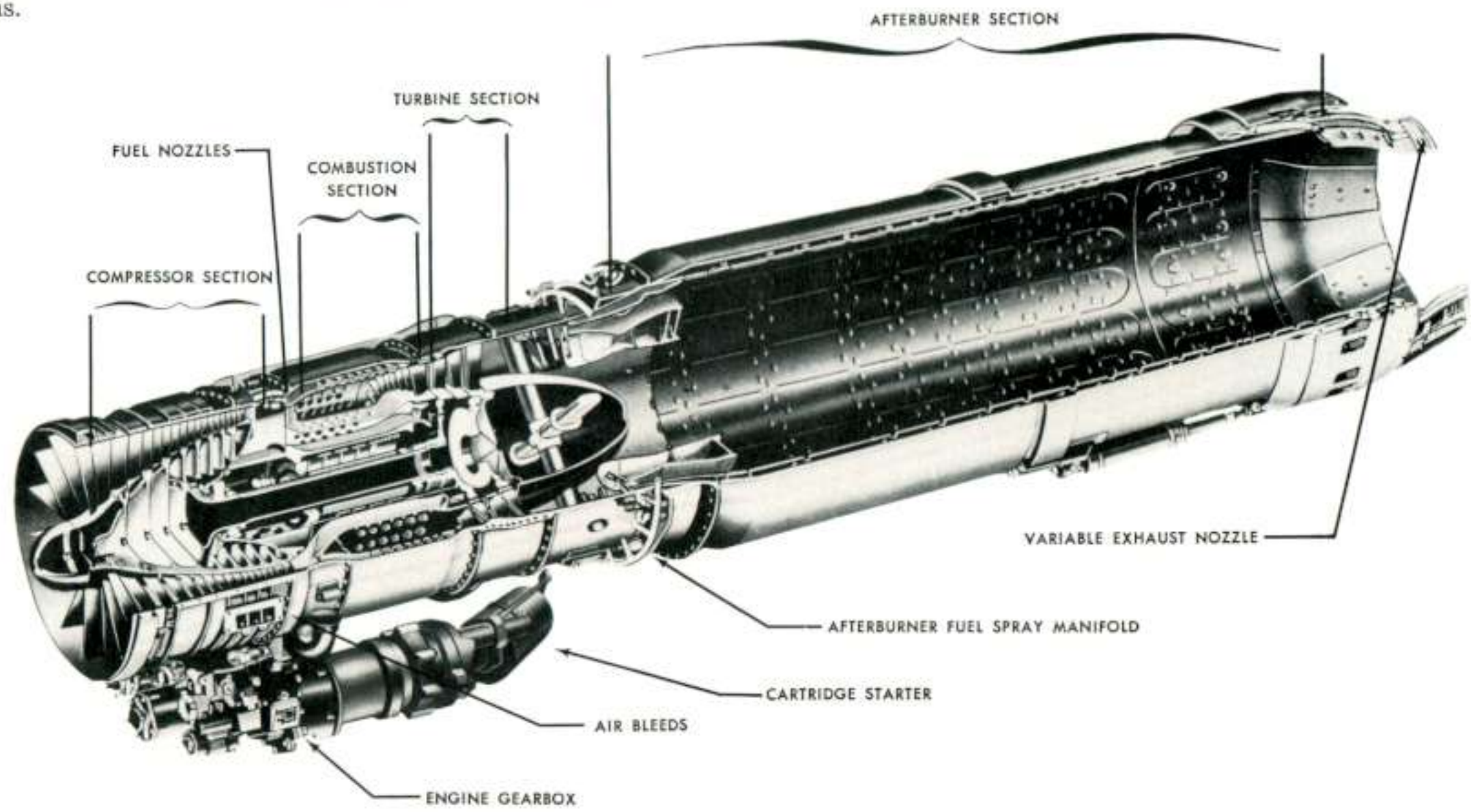

J85-GE-13 AFTERBURNING ENGINES
DRAG CHUTE
FUEL TANKS
PRESSURIZED COCKPIT
ENGINE AIR DUCTS
MAIN LANDING GEAR
LEADING EDGE FLAPS
NOSE LANDING GEAR
AVIONICS BAY

PROPULSION

The F-5A and F-5B are powered by two General Electric J85-GE-13 turbojet engines, each rated at 4080 pounds sea level static thrust with afterburner. This guaranteed thrust rating is achieved with an engine weight of 570 pounds, which is the highest thrust to weight ratio production engine in production. Each engine has an eight-stage axial flow compressor, an annular burner and variable afterburner. An integrated power package consisting of a two-speed autoshift gearbox, an alternating current generator, and a hydraulic pump is mounted on the airframe forward of each engine and driven by a shaft from the accessory gearbox. The entire package may be removed from the airframe by disconnecting the drive shaft. This allows engine removal with minimum disturbance to the electrical or hydraulic systems.

Each engine carries an independent oil supply and lubrication system, monitored by a pressure gage in the cockpit. Lights on the cockpit caution light panel warn of engine air inlet icing conditions and anti-ice valve malfunction. A fire detector system is provided in each engine bay, and an engine overheat signal is provided to the pilot.

Either engine may be motored for starting by low pressure air from a ground cart, or the solid propellant cartridge may be used to start the left engine, which then furnishes bleed air to start the other engine. Engine ignition may be supplied by either the onboard battery or an external source.

