REPORT MDC-J4176
1 MAY 1972

TA-4F & TA-4J
Two-Seater Skyhawks

MCDONNELL DOUGLAS


NAVY
260

Skyhawks have been in production longer than any other tactical jet aircraft in history.

The simplicity, reliability, survivability of the Skyhawk series ranks this aircraft among the most successful tactical and training aircraft of all time. Each new version of the Skyhawk has been upgraded with new design features and equipment. Based on experience, the best features were retained and new capabilities were added.

In combat, Skyhawks have established an unequaled record of high availability and low loss rates.

In peacetime training and tactical operations, Skyhawks have established and continue to demonstrate an unequaled record of high availability and low loss rates.

A major feature of the Skyhawk series is that both single-place and two-place models are available, both are combat equipped and combat capable.

This brochure describes the two-place TA-4F combat configured and TA-4J trainer models. Both are in service with the U.S. forces as tactical or advanced trainers. In regard to handling qualities, structure, equipment and combat survivability, these two-place models are common with single-place models.

Various combinations of avionics and equipment options are available to meet the tactical requirements of the operating unit.

DESIGN FEATURES

Structure

Maximum structural continuity. Three, one-piece wing spars covered with stiffened wing skin that is continuous from wing tip to wing tip.

Fatigue life of 7700 flight hours demonstrated to U.S. Navy.

Propulsion

Pratt & Whitney J52-P-8B engine developing 4,218 kg (9,300 pounds) of thrust under static sea level conditions.

Simple, two-tank internal fuel system – integral wing tank and self-sealing fuselage tank – with a total capacity of 2513 liters (664 gallons).

Jet-assisted takeoff (JATO) provisions.

Inflight refueling provisions.

Ordnance

Five external store stations with 4,082 kg (9,000 pounds) total capacity.

Two 20-mm cannons with 200 total rounds of ammunition or an optional installation of two 30-mm cannons with a total of 300 rounds, or two 20-mm cannons with a total of 400 rounds.

Flight Controls

Independent, dual hydraulic flight control system with manual reversion if hydraulic system is malfunctioning.

Three-axis automatic flight control system.

Landing wing lift spoilers and drag chute.

Landing Gear

High sink speed 7.32 m/sec (24 ft/sec) qualified landing gear.

Nose wheel steering.

Barrier arrestment qualification with arresting hook for emergency overrun.

Qualified for aircraft carrier operations.

Crew Escape System

TA-4's have the dual ESCAPAC I-F crew escape system with zero speed and zero altitude escape capability.

Electrical

Twelve-kva generator.

Avionics

Radar with terrain avoidance and ranging modes. Long-range and short-range navigation, communication, and identification equipment with a choice of ECM systems.

Production Base

Douglas Aircraft Company's broad and stable resources of facilities and personnel guarantees a firm financial base with capable engineering and product resources. Engineering and production facilities of over 970,000 square meters (10,455,000 square feet) are 89 percent company owned and more than $178,000,000 have been invested in these facilities since 1960. Over 36,200 people are employed of which 6200 are engineering personnel. This production base of military and commercial aircraft guarantees a stable work force and a level overhead for all programs.

Production Models

Douglas is currently in production on three Skyhawk models: A-4M, A-4N, and TA-4J. Systems in these airplanes vary from unsophisticated in the TA-4J advanced trainer to highly sophisticated in the A-4N tactical version; therefore, a wide choice of fully developed configurations is available.

International Customers

Douglas Skyhawks are operated by the U.S. Navy, U.S. Marine Corps., the Israel Air Force, the Royal Australian Navy, the Royal New Zealand Air Force, and the Argentine Navy and Argentine Air Force. Douglas has demonstrated broad experience in establishing and maintaining international support programs for the Skyhawk. This experience is a valuable asset for future programs.

SKYHAWK
FAMILY

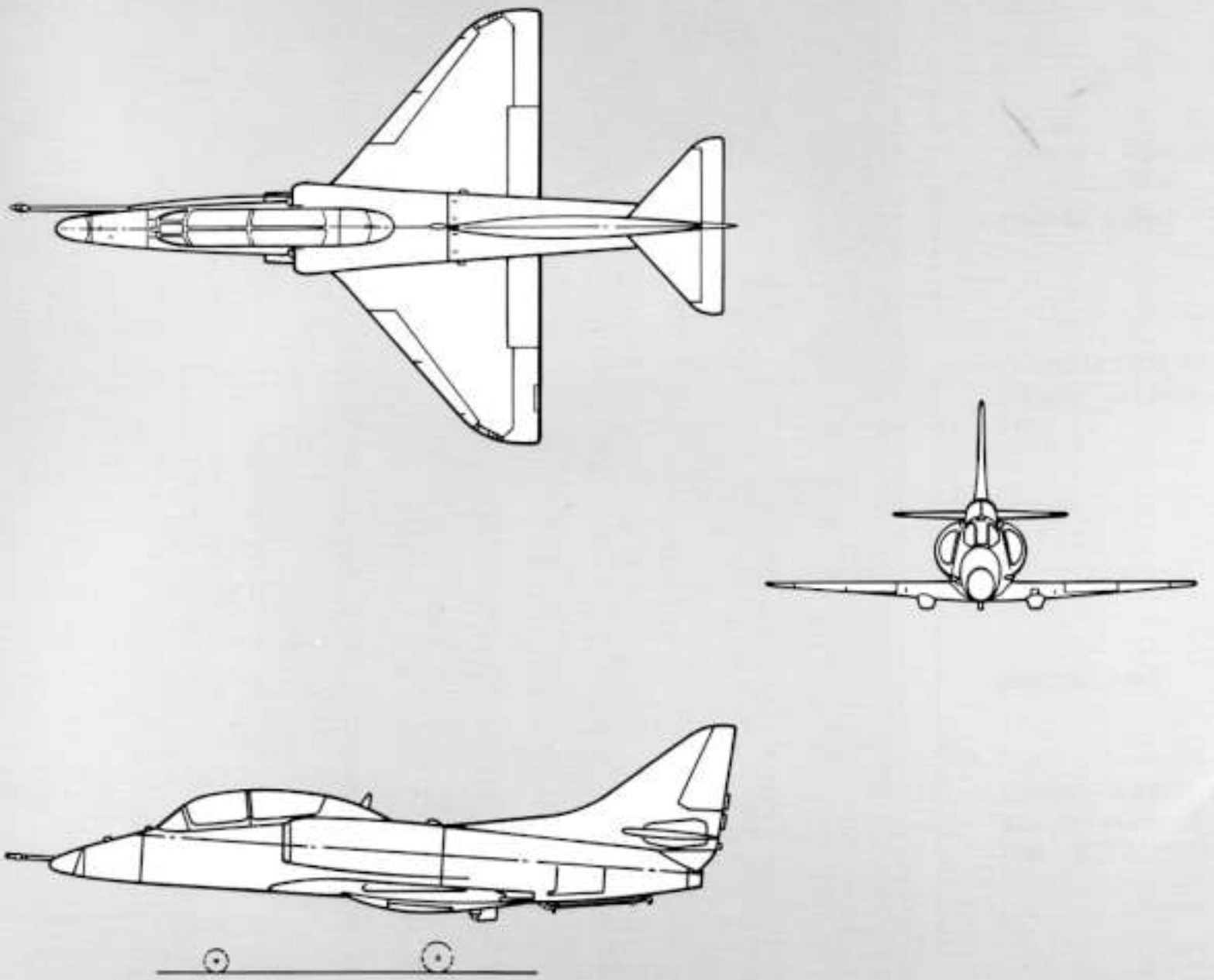
TA-4 SKYHAWK DIMENSIONS AND WEIGHTS

WING SPAN	8.38M	27.5 FT
LENGTH	12.98M	42.6 FT
HEIGHT	4.76M	15.6 FT
WHEEL BASE	4.3M	14.1 FT
TREAD	2.38M	7.8 FT
BASIC WEIGHT EMPTY[1]	49.93 KG	11,008 LB
MAXIMUM TAKEOFF WEIGHT	11,113 KG	24,500 LB

ENGINE (PRATT & WHITNEY, J52-P-8B)

	SEA LEVEL STATIC	SFC[2]
MILITARY THRUST (30 MINUTES)	4218 KG/9,300 LB	0.86
NORMAL THRUST	3720 KG/8,200 LB	0.81

NOTES:
(1) BASIC WEIGHT EMPTY INCLUDES WEAPON DELIVERY AND NAVIGATION SYSTEMS PLUS THREE PYLONS.
(2) LB/HR/LB



STRIKE MISSIONS

Mission Capabilities
TA-4F
J52-P-8B Engine

Close Air Support

Tactical Air Control

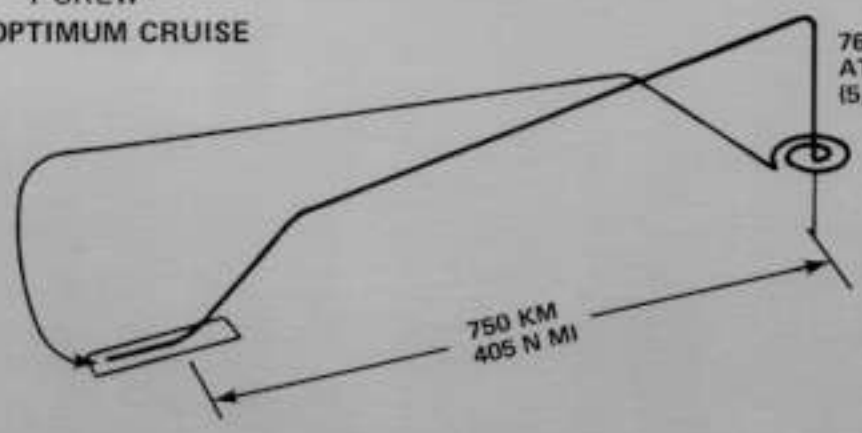
Sea-Level Strike

TA-4F Skyhawk capability in strike and fighter missions is shown in the following profiles. General performance is presented in the operating characteristics section. Mission performance is based upon JP-1 fuel at a density of 0.815 Kg/Liter (6.8 lb/gal).

Mission rules are as defined in U.S. Military Specifications requirements with the exception of reserve fuel which is 227 Kg (500 pounds) and takeoff fuel allowance which is calculated as fuel for 10 minutes at idle thrust plus fuel for military thrust takeoff and acceleration. Ammunition is retained for all missions and external tanks are retained for all but the fighter missions.

LOADING
BOMBS 900 KG – (2000 LB – 1 MK 83, 2 MK 82)
20-MM GUNS AND 200 ROUNDS
TWO 1140-LITER (300 GAL) TANKS
1 CREW

OPTIMUM CRUISE



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20-MM GUNS AND 200 ROUNDS
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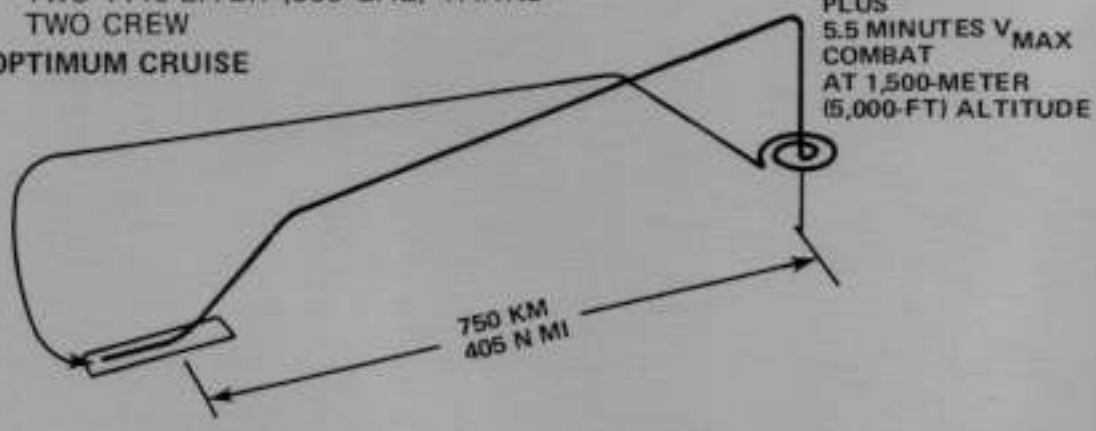

LOADING
BOMBS 900 KG – (2000 LB – 1 MK 83, 2 MK 82)
20-MM GUNS AND 200 ROUNDS
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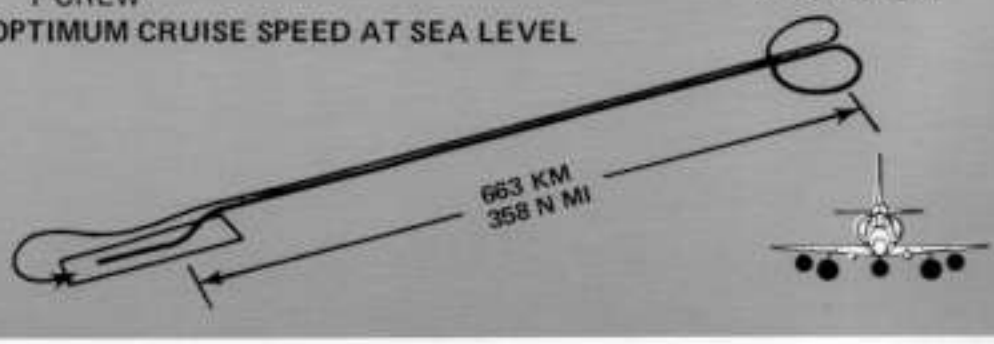
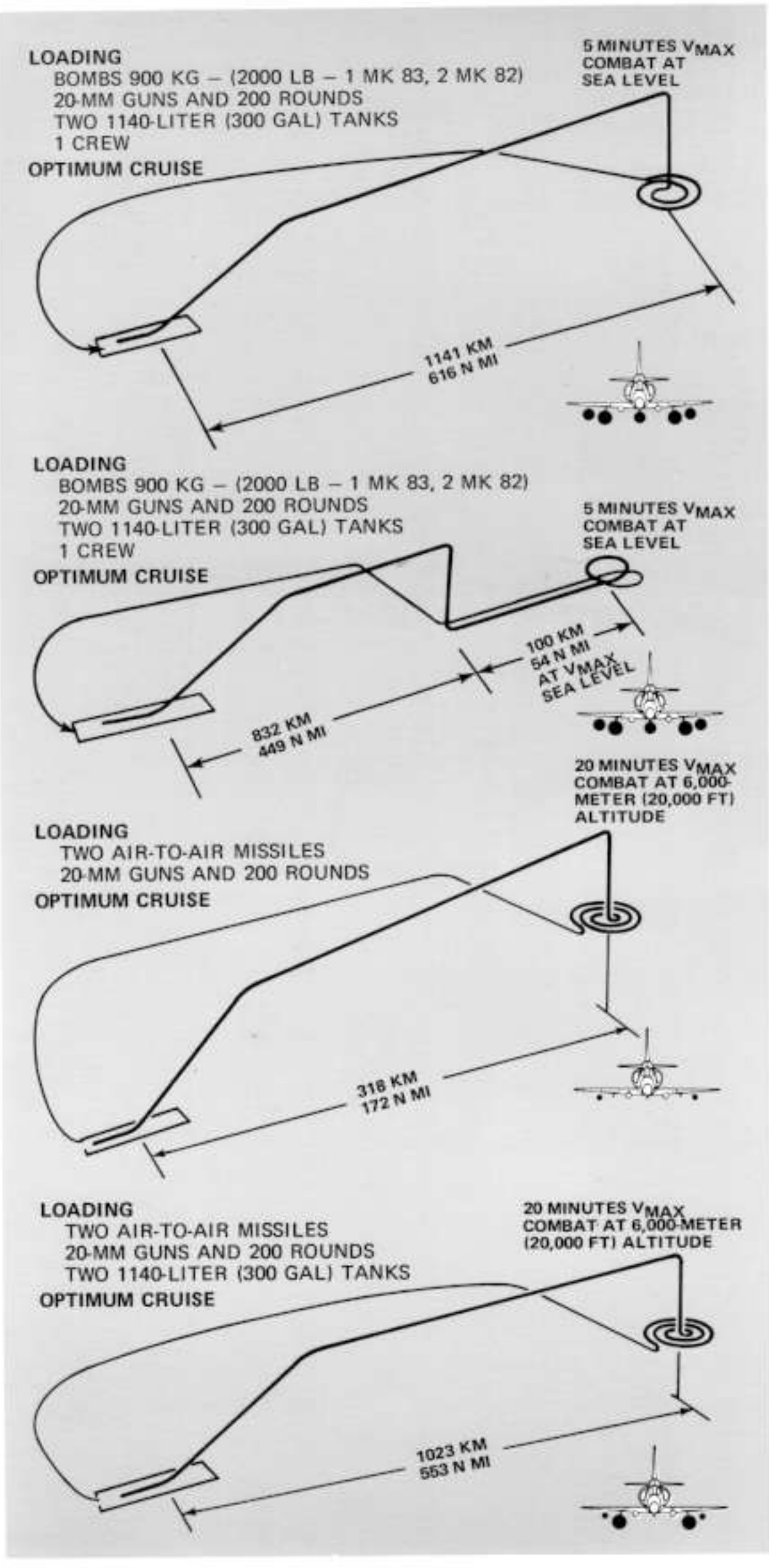
1 CREW

