MAJ Atchison

A-7D TACTICAL FIGHTER

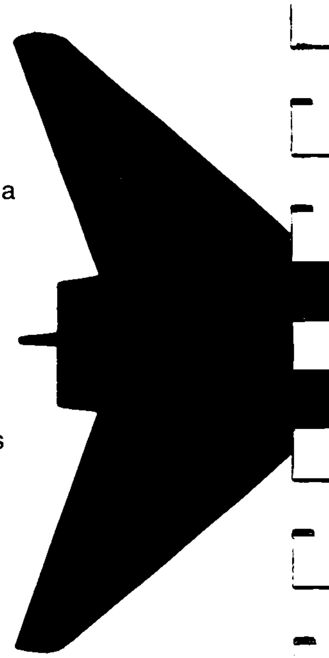
INTRODUCTION

Preface

An aerospace industry-wide competition began in 1963 for a new light-attack airplane. In November of that year LTV Aerospace Corporation was named winner. First flight of the Navy A-7 was made in September 1965, 1 month ahead of schedule. The U.S. Air Force and Office of the Secretary of the Defense conducted an effectiveness study that led to the decision in December 1965 to acquire an Air Force version of the A-7. In May 1966, the Air Force selected a preliminary configuration. This configuration included the addition of an M61 cannon and the Rolls Royce/Allison TF41-A-1 Spey turbofan engine, designed to provide improved takeoff performance, high-subsonic level flight capability and an extended radius of action.

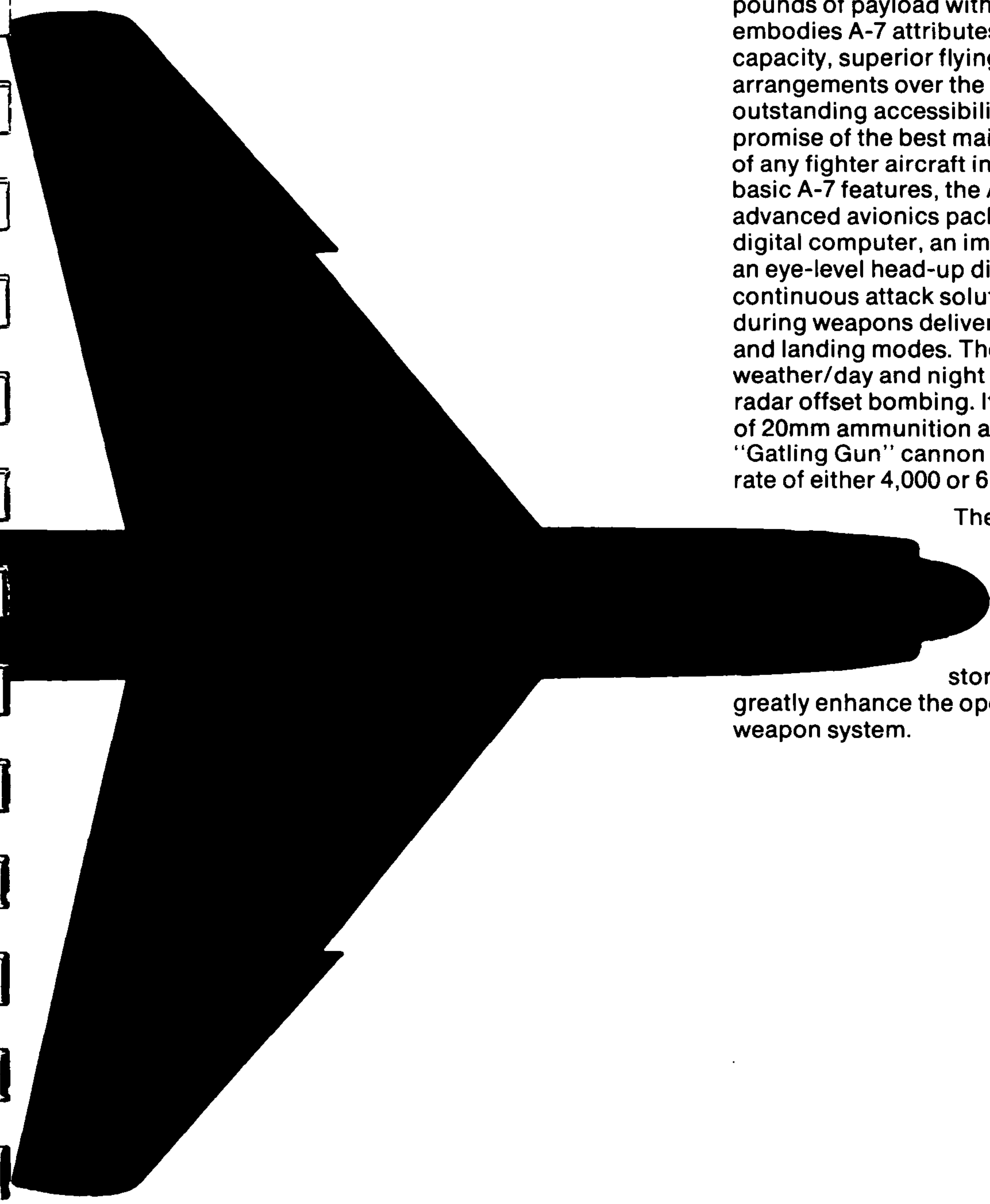
Negotiations with the Air Force resulted in a letter contract being issued to LTV for a modified A-7 (A-7D) model in August 1966, and a letter contract was issued to LTV Aerospace Corporation in October 1966. The contract provided for further study of such items as brakes, improved life support subsystem, and new weapon delivery avionics.

The complete weapon system was approved and authorized in December 1967 and the first A-7D was accepted by the Air Force exactly 1 year later.



Concept

The A-7D is a single-place tactical fighter and light attack airplane capable of delivering up to 15,000 pounds of payload with unprecedented accuracy. It embodies A-7 attributes such as a high internal fuel capacity, superior flying qualities with multiple stores arrangements over the entire speed range, and outstanding accessibility and serviceability, with promise of the best maintenance-to-flight-time ratio of any fighter aircraft in service. In addition to these basic A-7 features, the A-7D provides a highly advanced avionics package, including a central digital computer, an improved Doppler radar set, and an eye-level head-up display to provide the pilot with continuous attack solutions and navigation data during weapons delivery, enroute, terrain following and landing modes. These systems enhance the all-weather/day and night bombing capability, including radar offset bombing. It is equipped with 1,000 rounds of 20mm ammunition and a six-barreled M61 Vulcan "Gatling Gun" cannon with a pilot-selectable firing rate of either 4,000 or 6,000 rounds-per-minute.



The vast flexibility in armament and the tradeoffs available (in terms of fuel offload for increased payloads, or range extension at the same payloads with droppable fuel stores, and/or inflight refueling) greatly enhance the operational utilization of the weapon system.

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Introduction

This report presents information on the avionic navigation-weapon delivery systems, ordnance capabilities, delivery accuracy, and mission and maneuvering performance of the A-7D. For purposes of this report, information is based on the aircraft "27 and subsequent" configuration.

The Air Force A-7 tactical fighter incorporates the latest weapon delivery avionics with superior flying qualities with large store loads, and provides the most versatile and effective weapon delivery platform for close support and interdiction roles.

AIRPLANE CHARACTERISTICS

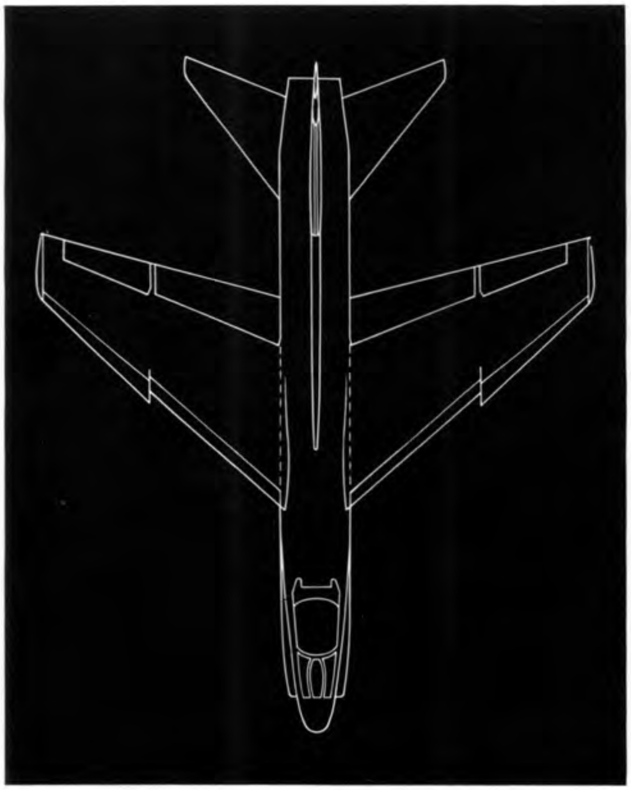
GENERAL

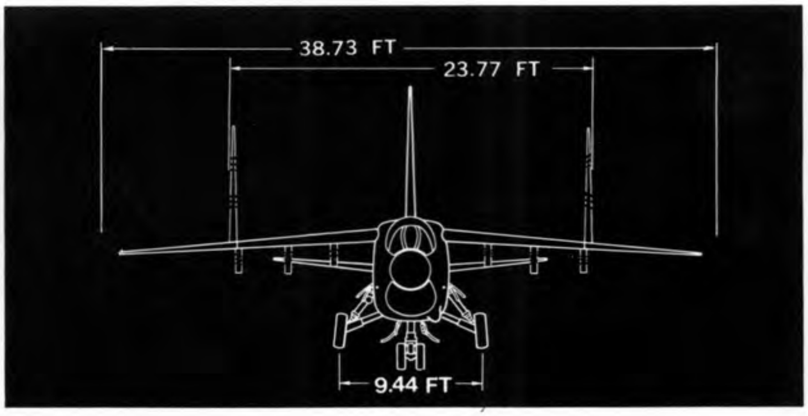
CONTINUOUSLY COMPUTED ATTACK SOLUTIONS
FULL-TIME AIR ALIGNED NAVIGATION SYSTEM
PILOT'S DISPLAY INTEGRATION (HUD)
NEW ERA OF PILOTING EASE
INCREASED WEAPONS ACCURACY
PRESTORED DESTINATIONS
ENHANCED FLEXIBILITY
REATTACK CAPABILITY
NAVIGATION ACCURACY
IMPROVED ECM
IMPROVED SURVIVABILITY AND SYSTEM SAFETY
IMPROVED MAINTENANCE AND TURNAROUND
SELF-DEFENSE CAPABILITY

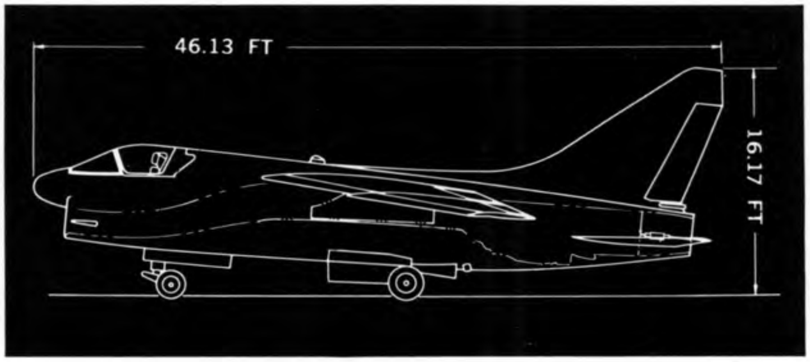
Airplane Characteristics

WEIGHT EMPTY—LB*			19,258
FUEL (JP-4)	INTERNAL	LB	9,263
		GAL.	1,425
	EXTERNAL	LB	7,800
		GAL.	1,200
STORE STATIONS			
	WING		6
	FUSELAGE		2
ENGINE			TF41-A-1
THRUST, SL STATIC		LB	14,250
INTERNAL GUN		20mm	M61a1
	AMMUNITION—20mm		1,000 rd

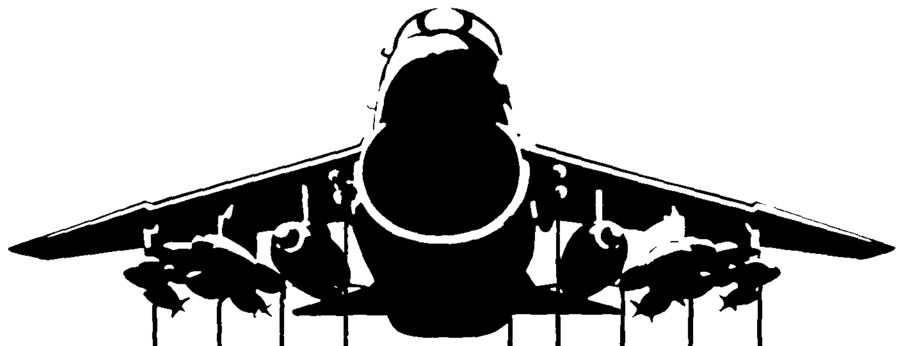
*Detail Specification SD-555-4 plus RAD ECPs





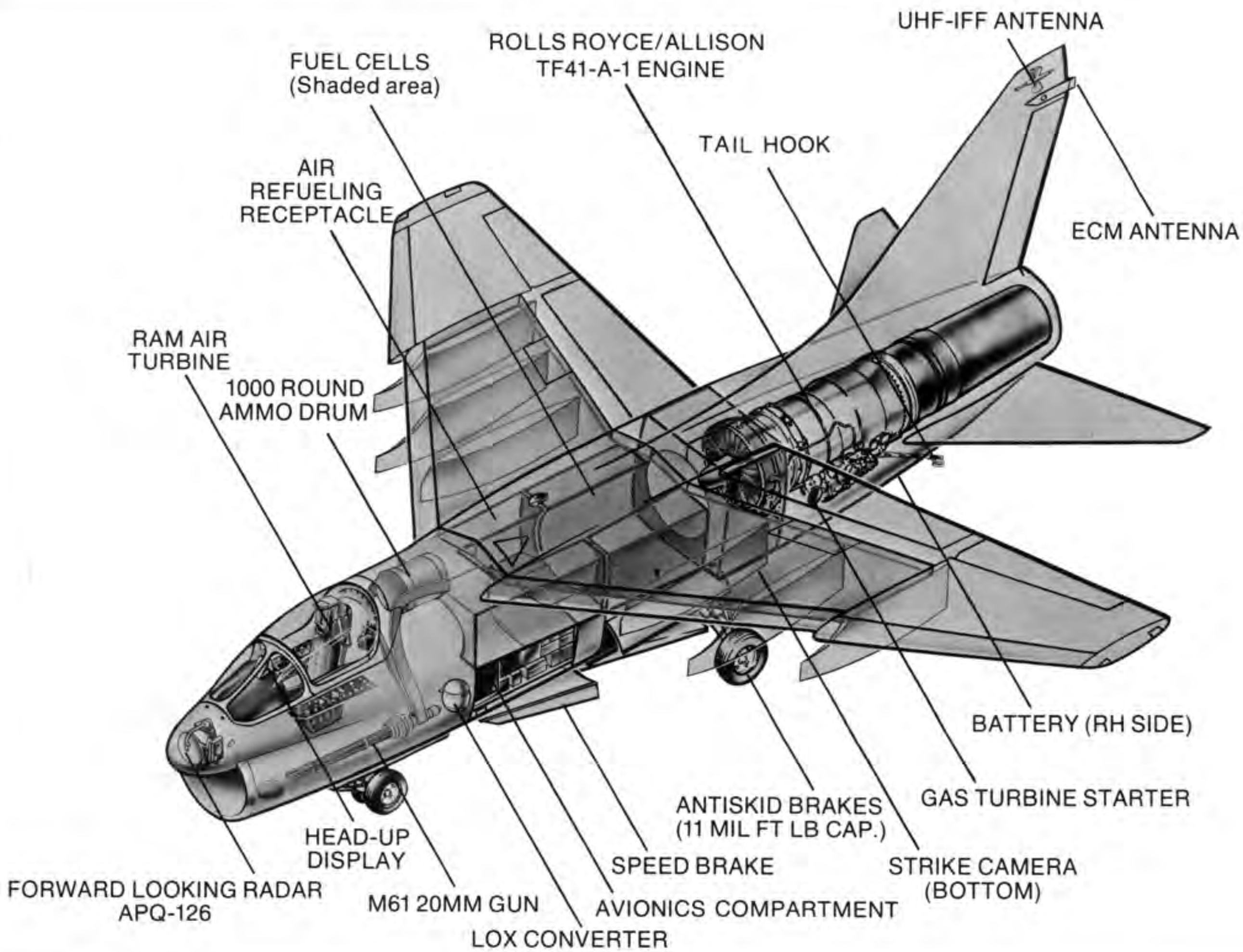


Ordnance Capability



M61A1 20MM GUN (INTERNAL)

STATION	8	7	6	5	4	3	2	1
NOMINAL PYLON CAPACITY IN LBS.	3500	3500	2500	500	500	2500	3500	3500
BOMBS AND FIRE BOMBS	●	●	●			●	●	●
ROCKETS	●	●	●			●	●	●
MINES	●	●	●			●	●	●
DISPENSERS	●	●	●			●	●	●
MISSILES (AIR-TO-GROUND)	●	●	●			●	●	●
SPECIAL PURPOSE: FLARES	●							●
SPECIAL PURPOSE: TRAINER (SUU-20)		●					●	
SPECIAL PURPOSE: LEAFLET	●							●
SPECIAL PURPOSE: TOW TARGET								●
CHEMICAL/BIOLOGICAL	●							●
ECM PODS	●							●
FUEL TANK	●		●			●		●
MISSILES (AIR-TO-AIR)				●	●			


UHF-IFF ANTENNA
ROLLS ROYCE/ALLISON
TF41-A-1 ENGINE
FUEL CELLS
(Shaded area)
TAIL HOOK
AIR
REFUELING
RECEPTACLE
ECM ANTENNA
RAM AIR
TURBINE
1000 ROUND
AMMO DRUM
BATTERY (RH SIDE)
ANTISKID BRAKES
(11 MIL FT LB CAP.)
GAS TURBINE STARTER
HEAD-UP
DISPLAY
SPEED BRAKE
STRIKE CAMERA
(BOTTOM)
FORWARD LOOKING RADAR
APQ-126
M61 20MM GUN
AVIONICS COMPARTMENT
LOX CONVERTER

Comparison of A-7D to A-7A/B

The A-7D differs from the A-7A/B as follows:

- Thrust increased from 11,350 to 14,250 pounds
- Ordnance delivery error from 20 mil to 10 mil
- Receptacle provided for Air Refueling Boom
- Avionics package improved to provide:
  - integrated bombing and navigation capability
  - head-up display (HUD)
  - tactical computer
  - projected map display (provisions)
- Survivability increased to best maximum:
  - all foam-filled fuel tanks
  - three separate power control systems
  - back-up controls, system redundancy
  - extensive ceramic and steel armor
  - ECM
- 20mm M61-A-1 gun
- Antiskid brake system

Reliability (AS-1652)