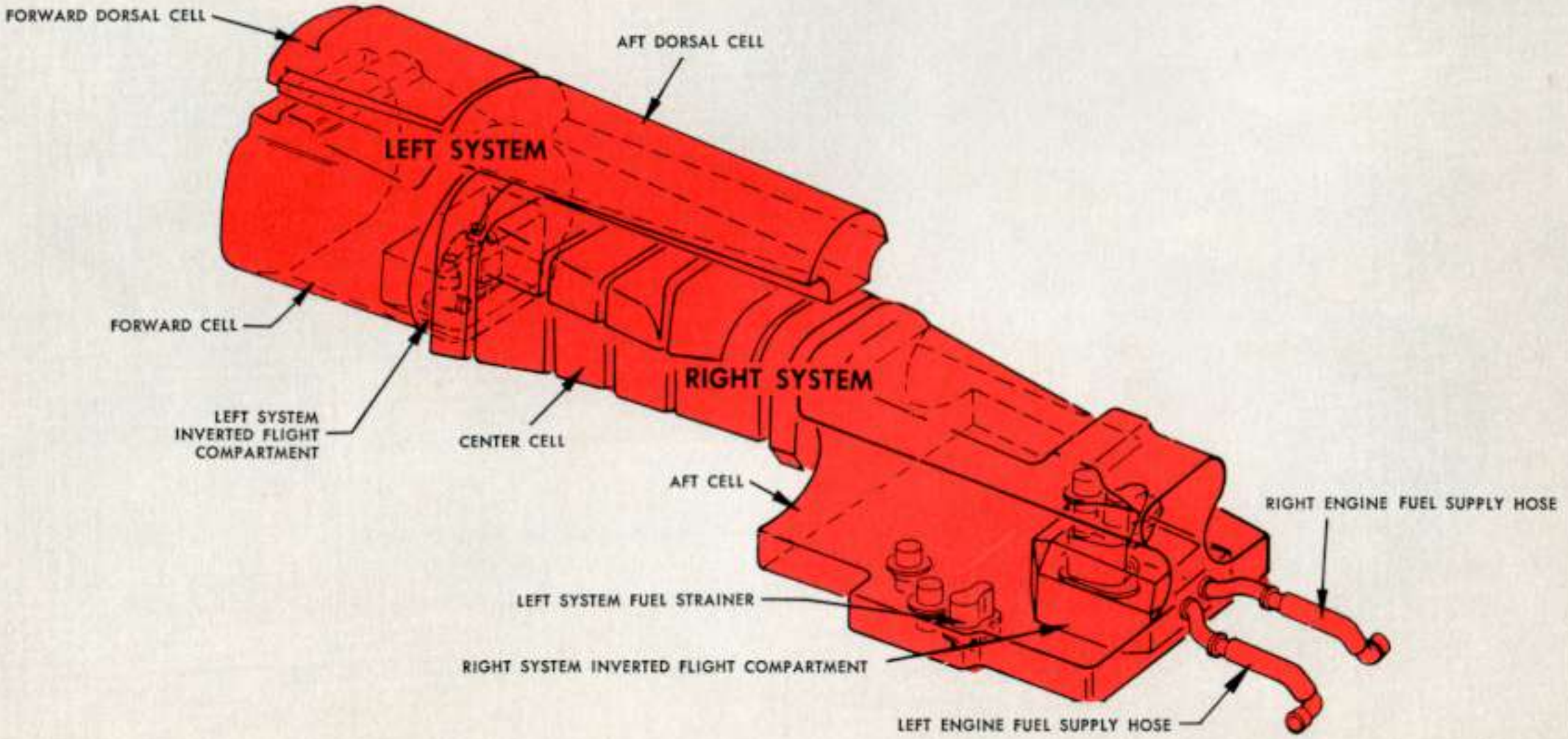


FUEL SYSTEM

Fuel management has been minimized in the F-5 series fuel system design, increasing flight safety and permitting the pilot to concentrate upon maximum mission effectiveness. Internal fuel (585 gallons) is contained in rubber-impregnated nylon fabric bladder cells in the fuselage. External tanks at the wing tips (50 gallons each) and inboard wing or fuselage centerline pylons (150 gallons each) can be used in combinations totalling 550 gallons.