OPTIMUM CRUISE SPEED AT SEA LEVEL





High-Altitude Strike

Sea-Level Dash

FIGHTER MISSIONS
ONE CREW

Combat at 6,000-Meter Altitude – No External Fuel

Combat at 6,000-Meter Altitude – External Fuel – 2,280 Liters

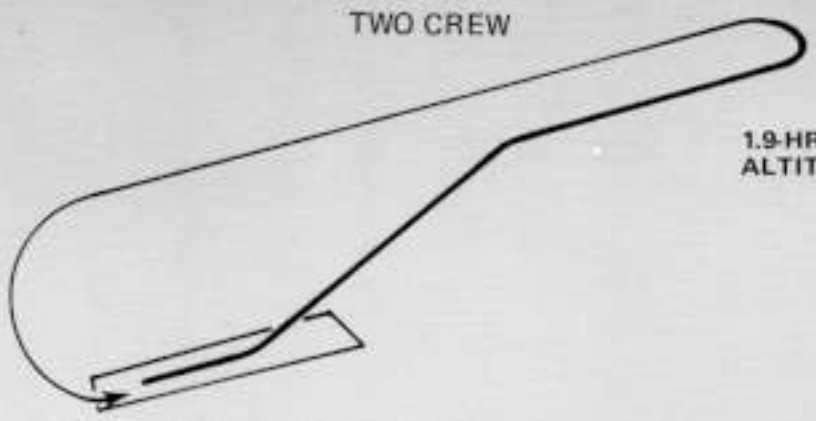
TRAINING MISSIONS

TA-4J
J52-P-8B Engine

Short Range

Long Range

LOADING
3 PYLONS
NO GUNS
TWO CREW



1.9-HR DURATION
ALTITUDE MISSION

454 KG (1000 LB) FUEL LANDING RESERVE

1.4-HR DURATION
SEA-LEVEL MISSION

454 KG (1000 LB) FUEL LANDING RESERVE

LOADING
3 PYLONS
TWO 1140-LITER (300 GAL) TANKS
NO GUNS
TWO CREW

3.8-HR DURATION
ALTITUDE MISSION

454 KG (1000 LB) FUEL LANDING RESERVE

2.8-HR DURATION
SEA-LEVEL MISSION

454 KG (1000 LB) FUEL LANDING RESERVE


NAVY

SKYHAWK OPERATIONAL RECORD

Combat Proven

The first of the Skyhawk series, the A-4A, was delivered to the U.S. Navy in 1954. Subsequent Skyhawk models have been mainstays of the light attack forces of the U.S. Navy and Marine Corps. Skyhawks have flown more combat missions in Southeast Asia than any other operational aircraft, and have consistently exhibited high-survivability and availability, and low maintenance workload. Skyhawks have flown more than 3,500,000 flight hours, averaged approximately 380 hours per year, and demonstrated peak utilization of over 90 hours per month during combat operations. Structurally no Skyhawk has exhibited stress or fatigue damage even after being subjected to severe flight overloads in combat.

Maintainable

The Skyhawk requires the fewest maintenance men per aircraft of any U.S. tactical aircraft. The uncomplicated subsystem design and ready access result in low Mean-Times-to-Repair. Fifteen-minute turnaround times for rearming and reloading the aircraft for restrike, with times lower than 6 minutes have been demonstrated under combat conditions. In flight training operations utilization is commonly four, or more, flights per day. Here, as in combat operations, the reliability and fast turnaround times have a high payoff.

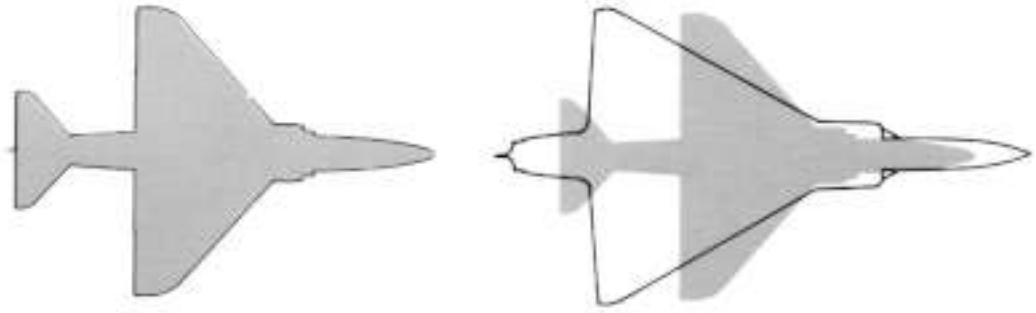
Simple to Fly

The Skyhawk is a "pilot's aircraft." Flying qualities are straightforward and aircraft systems are simple. Because of this, a large percentage of total flight time may be spent on mission training rather than in developing and maintaining rudimentary flight proficiency. Pilots can, therefore, achieve high levels of combat effectiveness after short training periods, and retain combat effectiveness with few flight hours.

- Three million five hundred thousand flight hours, four hundred thousand in combat.
- Average utilization 380 hours per year.
- No Skyhawk has ever been retired because of structural fatigue or damage from limit flight loads; 68 aircraft have more than 4000 hours and 474 aircraft have mmore than 3000 hours.
- Lowest manning level of any U.S. jet combat aircraft.
- Fifteen-minute turnaround time, including refueling and re-arming. Less than 6 minutes demonstrated under combat conditions.

SUMMARY

The survivability of the Skyhawk has been proven in thousands of combat missions against the full array of modern anti-air defenses. Its outstanding record of survivability results from fundamental characteristics: its small size makes it hard to see; if it is seen, its small size plus its agility make it hard to hit; if it is hit, its rugged construction allows it to continue to fly under control and return to base more often than other tactical aircraft. Of equal importance, combat damage can usually be repaired at the squadron level and the aircraft returned to service.



Probability of Hit

The probability of being hit by enemy fire is primarily determined by aircraft agility and size. The Skyhawk series aircraft have established an outstanding survivability record.

The importance of size in its effect on hit probability is shown in the following table. The data are normalized to the Skyhawk. It represents the relative probability of being hit when flying over a 57-mm AAA gun battery at a height of 3000 meters (10,000 feet) in 2g jinking.

RELATIVE HIT PROBABILITY

AIRCRAFT	RELATIVE SIZE	RELATIVE P_H
TA-4F (NORMALIZED)	1.00	1.00
G-91Y	1.18	1.16
MIRAGE	1.21	1.26
HUNTER	1.22	1.33

SURVIVABILITY FEATURES

The Skyhawk's ability to continue in controlled flight following a hit by enemy fire is outstanding because of the following design features:

- Dual hydraulic controls with manual backup
- Continuous, multiple-load path structure
- Engine compartment and fuel tanks separated
- Short engine inlets
- Shielded self-sealing fuselage tank
- Gravity emergency fuel feed
- Redundant fuel transfer system
- Free-fall emergency landing gear extension
- Wind-driven emergency generator
- Armor plate

These photographs show some of the extremes of combat damage that Skyhawks have survived.

An anti-aircraft shell exploded in left wing. Aircraft returned safely to base, was repaired, and returned to service.

An anti-aircraft shell exploded near leading edge of left wing. Aircraft returned safely to its carrier base where it was repaired and returned to service.

An anti-aircraft shell exploded in left wing root area. Two of the three main spars were severed. The aircraft landed aboard its carrier, where the damaged wing was removed and replaced.

Having survived combat damage it is of prime importance to repair the aircraft and return it to operation. In this respect, the Skyhawk is outstanding. A large percentage of the structure is fabricated from standard sheet and extruded stock, with few forgings or machined parts.

As a result, repairs may be made on most of the structure with the tools, materials, and skills available at the squadron level. To facilitate this, Douglas has prepared a Combat Damage Repair Manual which specifies detailed repairs for all parts of the structure. This has proven invaluable in assisting squadrons in getting damaged aircraft back in service. The Skyhawk record in combat repair is as impressive as its record in surviving combat damage. In combination, these qualities are a major contribution to combat effectiveness.

FLYING QUALITIES

The Skyhawk is noted for ease of handling and superior flying qualities, which are particularly suitable for its multiple mission roles. These characteristics result from the basic design and the improvements incorporated during the service use of the airplane. The excellent handling qualities have contributed to a superior safety record, and result in minimum flight time required to train fully operational pilots. In combat, violent flight control inputs can be made without fear of causing uncontrolled flight or structural damage.

Ease of Handling

The high thrust-to-weight ratio of the Skyhawk combined with its low wing loading provides the airplane with outstanding maneuvering performance. The turning and maneuvering capabilities are further enhanced with excellent roll-response characteristics. Roll rate is about 100 degrees per second at low speed and increases to 300 degrees per second at moderate speeds. Roll rate at supersonic or limit dive speed is about 100 degrees per second, ensuring adequate airplane control under these conditions. Stick forces in accelerated flight are light, varying between 2.4 and 4.5 kg (5.3 and 9.9 lb) per g depending on airplane center of gravity and flight conditions. Airplane longitudinal short period damping and control sensitivity is particularly good, ensuring high-speed, low-altitude flight without pilot induced oscillations.

High Roll Rate

Light Stick Forces

Another indication of the Skyhawk's outstanding flying qualities is that the only maneuvering restriction is a roll rate limitation of 180 degrees per second when carrying external stores heavier than 1270 kg (2800 lb) on the centerline station or 816 kg (1800 lb) on the inboard wing station. Tactically this limitation is not important as it allows bank angle changes of up to 180 degrees to be made with full control application.

No Significant Tactical Flight Restrictions

Airplane control in the landing configuration is excellent with slow approach speeds (235 km/hr – 126 knots at an airplane weight of 6350 kg – 14,000 lb). Wing lift spoilers which extend automatically on touchdown enable safe operational landings in direct cross winds of more than 46 km/hr/25 knots.

Landing Control

Good Stall Characteristics

Airplane stall warning is good and consists of aerodynamic buffet. Buffet onset occurs about 15 percent above stall speed and increases in intensity as the stall is approached. Stall characteristics are mild and consist of a slight nose down pitch with a lateral and directional oscillation that increases slightly in amplitude if the stall is maintained. Prompt stall recovery is achieved by relaxing aft stick.

Easy Spin Recovery

The Skyhawk spins only when deliberately forced to do so; when a spin is forced, recovery is conventional and simple. Recovery is achieved by applying rudder against the direction of spin and neutralizing the control stick.

Operational Effectiveness

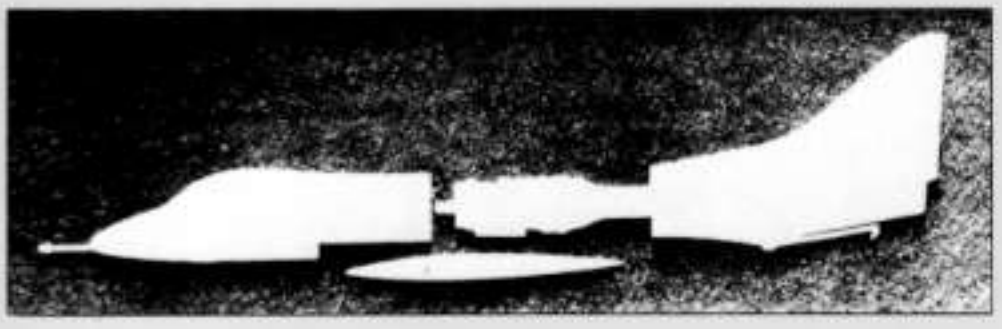
Because of the outstanding handling qualities of the Skyhawk, in combination with its straightforward aircraft systems, the pilot is free to devote his attention to the tactical aspects of the mission rather than having to concentrate on the rudiments of flight control.

The operational capabilities of the Skyhawk have been defined in the preceding sections. This section describes the subsystems and gives further insight into the details of aircraft design. The keynote of the original A-4 design was simplicity and reliability. This design philosophy has been successful in providing aircraft that are survivable and maintainable in combat, safe in peacetime operations, and that have had growth capacity to accommodate new systems to enhance effectiveness.

Design Simplicity

The primary structure is built in three major sections: fuselage forward section, fuselage aft section, and wing section.

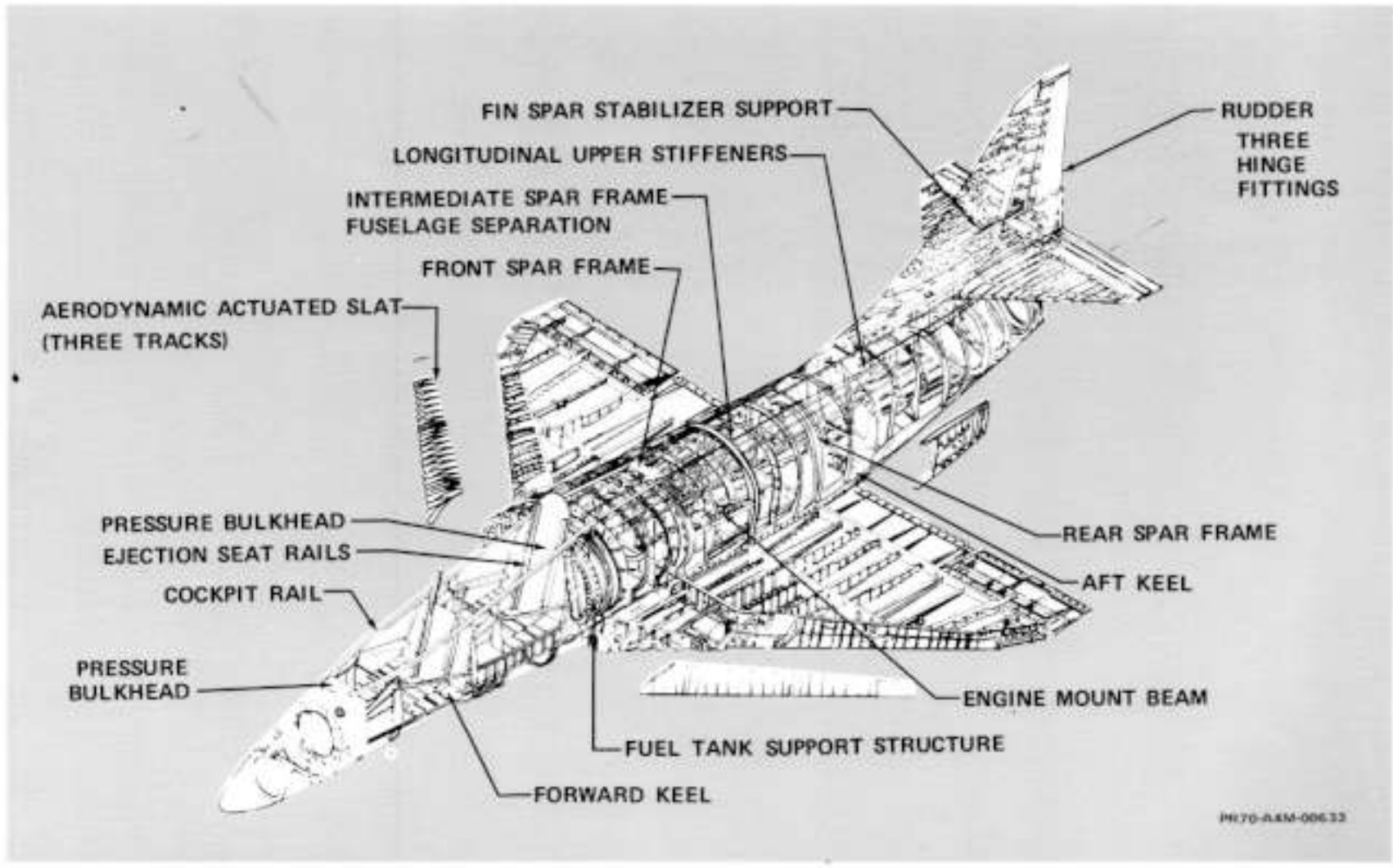
Three Major Sections



Wing Structure

Structurally, the wing is a three-spar box, continuous from tip to tip.

