USAF Almanac

Gallery of USAF Weapons

By Susan H.H. Young

Note: Inventory numbers are Total Active Inventory figures as of Sept. 30, 2000.

***B-1B** Lancer* (SSgt. Randy Mallard)

Bombers

B-1 Lancer

Brief: A long-range, air refuelable multirole bomber capable of flying missions over intercontinental range, then penetrating enemy defenses with a heavy load of ordnance.

Function: Long-range conventional bomber.

Operator: ACC, ANG.

First Flight: Dec. 23, 1974 (B-1A); Oct. 18, 1984 (B-1B).

Delivered: June 1985–May 1988.

IOC: Oct. 1, 1986, Dyess AFB, Tex. (B-1B).

Production: 104.

Inventory: 93 (B-1B).

Unit Location: Active: Dyess AFB, Tex., Ellsworth AFB, S.D., Mountain Home AFB, Idaho. ANG: McConnell AFB, Kan., Robins AFB, Ga.

Contractor: Boeing; AIL Systems; General Electric.

Power Plant: four General Electric F101-GE-102 turbofans, each 30,780 lb thrust.

Accommodation: four, pilot, copilot, and two systems officers (offensive and defensive), on zero/zero ejection seats.

Dimensions: span spread 137 ft, swept aft 78 ft, length 147 ft, height 34 ft.

Weights: empty equipped 192,000 lb, max operating weight 477,000 lb.

Ceiling: over 30,000 ft.

Performance: max speed at low level high subsonic; 900+ mph (Mach 1.2 at S/L); range intercontinental.

Armament: three internal weapons bays capable of accommodating in a conventional role up to 84 Mk 82 (500-lb) bombs or Mk 62 naval mines and up to 30 CBU-87/89 cluster munitions and CBU-97 Sensor Fuzed Weapons (SFWs), to be fitted with the Wind-Corrected Munitions Dispenser (WCMD) kits, and up to 24 2,000-lb GBU-31 Joint Direct Attack Munitions (JDAMs).

COMMENTARY

Of blended wing/body configuration, the B-1's variable-geometry design and turbofan engines combine to provide greater range and high speed at low level, with enhanced survivability. Unswept wing settings provide for maximum range during high-altitude cruise. The fully swept position is used in supersonic flight and for high subsonic, low-altitude penetration.

The bomber's offensive avionics include Synthetic Aperture Radar (SAR), Ground Moving Target Indicator (GMTI), and Terrain-Following Radar, an extremely accurate Global Positioning System/Inertial Navigation System (GPS/INS), computer-driven avionics, and a strategic Doppler radar, enabling aircrews to navigate, update target coordinates in flight, and precision bomb.

The current defensive avionics package, built around the ALQ-161 Electronic Countermeasures (ECM) system, is supplemented by the ALE-50 towed decoy and chaff and flares to protect against radar-homing and heat-seeking missiles. Aircraft structure and radar-absorption materials reduce the aircraft's radar signature to approximately one percent that of a B-52. The ALE-50 provides greater protection against RF threats.

B-1A. USAF acquired four prototype flight test models of this new strategic bomber in the 1970s, but the program was canceled in 1977. Flight test of the four B-1A models continued through 1981.

B-1B is the improved variant initiated by the Reagan Administration in 1981. First production model flew October 1984 and USAF produced a total of 100. The B-1 was first used in combat in support of operations against Iraq during Desert Fox in December 1998. B-1B's speed, superior handling qualities, and large payload make it a key element of any joint/composite strike force, with the flexibility to deliver a wide range of weapons or to carry additional fuel, as required. B-1Bs are currently acquiring the capability to carry up to 24 2,000-lb GPS–guided GBU-31 JDAMs, with fleet completion in FY02.

The B-1B's capability is being significantly enhanced by the ongoing Conventional Mission Upgrade Program (CMUP). This gives the B-1B greater lethality and survivability through the integration of precision and standoff weapons and a robust ECM suite. CMUP includes GPS receivers, a MIL-STD-1760 weapon interface, secure interoperable radios, and improved computers to support precision weapons, initially the GBU-31 JDAM, with follow-on computer and software upgrades permitting simultaneous carriage of mixed guided and unguided weapons, including WCMDs, AGM-154 Joint Standoff Weapons (JSOWs), and the AGM-158 Joint Air-to-Surface Standoff Missiles (JASSMs). The Defensive System Upgrade Program, incorporating the ALE-55 fiber-optic towed decoy, ALR-56M radar, and ALQ-210 receiver/processor, will improve aircrew situational awareness and jamming capability.

***B-2** Spirit* being refueled by a ***KC-10 A** Extender* (USAF photo by Gary Ell)

B-2 Spirit

Brief: Stealthy, long-range multirole bomber that can deliver conventional and nuclear munitions anywhere on the globe by flying through previously impenetrable defenses.

Function: Long-range heavy bomber.

Operator: ACC.

First Flight: July 17, 1989.

Delivered: Dec. 11, 1993–present.

IOC: April 1997, Whiteman AFB, Mo.

Production: 21.

Inventory: 21.

Unit Location: Whiteman AFB, Mo.

Contractor: Northrop Grumman, with Boeing, LTV, and General Electric as principal subcontractors.

Power Plant: four General Electric F118-GE-100 turbofans, each 17,300 lb thrust.

Accommodation: two, mission commander and pilot, on zero/zero ejection seats.

Dimensions: span 172 ft, length 69 ft, height 17 ft.

Weight: empty 125,000–153,700 lb, typical T-O weight 336,500 lb.

Ceiling: 50,000 ft.

Performance: minimum approach speed 140 mph, typical estimated unrefueled range for a hi-lo-hi mission with 16 B61 nuclear free-fall bombs 5,000 miles, with one aerial refueling more than 10,000 miles.

Armament: in a nuclear role: up to 16 nuclear weapons (B61, B61 Mod II, B83). In a conventional role: up to 16 GBU-31 (2,000-lb) JDAMs or a penetration version of a BLU-109, or 16 Mk 84 2,000-lb bombs; up to 16 2,000-lb GBU-36/B (GPS–Aided Munition); or up to eight 4,700-lb GBU-37 (GAM-113) near-precision guided weapons. Various other conventional weapons, incl the Mk 82 500-lb bomb, M117 750-lb bomb, Mk 62 500-lb naval mine, and up to 32 CBU-87/89/97 cluster bombs. JASSM and JSOW are presently being added to B-2 Block 30 aircraft through FY03.

COMMENTARY

The B-2 bomber is a unique, highly advanced system, combining sophisticated technologies, notably Low Observable (LO) stealth design, with high aerodynamic efficiency, enabling it to attack heavily defended targets and neutralize enemy defenses and, thereby, making way for less stealthy systems to operate.

Based on the flying wing concept, the B-2 has no vertical tail surfaces. The smoothly blended "fuselage" section accommodates two flight crew and two large weapon bays side by side in the lower centerbody. These bays contain rotary launchers or bomb rack assemblies capable of carrying a total weapons load of 40,000 lb.

Four nonafterburning turbofan engines are mounted in pairs within the wing structure, with scalloped over-wing intake ducts and shielded over-wing trailing-edge nozzles. The aircraft has a quadruple-redundant fly-by-wire digital flight-control system, actuating moving surfaces at the wing trailing edges that combine aileron, elevator, and rudder functions. A landing gear track of 40 ft enables the B-2 to use any runway that can handle a Boeing 727 airliner.

B-2A. B-2 production represents three successive blocks of capability. Block 10 aircraft carried B83 nuclear bombs or 16 Mk 84 2,000-lb conventional munitions. Block 20 aircraft additionally carried the B61/7 and B61/11 nuclear gravity bombs, as well as two GPS–Aided Munitions (GAMs), the GBU-37 and GBU-36B, on two rotary launcher assemblies, providing an interim, near-precision strike capability. All Block 10 and 20 aircraft have now been upgraded to Block 30.

Block 30 configuration retains weapon capability introduced in Block 10 and 20 and adds significant new capability. Using the rotary launcher assembly, all B-2s are capable of employing 16 Mk 84 JDAMs, 16 JSOWs, or 8 GAM-113s (to be replaced by EGBU-28 in the future). All of these weapons are individually targeted, giving the B-2 multiple-kills-per-pass capability. All B-2s are also capable of substituting bomb rack assemblies in place of the rotary launchers, providing the capability to employ 80 500-lb Mk 82s, 36 750-lb M117s, 34 tactical munitions dispensers, or 80 Mk 62 sea mines. Future modifications to the bomb racks will allow carriage of 80 independently targeted Mk 82 JDAMs. Other Block 30 enhancements include fully operational defensive and offensive avionics, a more sophisticated mission planning system, and additional operating modes for the Synthetic Aperture Radar (SAR).

The last original Block 20 B-2, used as a test aircraft at Edwards AFB, Calif., is being refurbished as an operational bomber and will enter operational service in September 2002.

The first combat mission took place March 24, 1999, against Serb targets in Allied Force. Two B-2s made a 30-hour-plus round-trip from Whiteman AFB to attack a variety of hard and soft targets. Each aircraft dropped 16 2,000-lb JDAMs.

B-52 Stratofortress

Brief: A long-range, heavy multirole bomber that can carry nuclear or conventional ordnance or air launched cruise missiles, with worldwide precision navigation capability.

Function: Long-range heavy bomber.
Operator: ACC, AFRC.
First Flight: April 15, 1952 (YB-52 prototype).
Delivered: November 1955–October 1962.
IOC: June 19, 1955.
Production: 744.
Inventory: 94.
Unit Location: Barksdale AFB, La., Minot AFB, N.D.
Contractor: Boeing.
Power Plant: eight Pratt & Whitney TF33-P-3 turbofans, each 17,000 lb thrust.
Accommodation: two pilots, side by side, plus navigator, radar navigator, and electronic warfare officer.
Dimensions: span 185 ft, length 159 ft 4 in, height 40 ft 8 in.
Weight: empty approx 188,000 lb, gross 488,000 lb.
Ceiling: 50,000 ft.
Performance (approx): max level speed 650 mph, range more than 10,000 miles.
Armament: 12 AGM-86B Air Launched Cruise Missiles (ALCMs) or AGM-129A Advanced Cruise Missiles (ACMs) externally, with provision for eight more ALCMs or gravity weapons internally. Conventional weapons incl AGM-86C/D Conventional ALCMs (CALCMs), bombs up to 2,000 lb, CBU 87/89/97 cluster munitions, WCMDs, GBU-31 JDAMs, JSOWs from 2001, JASSMs in 2002–03, and on some aircraft, three to four AGM-142A Have Nap missiles or eight AGM-84 Harpoons in under-wing clusters.

***B-52H** Stratofortress* (SSgt. Mary Smith)

COMMENTARY

Retaining a key role within USAF's manned strategic bomber force, the B-52's still-expanding weapons capability reflects its continuing ability to perform a wide range of missions despite 40 years–plus service, including show of force, maritime operations, long-range precision strikes, offensive counterair, air interdiction, and defense suppression.

The bomber is equipped with an Electro-Optical (EO) viewing system that uses Forward-Looking Infrared (FLIR) and high-resolution Low-Light-Level Television (LLLTV) sensors to augment the targeting, battle assessment, flight safety, and terrain avoidance systems, thus improving combat ability and low-level flight capability. Pilots have Night Vision Goggles (NVGs) to further enhance night operation. The B-52's ECM suite uses a combination of electronic detection, jamming, and infrared countermeasures to protect against hostile air defense systems. The aircraft can also detect and counter missile attack from the rear.

Several versions of the Stratofortress were produced, including:

B-52A. Initial production version, with J57-P-1W engines and provision for in-flight refueling. First flown Aug. 5, 1954, the three aircraft built were used by Boeing for technical development purposes. Delivered to SAC November 1957. Finally retired 1969.

B-52B. First operational version, 23 of which were built. Also, 27 RB-52B dual-role bomber/reconnaissance variants. First flown January 1955, with deliveries between June 1955–August 1956; powered by J57-P-1W, -19W, -29W, or -29WA engines. Retired in the mid-1960s.

B-52C. Multimission version with increased gross weight and larger under-wing tanks. Powered by J57-P-19W or -29WA engines. First flown March 1956, 35 were delivered June–December 1956. Majority retired 1971.

B-52D. Long-range bomber version, first flown June 1956. Total of 170 built, with deliveries beginning late 1956. Retired 1982–83.

B-52E. Version with improved bombing, navigation, and electronics systems. First flown October 1957. One hundred delivered October 1957–June 1958. Retired 1969–70.

B-52F. Version with uprated J57-P-43WA engines, first flown in May 1958. Eighty-nine delivered June 1958–February 1959. Retired 1978.

B-52G. Introduced important design changes, including a redesigned wing containing integral fuel tanks for increased range, fixed under-wing external tanks, a shorter tail fin of greater chord, and a remotely controlled tail gun turret that allowed the gunner to be repositioned with the rest of the crew. Initial flight August 1958, with the first of 193 aircraft entering service in February 1959. Withdrawn 1994.

B-52H. The only version still in service. The H introduced TF33 turbofans, providing increased unrefueled range, and improved defensive armament. First flown July 1960, 102 were built, with deliveries between May 1961–October 1962.

Deployment of the B-1 and B-2 led to a change in the primary role of the B-52 to cruise missile carrier with, typically, multiple cruise missile launches at high altitude, often followed by B-52 low-level descent to attack additional targets using gravity weapons.

Ongoing modernization of its conventional capabilities is extending the B-52's service life well into this century, with the ability to provide massive firepower in low-threat environments supplemented by a standoff attack capability. Upgrades include the installation of GPS, ARC-210 radios, Have Quick II anti-jam radio, KY-100 secure radio, and MIL-STD-1760 interfaces; weapons capability to include naval mines, precision guided weapons, such as AGM-84 Harpoon, AGM-142 Have Nap, and AGM-86C/D CALCM (a conventional variant of the nuclear AGM 86-B ALCM); and advanced weapons, such as JDAM, JSOW, JASSM, and WCMD. Modification of heavy stores adapter beams will standardize aircraft to carry all B-52–certified munitions.

***A-10A** Thunderbolt II* (SSgt. George F. Thompson)

Avionics improvements include the Avionics Midlife Improvement program, which replaces the current system processors and data transfer cartridges. Electronic attack improvements include the Situational Awareness Defensive Improvement panoramic threat receiver and the electronic combat modernization improvement upgrade to the ALQ-172 electronic countermeasures set.

Current plans encompass a force of around 76 aircraft.

***F-15C** Eagle* (A1C James L. Harper Jr.)

Fighter and Attack Aircraft

A-10 Thunderbolt II

Brief: A simple, effective, and survivable twin-engine aircraft specifically designed for Close Air Support of ground forces and which can be used against all ground targets, including tanks and other armored vehicles.

Function: Attack aircraft.

***F-15E** Strike Eagle* (Ted Carlson)

Operator: ACC, PACAF, USAFE, ANG, AFRC.

First Flight: Feb. 15, 1975 (preproduction).

Delivered: November 1975–March 1984.

IOC: October 1977.

Production: 713.

Inventory: 367.

Unit Location: Active: Davis–Monthan AFB, Ariz., Eglin AFB, Fla., Eielson AFB, Alaska, Moody AFB, Ga., Nellis AFB, Nev., Osan AB, South Korea, Pope AFB, N.C., Spangdahlem AB, Germany. ANG: Barnes MAP, Mass., Boise Air Terminal, Idaho, Bradley IAP, Conn., Martin State Airport, Md., W.K. Kellogg Airport, Mich., Willow Grove ARS, Pa. AFRC: Barksdale AFB, La., NAS New Orleans JRB, La., Whiteman AFB, Mo.

Contractor: Fairchild Republic.

Power Plant: two General Electric TF34-GE-100 turbofans, each 9,065 lb thrust.

Accommodation: pilot only, on zero-height/518 mph–zero-speed ejection seat.

Dimensions: span 57 ft 6 in, length 53 ft 4 in, height 14 ft 8 in.

Weight: empty 28,000 lb, max gross 51,000 lb.

Ceiling: 45,000 ft.

Performance: speed 420 mph, range with 9,500 lb of weapons and 1.7 hr loiter, 20 min reserve, 288 miles.

Armament: one 30 mm GAU-8/A gun; eight underwing hardpoints and three under fuselage for up to 16,000 lb of ordnance, incl various types of free-fall or guided bombs, Combined Effects Munition (CEM) dispensers, gun pods, up to six AGM-65 Maverick missiles, up to four AIM-9 Sidewinder missiles, and jammer pods. Chaff and flares carried internally to counter radar-directed or infrared-directed threats. The centerline pylon and the two flanking fuselage pylons cannot be occupied simultaneously.

COMMENTARY

Supporting the demands of the Close Air Support (CAS) mission, the A-10 combines large military load, long loiter, and wide combat radius with the ability to operate under 1,000-ft ceilings, with 1.5-mile visibility, and in darkness with NVGs. In a typical anti-armor mission, the A-10, nicknamed "Warthog," can fly 150 miles and remain on station for an hour. The 30 mm GAU-8/A gun provides a cost-effective weapon with which to defeat the whole array of ground targets, including tanks. The large bubble canopy provides all-around vision for the pilot, and the cockpit is protected with titanium armor, capable of withstanding projectiles up to 23 mm. Used extensively during the Persian Gulf War. Projected to serve well into the 2020s. An A-10 structural enhancement will begin in FY02.

A-10A equipment includes EGI, an Enhanced GPS/Inertial Navigation System (INS), Head-Up Display (HUD), NVGs, the Low-Altitude Safety and Targeting Enhancement (LASTE) system for ground collision avoidance, Pave Penny laser target identification pod, ECM, target penetration aids, self-protection systems, and AGM-65 Maverick and AIM-9 Sidewinder missiles. A precision engagement upgrade began in February 2001 to provide the A-10 with new cockpit displays, a digital stores management system, a situational awareness data link and integration of the JDAM and WCMD. A targeting pod, not yet selected, is also planned. Additionally, an upgraded automated chaff and flare system is planned for all aircraft by 2005.

OA-10A. Redesignated A-10s, used for forward air control of fighter aircraft, combat escort, search and rescue, and visual reconnaissance. The 30 mm GAU-8/A gun is retained, but under-wing stores are normally restricted to canisters of white phosphorous rockets for target marking. The first OA-10 unit reached Initial Operational Capability (IOC) in October 1987.

AC-130 Gunship

Brief: Heavily armed aircraft using side-firing weapons integrated with sophisticated sensor, navigation, and fire-control systems to provide precise firepower or area saturation for long periods, at night and in adverse weather.

Function: Attack aircraft.

Operator: AFSOC.

First Flight: 1967.

Delivered: 1968–95.

IOC: 1972 (AC-130H); 1995 (AC-130U).

Production: 39.

Inventory: 21.

Unit Location: Hurlburt Field, Fla.

Contractor: Lockheed Martin, Rockwell (AC-130U).

Power Plant: four Allison T56-A-15 turboprops, each 4,910 shp.

Accommodation: AC-130H crew of 14; AC-130U crew of 13.

Dimensions: span 132 ft 7 in, length 97 ft 9 in, height 38 ft 6 in.

Weight: H model: gross 155,000 lb.

Ceiling: 25,000 ft.

Performance: H model: speed 300 mph, range 1,500 miles, with air refueling unlimited.

Armament: two 20 mm Vulcan cannons with 3,000 rd (AC-130H); one 25 mm Gatling gun (AC-130U); one 40 mm Bofors cannon with 256 rd, and one Howitzer with 100 rd.

COMMENTARY

The AC-130 is a C-130 modified with gun systems, electronic and Electro-Optical (EO) sensors, fire-control systems, enhanced navigation systems, sophisticated communications, defensive systems, and in-flight refueling capability. These systems give the gunship crew the capability to acquire and identify targets day or night, coordinate with ground forces and Command-and-Control (C^2) agencies, and deliver surgical firepower in support of both conventional and special operations missions.

AC-130A was the initial version, deployed in Vietnam 1968–69. Eighteen produced.

AC-130E, an improved version, of which eight were built. Converted to H standard after service in Vietnam.

AC-130H Spectres serve with the 16th SOW. The unit has eight, each equipped with a digital fire-control computer. They employ EO sensors and target-acquisition systems, including FLIR and LLLTV, and are capable of in-flight refueling. Fire-control computers, navigation, communications, and sensor suites have been upgraded; an Infrared Suppression System (IRSS) overhaul is under way.

AC-130U Spookys are the most recent gunship conversions, converted by Rockwell, of which 13 were delivered to the 16th SOW's 4th SOS in 1994–95. These aircraft have greater altitude capability and combine increased firepower, reliability, and superior accuracy with the latest methods of target location. The two 20 mm cannon of the H model are replaced with one trainable 25 mm Gatling gun. All weapons can be subordinated to the APQ-180 digital fire-control radar, FLIR, or All-Light-Level Television (ALLTV) for adverse weather attack operations.

Although the AC-130H Spectre and AC-130U Spooky gunships use dissimilar avionics and other systems, fire support to ground parties is generally comparable. The AC-130U will not be required for most fire support missions but provides benefits under certain circumstances (weather, dual target attack, and defensive avionics).

F-15 Eagle

Brief: A supersonic, all-weather, highly maneuverable tactical fighter designed to permit USAF to swiftly gain and maintain air superiority in aerial combat.

Function: Fighter.

Operator: ACC, AETC, AFMC, PACAF, USAFE, ANG.

First Flight: July 27, 1972.

Delivered: from November 1974.

IOC: September 1975.

Production: 874.

Inventory: 522.

Unit Location: Active: Edwards AFB, Calif., Eglin AFB, Fla., Elmendorf AFB, Alaska, Kadena AB, Japan, Langley AFB, Va., Mountain Home AFB, Idaho, Nellis AFB, Nev., RAF Lakenheath, UK, Tyndall AFB, Fla. ANG: Hickam AFB, Hawaii, Jacksonville IAP, Fla., Klamath Falls IAP, Ore., Lambert–St. Louis IAP, Mo., NAS New Orleans JRB, La., Otis ANGB, Mass., Portland IAP, Ore.

Contractor: Boeing.

Power Plant: F-15C: two Pratt & Whitney F100-PW-220 turbofans, each 25,000 lb thrust, with max afterburner.

Accommodation: pilot only in F-15A/C; two seats in F-15B/D.

Dimensions: span 42 ft 10 in, length 63 ft 9 in, height 18 ft 8 in.

Weight: empty 28,600 lb, gross 68,000 lb.

Ceiling: 65,000 ft.

Performance: F-15C: max speed Mach 2.5, T-O run 900 ft, landing run without braking parachute 3,500 ft, ferry range with external fuel tanks more than 2,878 miles.

Armament: one internally mounted M61A1 20 mm six-barrel cannon; up to four AIM-9 Sidewinder and up to four AIM-7 Sparrow air-to-air missiles, or up to eight AIM-120 AMRAAMs, carried externally.

COMMENTARY

Superior maneuverability and acceleration, range, weapons, and avionics enable the F-15 to penetrate hostile defenses and establish air superiority over enemy systems. F-15 fighters deployed to the Persian Gulf for Desert Storm accounted for 29 of the 37 USAF air-to-air victories.

F-15A (single-seat) and **F-15B** (two-seat) fighters immediately became USAF's front-line fighter upon introduction in the mid-1970s. Basic equipment includes APG-63 pulse–Doppler radar for long-range detection and tracking of small high-speed objects down to treetop level and effective weapons delivery, a HUD for close-in combat, Identification, Friend or Foe (IFF), and INS. A/Bs now serve with the ANG.

F-15C (single-seat) and **F-15D** (two-seat) models followed in June 1979. Improvements include 2,000 lb of additional internal fuel and provision for carrying Conformal Fuel Tanks (CFTs), reducing in-flight refueling requirements and increasing time in the combat zone. Tactical capabilities have been extensively enhanced since 1983 through an ongoing program of installation or modification of new or existing avionics equipment, allowing for the carriage of more advanced weapons and increased self-protection. The last 43 aircraft included improved APG-70 radar, and 159 C/Ds are scheduled to receive an APG-63 upgrade, the APG-63(V)1. One squadron will receive a later version, the APG-63(V)2, featuring an advanced active electronic scanned array.