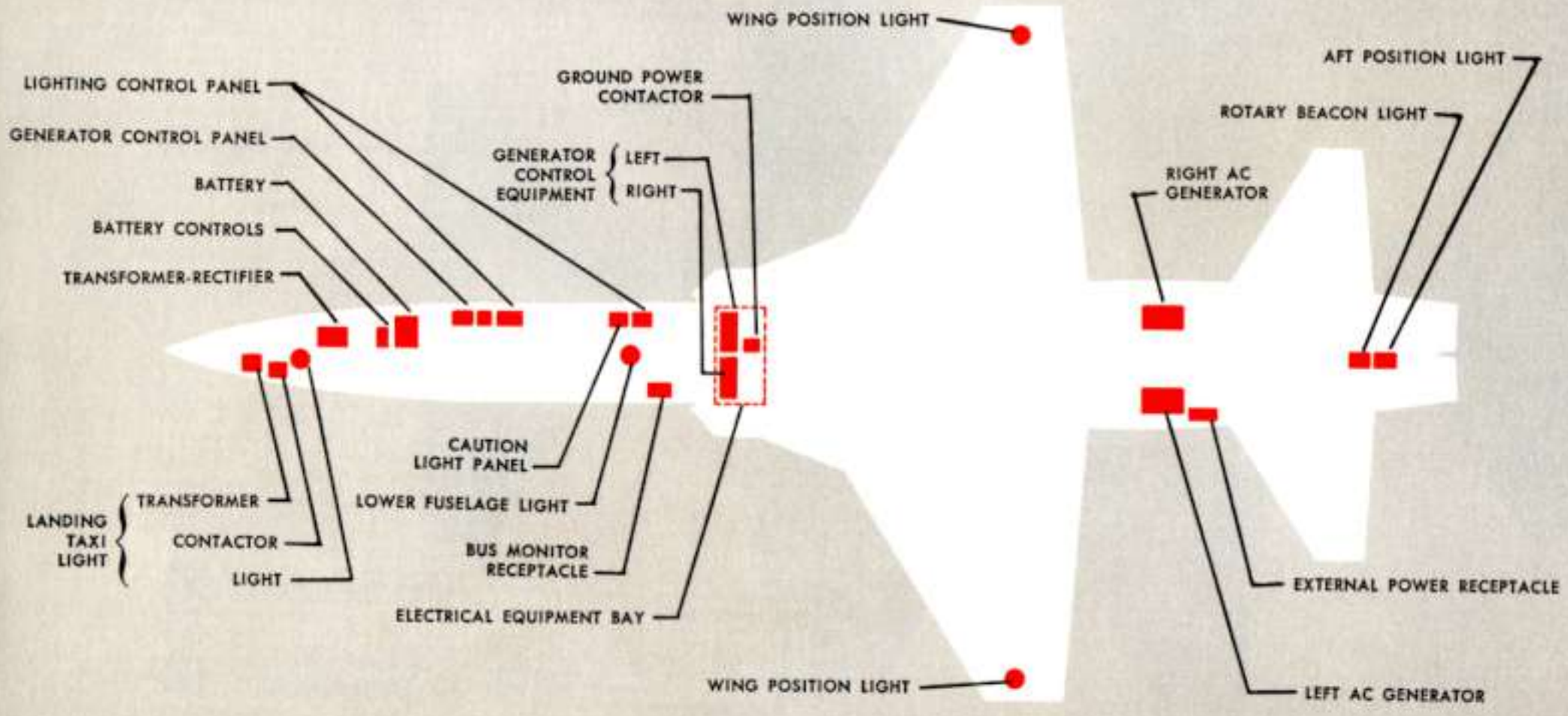
Single-point ground refueling of internal and external tanks is accomplished through a single pressure fitting on the underside of the fuselage. External tanks are pressurized and empty into the main tanks as fuel is consumed. Separate but interconnected fuel systems supply each engine. At the option of the pilot, fuel from either or both systems can be supplied to either or both engines.

Fuel is delivered to each engine by submerged double-ended booster pumps. Compartments containing the pumps hold fuel for use during inverted flight. A bypass valve automatically permits continuous gravity flow to the engine-driven pump, should booster pumps fail. In the F-5B, primary fuel controls will be located in the front cockpit only, although fuel control monitoring lights will be provided in the rear cockpit.



ELECTRICAL SYSTEM

Primary electrical power in the F-5A is supplied by two independent air-cooled AC generators driven by the airframe-mounted power unit. The generators produce 8 kva, 115/200 volt, 3-phase 320-480 cycle power at 6400-9600 rpm. Each generator supplies one-half the electrical power required by the aircraft, but automatic switching circuits enable either generator to assume the full electrical load during emergency conditions. A 28-volt DC system obtains power through a transformer-rectifier in the alternating current system and supplies this power to all equipment operating on direct current. A 28-volt, 11 ampere-hour, nickel cadmium battery provides power for ignition of engine starts, the interphone, fuel valves, the turn-and-slip indicator, and auxiliary lighting of the instrument panel. Circuit breakers which govern systems affecting flight safety of the aircraft are in the cockpit, readily accessible to the pilot during flight.



FLIGHT CONTROLS

The F-5A and F-5B are controlled through a primary system comprised of ailerons, rudder, and an all-moveable horizontal stabilizer. The secondary control system includes dive brakes and wing leading and trailing edge flaps.