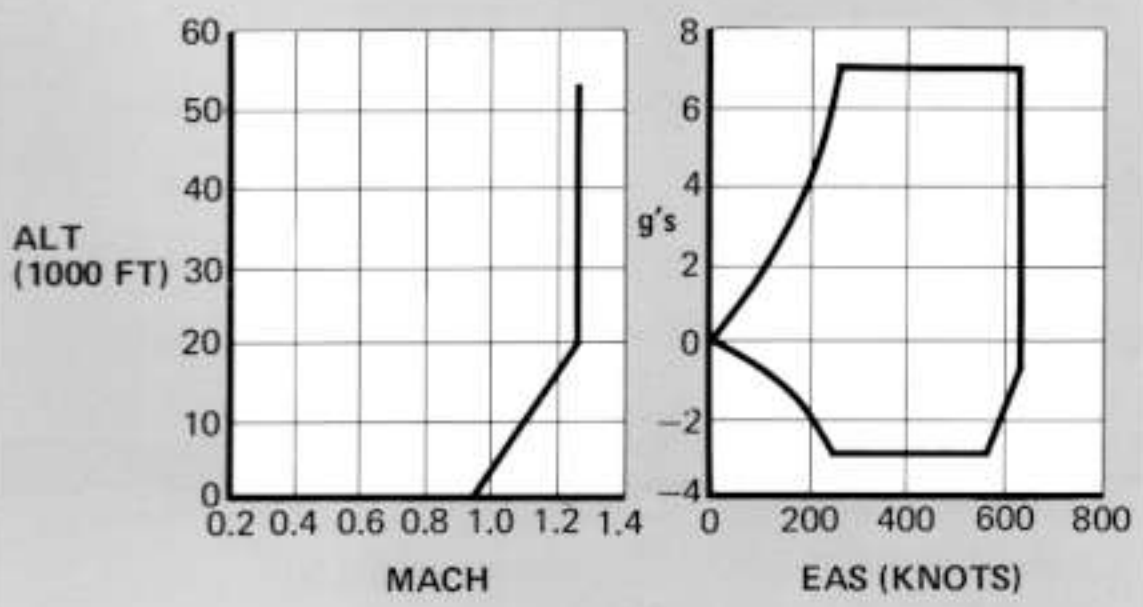
The rear and intermediate spars are straight, as well as being continuous, thereby eliminating the load concentration point caused by wing sweep in most high-performance aircraft. The low-wing arrangement permits all wing access to be provided from the upper surface, and virtually eliminates cutouts in the lower skin where the principal loading is tension.

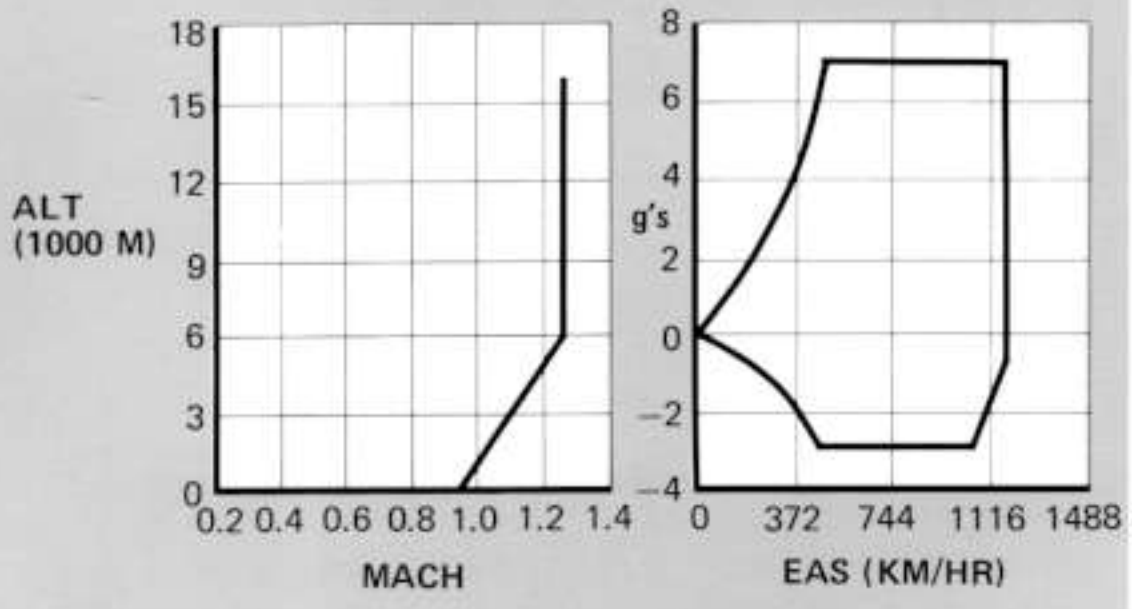


At subsonic speeds the structural strength of the A-4 exceeds its published limit by a wide margin. This was demonstrated in formal static and fatigue tests, on instrumented aero-structural flight tests, and on the many combat and operational flights where published limits were greatly exceeded with no resulting failure or deformation of structure.

The wing was laboratory fatigue tested to an equivalent service life of 7700 flight hours (with a scatter factor of two) at a typical combat weight of 7575 kg/16,700 lb. This test included 15 occurrences of 8g load factor.

Material selection and treatment to meet the aircraft carrier environment of salt spray and stack gases result in an extremely corrosion-resistant structure.





Skyhawk Strength Envelope

ENGINE

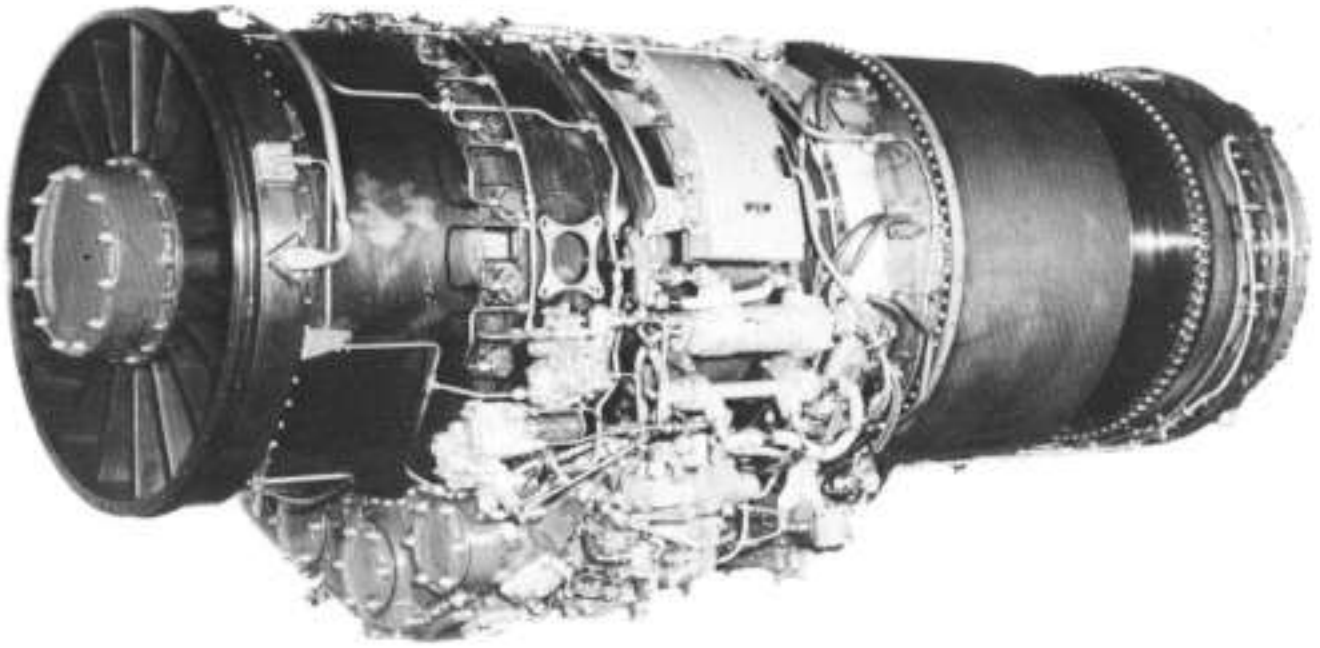
The J52-P-8B engine used in the Skyhawk is a two-spool, axial-flow turbojet manufactured by Pratt & Whitney.

Smokeless

The engine incorporates smokeless burner cans and an adjustment for use of fuels differing in specific gravity.

1500-Hour Overhaul

Pratt & Whitney J52 engines have been installed in the Skyhawk series since 1962. Based on previous experience with the J52 and on U.S. Navy planned use of this engine over the next decade, it is estimated that time between overhauls (TBO) will be extended to 1500 hours by 1974.



PRATT & WHITNEY J52-P-8B TURBOJET

RATING	SEA LEVEL STATIC THRUST		SFC (LB/HR/LB)	SFC (KG/HR/KG)
INTERMEDIATE (30 MINUTES)	4218 KG	9,300 LB	0.86	0.86
NORMAL	3720 KG	8,200 LB	0.81	0.81
IDLE	185 KG	407 LB	1.90	1.90

The TA-4 has a simple, two-tank fuel system with a total internal capacity of 2513 liters, 664 U.S. gallons; with only two tanks, the filling and transfer system has a minimum of components and a minimum number of possible leak paths.

- Self-sealing fuselage fuel tank – 394 liters/104 U.S. gallons.
- Integral wing tank – 2119 liters/560 U.S. gallons.
- Wing baffles prevent spanwise sloshing.
- Sump in fuselage tank, with flapper valves, to assure fuel supply to engine in all attitudes, including inverted for 30 seconds.
- External tank provisions at centerline and inboard store stations:

  Centerline – 568-, 1136-, 1514-liter tanks.

  – 150-, 300-, 400-gallon tanks.

  Inboard Wing Station – 568- and 1136-liter tanks.

  – 150- and 300-gallon tanks.

- All tanks, including external, may be serviced through ground level, single-point, pressure fueling system or by gravity filler in each tank.

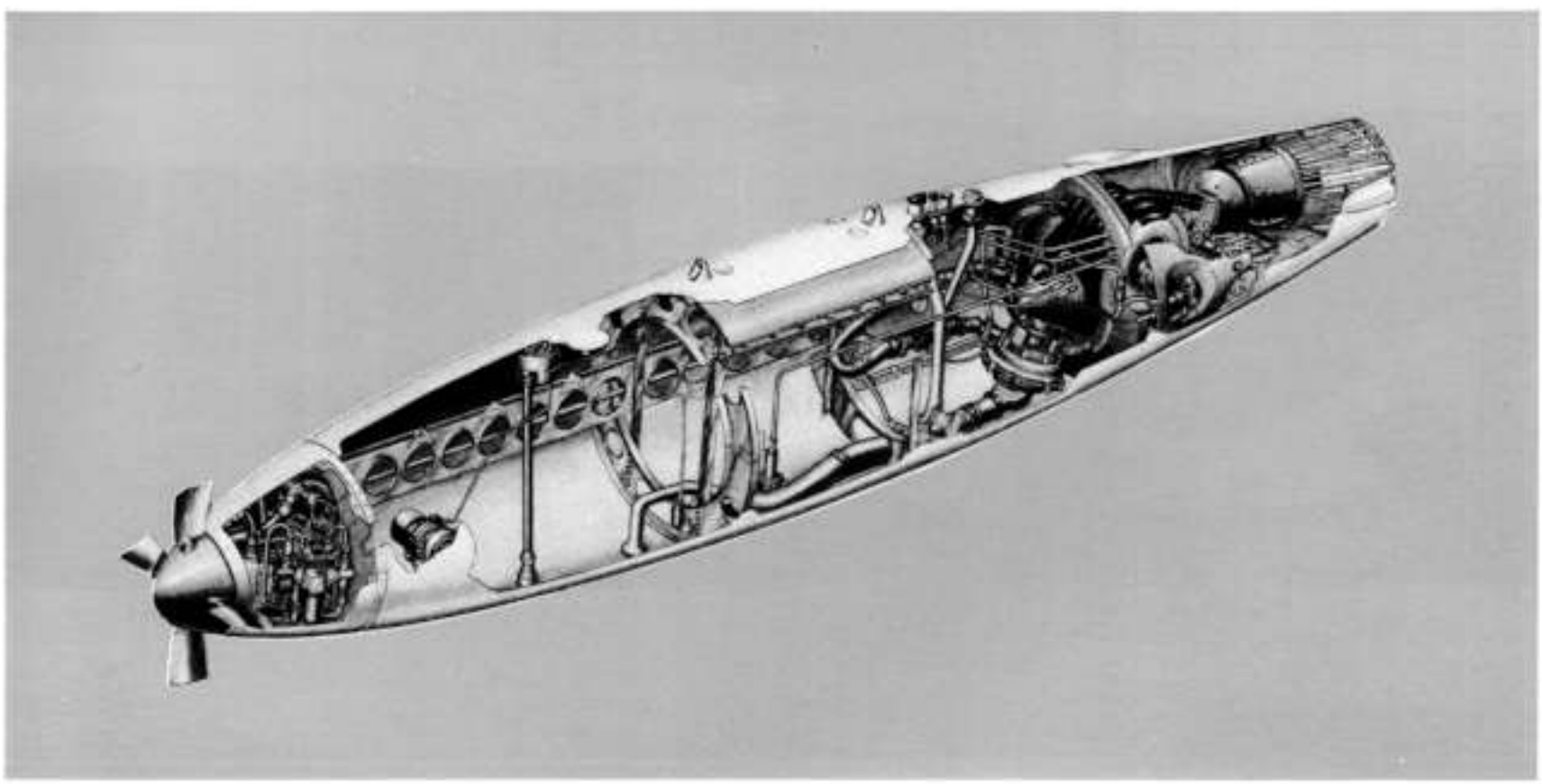
The self-contained centerline store shown below gives the Skyhawk an aerial tanker capability.

FUEL SYSTEM

2513 Liters
664 Gallons
Internal Fuel

3785 Liters
1000 Gallons
External Fuel

REFUELING STORE



Transfer System

- Fuel transfer is normally from wing to fuselage tanks by air-driven turbine fuel pump utilizing cooled engine compressor bleed air.
- Fuel is delivered to engine by electric motor driven boost pump in fuselage sump.
- External tank fuel may be pressure transferred to fuselage tank or to wing tank by pilot selection.