AIRPLANE WEAPON SYSTEM

RELIABILITY: 77.5% (MIN.) FOR 2.3 HOUR MISSION DESCRIBED
MAINTAINABILITY: 9.5 DMMH/FH (MAX)*

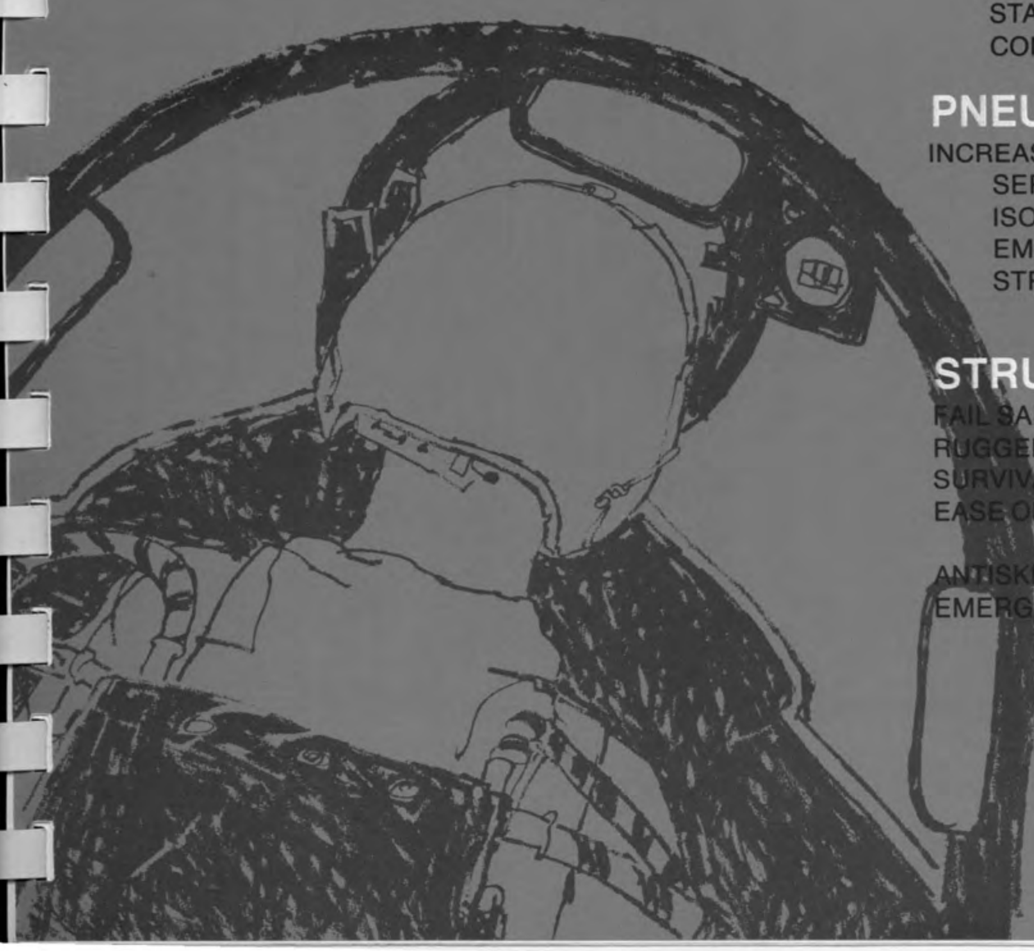
*Correction of defect(s) applies if DMMH/FH > 12.5

NAVIGATION WEAPON DELIVERY SYSTEM (NWDS)

("Bench" Tested in Accordance with MIL-STD-781A)

• DOPPLER RADAR SYSTEM (DRS)	500	HOUR, SPEC MTBF
• FORWARD LOOKING RADAR (FLR)	250	HOUR, SPEC MTBF
• HEAD-UP DISPLAY (HUD)	700	HOUR, SPEC MTBF
• AIR DATA COMPUTER (ADC)	1,000	HOUR, SPEC MTBF
• NAVIGATION/WEAPON DELIVERY COMPUTER (NWDC)	1,300	HOUR, SPEC MTBF
• INERTIAL MEASUREMENT SYSTEM (IMS)	650	HOUR, SPEC MTBF
• PROJECTED MAP DISPLAY SYSTEM (PMDS)	1,000	HOUR, SPEC MTBF
• INTERFERENCE BLANKING SET (IBS)	3,500	HOUR, SPEC MTBF
• ARMAMENT STATION CONTROL UNIT (ASCU)	1,000	HOUR, SPEC MTBF

SYSTEMS



PROPULSION

INCREASED THRUST
INCREASED LOW ALTITUDE PERFORMANCE
SHORT TAKEOFFS
ENHANCED POPUP
HIGHER CRUISE ALTITUDES
INCREASED VMAX
MANEUVERABILITY
SELF-START CAPABILITY
COOLER EXIT NOZZLE

FUEL SYSTEM

SIMPLICITY – NO MOVING PARTS (EJECTOR PUMPS)
SURVIVABILITY
- ALL CELLS FILLED WITH FOAM BAFFLES
- ALTERNATE FUEL FEED SYSTEM
- SELF-SEALING CELLS PROVIDE 300 NAUTICAL-MILE RETURN

AIR REFUELING – BOOM RECEPTACLE
MAINTENANCE ADVANTAGES (SIMPLIFIED SYSTEM)

ELECTRICAL

EMERGENCY POWER FOR
- APPROACH ATTITUDE INDICATOR
- STALL WARNING SYSTEM
- CONTROL SYSTEMS

PNEUDRAULIC

INCREASED SURVIVABILITY
- SEPARATED INTEGRAL SYSTEMS
- ISOLATED UTILITY SYSTEMS
- EMERGENCY CONTROL – UHT YOKE
- STRUCTURAL ROUTING AND REDUNDANCY

STRUCTURE

FAIL SAFE
RUGGED – HIGH LOAD CAPABILITY
SURVIVABLE – MULTIPLE TORQUE BOXES
EASE OF MAINTENANCE – NONSTRUCTURAL DOORS
ANTISKID BRAKE SYSTEM
EMERGENCY NOSEWHEEL EXTENSION

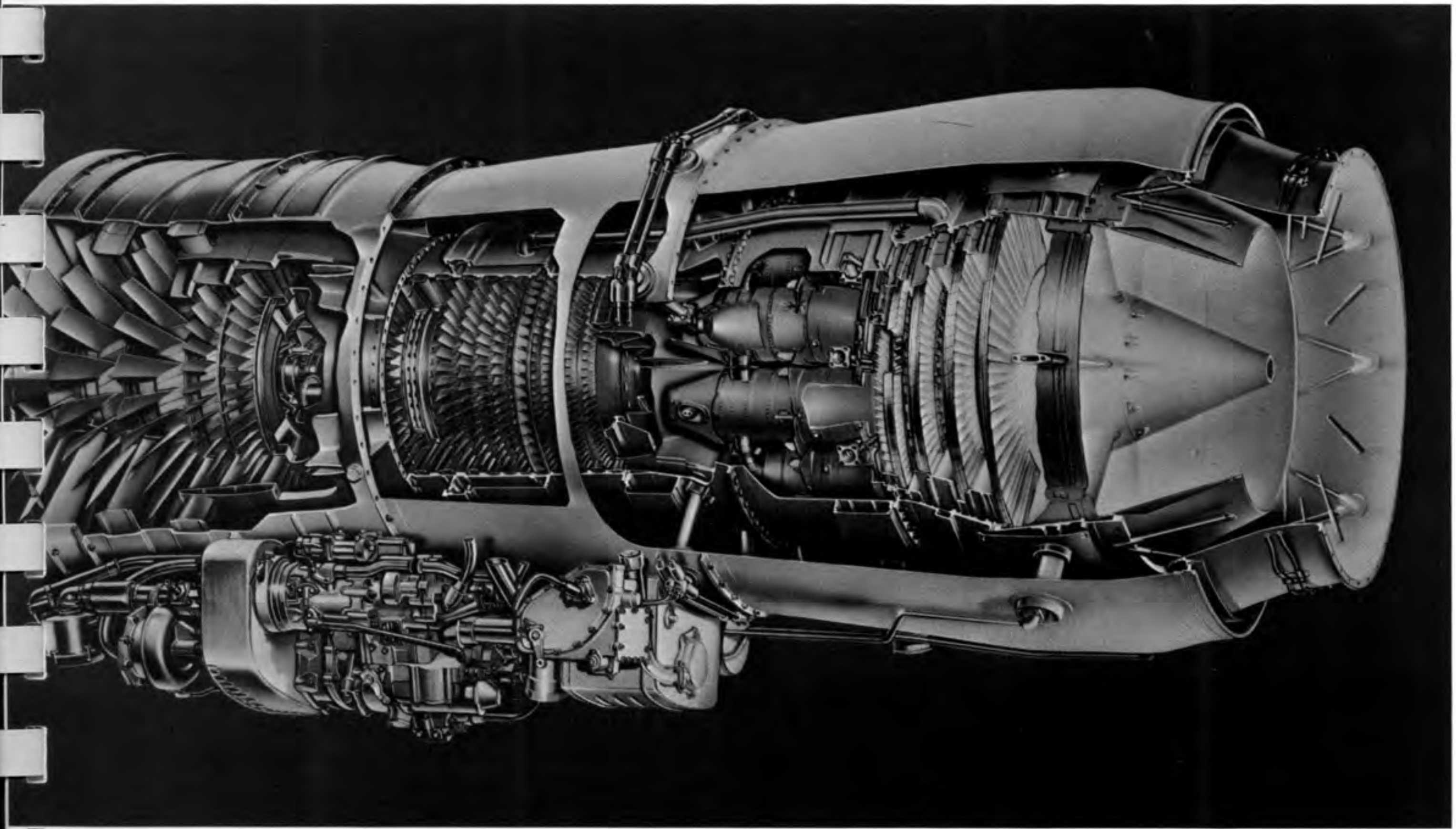
Propulsion

The A-7D is powered by the Allison/Rolls Royce TF41-A-1 nonafterburning turbofan jet engine with a static thrust rating of 14,250 pounds. This engine was selected to provide optimum low-altitude performance, shorter takeoff distances, increased popup capability, higher cruise ceilings and speeds, and increased maneuverability.

A self-start capability is provided. Normal ground starting power is supplied by an air breathing STU 26/A gas turbine starter, mounted on the engine accessory gearbox, which burns jet fuel supplied by the airplane fuel system. Starter initiation power is supplied by an aircraft-mounted, nickle-cadmium battery. (External electrical power is not required, but in the event of battery failure, it can be used.) The starter mechanically drives the engine, which is equipped with an electrical alternator for engine ignition. The alternator also supplies electrical power for air starting by either the automatic relight system or by a manually controlled normal air start.

In the automatic relight system, a flameout sensor, which is basically a differential pressure diaphragm arranged with one chamber restricted, senses a rapid change in pressure associated with a flameout. The diaphragm then moves to operate a switch which turns on ignition.

The engine design features two-spool axial-flow compressors driven by a low-pressure and a high-pressure turbine. A bypass duct directs a portion of the air from the fan compressor around the combustion section and back into the exhaust. An annular mixer blends bypass air with turbine exhaust gas for more efficiency and a cooler exit nozzle, which provides major advantages in terms of increased survivability against heat-seeking missiles.



Fuel System

The internal fuel system of the A-7D consists of six fuselage cells and an integral wing tank. Ejector pumps deliver engine fuel from the main sump cell. Ejector-type fuel pumps transfer fuel from the wing and aft cell into the sump cell. Fuel can also be supplied to the sump cell by gravity flow. The sump cell and lower one-third portion of the aft fuselage cell are self-sealing to allow sufficient fuel for a 300-nautical-mile range.

An alternate fuel feed system is incorporated in the aircraft that will permit transfer of fuel from the aft tank or wing tank directly to the engine should the main sump tank feed system become damaged.

The usable fuel in the fuselage is distributed as follows:

Forward (two bladder-type cells)	173 gallons
Mid (two bladder-type cells)	146
Sump (self-sealing)	76
Aft (lower third self-sealing remainder bladder)	310
	705 gallons

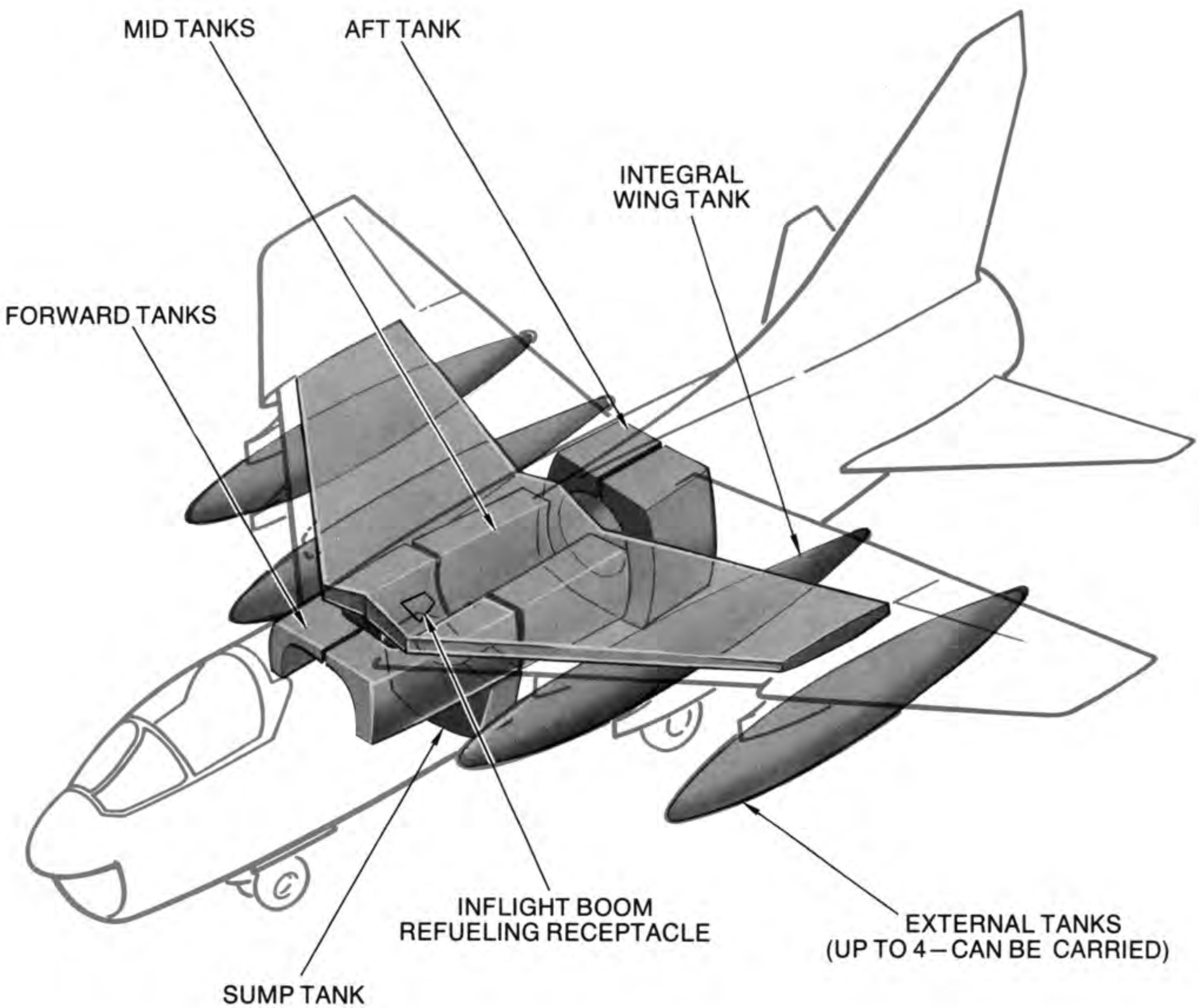
In addition, the integral wing tank contains 720 gallons, and also serves as the vent tank for the total integral fuel system (whose total usable fuel capacity is 1,425 gallons.) A total of 1,200 gallons of external fuel may be carried on the wing stations.

Pressure fueling is accomplished through a wheel-well receptacle; gravity fueling can be done through wing and fuselage points. The A-7D is also equipped with a fuel receptacle opening behind the cockpit for inflight refueling by tankers equipped with the flying boom system.

For defueling, all internal fuel can be removed without external electrical power or air pressure, by applying suction to the pressure fueling receptacle. All wing fuel can be removed before the fuselage cells begin to empty. (Wing fuel can be jettisoned in flight by gravity flow within 7.5 minutes.) External stores defueling requires external air pressure which transfers fuel from the stores into fuselage cells where it is then removed in the same manner as fuselage fuel.

All internal fuel cells are filled with reticulated polyurethane orange foam baffles which keep the cells sufficiently fuel rich to avoid combustion. The baffles do not restrict flow.

The main fuel quantity gaging system for the A-7D includes cockpit indication of total fuel, both internal and external fuel (by a dual-pointer counter) and a fuel flow gage.


MID TANKS
AFT TANK
INTEGRAL
WING TANK
FORWARD TANKS
INFLIGHT BOOM
REFUELING RECEPTACLE
EXTERNAL TANKS
(UP TO 4—CAN BE CARRIED)
SUMP TANK

200 AMP TRANSFORMER
RECTIFIER UNIT

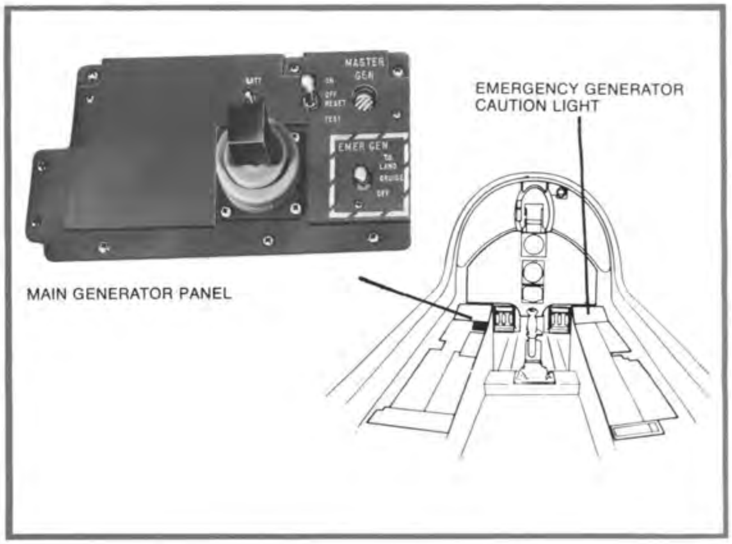
MAIN GENERATOR AND
EXTERNAL POWER CONTACTOR
RELAY (RH AVIONICS COMPT)

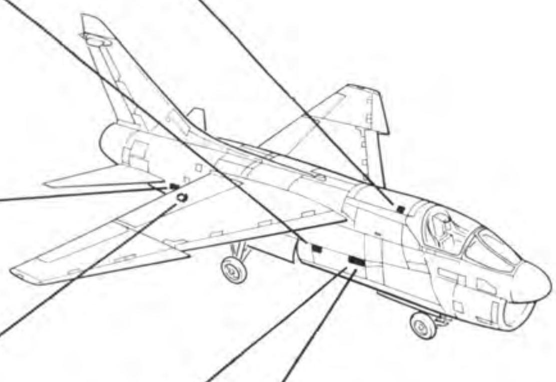
GENERATOR AND CONSTANT
SPEED DRIVE (ENGINE COMPT)

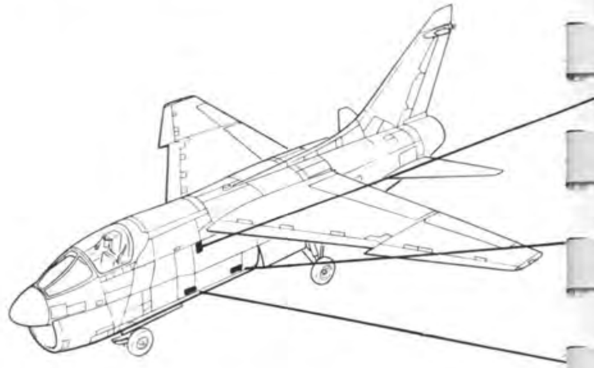
BATTERY

GENERATOR CONTROL PANEL
(RH AVIONICS COMPT)

RAM AIR TURBINE
(RAT)







Electrical

The main power supply system of the A-7D energizes the airplane buses with 115-volt ac, 3-phase, 400 cps power through the power distribution system to the electrically controlled or actuated systems. It provides regulated ac power and circuit protection to the airplane ac buses. The ac system consists of a master ac generator, generator control panel, constant current transformers, master generator switch, ac power relay, primary ac relay, emergency ac relay, and instrument transformer. A thermally-insulated, nickel-cadmium battery is used for starting and temporary emergency power. The battery is charged from a constant current charger and powers the battery bus and inverter.

The dc power system energizes the airplane dc buses with 28 volts dc, and consists of a transformer-rectifier, primary dc relay, and emergency dc relay. The emergency dc bus supplies power for the angle-of-attack indicating system and stall warning system.

The external power supply system consists of an external power receptacle, external power monitor, external power arming relay, and remote control switch.

The ram air turbine emergency power system provides emergency ac and dc electrical power for the primary and emergency buses and emergency hydraulic power for PC 1 hydraulic system circuits. It consists of emergency ac and dc relays, an extension relay, hydraulic valves, and the RAT. The RAT is self-contained, consisting of a four-bladed turbine-governor assembly, a hydraulic pump with limited variable displacement, and an ac/dc generator.

Only ac external power is required for ground maintenance.