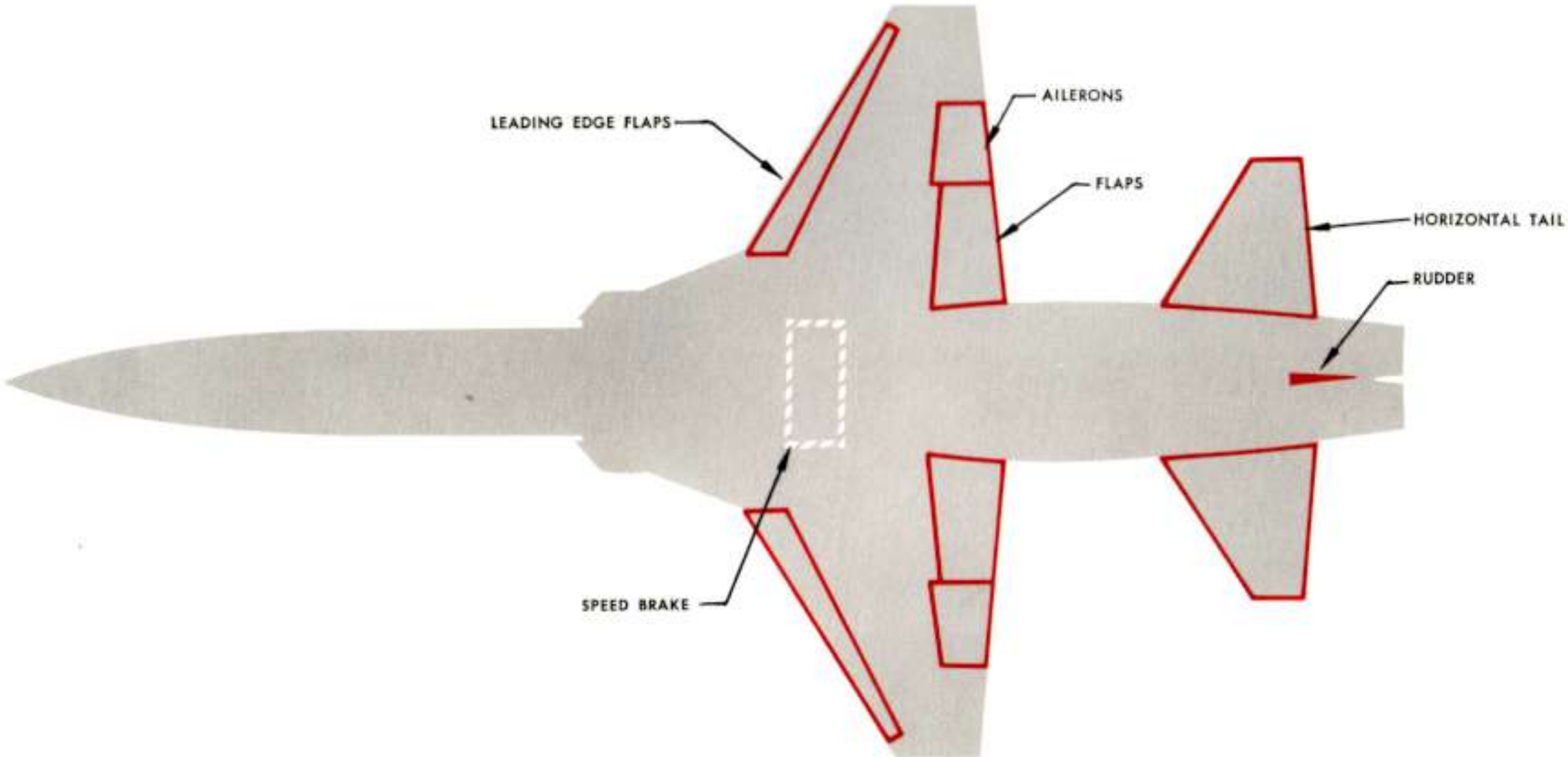
Flight control system operation is by conventional stick and rudder pedals connected by cables and pushrods to the servovalve controlling the actuating cylinders. The control sticks and rudder pedals are mechanically interconnected between the cockpits of F-5B aircraft. Hydraulic power at 3000 psi operates all flight control surface actuators.

The horizontal tail is preset for takeoff with the takeoff trim button. All stick forces are trimmed out in flight by movement of the spring-loaded trim switch on the control stick grip.

A stability augmenter system, powered by the utility hydraulic system, controls both rudder and horizontal tail motion, damps short period pitch and yaw oscillations, and provides rudder trim. Control force requirements, however, are light enough that the pilot can maintain satisfactory control of the airplane throughout the entire flight envelope with the augmenter system inoperative.

A speed brake on the lower fuselage, forward of the main landing gear doors, is actuated hydraulically by a switch on the throttle quadrant.