Emergency Transfer

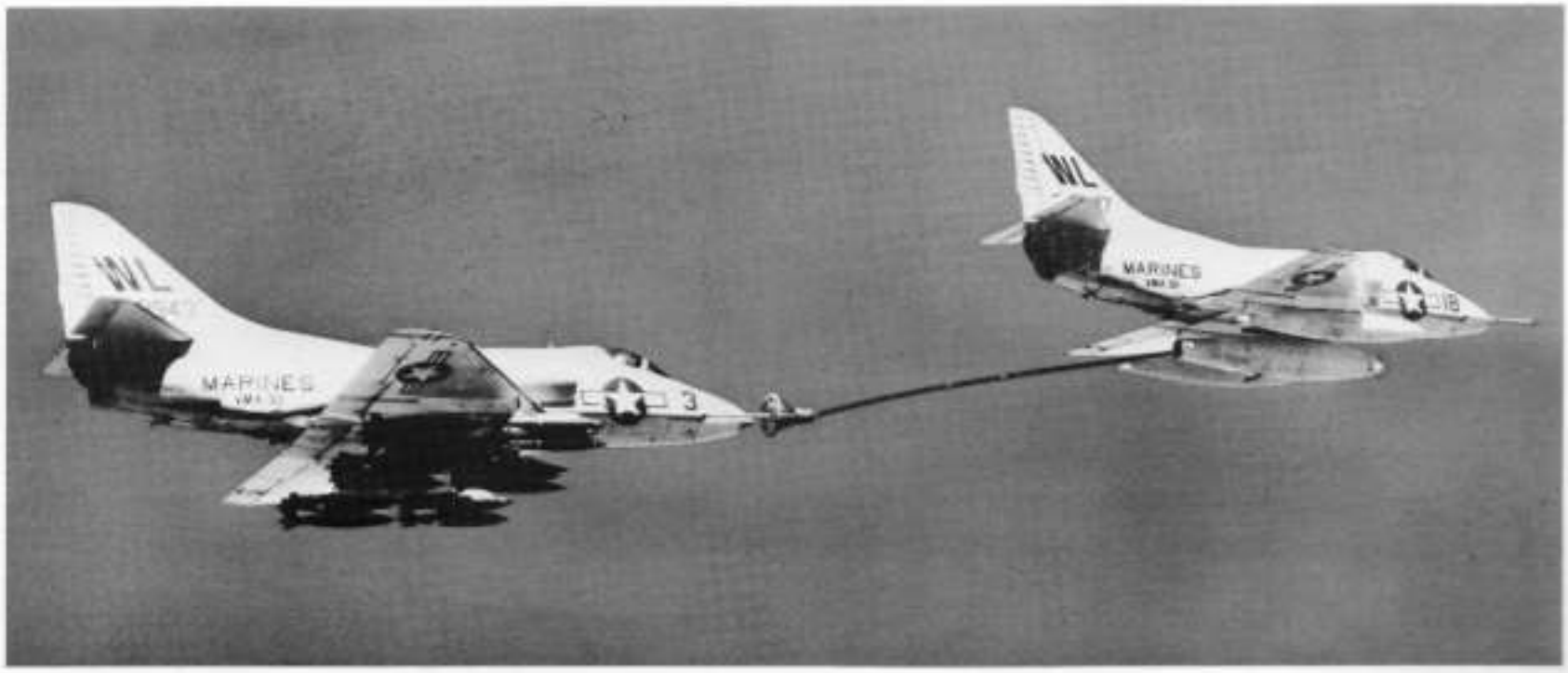
- Emergency transfer, bypassing wing pump, can be accomplished by pressurizing wing tank.
- Gravity flow transfer from fuselage tank to engine if boost pump fails.

Fuel Jettisoning

- Wing fuel may be dumped at 380 liters per minute (100 U.S. gallons per minute).
- External wing tanks may be jettisoned by ejector racks without loss of internal fuel.

Inflight Refueling Advantages

- Extend loiter time in case of landing delays.
- Top-off after takeoff for extended range.
- Safe return of aircraft which are low on fuel due to combat or other damage.



FLIGHT CONTROLS

The primary flight controls for the Skyhawk are the hydraulic power-actuated ailerons, rudder, and elevators.

Two Separate Hydraulic Flight Controls

- Each control is actuated by an irreversible, tandem, hydraulic power cylinder with normal power supplied by both the flight control and utility hydraulic systems.

Independent Mechanical Backup Flight Control

- If both hydraulic systems should fail, the aileron and elevator actuators can be disconnected and the ailerons, rudder and elevators can be operated manually. In the manual flight control mode, flight speed is limited to 555 km/hr/300 knots or 0.8 Mach because of high control forces, but disengagement can be made at higher speeds. Carrier landings can be made using the manual flight controls.
- Longitudinal trim is provided by positioning the horizontal stabilizer with an electric, motor-driven, jackscrew-type actuator.
- Lateral and directional trim is achieved by electric, motor-driven actuators that reposition the pilot's load feel bungees. An aileron follow-up tab provides lateral trim when flying on emergency manual control.

Three-Axis Automatic Flight Control System

The automatic flight control system (AFCS) relieves the pilot from routine control of the airplane on long flights. The AFCS controls ailerons, rudder, and elevators to perform functions of:

- Attitude hold – Maintains airplane attitude established by pilot.
- Altitude hold – Maintains airplane altitude and attitude.
- Heading hold – Maintains compass heading.
- Preselect heading – Turns airplane to compass heading selected by pilot.
- Control stick steering – Enables pilot to fly the airplane through the AFCS using the control stick.
- Stability augmentation – Provides yaw damping.

Hydraulic System

Two independent hydraulic systems supply the hydraulic power requirements of the Skyhawk. They are the flight control system and the utility system. Each system has its own reservoir and pump (engine driven) and operates at 204 atmospheres pressure. Piping for each of these systems is separated in the aircraft for minimum vulnerability.

Hydraulic System (continued)

Tandem power cylinders are used in the aileron, elevator, and rudder power controls. One-half of each cylinder is operated by the flight-control system pressure, and the other half by utility system pressure. If one system should fail, the other will operate the controls to only slightly reduced control deflection at high speed. The utility system also operates the landing gear, wing flaps, spoilers, speed brakes, arresting hook, and JATO jettisoning subsystems. Warning lights indicate, to the pilot, loss of pressure in either system. Steel tubing with brazed joints are used for maximum reliability.

Emergency Extension by Free Fall

Utility hydraulic system pressure retracts the tricycle landing gear during normal operation. All gear retract up and forward and are held up by hydraulic pressure. In the case of hydraulic system failure, the gear will rest on the doors and is held up by latches on the gear doors. The doors can be mechanically released to allow free fall of the landing gear to the down and locked position in the event of utility hydraulic system failure.

Nose Wheel Steering

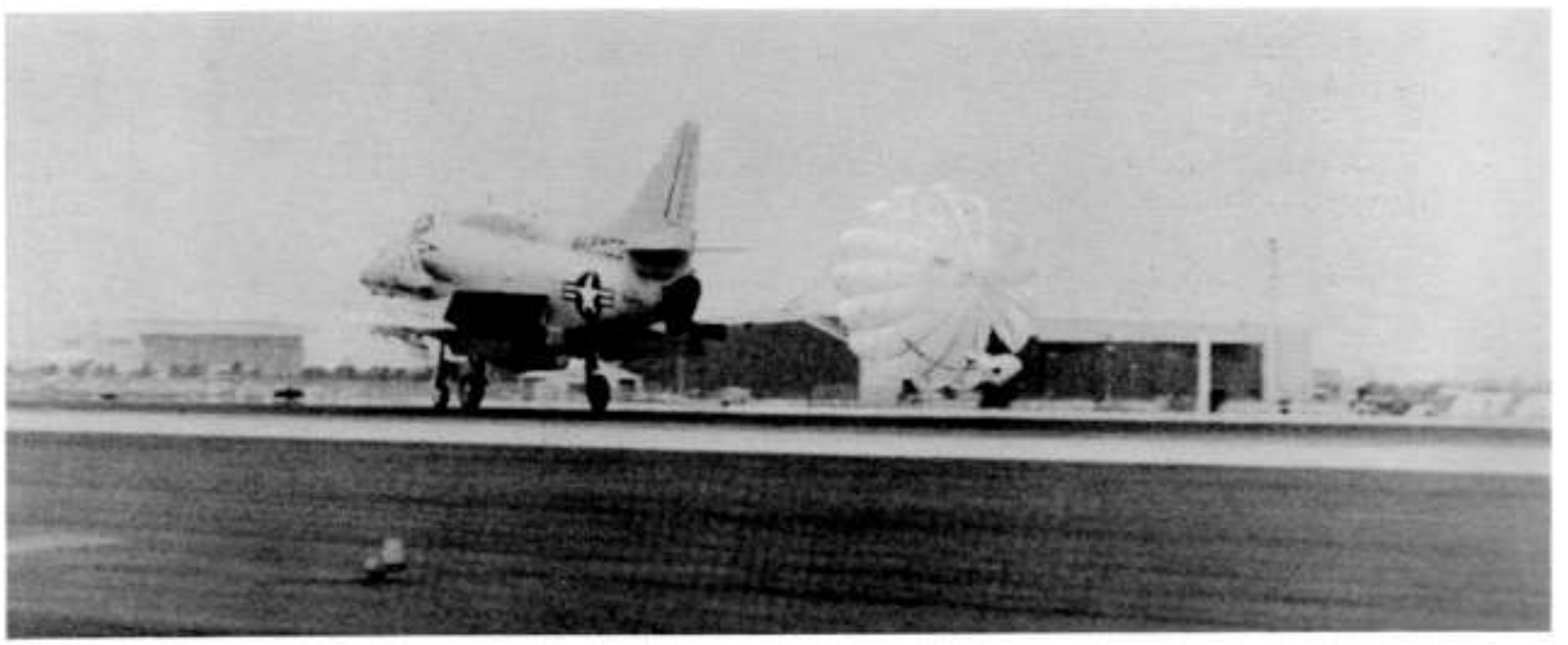
Nose wheel steering gives better aircraft handling during crosswind landings, reduces braking during taxi, and facilitates taxi in restricted areas. Steering is controlled from either seat by pilot inputs through the rudder pedals and is powered by the utility hydraulic system.

Wheel Brakes

Wheel brakes are self-contained and independent of the utility or flight control hydraulic systems. Braking action is obtained by pilot exerting force on the brake pedals hinged about the rudder pedals.

Drag Chute

A 4.88-meter, 16-foot drag chute significantly decreases ground roll distance after touchdown and greatly increases brake and tire life.



ELECTRICAL

The main electrical power source is a 12-kva generator driven by the engine through a constant-speed drive. Direct current is provided by a 50-ampere, 28-volt, d-c transformer-rectifier. No battery is required.

60 Percent Growth in Electrical Capacity

Maximum continuous airplane electrical load of the TA-4F is about 8 kva allowing 60 percent of rated capacity for future growth. Maximum continuous airplane electrical load of the TA-4J is about 6 kva.

Emergency Generator

Emergency power from an extendable, 1.7-kva air-driven generator provides sufficient power to return to base under instrument conditions.

ESCAPE SYSTEM

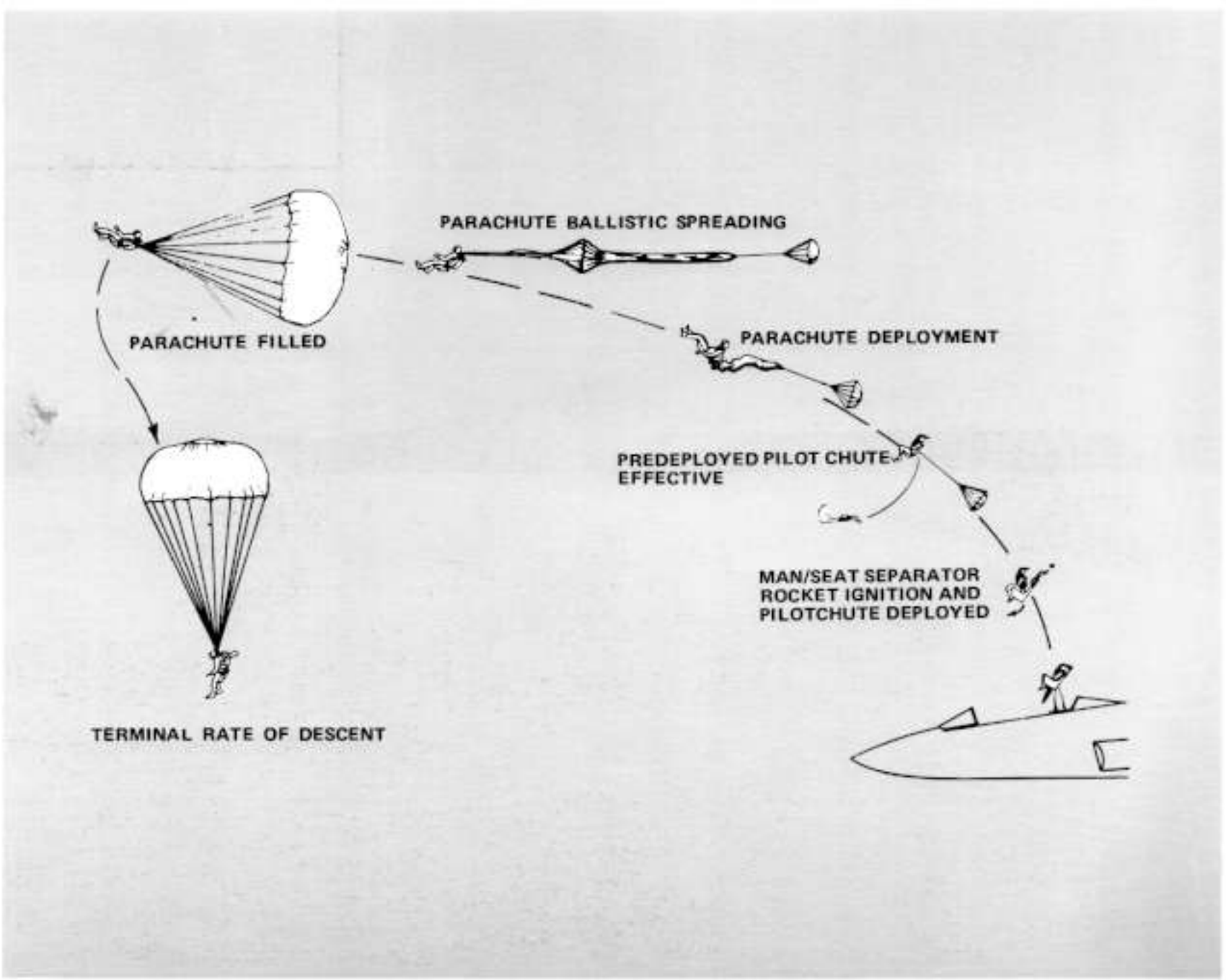
Zero-Zero
Ejection Seat

The Douglas ESCAPAC I-F seat provides safe crew escape throughout the operating envelope:

Speed Range – 0 to 600 KEAS

Altitude – 0 to 15,000 meters/50,000 feet.

Sink rate – 900 meters per minute/3000 feet per minute based on recovery at ejection initiation altitude.



The Skyhawk 20-mm gun installation is used in several Skyhawk models. One hundred rounds are carried for each gun for a total of 200 rounds. An alternate installation is available, utilizing two 30-mm guns with 150 rounds of ammunition per gun as shown below. The 30-mm installation is shown below. Another option of two 20-mm cannons with 200 rounds for each gun is available.