MAIN GENERATOR
TEST PANEL
(LOX COMPT)

EXTERNAL POWER MONITOR
(LH AVIONICS COMPT)

EXTERNAL
AC POWER RECEPTACLE

Pneudraulic

The overall hydraulic system for the A-7D consists of three power sources and three pump systems arranged into three power control (PC) systems.

PC 1 operates one-half of all primary flight controls (except rudder), and one-half of the roll autopilot system.

PC 2 is coupled through a separate set of lines and dual actuators to operate one-half of the RH UHT, one-half rudder, one-half roll feel isolation, one-half pitch autopilot system, one-half RH aileron, and one-half RH spoiler. It also operates the inflight refueling receptacle, speed brake, M61A1 gun, utility system, and the hydraulic motor-driven fuel boost pump.

PC 3 is a completely separate, integral hydraulic system, backed up with an emergency air-turbine-driven pump which supplies sufficient pressure and flow for control of the airplane during cruise and landing conditions. It operates one-half of the LH aileron, one-half of the LH spoiler, one-half of the LH UHT, one-half of the feel isolation actuator and one-half of the rudder.

A pilot-controlled isolation valve is available to separate the utilities used in takeoff and landing from PC 2, so that a failure in any portion of the utility systems will not cause loss of fluid from PC 2 when the isolation valve is closed. The isolated utility systems are:

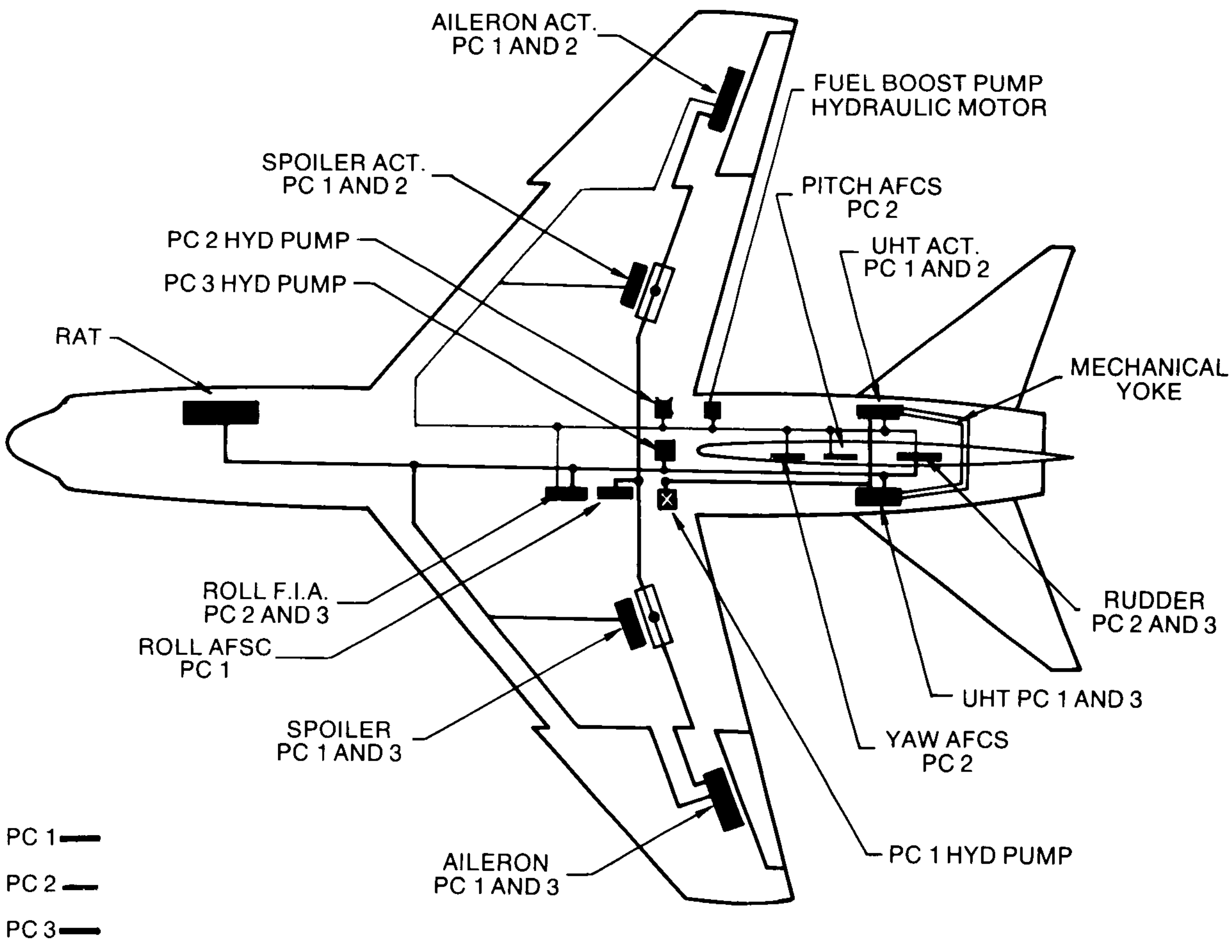
Wheel Brakes	Landing Gear
Wheel Brakes Snubbing	Wingfold
Leading and Trailing-Edge Flaps	Hand Pump
Arresting Gear	Nose Gear Steering

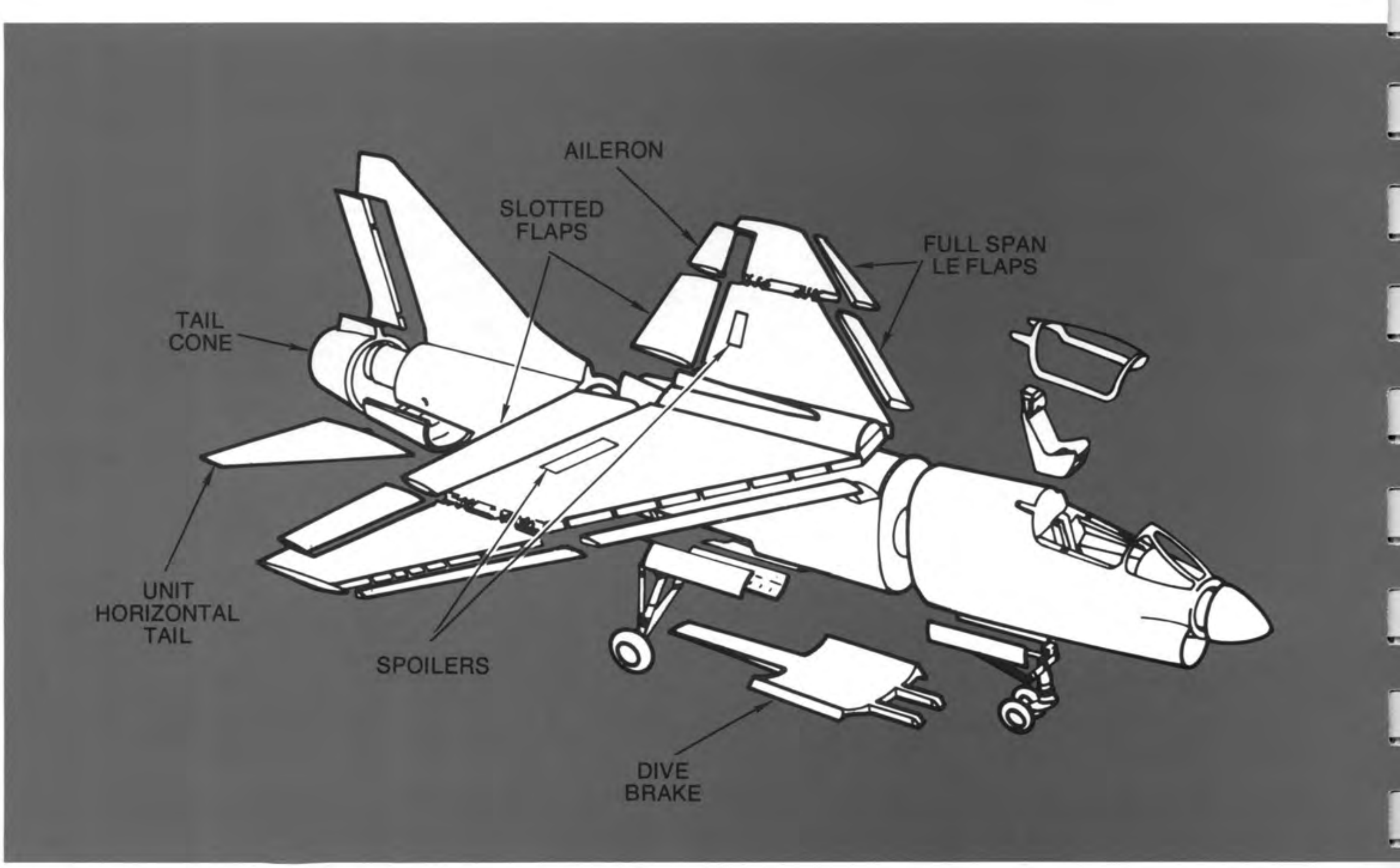
Emergency hydraulic systems are provided for the wheel brakes, leading- and trailing-edge flaps, and the landing gear. Each of these systems has a nitrogen-charged hydraulic accumulator, for single-shot operation.

PC 1, PC 2, and PC 3 are physically separated integral systems, except at the dual ended control actuators, to reduce vulnerability. A mechanical yoke between the UHT surfaces permits control of both surfaces by a single system. A supplementary control system that interconnects the RH and LH UHT actuator valves is provided by a flexible push-pull control unit, for use in case of damage to the primary control linkages. Structural redundancy and routing to make maximum use of the structure for protection also safeguards the system.

All three PC systems have a designed working pressure of 3,000 psi and use standard MIL-H-5606 fluid. The pressures can be read from gages in the cockpit, and a cockpit warning light signals whenever pressure in any system drops below 1,500 psi. Each system separately has sufficient power to provide the pilot with adequate control of the airplane to ensure return to friendly territory after sustaining combat damage.

A hand pump for ground checking equipment without running the engine is located in the RH wheel well.




AILERON
SLOTTED
FLAPS
FULL SPAN
LE FLAPS
TAIL
CONE
UNIT
HORIZONTAL
TAIL
SPOILERS
DIVE
BRAKE

Wing Fuselage Tail

The A-7D fixed wing has a sweep of 35 degrees and a total wing area of 375 square feet. It consists of a fixed center wing section, incorporating an integral fuel tank, and a foldable outer wing section. The wing structure is a failsafe multicell box comprised of beams with heavy upper and lower skins. In the event of structural damage, bending moment, torsion, and shear are redistributed to the remaining cells. Multiple wingfold lugs provide for flight operation with as many as four center section and six outer panel lugs incapacitated. High lift surfaces consist of full span center and outer section leading edge flaps and single slotted variable-position trailing edge flaps. Lateral control is provided by an arrangement of inboard spoiler-slot-deflectors and conventional outer panel ailerons. (The spoiler/deflector acts as a failsafe mechanism for aileron loss.) For optimum cruise and maneuvering performance, the wing has a built-in fixed leading edge camber. There are six wing and two fuselage store station pylons.

The fuselage is a conventional structure consisting of redistribution bulkheads, continuous longerons, and shear-carrying skins stiffened by frames. The multiple-longeron arrangement provides a failsafe feature in that if a longeron is severed, the load redistributes to the remaining longerons. Another failsafe feature is that in case a shear web is damaged so that it can no longer carry the load, the longerons and bulkheads that frame the panel will redistribute that load into the adjacent shear panels. Fuselage length has been kept to a minimum, and the present fuselage structure represents an optimum compromise for airplane maintainability, equipment accessibility, and balance. The use of nonstructural skin between the mid and lower longerons allows the use of quick-opening panels for maintenance access to the Avionics and LOX compartments. A single T-shaped brake is centrally located on the bottom of the fuselage. An arresting gear for emergency cable engagement retracts under the fuselage aft section.

Empennage components consist of two separate, but synchronized unit horizontal tails, vertical stabilizer, and a conventional rudder at the trailing edge of the vertical stabilizer. The vertical stabilizer structure is a multicell box similar to the wing structure, and has the capability of redistributing load to the remaining cells in the event of structural damage.

The A-7D structure is designed for 4,000 flight-hours and a load factor of 7g's at a 29,575-pound combat weight.

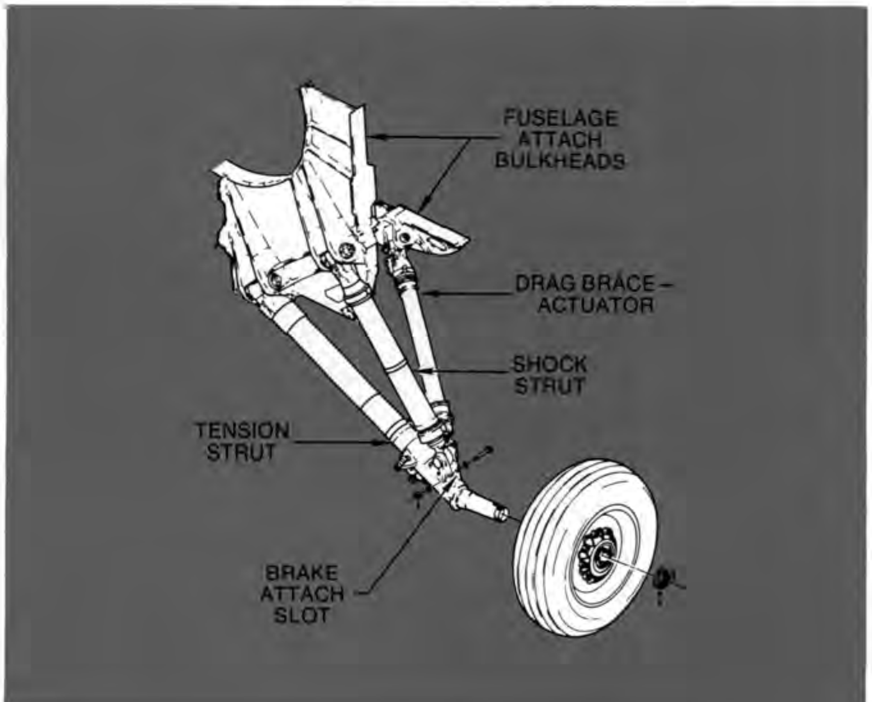
Landing Gear

The two main gears consist of single-wheel tripod struts with associated tires and brakes. This configuration allows the airplane to operate from an airfield with a California Bearing Ratio of 10.

The vertical strut is the air-oil energy (shock) absorber; the most horizontal is the tension-, bending-, and torsion-resistant member; and the fore-and-aft member is the drag strut. They retract forward, upward, and inward into the lower fuselage section below the wing. Clamshell doors, sequenced by a mechanical interlock with the gear uplock hook, are closed by an overcenter linkage. The tension strut is designed as a one-piece unit with an integral axle fabricated from 200,000-psi heat-treated steel.

To prevent inadvertent landing with the speed brake extended, extension of the landing gear automatically retracts and locks the speed brake.

Each brake has a normal energy capacity of 11,000,000 foot pounds. In addition, an antiskid-control braking system is provided. The system is designed to detect an impending skid by measuring the landing wheels deceleration, and to reduce the brake pressure proportionally to prevent the tire from continuing into a skid, and to modulate the brake pressure in a manner to achieve the most efficient brake stop under all runway conditions. The system contains a full-time circuit checkout and fail-safe feature which reverts the system to manual braking in case of malfunction.

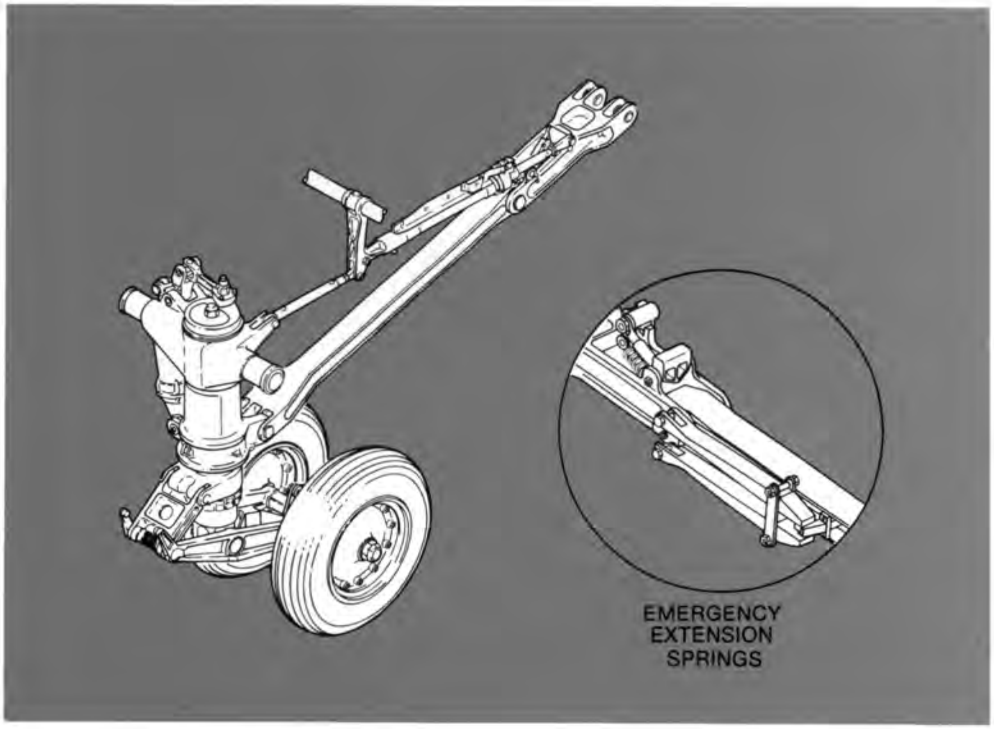


Nose Gear

The dual-wheeled nose gear is an air-oil energy-absorbing strut which retracts aft and upward into the fuselage front section. The clamshell doors operate in the same manner as the main gear doors. Emergency extension springs and an emergency hydraulic accumulator extend and lock the nose gear in the down position in case of hydraulic failure.

The dual nose wheel requires significantly less turning torque than an equivalent single-wheel installation. This advantage, added to the reduced ground loading and smaller footprint, results in excellent cornering capability and reduced power requirements for taxiing. Power steering is available through a range of 61 degrees each side of center.

The A-7D structure and gear is designed for landing at 32,251 pounds gross weight at sink rates up to 10 feet per second, permitting landing with up to 13,114 pounds of fuel and/or ordnance retained. It can take off at gross weights up to 42,000 pounds.