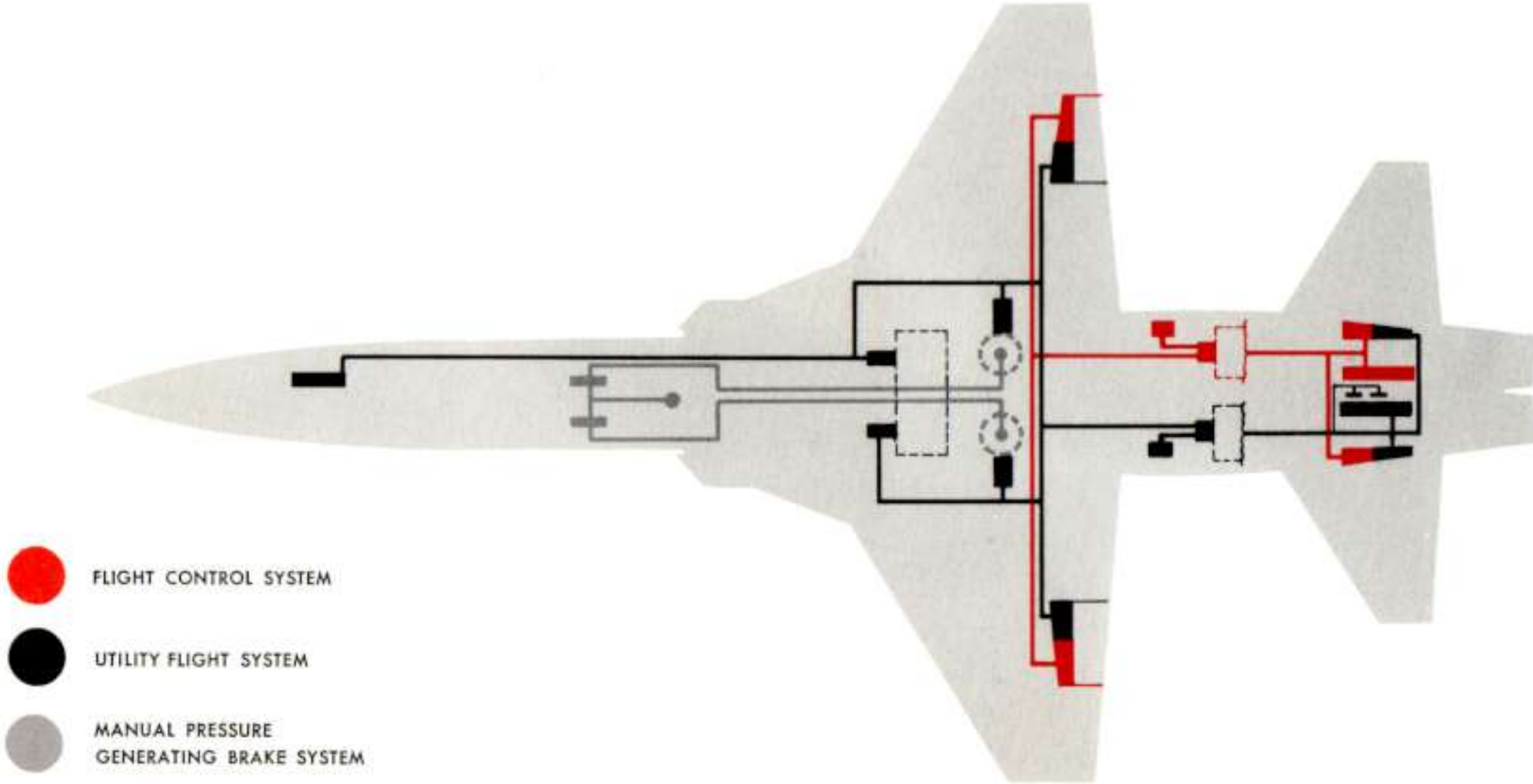
Flaps on the leading and trailing edges of the wing are electrically operated to any of three positions by separate motors. The flaps are interconnected mechanically to ensure full, synchronous actuation if one flap motor fails.



HYDRAULIC SYSTEM

The F-5A has two independent hydraulic systems operating from pumps driven by the airframe-mounted power packages. The right engine powers the flight control system, and the left engine drives the utility system. The systems operate at 3000 psi with hydraulic fluid from separate reservoirs pressurized by compressor bleed air. Both systems power the primary flight control surfaces. If one system becomes inoperative, the remaining system automatically supplies adequate flight control power through its independent actuating system. The utility system also supplies power for the landing gear, dive brakes, nose wheel steering, power brakes, and the stability augmenter. If both engines fail, one windmilling engine provides sufficient power to generate the hydraulic pressure needed to maintain flight control for glide and safe landing.

Safe extension and locking of the landing gear is indicated by three gear-indicator lights in the cockpit. Identical lights are in the second cockpit of the F-5B. An emergency system is also provided; a release handle enables the pilot to extend the gear by gravity with the aid of the airstream. When the hydraulic actuator is not used for steering it acts as a nose wheel shimmy damper. A self-contained power brake system operates the multiple-disc brakes, and is controlled by rudder-brake pedals. In the F-5B aircraft, nose wheel steering and power braking can be actuated by either crew member.



AVIONICS

F-5A and F-5B avionics equipment provides optimum reliability and performance without complex maintenance requiring extraordinarily trained technicians.