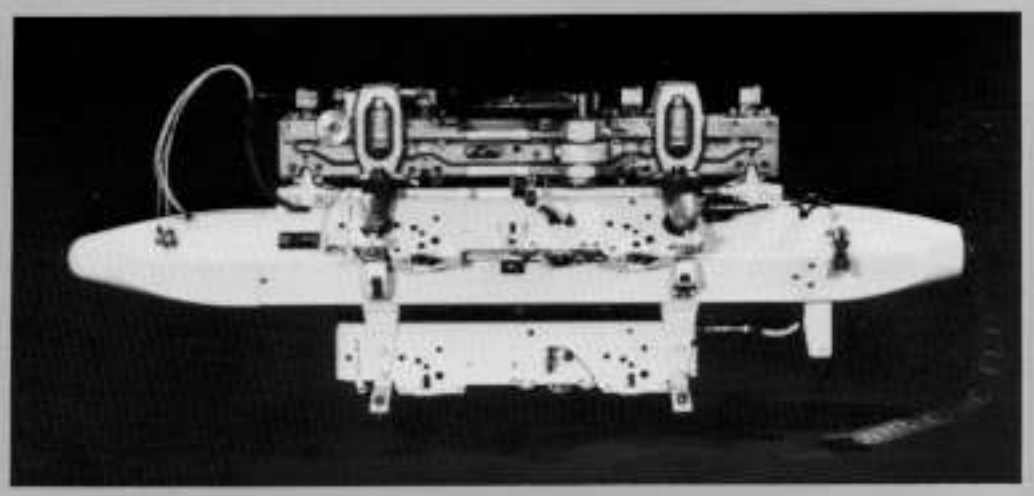
ARMAMENT

20-mm
200 Rounds

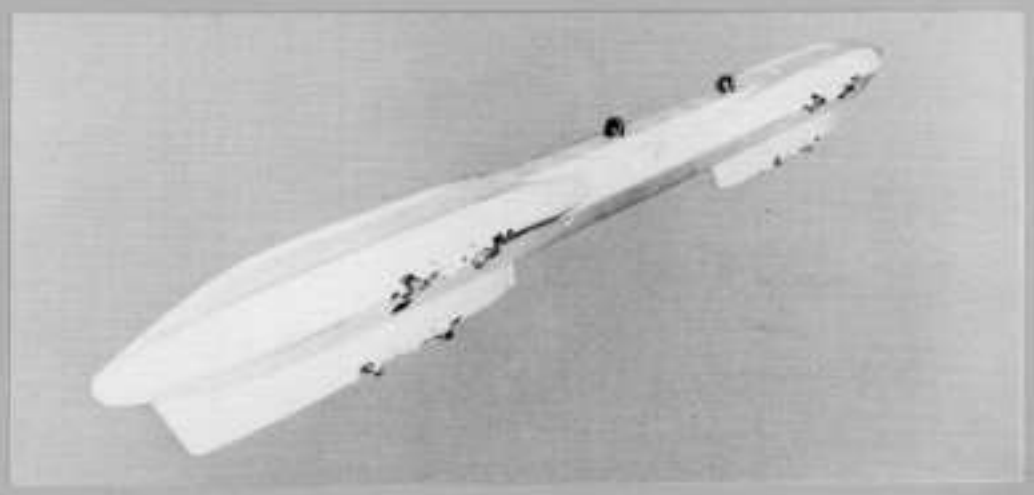
30-mm
Option

External ordnance is carried on either Aero 7A ejector bomb racks on the centerline pylon, or Aero 20A ejector bomb racks on the wing pylons.

The Aero 7A racks have 36- and 76-cm (14- and 30-inch) hook spacing; the Aero 20A racks have 36-cm (14-inch) spacing. These racks can accommodate a wide variety of bombs, rockets, missiles, and tanks as well as the Douglas designed and manufactured triple-ejection rack (TER) and multiple-ejection rack (MER).



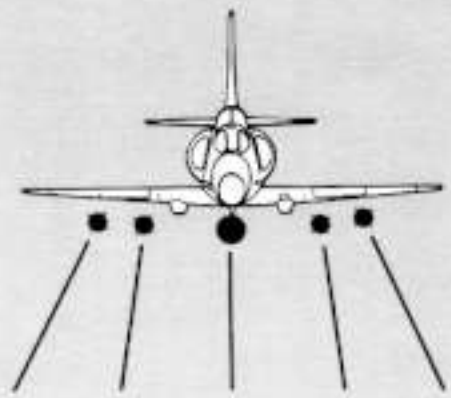
Triple Ejection Rack



Multiple Ejection Rack

Safety of the bombing system is ensured, during loading of stores and prior to flight, by manually inserted safety pins which interrupt the firing circuits and mechanically lock the ejectors.

Store hoisting can be accomplished by standard available lift trucks or conventional bomb hoists suspended from brackets which mount on the bomb racks.



Typical Ordnance Loading

HIGH EXPLOSIVE BOMB	X	X	X	X	X
AIR-TO-AIR MISSILE	X	X		X	X
MULTIPLE CARRIAGE		X	X	X	
AIR-TO-SURFACE MISSILE	X	X	X	X	X
ROCKET PACKAGE	X	X	X	X	X
EXTERNAL FUEL TANK/NAPALM		X	X	X	
IN-FLIGHT REFUELING STORE			X		
MAXIMUM STATION WEIGHT					
KILOGRAMS	257	1000	1608	1000	257
POUNDS	570	2240	3575	2240	570

AVIONICS

Meet any Requirement

Wide Choice

Avionics has been one of the most significant development areas for tactical aircraft both in terms of capability and reliability. Skyhawk models have flown with production navigation and weapon delivery systems that vary from pilot dead reckoning with a depressible fixed reticle gunsight to the most advanced head-up display, digital navigation-weapons delivery computer using an inertial platform reference. Electronic countermeasure equipment varying from simple chaff systems to the most sophisticated devices have been installed. Communication-navigation transmitters and receivers in the FM, VHF, and UHF frequency bands are flying in various Skyhawk models. The wide variety of essentially off-the-shelf systems with proven installations enable the choice of a communication navigation weapons delivery system with minimal or no development necessary to meet any requirements.

The following charts show various combinations of existing navigation and weapon delivery components. They show a relative comparison between accuracy and delivery effectiveness:

WEAPON DELIVERY SYSTEMS

	CONFIGURATIONS A	B
EQUIPMENT		
DEPRESSIBLE SIGHT	X	X
WEAPONS RELEASE COMPUTER		X
RADAR		X
ATTITUDE REFERENCE SYSTEMS AJB-3	X	X
RELATIVE DELIVERY EFFECTIVENESS	1.0	1.6
AIR-TO-AIR GUNS AND ROCKET SOLUTION	NO	NO

NAVIGATION SYSTEMS

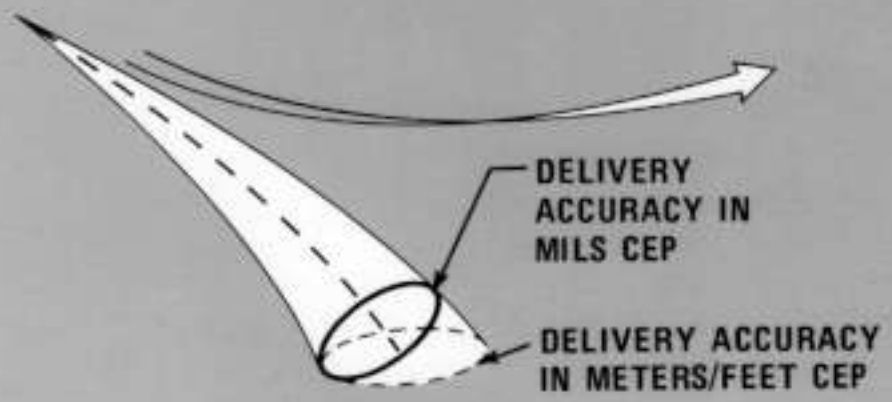
EQUIPMENT			
PILOT DEAD RECKONING (AJB-3 REF)	X		
ASN-41 NAVIGATION COMPUTER (AJB-3 REF)		X	
ASN-41 NAVIGATION COMPUTER AND DOPPLER (AJB-3 REF)			X
NAVIGATION ACCURACY KILOMETERS/HR	9-13	6-9	6
NAVIGATION ACCURACY NAUTICAL MILES/HR	5-7	3-5	3

WEAPON DELIVERY SYSTEM ACCURACY

The stability and excellent controllability of the Skyhawk at high speeds make it outstandingly effective in weapons delivery. Delivery accuracy is measured in meters/feet or mils. The diameter of the circle on the ground encompassing one-half of the weapon impact points closest to the target is measured in meters/feet and is referred to as Circular Error Probable (CEP). The angular measurements from the release point to the ground CEP circle projected in a plane perpendicular to the bomb fall line are measured in mils.

This table reflects the CEP for a low-drag bomb released at 835 km/hour (450 knots) with an accuracy of 25 mils. (Configuration B)

DIVE ANGLE (DEGREES)	RELEASE SLANT RANGE 3000 METERS/10,000 FEET
30	122/402 CEP
45	97/320 CEP
60	81/267 CEP



Measurement of Delivery Accuracy

COCKPIT

The pilot's field of view from the cockpit of the Skyhawk is unusually wide and unobstructed. The large canopy enables excellent vision even to the rear where the tail surfaces can be seen. This wide field of view is of extreme importance in acquiring and retaining both ground and air targets.

Cockpit Outside Visibility

	MAXIMUM DEGREES
FORWARD AND DOWNWARD	19
SIDEWARD AND DOWN (AT 90°)	57

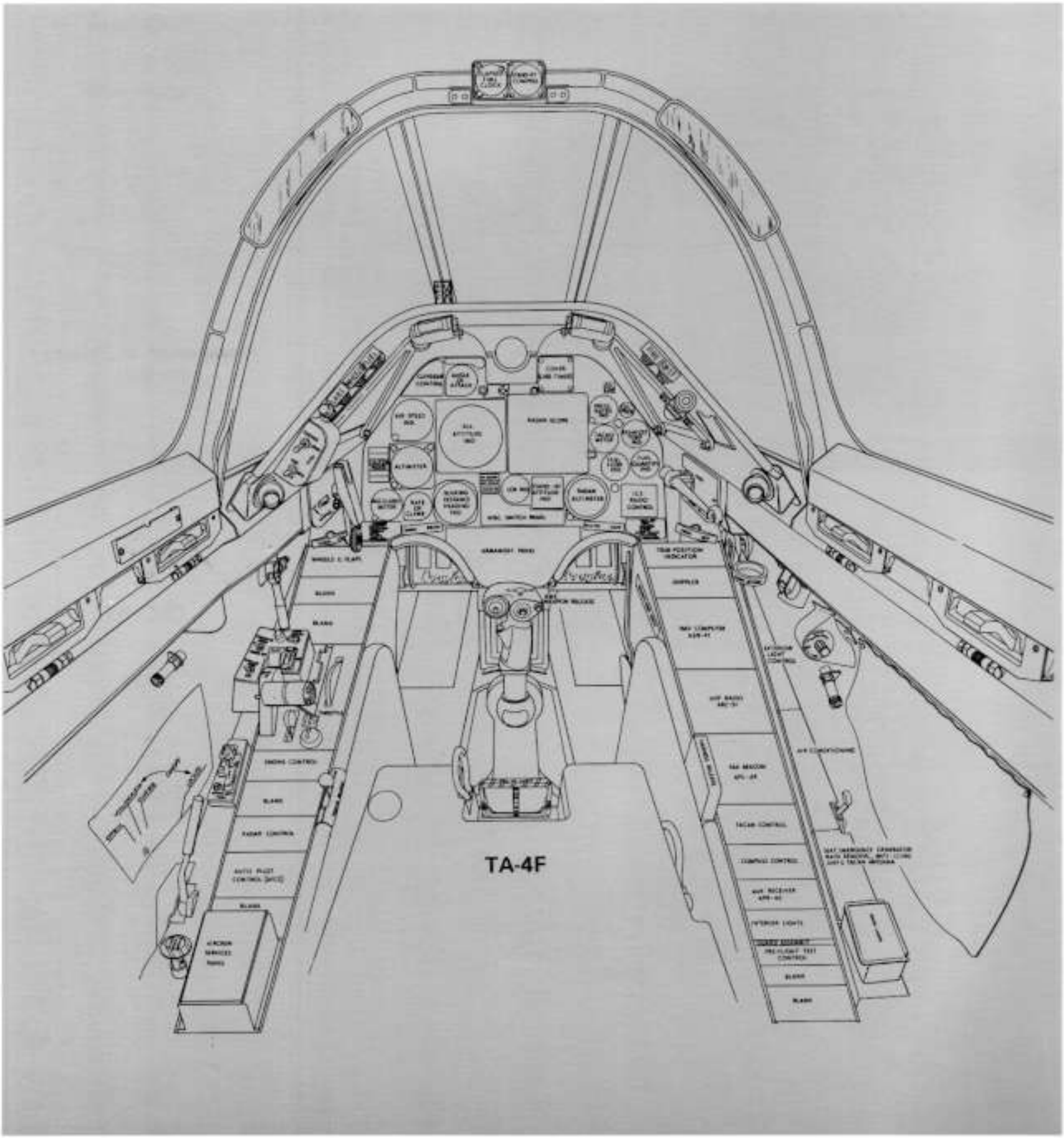
Excellent Visibility

The cockpit center windshield, which is electrically heated for defogging and defrosting, is a 3.3-cm 1-5/16-inch-thick flak-resistant panel of laminated glass and vinyl. The windshield side panels are of cast acrylic plastic and are also electrically heated.

A combination air-conditioning and pressurization system heats, cools, ventilates, and pressurizes the cockpit. Oxygen is provided from a liquid container. A gaseous oxygen configuration is also available.

Instruments Easy to See and Reach

The instrument panel and console arrangement is shown below. This arrangement has positioned all similar controls and functions in optimum location, i.e., ordnance switches are grouped on the upper left of the instrument panel for easy access and visibility.



SERVICING AND MAINTENANCE

Simple

The simplicity of Skyhawk systems and servicing results in high operational capability. The effectiveness of this design has been proven in combat and in training, in operations from aircraft carriers and from advanced land bases.

Rapid Turnaround

Turnaround time required for servicing under combat time requires six men. The normal time for refueling, reloading stores and ammunition, servicing oxygen, and inspecting the aircraft is 15 minutes. Turnaround time has been demonstrated at less than 6 minutes.

Servicing

- Principal servicing doors are the quick-opening type and provide adequate access.

Single-Point Refueling

- The single-point pressure fueling fitting for normal use is located on the lower fuselage near the trailing edge of the wing. The aircraft may be refueled when the engine is running by attaching the fueling hose to the inflight fueling probe.

Oxygen

- Oxygen servicing door is in the aft fuselage below the speed brake. Liquid oxygen is easily serviced by changing canisters.

Easy Loading

- The low wing arrangement simplifies store station loading and makes possible manual loading. Stores may be hoisted by lift trucks or by conventional bomb hoists suspended from brackets mounted on the bomb ejector racks.

- Ammunition is loaded through the engine access compartment in the bottom of the fuselage ahead of the wing front spar.

- Engine inlet ducts are short and large enough for easy inspection. There is little occurrence of foreign object damage because of the high duct location.