Flight Control System

PRIMARY

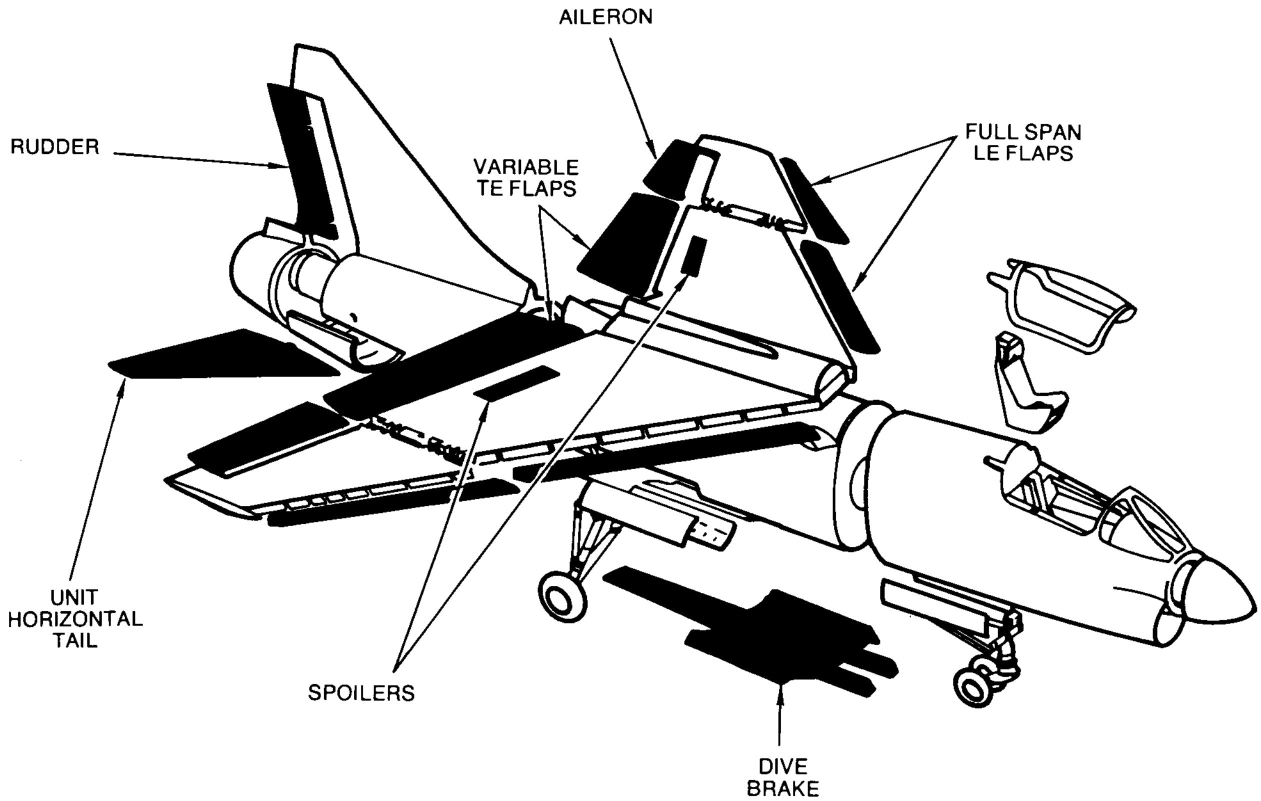
The A-7D primary flight control system includes the directional (yaw), lateral (roll), and longitudinal (pitch) systems. The lateral system consists of outer wing section ailerons and center wing section spoiler-slot-deflectors. Two horizontal stabilizers (UHT) are in the longitudinal system, and a conventional rudder is installed at the trailing edge of the vertical fin for directional control. All surfaces are driven by irreversible dual-tandem hydraulic actuators controlled by the pilot through cables and/or mechanical linkage. A supplementary control system and a mechanical yoke between UHT surfaces permits control in case of damage to primary control linkages.

The flight path angle and speed control systems are the leading and trailing edge flaps and the speed brake. The leading edge flaps are composed of the entire span of the leading edge of the wing center section and outer panels. All leading edge surfaces are two position and droop from the clean position to full down upon actuation. The trailing edge flaps extend across the entire span of the wing center section trailing edge. These are multiposition (variable) surfaces with the degree of droop selective throughout the entire 0- to 40-degree range.

Automatic flight and trim control inputs augment pilot command. The lateral and longitudinal systems respond to autopilot inputs, and the directional system responds to stabilization inputs. Series trim is introduced into the rudder and aileron signal linkages and parallel trim inputs into the unit UHT linkage. Artificial feel and centering forces are provided by simple mechanical springs installed in parallel with the signal linkage in all primary systems. Additional feel force compensation is provided in the longitudinal system by a system of bobweights and viscous dampers which sense both normal and pitching accelerations.

Inflight braking of the airplane to decrease airspeed is accomplished by the speed brake system, an electrically controlled, hydraulically operated system. The amount of braking is proportional to the extent the brake surface is extended into the airstream. Maximum speed brake extension is 60 degrees, and the speed brake automatically retracts when the landing gear is extended or electrical power is lost. A cockpit advisory light indicates when the speed brake is not closed.

The primary flight control system has been designed to meet the stringent requirements of the attack mission with particular emphasis on high-speed, low-altitude maneuvering under varied and/or asymmetric armament loadings.



AUTOMATIC FLIGHT CONTROL

The Automatic Flight Control System (AFCS) is a three-axis, dual-channel autopilot system utilizing solid-state circuitry to provide high-gain stick steering and automatic modes of operation. Each axis (pitch, roll and yaw) is basically comprised of an amplifier/ computer which provides servo-command signals for plane control surfaces displacement, a dual electro-hydraulic actuator, and motion sensing components.

The AFCS receives input signals supplied by rate gyros, normal and lateral accelerometers, and a stick force sensor. Additional input signals supplied by other systems to the AFCS are the air data computer, the Horizontal Situation Indicator, the AN/ASN-90 Inertial Measurement Set (IMS), and the Standby Attitude System.

The AFCS provides automatic altitude, attitude and path control. The six operational modes available for pilot selection are:

1. Yaw stabilization
2. Control augmentation
3. Attitude hold
4. Heading hold
5. Heading select
6. Altitude hold

The system provides self-test circuits which allow a functional checkout of system components to be made from the cockpit.

Both the roll and pitch trim systems are "beep" trim (fixed rate) commanded, with emergency disconnects, and utilize electromechanical actuators. The pilot can readily overpower the effects of a runaway roll or pitch trim. Yaw trim is displacement commanded, positioning the rudder surface by means of the dual-channel yaw AFCS actuator. A lock-to-center tracking monitor prevents a single malfunction resulting from a runaway trim.

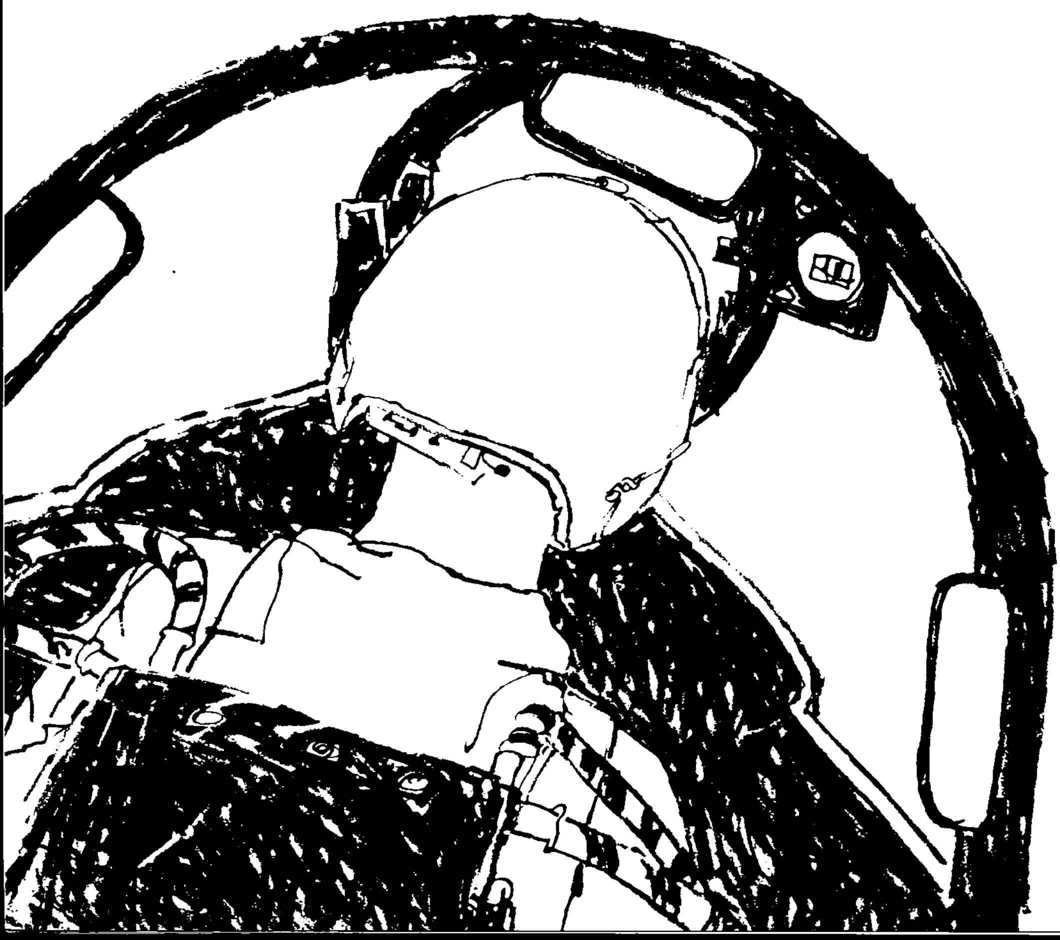
THE COCKPIT

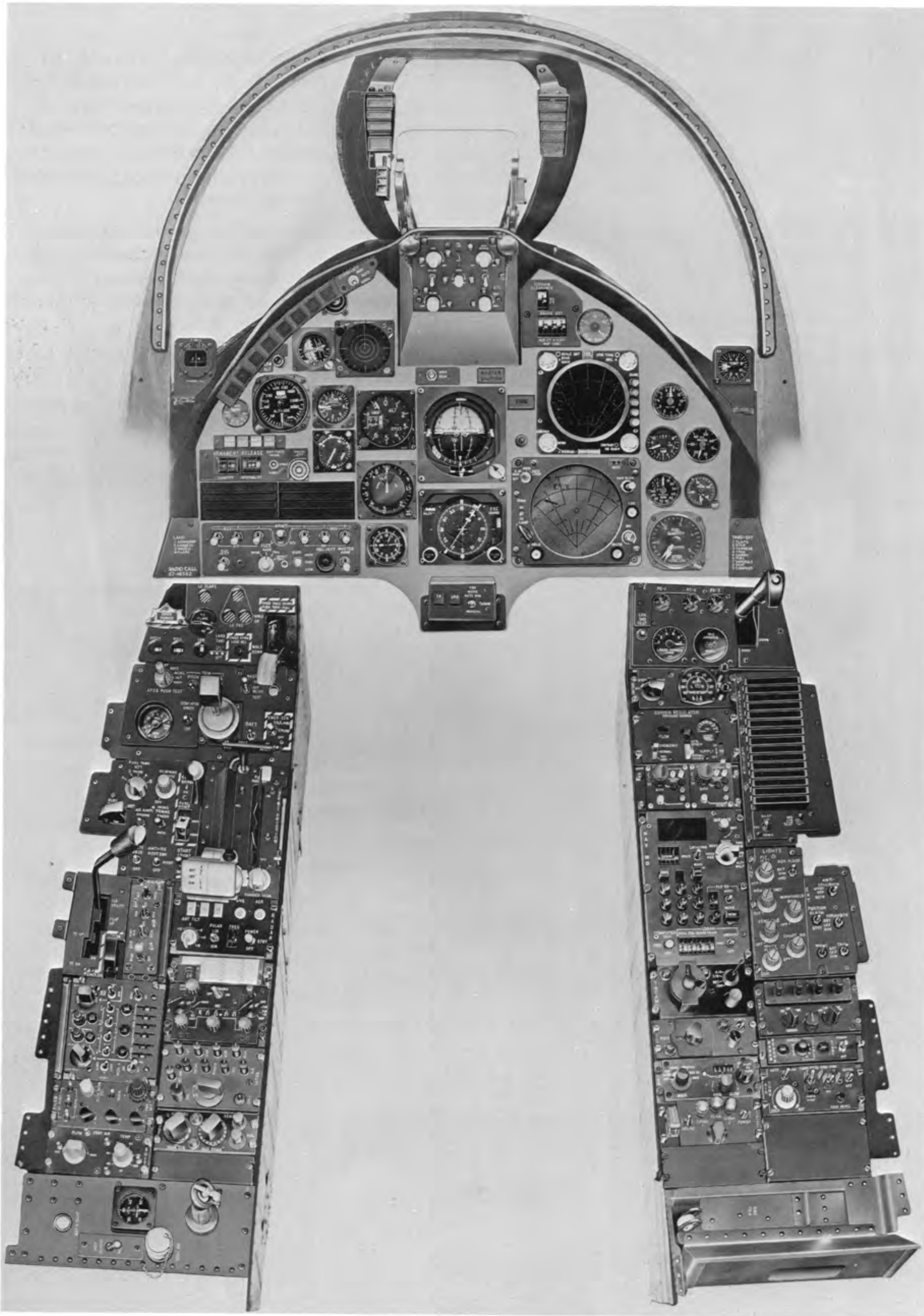
EXCELLENT VISIBILITY
INTEGRATED HEAD-UP DISPLAYS
SIMPLICITY
INSTRUMENT SCAN LOGIC
IMPROVED INSTRUMENT GROUPING
READY ACCESS
ZERO ZERO ESCAPE

The Cockpit

The arrangement of the A-7D cockpit is the result of extensive analysis of various mission requirements including pilot evaluation in a full-size cockpit mockup. The end result is a cockpit in which the pilot may easily perform assigned tasks in an efficient, functional environment. The special A-7D cockpit provides:

1. Excellent vision over the nose and sides.
2. Widely spaced longerons and lowered consoles for ready access to all controls.
3. All controls and displays located on prime cockpit surfaces and readily visible at all times.
4. The radarscope is located on the right-hand side of the main instrument panel preserving proper pilot instrument scan of basic instruments.
5. Symbolic controls and head-up displays increasing piloting efficiency and ease.
6. Safe escape under zero-zero conditions.



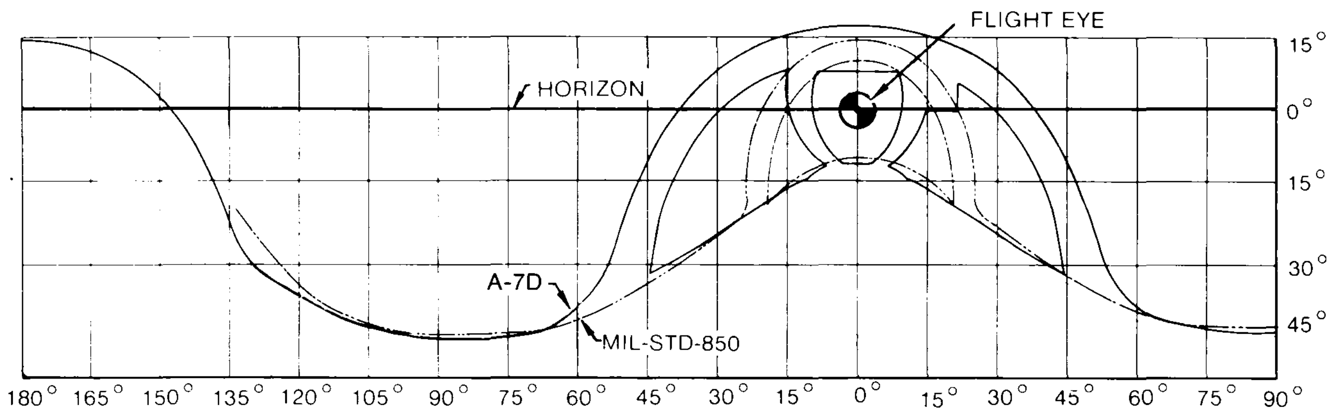


Cockpit Panels

Instruments are functionally grouped on the A-7D cockpit panels, with navigation and flight instruments in the center. System monitoring (fuel quantity, oil pressure, turbine outlet pressure and temperature) instruments are grouped in the lower right side of the panel. Armament controls and indicators are located on lower center and left sections.

The left console mounts controls and indicators for AFCS, landing gear, ram air turbine, autopilot, engine, fuel, flaps, UHF communications (IFF), radar, ECM, armament, intercommunications, suit vent, and pilot services.

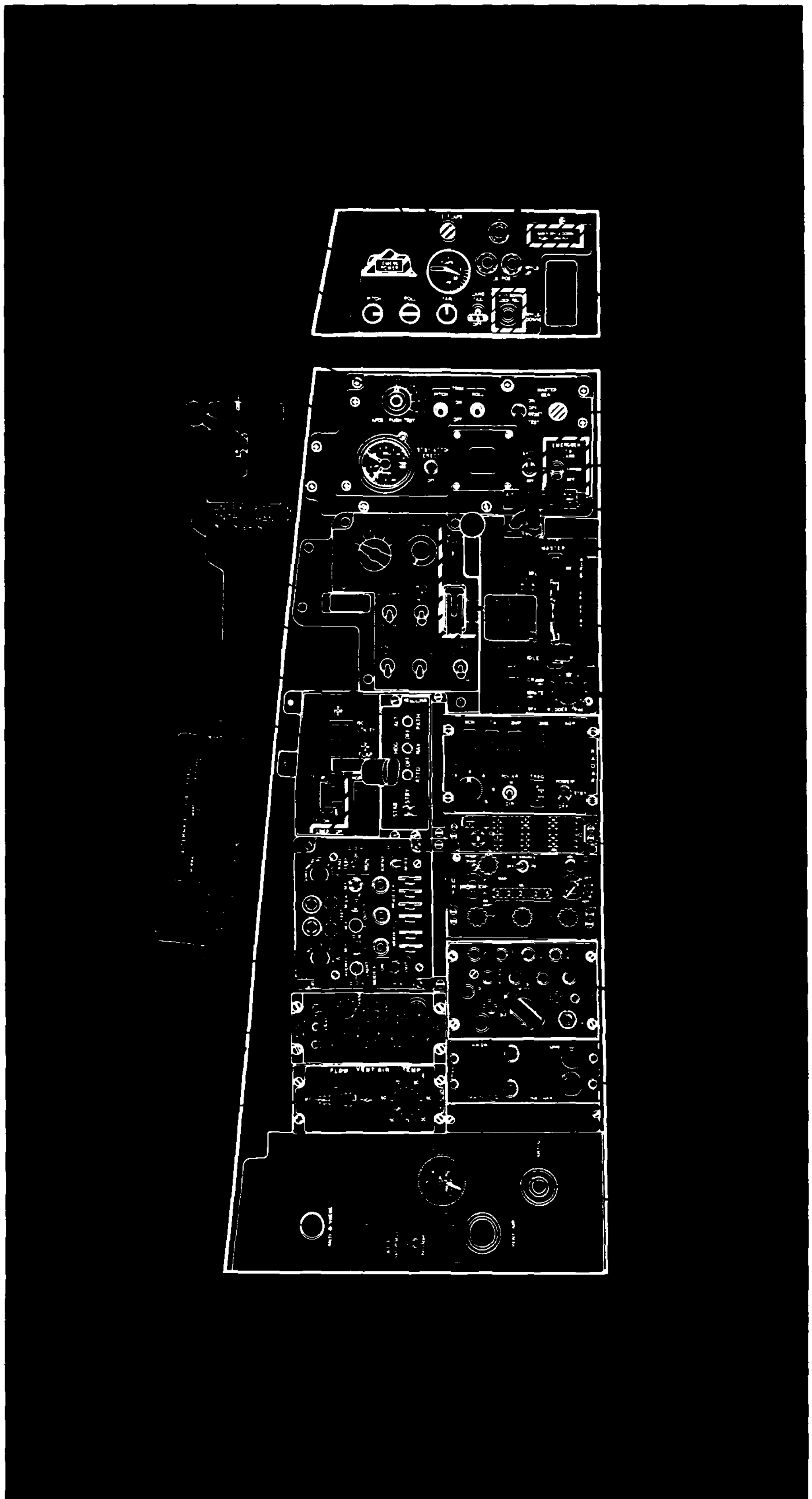
Located on the right console are interior and exterior lighting caution and advisory annunciators, and controls and indicators for oxygen quantity, hydraulic pressure, arresting hook, Doppler radar, tactical computer, TACAN, ILS, ECM pods, VHF communications, inertial measurement set (IMS), speech security set, radar beacon, and oxygen, environmental, and wingfold systems.