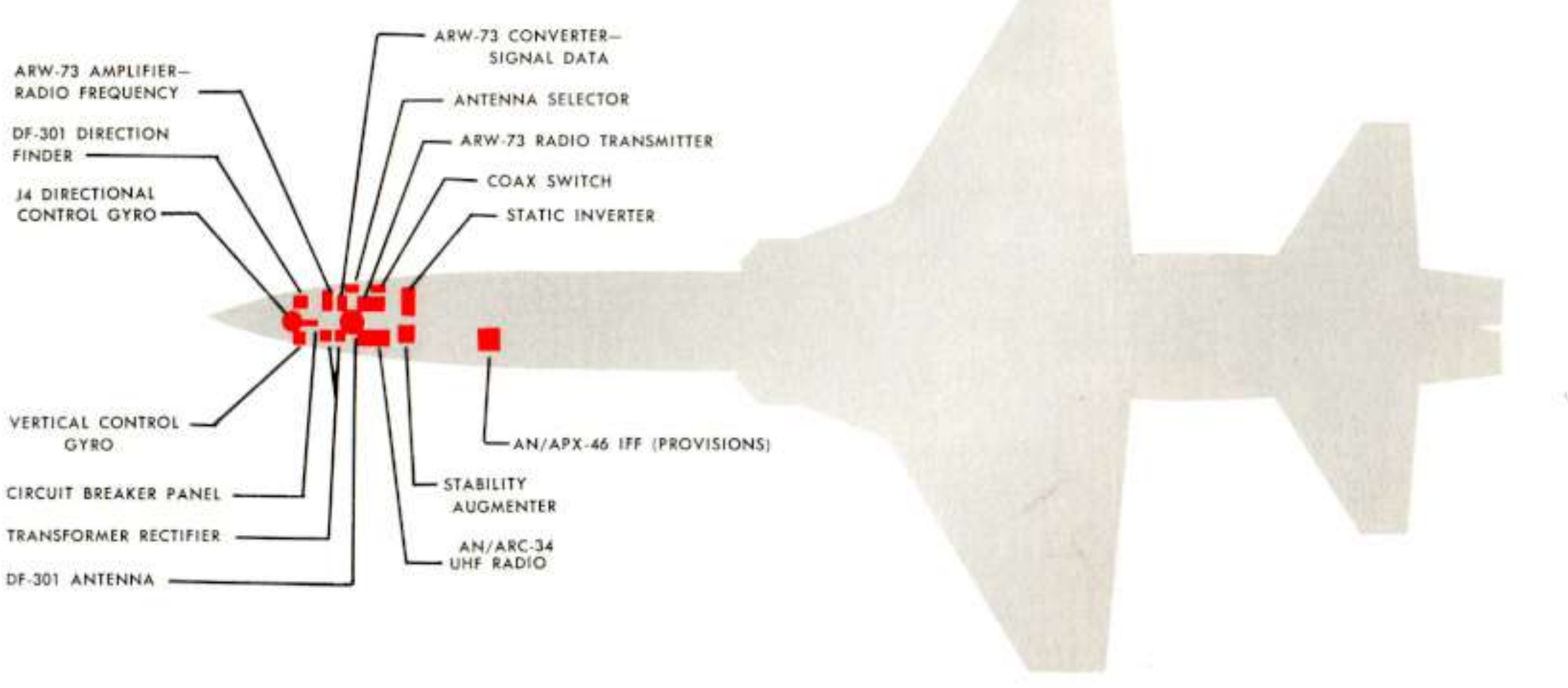
The AN/ARC-34AX command radio is employed for two-way air-to-air or air-to-ground voice communication. Any of 1750 frequencies from 225 to 400 megacycles may be selected manually. Twenty frequencies may be preset for rapid selection during flight. The radio also is equipped with fulltime "emergency" and "guard" channels.

An AN/AIC-18 interphone permits communication between F-5B crew members and for the F-5A, between pilot and ground crew through use of an external jack on the fuselage. The interphone uses transistorized audio amplifiers, and an open microphone permits instantaneous communication without use of switches. There are separate control panels in each cockpit of the F-5B. Both panels are connected to the command communication and navigation equipment. The interphone also may preamplify the AN/ARC-34AX command radio and amplify the audio tone from the infrared seeker on the Sidewinder 1A missiles.

The J-4 directional gyro compass provides precise heading signals to the course indicator. The system may be operated as a magnetically slaved directional gyro in the lower latitudes, and as a corrected directional gyro in higher latitudes where magnetic reference is degraded.

The DF-301 direction finder operates in the UHF spectrum from 225 to 400 megacycles and enables the pilot to fly the aircraft to any selected station. The system can also be used to determine the aircraft's location by triangulating signals from three known stations.

The pylon-mounted GAM-83 Bullpup missiles are guided by a proportional control system operated from the cockpit by a lever on the left console.