Maintenance Low Manning

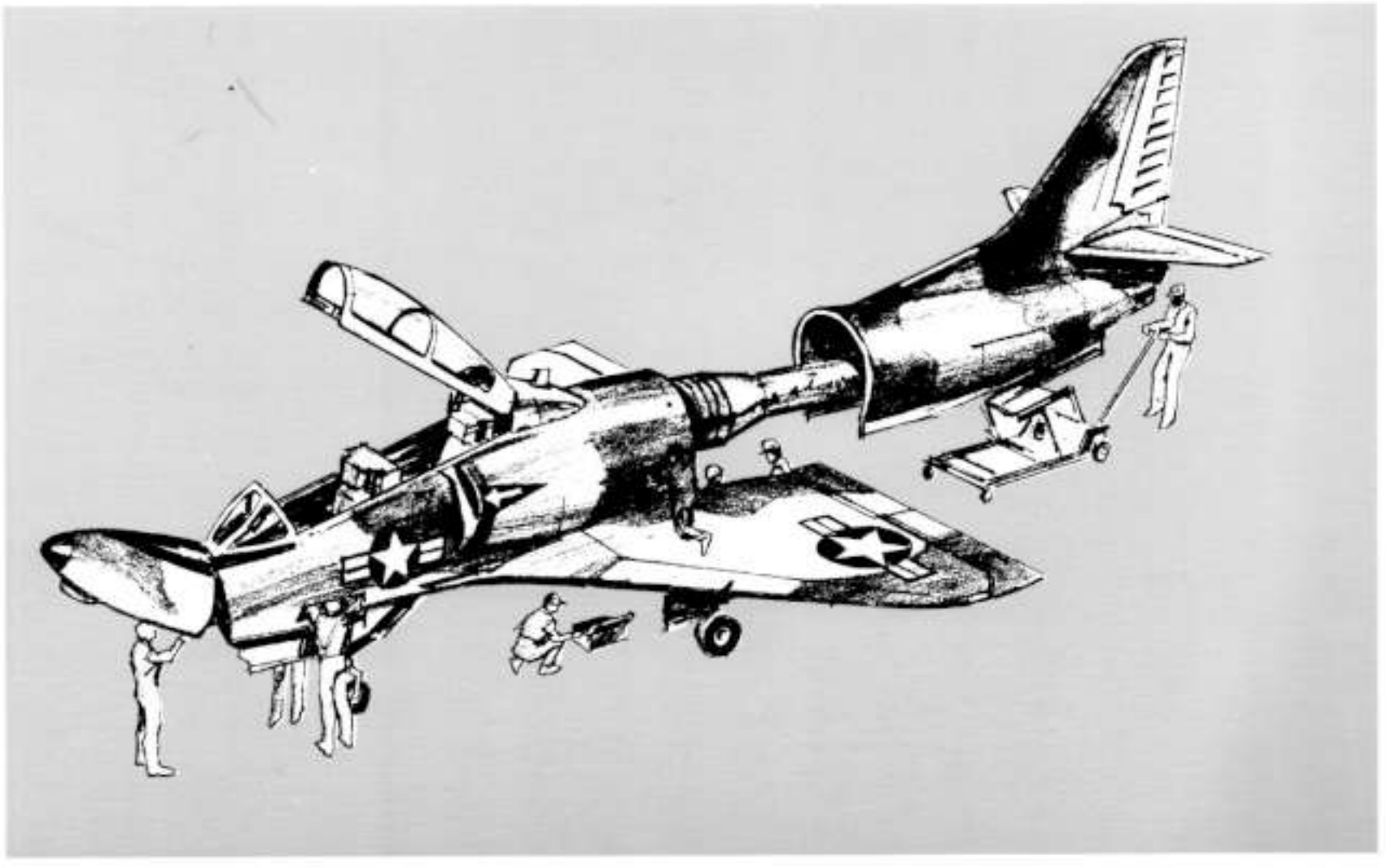
The accessibility and simple maintenance procedures combined with the Skyhawk's uncomplicated subsystems have consistently resulted in the lowest maintenance personnel requirements for U.S. Armed Forces jet squadrons.

Engine Maintenance

The Skyhawk conveniently separates into three major interchangeable components: forward fuselage, wing, and aft fuselage.

- The aft fuselage is easily detached for engine removal.
- Large access doors and panels are provided for inspection and repair.
- All engine accessories can be replaced without removing the engine.
- Generator and constant-speed drive access is through the forward engine compartment door, then through doors in the engine inlet duct walls.

Spare parts usage is reduced because of highly tested and proven equipment.



The McDonnell Douglas Corporation policy regarding support of its products is affirmed in a directive signed by Corporate Vice President Donald W. Douglas, Jr.:

"The MDC divisional companies and subsidiaries shall be responsible for management and production or procurement when applicable of the necessary support elements to ensure effective and economical support of hardware, software and services for the programmed life cycle of their products."

Douglas, through its worldwide support organization, provides technical, engineering and support materials for all operating models from the DC-3 through the DC-9 and the still active A-1 Skyraider and A-4 Series Skyhawks.

The integrated product support programs are designed to include the elements of traditional support operations. Support elements include, but are not limited to:

- Maintenance planning and procedures
- Maintainability, reliability, and verifications
- Support and test equipment
- Spare parts, inventory, and shipping
- Technical publications and customer vendor data
- Customer field support and technical support services
- Customer training and training equipment
- Repair, overhaul, and modifications

TA-4F/J
COMPARISON

	TA-4F	TA-4J
REFUELING PROBE	YES	YES
AIR REFUELING STORE	PROVISIONS	PROVISIONS
AUTOPILOT	YES	YES
APG-53A RADAR	YES	PROVISIONS
ASN-41 NAV COMPUTER	YES	PROVISIONS
10-LITER LOX SYSTEM	YES	YES
BOMB STATIONS	FIVE	THREE[1]
NOSEWHEEL STEERING	YES	YES
SPOILERS	YES	YES
ARC-51A UHF COMM	YES	YES
ARR-69 UHF AUX REC	YES	YES
RADAR IFF	APX-64	APX-72
APN-153 DOPPLER RADAR	YES	PROVISIONS
TACAN ARN-52	YES	YES
ARA-50 ADF (UHF)	YES	YES
ARN-141 RADAR ALTIMETER	YES	YES
LABS WEAPON DELIVERY	YES	PROVISIONS
CP-741 WEAPON DELIVERY	YES	PROVISIONS
FULL CAPABILITY PYLONS	YES	NO

[1]PROVISIONS FOR OUTBOARD STATIONS

Options

- 30-MM GUNS
- DRAG CHUTE
- GASEOUS OXYGEN

TA-4F

The Skyhawk Series of aircraft is the product of a planned effort in simple, careful design. Since its initial introduction into service, these outstanding aircraft have flown over 3,500,000 hours, with 400,000 in combat. The Skyhawk has established itself as being the lowest cost, high-performance tactical aircraft with proven combat survivability and safety. The Skyhawk Trainer provides:

- Simple and rugged construction.
- Outstanding combat survivability record.
- Low maintenance.
- Multiple mission capability.
- Forward base and aircraft carrier operations.