F-15E Strike Eagle

Brief: A heavily modified, two-seat, dual-role variant of the original F-15, with weapon systems totally integrated for all-weather deep interdiction missions as well as air-to-air combat.

Function: Dual-role fighter.

Operator: ACC, AFMC, PACAF, USAFE.

First Flight: Dec. 11, 1986.

Delivered: December 1988–present.

IOC: May 1989.

Production: 226.

Inventory: 218.

Unit Location: Edwards AFB, Calif., Eglin AFB, Fla., Elmendorf AFB, Alaska, Mountain Home AFB, Idaho, Nellis AFB, Nev., RAF Lakenheath, UK, Seymour Johnson AFB, N.C.

Contractor: Boeing.

Power Plant: two Pratt & Whitney F100-PW-220, each 25,000 lb thrust; or F100-PW-229 turbofans, each 29,000 lb thrust with max afterburner.

Accommodation: crew of two on zero/zero ejection seats.

Dimensions: span 42 ft 9 in, length 63 ft 9 in, height 18 ft 5 in.

Weight: empty 32,000 lb, gross 81,000 lb.

Ceiling: 65,000 ft.

Performance: max level speed at altitude Mach 2.5, ferry range with CFTs 3,000 miles.

Armament: one internally mounted M61A1 20 mm six-barrel cannon; up to four AIM-9 Sidewinder and up to four AIM-7 Sparrow air-to-air missiles, or up to eight AIM-120 AMRAAMs; up to six AGM-65 Maverick air-to-surface missiles; AGM-130; EGBU-15; EO, IR, and standard bombs; CBU 87/89/97 cluster munitions; and nuclear weapons. JSOW, JDAM, and WCMD capability from FY03.

COMMENTARY

F-15E has a strengthened airframe for increased gross weight at takeoff and maneuver at 9 Gs throughout the flight envelope. Cockpit controls and displays are improved, and a wide-field-of-view HUD is included.

For low-altitude, high-speed penetration and precision attack on tactical targets at night and in adverse weather, the F-15E carries a high-resolution APG-70 SAR and LANTIRN (Low-Altitude Navigation and Targeting Infrared for Night) pods, with wide-field FLIR. The APG-70 gives the F-15E, with its AMRAAM, AIM-7, and AIM-9 load, a true multirole capability with the inherent air-to-air capability of the F-15C. The digital, triple-redundant flight-control system permits automatic terrain following. Other improvements include a ring-laser gyro INS, with GPS capability from 1997, and, in FY03, the capability to carry smart weapons (JSOW, JDAM, and WCMD). CFTs, adapted to carry ordnance tangentially, can be fitted to reduce drag while increasing combat range.

During Desert Storm 48 USAF F-15Es were deployed to the Persian Gulf where they operated mainly at night, hunting Scud missile launchers and artillery sites using the LANTIRN system. They also operated successfully with Joint STARS aircraft.

F-16 Fighting Falcon

Brief: A compact, versatile, and low-cost multirole fighter aircraft that is highly maneuverable and has repeatedly proved itself in air-to-air combat and air-to-surface attack.

Function: Multirole fighter.

Operator: ACC, AETC, AFMC, PACAF, USAFE, ANG, AFRC.

First Flight: Dec. 8, 1976 (full-scale development).

Delivered: August 1978–present.

IOC: October 1980, Hill AFB, Utah.

Production: 2,206.

Inventory: 1,412.

Unit Location: 14 active wings, 28 ANG, and five AFRC units (one Associate aircraft).

Contractor: Lockheed Martin.

Power Plant: one augmented turbofan. General Electric F110-GE-100 (27,600 lb thrust) and Pratt & Whitney F100-PW-220 (23,450 lb thrust) are alternative standard engines. Increased Performance Engines (IPEs) in aircraft delivered from late 1991: Block 50: F110-GE-129 (29,000 lb thrust); Block 52: F100-PW-229 (29,100 lb thrust).

Accommodation: pilot only, on zero/zero ejection seat.

Dimensions: wingspan with missiles 32 ft 8 in, length overall 49 ft 5 in, height 16 ft.

Weight: (F-16C) empty (F100-PW-229) 18,591 lb, (F110-GE-129) 18,917 lb; gross, with external load (Block 40/42) 42,300 lb.

Ceiling: above 50,000 ft.

Performance: max speed Mach 2, radius of action: Block 40 with two 2,000-lb bombs, two AIM-9 missiles, and external fuel, hi-lo-lo-hi 852 miles.

Armament: one M61A1 20 mm multibarrel cannon, with 511 rd, mounted in fuselage; wingtip-mounted missiles; seven other external stores stations for fuel tanks and a range of air-to-air and air-to-surface munitions.

COMMENTARY

The F-16 is the workhorse of the USAF fighter fleet. The 200+ USAF F-16 multimission fighters deployed to the Persian Gulf theater flew more sorties than any other type during Desert Storm, with 13,500 missions, and were again used extensively during Allied Force. F-16s are deployed to patrol the no-fly zones in northern and southern Iraq.

F-16A (single-seat) and **F-16B** (two-seat) versions, which entered service with the 388th TFW, Hill AFB, Utah, incorporated advanced technologies from the start, making these aircraft two of the most maneuverable fighters built. Equipment includes a multimode radar with a clutter-free look-down capability, advanced Radar Warning Receiver (RWR), HUD, internal chaff/flare dispensers, and a 500-rd 20 mm internal gun.

Production of the F-16A and B for USAF ended in 1985. Most now belong to ANG. USAF and NATO operators have cooperated in an operational capabilities upgrade. Under this midlife update program the radar, fire-control computer, stores-management computer, and avionics software are improved, giving F-16A/Bs the ability to use next-generation air-to-air and air-to-surface weapons.

Reliability and maintainability improvements include a ring-laser gyro INS and installation of the upgraded F100-PW-220E turbofan.

The Multinational Staged Improvement Program (MSIP), implemented in 1980, ensured the aircraft could accept systems under development, thereby minimizing retrofit costs. All F-16s delivered since November 1981 have had built-in structural and wiring provisions and systems architecture that expand the single-seater's multirole flexibility to perform precision strike, night attack, and beyond-visual-range intercept missions.

F-16C (single-seat) and **F-16D** (two-seat) aircraft were introduced at production Block 25 with MSIP II improvements in the cockpit, airframe, and core avionics and an increased-range APG-68 radar. Deliveries began in 1984. With the exception of AFMC, all of the active and many of the Guard and Reserve units have since converted to F-16C/Ds.

Block 40/42 F-16s specialize in night attack operations with precision guided weapons. Follow-on improvements include ALE-47 improved defensive coun-

Block 40 F-16CG *Fighting Falcon* (SSgt. Vince Parker)

Block 50 F-16CJ *Fighting Falcon* (SSgt. Sean M. Worrell)

termeasures, ALR-56M advanced RWR (Block 40 only), Very High Speed Integrated Circuit (VHSIC) technology in the APG-68(V5) fire-control radar, a ring-laser gyro INS, a LANTIRN nav/attack system, and IPEs. System improvements also introduced at Block 40/42 include core avionics hardware, installation of a LANTIRN nav/attack system, GPS, enhanced-envelope gunsight, digital flight controls, automatic terrain following, increased takeoff weight and maneuvering limits, an 8,000-hour airframe, and expanded envelope 9 G capability.

Block 50/52 F-16C/Ds have MSIP Stage III improvements, which also show up in selected retrofits of earlier F-16 blocks. These aircraft incorporate the latest cockpit control and display technology, including a wide-angle HUD. Weapons improvements include multishot AMRAAM compatibility. Integration of AGM-154 JSOW and WCMD is under way.

In another program, Block 40/42/50/52 USAF F-16C/Ds are to be retrofitted with a new modular mission computer being developed under an F-16 Common Configuration Implementation Program. This effort includes the participating European governments of the F-16 Multinational Fighter Program. Other improvements to be incorporated include Litening II targeting pods, joint helmet mounted cueing system, AIM-9X, Link 16 data link, and improved weapons capabilities.

***F-22** Raptor* (Ted Carlson)

***F-117A** Nighthawk* (Ted Carlson)

Block 60 F-16C/Ds include most Block 40 and 50 configurations and other improvements, such as a new internal sensor suite, which is similar to LANTIRN but with only the sensor heads outside the aircraft. Block 60 will also include a new Integrated Electronic Warfare System and the Agile Beam Radar from Northrop Grumman. Either the General Electric or Pratt & Whitney IPE power plants are being offered. Currently Lockheed Martin will deliver 80 Block 60 fighters from 2004–07 to the United Arab Emirates.

The Block 60 is considered the chief alternative for USAF if the Joint Strike Fighter is canceled.

F-16CG designated aircraft are equipped with LANTIRN for precision day or night attack.

F-16CJ/DJ designated Block 50 aircraft are equipped with the HARM Targeting System for Suppression of Enemy Air Defenses (SEAD), the role previously undertaken by F-16C/Ds with interim High-speed Anti-Radiation Missile (HARM) capability in conjunction with the now-retired F-4G Wild Weasel aircraft. Thirty additional F-16CJs have been budgeted by USAF beginning in the FY00 budget and ending in FY05.

F-22 Raptor

Brief: High-technology follow-on for the F-15C. An all-weather fighter that combines an extremely maneuverable airframe at both sub- and supersonic speeds with stealth technologies and highly integrated avionics to help it penetrate enemy airspace and achieve air superiority in aerial combat.

Function: Fighter.

Operator: ACC.

First Flight: Sept. 7, 1997.

Delivery: 2001 (first production representative aircraft).

IOC: December 2005.

Production: 339 (planned).

Inventory: five test aircraft.

Unit Location: Langley AFB, Va. (preferred option).

Contractor: Lockheed Martin, with Boeing and Pratt & Whitney as principal subcontractors.

Power Plant: two Pratt & Whitney F119-PW-100 turbofans, each in 35,000-lb thrust class.

Accommodation: pilot only, on zero/zero ejection seat.

Dimensions: span 44 ft 6 in, length 62 ft 1 in, height 16 ft 7 in.

Weight: empty 40,000-lb class, gross approx 60,000 lb.

Ceiling: above 50,000 ft.

Performance (design target): max level speed at S/L 900+ mph, range more than 2,000 miles.

Armament: (projected) one internal M61A2 20 mm gun, two AIM-9 Sidewinders stored internally in the sides of the fuselage; six AIM-120 AMRAAMs in the main weapons bay; for ground attack, two 1,000-lb JDAMs will replace four AMRAAMs internally.

COMMENTARY

This ultrasophisticated multimission air superiority fighter aircraft is designed to penetrate high-threat enemy airspace and achieve air superiority with a first-look, first-kill capability against multiple targets. It will cruise at supersonic speed without using its afterburners (supercruise). Its fully integrated avionics and weapon systems will permit simultaneous engagement of multiple targets. Extreme maneuverability is achieved through the combination of the avionics system, structural strength, and thrust vectoring nozzles. A Raytheon Common Integrated Processor will tie together various avionics functions.

Two prototypes were built for competitive evaluation with Northrop/McDonnell Douglas YF-23 prototypes. First flight was Sept. 29, 1990. **YF-22** selected as winner in April 1991.

F-22A. Production-configured version entered Engineering and Manufacturing Development (EMD) phase in August 1991. USAF is receiving nine single-seat F-22As, three without avionics to explore flight characteristics, flutter, loads, propulsion, and envelope expansion, and six as avionics test beds. It is also testing one static test and one fatigue test airframe.

With a decision taken toward the end of 1999 to continue development, the next six F-22s are production representative test aircraft used for follow-on testing of avionics, stealthiness, and weapons delivery systems. A critical series of avionics flight testing milestones had to be achieved prior to the decision on Low-Rate Initial Production (LRIP), including, crucially, the first flight of an F-22 equipped with combat-capable Block 3.0 avionics, achieved by Raptor 4005 on Jan. 5, 2001. However, DOD postponed an LRIP decision until after a defense program and strategy review in fall 2001.

F-117 Nighthawk

Brief: World's first operational aircraft designed to exploit Low Observable (LO) stealth technology to expand the range of heavily defended strategic targets that can be attacked.

Function: Attack aircraft.

Operator: ACC, AFMC.

First Flight: June 18, 1981.

Delivered: 1982–summer 1990.

IOC: October 1983.

Production: 59.

Inventory: 55.

Unit Location: Eglin AFB, Fla., Holloman AFB, N.M.

Contractor: Lockheed Martin.

Power Plant: two General Electric F404-GE-F1D2 nonafterburning turbojets, each 10,800 lb thrust.

Accommodation: pilot only, on zero/zero ejection seat.

Dimensions: span 43 ft 4 in, length 65 ft 11 in, height 12 ft 5 in.

Weight: empty (estimated) 29,500 lb, max gross 52,500 lb.

Ceiling: 35,000 ft.

Performance: high subsonic, mission radius, unrefueled (5,000-lb weapon load) 656 miles.

Armament: full internal carriage of what is described as a wide variety of tactical weapons, incl laser-guided 2,000-lb munitions.

COMMENTARY

Acknowledged publicly in November 1988, the F-117's first operational deployment was to Panama in 1989 for Just Cause. During the Persian Gulf War in 1991, a fleet of more than 40 F-117As undertook 1,270 missions. No aircraft were lost or damaged by hostile fire. An F-117 was lost March 27, 1999, while participating in Allied Force in Yugoslavia.

F-117A development and manufacture began simultaneously in November 1978 within a highly classified environment, using many parts either transferred or modified from existing aircraft. The F-117As were deployed initially with the 4450th Tactical Group (redesignated 37th TFW in 1989) at Tonopah Test Range Airfield, Nev., where operations were restricted mainly to night flying to maintain secrecy, although three aircraft were lost in much-publicized accidents.

To achieve the aircraft's minimal radar signature, the skin panels of the arrowhead-shaped airframe are divided into many small, perfectly flat surfaces (facets), which deflect at a variety of angles all signals from probing hostile ground or airborne radars. In addition, much of the aircraft's external surface is made of composites and radar-absorbent materials. The F-117A's dull black finish reflects little light, and the engine air intakes and exhaust nozzles are above the wings and rear fuselage, respectively, to shield them from IR seekers below. The two nonafterburning turbofans give the aircraft low noise signature and high subsonic performance.

Key features include a state-of-the-art digital avionics suite integrating sophisticated navigation and attack systems, complemented by a specially developed automated mission-planning system. High-precision INS is installed, with upgraded FLIR and DLIR (Downward-Looking Infrared), each with a boresight laser designator and an autotracker, to ensure precision attack.

Improvements since 1989 have included upgraded cockpit display and instrumentation, GPS capability, and ring-laser gyro INS. Current modification aims at providing a single, optimal LO configuration, adverse

weather capability via advanced weapons, and at maintaining the fleet through its service life.

Joint Strike Fighter

Brief: An affordable, highly common family of next-generation strike aircraft.

Function: Multirole fighter.

Operator: ACC for USAF.

First Flight: Boeing X-32A Sept. 18, 2000; Lockheed Martin X-35A Oct. 24, 2000.

Delivery: 2008 (anticipated first production aircraft).

IOC: 2011 (USAF).

Production: planned: 1,763 (USAF), 480 (USN), 609 (USMC), 150 (UK).

Inventory: TBD

Unit Location: TBD

Contractor: Lockheed Martin and Boeing are competing contractors; Pratt & Whitney is primary propulsion contractor; General Electric is alternate engine contractor.

Power Plant: one Pratt & Whitney F119 derivative turbofan, in 35,000-lb thrust class.

Accommodation: pilot only, on zero/zero ejection seat.

Dimensions: TBD

Weight: TBD

Ceiling: TBD

Performance (design targets): max level speed at S/L 630 knots calibrated airspeed for Navy and Short Takeoff and Vertical Landing (STOVL) variants, Mach 1 for USAF variant, combat radius more than 678.5 miles for USAF variant, 690 miles for Navy variant, and 517.5 miles for STOVL variant.

Armament: (main weapons bay): USAF variant: one internal gun, two AMRAAMs, and two 2,000-lb JDAMs. USN variant: two AMRAAMs and two 2,000-lb JDAMs. STOVL variant: two AMRAAMs and two 1,000-lb JDAMs. External carriage will also be available. (Note: Numerous other weapons capabilities will be added as system development continues.)

COMMENTARY: USAF is developing the Joint Strike Fighter (JSF) to replace its current force of F-16 and A-10 aircraft with a stealthy multirole fighter that will comprise the bulk of USAF's fighter fleet for up to 50 years. This advanced multimission fighter is designed to penetrate high-threat enemy airspace and engage all enemy targets in any conflict. In addition to its advanced LO design, the JSF incorporates stealth, maneuverability, long range, and highly advanced avionics to accomplish the bulk of USAF missions. Its fully integrated avionics and weapon systems will permit simultaneous engagement of multiple targets in enemy airspace.

The Concept Demonstration Phase (CDP) of the program commenced in November 1996 with competitive contract awards to Lockheed Martin and Boeing. This phase focuses on EMD risk reduction and flight test of the Boeing and Lockheed Martin concept demonstrator aircraft. First flight of the Boeing X-32A concept demonstration aircraft took place on Sept. 18, 2000, followed by the Lockheed Martin X-35A on Oct. 24. Objectives of CDP include demonstration of commonality and modularity, STOVL hover and transition, and low-speed handling qualities. Final selection is currently scheduled for October 2001. Pratt & Whitney received a contract to provide propulsion hardware and engineering support for the weapons system concept demonstration efforts. General Electric is continuing technical efforts related to development of an alternate engine source for production.

YAL-1A Attack Airborne Laser

Brief: The prototype YAL-1A, using a modified 747-400F platform, will be the world's first operational airborne high-energy laser weapon system. It will be used to kill Theater Ballistic Missiles (TBMs) in their boost, or very earliest, phase of flight, when the TBMs display bright plumes and are under tremendous dynamic stresses, making them vulnerable to laser weapons. The Airborne Laser can target TBMs hundreds of miles away and thus can fly over friendly territory to kill TBMs as they are launched.

Function: Airborne laser.

Operator: ACC.

First Flight: 2002.

Delivered: to be completed by FY10–12 (planned).

IOC: FY08–10 (planned).

Production: seven (planned).

Inventory: TBD

Unit Location: TBD

Contractor: Boeing (ABL platform; battle management system), TRW (COIL and subsystems), Lockheed Martin (beam control system).

Power Plant: four GE CF6-80 turbofans, each 61,500 lb thrust.

Accommodation: flight crew of two, plus four mission specialists.

Dimensions: span 211 ft 5 in, length 228 ft 9 in, height 63 ft 8 in.

Weight: empty 423,882 lb, gross 800,000 lb.

Ceiling: 45,000 ft.

Performance: max operating speed Mach 0.83, max laser weapon range hundreds of kms, unrefueled endurance at 40,000 ft with operational laser weapon load approx 6 hr.

COMMENTARY

The Airborne Laser is on track to become the first directed energy weapon in the US arsenal. Air Combat Command plans to base the Attack Laser in CONUS, but it has the ability to deploy with minimal airlift support to any region of the world. It will arrive in theater with its crew, laser fuel, and initial spares ready to fight. Typical deployment would include five aircraft to establish two, near continuous combat air patrols as directed by the joint force commander. The aircraft will fly above the clouds and typically operate at an altitude of approx 40,000 ft, initially located some 50 miles from the enemy but able to be moved forward as US forces gain air superiority. Information on the hostile launch location can also be determined by the ABL and passed on to attack airplanes.

The Attack Laser's main armament is a lightweight, megawatt-class Chemical Oxygen–Iodine Laser (COIL). The laser weapon contains 14 COIL modules and sufficient chemical fuel for 20–40 TBM kills. An optical system transports the laser beam up to the aircraft nose, where a 4.5-ft-diameter mirror in a ball turret points the beam at the target. The optical system contains low-power lasers, sensors, steering mirrors, and adaptive optics (deformable mirrors) to precisely track targets and correct atmospheric distortions, thereby increasing the high-energy laser beam's intensity on target and the system's lethal range.

The test aircraft will offer limited operational capability; this aircraft will eventually be converted to a fully operational model.

Reconnaissance and Surveillance Aircraft

E-3 Sentry

Brief: Modified Boeing 707, fitted with a rotating radar dome 30 ft wide and 6 ft thick, which provides all-weather air surveillance and C^3 for tactical and air defense forces. Capable of surveillance from Earth's surface up to the stratosphere, over land or water, at more than 200 miles.

Function: Airborne early warning, Battle Management (BM), C^3 aircraft.

Operator: ACC, PACAF, AFRC (associate).

First Flight: Oct. 31, 1975 (full avionics).

Delivered: March 1977–84.

IOC: 1977.

Production: 34.

Inventory: 32.

Unit Location: Elmendorf AFB, Alaska, Kadena AB, Japan, Tinker AFB, Okla.

Contractor: Boeing.

Power Plant: four Pratt & Whitney TF33-PW-100/100A turbofans, each 21,000 lb thrust.

Accommodation: basic operational crew of 17–23, incl 13–19 AWACS mission specialists and four flight crew members.

***X-32A** Boeing Joint Strike Fighter concept demonstrator* (Ted Carlson)

***X-35A** Lockheed Martin Joint Strike Fighter concept demonstrator* (Ted Carlson)

Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 41 ft 9 in.

Weight: gross 335,000 lb; max T-O 347,000 lb.

Ceiling: above 38,000 ft.

Performance: optimum cruise Mach 0.78, endurance eight hr unrefueled.

COMMENTARY

The E-3 Sentry is an Airborne Warning and Control System (AWACS) aircraft that provides all-weather surveillance and command, control, and communications (C^3) needed by commanders of US, NATO, and other allied air forces. Constantly in high operational demand the AWACS aircraft is a militarized version of the Boeing 707-320B, equipped with an extensive complement of mission avionics, including computer, radar, IFF, communications, display, and navigation systems. Its primary capability is provided by its look-down radar, which makes possible all-altitude surveillance over land or water, with an ability to track both air and sea targets simultaneously.

E-3A. Of the 24 built for USAF in standard production configuration, 22 were later upgraded.

An improved US/NATO Standard E-3A configuration was initiated with the 25th USAF Sentry, delivered in December 1981, with a larger-memory computer and a

***E-3C** Sentry* (SSgt. Sean M. Worrell)

maritime detection capability. Nine were built new for USAF, and one of the original E-3As was upgraded.

E-3B is the upgraded earliest version E-3A. Twenty-two production models and two prototypes were produced. Improvements include much-enhanced computer capabilities, jam-resistant communications, austere maritime surveillance capability, additional radio communications, and five additional display consoles.

E-3C is an upgrade to the original 10 US/NATO Standard E-3A aircraft, with additional radio, console, and radar capabilities. Redelivered 1984.

USAF E-3s are undergoing major sustainability, reliability, and availability upgrades. Mission system upgrades include new passive detection systems, known as Electronic Support Measures, that complement the active beaming radar, enabling the aircraft to detect signals emitted by both hostile and friendly targets. Additional enhancements include upgrade of the Joint Tactical Information Distribution System (JTIDS), jam-resistant communications, increased computer capacity, and GPS capability. Full operational capability on these improvements is expected soon. Radar system improvements will permit AWACS aircraft operating in the pulse–Doppler mode to detect smaller, stealthier targets. IOC for these radar improvements is imminent.

E-8 Joint STARS

Brief: A modified Boeing 707 equipped with a large, canoe-shaped radome mounted under the forward part of the fuselage, housing long-range, air-to-ground radar capable of locating, classifying, and tracking vehicles moving on Earth's surface out to distances in excess of 124 miles. Such data are then transmitted via data link to ground stations or other aircraft.