VISION PLOT

LH CONSOLE ARRANGEMENT

1. AFCS TRIM INDICATORS
2. RAM AIR TURBINE HANDLE
3. LE AND TE FLAPS POSITION INDICATORS
4. LANDING GEAR POSITION LIGHTS
5. LANDING GEAR CONTROL HANDLE
6. GENERATOR INDICATOR
7. AN/ARW-77 CONTROL
8. INFLIGHT REFUELING HANDLE
9. EMERGENCY BRAKE CONTROL
10. THROTTLE CONTROL
11. RUDDER TRIM CONTROL
12. RADAR CONTROL PANEL
13. UHF CONTROL PANEL
14. INTERCOM PANEL
15. AUXILIARY UHF RCVR CONTROL PANEL
16. CABIN PRESSURE ALT
17. PILOT SERVICES PANEL
18. SUIT VENT AIR CONTROL PANEL
19. APR-36/37 CONTROL PANEL
20. IFF CONTROL PANEL
21. AUTO PILOT CONTROL PANEL
22. FLAPS CONTROL
23. ANTISKID AND STARTER ABORT SWITCHES
24. FUEL MANAGEMENT CONTROL PANEL
25. TRIM POSITION INDICATOR
26. AFCS TEST CONTROL
27. CANOPY JETTISON CONTROL



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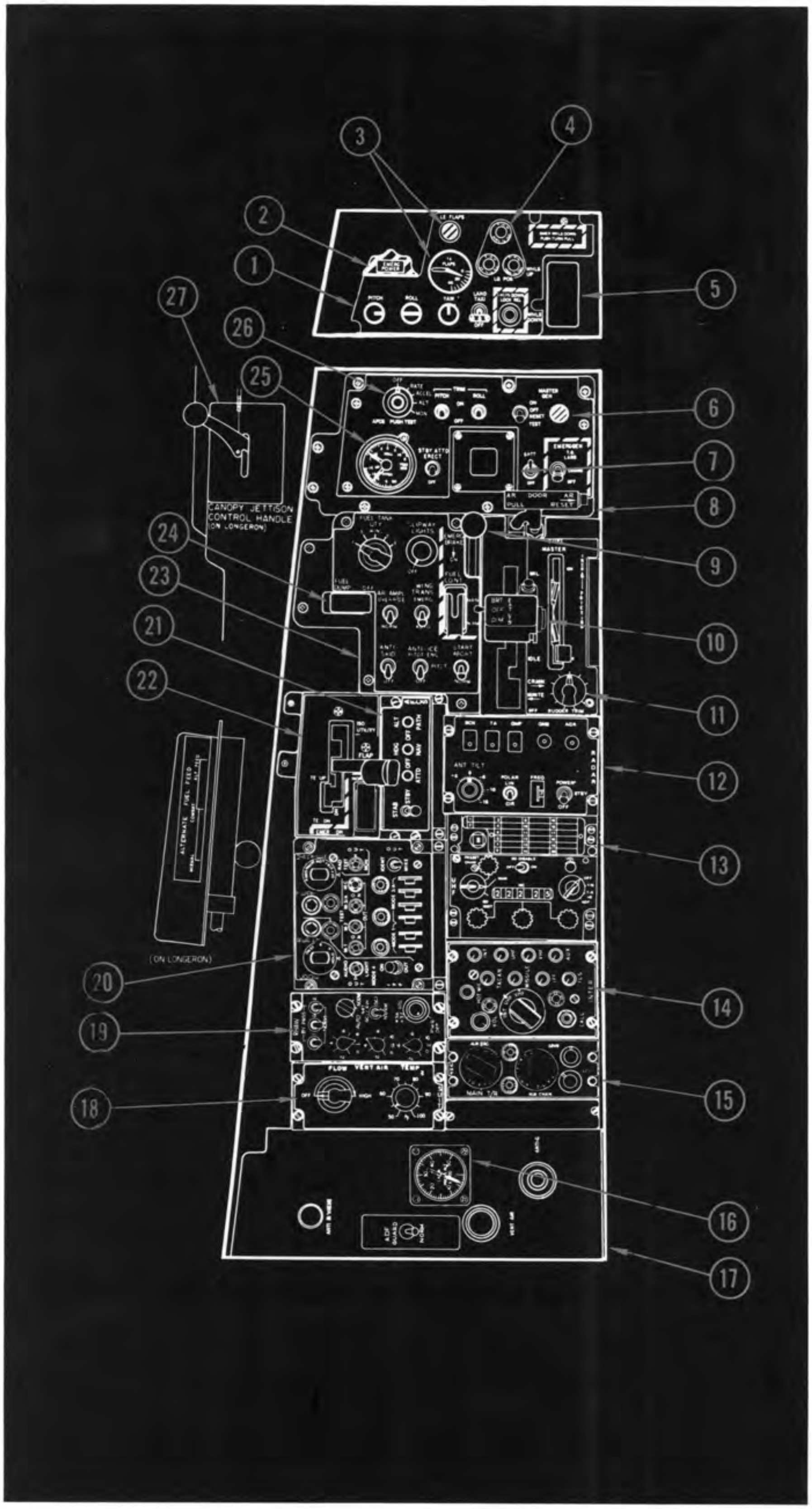

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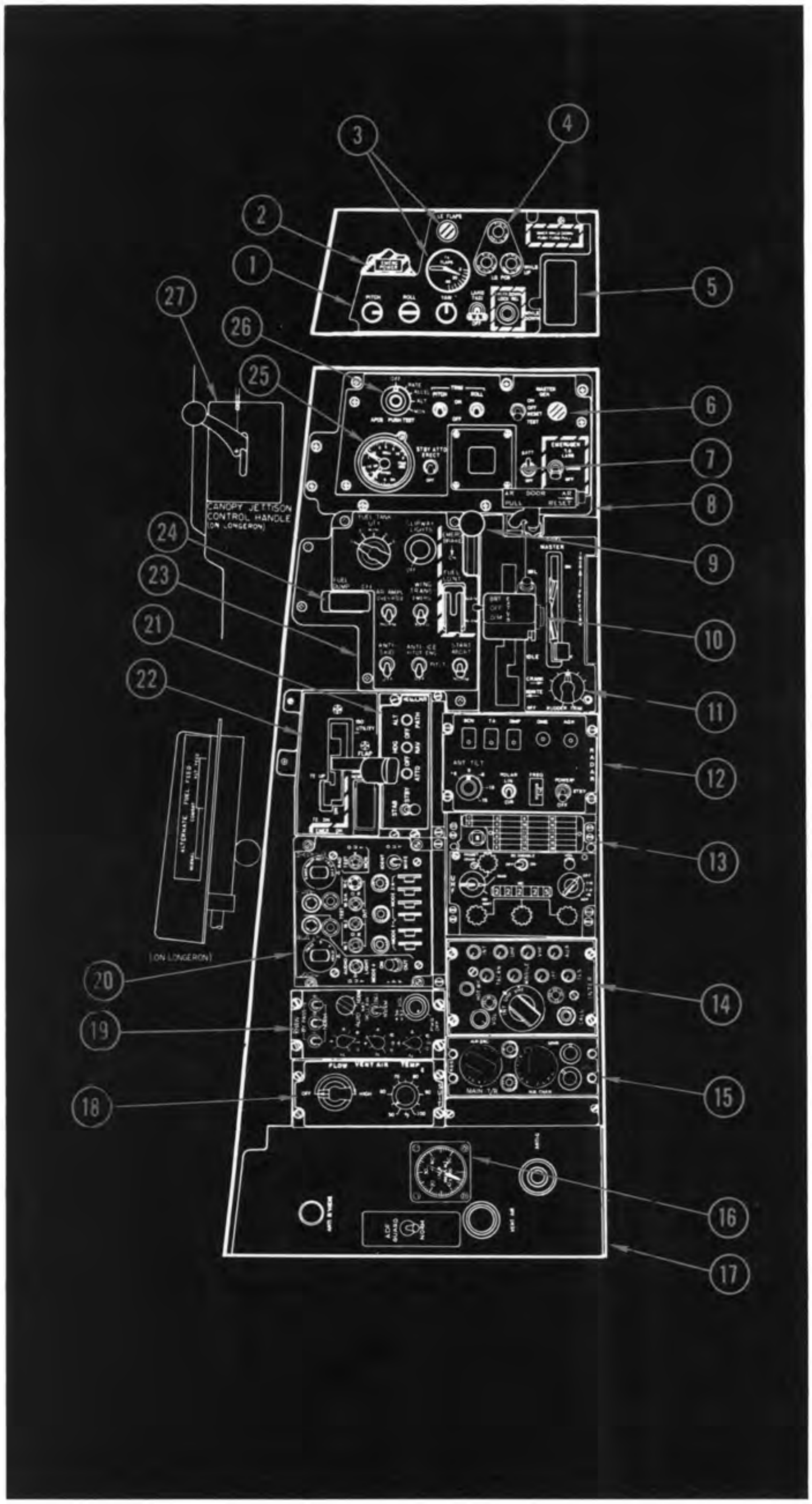
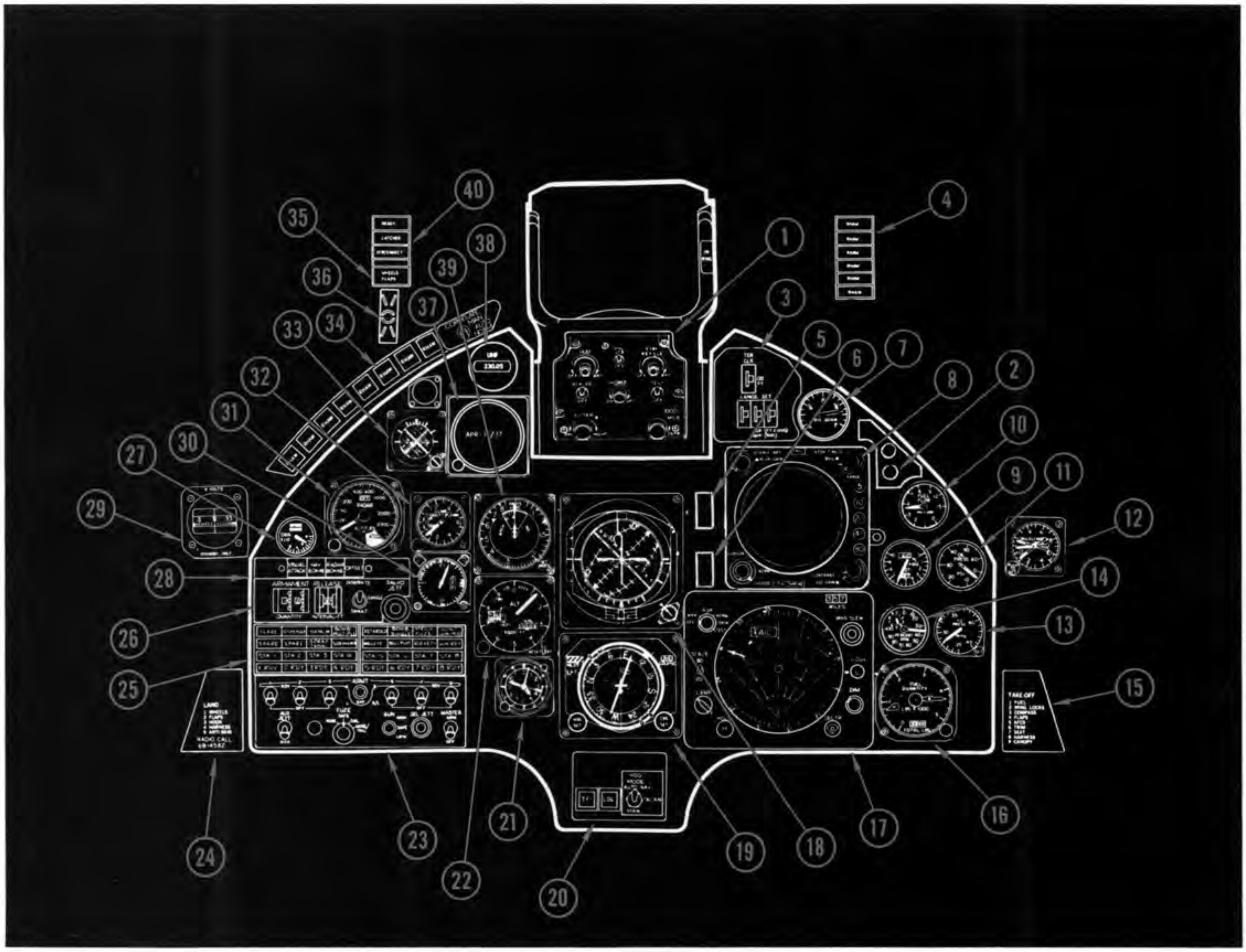
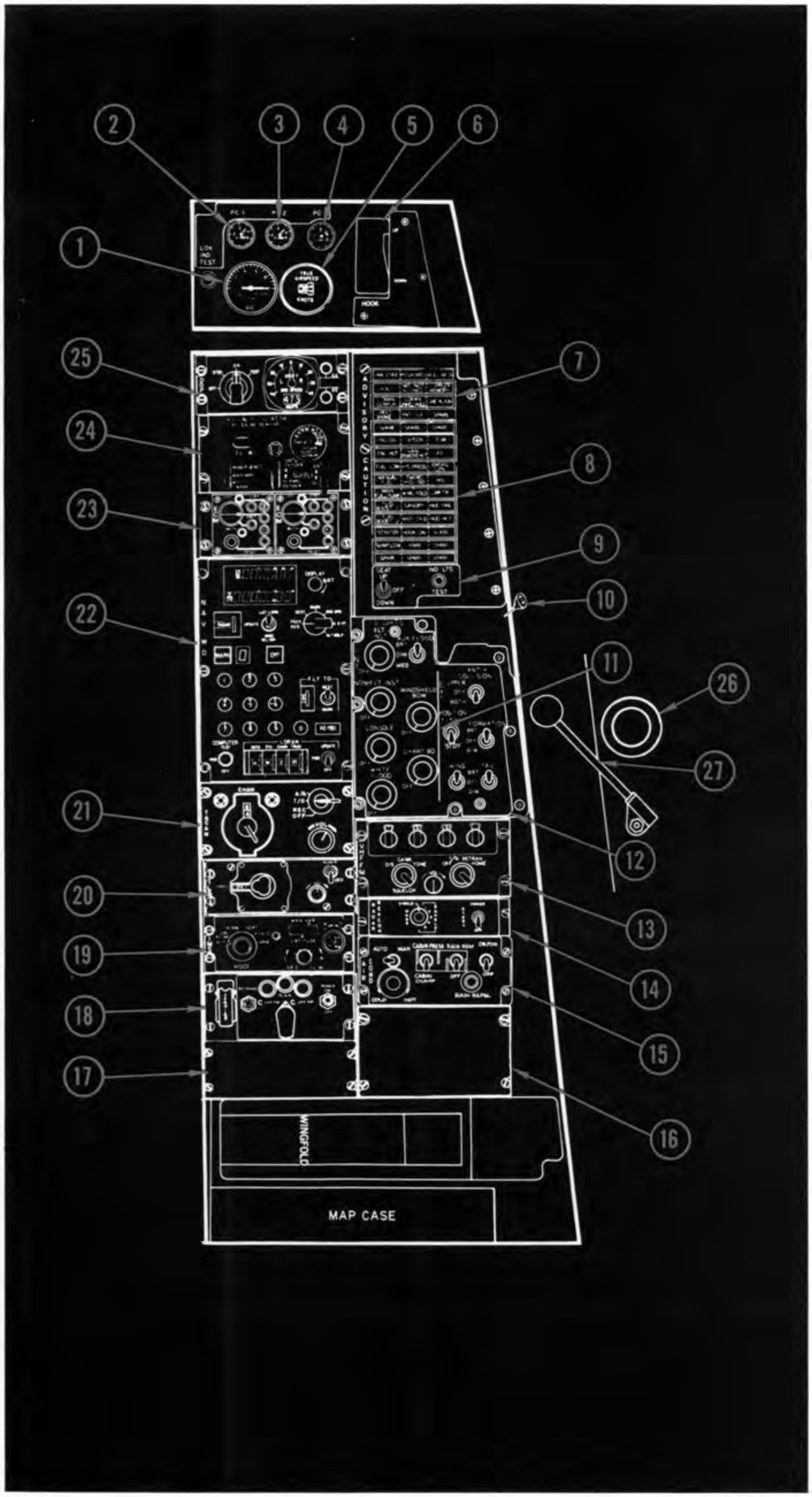




INSTRUMENT BOARD ARRANGEMENT

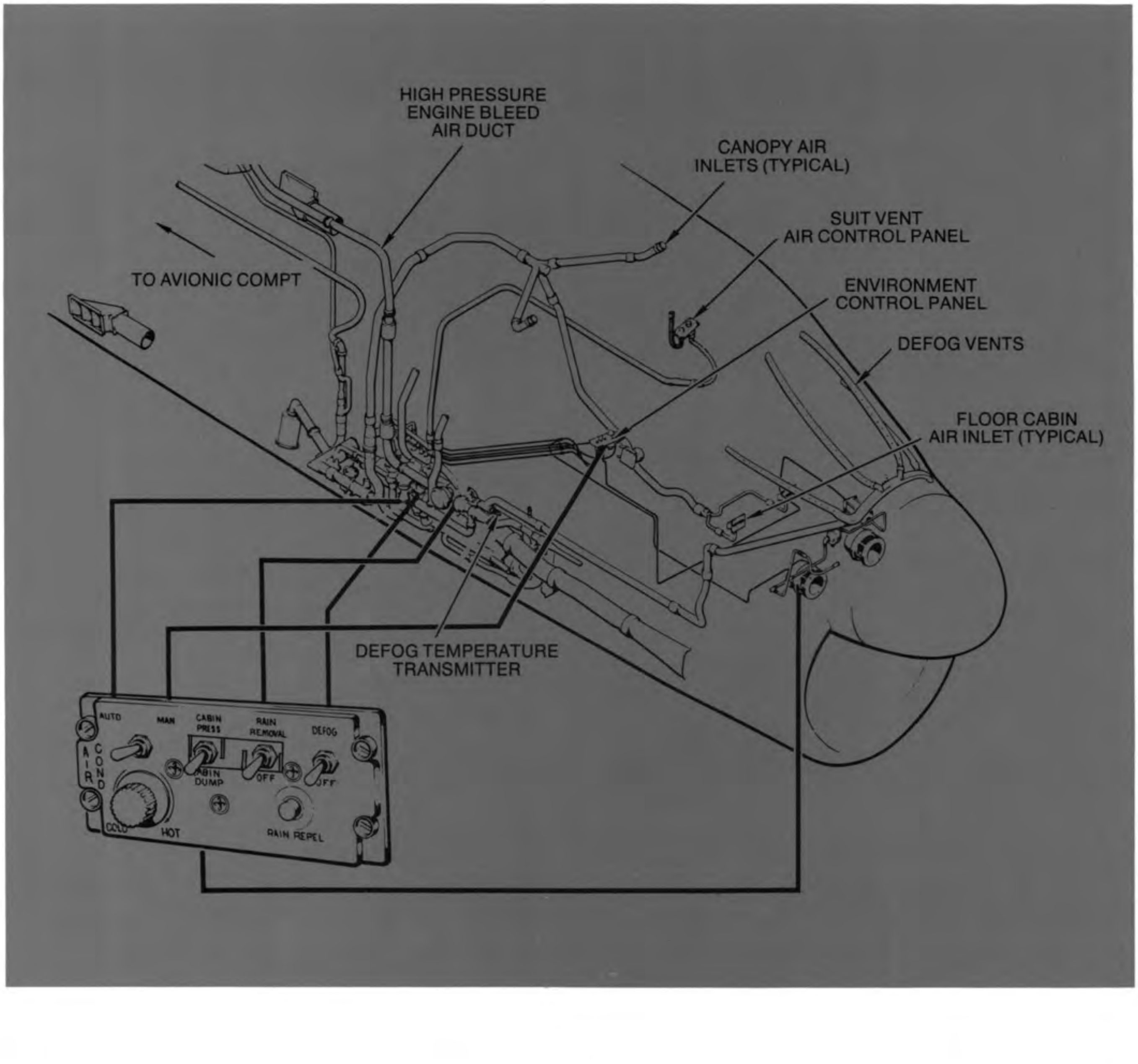
1. HEAD-UP DISPLAY
2. RADAR BEACON/ALTITUDE WARNING LIGHT
3. RADAR RANGE-TERRAIN CLEARANCE CONTROL
4. RADAR WARNING LIGHTS PANEL
5. FIRE WARNING LIGHT/PRESS-TO-TEST SWITCH
6. MASTER CAUTION LIGHT
7. OIL QUANTITY INDICATOR
8. RADAR INDICATOR
9. TURBINE OUTLET TEMPERATURE INDICATOR
10. FUEL FLOW INDICATOR
11. OIL PRESSURE INDICATOR
12. ACCELEROMETER
13. TURBINE OUTLET PRESSURE INDICATOR
14. TACHOMETER
15. TAKEOFF CHECKLIST
16. FUEL QUANTITY INDICATOR
17. PROJECTED MAP DISPLAY UNIT
18. ALTITUDE DIRECTIONAL INDICATOR
19. HORIZONTAL SITUATION INDICATOR
20. HEADING MODE CONTROLS
21. CLOCK
22. SERVOED ALTIMETER
23. ARMAMENT SELECTOR PANEL
24. LAND CHECKLIST-RADIO CALL PLACARD
25. STATION READY LIGHTS
26. ARMAMENT RELEASE CONTROL
27. SPEED BRAKE POSITION INDICATOR
28. ATTACK MODE CONTROLS
29. STANDBY COMPASS
30. ANGLE OF ATTACK INDICATOR
31. RADAR ALTIMETER
32. VERTICAL VELOCITY INDICATOR
33. STANDBY ATTITUDE INDICATOR
34. RADAR THREAT LIGHTS
35. WHEELS FLAPS WARNING LIGHT
36. ANGLE OF ATTACK APPROACH INDEXER
37. APR-36/37 DISPLAY
38. UHF CHANNEL FREQUENCY INDICATOR (PROVISION)
39. AIRSPEED INDICATOR
40. AIR REFUELING LIGHTS