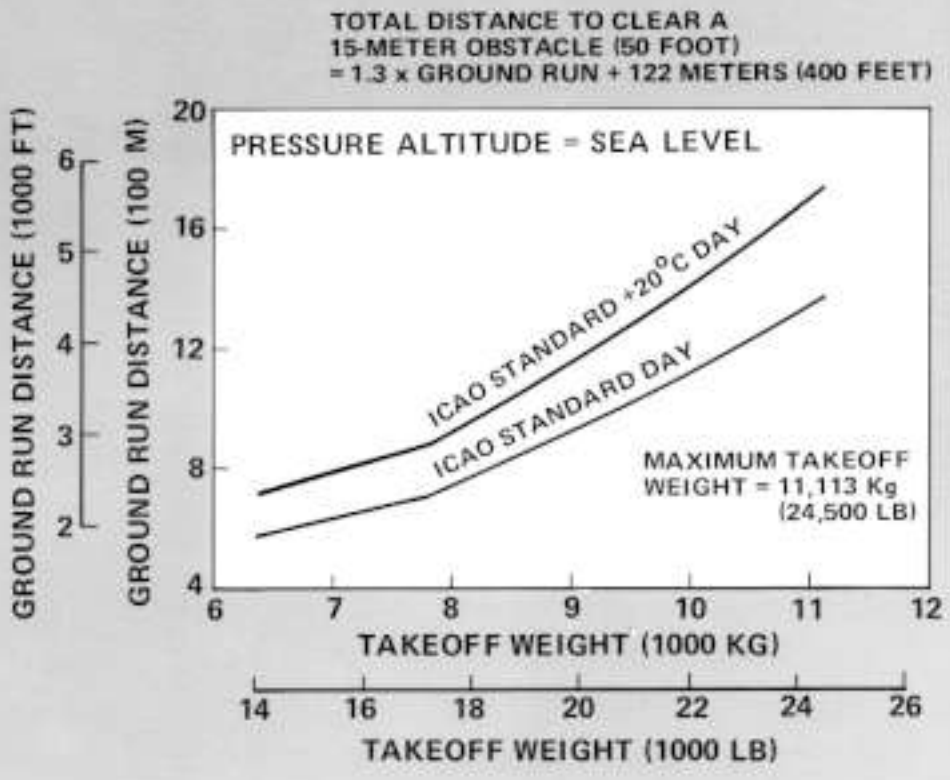
CONCLUSION

OPERATIONAL TAKEOFF DISTANCE

MODEL TA-4F/TA-4J
J52-P-8B ENGINE

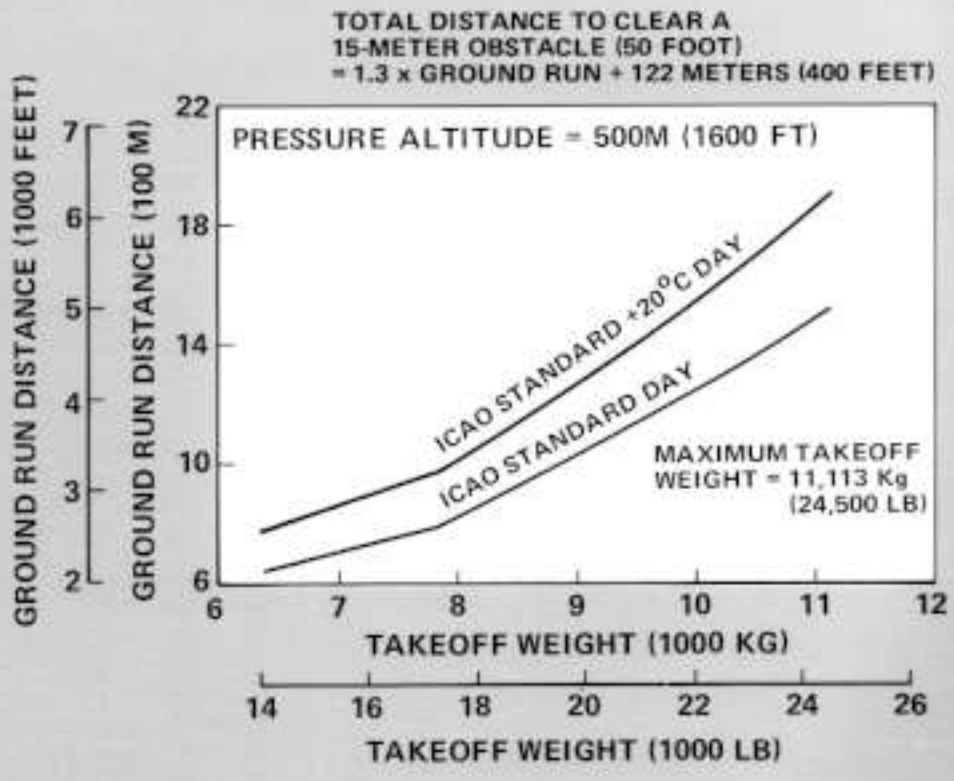
HALF FLAPS
ZERO GRADIENT
MILITARY THRUST
ZERO WIND

HARD SURFACE RUNWAY



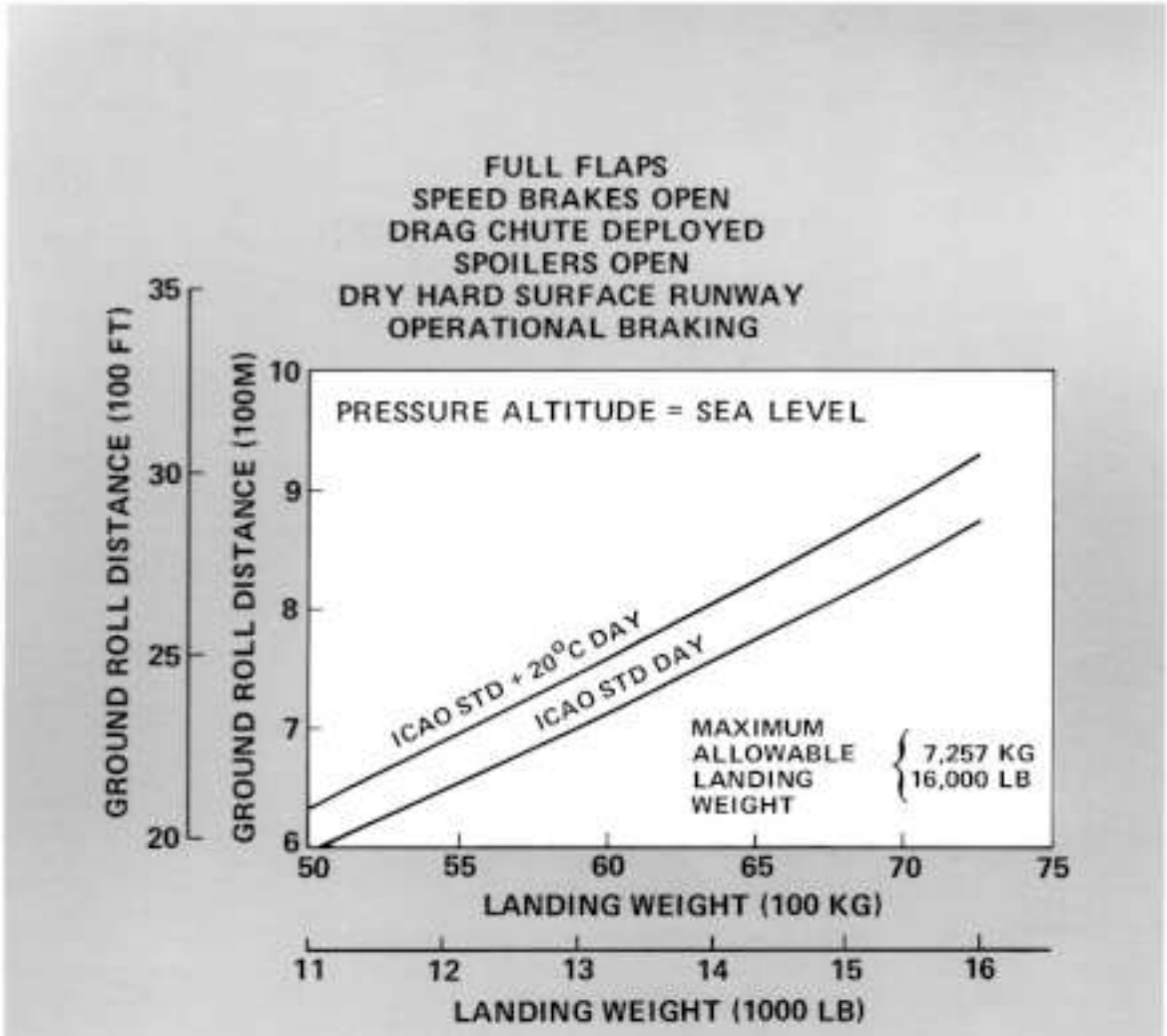
HALF FLAPS
ZERO GRADIENT
MILITARY THRUST
ZERO WIND

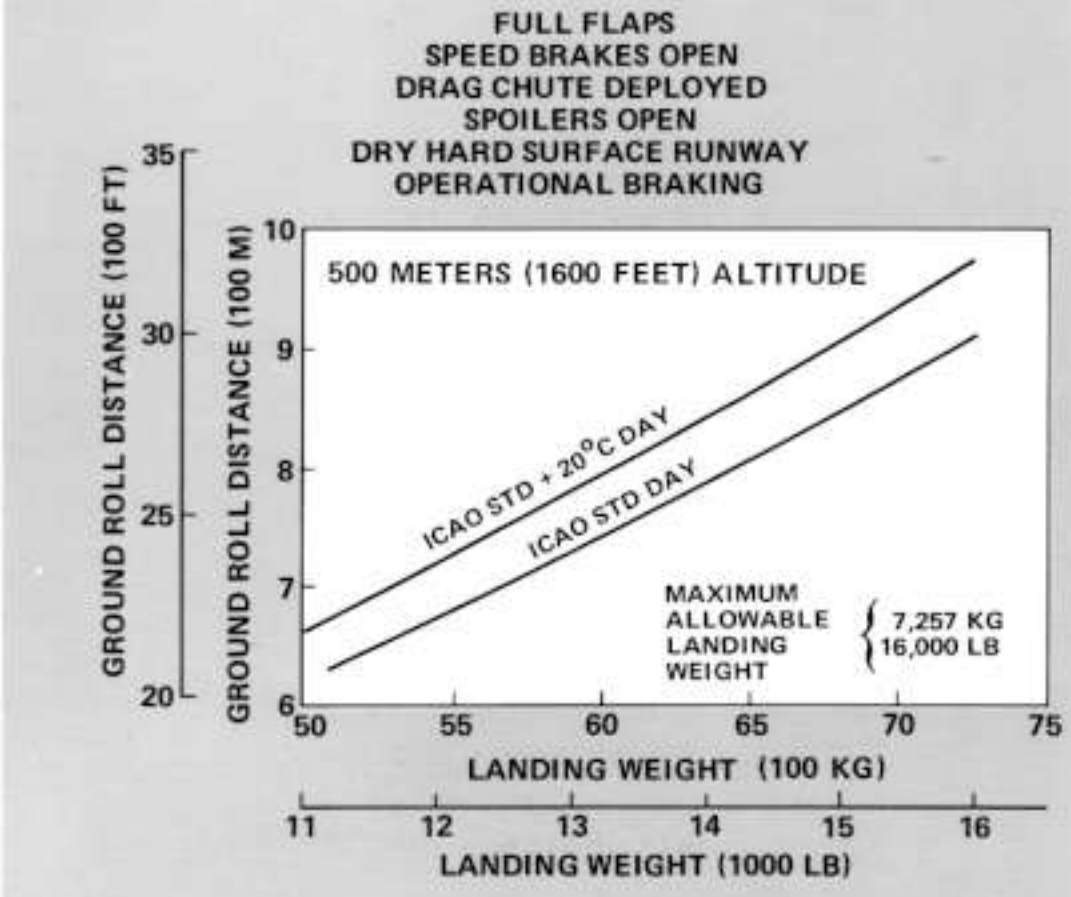
HARD SURFACE RUNWAY



LANDING GROUND ROLL

MODEL TA-4F/TA-4J



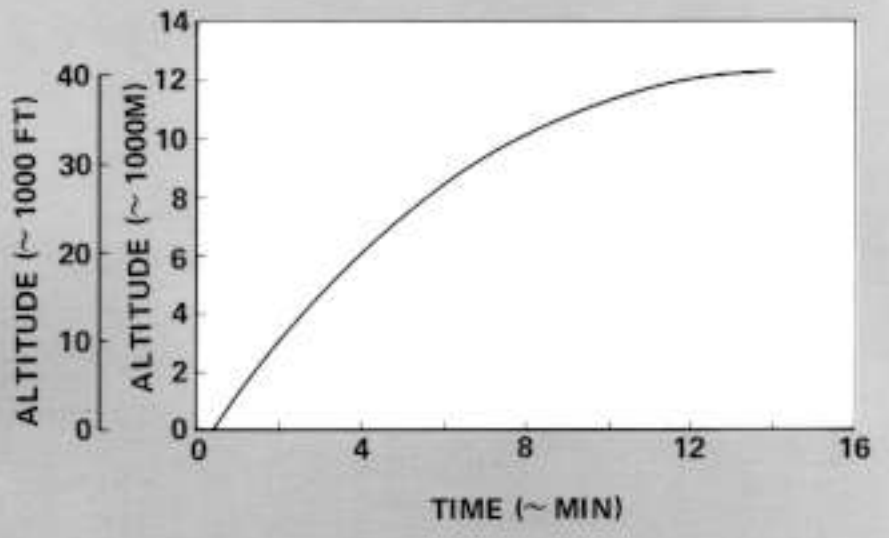


MODEL TA-4F
J52-P-8B ENGINE

TIME FROM BRAKE RELEASE TO ALTITUDE

MILITARY THRUST ICAO STD DAY

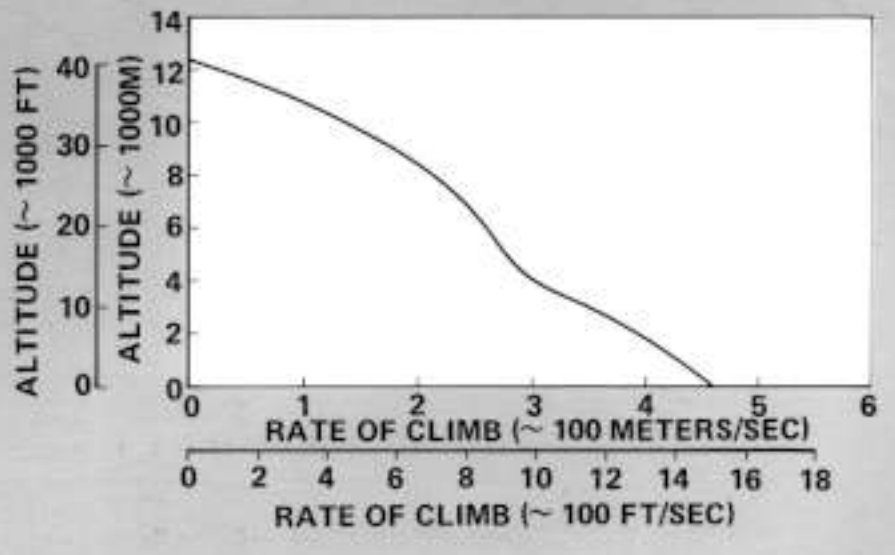
LOADING
3 PYLONS
2 AAM'S
20 MM GUNS AND 200 ROUNDS
FULL INTERNAL FUEL
T.O. WEIGHT = 7,706 KG (16,989 LB)



RATE OF CLIMB

MILITARY THRUST ICAO STD DAY

LOADING
3 PYLONS
2 AAM'S
20 MM GUNS AND 200 ROUNDS
FULL INTERNAL FUEL
T.O. WEIGHT = 7,706 KG (16,989 LB)

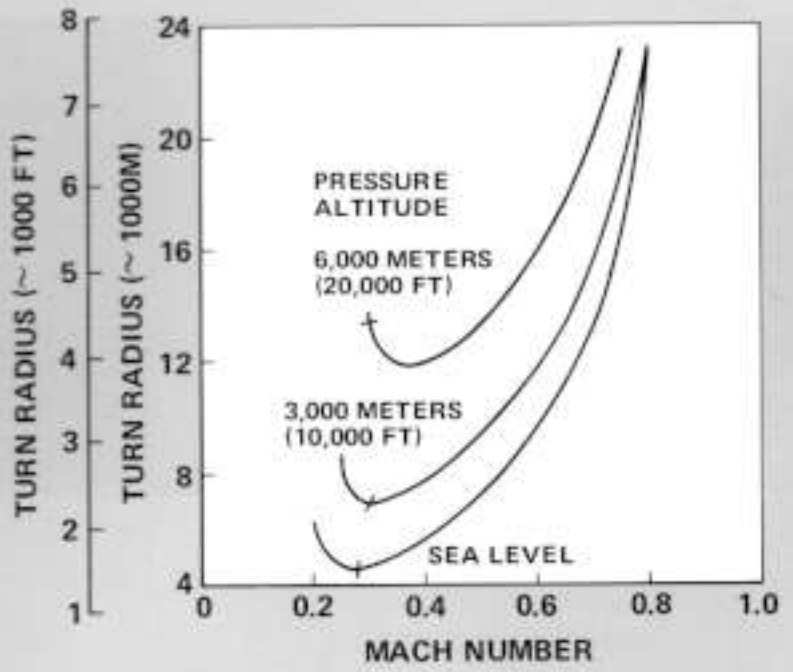


MODEL TA-4F
J52-P-8B ENGINE

TURN RADIUS

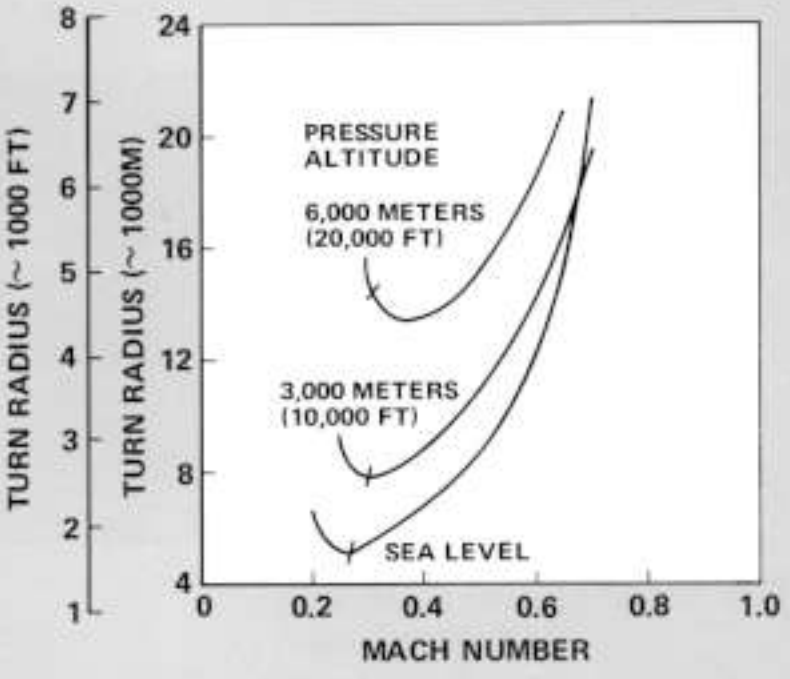
MILITARY THRUST ICAO STD DAY

LOADING: 3 PYLONS, 2 AAM'S, 20 MM GUNS AND 200 RDS
60% INTERNAL FUEL
WEIGHT = 6,892 KG (15,194 LB)



MILITARY THRUST ICAO STD + 20°C DAY

LOADING: 3 PYLONS, 2 AAM'S, 20 MM GUNS AND 200 RDS
60% INTERNAL FUEL
WEIGHT = 6,892 KG (15,194 LB)

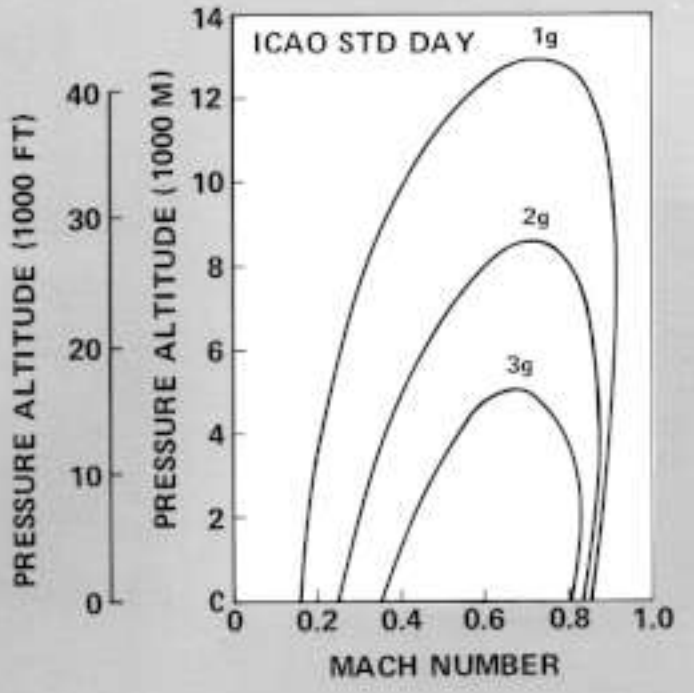


STEADY-STATE
PERFORMANCE
ENVELOPE

MODEL TA-4F
J52-P-8B ENGINE

MILITARY THRUST ICAO STD DAY

LOADING: 3 PYLONS, 2 AAM'S, 20 MM GUNS AND 200 RDS
60% INTERNAL FUEL
WEIGHT = 6,892 KG (15,194 LB)

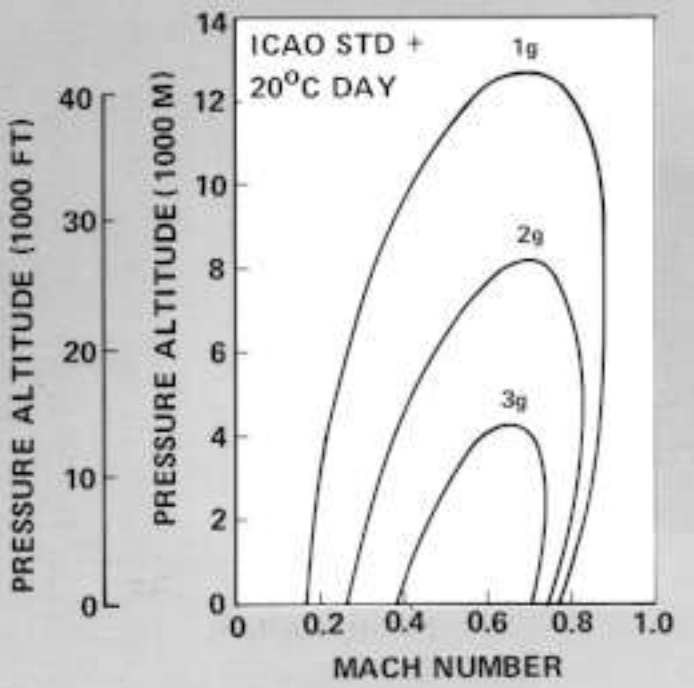


STEADY-STATE
PERFORMANCE
ENVELOPE

MODEL TA-4F
J52-P-8B ENGINE

MILITARY THRUST ICAO STD + 20°C DAY

LOADING: 3 PYLONS, 2 AAM'S, 20 MM GUNS AND 200 RDS
60% INTERNAL FUEL
WEIGHT = 6,892 KG (15,194 LB)

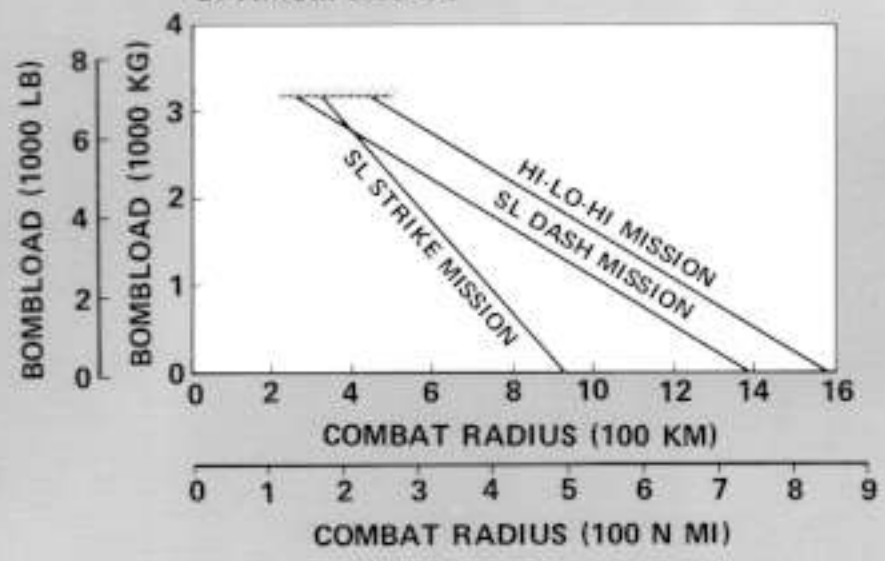


BOMBLOAD VS COMBAT RADIUS

MODEL TA-4F
J52-P-8B ENGINE

ICAO STD DAY JP-1 FUEL

20 MM GUNS AND 200 RDS AMMUNITION
EXT TANKS (IF ANY) RETAINED
MK 82, 83 AND 84 BOMBS
MAX T.O. WT = 11,113 KG (24,500 LB)
LANDING RESERVE FUEL = 227 KG (500 LB)
OPTIMUM CRUISE

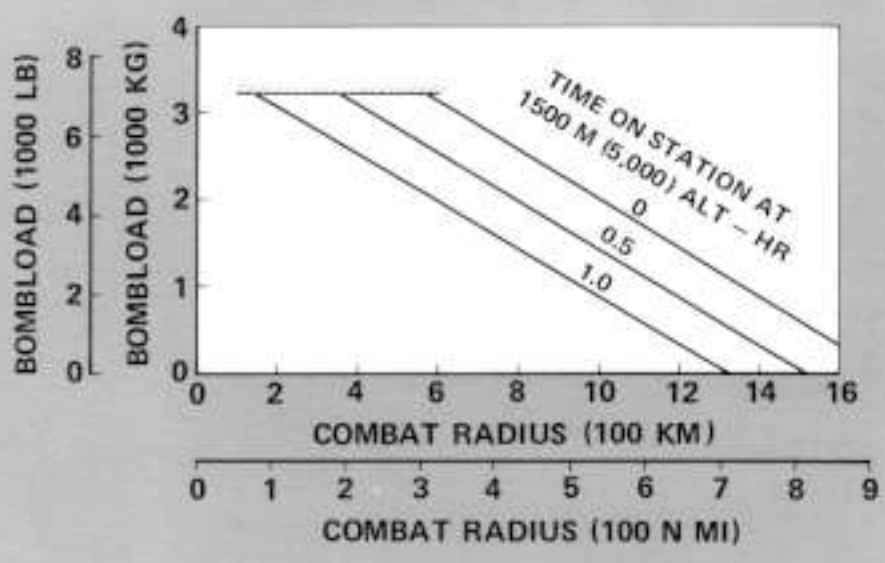


NOTE: DO NOT ATTEMPT TO COMPARE DATA FROM THIS FIGURE WITH TABULATED DATA ON PAGES 6 AND 7. THESE DATA INCLUDE MAXIMUM ALLOWABLE EXTERNAL FUEL. DATA ON PAGES 6 AND 7 ARE LIMITED TO TWO 300 GALLON EXTERNAL TANKS.