Function: Ground surveillance, BM, C^2 aircraft.
Operator: ACC.
First Flight: December 1988.
Delivered: May 1996–present.
IOC: Dec. 18, 1997.
Production: 16 (planned).
Inventory: eight.
Unit Location: Robins AFB, Ga.
Contractor: Northrop Grumman.
Power Plant: four Pratt & Whitney TF33-102C turbojets, each 19,200 lb thrust.
Accommodation: mission crew of 21 Air Force/Army operators (can be augmented to 34).
Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 42 ft 6 in.
Weight: empty 171,000 lb, gross 336,000 lb.
Ceiling: 42,000 ft.
Performance: max operating speed Mach 0.84, endurance with one in-flight refueling 20 hr.
COMMENTARY

Joint STARS is a Battle Management platform capable of providing theater commanders with C^2 of air to ground forces and simultaneous near-real-time wide area surveillance as well as downlink of targeting information to air and ground commanders. Joint STARS battle managers, in combination with a robust communications suite, conduct C^2 of air operations to engage enemy forces in day, night, and adverse weather conditions. Joint STARS also conducts near-real-time surveillance and reporting for use by air and ground forces. The radar subsystem features a multimode, side-looking, phased-array radar that provides interleaved Moving Target Indicator (MTI), SAR, and Fixed Target Indicator (FTI) imagery. Joint STARS downlinks via a secure, jam-resistant digital data link. Multiple receivers are in use, predominantly the US Army's Common Ground Station and Joint Services Work Station.

As part of their operational test and evaluation, Joint STARS aircraft flew more than 150 operational missions during Desert Storm (with two E-8A development aircraft) and Joint Endeavor (with one E-8A and one test bed E-8C).

E-8A. Prototype version, with specialized equipment installed aboard two specially modified 707-300 airframes. One was converted to an in-flight pilot trainer in 1997, and the second has been placed in long-term storage.

E-8C. Production version, based on former commercial 707-300 airframes. Equipped with 18 operations-and-control consoles, two of which double as communications stations. The first E-8C flew in March 1994 and served as the preproduction test bed. The last six production aircraft will have more advanced computer systems, which will be retrofitted on the 10 earlier aircraft.

OC-135 Open Skies

Brief: A modified C-135 aircraft that flies unarmed observation and verification flights over nations that are parties to the 1992 Open Skies Treaty.

Function: Reconnaissance aircraft.
Operator: ACC.
First Flight: June 1993.
Delivered: October 1993.
IOC: October 1993.
Production: three.
Inventory: two.
Unit Location: Offutt AFB, Neb.
Contractor: Boeing.
Power Plant: four Pratt & Whitney TF33-P-5 turbofans, each 16,050 lb thrust.
Accommodation: seating for 38.
Dimensions: span 131 ft, length 135 ft, height 42 ft.
Weight: gross 297,000 lb.
Ceiling: 50,000 ft (basic C-135).
Performance: speed: 500+ mph, unrefueled range 3,900 miles.
COMMENTARY

A modified version of the WC-135, used for specialized reconnaissance with an infrared linescanner, Synthetic Aperture Radar, and forward- and vertical-looking video cameras, to monitor the 1992 Open Skies Treaty.

OC-135B modifications center around four cameras installed in the rear of the aircraft. Cameras installed include one vertical and two oblique KS-87 framing cameras, used for low-altitude photography approximately 3,000 ft above the ground, and one KA-91 pan camera, which pans from side to side to provide a wide sweep for each picture, used for high-altitude photography at approximately 35,000 ft. Data is processed and recorded by the Miletus camera annotation system.

RC-135

Brief: Specially configured variant of the Boeing C-135 Stratolifter, having an elongated nose and cheeks containing highly advanced electronic signal collection systems. Used to acquire real-time electronic intelligence data for theater and tactical commanders.

Function: Electronic reconnaissance aircraft.
Operator: ACC.
First Flight: not available
Delivered: circa 1973–99.
IOC: circa 1973 (Rivet Joint).
Production: (converted).
Inventory: 21.
Unit Location: Offutt AFB, Neb.
Contractor: Raytheon.
Power Plant: four Pratt & Whitney TF33-P-5/9 turbofans, each 18,000 lb thrust. (Replaced with CFM International F108-CF-100s in one W version; re-engining of further aircraft anticipated.)
Accommodation: flight crew of four; 25–35 mission crew.
Dimensions: span 145 ft 9 in, length 164 ft, height 42 ft 6 in.
Weight: max gross 336,000 lb.
Ceiling: 45,000 ft.
Performance: speed 500 mph plus, range, with air refueling, unlimited.
COMMENTARY

The 55th Wing at Offutt AFB, Neb., operates a highly specialized fleet for worldwide reconnaissance missions.

RC-135S Cobra Ball is used for missile tracking. Equipment includes wide-area IR sensors, long-range optical telescopes, and an advanced communications suite that can locate a missile more than 250 miles away and calculate its trajectory and impact point.

RC-135U Combat Sent. Two aircraft with larger tailcone and fin fairing, used for measuring and analyzing foreign electronic and IR equipment. IOC: 1967.

RC-135 V/W Rivet Joint. Used for electronic surveillance. RC-135 Rivet Joints loiter near battlefields and provide near-real-time data updates on enemy defensive and offensive activities to warfighters via the Tactical Information Broadcast System and JTIDS to crews of F-16CJ HTS aircraft. The aircraft's recon systems are continuously upgraded to keep pace with new threats.

TC-135S/W. Used for training purposes.

RQ-1A Predator

Brief: A medium-altitude, long-endurance Unmanned Aerial Vehicle (UAV), flown remotely. Joint force commander asset with multiple imagery sensors.

Function: Unmanned reconnaissance aircraft.
Operator: ACC.
First Flight: July 1994.
Delivered: November 1996–present.
IOC: TBD
Production: 12 systems planned (system typically consists of four air vehicles, one ground control station, and one Trojan Spirit II satellite communications suite). Sixty vehicles total ordered.
Inventory: Eight systems.
Unit Location: Indian Springs AFAF, Nev.
Contractor: General Atomics.
Power Plant: one Rotax 914 engine.
Accommodation: unmanned system.
Dimensions: length 27 ft, height 6 ft 9 in, span 48 ft 8 in.

***RQ-1A** Predator* (USAF photo)

Weight: empty 950 lb, gross 2,250 lb.
Ceiling: 25,000 ft.
Performance: cruise speed up to 80 mph, continuous coverage on station with multiple air vehicles and relief on station, 460 miles from base at altitude of 25,000 ft, endurance 40 hr.

COMMENTARY

USAF has two Predator squadrons, the 11th and 15th RS. Both squadrons support operational deployment commitments, and the 11th conducts mission qualification training. The system demonstrated its operational capability during surveillance missions over Bosnia and Iraq. Navigation is by GPS/INS. Equipped with EO/IR and SAR sensors with C-band line of sight and Ku-band satellite data link allowing near-real-time transmissions of video images to the ground control station. System upgrades are under way to expand capability. Armed Predator tests have been undertaken to assess its potential for the attack mission. USAF is also contemplating an air-to-air role.

RQ-4A Global Hawk

Brief: A high-altitude, long-range, long-endurance Unmanned Aerial Vehicle.
Function: Unmanned reconnaissance aircraft.
Operator: ACC.
First Flight: Feb. 28, 1998.
Delivered: five.
IOC: 2003 (anticipated).
Production: MSII/LRIP decision expected in FY01.
Inventory: TBD
Unit Location: Beale AFB, Calif. (preferred option).
Contractor: Northrop Grumman.
Power Plant: one Rolls Royce–Allison AE 3007H turbofan, 7,600 lb thrust.
Accommodation: unmanned system.
Dimensions: length 44 ft 5 in, height 15 ft 2 in, span 116 ft 2 in.
Weight: empty 9,200 lb, gross 25,600 lb.
Ceiling: 67,300 ft.
Performance: design goals incl endurance of up to 40 hr at a cruise speed of 400 mph and at an altitude of 65,000 ft. This would allow loiter on station 3,450 miles from base for 24 hr.

COMMENTARY

A high-altitude endurance UAV carrying a 2,000-lb payload, incorporating EO/IR and SAR sensors that permit switching among radar, IR, and visible wavelengths as required. Objective system will add signals intelligence (Sigint) and improved Moving Target Indicator (MTI) capability. Navigation is by GPS/INS. Global Hawk flies autonomously from takeoff to landing, providing near-real-time imagery products for tactical and theater commanders. Vehicle ground track and mission plan can be updated in real time to respond to changing air traffic control needs and/or mission collection needs. Global Hawk No. 2 crashed March 29, 1999. Vehicle No. 3 was damaged Dec. 6, 1999, after a test flight. Vehicle No. 1 resumed test flights March 11, 2000, after a precautionary standdown.

Global Hawk completed its advanced concept technology demonstration on June 30, 2000. It completed 58 flights, flew in excess of 66,000 ft altitude and 31 hours endurance, accumulating more than 700 hours total flight time. Global Hawk participated in several joint/NATO exercises, to include flying over water to Alaska and completing the first transoceanic crossing to Portugal and back.

A military utility assessment completed in September 2000 found that the system demonstrated military utility and should be expeditiously fielded. The Air Force is currently evaluating options to field operational Global Hawks, with upgraded sensor capabilities, following a positive acquisition decision in FY01.

Projected Primary Aircraft Inventory (PAI) is 18 imagery intelligence (Imint) and 12 Sigint aircraft. Total buy TBD.

U-2 Dragon Lady

Brief: Single-seat, single-engine, high-altitude endurance reconnaissance aircraft carrying a wide variety of sensors and cameras, providing continuous day or night, high-altitude, all-weather area surveillance in direct support of US forces.
Function: High-altitude reconnaissance.
Operator: ACC.
First Flight: August 1955 (U-2); 1967 (U-2R); October 1994 (U-2S).
Delivered: 1955–October 1989.
IOC: circa 1956.
Production: 35 (U-2S/ST).
Inventory: 35.
Unit Location: Beale AFB, Calif.
Contractor: Lockheed.
Power Plant: F118-GE-101 turbojet.
Accommodation: one (two for trainer).
Dimensions: span 103 ft, length 63 ft, height 16 ft.
Weight: gross 40,000 lb.
Ceiling: above 70,000 ft.
Performance: max cruising speed ceiling, more than 430 mph; range more than 4,500 miles; max endurance 14+ hr.

***U-2** Dragon Lady* (SSgt. Sean M. Worrell)

COMMENTARY

The U-2 is the Air Force's premier high-altitude reconnaissance system, capable of carrying Imint and Sigint sensors simultaneously.

The current generation of imaging (SAR, EO camera) and signals sensors are being modified and will reach the field along with a new aircraft power distribution system over the coming year.

U-2R (single-seat) and **U-2RT** (two-seat) aircraft, derived from the original version that had a key role in the Cuban missile crisis of 1962, were significantly larger and more capable than the earlier aircraft. The last U-2R aircraft were delivered to USAF in October 1989. In 1992, all existing U-2s and tactical TR-1s were consolidated under the designation U-2R.

U-2S (single-seat) and **U-2ST** (two-seat) are the current designations of all 35 aircraft (31 U-2S mission aircraft, four U-2ST trainers) in the inventory, having completed conversion to S model configuration with the new GE F118 engine, incorporating significant improvements in reliability and performance over the U-2R. The Air Force accepted the first U-2S in October 1994.

WC-130 Hercules

Brief: A high-wing, medium-range aircraft flown by Air Force Reserve Command for weather reconnaissance missions. It flies into the eye of tropical cyclones or hurricanes, collecting weather data from within the storm's environment.
Function: Weather reconnaissance aircraft.
Operator: AFRC.
First Flight: circa 1959.
Delivered: C-130J: October 1999–present.
IOC: 1959 (B model), 1962 (E), 1964 (H).
Production: (no new-build WC-130H).
Inventory: 14 (WC-130H).
Unit Location: Keesler AFB, Miss.
Contractor: Lockheed.
Power Plant: four Allison T56-A-15 turboprops, each 4,910 shp.
Accommodation: six.
Dimensions: span 132 ft 6 in, length 99 ft 4 in, height 38 ft 6 in.
Weight: gross 155,000 lb.
Ceiling: 33,000 ft at 100,000 lb gross T-O weight.
Performance: speed 374 mph at 20,000 ft, range 4,000 miles.

COMMENTARY

The WC-130 is flown by AFRC organizations known as the Hurricane Hunters. The hurricane reconnaissance area includes the Atlantic Ocean, Caribbean Sea, Gulf of Mexico, and central Pacific Ocean areas.

WC-130B/E. Earlier version C-130 modifications used for weather reconnaissance. Now retired.

WC-130H. Improved version, currently operated by the 53rd WRS for weather reconnaissance duties, including penetration of tropical storms, to obtain data for forecasting storm movements.

It is equipped with two external 1,400-gallon fuel tanks, an internal 1,800-gallon fuel tank, and uprated engines. An average weather reconnaissance mission might last 11 hours and cover almost 3,500 miles while the crew collects and reports weather data every minute. Results are transmitted via satellite to the National Hurricane Center, Miami, Fla.

WC-130J. Weather-capable versions of the latest C-130 model, powered by four Allison AE2100D3 turboprops. First of 10 aircraft that will replace the WC-130H was delivered Oct. 12, 1999. First test and evaluation sortie made Nov. 18, 1999.

Special Duty Aircraft

E-4B National Airborne Operations Center

Brief: A four-engine, swept-wing, long-range, high-altitude airplane providing a modern, highly survivable, C^3 center allowing the National Command Authority to direct US forces, execute emergency war orders, and coordinate actions by civil authorities.
Function: Airborne operations center.
Operator: ACC.
First Flight: June 13, 1973 (E-4A); June 10, 1978 (E-4B).
Delivered: December 1974–85.
IOC: December 1974 (E-4A); January 1980 (E-4B).
Production: four.
Inventory: four.
Unit Location: Offutt AFB, Neb.
Contractor: Boeing.
Power Plant: four General Electric CF6-50E2 turbofans, each 52,500 lb thrust.
Accommodation: up to 114.
Dimensions: span 195 ft 8 in, length 231 ft 4 in, height 63 ft 5 in.
Weight: gross 800,000 lb.
Ceiling: above 30,000 ft.
Performance: unrefueled endurance in excess of 12 hr; with aerial refueling up to 72 hr.

COMMENTARY

E-4 aircraft are used to execute the National Airborne Operations Center (NAOC), previously the National Emergency Airborne Command Post (NEACP), mission. The E-4B fleet provides a survivable C^3 platform capable of supporting the National Command Authority throughout the full threat spectrum, including sustained operations in a nuclear environment.

A militarized version of the Boeing 747-200, the first B model was delivered to the Air Force in January 1980. Four were produced, of which three were converted E-4As. The first operational mission was flown in March 1980. They are hardened against the effects of nuclear explosions, including electromagnetic pulse, and have in-flight refueling capability. A 1,200-kVA electrical system supports advanced system electronics as well as state-of-the-art communications and data processing equipment such as Extremely High Frequency (EHF) Milstar satellite terminals and six-channel International Maritime Satellite (INMARSAT). A triband radome also houses the E-4B's Super High Frequency (SHF) Frequency Demand Multiple Access (FDMA) communications antenna, the only such system on an airborne platform.

The E-4B system is capable of linking with commercial telephone and radio networks and could be used for radio broadcasts to the general population. E-4Bs also support the Federal Emergency Management Agency (FEMA).

In early 2000, the E-4B entered the EMD phase of a modernization program aimed at updating the electronic infrastructure supporting the aircraft's primary mission equipment and increasing the bandwidth of external communications and onboard data transfer. These updates, along with programmed changes to the aircraft's interior configuration, internal noise reduction modifications, Battle Management improvements, and Global Air Transport Management (GATM) avionics modifications, will ensure the E-4B aircraft can effectively execute its NAOC and FEMA missions for the foreseeable future.

EC-18

Brief: A heavily modified Boeing 707 used as a flexible airborne telemetry and other data recording and relay station in tests of aircraft, spacecraft, and missiles.

Function: Electronic surveillance.
Operator: AFMC.
First Flight: February 1985.
Delivered: January 1986.
IOC: January 1986.
Production: six.
Inventory: three.
Unit Location: Edwards AFB, Calif.
Contractor: Boeing.
Power Plant: four Pratt & Whitney TF33 turbofans, each 18,000 lb thrust.
Accommodation: 16–24 in EC-18B.
Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 42 ft 5 in.
Weight: gross 326,000 lb.
Ceiling: 42,000 ft.
Performance: max cruise speed 470 mph, range 7,610 miles.

COMMENTARY

EC-18B Advanced Range Instrumentation Aircraft (ARIA), modified former commercial Boeing 707-320 transports, replaced some of the EC-135A/E ARIA aircraft. The EC-18B is similarly equipped, with the world's largest airborne steerable antenna housed in a bulbous nose. Range, cabin space, and fuel efficiency are all increased to provide greater support for the ARIA mission, including DOD and NASA space and missile programs. The last is to retire by the end of FY01.

EC-18D Cruise Missile Mission Control Aircraft (CMMCA) are Boeing 707s, modified by Chrysler, to include an AN/APG-63 surveillance radar, telemetry receiver, and weather radar. Operated by the 452nd FTS, the two aircraft support USAF and USN missile testing and are also capable of monitoring and controlling UAVs.

EC-130E/J

Brief: A heavily modified C-130 which, in its several variants, is used to carry out battlefield command, electronic warfare, and electronic combat.

Function: Electronic warfare.
Operator: ACC, ANG.
First Flight: January 1990.
Delivered: March 1990.
IOC: December 1990.
Production: (no USAF new-build EC-130Es).
Inventory: 15.
Unit Location: Active: Davis–Monthan AFB, Ariz. ANG: Harrisburg IAP, Pa.
Contractor: Lockheed Martin.
Power Plant: four Allison T56-A-15 turboprops, each 4,910 shp.
Accommodation: four flight crew, 15 mission personnel.
Dimensions: span 132 ft 7 in, length 100 ft 6 in, height 38 ft 3 in.
Weight: gross 155,000 lb.
Ceiling: 20,000 ft.
Performance: speed 299 mph, range in excess of 2,100 miles.

COMMENTARY

EC-130E ABCCC is an Airborne Battlefield Command and Control Center. Seven aircraft were updated by Unisys to ABCCC III standard. The advanced JTIDS receives data transmitted by AWACS aircraft and other systems, enabling the crew to see a real-time picture of air operations over a combat area. EC-130s have been deployed in support of NATO operations.

EC-130E Commando Solo. ANG uses this version as a broadcasting station for psychological warfare operations. Specialized modifications include enhanced navigation systems, self-protection equipment, and worldwide color television configuration. Commando Solo aircraft have been used in numerous military operations. They also have a role in civil emergencies. Secondary mission is electronic attack in the military frequency spectrum.

EC-130J Commando Solo. Four specialist versions of the latest C-130 aircraft ordered. First expected to enter operational service mid-2001 with the 193rd Special Operations Wing (ANG), Harrisburg.

EC-130H Compass Call

Brief: A heavily modified C-130 for electronic combat.
Function: Electronic warfare.
Operator: ACC.
First Flight: 1981.
Delivered: 1982.
IOC: 1983.
Production: (converted).
Inventory: 14.
Unit Location: Davis–Monthan AFB, Ariz.
Contractor: Lockheed Martin.
Power Plant: four Allison T56-A-15 turboprops, each 4,910 shp.
Accommodation: standard crew 13.
Dimensions: span 132 ft 7 in, length 100 ft 6 in, height 38 ft 3 in.
Weight: 155,000 lb.
Ceiling: 20,000 ft.
Performance: speed 374 mph at 20,000 ft.

COMMENTARY

A variant used as an airborne communications jamming and information warfare platform. It played a vital role in disrupting Iraqi military communications at strategic and tactical levels during the Persian Gulf War and has since been deployed to the Balkans and Southwest Asia.

EC-135

Brief: Modified KC-135 tanker aircraft extensively equipped with sophisticated communications equipment was used to provide continuous airborne alert in support of national command and control; other aircraft used for telemetry and voice relay.

Function: Specialized test aircraft.
Operator: AFMC.
First Flight: not available
Delivered: not available
IOC: Feb. 3, 1961.
Production: (converted).
Inventory: three.
Unit Location: Edwards AFB, Calif.
Contractor: Boeing.
Power Plant: (EC-135C) four Pratt & Whitney TF33-P-9 turbofans, each 18,000 lb thrust.
Accommodation: flight crew of four, plus various specialists.
Dimensions: span 130 ft 10 in, length 136 ft 3 in, height 38 ft 4 in.
Weight: (ARIA) gross 300,500 lb.
Ceiling: (ARIA) 33,000 ft.
Performance: (ARIA) max cruise speed 490 mph, operational radius 2,675 miles.

COMMENTARY

Several KC-135A tankers were modified for use as airborne command posts during the 1960s.

EC-135A/G/L were operated by SAC; **EC-135H** by USAFE; **EC-135J/P** by PACAF; and **EC-135K** by TAC. **EC-135N**s had specialized nose radar and tracking equipment to support the Apollo program. Other EC-135 aircraft included **J** and **Y** versions. Virtually all retired.

EC-135C aircraft, known as Looking Glass, supported STRATCOM's Airborne National Command Post mission, as well as other command-and-control missions. Delivered as KC-135Bs, they were redesignated in 1964 to reflect their role. Continuous airborne alert status ended July 24, 1990, and all retired by September 1998 as the USN's E-6B aircraft took over the NCP mission.

EC-135E ARIA. The last E model, which functioned as a telemetry data recording and relay station to supplement land and marine telemetry stations that support DOD and NASA space and missile programs, was retired in November 2000. Specialized equipment included an airborne steerable antenna housed in a bulbous nose, a probe antenna on each wingtip, and a trailing wire antenna on the bottom of the fuselage. The cargo compartment was modified to include all of the instrumentation subsystems installed as a 30,000-lb modular package.

***EC-130H** Compass Call* (Ted Carlson)

Tanker Aircraft

HC-130N/P King

Brief: An extended-range, Combat Search-and-Rescue (CSAR) configured C-130 that extends the range of rescue helicopters through in-flight refueling and performs tactical delivery of Pararescue Jumper (PJ) specialists and/or equipment in hostile environments.

Function: Aerial refueling/transport.
Operator: ACC, ANG, AFRC.
First Flight: Dec. 8, 1964 (as HC-130H).
Delivered: from 1965.
IOC: 1986.
Production: (converted).
Inventory: 30.
Unit Location: active: Moody AFB, Ga; ANG: Francis S. Gabreski IAP, NY, Kulis ANGB, Alaska; AFRC: Davis–Monthan AFB, Ariz., Patrick AFB, Fla., Portland IAP, Ore.
Contractor: Lockheed (now Lockheed Martin).
Power Plant: four Allison T56-A-15 turboprops, each 4,910 shp.
Accommodation: four flight crew, plus mission crew.
Dimensions: span 132 ft 7 in, length 98 ft 9 in, height 38 ft 6 in.
Weight: gross 155,000 lb.
Ceiling: 33,000 ft.
Performance: speed 289 mph, range more than 4,000 miles.

COMMENTARY

The HC-130 can perform extended visual/electronic searches over land or water and operate from unimproved airfields. A three-man PJ team, trained in emergency trauma medicine, harsh environment survival, and assisted evasion, is part of the normal mission crew complement.

Combat air forces' HC-130 aircraft are equipped with an integrated GPS/INS navigation package, radar/missile warning receivers, and chaff/flare countermeasures dispensers. Some aircraft have FLIR systems and personnel locator systems compatible with aircrew survival radios. Ongoing modifications include an improved digital low-power color radar, integrated satellite communications radio, NVG–compatible interior/exterior lighting, and cockpit armor. HC-130 avionics are slated for complete update through the C-130 Avionics Modernization Program.

KC-10 Extender

Brief: A modified McDonnell Douglas DC-10 that combines in a single aircraft the operations of aerial refueling and long-range cargo transport.