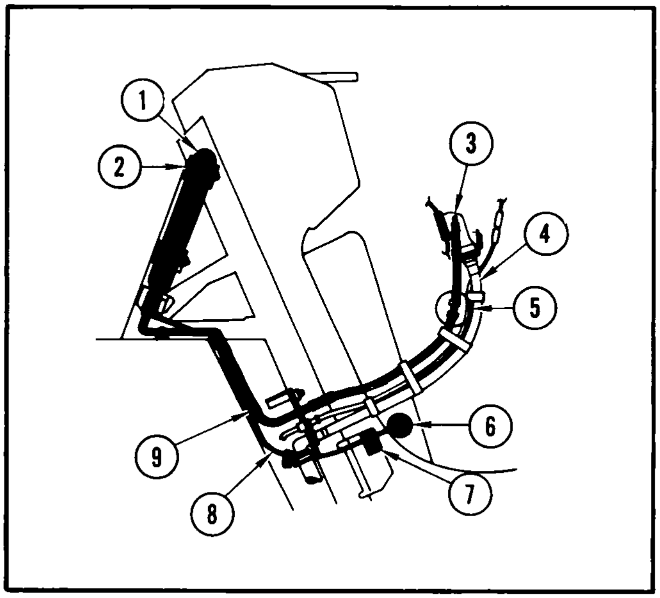


RH CONSOLE ARRANGEMENT

1. OXYGEN QUANTITY INDICATOR
2. PC-1 PRESSURE INDICATOR
3. PC-2 PRESSURE INDICATOR
4. PC-3 PRESSURE INDICATOR
5. TRUE AIR SPEED INDICATOR
6. ARRESTING HOOK CONTROL
7. ADVISORY LIGHTS
8. CAUTION LIGHTS
9. SEAT & INDICATOR LIGHT TEST SWITCHES
10. FOOT AIR VENT CONTROL
11. INTERIOR LIGHTS CONTROL PANEL
12. EXTERIOR LIGHTS CONTROL PANEL
13. VHF FM CONTROL PANEL
14. RADAR BEACON CONTROL
15. AIR-CONDITIONING CONTROL PANEL
16. BLANK PANEL
17. BLANK PANEL
18. JULIET CONTROL PANEL
19. IMS CONTROL PANEL
20. ILS CONTROL PANEL
21. TACAN CONTROL PANEL
22. NAV/WEAPON COMPUTER PANEL
23. ECM CONTROL PANEL
24. OXYGEN REGULATOR PANEL
25. DOPPLER RADAR CONTROL PANEL
26. EMERGENCY VENT AIR CONTROL
27. CANOPY LOCK HANDLE

Cockpit Environmental Control





EMERGENCY OXYGEN SYSTEM

1. MBU-5/P MOD (USAF) EMERGENCY OXYGEN CYLINDER
2. QUICK-RELEASE BRACKETS
3. CRU-60/P CONNECTOR
4. AIRCRAFT HOSE
5. EMERGENCY OXYGEN QUICK-DISCONNECT
6. GREEN APPLE
7. QUICK-RELEASE PULL CABLE CLAMP
8. PULL CABLE
9. QUICK-RELEASE CLAMPS FOR CYLINDER HOSE AND PULL CABLE

Environmental Systems

Cockpit pressurization is provided by temperature-controlled air from the air-conditioning system. Pressurized air enters the cockpit through windshield vents, canopy rail vents, and two floor vents when selected. If the air-conditioning system should fail, a pilot-controlled manual emergency vent provides ram airflow into the cockpit.

Cockpit air temperature is controlled by an electro-pneumatic control system that regulates the amount of high temperature air (engine bleed air) to be mixed with refrigerated air. The system is controlled automatically by a cockpit sensor system, but may be controlled manually. A water separator is provided to remove a major portion of the entrained moisture from air going to the cockpit.

The airplane is supplied with conditioned air through a bootstrap cycle refrigerator unit utilizing high-pressure engine bleed air. The system provides conditioned air to (1) cool, heat, ventilate, and pressurize the cabin; (2) defog the canopy and windshield; (3) ventilate the pilot's antiexposure suit; (4) provide cooling air for portions of the electronic equipment and defog and maintain operational environment in the camera compartment; and (5) pressurize the anti-g suit.

A combination jet blast rain-removal and rain-repellent system is provided for the center and left-hand windshields. Bleed air for this system and the gun compartment purge system and for external fuel transfer is obtained from the engine compressed low-pressure bleed section.

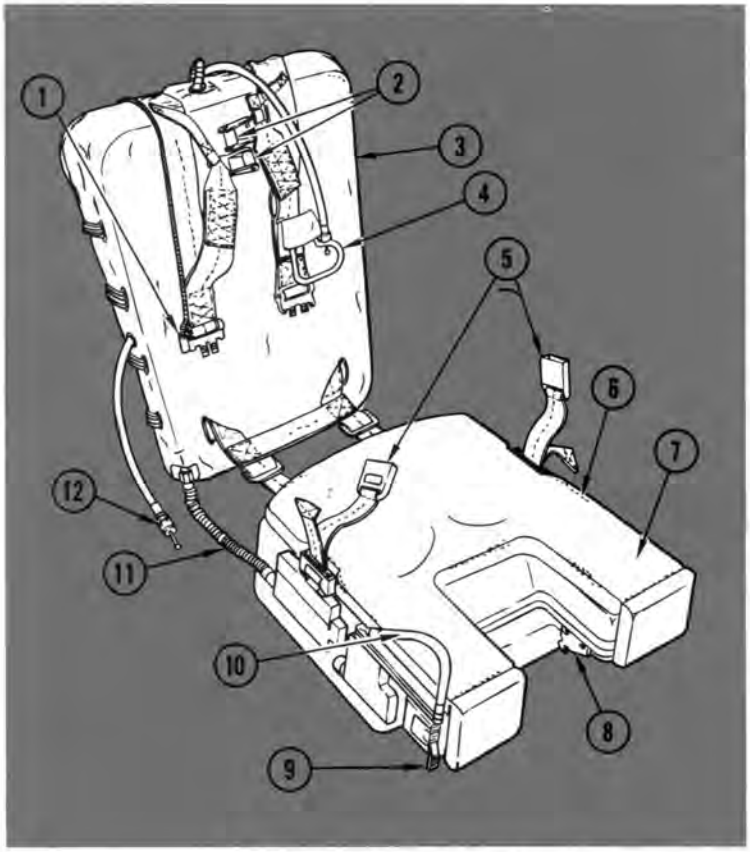
The A-7D oxygen system consists of a single 10-liter oxygen converter located in the lower left side of the fuselage; its location provides for easy access for filling while in the airplane or for quick removal for maintenance or filling outside of the airplane. Oxygen flow from the converter is regulated by a panel-mounted diluter demand regulator located on the right-hand console. The oxygen is then routed to the pilot's harness connector and mask by the pilot services disconnect hose assembly located just aft of the right-hand seat rail. An oxygen cylinder and a manual actuator handle located on the airplane structure provide the pilot with emergency oxygen for 8 to 10 minutes.

Escape System/Survival Equipment

The A-7D escape system consists of an improved version of the ESCAPAC I-C2 ejection seat, a modified NB-10 parachute, a USAF/VAD configuration automatically deployable survival kit, and a ballistically initiated canopy jettison system. An escape sequence can be initiated by either a face curtain or a between-the-legs D-ring; all functions following initiation, including canopy jettison, are fully automatic.

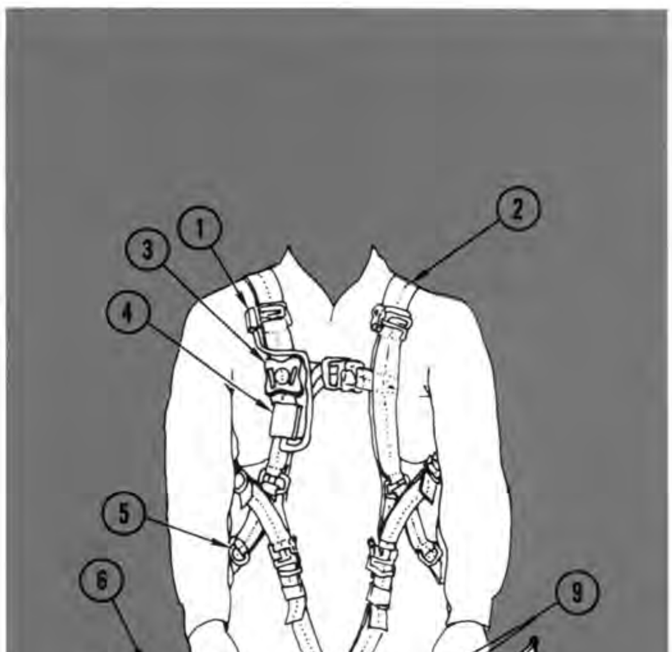
The system will provide safe egress from 0 to 650 knots IAS at altitudes from sea level through 50,000 feet. A ballistic/mechanical linkage between the seat and the canopy ejects the seat as soon as the canopy is clear of the ejection path, thus bypassing the fixed pyrotechnic delay. The resultant reduction in delay between canopy jettison and seat ejection allows the system to accommodate high sink rates.

Manual emergency egress can be accomplished in either of two modes: (1) with parachute and survival kit, or (2) with parachute only. The second mode is accomplished by pulling the survival kit deployment handle and the seat-mounted harness release handle; the first mode is accomplished by pulling only the seat-mounted harness release handle.



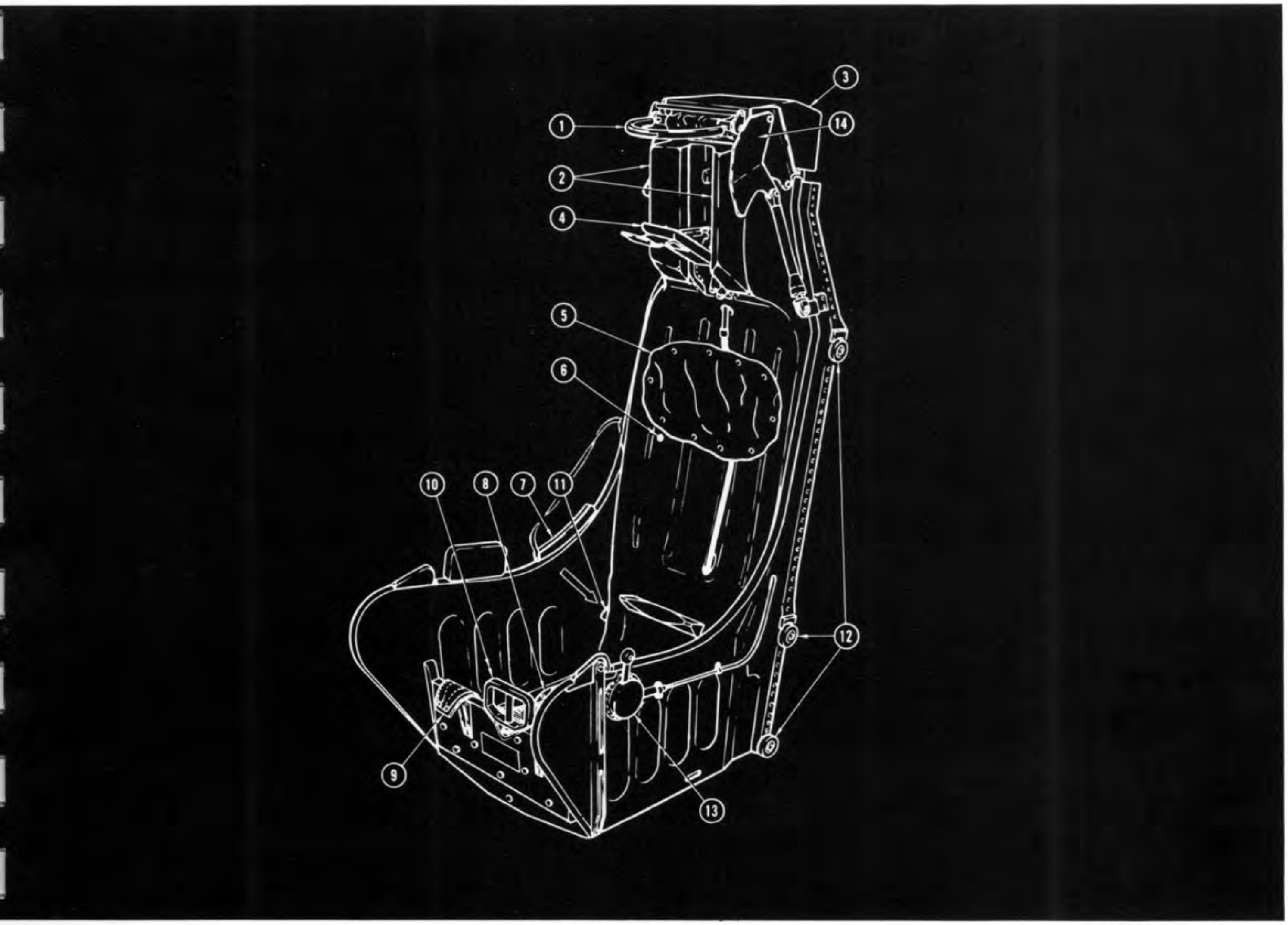
PARACHUTE AND SURVIVAL KIT

1. URT-33 ANTENNA CONNECTION
2. INERTIA REEL ROLLER FITTINGS
3. NB-10 USAF MODIFIED
4. PARACHUTE D-RING
5. AIR LOCK 720 CONNECTORS (KIT TO HARNESS)
6. SURVIVAL KIT
7. CUSHION
8. SURVIVAL KIT HOOKS
9. KIT DEPLOYMENT MODE SELECTOR SWITCH
10. MANUAL KIT RELEASE HANDLE
11. PARACHUTE SENSING SYSTEM
12. PARACHUTE ARMING LANYARD



RESTRAINT SYSTEM

1. URT-33 ANTENNA CONNECTION
2. PCU-3/P TORSO HARNESS
3. CRU-60/MOUNTING PLATE
4. URT-33 RADIO
5. ACCESSORY RING (SURVIVAL KIT ATTACH POINT)
6. END FITTINGS P/N NARF 578227
7. KOCH BELT ADJUSTER
8. LAP BELT
9. KOCH CONNECTOR P/N 015-11367-1

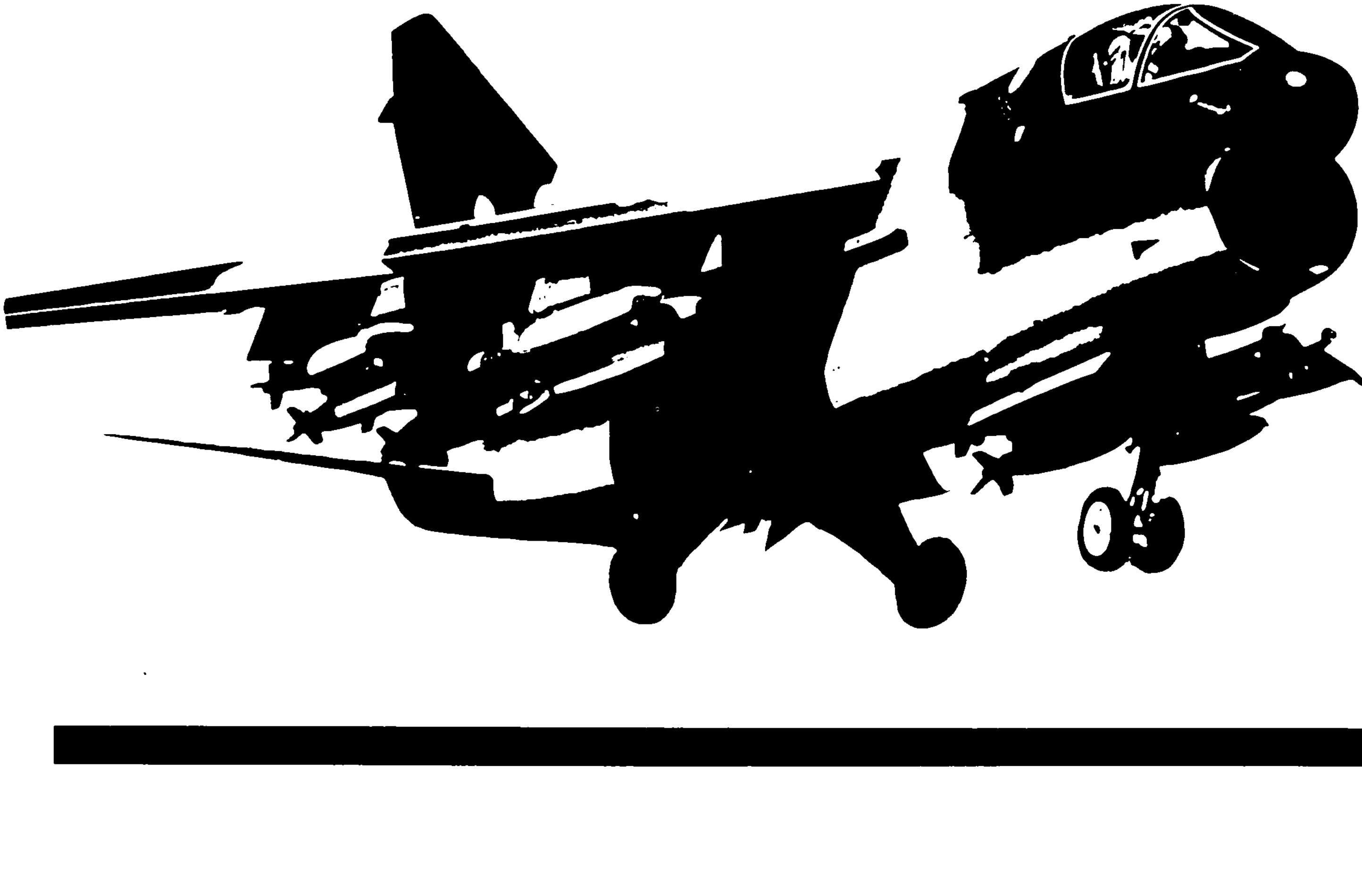


EJECTION SEAT

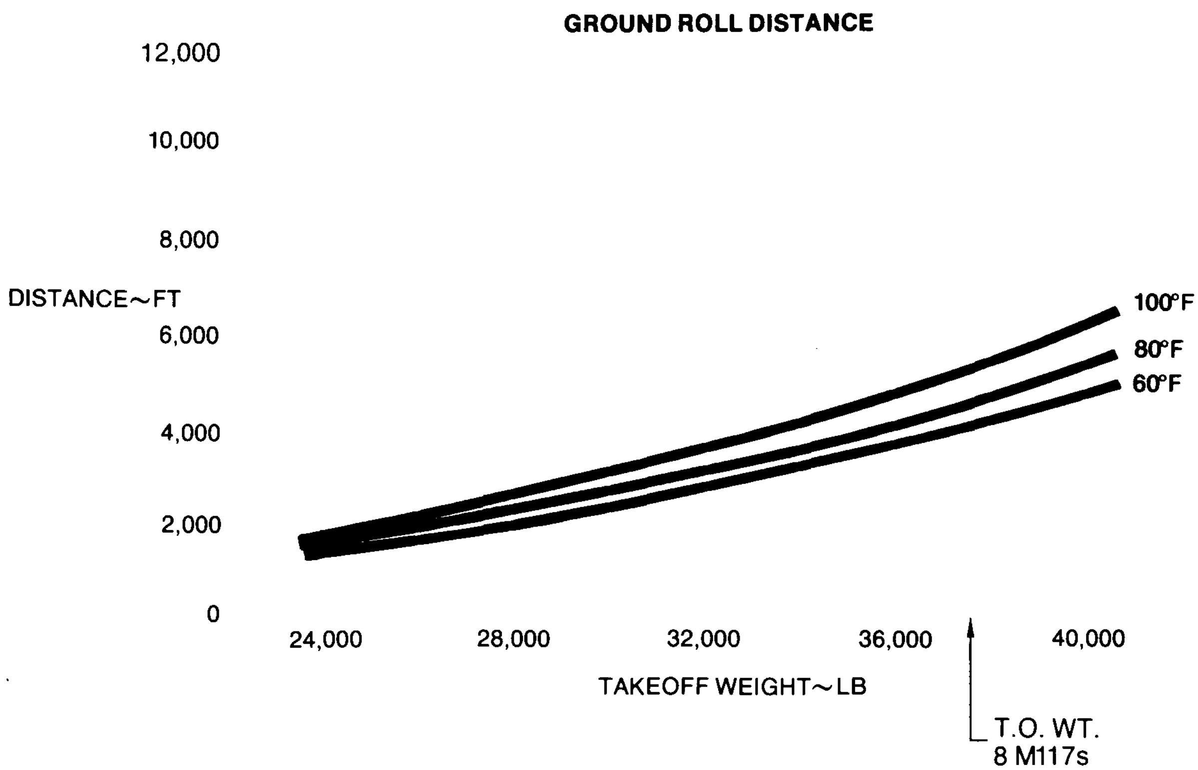
1. FACE CURTAIN EJECTION CONTROL HANDLE
2. HEADREST PADS
3. FIRING CONTROLS COVER
4. EJECTION CONTROLS SAFETY HANDLE
5. BACK SEPARATION BLADDER
6. NITROGEN BOTTLE INSPECTION HOLE
7. PARACHUTE ARMING LANYARD CHANNEL
8. SEAT PAN SEPARATION BLADDER
9. FABRIC SLING ASSEMBLY
10. PRIMARY EJECTION CONTROL HANDLE
11. LAP BELT ATTACH FITTINGS (2)
12. ROLLERS (6)
13. INERTIA REEL CONTROL LEVER
14. CANOPY BREAKERS