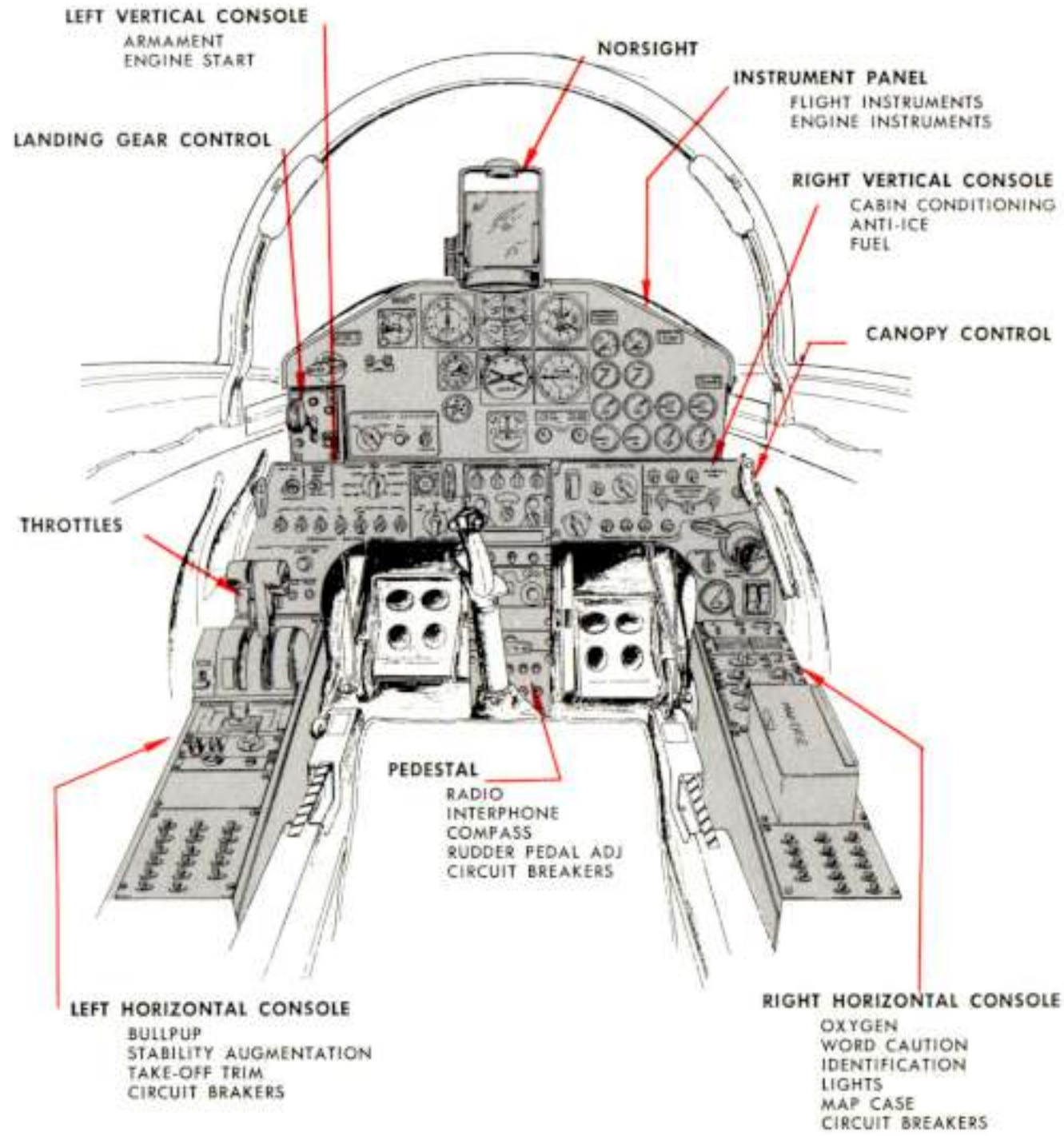
COCKPIT ARRANGEMENT

Maximum safety and crew comfort are inherent in the design of the 30-inch wide cockpit of the F-5 aircraft. Optimum control and instrument grouping enables the aircraft to be employed successfully in a broad spectrum of missions and configurations. Side and downward vision in the F-5 series is unrestricted. Forward vision in the F-5A and front cockpit of the F-5B extends 11 degrees below the horizon, and the F-5B rear seat is elevated 10 inches to provide its occupant with a full field of view over the head of the crew member in the forward cockpit.

Basic flight instruments, including air speed, attitude, altitude, rate of climb, and course are displayed centrally in front of the pilot. Engine instruments are clustered conventionally at the right side of the display, and fuel switches are immediately below the fuel gages.

Northrop Corporation's Norsight, a fixed optical sight reference system, is centered above the display, approximately 24 inches from the pilot's eyes. The pilot can sight without bending forward in the seat. In addition to air-to-air capability, Norsight provides 10 degrees downward deflection for air-to-ground missions.

Operation of all flight controls, activation of ordnance, and initiation of emergency procedures may be effected from either cockpit of the F-5B.



AUXILIARY EQUIPMENT

CANOPY

F-5 canopy enclosures assure maximum flight safety and crew protection, outstanding visibility, and unparalleled ease of access to instruments and controls. The single cockpit of the F-5A and the dual cockpits of the F-5B have manually operated, counterbalanced canopies which can be opened, closed, locked, and jettisoned independently from inside or outside the aircraft.

Latch-hinges at the aft end disconnect automatically during jettison. A one-piece windscreen is hinged at its forward edge for accessibility to equipment forward of the instrument panel. In the F-5B, the transparent windscreen that separates the cockpits protects the rear cockpit from wind and rocket blast during canopy jettison. In both aircraft, a rubber seal is automatically inflated by compressor bleed air when the canopies are down and locked. A red light in the cockpit warns of an unlocked canopy.