Function: Aerial refueling/transport.
Operator: AMC, AFRC (associate).
First Flight: April 1980.
Delivered: March 1981–April 1990.
IOC: August 1982.
Production: 60.
Inventory: 59.
Unit Location: McGuire AFB, N.J., Travis AFB, Calif.
Contractor: McDonnell Douglas (now Boeing).
Power Plant: three General Electric CF6-50C2 turbofans, each 52,500 lb thrust.
Accommodation: crew of four; additional seating possible for up to 75 persons; max 27 pallets; max cargo payload 169,409 lb.
Dimensions: span 165 ft 5 in, length 181 ft 7 in, height 58 ft 1 in.
Weight: gross 590,000 lb.
Ceiling: 42,000 ft.
Performance: cruising speed Mach 0.825, range with max cargo 4,370 miles.

COMMENTARY

The KC-10 combines the tasks of tanker and cargo aircraft in a single unit, enabling it to support worldwide fighter deployments, strategic airlift, strategic reconnaissance, and conventional operations.

***KC-135R** Stratotanker* (Ted Carlson)

The KC-10 can be air refueled by a KC-135 or another KC-10, increasing its range and diminishing the need for forward bases, leaving vital fuel supplies in the theater of operations untouched.

KC-10A is a DC-10 Series 30CF, modified to include fuselage fuel cells, an air refueling operator's station, aerial refueling boom and integral hose reel/drogue unit, a receiver refueling receptacle, and military avionics. Later modification included wing-mounted air refueling pods to increase capability.

Because it has both types of tanker refueling equipment installed, the KC-10A can service USAF, USN, USMC, and allied aircraft on the same mission. Special lighting permits night operations.

KC-135 Stratotanker

Brief: A short- to medium-range tanker aircraft, meeting the air refueling needs of USAF bomber, fighter, cargo, and reconnaissance forces. It also supports US Navy, Marine Corps, and allied aircraft.

Function: Aerial refueling/airlift.

Operator: ACC, AETC, AFMC, AMC, PACAF, USAFE, ANG, AFRC.

First Flight: August 1956.

Delivered: January 1957–66.

IOC: June 1957, Castle AFB, Calif.

Production: 732.

Inventory: 546.

Unit Location: Altus AFB, Okla., Fairchild AFB, Wash., Grand Forks AFB, N.D., Kadena AB, Japan, MacDill AFB, Fla., McConnell AFB, Kan., Mountain Home AFB, Idaho, RAF Mildenhall, UK, Robins AFB, Ga. ANG: 19 units. AFRC: seven units.

Contractor: Boeing.

Power Plant: KC-135R/T: four CFM International F108-CF-100 turbofans, each 22,224 lb thrust; KC-135E: four TF33-PW-102 turbofans, each 18,000 lb thrust.

Accommodation: crew of four; up to 80 passengers.

Dimensions: span 130 ft 10 in, length 136 ft 3 in, height 38 ft 4 in.

Weight: empty 119,231 lb, gross 322,500 lb (KC-135E 301,600 lb).

Ceiling: 50,000 ft.

Performance: max speed at 30,000 ft 610 mph, range with max fuel 11,015 miles.

COMMENTARY

Backbone of the USAF tanker fleet, the long-serving KC-135 is similar in size and appearance to commercial 707 aircraft but was designed to military specifications, incorporating different structural details and materials. The KC-135 fuel tanks are located in the "wet wings" and in fuel tanks below the floor in the fuselage.

KC-135A. Original version with J57 turbojets. USAF built 732, since modified to other standards.

KC-135E. The JT3D re-engining program upgraded 163 AFRC and ANG KC-135As to KC-135E standard with JT3D turbofans removed from surplus commercial 707s; fuel carrying capacity is increased by 20 percent.

KC-135R/T. Designation of re-engined KC-135As with CFM56 turbofans. They embody modifications to 25 major systems and subsystems and not only carry more fuel farther but have reduced maintenance costs, are able to use shorter runways, and meet Stage III requirements. The first KC-135R flight was in October 1982, and redeliveries began in July 1984. KC-135T aircraft were capable of refueling the now-retired SR-71s. The program continues.

Ongoing modifications are extending the capability and operational utility of the KC-135 well into this century. Renewal of the lower wing skin added 27,000 flying hours to the aircraft. The Pacer CRAG avionics modernization program permits operation by a three-person flight crew, with avionics upgrades under way that will significantly improve systems reliability and maintainability. The entire fleet will be fitted with improved cockpit and navigation suites, including color weather radar, and integrated INS/GPS. Reduced vertical separation minima and GATM upgrades are also planned for the entire fleet. Some KC-135Rs have been fitted with wing-mounted hose-and-drogue refueling pods to enhance interoperability and support to the US Navy, US Marines, NATO, and other allied receiver aircraft.

MC-130P Combat Shadow

Brief: Aircraft that flies clandestine or low-visibility, low-level missions into denied areas to provide air refueling for Special Operations Forces (SOF) helicopters or to airdrop small special operations teams, small bundles, and zodiac and combat rubber raiding craft.

Function: Air refueling for SOF helicopters/airdrop.

Operator: AETC, AFSOC, ANG, AFRC.

First Flight: Dec. 8, 1964 (as HC-130H).

Delivered: from 1965.

IOC: 1986.

Production: (converted).

Inventory: 28.

Unit Location: Active: Eglin AFB, Fla., Kadena AB, Japan, Kirtland AFB, N.M., RAF Mildenhall, UK. ANG: Moffett Federal Airfield, Calif. AFRC: Duke Field, Fla.

Contractor: Lockheed.

Power Plant: four Allison T56-A-15 turboprops, each 4,910 shp.

Accommodation: four flight crew, plus four mission crew.

Dimensions: span 132 ft 7 in, length 98 ft 9 in, height 38 ft 6 in.

Weight: gross 155,000 lb.

Ceiling: 33,000 ft.

Performance: speed 289 mph, range more than 4,000 miles.

COMMENTARY

MC-130P Combat Shadow aircraft are currently tasked with clandestine formation or single-ship intrusion of hostile territory to provide aerial refueling of special operations helicopters and the infiltration, exfiltration, and resupply of Special Operations Forces by airdrop or air-land operations. To perform these missions, depending upon the enemy threat, crews navigate using both visual and electronic means, or visual means only. Primary emphasis is on NVG operations.

Modifications include improved secure communications, advanced integrated navigation equipment, including digital scan radar, ring-laser gyro INS, FLIR, GPS, and dual nav stations, as well as new missile warning systems and countermeasures for refueling missions in hostile environments. Some aircraft have been modified with an in-flight refueling system allowing them to be air refuelable.

Strategic Transports

C-5 Galaxy

Brief: A heavy-lift, air refuelable cargo transport for massive strategic airlift over long ranges, including outsize cargo. Supports special operations missions.

Function: Cargo and troop transport.

Operator: AETC, AMC, ANG, AFRC.

First Flight: June 30, 1968.

Delivered: October 1969–April 1989.

IOC: September 1970.

Production: 131.

Inventory: 126.

Unit Location: Active: Altus AFB, Okla., Dover AFB, Del., Travis AFB, Calif. ANG: Stewart IAP, N.Y. AFRC: Dover AFB, Del., Kelly AFB, Tex., Travis AFB, Calif., Westover ARB, Mass.

Contractor: Lockheed.

Power Plant: four General Electric TF39-GE-1C turbofans, each 41,000 lb thrust.

Accommodation: normal crew of six (two pilots, two engineers, and two loadmasters), plus rest area for 15 (relief crew, etc.) and seating for 75. There is no piece of Army combat equipment the C-5 can't carry. Possible loads: six Apache helicopters, two M1 main battle tanks (each weighing 135,400 lb), six Bradley vehicles, three CH-47 helicopters, the 74-ton mobile bridge, a quarter-million pounds of relief supplies, or a maximum of 340 passengers in an airbus configuration. Airdrop capability for single platforms weighing up to 42,000 lb.

Dimensions: span 222 ft 9 in, length 247 ft 10 in, height 65 ft 1 in.

Weight: empty 374,000 lb, gross 769,000 (wartime 840,000) lb.

Ceiling: 34,000 ft with a 605,000-lb load.

Performance: max speed at 25,000 ft 571 mph, 35,750 ft, T-O run at S/L 8,300 ft, landing run, max landing weight at S/L 2,380 ft, range with max payload 3,434 miles, range with max fuel 6,469 miles. Normal cruising speed at altitude 518 mph (Mach 0.77), unlimited range with in-flight air refueling.

COMMENTARY

One of the world's biggest aircraft, the C-5 is able to carry unusually large and heavy cargo for intercontinental ranges at jet speeds. It can take off and land in relatively short distances and taxi on substandard surfaces during emergency operations. Front and rear cargo openings permit simultaneous drive-through loading and off-loading.

C-5A. USAF took delivery of 81 of these basic models between December 1969 and May 1973. A major wing modification was subsequently undertaken, extending the aircraft's service life by 30,000 flight hours. Additionally, the avionics subsystems developed for the C-5B have been incorporated into the C-5A fleet. One ANG and two AFRC squadrons are C-5A–equipped. The reliability and maintainability of the C-5A version have been the focus of numerous AMC studies.

C-5B is generally similar to the C-5A but embodies

***C-5** Galaxy* (SSgt. Jim Howard)

***C-17** Globemaster III* (TSgt. Cary Humphries)

all the improvements introduced since completion of C-5A production, including the strengthened wings, improved turbofans, and updated avionics, with color weather radar and triple INS. The first C-5B flew for the first time in September 1985 and was delivered to Altus AFB, Okla., in January 1986.

C-5C. Two C-5As assigned to Travis AFB, Calif., were modified to carry outsize space cargo for NASA by extending the cargo bay and modifying the aft doors.

All USAF Galaxys are on contract to undergo a complete avionics modernization program that will install a state-of-the-art cockpit and ensure global access navigation safety compliance by the end of 2005. To baseline this modification, all C-5s have had their flight-management systems modernized and GPS receivers installed. A number of C-5s have been equipped with a prototype missile defense system. Additionally, the Air Force is planning a comprehensive modernization program including a re-engining effort, initially for the C-5B aircraft, to take advantage of an estimated service life through 2040.

C-17 Globemaster III

Brief: A heavy-lift, air refuelable cargo transport for intertheater (strategic) and intratheater (tactical) direct delivery airlift of all classes of military cargo, including outsize items.

Function: Cargo and troop transport.
Operator: AETC, AFMC, AMC, AFRC.
First Flight: Sept. 15, 1991.
Delivered: June 1993–present.
IOC: Jan. 17, 1995.
Production: 120 minimum.
Inventory: 67.
Unit Location: Altus AFB, Okla., Charleston AFB, S.C., McChord AFB, Wash. AFRC: Charleston AFB, S.C., McChord AFB, Wash.
Contractor: Boeing.
Power Plant: four Pratt & Whitney F117-PW-100 turbofans, each 40,440 lb thrust.
Accommodation: normal flight crew of three (two pilots plus loadmaster). Provisions for full range of military airlift missions, incl capacity for up to 102 passengers/paratroops or 36 litters; range of military cargo incl tanks, jeeps, and up to three AH-64A helicopters; three Bradley vehicles; one M1 main battle tank with other equipment; airdrop capability for single platforms weighing up to 60,000 lb.
Dimensions: span over winglet tips 169 ft 10 in, length 173 ft 11 in, height 55 ft 1 in.
Weight: empty 277,000 lb, max payload 170,900 lb, gross 585,000 lb.
Ceiling: 45,000 ft.
Performance: normal cruising speed 484 mph at 35,000 ft or 518 mph (Mach .74) at 28,000 ft, unrefueled range with 160,000-lb payload 2,760 miles, unlimited with refueling.
COMMENTARY
Developed to meet US force projection requirements, the C-17 is able to operate routinely into small, austere airfields (3,000 ft x 90 ft) previously restricted to C-130s and provides the first capability to air-land or airdrop outsize cargo in the tactical environment.
C-17A is the first military transport to feature a full digital fly-by-wire control system and two-person cockpit, with two full-time, all-function HUDs and four multifunction electronic displays. For operational deployments to Bosnia, the C-17 was the only aircraft capable of carrying outsize cargo into Tuzla AB.

C-135 Stratolifter

Brief: A version of the KC-135 tanker, without refueling equipment, produced for nontanker duties.
Function: Passenger and cargo airlifter.
Operator: AFMC, PACAF.
First Flight: May 1961.
Delivered: 1961–62.
IOC: circa 1961.
Production: 48, plus five WC/TC-135s.
Inventory: five.
Unit Location: Edwards AFB, Calif., Hickam AFB, Hawaii.
Contractor: Boeing.
Power Plant: (C-135B) four Pratt & Whitney TF33-P-5 turbofans, each 18,000 lb thrust.
Accommodation (C-135B): 60 passengers.
Dimensions: span 130 ft 10 in, length 134 ft 6 in, height 38 ft 4 in.
Weights (C-135B): operating weight empty 102,300 lb, gross 275,500 lb.
Ceiling: 50,000 ft.
Performance (C-135B): max speed 600 mph, range with 54,000 lb payload 4,625 miles.
COMMENTARY
Several C-135 transports and variants, without the KC-135's refueling equipment, remain operational within USAF. They were ordered originally to serve as interim jet passenger or cargo transports, pending delivery of C-141s. Three converted KC-135s were followed by 45 production Stratolifters in two versions.
C-135A. The first 15 aircraft were equipped with J57-P-59W turbojets.
C-135B. The next version included upgraded Pratt & Whitney turbofans. USAF retrofitted 11 Bs with revised interior for VIP transportation.

C-141 Starlifter

Brief: Workhorse of the US airlift force, the Starlifter can project combat forces over long distances, inject those forces and their equipment either by air-land or airdrop, resupply these employed forces, and extract the sick and wounded from the hostile area to advanced medical facilities. Primary strategic special operations and airdrop platform.
Function: Long-range, air refuelable troop and cargo airlift.
Operator: AETC, AMC, ANG, AFRC.
First Flight: Dec. 17, 1963.
Delivered: October 1964–June 1982.
IOC: May 1965.
Production: 285.
Inventory: 130.
Unit Location: Active: Altus AFB, Okla., Charleston AFB, S.C., Edwards AFB, Calif., McChord AFB, Wash., McGuire AFB, N.J. ANG: Jackson IAP, Miss., Memphis IAP, Tenn. AFRC: Andrews AFB, Md., Charleston AFB S.C. (associate), March ARB, Calif., McChord AFB, Wash., McGuire AFB, N.J., Wright–Patterson AFB, Ohio.
Contractor: Lockheed.
Power Plant: four Pratt & Whitney TF33-P-7 turbofans, each 21,000 lb thrust.
Accommodation: crew of five; cargo on 13 standard 463L pallets. Alternative freight or vehicle payloads, 200 fully equipped troops, 155 paratroops, or 103 litter patients plus attendants.
Dimensions: span 159 ft 11 in, length 168 ft 4 in, height 39 ft 3 in.
Weight: operating 150,000 lb; max payload 68,725 lb normal, 89,000 lb emergency war planning; gross 325,000 lb normal, 344,900 lb emergency war planning.
Ceiling: 41,600 ft.
Performance: max cruising speed 566 mph, range with max payload 2,170 miles without air refueling.
COMMENTARY
Longtime mainstay of USAF's airlift fleet, the C-141 was the first jet aircraft designed to meet military standards as a troop and cargo carrier. Current plans call for retirement of all C-141s in active units by 2006.

C-141A entered service with MAC in April 1965; 285 were built, some of which were structurally modified to accommodate the Minuteman ICBM.

C-141B is a stretched C-141A with in-flight refueling capability. All C-141As (except four AFMC aircraft used for test purposes) were lengthened by 23 ft 4 in to expand lift capacity. First C-141B flew March 1977 and redeliveries took place between December 1979 and June 1982. The modification gave USAF the equivalent of 90 additional C-141A aircraft. Subsequent improvements include structural upgrades, a state-of-the-art autopilot and all-weather landing system, and improved airdrop systems. Modification of 13 C-141Bs is aimed at increasing their SOLL (Special Operations Low Level) capability and survivability.

C-141C is a C-141B modified with computerized glass-cockpit instrumentation and digital flight-management system, with integrated GPS data for navigation and modern navigation safety equipment. The first version, which rolled out at Warner Robins ALC, Ga., Oct. 1, 1997, was assigned to AFRC's 452nd Air Mobility Wing, March ARB, Calif. Sixty-three of these glass-cockpit transports are slated for ANG and AFRC.

Theater and Special Use Transports

C-9 Nightingale

Brief: A twin-engine, medium-range, swept-wing jet aircraft used primarily for the aeromedical evacuation mission. A modified version of the DC-9, it is the only USAF aircraft specifically designed for the movement of litter and ambulatory patients.
Function: Aeromedical evacuation.
Operator: AMC, PACAF, USAFE, AFRC.
First Flight: August 1968.
Delivered: August 1968–February 1975.
IOC: circa 1968.
Production: 24.
Inventory: 23.
Unit Location: Andrews AFB, Md., Ramstein AB, Germany, Scott AFB, Ill., Yokota AB, Japan.
Contractor: McDonnell Douglas (now Boeing).
Power Plant: two Pratt & Whitney JT8D-9A turbofans, each 14,500 lb thrust.
Accommodation: crew of three; 40 litter patients or 40 ambulatory patients, or a combination of both, plus five medical staff.
Dimensions: span 93 ft 5 in, length 119 ft 3 in, height 27 ft 5 in.
Weight: gross 121,000 lb.
Ceiling: 35,000 ft.
Performance: max cruising speed at 25,000 ft 565 mph, range more than 2,000 miles.
COMMENTARY
C-9A transport is a derivative of the DC-9 Series 30 commercial airliner, modified to include a special-care compartment with separate atmospheric and ventilation controls. One C-9A also provides DV airlift in Europe. Because of the critical nature of its mission, the aircraft carries a flight mechanic and a small supply of spares.
C-9C. Three specially configured C-9s were delivered to Andrews AFB, Md., in 1975 for Presidential and other US governmental duties.

C-12 Huron

Brief: Aircraft to provide airlift support for attaché and military advisory groups worldwide.
Function: Special airlift.
Operator: AETC, AFMC, PACAF.
First Flight: Oct. 27, 1972 (Super King Air 200).
Delivered: 1974–late 1980s.
IOC: circa 1974.
Production: 88.
Inventory: 30.
Unit Location: Elmendorf AFB, Alaska, Keesler AFB, Miss., Osan AB, South Korea, various overseas embassies.
Contractor: Beech.
Power Plant: (C-12J) two Pratt & Whitney Canada PT6A-65B turboprops, each 1,100 shp.
Accommodation: crew of two; C-12C: up to eight passengers; C-12J: up to 19 passengers.
Dimensions: (C-12J) span 54 ft 6 in, length 43 ft 9 in, height 15 ft.
Weight: (C-12J) empty 9,850 lb, gross 16,600 lb.
Ceiling: (C-12J) 25,000 ft.
Performance: (C-12J) max cruising speed at 16,000 ft 307 mph, range with 10 passengers 1,806 miles.
COMMENTARY
C-12C. Re-engined C-12As, with PT6A-41 turboprops, deployed to overseas embassies.

C-12D. Similar to C model and also deployed to overseas embassies.

C-12F. With uprated PT6A-42 engines, can support medical airlift.

C-12J. A military version of the larger Beechcraft Model 1900, operated by PACAF.

C-20 Gulfstream

Brief: A twin-engine turbofan aircraft acquired to provide airlift for high-ranking government and DOD officials.

Function: Operational support airlift; special air missions.

Operator: AMC, USAFE.

First Flight: December 1979.

Delivered: from September 1983.

IOC: circa 1983.

Production: not available

Inventory: 13.

Unit Location: Andrews AFB, Md., Ramstein AB, Germany.

Contractor: Gulfstream.

Power Plant: C-20A/B: two Rolls Royce–Spey MK511-8 turbofans, each 11,400 lb thrust; C-20H: two Rolls Royce–Tay MK611-8 turbofans, each 13,850 lb thrust.

Accommodation: crew of five; 12 passengers.

Dimensions: span 77 ft 10 in, length 83 ft 1 in, height 24 ft 4 in.

Weight: C-20A/B gross 68,200 lb; C-20H gross 74,600 lb.

Ceiling: 45,000 ft.

Performance: max cruising speed 561 mph, range 4,050 miles.

COMMENTARY

C-20A. Three Gulfstream III transports were acquired to replace aging C-140B aircraft. They provide USAFE's Operational Support Airlift fleet with intercontinental range and ability to operate from short runways.

C-20B. Seven C-20B versions, with advanced mission communications equipment and revised interior, were acquired in the late 1980s. Two C-20B aircraft have been retired.

C-20C. Three special missions aircraft, with hardened strategic communications equipment.

C-20H. Two Gulfstream IV–SP aircraft, with advanced-technology flight-management systems and upgraded Rolls Royce engines, were acquired by USAF to meet expanding special air mission requirements.

C-21

Brief: Aircraft designed to provide cargo and passenger airlift and transport litters during medical evacuations.

Function: Pilot seasoning, passenger and cargo airlift.

Operator: AETC, AMC, PACAF, USAFE, ANG.

First Flight: January 1973.

Delivered: April 1984–October 1985.

IOC: April 1984.

Production: 84.

Inventory: 78.

Unit Location: Andrews AFB, Md., Keesler AFB, Miss., Langley AFB, Va., Maxwell AFB, Ala., Offutt AFB, Neb., Peterson AFB, Colo., Ramstein AB, Germany, Randolph AFB, Tex., Scott AFB, Ill., Stuttgart, Germany, Wright–Patterson AFB, Ohio, Yokota AB, Japan.

Contractor: Raytheon.

Power Plant: two AlliedSignal TFE731-2 turbofans, each 3,500 lb thrust.

Accommodation: crew of two and up to eight passengers or 3,153 lb cargo. Convertible to aeromedical evacuation configuration.

Dimensions: span 39 ft 6 in, length 48 ft 7 in, height 12 ft 3 in.

Weight: empty, equipped 10,119 lb, gross 18,300 lb.

Ceiling: 45,000 ft.

Performance: max level speed at 25,000 ft 542 mph, range with max passenger load 2,420 miles, with max cargo load 1,653 miles.

COMMENTARY

C-21A aircraft provide operational support airlift for time-sensitive movement of people and cargo throughout the US and the Pacific and European theaters, including aeromedical missions if required.

C-22

Brief: A Boeing 727-100 used by the Air National Guard as its primary medium-range aircraft for airlift of personnel.

Function: Passenger transportation.

Operator: ANG.

First Flight: February 1963 (commercial).

Delivered: 1984.

IOC: circa 1984.

Production: four.

Inventory: three.

Unit Location: Andrews AFB, Md.

Contractor: Boeing.

Power Plant: three JTD8D-7 turbofans, each 14,000 lb thrust.

Accommodation: flight crew of four, plus three or four cabin crew; up to 89 passengers.

Dimensions: span 108 ft, length 133 ft 2 in, height 34 ft.

Weight: gross 170,000 lb.

Ceiling: 37,400 ft.

Performance: max speed 630 mph, range 2,000 miles, 5.5 hr endurance.

COMMENTARY

C-22B. Boeing 727 commercial transports purchased and modified as C-22Bs for use by ANG on operational support airlift missions. Two were further modified to accommodate an additional 1,100 gallons of fuel and landing gear rated for 170,000 lb gross landing weight.

C-26

Brief: A modified commuter transport aircraft.

Function: Transport, medevac, and counterdrug.

Operator: ANG.

First Flight: not available

Delivered: March 1989–present.

IOC: March 1989.

Production: not available

Inventory: 12 (C-26B, UC-26C).

Unit Location: various ANG units.

Contractor: Fairchild.

Power Plant: two AlliedSignal TPE331-11U-612G turboprops, each 1,100 shp (C-26A); TPE331-12UAR-701G, each 1,119 shp (C-26B); or TPE331-3U-303G, each 840 shp (UC-26C).

Accommodation: crew of two; 14–22 passengers.

Dimensions: (UC-26C) span 57 ft, length 59 ft 4 in, height 16 ft 8 in.

Weight: (UC-26C) gross 12,500 lb.

Ceiling: (UC-26C) 30,000 ft.