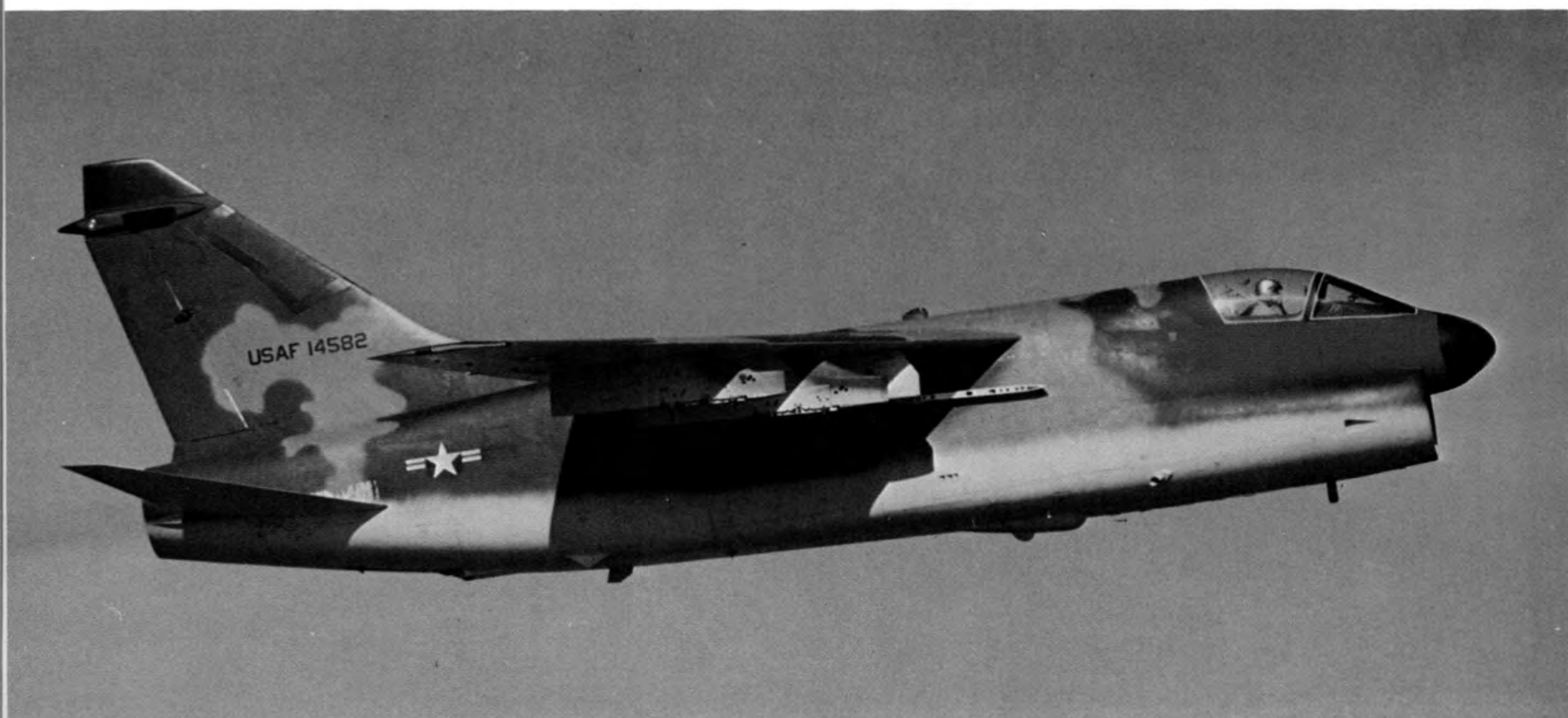
PERFORMANCE

LOW ALTITUDE CRUISE ABILITY
IMPROVED LOITER
AGILITY-MANEUVERABILITY
HIGH SUBSONIC SPEED
DIVE STABILITY
SHORT TAKEOFF-LANDING
EXTENDED LOW ALTITUDE MISSIONS
WITHOUT EXTERNAL FUEL OR IFR