CLOSE AIR SUPPORT MISSION

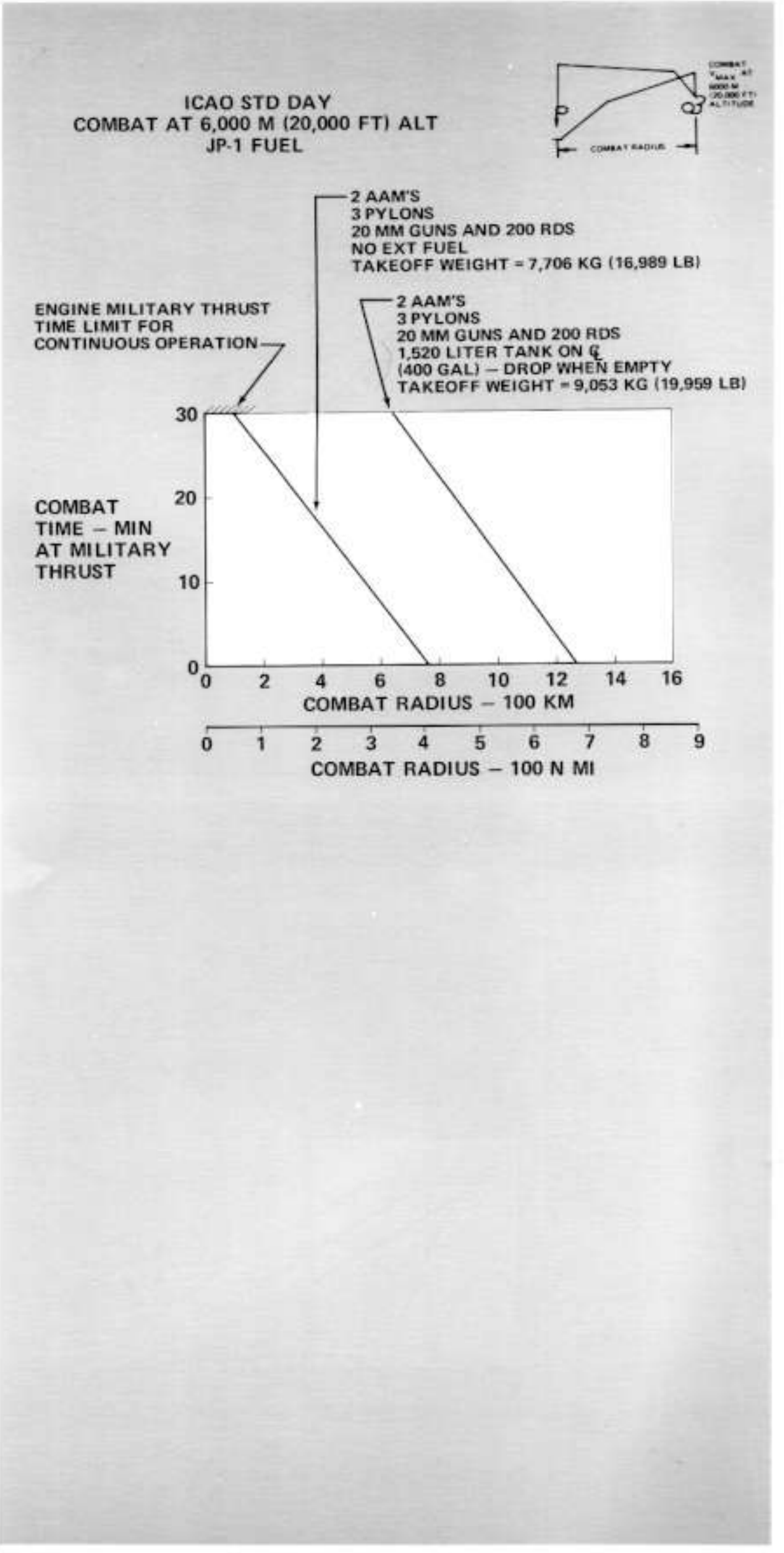
JP-1 FUEL ICAO STD DAY

20 MM GUNS AND 200 RDS AMMO
EXT TANKS (IF ANY) RETAINED
MK 82, 83 AND 84 BOMBS
MAX T.O. WT = 11,113 KG (24,500 LB)
LANDING RESERVE FUEL = 227 KG (500 LB)



COMBAT TIME VS RADIUS

MODEL TA-4F
J52-P-8B ENGINE




NAVY
259
3F
NAVY
260
3F
NAVY
261
VT-22
3F
262
NAVY
VT-22

SINGLE-PLACE SKYHAWK

COMPARISON WITH SINGLE-PLACE MODEL

The primary characteristics of the two-place Skyhawk discussed so far apply equally to the single-place models.

As this brochure deals primarily with the two-place Skyhawks, the principal dimensions and characteristics of the single-place model are shown here for comparison.

WING SPAN	8.38M	27.5 FT
LENGTH	12.6M	41.3 FT
HEIGHT	4.57M	15.0 FT
WHEEL BASE	3.57M	11.7 FT
TREAD	2.38M	7.8 FT
BASIC WEIGHT EMPTY[1]	5,665 KG	12,489 LB
MAXIMUM TAKEOFF WEIGHT	11,567 KG	25,500 LB

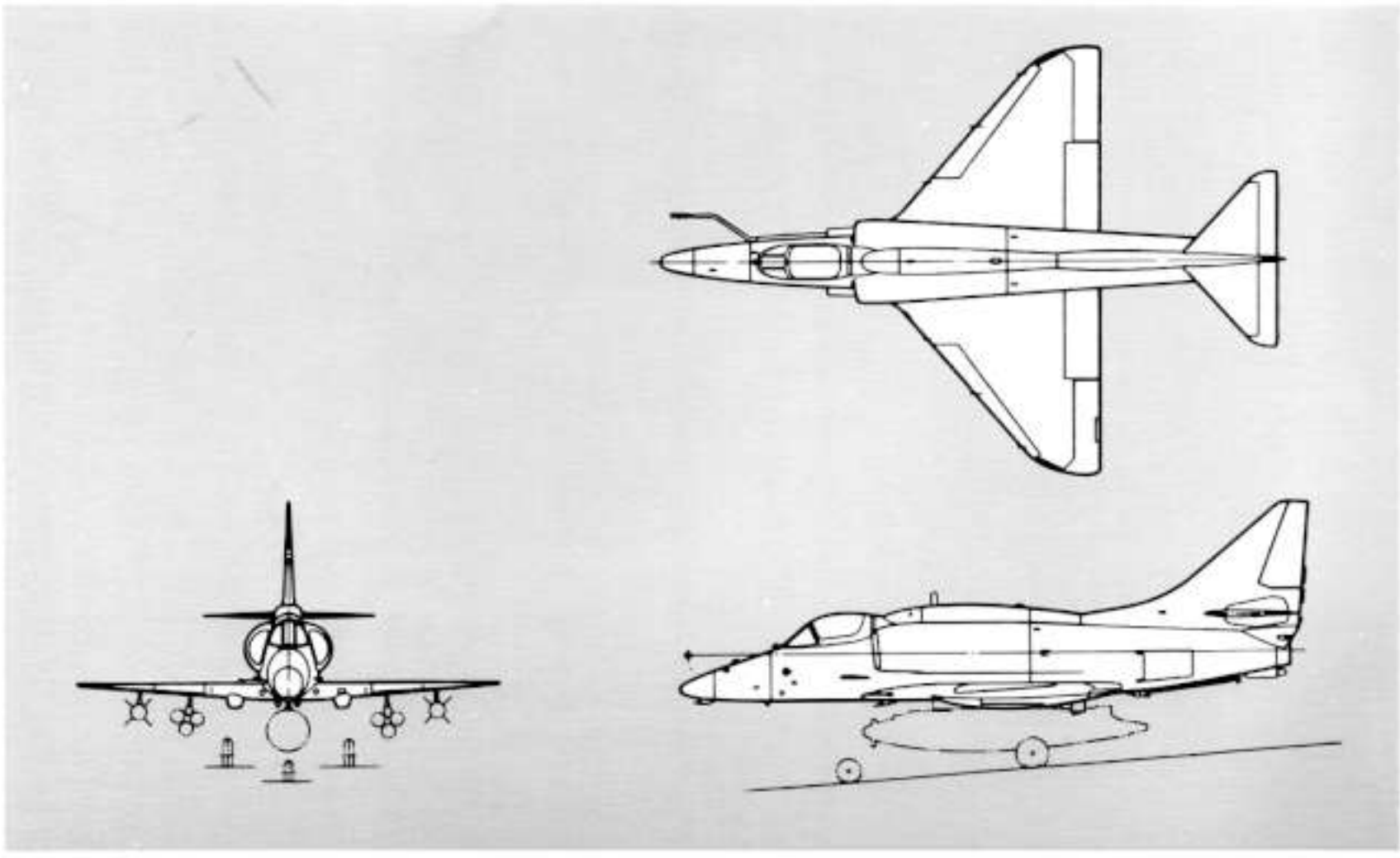
ENGINE (PRATT & WHITNEY, J52-P-408)

	SEA LEVEL STATIC	SFC[2]
MILITARY THRUST (30 MINUTES)	5,080 KG/11,200 LB	0.89
MAXIMUM CONTINUOUS	4,490 KG/9,900 LB	0.84

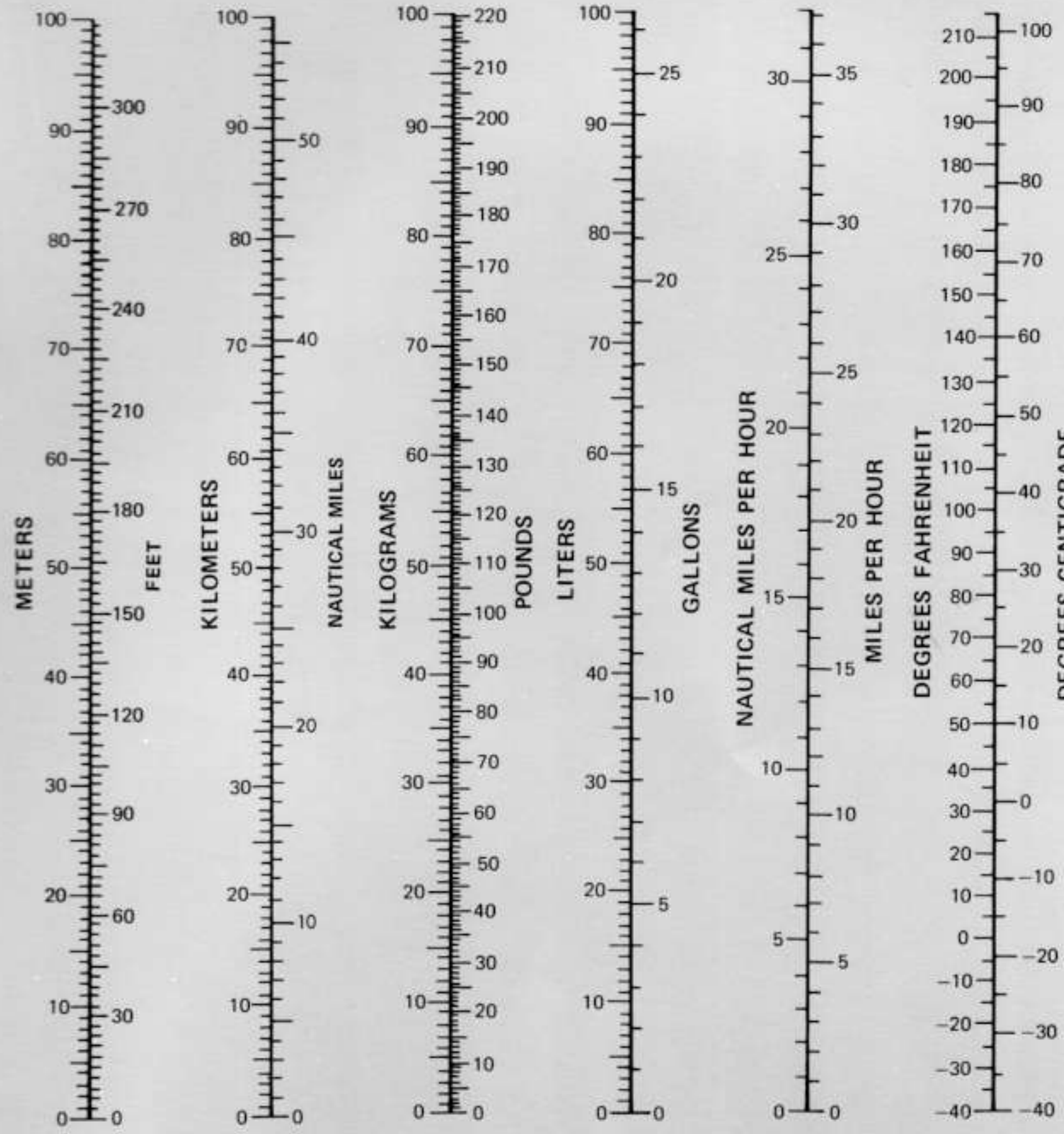
NOTES:

(1) BASIC WEIGHT EMPTY INCLUDES WEAPON DELIVERY AND NAVIGATION SYSTEM, TWO 30-MM DEFA GUNS WITH 280 ROUNDS OF AMMUNITION, ARMOR PLATE, FIVE PYLONS, CHAFF AND DISPENSER.

(2) LB/HR/LB.



CONVERSION SCALES



FEET	X 0.3048	= METERS		X 3.2808	= FEET
MILES	X 1.6093	= KILOMETERS		X 0.6214	= MILES
KILOGRAMS	X 2.2046	= POUNDS		X 0.4536	= KILOGRAMS
LITERS	X 0.2642	= GALLONS		X 3.7853	= LITERS
NAUT MILES	X 1.1516	= MILES		X 0.8684	= NAUT MILES
DEG CENT.	X 9/5 +32	= FAHRENHEIT		−32 X 5/9	= CENTIGRADE
NAUT MILES	X 1.3975	= KILOMETERS		X 0.5396	= NAUT MILES

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