Performance: max cruising speed at midcruise weight of 12,500 lb 321 mph, range with 19 passengers 1,224 miles.

COMMENTARY

C-26A. USAF acquired 13 Fairchild Metro III commuter transport aircraft, under the designation C-26A, to replace ANG C-131s. C-26As serving in the ANG Operational Support Transport Aircraft (ANGOSTA) role have a quick-change interior, enabling passenger seats to be replaced by a medevac or cargo-carrying configuration.

C-26B. C-26Bs, modified Fairchild Metro 23s, have FLIR, TCAS II, GPS, and microwave landing systems.

UC-26C. A modified Fairchild Merlin IVC, used for counterdrug operations.

C-32

Brief: A modified Boeing 757-200 used to provide transportation for the vice president, cabinet, Congressional members, and other high-ranking US and foreign officials.

Function: VIP air transport.

Operator: AMC.

First Flight: Feb. 19, 1982 (USAF Feb. 11, 1998).

Delivery: June–December 1998.

IOC: 1998.

Production: four.

Inventory: four.

Unit Location: Andrews AFB, Md.

Contractor: Boeing.

Power Plant: two Pratt & Whitney PW2040 turbofans, each 41,700 lb thrust.

Accommodation: 16 crew and 45 passengers.

Dimensions: span 124 ft 10 in, length 155 ft 3 in, height 44 ft 6 in.

Weight: empty 127,800 lb, gross 255,000 lb.

Performance: cruise speed Mach 0.8–0.86, cruise altitude 41,000 ft.

COMMENTARY

New Boeing 757-200s, known as C-32As, were acquired as replacements for C-137B/C aircraft. The commercial DV interior includes a crew rest area, DV stateroom, conference area, and general passenger area. The passenger communications system provides worldwide, clear and secure voice and data communications. Modern flight deck avionics allow operations to any suitable airfield in the world and provide an upgrade path as new capabilities become available.

C-37A

Brief: A modified Gulfstream V utilized as part of the executive fleet, providing transportation for the vice president, cabinet, Congressional members, Secretary of Defense, service secretaries, and other prominent US and foreign officials.

Function: VIP air transport.

Operator: AMC.

First Flight: USAF October 1998.

Delivery: October 1998–February 2000.

IOC: Dec. 9, 1998.

Production: three.

Inventory: three.

Unit Location: Andrews AFB, Md.

Contractor: Gulfstream.

Power Plant: two BMW–Rolls Royce BR710A1-10 turbofans, each 14,750 lb thrust.

Accommodation: five crew and 12 passengers.

Dimensions: span 93 ft 6 in, length 96 ft 5 in, height 25 ft 10 in.

Weight: empty 47,601 lb, gross 90,500 lb.

Performance: cruise speed Mach 0.8, cruise altitude up to 51,000 ft.

COMMENTARY

Two C-37As, along with the C-32s, are replacements for the VC-137B/C aircraft. They can conduct simultaneous diplomatic missions with secure communications. Capable of operations at any suitable civilian or military airfield in the world. The third C-37 is a CINC support airlift aircraft based in the European Theater as a pooled aircraft.

C-38A

Brief: A twin-engine transcontinental aircraft used to provide transportation for DVs, such as Congressional or high-ranking military members. It can also be configured for medevac and cargo use.

Function: VIP air transport and operational support.

Operator: ANG.

First Flight: 1998.

Delivered: April–May 1998.

IOC: 1998.

Production: two.

Inventory: two.

Unit Location: Andrews AFB, Md.

Contractor: Tracor (Israel Aircraft Industries Ltd).

Power Plant: two AlliedSignal TFE731-40R-200G, each 4,250 lb thrust.

Accommodation: typically two crew and eight passengers. In medevac role: two Spectrum 500 Life Support Units and two medical attendants. All seats removable for cargo.

Dimensions: span 54 ft 7 in, length 55 ft 7 in, height 18 ft 2 in.

Weight: gross 24,800 lb.

Performance: cruise speed Mach 0.87, cruise altitude 33,000 ft.

COMMENTARY

The C-38A is a military version of the Astra SPX

***C-20** Gulfstream* (Ted Carlson)

***MC-130E** Combat Talon* (Ted Carlson)

produced by IAI and supported worldwide by Galaxy Aerospace. Two aircraft are operated by ANG's 201st AS replacing Learjet C-21As. The contract includes an option for two additional aircraft.

C-130 Hercules

Brief: A rugged aircraft capable of operating from rough dirt strips to provide theater airlift and paradropping of troops and equipment into hostile areas.

Function: Inter- and intratheater airlift.

Operator: AETC, AFMC, AMC, PACAF, USAFE, ANG, AFRC.

First Flight: August 1954 (C-130A).

Delivered: December 1956–present.

IOC: circa 1958.

Production: more than 2,200.

Inventory: 533: 228 (E), 293 (H), 12 (J).

Unit Location: Active: Dyess AFB, Tex., Edwards AFB, Calif., Elmendorf AFB, Alaska, Little Rock AFB, Ark., Pope AFB, N.C., Ramstein AB, Germany, Yokota AB, Japan. ANG: 22 units. AFRC: 10 units.

Contractor: Lockheed Martin.

Power Plant: (C-130H) four Rolls Royce–Allison T56-A-15 turboprops, each 4,300 shp. (C-130J) four Rolls Royce–Allison AE2100D3 engines.

Accommodation: (C-130H) crew of five; up to 92 troops, 64 paratroops, 74 litter patients plus attendants, 54 passengers on palletized seating, or up to five 463L standard freight pallets, etc.

Dimensions: span 132 ft 7 in, length 97 ft 9 in, height 38 ft 1 in.

Weight: (C-130H) empty 81,000 lb, fuel/cargo max gross 155,000 lb.

Ceiling: 33,000 ft at 100,000 lb T-O weight.

Performance: (C-130H) max cruising speed 385 mph, T-O run 3,585 ft, landing run (at 130,000 lb) 1,700 ft, range with 40,000-lb payload 2,240 miles.

COMMENTARY

First flown 46 years ago, the C-130 Hercules transport continues in production and has been delivered to more than 60 countries. Basic and specialized versions operate throughout USAF, performing diverse roles in both peace and war situations, including airlift support, Arctic ice cap resupply, aeromedical missions, aerial spray missions, fire-fighting duties for the US Forest Service, and natural disaster and humanitarian relief missions.

C-130A, B, and D. Early versions, now retired. The initial production C-130A had four Allison T56-A-11 or -9 turboprop engines. USAF ordered a total of 219. The C-130B had improved range and higher weights and introduced Allison T56-A-7 turboprops; 134 were produced, with delivery from April 1959. Twelve were modified beginning 1961 as **JC-130B**s for air-snatch satellite recovery together with three early H models. Twelve C-130Ds were modified As for Arctic operations.

C-130E is an extended-range development of the C-130B, with large under-wing fuel tanks; 389 were ordered, with deliveries beginning in April 1962. A wing modification to correct fatigue and corrosion has extended the life of the aircraft well into this century. Other modifications include a self-contained navigation system, with an integrated communications/navigation management suite, GPS capability, and a state-of-the-art autopilot that incorporates a ground collision avoidance system. ANG C-130Es are used in fire-fighting missions.

C-130H is generally similar to the E model but has updated turboprops, a redesigned outer wing, and improved pneumatic systems; delivery began in July 1974. Subsequent improvements include updated avionics, improved low-power color radar, and other minor modifications. Night vision instrumentation system was introduced from 1993, TCAS II in new aircraft from 1994. ANG and AFRC C-130Hs are used in fire-fighting missions. Specifically modified aircraft are used by AFRC's 757th AS for aerial spraying, typically to suppress mosquito-spread epidemics. The ANG's 109th AW, Schenectady County Airport, N.Y., operates 10 LC-130H/Rs, modified with wheel-ski gear in support of Arctic and Antarctic operations. Two **DC-130H**s were modified for UAV control duties.

USAF plans to upgrade C-130E/H aircraft under the Avionics Modernization Program.

C-130J. This newest model features a three-crew flight operation system, 6,000-shp Rolls Royce–Allison AE2100D engines, all composite six-blade Dowty Aerospace R391 propeller system, digital avionics, and mission computers. Compared to earlier production C-130Es, its speed is up 21 percent, cruising altitude is 40 percent higher, and range 40 percent longer. The J also features improved reliability and maintainability. USAF plans to procure C-130Js to replace its oldest 1960s-vintage C-130Es. ANG and AFRC units have already begun receiving J models.

C-137 Stratoliner

Brief: A modified Boeing 707 providing transportation for the vice president, cabinet and Congressional members, and other high-ranking US and foreign officials. It also serves as a backup for Air Force One, the Presidential aircraft.

Function: VIP air transport.

Operator: AMC.

First Flight: April 1959.

Delivered: from 1959.

IOC: 1962.

Production: seven.

Inventory: one.

Unit Location: Andrews AFB, Md.

Contractor: Boeing.

Power Plant: four Pratt & Whitney JT3D-3B turbofans, each 18,000 lb thrust.

Accommodation: varies with mission.

Dimensions: span 145 ft 9 in, length 152 ft 11 in, height 42 ft 5 in (VC-137C).

Weight: gross 322,000 lb (VC-137C).

Ceiling: 42,000 ft.

Performance: max speed 627 mph, range 6,000 miles (VC-137C).

COMMENTARY

One specially modified Boeing 707 transport is operated by AMC's 89th Airlift Wing for VIP duties. Other aircraft have been replaced by new Boeing 757-200s, designated C-32A, and two Gulfstream-5s, designated C-37A.

VC-137A. Three specially configured 707-120 aircraft, acquired by USAF for VIP duties. All modified to B standard.

C-137B. VC-137A aircraft modified with turbofan engines. All retired.

C-137C. Four VIP–configured 707-320Bs, two of which have been Air Force One aircraft. Aircraft tail #26000, the first VC-137C in service (Oct. 12, 1962) and the first specifically purchased for use as Air Force One, retired in May 1998. It is perhaps most well-known as the aircraft that was used to return President John F. Kennedy's body to Washington and to host the swearing in of President Lyndon B. Johnson in 1963. The sole operational C-137 Air Force One, tail #27000, entered service Aug. 4, 1972.

CV-22

Brief: A tilt rotor, multimission transport aircraft designed to have the maneuverability and lift capability of a helicopter and the speed of a fixed wing aircraft.

Function: Multimission airlift.

Operator: AFSOC.

First Flight: March 19, 1989 (V-22).

Delivery: 2003 (planned).

IOC: 2005 (planned).

Production: 50 (planned).

Inventory: 50 (planned).

Unit Location: Hurlburt Field, Fla.

Contractor: Bell–Boeing.

Power Plant: two Rolls Royce–Allison AE1107C turboshafts, each 6,200 shp.

Accommodation: four (two pilots, two flight engineers), up to 24 troops or 8,000 lb internal cargo.

Dimensions: proprotor diameter 38 ft, width, rotors turning 84 ft 7 in, fuselage length 57 ft 4 in, height over tail fins 17 ft 8 in.

Weight: gross weight, VTO 52,870 lb; STO 57,000 lb, self-deploy T-O 60,500 lb.

Ceiling: 25,000 ft.

Performance: typically will carry troops or cargo over a 575-mile combat radius at 265 mph. Self-deployment range with one air refueling 2,417 miles.

COMMENTARY

CV-22 is the designation for the US Special Operations Command variant of the V-22 Osprey, currently undergoing combined testing at Edwards AFB, Calif. It is a tilt rotor, Vertical/Short Takeoff and Landing (V/STOL) aircraft capable of operations in austere environments from remote bases or air capable ships. The CV-22's mission is long-range clandestine penetration of denied areas in adverse weather and low visibility to infiltrate, exfiltrate, and resupply SOF. Capable of air-to-air refueling, its range is limited only by crew endurance.

CV-22 avionics include a fully integrated precision navigation suite, with GPS and INS; a digital cockpit management system oriented around four Multifunction Displays (MFDs); FLIR; an integrated NVG HUD; Terrain-Following/Terrain-Avoidance (TF/TA) radar; and digital map system. The CV-22 also incorporates an extensive defensive countermeasures suite. Components of this system include a Radar Warning Receiver (RWR), missile warning system, laser detection system, radar missile jammer, IR missile jammer, and a countermeasures dispensing system. The communications suite will include secure UHF, VHF (AM and FM), and SATCOM radios.

The first CV-22 is planned to begin initial operational test and evaluation at Kirtland AFB, N.M., in spring 2002. Initial training capability is scheduled for September 2003 at Kirtland AFB, N.M., and IOC for February 2005 at Hurlburt.

MC-130E/H Combat Talon

Brief: A modified C-130 able to provide global, day, night, and adverse weather capability to air-drop personnel and to deliver personnel and equipment to support US and allied SOF.

Function: SOF infiltration, exfiltration, and resupply.

Operator: AETC, AFSOC, AFRC.

First Flight: circa 1965 (E); January 1990 (H).

Delivered: initially 1966.

IOC: 1966 (E); June 1991 (H).

Production: 24 (new-build Hs).

Inventory: 14 (E); 24 (H).

Unit Location: Active (associate) and AFRC MC-130Es at Duke Field, Fla. Active MC-130H at Hurlburt Field, Fla., Kadena AB, Japan, Kirtland AFB, N.M., RAF Mildenhall, UK.

Contractor: Lockheed Martin.

Power Plant: four Allison T56-A-15 turboprops, each 4,508 shp.

Accommodation: E: crew of nine; 53 troops or 26 paratroops; H: crew of seven; 75 troops or 52 paratroops.

Dimensions: span 132 ft 7 in, height 38 ft 6 in, length 100 ft 10 in (E), 99 ft 9 in (H).

Weight: empty 72,892 lb, gross 155,000 lb.

Ceiling: 33,000 ft.

Performance: max speed 366 mph, range 3,110 miles, unlimited with refueling.

COMMENTARY

MC-130 Combat Talon aircraft are equipped with in-flight refueling equipment, TF/TA radar, INS/GPS, ECM, and a high-speed aerial delivery system, enabling them to conduct infiltration, exfiltration, resupply, psychological operations, and aerial reconnaissance into hostile or denied territory. Combat Talons are able to deliver or air-drop personnel or equipment on austere, marked and unmarked landing zones/drop zones. They can conduct overt, clandestine, and low-visibility operations.

MC-130E (Combat Talon I). Fourteen modified C-130E aircraft, nine of which are equipped with a surface-to-air Fulton air recovery system. The MC-130Es are also equipped to air refuel helicopters. During Operation Desert Storm, MC-130Es played a vital role performing psychological operations, with a secondary mission in CSAR.

MC-130H (Combat Talon II). Twenty-four new-build MC-130Hs were acquired to supplement the Talon I. They include an integrated glass cockpit compatible

with NVGs and improved infrared and electronic defensive countermeasures. The 1st, 7th, and 15th SOSs employ the Combat Talon II, supporting unconventional warfare units from their bases in Japan, Europe, and CONUS, respectively. The 58th SOW at Kirtland AFB, N.M., is responsible for MC-130H mission qualification training.

VC-25 Air Force One

Brief: A specially configured Boeing 747-200B used for air transport of the President and his entourage. When the President is aboard, it has the radio call sign "Air Force One."

Function: Air transport of the President.
Operator: AMC.
First Flight: First flown as Air Force One Sept. 6, 1990.
Delivered: August–December 1990.
IOC: circa 1990.
Production: two.
Inventory: two.
Unit Location: Andrews AFB, Md.
Contractor: Boeing.
Power Plant: four General Electric CF6 turbofans, each 56,700 lb thrust.
Accommodation: crew of 26; up to 76 passengers.
Dimensions: span 195 ft 8 in, length 231 ft 10 in, height 63 ft 5 in.
Weight: long-range mission T-O weight 803,700 lb., gross 833,000 lb.
Ceiling: 45,000 ft.
Performance: high-speed cruise Mach 0.88–0.91, normal cruising speed Mach 0.84, unrefueled range 7,140 miles.
COMMENTARY
Based on the Boeing 747-200B airframe, two VC-25A Presidential transports replaced the former primary and backup Air Force One C-137Cs. Equipment aboard the aircraft makes them practically self-sufficient, and despite their long range they are air refuelable.

Trainer Aircraft

T-1 Jayhawk

Brief: A medium-range, twin-engine jet trainer version of the Beechcraft 400A. It is used by the Air Force to train student pilots to fly airlift, tanker, and bomber aircraft.
Function: Advanced pilot training.
Operator: AETC, AFRC (associate).
First Flight: Sept. 22, 1989 (Beechcraft 400A).
Delivered: Jan. 17, 1992–July 1997.
IOC: January 1993.
Production: 180.
Inventory: 180.
Unit Location: Columbus AFB, Miss., Laughlin and Randolph AFBs, Tex., Vance AFB, Okla.
Contractor: Raytheon.
Power Plant: two Pratt & Whitney Canada JT15D-5B turbofans, each 2,900 lb thrust.
Accommodation: two side by side and one to the rear; rails are fitted to accommodate an extra four seats to permit transport of maintenance teams.
Dimensions: span 43 ft 6 in, length 48 ft 5 in, height 13 ft 11 in.
Weight: empty 5,200 lb, gross 16,300 lb.
Ceiling: 41,000 ft.
Performance: max speed at 27,000 ft 538 mph, range 2,222 miles.
COMMENTARY
Pilots trained in the T-1 progress to transports such as the C-5 and C-17 or to tankers such as the KC-10 and KC-135.

T-1A. The swept-wing T-1A is a military version of the Beech 400A used for Joint Specialized Undergraduate Pilot Training (JSUPT). The T-1A differs from its commercial counterpart, having a single-point refueling system with greater capacity and increased bird strike protection in the windshield and leading edges for sustained low-level operation. A GPS retrofit program has been completed.

T-6A Texan II

Brief: A single-engine turboprop aircraft to be used for training student pilots, navigators, and naval flight officers in fundamentals of aircraft handling and instrument, formation, and night flying.
Function: Primary trainer.
Operator: AETC (USAF), USN.
First Flight: July 15, 1998.
Delivery: May 2000–present (operational aircraft).
IOC: FY01 (planned).
Production: USAF 454, USN 328 (planned).
Inventory: 18 (as at Nov. 3, 2000).
Unit Location: total planned: USAF: Columbus AFB, Miss., Laughlin, Randolph, and Sheppard AFBs, Tex., Moody AFB, Ga., Vance AFB, Okla. Navy: NAS Corpus Christi, Tex., NASs Pensacola and Whiting, Fla.
Contractor: Raytheon Beech.
Power Plant: one Pratt & Whitney Canada PT6A-68 turboprop, 1,100 shp.
Accommodation: two, in tandem, on zero/zero ejection seats.
Dimensions: span 33 ft 5 in, length 33 ft 4 in, height 10 ft 8 in.
Weight: empty (approx) 4,707 lb; gross 6,300 lb.
Ceiling: 31,000 ft.
Performance: max speed 368 mph.
COMMENTARY
The Joint Primary Aircraft Training System (JPATS) T-6A Texan II is based on the Swiss Pilatus PC-9 aircraft, modified to include a strengthened fuselage, upgraded engine, increased fuel capacity, pressurized cockpit, larger, bird-resistant canopy, and new digital avionics. The JPATS will replace USAF's T-37Bs and USN's T-34Cs in primary pilot training, as well as supporting undergraduate naval flight officer and USAF navigator training.

T-37 Tweet

Brief: A twin-engine jet used for training undergraduate pilots and undergraduate navigator and tactical navigator students in fundamentals of aircraft handling and instrument, navigation, formation, and night flying.
Function: Primary trainer.
Operator: AETC, AFRC.
First Flight: September 1955.
Delivered: from December 1956.
IOC: 1957.
Production: 985.
Inventory: 417.
Unit Location: Columbus AFB, Miss., Laughlin, Randolph, and Sheppard AFBs, Tex., Vance AFB, Okla.
Contractor: Cessna.
Power Plant: two Continental J69-T-25 turbojets, each 1,025 lb thrust.
Accommodation: two, side by side, on ejection seats.
Dimensions: span 33 ft 8 in, length 29 ft 3 in, height 9 ft 2 in.
Weight: empty 3,870 lb, gross 6,625 lb.
Ceiling: 35,000 ft.
Performance: max speed at 25,000 ft 426 mph, range at 360 mph with standard tankage 870 miles.
COMMENTARY
USAF's first purpose-built jet trainer, the T-37 is currently AETC's standard two-seat primary trainer. A distinctive blue-and-white finish is intended to help formation training and ease maintenance.

T-37A, with J69-T-9 turbojets; all have been modified to T-37B standards.

T-37B. The original T-37A was superseded in November 1959 by the T-37B, with improved radio navigational equipment, UHF radio, and upgraded instruments. All A models were later converted to B standard. Kits were subsequently produced to extend the capability of the T-37 by modifying or replacing critical structural components. AETC began replacing the T-37B with the new T-6A Texan II in 2000.

T-38 Talon

Brief: A twin-engine, high-altitude, supersonic jet trainer used in a variety of roles, primarily for undergraduate pilot and pilot instructor training.
Function: Trainer.
Operator: ACC, AETC, AFMC, AFRC.
First Flight: April 1959.
Delivered: 1961–72.
IOC: March 1961.
Production: more than 1,100.
Inventory: 509.
Unit Location: Beale and Edwards AFBs, Calif., Columbus AFB, Miss., Eglin AFB, Fla., Holloman AFB, N.M., Laughlin, Randolph, and Sheppard AFBs, Tex., Moody AFB, Ga., Vance AFB, Okla., Whiteman AFB, Mo.
Contractor: Northrop.
Power Plant: two General Electric J85-GE-5A turbojets, each 2,680 lb thrust dry, 3,850 lb thrust with afterburning.
Accommodation: two, in tandem, on ejection seats.
Dimensions: span 25 ft 3 in, length 46 ft 4 in, height 12 ft 10 in.
Weight: empty 7,164 lb, gross 12,093 lb.
Ceiling: above 55,000 ft.
Performance: max level speed at 36,000 ft more than Mach 1.23 (812 mph), range, with reserves, 1,093 miles.

***T-37** Tweet* (Ted Carlson)

***T-6** Texan II (USAF photo)*

***T-38** Talon* (Ted Carlson)

COMMENTARY

Most of the T-38s in service are used by AETC for advanced bomber–fighter training track in JSUPT. Capabilities are being enhanced through an ongoing program of modifications and structural renewal, including a full avionics upgrade and integrated GPS/INS. As a result of the reduction in the T-38's workload through introduction of the T-1A and JSUPT, the service life of the T-38s should extend well beyond 2020.

T-38A. Close in structure to the F-5A export tactical fighter, the T-38A was the world's first supersonic trainer aircraft. It is used to teach supersonic techniques, aerobatics, formation, night and instrument flying, and cross-country and low-level navigation. Also used to train test pilots and flight engineers at Edwards AFB, Calif., by AFMC to test experimental equipment, and by ACC to maintain pilot proficiency.

AT-38B. A slightly different version, with a gunsight and practice bomb dispenser, used by AETC for Introduction to Fighter Fundamentals.

T-38C. All T-38A and AT-38B airframes will be redesignated as C models upon modification of the avionics systems, begun in 2000.

T-43

Brief: A medium-range, swept-wing jet aircraft equipped with navigation and communications equipment to train navigators for strategic and tactical aircraft.

Function: Navigation trainer.
Operator: AETC.
First Flight: April 1973.
Delivered: September 1973–July 1974.
IOC: 1974.
Production: 19.
Inventory: 11.
Unit Location: Randolph AFB, Tex.
Contractor: Boeing.
Power Plant: two Pratt & Whitney JT8D-9 turbofans, each 14,500 lb thrust.
Accommodation: crew of two; 12 students and six instructors.
Dimensions: span 93 ft, length 100 ft, height 37 ft.
Weight: gross 115,500 lb.
Ceiling: 37,000 ft.
Performance: econ cruising speed at 35,000 ft Mach 0.7, operational range 2,995 miles.