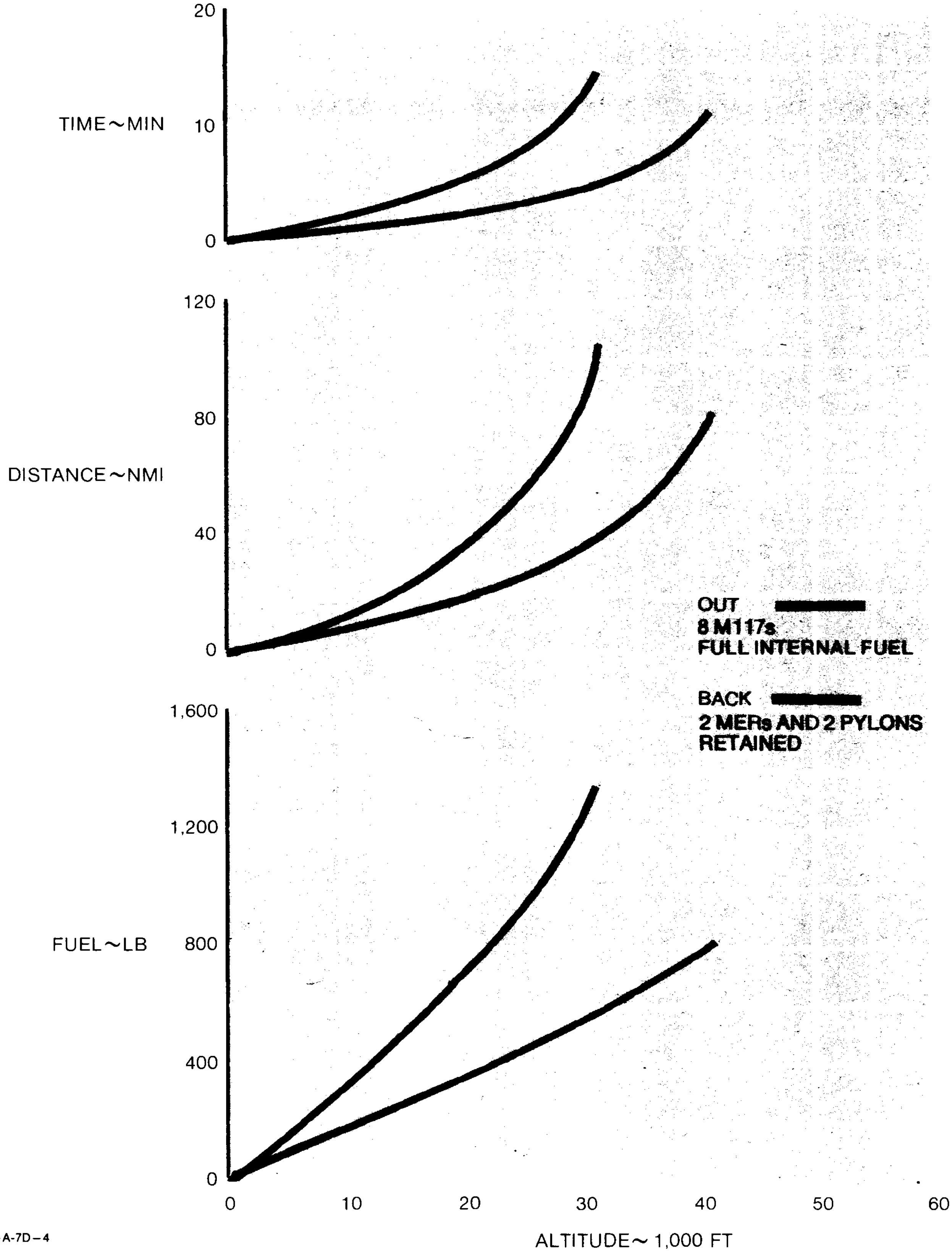


Takeoff Performance
SEA LEVEL

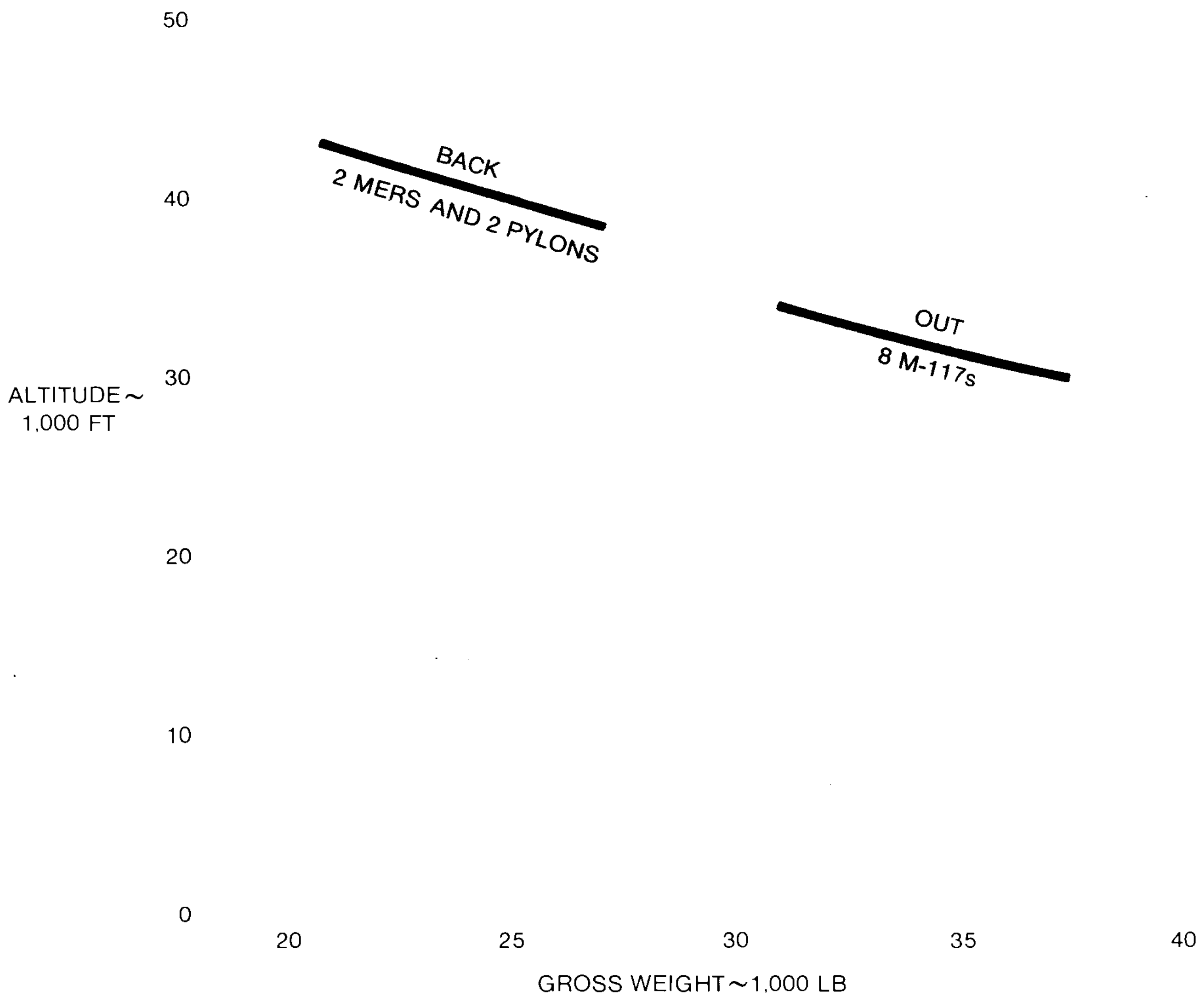



USAF 14582

Climb Performance
STANDARD DAY



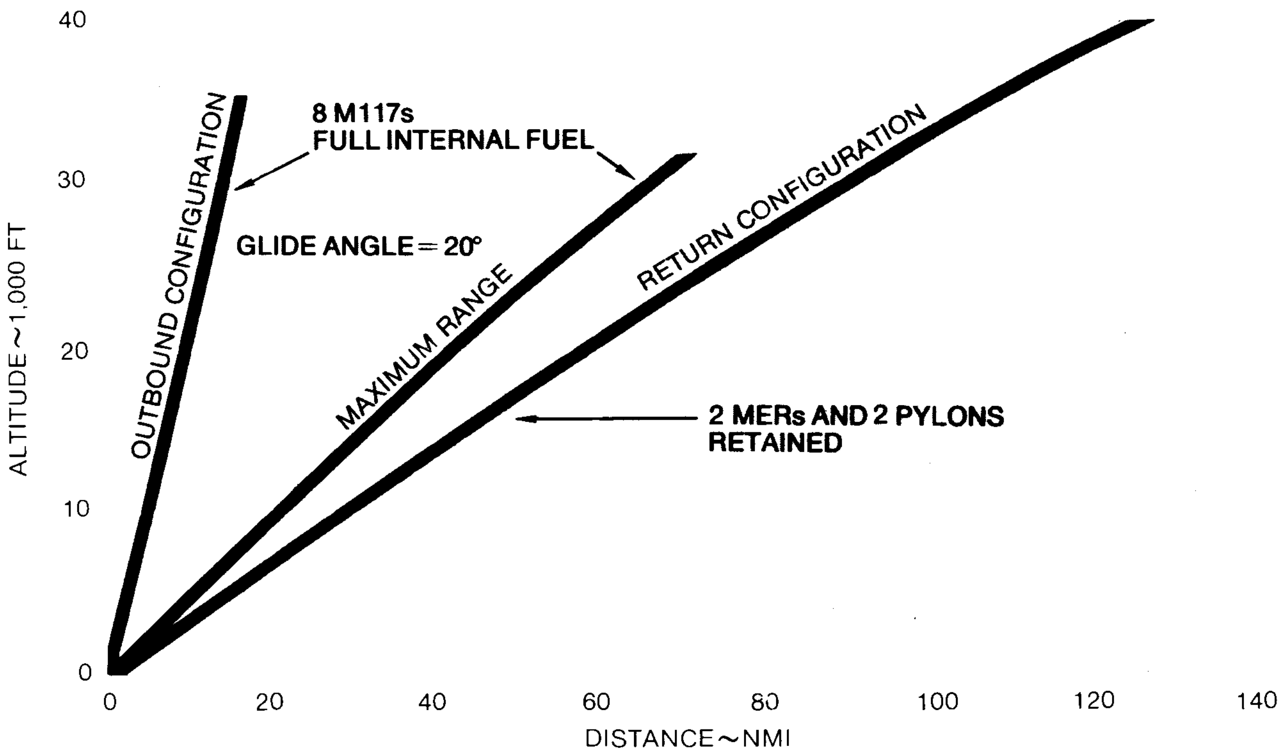
Cruise Altitude

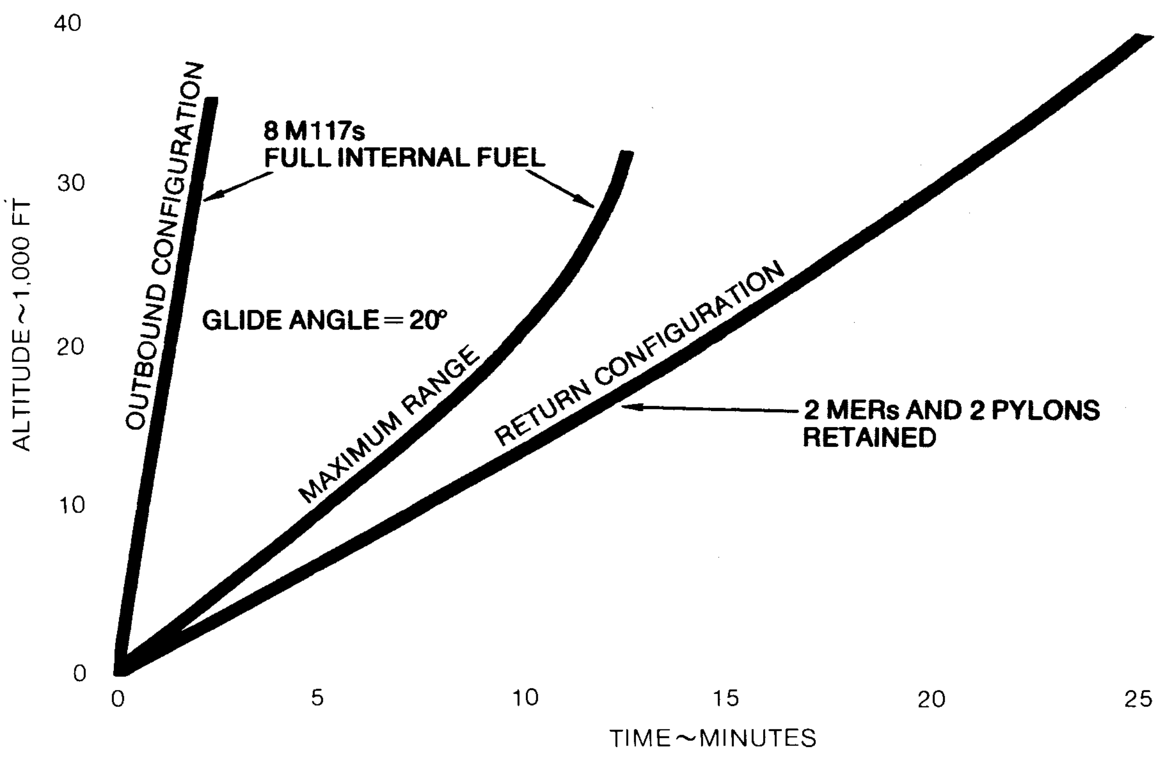


Descent Performance

IDLE THRUST

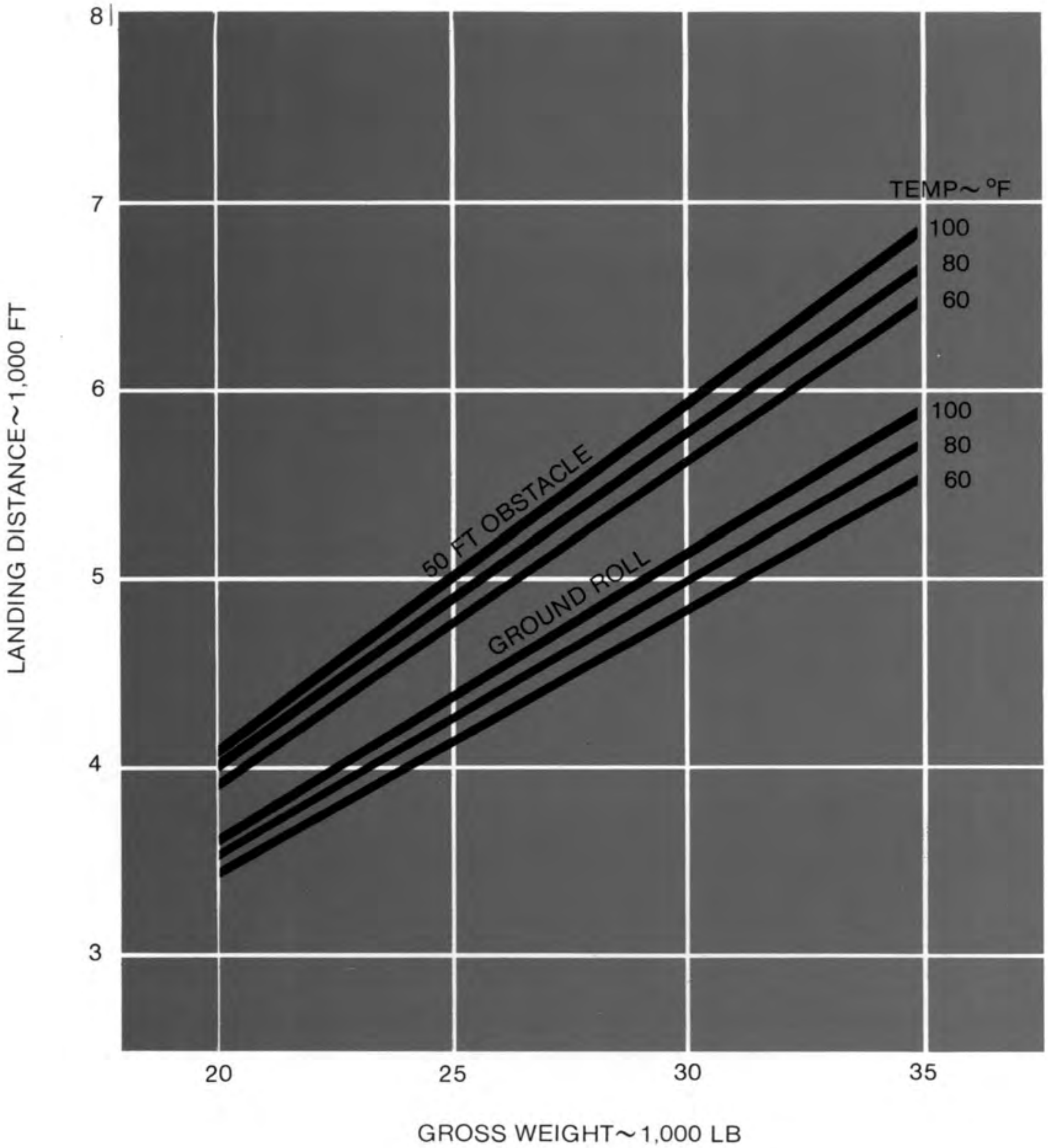
STANDARD DAY



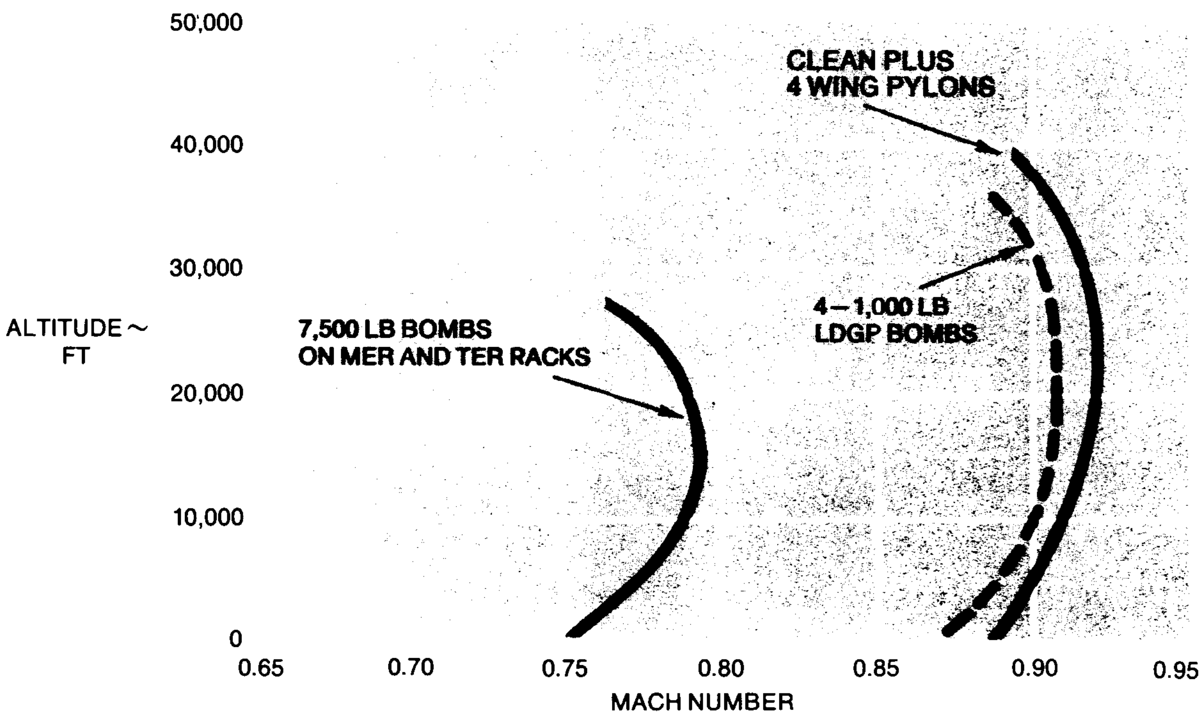


Landing Distance

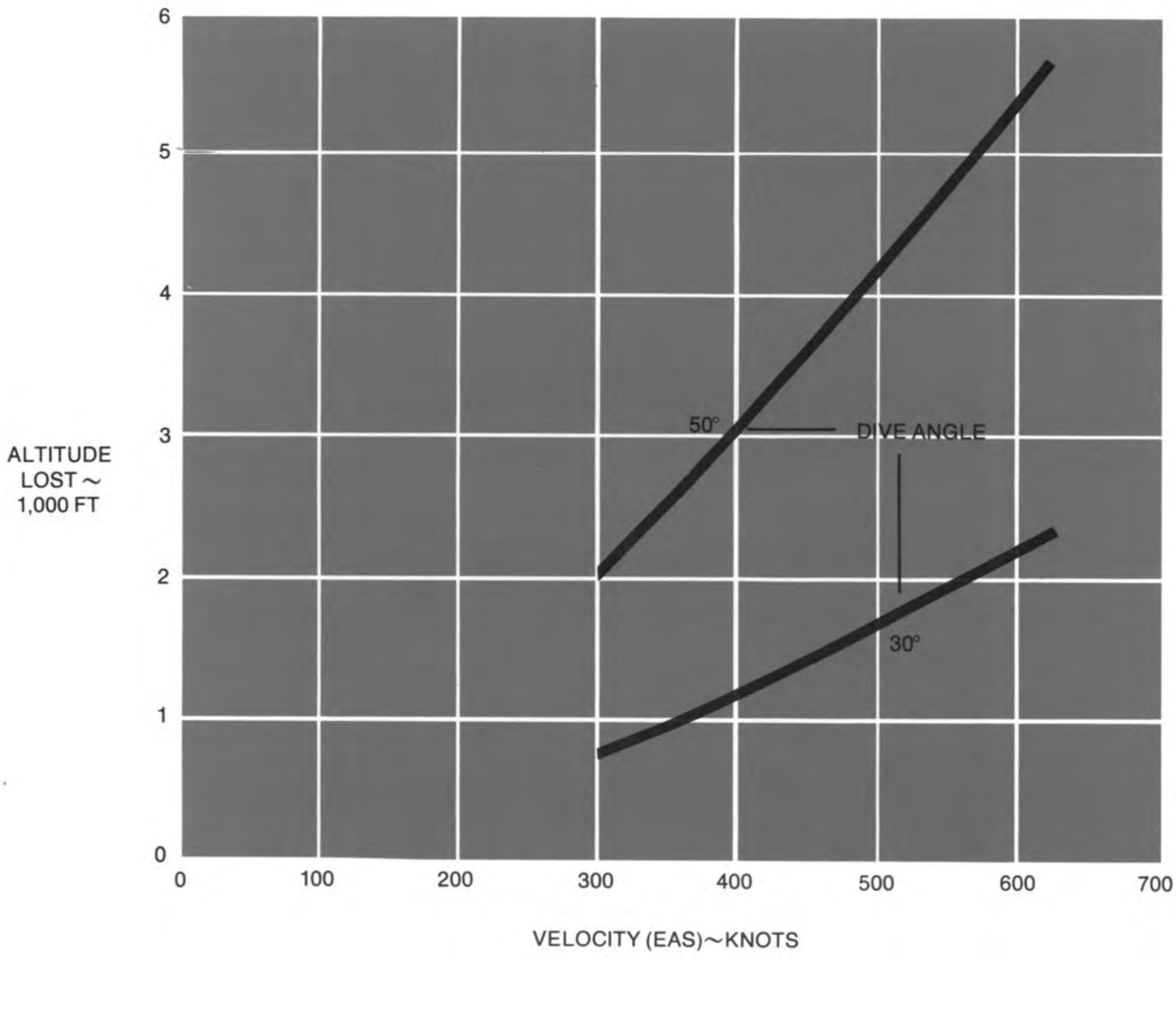
SEA LEVEL
C.G. = 28%



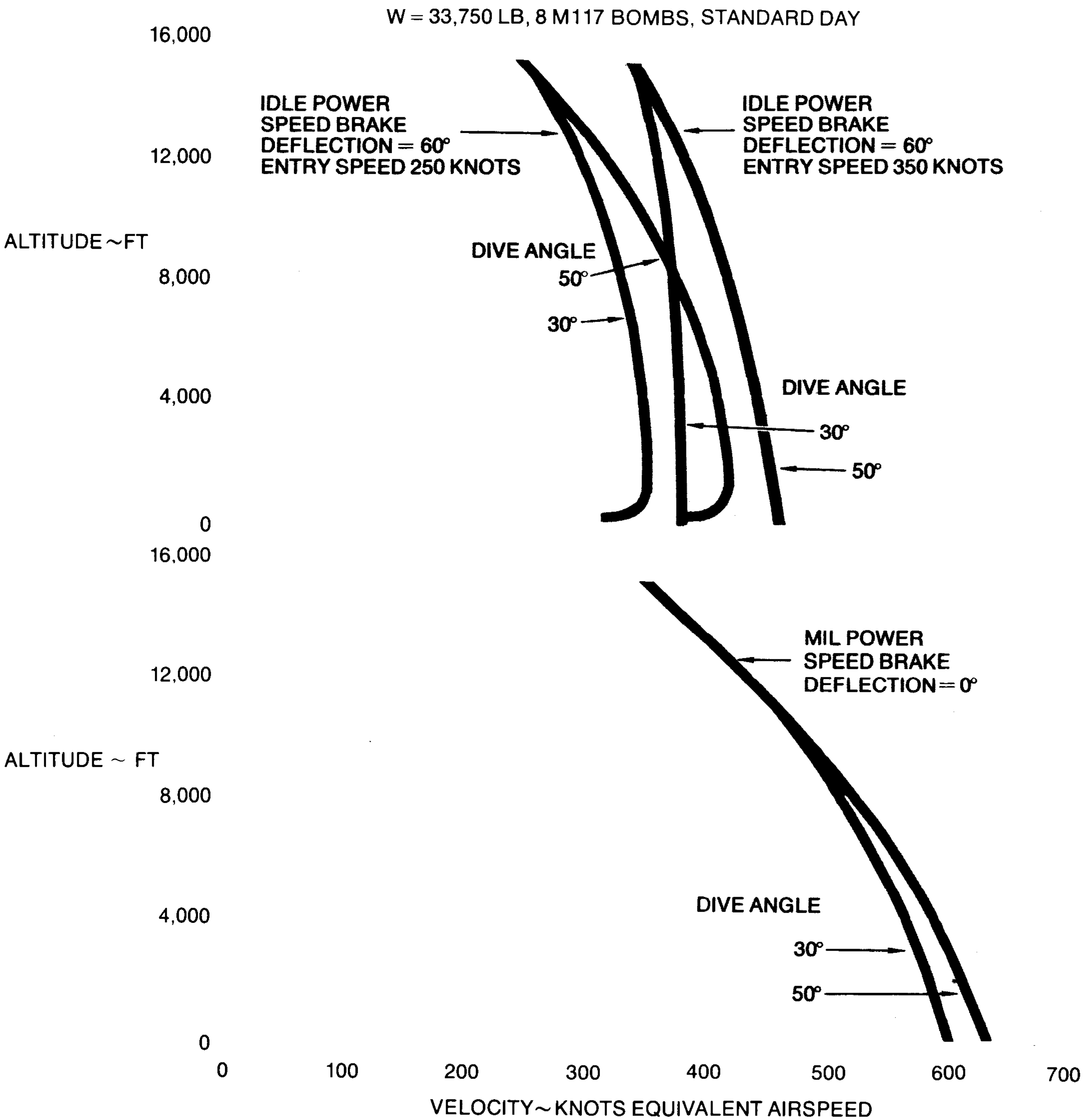
Level Flight V_{Max}



Altitude Lost During 4g Pull-up

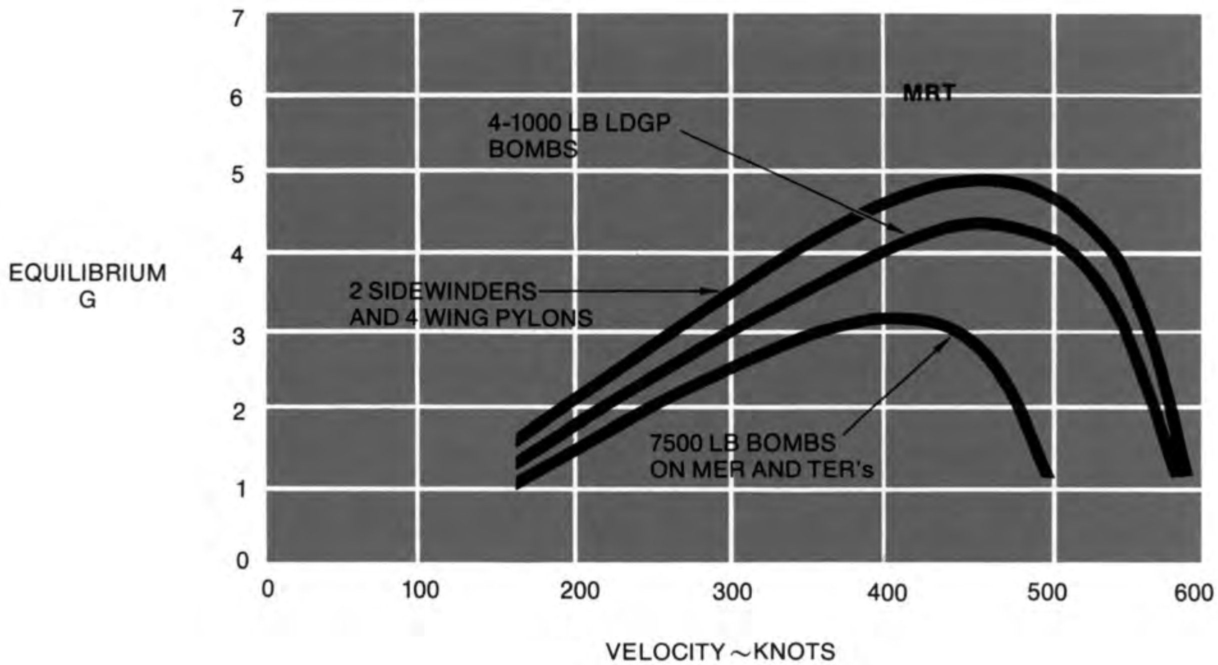


Typical Dive Performance



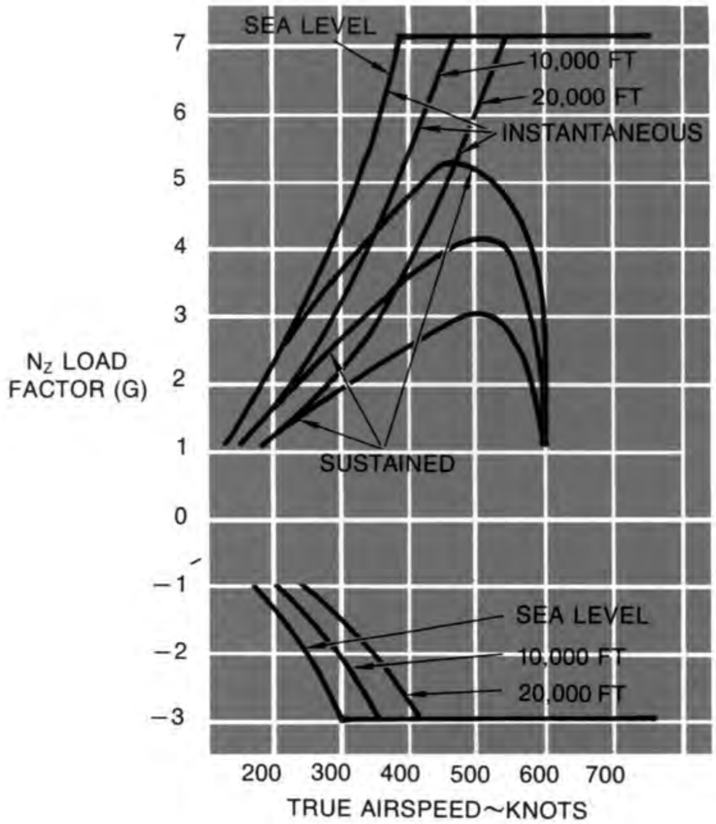
Equilibrium Turn

SEA LEVEL
STANDARD DAY – 60% FUEL (855 GAL)
FULL LOAD 20 mm AMMO



Maneuverability

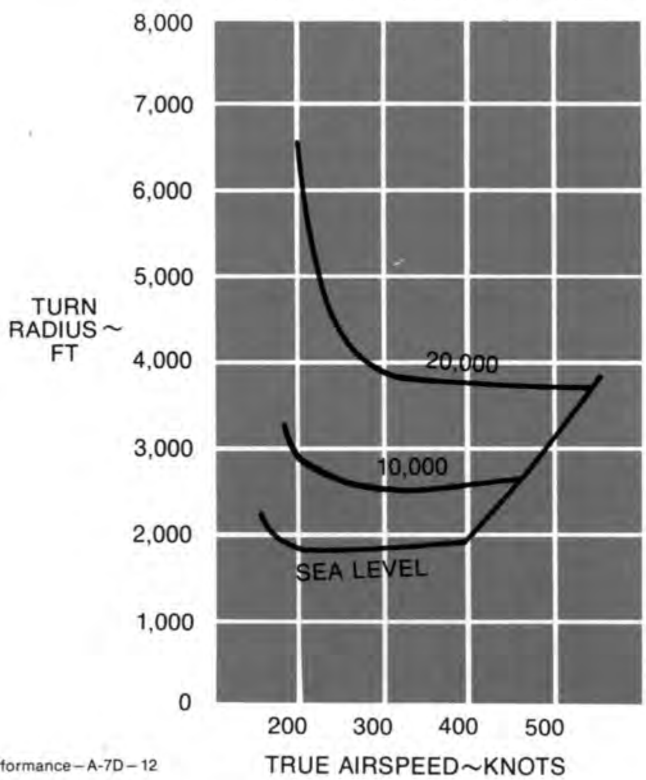
MAXIMUM LOAD FACTOR



CONFIGURATION AFTER ORDNANCE DELIVERY

- 6 WING PYLONS
- 2 SIDEWINDERS ON FUSELAGE STATIONS
- 40% FUEL REMAINING
- FULL 20MM AMMO—1,000 ROUNDS
- MRT

INSTANTANEOUS TURN RADIUS



SUSTAINED TURN RADIUS