OXYGEN

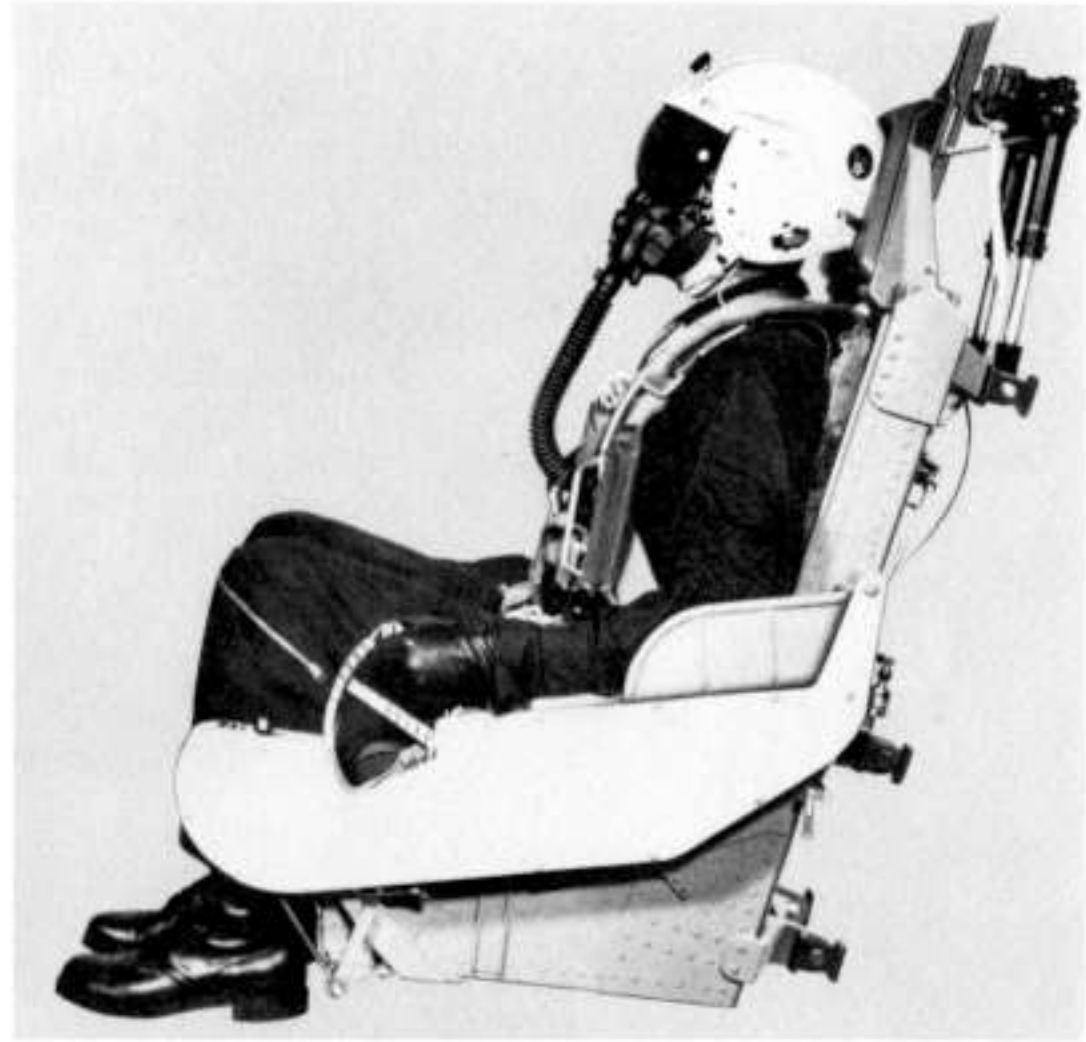
Breathing oxygen for the pilot is supplied by a 10-liter liquid oxygen system, enough for 18 to 20 hours flight under maximum usage. The internal system is supplemented by an emergency bailout bottle attached to the parachute pack to sustain the pilot during parachute descent from high altitudes.

The internal system mixes air and oxygen in a gradually decreasing ratio as the aircraft cabin altitude approaches 30,000 feet. At this point, only pure oxygen is delivered. Oxygen furnished at 100 psi to the regulator in the right console is monitored with a gage and a low-level warning light. It is then ducted through a quick-disconnect fitting on the parachute harness and into the pilot's mask. The system is filled through a valve on the fuselage nose section; the F-5B system is identical to the F-5A except for the addition of pressure indicators and controls in the rear cockpit.

ESCAPE

Upward ejecting, rocket-assisted seats furnish F-5 crew members with optimum safety at high altitudes or while the aircraft is on or near the ground. These seats are specially designed and qualified to minimize "g" forces on the occupant during emergency ejection.

The ejection sequence is triggered by a simple, continuous movement of the pilot's hands and arms by pulling one or both of the pull-handles at the sides of the seat. Oxygen and electrical lines are disconnected as the seat rises, and a hinged leg guard is pulled down to protect the pilot's legs. The parachute is deployed after pilot's automatic separation from the seat. A manual override is included for fail-safe operation.



CONDITIONING

Environmental control for F-5 crew members and avionics equipment is provided by compressed air ducted from the engine compressor section. Bleed air pressurizes and conditions the cabin, defogs windshield and canopy, inflates the canopy seals and the pilot's anti-G suit, cools equipment, and pressurizes the hydraulic reservoir. Bleed air is filtered, pressure-regulated, and temperature-controlled before it is ducted into the cockpit. Below 8,000 feet altitude, cockpit pressure is held to ambient pressure. From 8,000 to 23,000 feet, pressure corresponds to 8,000 foot ambient pressure. Above 23,100 feet, cabin pressure is maintained at 5.0 psi above outside pressure. A relief valve bleeds off excess pressure above 31,000 feet. When atmospheric pressure exceeds cabin pressure, the relief valve opens inward to equalize pressure.

Cabin air is ducted into the nose equipment bay to cool electronic equipment. Cabin air is supplemented by ram air if cabin exhaust flow is inadequate.

Additional cabin ventilation is provided in flight by the ram air portion of the system, which is independent of the conditioning unit.

Further information on the F-5 aircraft may be obtained from Northrop Corporation representatives in the following cities:

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