COMMENTARY

T-43A. The T-43A was derived from the commercial Boeing Model 737-200 and was equipped with the same onboard avionics as most USAF operational aircraft, including mapping radar, VOR and Tacan radio systems, INS, radar altimeter, all required communications equipment, and celestial navigation capability.

Several T-43s are configured for passengers and provide operational support to assigned commands.

TG-3A

Brief: Single-seat, medium-performance sailplane used for cross-country and spin training.

Function: Cross-country and spin trainer.
Operator: USAFA.
First Flight: not available
Delivered: circa 1960.
IOC: circa 1960.
Production: not available
Inventory: three.
Unit Location: USAFA, Colo.
Contractor: Schweizer Aircraft.
Accommodation: one pilot.
Dimensions: span 40 ft, length 21 ft 7 in, height 7 ft 3 in.
Weight: 700 lb.
Ceiling: FL 250 ft.
Performance: speed 114 mph, glide ratio 23:1, range dependent on soaring conditions.

COMMENTARY

The **TG-3A** is a medium-performance sailplane that allows students to master basic flight maneuvers while solo before progressing to a more advanced sailplane. With the exception of the fabric covered horizontal stabilizer and control surfaces, the aircraft is all-metal construction. It is primarily used for cross-country training and high-altitude wave flight with up to six-hour flight duration.

TG-4A

Brief: Conventional two-place tandem, basic training sailplane used to introduce all USAFA cadets to flight.

Function: Flight introduction.
Operator: USAFA.
First Flight: not available
Delivered: October 1984.
IOC: not available
Production: not available
Inventory: 14.
Unit Location: USAFA, Colo.
Contractor: Schweizer Aircraft.
Accommodation: two (student pilot and instructor).
Dimensions: span 51 ft, length 25 ft 9 in, height 9 ft 4 in.
Weight: gross 1,040 lb.
Ceiling: 14,000 ft.
Performance: speed 98 mph, glide ratio 23:1.

COMMENTARY

The **TG-4A** has an all-metal airframe with aluminum covering on wings and vertical tail and a one-piece canopy for increased visibility. USAFA introduces all cadets to flight through the Soar-for-All program using the TG-4A. It can perform aerotow, stall recovery, slow flight, steep turn, and rectangular traffic pattern maneuvers.

TG-7A

Brief: A conventional two-place, side-by-side, fixed gear, low-wing, motorized glider that is equipped with spoilers and used to simulate the flight characteristics of the TG-4A and reduce the number of sorties needed to solo.

Function: Trainer.
Operator: USAFA.
First Flight: not available
Delivered: 1984.
IOC: not available
Production: not available
Inventory: nine.
Unit Location: USAFA, Colo.
Contractor: Schweizer Aircraft.
Power Plant: one Lycoming 0-235-L2C 4-cylinder engine, 112 hp.
Accommodation: two (student pilot and instructor).
Dimensions: span 59 ft 6 in, length 27 ft 6 in, height 7 ft 8 in.
Weight: gross 1,850 lb.
Ceiling: 14,000 ft.
Performance: speed 136 mph, range 230 miles.

COMMENTARY

The **TG-7A** motor glider is a single-engine, fixed gear, conventional configuration, low-wing monoplane of all-metal construction with side-by-side seating. Students use it to practice multiple pattern, aerial maneuvers, and landing procedures, reducing by half the number of sorties needed to achieve a solo flight.

TG-9A

Brief: Medium-performance sailplane with tandem seating used for spins, aerobatics, and cross-country soaring.

Function: Trainer.
Operator: USAFA.
First Flight: not available
Delivered: October 1984.
IOC: not available
Production: not available
Inventory: four.
Unit Location: USAFA, Colo.
Contractor: Schleicher GmbH, Germany.
Accommodation: two tandem.
Dimensions: span 55 ft 9 in, length 27 ft 5 in, height 5 ft.
Weight: gross 1,320 lb.
Ceiling: FL 250 ft.
Performance: speed 150 mph, glide ratio 34:1, range dependent on soaring conditions.

COMMENTARY

The **TG-9A** (ASK-21) sailplane has a midwing configuration with a T-tail and air brakes on the upper wing surface. It is used primarily for spin training and aerobatic demonstrations. It is used at the regional and national level for cross-country and aerobatic competition.

TG-11

Brief: Conventional two-place, side-by-side, self-launched, high-performance sailplane used for cross-country training.

Function: Trainer.
Operator: USAFA.
First Flight: not available
Delivered: Summer 1995.
IOC: not available
Production: not available
Inventory: two.
Unit Location: USAFA, Colo.
Contractor: Stemme GmbH, Germany.
Power Plant: one Limbach L-2400 EB1.AD 4-cylinder engine, T-O 93 hp at 3,400 rpm, cruise 80 hp at 3,000 rpm (S/L).
Accommodation: two side by side.
Dimensions: span 75 ft 6 in, length 27 ft 7 in, height 5 ft 8 in.
Weight: gross 1,874 lb.
Ceiling: 17,450 ft powered cruise, FL 250 ft.
Performance: speed 168 mph, 138 mph powered cruise, glide ratio 50:1, range 860 miles powered.

COMMENTARY

The **TG-11** self-launched, high-performance sailplane has a folding propeller that is stored behind a retractable propeller dome on the aircraft nose during soaring flight. It is used primarily for dual cross-country training, field selection, and advanced sailplane training.

T-41 Mescalero

Brief: Short-range, high-wing trainer used primarily for aerodynamic and navigation courses.

Function: Training, support.
Operator: USAFA.
Delivered: 1969.
Inventory: three.
Unit Location: USAFA, Colo.
Contractor: Cessna.
Power Plant: one Continental IO-360-DB piston engine, 210 hp thrust.
Accommodation: two side by side.
Dimensions: span 36 ft 2 in, length 26 ft 6 in, height 8 ft 11 in.
Weight: gross 2,550 lb.
Ceiling: 16,000 ft.
Performance: speed 182 mph, range 690 miles.

COMMENTARY

The **T-41,** a military version of the Cessna 172, is an all-metal, strut-braced, high-wing monoplane. It is also used for Aero 456 flight testing, USAFA flying team support, and orientation flights.

UV-18 Twin Otter

Brief: Modified utility transport used for parachute jump training.

Function: Paradrop.
Operator: AETC.
First Flight: May 1965 (commercial version).
Delivered: 1977.
IOC: 1977.
Production: three.
Inventory: three.
Unit Location: USAFA, Colo.
Contractor: de Havilland Aircraft of Canada.
Power Plant: two Pratt & Whitney Canada PT6A-27 turboprops, each 620 ehp.
Accommodation: crew of two and up to 20 passengers.
Dimensions: span 65 ft, length 51 ft 9 in, height 19 ft 6 in.
Weight: gross 12,500 lb.
Ceiling: 26,700 ft.
Performance: max cruising speed 210 mph, range

with 2,500 lb payload 806 miles.

COMMENTARY

The UV-18B is a military version of the DHC-6 Twin Otter STOL utility transport used for parachute jump training at the US Air Force Academy.

Helicopters

HH-60G Pave Hawk

Brief: Specially modified helicopters used for SAR and support missions.

Function: SOF heavy-lift helicopter.

Operator: ACC, AETC, PACAF, ANG, AFRC.

First Flight: October 1974.

Delivered: 1982–present.

IOC: circa 1982.

Production: 105.

Inventory: 104.

Unit Location: Eglin AFB, Fla., Holloman AFB, N.M., Kadena AB, Japan, Kirtland AFB, N.M., Moody AFB, Ga., NAS Keflavik, Iceland, Nellis AFB, Nev. ANG: Francis S. Gabreski IAP, N.Y., Kulis ANGB, Alaska, Moffett Federal Airfield, Calif. AFRC: Davis–Monthan AFB, Ariz., Patrick AFB, Fla., Portland IAP, Ore.

Contractor: Sikorsky.

Power Plant: two General Electric T700-GE-700/701C turboshafts, each 1,620 (continuous) shp.

Accommodation: crew of three or four; 11–14 troops, up to six litters, or internal or external cargo.

Dimensions: rotor diameter 53 ft 7 in, length of fuselage 64 ft 8 in, height 16 ft 8 in.

Weight: empty 12,330 lb, max gross 22,500 lb.

Ceiling: 14,200 ft.

Performance: max speed 222 mph, max range, with reserves, 373 miles (internal fuel), 500 miles (auxiliary tank).

Armament: two 7.62 mm miniguns, with provision for two .50 caliber machine guns in cabin doors.

COMMENTARY

One hundred four Black Hawk helicopters were modified to **HH-60G** Pave Hawk configuration for use by active duty, ANG, and AFRC air rescue units for SAR and various mission-support activities worldwide. The Pave Hawk is a highly modified version of the Army Black Hawk helicopter, featuring an upgraded communications/navigation suite that includes INS/GPS/Doppler navigation systems, Satellite Communications (SATCOM), secure/anti-jam communications, and a Personnel Locating System (PLS) that provides range/bearing data to compatible survivor radios.

Further modifications include an automatic flight-control system, NVG lighting, FLIR, color weather radar, engine/rotor blade anti-ice system, retractable in-flight refueling probe, internal auxiliary fuel tanks, and an integral rescue hoist. Combat enhancements include RWR, IR jammer, flare and chaff countermeasures dispensing system, and two 7.62 mm machine guns.

MH-53 Pave Low

Brief: Specially outfitted heavy-lift helicopters used by Air Force Special Operations Forces for infiltration/exfiltration as well as CSAR missions.

Function: SOF heavy-lift helicopter.

Operator: AETC, AFSOC.

First Flight: March 1967.

Delivered: from July 1987 (MH-53J).

IOC: 1988 (MH-53J).

Production: not available

Inventory: 38.

Unit Location: AETC: Kirtland AFB, N.M. AFSOC: Hurlburt Field, Fla., Osan AB, South Korea, RAF Mildenhall, UK.

Contractor: Sikorsky.

Power Plant: two General Electric T64-GE-100 turboshafts, each 4,330 shp.

Accommodation: crew of six; 38 troops.

Dimensions: rotor diameter 72 ft 3 in, length of fuselage (without refueling probe) 67 ft 2 in, height 25 ft.

Weight: gross 50,000 lb.

Ceiling: 16,000 ft.

Performance: speed 164 mph, max range 630 miles, unlimited with air refueling.

Armament: mounts for any combination of three 7.62 miniguns and .50 caliber machine guns.

COMMENTARY

MH-53H. Older version of the helicopter, all of which, together with all HH/CH-53B/Cs, were upgraded to MH-53J Pave Low III "Enhanced" standard from 1986.

MH-53J. A long-range deep penetration helicopter, adverse weather capable and equipped for extended operations when air refueled. Equipped with a nose-mounted FLIR, an integrated digital avionics suite that includes TF/TA radar, Kalman filtered navigation suite (GPS, INS, Doppler), Projected Map Display, secure UHF, VHF, FM, HF communications, PLS, SATCOM, hover coupler, rescue hoist, mission commander's C^2 panel, armor plating, and an ECM suite with radar and IR missile jammers, flare/chaff dispensers, RWR, and missile launch detectors.

A Service Life Extension Program (SLEP) upgraded the aircraft's hydraulics, wiring, and basic airframe structure for increased gross weight, and an automated blade/pylon fold system optimized for shipboard compatibility. All aircraft modified to support aircrew eye/respiratory protection system.

MH-53M. MH-53J helicopters upgraded to Pave Low IV standard, delivered from 1999. Upgrades include the interactive defensive avionics suite/multimission advanced tactical terminal capability which integrates on-board EW systems with off-board, over-the-horizon, near-real-time intelligence, and mission software improvements. Cockpit modifications include three MFDs, integrated digital map, and mission commander situation awareness panel in the cabin area.

TH-53A. Six TH-53As (modified USMC CH-53As) are used by the 58th SOW as basic qualification trainers. Modifications include the installation of General Electric T64-GE-100 engines, air refueling probe, and standard USAF avionics and communications equipment.

UH-1 Iroquois

Brief: Modified Bell helicopter used to support Air Force ICBM facilities and for administrative airlift.

Function: Utility helicopter.

Operator: AETC, AFMC, AFSOC, AFSPC, AMC, PACAF.

First Flight: circa 1956.

Delivered: from September 1970.

IOC: circa 1970.

Production: 79.

Inventory: 62.

Unit Location: Andrews AFB, Md., Fairchild AFB, Wash., F.E. Warren AFB, Wyo., Hurlburt Field, Fla., Kirtland AFB, N.M., Malmstrom AFB, Mont., Minot AFB, N.D., Vandenberg AFB, Calif., Yokota AB, Japan.

Contractor: Bell.

Power Plant: Pratt & Whitney Canada T400-CP-400 Turbo "Twin-Pac," 1,290 shp.

Accommodation: two pilots and 14 passengers or cargo, or external load of 4,000 lb.

Dimensions: rotor diameter (with tracking tips) 48 ft 2 in, fuselage length 42 ft 4 in, height 14 ft 4 in.

Weight: gross and mission weight 11,200 lb.

Ceiling: 13,000 ft.

Performance: max cruising speed at S/L 115 mph, max range, no reserves, 261 miles.

Armament: (optional) two General Electric 7.62 mm miniguns or two 40 mm grenade launchers; two seven-tube 2.75-in rocket launchers.

COMMENTARY

UH-1N is a twin-engine version of the UH-1 utility helicopter (Bell Model 212), most of which are allocated for AFSPC missile site support and for administrative/DV airlift. The UH-1N is also used by AETC's 58th SOW, Kirtland AFB, N.M., for training purposes and by the 336th TG, Fairchild AFB, Wash., for aircrew survival training. Two UH-1N helicopters are maintained by AFSOC for aviation advisory aircrew flight proficiency.

***MH-53J** Pave Low III* (MSgt. Val Gempis)

***UH-1N** Iroquois* (Guy Aceto)

Strategic Missiles

AGM-86 Air Launched Cruise Missile

Brief: A small, subsonic, unmanned, winged air vehicle, currently deployed on B-52H aircraft, which can be equipped with either a nuclear or conventional warhead and can be used to help dilute air defenses and complicate an enemy's air defense task.

Function: Strategic air-to-surface cruise missile.

Operator: ACC.

First Flight: June 1979 (FSD).

Delivered: from 1981.

IOC: December 1982, Griffiss AFB, N.Y.

Production: 1,700+.

Inventory: 1,600.

Unit Location: Barksdale AFB, La., Minot AFB, N.D.

Contractor: Boeing.

Power Plant: Williams/Teledyne CAE F107-WR-10 turbofan, 600 lb thrust.

Guidance: AGM-86B: inertial plus Terrain Contour Matching (TERCOM); AGM-86C: inertial plus GPS.

Warhead: AGM-86B: W80-1 nuclear; AGM-86C: blast/fragmentation conventional; AGM-86D: hard target penetrating warhead.
Dimensions: length 20 ft 9 in, body diameter 2 ft, wingspan 12 ft.
Weight: 3,200 lb.
Performance (approx): speed Mach 0.6, range 1,555 miles.
COMMENTARY
AGM-86A. A prototype cruise missile, developed in the mid-1970s. Slightly smaller than the later versions, it never entered production.
AGM-B. First production version, the B is programmed for precision attack on surface targets. Small radar signature and low-level flight capability enhance the missile's effectiveness. The last of 1,715 production models was delivered in October 1986.
AGM-86C. A non-nuclear version, developed from 1986, the Conventional Air Launched Cruise Missile (CALCM) was first used operationally during the Persian Gulf War and has since been widely used in combat operations. CALCM provides the warfighter with an adverse weather, day/night, air-to-surface, accurate, standoff outside theater defenses strike capability, with a range greater than 575 miles and a 3,000-lb class warhead. CALCM is equally effective for stand-alone, clandestine/punitive strikes, and fully integrated theater warfare. Boeing is currently under contract to convert 322 Bs to conventional configuration, the first of which was delivered November 1999. One hundred thirty-two will feature new Block 1A enhancements with improved accuracy and increased immunity to electronic jamming.
AGM-86D. CALCM penetrator version with a Lockheed Martin AUP-3(M) warhead. The last 50 of the 322 CALCM conversions will be to AGM-86D configuration. The CALCM penetrator will provide the warfighter with a cost-effective, standoff outside theater defenses capability against a wide range of hardened, deeply buried targets. Final delivery expected late 2001.

AGM-129 Advanced Cruise Missile
Brief: A stealthy, long-range, winged air vehicle equipped with a nuclear warhead and designed to evade enemy air and ground-based defenses in order to strike hard, heavily defended targets at standoff distances.
Function: Strategic air-to-surface cruise missile.
Operator: ACC.
First Flight: July 1985.
Delivered: June 1990–August 1993.
IOC: circa 1991.
Production: 461.
Inventory: not available
Unit Location: Barksdale AFB, La., Minot AFB, N.D.
Contractor: General Dynamics/McDonnell Douglas (now Boeing).
Power Plant: Williams International F112-WR-100 turbofan.
Guidance: inertial, with TERCOM update.
Warhead: W80-1 nuclear.
Dimensions: length 20 ft 10 in, body width 2 ft 3 in, wingspan 10 ft 2 in.
Weight: 3,709 lb.
Performance (approx): range 1,865 miles.
COMMENTARY
AGM-129A. Embodying stealth technology, the AGM-129A has improved range, accuracy, survivability, and targeting flexibility, compared with the AGM-86B. Developed by General Dynamics, McDonnell Douglas was certified as second source for this advanced system, which is deployed on B-52H aircraft.

***LGM-30G** Minuteman III* (Guy Aceto)

LGM-30 Minuteman
Brief: A solid-fuel, intercontinental-range ballistic missile capable of being fired from silo launchers and delivering a thermonuclear payload of one to three warheads with high accuracy over great distances.
Function: Strategic surface-to-surface ballistic missile.
Operator: AFSPC.
First Flight: February 1961.
Delivered: 1962–December 1978.
IOC: December 1962, Malmstrom AFB, Mont.
Production: 1,800.
Inventory: 500.
Unit Location: F.E. Warren AFB, Wyo., Malmstrom AFB, Mont., Minot AFB, N.D.
Contractor: Boeing.
Power Plant: stage 1: Thiokol M-55 solid-propellant motor, 210,000 lb thrust; stage 2: Aerojet–General SR19-AJ-1 solid-propellant motor, 60,300 lb thrust; stage 3: Thiokol SR73-AJ-1 solid-propellant motor, 34,400 lb thrust.
Guidance: inertial guidance system.
Warheads: one–three Mk 12/12A MIRVs (downloaded to one).
Dimensions: length 59 ft 10 in, diameter of first stage 5 ft 6 in.
Weight: launch weight (approx) 78,000 lb.
Performance: speed at burnout more than 15,000 mph, highest point of trajectory approx 700 miles, range with max operational load more than 7,000 miles.
COMMENTARY
Minuteman remains a key element in the US strategic deterrent posture. It is a three-stage, solid-propellant ICBM, housed in underground silos for which an upgrade program was completed in 1980 to provide increased launch facility protection.
LGM-30A/B. Minuteman I version deployed in the early 1960s. The last Minuteman I missile was removed from its silo at Malmstrom AFB, Mont., in February 1969. USAF had deployed 150 A and 650 B models in 16 squadrons.
LGM-30F. Minuteman II version incorporated a larger second stage, an improved guidance package, greater range and payload capability, and hardening against the effects of nuclear blast. IOC was reached in October 1965 at Grand Forks AFB, N.D. USAF deployed 450 in nine squadrons.
LGM-30G. The Minuteman III became operational in June 1970, providing improved range, rapid retargeting, and the capability to place three Multiple Independently Targetable Re-entry Vehicles (MIRVs) on three targets with a high degree of accuracy. USAF initially deployed 550 in 11 squadrons.
A single re-entry vehicle configuration has been demonstrated, planned for, and is being worked in accordance with strategic arms control negotiations. Currently a total of 500 Minuteman IIIs are based at Minot AFB, N.D.; F.E. Warren AFB, Wyo.; and Malmstrom AFB.
An extensive life extension program is ensuring Minuteman's continuing viability. Major upgrades include refurbishment of liquid propulsion post-boost rocket engine, remanufacture of the solid-propellant rocket motors, replacement of the environmental control system, repair of launch facilities, and installation of updated, survivable communications equipment and a C^2 sustainment program.

LG-118 Peacekeeper
Brief: A solid-fuel intercontinental-range ballistic missile capable of delivering a thermonuclear payload of 10 warheads with high accuracy over great distances.
Function: Strategic surface-to-surface ballistic missile.
Operator: AFSPC.
First Flight: June 17, 1983.
Delivered: June 1986–December 1988.
IOC: December 1986, F.E. Warren AFB, Wyo.
Production: 50.
Inventory: 50.
Unit Location: F.E. Warren AFB, Wyo.
Contractor: Lockheed Martin.
Power Plant: first three stages: solid-propellant; fourth stage: storable liquid; by Thiokol, Aerojet, Hercules, and Rocketdyne, respectively.
Guidance: inertial guidance system.
Warheads: 10 Avco Mk 21 MIRVs.
Dimensions: length 71 ft, diameter 7 ft 8 in.
Weight: approx 195,000 lb.
COMMENTARY
LG-118A. Developed initially in response to an increased Soviet strategic threat, the ending of the Cold War caused the US to cap deployment at only 50 Peacekeeper missiles in the FY90 budget and to cease development of a rail-garrison mode of deployment.
Housed in converted Minuteman III silos, Peacekeeper is a four-stage ICBM that carries up to 10 independently targetable re-entry vehicles. It is more accurate and has a greater payload and range than the Minuteman III. Its greater resistance to nuclear effects and its more capable guidance system provide a greatly improved ability to destroy very hard targets. These attributes, combined with its prompt response, provide a decisive deterrent. Peacekeeper will be scheduled for retirement under the provisions of the START II treaty; however no retirement action will occur until its terms come into force.

Tactical Missiles and Weapons

AIM-7 Sparrow
Brief: A supersonic, medium-range, semiactive radar-guided air-to-air missile with all-weather, all-altitude, and all-aspect offensive capability and a high-explosive warhead, carried by fighter aircraft.
Function: Air-to-air guided missile.
First Flight: December 1983 (AIM-7M).
Delivered: from 1956.
IOC: April 1976 (AIM-7F).
Production: sustainment phase.
Inventory: classified.
Contractor: Raytheon/Hughes; General Dynamics.
Power Plant: Hercules Mk 58 Mod 0 boost–sustain rocket motor.
Guidance: AIM-7M: monopulse semiactive radar.
Warhead: high-explosive, blast fragmentation, weighing 86 lb.
Dimensions: length 12 ft, body diameter 8 in, wingspan 3 ft 4 in.
Weight: launch weight 504 lb.
Performance (estimated): max speed more than Mach 3.5, range more than 30 miles.
COMMENTARY
Early versions. Production of Sparrow has been under way for more than 40 years. Approximately 34,000 early models (AIM-7A/B/C/D/E) were produced. Compared to the earlier versions, the advanced solid-state AIM-7F, introduced in 1975, had a larger motor, Doppler guidance, improved ECM, and better capability over both medium and "dogfight" ranges. USAF produced approximately 5,000, but none are now in USAF service.
AIM-7M, a joint Navy–USAF project to produce a monopulse version of Sparrow aimed at reducing cost and improving performance in the ECM and look-down clutter regions. It began operational service in FY83. This version provides all-weather, all-altitude, all-aspect capability and equips USAF F-15s, F-16s (ADF), and Navy F-14s and F-18s.

AIM-9 Sidewinder
Brief: A supersonic, short-range, passive IR–guided air-to-air missile carried by fighter aircraft, having a high-explosive warhead.
Function: Air-to-air missile.
First Flight: September 1953.
Delivered: 1983–98 (AIM-9M current operational variant).
IOC: circa 1983 (AIM-9M).
Production: sustainment phase (AIM-9M); LRIP from November 2000 (AIM-9X).
Inventory: classified.
Contractor: Raytheon/Loral.
Power Plant: Thiokol Mk 36 Mod 11 solid-propellant rocket motor.
Guidance: solid-state passive IR homing guidance.

AIM-9** Sidewinder* (top) ***EGBU-15 (center) ***AIM-120** AMRAAM* (bottom) (Guy Aceto)

Warhead: high-explosive, weighing 20.8 lb.
Dimensions: length 9 ft 5 in, body diameter 5 in, finspan 2 ft 1 in.
Weight: launch weight 190 lb.
Performance: max speed above Mach 2, range 10+ miles.

COMMENTARY

Early versions. AIM-9A was the prototype version. The AIM-9B, initial production version, entered the inventory in 1957 and was effective only at close range during day. These shortcomings were eliminated on subsequent AIM-9E/H/J/P versions. The third-generation Sidewinder, AIM-9L, added a more powerful solid-propellant rocket motor as well as tracking maneuvering ability. Production and delivery began in 1976; production ended in 1981.

AIM-9M, a joint Navy–USAF project aimed at producing an improved version of AIM-9L with all-altitude, all-aspect, launch-and-leave intercept capability. Carriage options include: A-10, F-14, F-15, F-16, F-16 ADF, and F-18. This version has increased Infrared Counter-Countermeasures (IRCCM) capability, improved background discrimination, and a reduced-smoke rocket motor. First flight of prototype was in February 1978. Full production began in FY81.

AIM-9M-9. A recently completed modification to improve IRCCM capability of early missiles.

AIM-9X is the result of a Navy–Air Force program, derived from a jointly funded demonstration and validation contract. Raytheon is the EMD contractor. The AIM-9X program recently completed a successful operational assessment and gained Defense Acquisition Board approval to enter into LRIP. The flight test program has completed 11 live guided-missile firings with nine kills of QF-4 target drones. USAF plans to buy 5,080 missiles.

The AIM-9X incorporates advanced technologies such as a focal plane array imaging seeker, high off-boresight sensor, and a highly maneuverable jet-vane control system. The missile utilizes the existing AIM-9M rocket motor, warhead, and fuze. It will be integrated with the joint helmet mounted cueing system to maximize its high off-boresight capability. It will be employed on F-15, F-16, F/A-18, F-22, and potentially JSF aircraft.

AIM-120 AMRAAM

Brief: A new-generation supersonic, medium-range, active radar-guided air-to-air missile with a high-explosive warhead.
Function: Air-to-air guided missile.
First Flight: December 1984.
Delivered: 1988–present.
IOC: September 1991.
Production: more than 12,000 planned for USAF/USN.
Inventory: classified.
Contractor: Raytheon.
Power Plant: Alliant boost-sustain solid-propellant rocket motor.
Guidance: inertial and command inertial with active radar terminal homing.
Warhead: high-explosive directed fragmentation weighing 48 lb.
Dimensions: (A/B models) length 12 ft, body diameter 7 in, span of tail control fins 2 ft 1 in.
Weight: 335 lb.
Performance: cruising speed approx Mach 4, range more than 20 miles.

COMMENTARY

A joint project between Navy and USAF, the AIM-120 Advanced Medium-Range Air-to-Air Missile (AMRAAM) is a replacement for the AIM-7 Sparrow. The AIM-120 equips F-15, F-16, F/A-18, and F-22 fighters. (The F-22 will only carry the C model.) Inertial and command inertial guidance and active radar terminal homing provide launch-and-maneuver capability. Significant improvements in operational effectiveness over the AIM-7 include increased average velocity, reduced miss distance, improved fuzing, increased warhead lethality, multiple target engagement capability, improved clutter rejection in low-altitude environments, enhanced electronic protection capability, increased maximum launch range, a reduced-smoke motor, and improved maintenance and handling.

AIM-120A was the first production version, delivered by Hughes in 1988 to the 33rd TFW at Eglin AFB, Fla.

AIM-120B/C are upgraded, reprogrammable variants of the AIM-120. The AIM-120C currently in production has smaller, clipped control surfaces to provide for internal carriage capability in the F-22.

AGM-65 Maverick

Brief: A tactical, TV– or Imaging-Infrared–guided air-to-surface missile carried by fighters and designed for use in CAS, interdiction, and defense suppression missions, having standoff capability and high probability of strike against a wide range of targets.
Function: Air-to-surface guided missile.
First Flight: August 1969.
Delivered: from August 1972.
IOC: February 1973.
Production: sustainment phase.
Inventory: 7,300 AGM-65A/B/H/K (EO guidance); 12,000 AGM-65D/G (IR guidance).
Contractor: Raytheon.
Power Plant: Thiokol TX-481 solid-propellant rocket motor.
Guidance: self-homing, EO guidance system (IIR on D and G models).
Warhead: AGM-65A/B/D/H 125-lb high-explosive, shaped charge; AGM-65G/K 298-lb blast fragmentation.
Dimensions: length 8 ft 2 in, body diameter 1 ft, wingspan 2 ft 4 in.
Weight: launch weight (AGM-65A) 462 lb, (AGM-65G) 677 lb.
Performance: range 0.6 to 14 miles.

COMMENTARY

Maverick missiles were first employed by USAF in Vietnam and were used extensively during the Persian Gulf War. They currently equip A-10, F-15E, and F-16 aircraft for use against tanks and columns of vehicles and in the SEAD role.

AGM-65A. The basic Maverick is a launch-and-leave, TV–guided air-to-surface missile that enables the pilot of the launch aircraft to seek other targets or leave the target area once the missile has been launched. Production was initiated in 1971, following successful test launches over distances ranging from a few thousand feet to many miles and from high altitudes to treetop level.

AGM-65B. A version with a "scene magnification" TV seeker that enables the pilot to identify and lock on to smaller or more distant targets.

AGM-65D. System developed to overcome limitations of the TV Maverick, which can be used only in daylight and clear-weather conditions. This version has an IIR seeker as well as a lower-smoke motor. IIR Maverick became operational on A-10s in February 1986.

AGM-65G. Uses the IIR seeker with an alternate 298-lb blast fragmentation warhead for use against hardened targets. Software has been modified to include options for targeting ships and large land targets as well as mobile armor. This version also has a digital autopilot and a pneumatic, rather than hydraulic, actuation system. USAF received its first G model in 1989.

AGM-65H. AGM-65B modified with an upgraded TV seeker providing significant reliability, maintainability, and performance improvements over the AGM-65B seeker and double the standoff range.

AGM-65K. AGM-65G modified with the same upgraded TV seeker as in the AGM-65H to provide a TV–guided version of the Maverick with the 298-lb blast fragmentation warhead.

AGM-84 Harpoon

Brief: An adverse weather capable, sea-skimming, active radar-guided, anti-ship cruise missile system capable of being fired from B-52H aircraft, ships, and submarines.
Function: Air-to-surface anti-ship missile.
First Flight: March 1974 (for USN).
Delivered: from 1977 (USN).
IOC: circa 1985 (USAF).
Production: sustainment phase.
Inventory: 68.
Contractor: McDonnell Douglas (now Boeing).
Power Plant: Teledyne CAE J402-CA-400 turbojet, 660 lb thrust.
Guidance: sea-skimming cruise monitored by radar altimeter, active radar terminal homing.
Warhead: penetration high-explosive blast type, weighing 488 lb.
Dimensions: length 12 ft 7 in, body diameter 1 ft 1 in, wingspan 3 ft.
Weight: 1,145 lb.
Performance: speed high subsonic, range more than 57 miles.

COMMENTARY

Harpoon and its launch control equipment provide USAF the capability to interdict ships at ranges well beyond those of other aircraft. Originally acquired to equip two squadrons of now-retired B-52G aircraft for maritime anti-surface operations, the Harpoon all-weather anti-ship missile currently arms conventional-mission B-52Hs.

AGM-84D is a variant of the USN Harpoon that has been adapted for use on B-52 bombers, which can carry eight missiles.

***AGM-65** Maverick* (SrA. Stan Parker)

AGM-88 HARM

Brief: An air-to-surface tactical missile designed to seek and destroy enemy radar-equipped air defense systems, using an advanced guidance system that senses and homes in on enemy radar emissions.

Function: Air-to-surface anti-radiation missile.
First Flight: April 1979.
Delivered: 1982–98.
IOC: circa 1984.
Production: sustainment phase.
Inventory: currently 7,500.
Contractor: Raytheon.
Power Plant: Thiokol smokeless, dual-thrust, solid-propellant rocket motor.
Guidance: passive homing guidance system, using seeker head that homes on enemy radar emissions.
Warhead: high-explosive fragmentation, weighing 145 lb.
Dimensions: length 13 ft 9 in, body diameter 10 in, wingspan 3 ft 9 in.
Weight: 807 lb.
Performance: cruising speed supersonic, altitude limits S/L to 40,000 ft, range more than 10 miles.

COMMENTARY

The High-speed Anti-Radiation Missile (HARM) exhibits great velocity along with an ability to cover a wide range of frequency spectrums through the use of programmable digital processors in both the carrier aircraft's avionics equipment and in the missile. The combination gives this second-generation anti-radiation missile greatly improved capability over first-generation Shrikes and Standards. The AGM-88 proved highly effective against enemy ground radar during the Persian Gulf War and continues in use in current operations. HARMs equip F-16 Block 50/52s dedicated to the SEAD mission.

AGM-88A. A factory-programmed version used to equip the now-retired F-4G Wild Weasel to increase its lethality in electronic combat.

AGM-88B. Older versions of the AGM-88B are being upgraded with the new, enhanced capability guidance seeker currently equipping the C version.

AGM-88C. This current production version has a more lethal warhead, containing tungsten alloy cubes, rather than steel, and the enhanced-capability AGM-88C-1 guidance head.

Erasable electronically programmable read-only memory has been retrofitted on USAFE, PACAF, and ACC HARMs, permitting changes to missile memory in the field. Current upgrade initiatives are aimed at increasing capability of both B and C versions against target shutdown, blanking, and blinking and at reducing potential damage to friendly radars in the target area; home-on jamming capability will be added to the C. Further upgrades under development will introduce GPS precision navigation capability.

AGM-130

Brief: A powered TV– or IIR–guided air-to-surface missile, carried by the F-15E and designed for high- and low-altitude strikes at standoff ranges against heavily defended targets.

Function: Air-to-surface guided and powered bomb.
First Flight: 1984.
Delivered: November 1992–present.
IOC: 1994.
Production: sustainment phase.
Inventory: 490 (as of Sept. 30, 2000).
Contractor: Boeing.
Guidance: TV or IIR seeker, or DME transponder.
Warhead: Mk 84 bomb (2,000-lb unitary) or BLU-109.
Dimensions: length 12 ft 10 in, body diameter 1 ft 6 in, wingspan 4 ft 11 in.
Weight: launch weight 2,917 lb.
Performance: cruising speed subsonic, ceiling in excess of 30,000 ft.

COMMENTARY

AGM-130 is a product improvement to the GBU-15 glide bomb, with a guidance system designed to give pinpoint accuracy from low or medium altitudes. The AGM-130 adds a rocket motor, radar altimeter, and digital control system, providing it with double the standoff range of the GBU-15.

Upgrades include a new solid-state TV seeker, an improved IR seeker, and INS/GPS guidance that permit operation in adverse weather and improve target acquisition.

AGM-130s have been used extensively in Iraq and the Balkans.

AGM-130A, with the Mk 84 warhead.

AGM-130C, with the BLU-109/B penetrating warhead.

AGM-142 Have Nap

Brief: A medium-range standoff attack missile that is carried by USAF B-52Hs to provide this long-range aircraft with a conventional precision strike capability.

Function: Air-to-surface guided missile.
First Flight: 1990.
Delivered: 1992.
IOC: June 1992.
Production: 240.
Inventory: 186.
Contractor: Rafael (Israel).
Power Plant: solid-propellant rocket motor.
Guidance: inertial, with data link, TV, or IIR homing.
Warhead: high-explosive, 750-lb blast/fragmentation or 800-lb penetrator.
Dimensions: length 15 ft 11 in, body diameter 1 ft 9 in, wingspan 5 ft 9 in.
Weight: 2,998 lb.
Performance: range approx 50 miles.

COMMENTARY

The AGM-142 missile system provides a conventional, precision, standoff hard target penetrator weapon for the B-52H. The system consists of a standoff, air-to-ground EO precision guided missile, weapon data link pod, and associated support and training equipment. Initial operational test and evaluation launches were completed in May 1990. There are six variants of the AGM-142.

AGM-142A. TV seeker with 750-lb blast/frag warhead.

AGM-142B. IIR seeker with 750-lb blast/frag warhead.

AGM-142B-1. IIR-Z seeker with 750-lb blast/frag warhead.

AGM-142C. TV seeker with 800-lb penetrator warhead.

AGM-142D. IIR seeker with 800-lb penetrator warhead.

AGM-142D-1. IIR-Z improved seeker with 800-lb penetrator warhead.

AGM-154 Joint Standoff Weapon

Brief: First in a joint USAF and Navy family of low-cost, highly lethal glide weapons with a standoff capability, usable against heavily defended targets.

Function: Air-to-surface guided missile.
First Flight: December 1994.
Delivered: from 2000.
IOC: 2000 (USAF).
Production: 6,000 (planned).
Inventory: 60 (as of Sept. 30, 2000).
Contractor: Raytheon.
Guidance: INS/GPS.
Dimensions: length 13 ft 4 in.
Weight: 1,065–1,500 lb.
Performance: range: low-altitude launch 17 miles, high-altitude launch 40+ miles.

COMMENTARY

A medium-range, INS/GPS–guided, standoff air-to-ground weapon designed to attack a variety of soft and armored area targets (fixed, relocatable, and mobile) during day/night/adverse weather conditions. JSOW enhances aircraft survivability, as compared to current interdiction weapon systems, by providing the capability for launch aircraft to stand off outside the range of enemy point defenses. JSOW accuracy and launch-and-leave capability will allow several target kills per aircraft sortie. Integration of JSOW is currently on F-16 Block 50 and B-2 aircraft, with follow-on capability on B-1B, B-52, F-15E, and F-16 Block 30/40.

AGM-154A. The baseline BLU-97 variant for use against area targets; in full-rate production.

AGM-154B. The BLU-108 variant providing anti-armor capability; began production in FY99.

AGM-154C. The third variant (used by Navy only), JSOW/Unitary integrates an IIR terminal seeker and a 500-lb unitary warhead.

AGM-158A Joint Air-to-Surface Standoff Missile

Brief: An advanced weapon designed to attack heavily defended targets with high precision at great standoff range.

Function: Air-to-surface guided weapon.
First Flight: April 8, 1999.
Delivered: TBD
IOC: FY03 (planned).
Production: 2,400 (USAF planned); TBD (Navy).
Inventory: TBD
Contractor: Lockheed Martin.
Power Plant: Teledyne Continental Motors.
Dimensions: 14 ft.
Weight: 2,250 lb.
Performance: 1,000-lb class warhead (both versions).

COMMENTARY

JASSM is intended to be an affordable, stealthy standoff cruise missile with autonomous guidance and conventional warhead for use against high-value, heavily defended, or mobile targets. The missile will use an IR seeker for terminal guidance, with GPS/INS for mid-course and backup terminal guidance. EMD program commenced November 1998. DOD plans to use JASSM on threshold aircraft B-52H and F-16. Objective aircraft include B-1B, B-2, F/A-18E/F, F-15E, F-117, and P-3C.

CBU-87/103 Combined Effects Munition

Brief: The CBU-87 CEM is an area cluster munition effective against light armor, materiel, and personnel and used by USAF and Navy fighters and bombers for interdiction.

Function: Area cluster munition.
Production: sustainment phase.
Inventory: 122,416 (CBU-87); 280 (CBU-103).
Contractor: Aerojet General/Honeywell.
Guidance: none (CBU-87).
Dimensions: length 7 ft 8 in; diameter 1 ft 4 in.
Weight: 950 lb.
Performance: dispenses 202 BLU-97 Combined Effects Bomblets over an area roughly 800 ft by 400 ft.

COMMENTARY

The CBU-87 Combined Effects Munition dispenses 202 BLU-97 shaped charge anti-personnel/anti-materiel fragmentary/incendiary bomblets over the target in a rectangular pattern. It is currently delivered by USAF and Navy aircraft as an unguided gravity weapon. Density and size of the area covered depends on release parameters and spin rates. During Desert Storm USAF dropped 10,035 CBU-87s.

CBU-103. USAF is retrofitting its inventory of CEMs with the WCMD tail kit. The WCMD will improve the munitions delivery accuracy when released from medium to high altitude. Tail kit purchases are based on available funding.

CBU-89/104 Gator

Brief: The CBU-89 Gator is an anti-armor/anti-personnel mine dispenser used by USAF and Navy fighters and bombers for interdiction.

Function: Scatterable mines.
Production: sustainment phase.
Inventory: 9,236 (CBU-89).
Contractor: Aerojet General/Honeywell.
Guidance: none (CBU-89).
Dimensions: length 7 ft 8 in; diameter 1 ft 4 in.
Weight: 710 lb.
Performance: dispenses 72 BLU-91 anti-armor and 22 BLU-92 anti-personnel mines.

COMMENTARY

The CBU-89 Gator dispenser holds 94 mines, of which 72 are anti-tank and 22 are anti-personnel. The mines are dispersed over the target in a rectangular pattern. The

***AIM-120** AMRAAM* (top) ***AIM-9** Sidewinder* (center) ***AGM-88** HARM* (bottom) (Guy Aceto)

anti-tank mines, which can be fuzed for up to a 72-hour delay, have a magnetic influence fuze to sense armor.

CBU-104. USAF is retrofitting its inventory of Gators with the WCMD tail kit, which will improve the munitions delivery accuracy when released from medium to high altitude. Tail kit purchases are based on available funding.

CBU-97/105 Sensor Fuzed Weapon

Brief: The CBU-97 SFW is an anti-armor cluster munition used by fighters and bombers for multiple kills per pass against moving and stationary land combat vehicles.

Function: Wide-area cluster munition.
First Flight: circa 1990.
Delivered: from 1994.
IOC: 1997.
Production: 5,000 (planned).
Inventory: classified.
Contractor: Textron Systems.
Guidance: IR sensors in each warhead search for targets, then detonate over them.

GBU-28 (SrA. Jeff Fitch)

GBU-24 *Paveway III* (Cindy Farmer)

Dimensions: length 1 ft 8 in; diameter 1 ft 4 in.
Weight: 927 lb.
Performance: delivers 40 lethal projectiles over an area of about 500 ft by 1,200 ft.
COMMENTARY

The CBU-97 Sensor Fuzed Weapon comprises an SUU-66/B tactical munitions dispenser with an FZU-39 fuze. Each tactical munitions dispenser contains 10 BLU-108/B submunitions, and each submunition contains four "skeet" projectiles that, upon being thrown out, seek out their target and deliver a projectile. Each SFW can deliver a total of 40 lethal projectiles. The projectiles' IR sensors can detect a vehicle's infrared signature; if no target is detected, the warhead detonates after a preset time. The SFW's primary targets are tanks, armored personnel carriers, and propelled targets. It also provides direct attack capability and interdiction against C^2 centers.

The SFW is currently delivered as an unguided gravity weapon from the B-1, B-2, B-52H, F-15E, and F-16. The Air Force is completing development of an improved version, leading to reduced cost and increased capability. Among ongoing changes, the service is adding a laser range finder to enable the SFW to detect targets based on height as well as IR signature, a multimission warhead for softer targets, and a wider attack area.

CBU-105. USAF is retrofitting its inventory of SFWs with the WCMD tail kit, which will improve the munitions delivery accuracy when released from medium to high altitude.

GBU-15

Brief: An unpowered glide weapon carried by the F-15E and used to destroy high-value enemy targets from short standoff distances.

Function: Air-to-surface guided munition.
First Flight: 1975.
Delivered: from 1983.
IOC: 1983.
Production: more than 2,000.
Inventory: 1,650 (as of Sept. 30, 2000).
Contractor: Boeing and Raytheon.
Guidance: TV or IIR seeker.
Warhead: Mk 84 bomb (2,000-lb unitary) or BLU-109.
Dimensions: length 12 ft 10 in, body diameter 1 ft 6 in, wingspan 4 ft 11 in.
Weight: 2,450 lb.
Performance: cruising speed subsonic.
COMMENTARY

GBU-15 is an air-launched, cruciform-wing glide bomb fitted with a guidance system designed to give it pinpoint accuracy from low or medium altitudes. It also has a standoff capability. Development began in 1974, based on experience gained in Vietnam with the earlier Pave Strike GBU-8 modular weapon program. The GBU-15 is intended for tactical use to suppress enemy defenses and to destroy heavily defended targets. The target-detecting device is carried on the front of the warhead. The control module, with autopilot and data link module, attaches to the rear.

The weapon has two modes of attack. In direct attack, the weapon is locked on to the target before launch and flies a near line-of-sight profile to impact. In the indirect mode, the seeker can be locked on to the target after launch, or the operator can fly the weapon manually to impact, using guidance updates provided through the data link. A "buddy" system may be operated whereby the weapon is launched from one aircraft and controlled by another. The GBU-15 is deployed with the F-15E.

GBU-15(V)1/B. A TV–guided variant, qualified for operational service in 1983 (production complete).

GBU-15(V)2/B. IIR version entered service in 1987.

GBU-15-I. Combines accuracy of GBU-15 with the penetration capability of the improved 2,000-lb BLU-109/B penetrator bomb.

During Desert Storm F-111F pilots used GBU-15 glide bombs with great effect to address numerous targets.

EGBU-15. GPS–guided variant, allowing pilot to select either TV, IR, or GPS guidance over the target, depending on weather and/or threat conditions. USAF had 100 initially produced for Allied Force, with field-level upgrade of over 1,200 existing GBU-15s due for completion FY01.

GBU-24

Brief: A precise air-to-ground penetrating glide bomb equipped with an advanced guidance kit.

Function: Air-to-surface guided bomb.
First Flight: GBU-24A/B (USAF) in service May 1985; GBU-24B/B (Navy) June 1992.
Delivered: from 1986.
IOC: 1986.
Production: USAF 14,000; Navy 12,000.
Inventory: classified.
Contractor: Raytheon.
Guidance: semiactive laser.
Dimensions: length 14 ft 2 in.
Weight: 2,350 lb.
COMMENTARY

GBU-24A/B. This is an air-to-ground weapon equipped with a third-generation Laser-Guided Bomb guidance kit called Paveway III integrated with a BLU-109 penetrating warhead. The kit consists of an advanced guidance section and high-lift airframe. It is extremely precise and highly effective against a broad range of high-value hard targets. The system can be employed from low, medium, and high altitudes, providing operational flexibility through the use of an adaptive digital autopilot and large field-of-regard, highly sensitive scanning seeker.

The GBU-24A/B adapts to conditions of release, flies an appropriate midcourse, and provides trajectory shaping for enhanced warhead effectiveness. The weapon is deployed on the F-15E and F-16. The GBU-24A/B was highly successful in the Persian Gulf War.

GBU-27

Brief: A precise air-to-ground penetrating glide bomb equipped with an advanced guidance kit.

Function: Air-to-surface guided bomb.
First Flight: not available
Delivered: from 1988.
IOC: 1988 (unconfirmed).
Production: approx 3,000.
Inventory: classified.
Contractor: Lockheed Martin.
Guidance: semiactive laser.
Dimensions: span 5 ft 6 in, length 13 ft 11 in.
Weight: 2,170 lb.
COMMENTARY

To meet the unique requirements of the F-117A, the GBU-24A/B was adapted to GBU-27 standard, incorporating specific guidance features to accomplish this mission. The GBU-27 is extremely precise and was used to great effect in the Persian Gulf War.

EGBU-27. Integrates GPS/INS guidance into the existing GBU-27 laser seeker to provide adverse weather capability and improved target location. Entered production in FY98.

GBU-28

Brief: A large 5,000-lb-class air-to-ground penetrating glide bomb equipped with an advanced laser guidance kit, used for striking and destroying hard underground targets.

Function: Air-to-surface guided bomb.
First Flight: February 1991.
Delivered: circa 1991.
IOC: 1991.
Production: approx 500.
Inventory: classified.
Contractor: Raytheon.
Dimensions: length 19 ft 2 in, diameter 1 ft 2 in.
Weight: 4,676 lb.
Performance: classified.
COMMENTARY

Under USAF's rapid-response program, the GBU-28 laser-guided bunker-busting weapon was developed for Desert Storm for use against deeply buried, hardened C^2 facilities. Four of the GBU-28 weapons were used during the war: two for testing and two by F-111Fs against a bunker complex Feb. 27, 1991. Guidance is by a modified GBU-27 system.

EGBU-28. Integrates GPS/INS guidance into the existing GBU-28 guidance control unit to provide adverse weather capability and improved target location. Entered production in FY99.

GBU-31/32/XX Joint Direct Attack Munition

Brief: A joint USAF–Navy INS/GPS–guided weapon, carried by fighters and bombers, that provides highly accurate, autonomous, all-weather, conventional bombing capability.

Function: Air-to-surface guided bomb.

First Flight: Oct. 22, 1996.

Delivered: 1998–present (production weapon).

IOC: 1998.

Production: USAF 62,000; USN 25,496 (planned).

Inventory: 3,870.

Contractor: Boeing.

Dimensions: Mk 84 with JDAM 12 ft. 9 in; BLU-109 with JDAM 12 ft 5 in; Mk 83 with JDAM 10 ft.

Weight: Mk 84 2,036/2,056 (USAF/USN); BLU-109 2,115/2,135; Mk 83 1,013/1,028.

Performance: range up to 15 miles, 42 ft 11 in CEP with GPS; 99 ft CEP with INS only.

COMMENTARY

JDAM will upgrade the existing inventory of general-purpose bombs by integrating them with a GPS/INS guidance kit to provide accurate all-weather attack from medium/high altitudes. While still aboard the launch aircraft, JDAM is passed target information through the aircraft's avionics system. Once released, the inertial guidance kit will take over and, with periodic GPS updates to the INS, will guide the weapon to its target. JDAM is intended for use on a variety of aircraft, including the B-1B, B-2, B-52, F-14, F-15E, F-16, F-22, F-117A, F/A-18C/D and E/F, AV-8B, and JSF.

GBU-31. Variant that adds an INS/GPS guidance kit to the 2,000-lb general-purpose Mk 84 bomb or the 2,000-lb BLU-109 penetrator. First used in combat March 24, 1999.

GBU-32. Variant that adds an INS/GPS guidance kit to the 1,000-lb general-purpose Mk 83 bomb or the 1,000-lb BLU-110 penetrator. Under development.

GBU-XX. Variant that adds an INS/GPS guidance kit to the 500-lb general-purpose Mk 82 bomb. Under development.

Wind-Corrected Munitions Dispenser

Brief: A tail kit to be fitted to CBU 87/89/97 dispenser weapons. When dropped from high altitude its inertial guidance system corrects for launch transients and wind effects to enhance accuracy.

Function: Guidance tail kit.

First Flight: February 1996.

Delivered: FY00.

IOC: FY00.

Production: 40,000 (planned).

Inventory: 280 (as of Sept. 30, 2000).

Contractor: Lockheed Martin.

Dimensions: length 1 ft 5 in, diameter 1 ft 3 in.

Weight: 100 lb.

Performance: range about eight miles.

COMMENTARY

USAF is to modify 40,000 standard tactical munition dispensers with guidance kits to compensate for wind drift on downward flight from high altitudes. WCMD kits each have an INS guidance unit, movable tail fins that pop out in flight, and a signal processor. A WCMD tail kit is fitted on inventory cluster weapons: CEM (CBU-103), Gator (CBU-104), and SFW (CBU-105). Successful flight testing began in February 1996; WCMDs are now operational on F-16 and B-52 aircraft. Objective aircraft are B-1, F-15E, F-22, and F-117.

Launch Vehicles

Atlas

Brief: An expendable, medium-lift launch vehicle whose primary mission is the launch into space of the Defense Satellite Communications System (DSCS) satellite and other national missions.

Function: Medium expendable spacelift vehicle.

Operator: commercial (AFSPC oversight).

First Launch: December 1957; February 1992 (Atlas IIA); December 1993 (Atlas IIAS); May 2000 (Atlas III).

IOC: September 1959.

Launches Scheduled: three (FY01); three (FY02).

Unit Location: Cape Canaveral AFS, Fla., Vandenberg AFB, Calif.

Contractor: Lockheed Martin.

Power Plant: Atlas II: uprated Rocketdyne MA-5 propulsion system in Atlas stage, comprising central sustainer motor and two boosters; total thrust 490,000 lb. Atlas IIAS version adds four Thiokol Castor IVA Solid Rocket Motors (SRMs), providing an average thrust of 112,000 lb. Atlas III: two-chamber RD-180 built by NPO Energomash of Russia. The RD-180 is a throttleable engine fed by liquid oxygen and kerosene propellants, providing a total sea-level rated thrust of 860,200 lb. Atlas IIIA uses a Centaur upper stage in the single-engine (RL10A-4-1) configuration; Atlas IIIB uses a stretched Centaur stage powered by either one or two RL10A-4-2 engines.

Dimensions: Atlas IIA/IIAS: length 81 ft 7 in, max body diameter 10 ft. Atlas IIIA: length 170 ft 2 in, diameter 10 ft, with standard 14-ft-diameter payload fairing; Atlas IIIB: length 174 ft 2 in with large payload fairing.

Launch Weight: 408,800 lb (Atlas IIA); 486,500 lb (Atlas IIIA).

Performance: Atlas IIAS capable of putting 19,050 lb into a Low Earth Orbit (LEO) from Cape Canaveral AFS, Fla. Range of payloads Atlas II through Atlas IIAS can lift into Geosynchronous Transfer Orbit (GTO) from Cape Canaveral is 4,900–8,150 lb and 13,650–15,900 lb to LEO from Vandenberg. Atlas IIIA capable of lifting up to 9,920 lb into GTO from Cape Canaveral.

COMMENTARY

Early Atlas launchers were refurbished Atlas ICBMs used from December 1957 to launch military payloads into space. Versions include Atlas D/E/F and SLV-3A and 3D with longer tanks and increased engine thrust, compatible, respectively, with the Agena and Centaur upper stages.

Atlas II. Upgraded version of the Atlas Centaur vehicle developed to meet USAF's continuing medium launch vehicle requirement. The familiar stage-and-a-half configuration of the original ICBM is retained. Changes include lower-cost advanced avionics, an improved flight computer, booster engines with greater thrust, and longer propellant tanks. The engine and tank changes were made to both the Atlas and Centaur stages.

The **Atlas IIAS** is essentially the same booster as the IIA but adds four Thiokol Castor IVA solid rocket motors.

The first Atlas II DSCS launch took place from Cape Canaveral AFS, Fla., on July 2, 1992.

Atlas III. Commercial version which includes a new Russian–designed and built single-stage Atlas RD-180 engine, additional lengthening of the Atlas booster, a single-engine Centaur upper stage for the Atlas IIIA, and a dual engine, stretched Centaur for the upcoming IIIB. The first Atlas IIIA mission successfully launched a commercial communications satellite May 24, 2000.

Atlas V. See EELV below.

Centaur Upper Stage

Brief: A high-energy upper stage with multiburn and extended coast capability.

Atlas/Centaur (DOD photo)

Function: High-energy upper stage.

Operator: commercial (AFSPC oversight).

First Launch: November 1963; earlier flight in May 1962 unsuccessful.

IOC: 1966.

Unit Location: Cape Canaveral AFS, Fla., Vandenberg AFB, Calif.

Contractor: Lockheed Martin.

Power Plant: for Atlas IIA/AS configuration, two Pratt & Whitney RL-10A-4-1 liquid oxygen/liquid hydrogen rocket engines, each 22,300 lb thrust; for Atlas IIIA, one RL-10A-4-1 engine; for Atlas IIIB/Atlas V, one or two RL-10A-4-2 engines, each 22,300 lb thrust; for Delta IV, one uprated RL-10B-2 engine; G–prime: two RL10A-3-3A engines, each with 16,500 lb thrust.

Dimensions: for Atlas IIA/AS/IIIA, length 33 ft, diameter 10 ft; for Atlas IIIB, length 38 ft 6 in; G–prime: length 29 ft, diameter 14 ft 2 in.

Launch Weight: D-2A (approx) 45,000 lb; G–prime-mod (approx) 53,000 lb.

COMMENTARY

Centaur was the first US high-energy upper stage and the first to use liquid hydrogen as a propellant. Its multiburn and extended coast capability were first used operationally during the 1977 Mariner Jupiter/Saturn missions.

D-1A. The D-1A version used with the Atlas demonstrated wide-ranging applications and capabilities. The nose section of Atlas was modified to a constant 10-ft diameter to accommodate the Centaur, which, in turn, provided most of the electronic C^2 systems for the launch vehicle. A 10-ft-diameter fairing protected payloads for Centaur D-1A.

D-2A. The D-2A, used with the current Atlas II, has been stretched 3 ft to include more propellant and thus has increased thrust. Payload fairings of either 11-ft or 14-ft diameter can be used. Centaur upper stages used in the Atlas IIIA will have a single RL-10A-4-1 engine; a dual engine, stretched version is applicable to the Atlas IIIB. The Centaur stage for Atlas V is virtually identical to that used on Atlas IIIB. Centaur stage for Delta IV has the uprated RL-10B-2 engine.

Centaur G–prime modified upper stage, with high-energy cryogenic propellants and multiple restart capability, for use with the Titan IVB, creating the greatest weight-to-altitude capability of any US launch vehicle by placing a 10,200-lb payload into Geosynchronous Earth Orbit (GEO).

Delta

Brief: An expendable, medium-lift launch vehicle now used to launch Navstar Global Positioning System satellites into orbit, providing navigational data to military and civilian users, and to launch civil and commercial payloads into low Earth, polar, geo transfer, and geosynchronous orbits.

Function: Medium expendable spacelift vehicle.

Operator: commercial (AFSPC oversight).

First Launch: May 13, 1960; Feb. 14, 1989 (Delta II); Aug. 26, 1998 (Delta III).

IOC: 1989 (Delta II).

Launches Scheduled: four (FY01); four (FY02).

Unit Location: Cape Canaveral AFS, Fla., Vandenberg AFB, Calif.

Contractor: Boeing.

Power Plant: stage 1: Boeing RS-27A liquid-propellant engine, 237,000 lb thrust; stage 2: Aerojet AJ10-118K engine, 9,750 lb thrust; stage 3: Thiokol STAR-48B solid-propellant motor, 14,920 lb thrust; nine strap-on SRMs, 100,270 lb thrust (s/l). Delta III stage 1: Boeing RS-27A liquid-propellant engine, 237,000 lb thrust; stage 2: Pratt & Whitney RL-10B-2 engine, 20,500 lb thrust; stage 3: Thiokol Star 48B (modified); nine strap-on SRMs producing 25 percent more thrust.

Dimensions: Delta II: length 125 ft, diameter 8 ft; bulbous payload fairing, max diameter 10 ft. Delta III: length 148 ft, diameter 1 ft; payload fairing, diameter 10 ft; payload fairing, diameter 13 ft.

Launch Weight: Delta II: 511,190 lb; Delta III: 663,200 lb.

Performance: Delta II: up to 11,100 lb to near Earth orbit, up to 4,010 lb to GTO, up to 2,000 lb to GEO. Delta III: up to 8,930 lb to GTO; up to 18,280 lb to Low Earth Orbit (LEO).

COMMENTARY

Delta I. Delta launch vehicle family began in 1959 with a contract to Douglas Aircraft Co. (now Boeing) for the production and integration of 12 space-launch vehicles. The Delta used components from USAF's Thor intermediate-range ballistic missile as its first stage and the Navy's Vanguard launch vehicle program as its second. The first Delta was launched from Cape Canaveral and had the ability to deliver a 100-lb spacecraft into GTO.

Delta II. Selected by the Air Force in 1987 to launch the Navstar GPS satellites, the Delta II is slightly larger than the earlier Delta rocket, to satisfy USAF's medium-payload requirement. The first launch took place in February 1989, and AFSPC continues to maintain a

fully operational 24-satellite constellation.

Delta II is a three-stage booster surrounded by nine solid-propellant Graphite Epoxy Motors. For LEO missions, stage 3 is typically not used. In December 1995, a newly assigned vehicle, complete with new avionics, an increased expansion ratio on three of the GEMs, and a new launch control system, successfully placed a NASA payload into orbit. Delta II will continue to support GPS by replenishing aging satellites as they fail and is supporting other DOD payloads.

Delta III. Developed to address the needs of the commercial market, Delta III increases GTO capacity to 8,930 lb. Notable features include a cryogenically propelled single-engine upper stage, bigger and more powerful strap-on SRMs than Delta II, three of which are equipped with thrust-vector control, and a larger composite fairing to house bigger payloads.

Delta IV. See EELV below.

Evolved Expendable Launch Vehicle: Delta IV/ Atlas V

Brief: EELV is USAF's spacelift modernization program to field two new families of expendable launch vehicles with an objective to reduce the cost of launch by 25 to 50 percent over current systems. Will eventually replace current Delta II, Atlas II, Titan II, and Titan IV launch vehicles.

Function: Medium/heavy expendable launch vehicle.

Operator: commercial (oversight AFSPC).

IOC: TBD

Launches Scheduled: first government FY02.

Unit Location: Cape Canaveral AFS, Fla., Vandenberg AFB, Calif.

Contractor: Boeing (Delta IV) and Lockheed Martin (Atlas V).

Power Plant: Delta IV: Rocketdyne RS-68 (Heavy, two additional core engines), 650,000 lb thrust; stage 2 (both): Centaur: Pratt & Whitney RL-10B-2. Atlas V: RD AMROSS LLC RD-180 (Heavy, two additional engines), 860,200 lb thrust; up to five strap-on solid rocket boosters; stage 2 (both) Centaur: one or two Pratt & Whitney RL-10A-4s, each 22,300 lb thrust.

Dimensions: Delta IV: length 235 ft, diameter (Medium) 13 ft, (Heavy) 16 ft 8 in. Atlas V: length 106 ft 2 in, diameter 12 ft 6 in.

Launch Weight: Delta IV: 565,000–1.6 million lb. Atlas V: 734,850–1.2 million lb.

Performance: Delta IV: (Medium) 9,200 lb to GTO; (Heavy) 29,000 lb to GTO. Atlas V: (Medium) 18,900 lb to LEO; (Heavy) 42,000 lb to LEO.

COMMENTARY

EMD and Initial Launch Services (ILS) contracts were awarded Oct. 16, 1998, to Boeing and Lockheed Martin. The ILS contracts cover the first 28 government EELV launches between FY02–06. Due to a recent realignment of the ILS contracts, Boeing has 21 of the launches and Lockheed Martin seven. The first commercial launch is scheduled for FY01. The first government medium launch is set for FY02, and the first government heavy launch is scheduled for FY02.

Inertial Upper Stage

Brief: An upper stage for use with DOD's Titan IV launcher as well as with NASA's shuttle.

Function: Upper stage for space launchers.

Operator: commercial (AFSPC oversight).

First Launch: October 1982.

IOC: circa 1982.

Unit Location: Cape Canaveral AFS, Fla., Vandenberg AFB, Calif.

Contractor: Boeing.

Power Plant: aft-stage SRM 41,700 lb thrust; forward-stage SRM 17,200 lb thrust.

Guidance: inertial.

Dimensions: length 17 ft, diameter 9 ft 6 in.

Launch Weight: 32,600 lb.

Performance: 5,350 lb into GEO when used on Titan IVB.

COMMENTARY

Serving as an upper stage for the Titan IV for DOD, as well as with the shuttle for NASA, the highly reliable IUS consists of an aft skirt, an aft-stage SRM, an interstage, a forward-stage SRM, and an equipment support structure.

Pegasus

Brief: A small winged launcher tasked to carry small payloads to LEO.

Function: Expendable launch vehicle.

Operator: commercial (AFSPC oversight for DOD payloads).

First Launch: April 5, 1990.

IOC: circa 1996 (DOD).

Launches Scheduled: none for DOD (FY01/02).

Contractor: Orbital Sciences/Alliant.

Power Plant: three solid-propellant motors developing 109,400 lb, 27,600 lb, and 7,800 lb thrust, respectively.

Titan IV (DOD Photo)

Guidance: inertial guidance.

Dimensions: length 49 ft, wingspan 22 ft, diameter 4 ft 2 in.

Launch Weight: 42,000 lb.

Performance: 850–1,050-lb payloads to LEO.

COMMENTARY

This three-stage winged vehicle was air-launched originally from a B-52. Orbital Sciences currently uses an L-1011 aircraft. Developed jointly as a private venture by Orbital and Hercules, the vehicle was under contract to the Defense Advanced Research Projects Agency (DARPA) for its initial two flights. In July 1991, it successfully placed seven minisatellites in orbit. The Air Force now manages DOD launches for the USAF space test program and the Ballistic Missile Defense Organization. The enhanced-performance Pegasus XL successfully launched a DOD payload into polar orbit March 8, 1996, following two earlier, unsuccessful launch attempts.

Taurus

Brief: A small ground-based launch vehicle for use in testing a quick-readiness, mobile launch facility.

Function: Expendable launch vehicle.

Operator: commercial (AFSPC oversight for DOD payloads).

First Launch: March 13, 1994.

IOC: March 13, 1994.

Launches Scheduled: none for DOD (FY01/02).

Contractor: Orbital Sciences.

Power Plant: four solid-propellant motors generating 495,400 lb, 109,140 lb, 26,900 lb, and 7,200 lb thrust, respectively.

Dimensions: length 89 ft, max body diameter 50–92 in.

Weight: gross 50,000 lb.

Performance: capable of lifting 3,000 lb to LEO and 800 lb to GTO using a Star 37 perigee kick motor.

COMMENTARY

A more powerful version of the Pegasus space launch vehicle, using an LGM-118 Peacekeeper missile first-stage addition and with the Pegasus wings removed. Taurus is ground-launched from regular launch complexes. The first launch, March 13, 1994, put two USAF and DARPA satellites into a 340-mile polar orbit.

Minotaur

Brief: Low-cost ground-based launch vehicle tasked to deliver small satellites into orbit.

Function: Expendable launch vehicle.

Operator: commercial (AFSPC oversight for DOD payloads).

First Launch: Jan. 26, 2000.

IOC: January 2000.

Launches Scheduled: none for DOD as of September 2000.

Contractor: Orbital Sciences.

Power Plant: first and second stages: deactivated Minuteman II rocket motors; third and fourth stages: Orion 50 and Orion 38 solid-propellant motors.

Dimensions: length 53 ft 7 in, alternative payload fairings for 3 ft 10 in or 5 ft diameter payloads.

Performance: capable of lifting up to 750 lb into orbit.

COMMENTARY

Minotaur is a low-cost, four-stage rocket for use in USAF's Orbital/Suborbital program. First and second stages comprise decommissioned motors from deactivated Minuteman II ICBMs; third and fourth stages utilize Orion motors derived from the Pegasus XL launcher, together with the guidance and control technology from that system. Two successful launches conducted in 2000.

Titan II

Brief: Modified ICBM used to launch military, classified, and NASA payloads into space.

Function: Expendable launch vehicle.

Operator: commercial (AFSPC oversight).

First Launch: April 1964 (NASA's Titan II–Gemini).

IOC: Sept. 5, 1988 (USAF).

Launches Scheduled: one (FY01); none (FY02).

Unit Location: Vandenberg AFB, Calif.

Contractor: Lockheed Martin.

Power Plant: stage 1 and 2: Aerojet liquid hypergolic propellant rocket engines; stage 1: 430,000 lb thrust; stage 2: 100,000 lb thrust.

Guidance: inertial guidance system.

Dimensions: stage 1 and 2: height 110 ft, diameter 10 ft; payload fairing heights 20, 25, and 30 ft, diameter 10 ft.

Launch Weight: 408,000 lb.

Performance: more than 4,200 lb to polar LEO.

COMMENTARY

Titan I. The Titan family was established in October 1955 when the Air Force awarded the then Martin Co. (now Lockheed Martin) a contract to build a heavy-duty space system. It became known as the Titan I, the nation's first two-stage and first silo-based ICBM.

Titan II. Titan I provided many structural and propulsion techniques that were later incorporated into the Titan II. The launcher was used in the 1960s for the manned Gemini flights.

Fourteen Titan II ICBMs were subsequently refurbished and modified to provide expendable space launch capability. Ten successful launches have included the launch of the space probe Clementine I toward the Moon in January 1994, marking the first US lunar mission since Apollo 17 in December 1972. Remaining refurbished Titan IIs are assigned to place Defense Meteorological Satellite Program (DMSP), National Oceanic and Atmospheric Administration (NOAA) satellites, and other government agencies' satellites into polar orbit.

Titan IV

Brief: A heavy-lift space launch vehicle used to carry DOD payloads such as Defense Support Program (DSP) and Milstar satellites into space. It is the largest unmanned space booster used by the Air Force.

Function: Heavy expendable spacelift vehicle.

Operator: commercial (AFSPC oversight).

First Launch: June 14, 1989 (Titan IVA); Feb. 23, 1997 (Titan IVB).

IOC: June 14, 1989.

Launches Scheduled: three (FY01); five (FY02).

Unit Location: Cape Canaveral AFS, Fla., Vandenberg AFB, Calif.

Contractor: Lockheed Martin.

Power Plant: Aerojet liquid hypergolic propellant rocket engines; stage 1: two engines 551,200 lb thrust each; stage 2: 106,150 lb thrust; two Alliant Techsystems SRMs, each 1.7 million lb thrust.

Guidance: digital avionics system on Titan IVB.

Dimensions: stage 1 and 2: height 119 ft 2 in, diameter 10 ft.

Launch Weight: 1.9 million lb.

Performance: 12,700 lb to GEO; 47,800 lb to LEO.

COMMENTARY

USAF's primary heavy-lift launcher, Titan IV was selected in 1985 to augment the space shuttle and is used to launch critical military payloads, including DSP and Milstar satellites. It is a growth version of the earlier Titan 34D, with stretched first and second stages, three-segment solid boosters, and a 16-ft 9-in–diameter payload fairing, with various heights of payload fairings available.

Titan IVA. The last Titan IVA was launched Aug. 12, 1998. This version was capable of placing a

32,000-lb payload into polar LEO and 39,000 lb into LEO. With a modified Centaur G–prime upper stage, it could place 10,200 lb into GEO, or with an alternative IUS, 5,200 lb into GEO.

Titan IVB. The latest Titan IVB version has mission-unique kits, providing a standard interface for payloads to permit launch-site processing, a new electrical system on the booster core, a new ground system, and upgraded SRMs with 25 percent improved performance. First Titan IVB launch from Cape Canaveral was made successfully Feb. 23, 1997.

Satellite Systems

Defense Meteorological Satellite Program

Brief: Satellites that collect air, land, sea, and space environmental data to support worldwide strategic and tactical military operations.

Function: Environmental monitoring satellite.

Operator: National Polar-orbiting Operational Environmental Satellite System (NPOESS) program office.

First Launch: circa 1960s (classified until 1973).

IOC: classified but in use during Vietnam War.

Constellation/on-orbit: Two.

Design Life: 48 months (Block 5D-2); 54 months (Block 5D-3).

Launch Vehicle: Titan II.

Unit Location: Suitland, Md.

Orbit Altitude: approx 500 miles.

Contractor: Lockheed Martin.

Power Plant: solar arrays generating 500–600 watts.

Dimensions: length 20 ft 2 in (with array deployed), width 4 ft.

Weight: 1,750 lb.

Performance: DMSP satellites orbit Earth at about 500 miles altitude and scan an area 1,800 miles wide. Each system covers the Earth in about 12 hr.

COMMENTARY

The Defense Meteorological Satellite Program (DMSP) has been supporting US military operations for nearly 40 years. DMSP's primary mission is to provide high-resolution visual and infrared cloud imagery to support both strategic and tactical operations anywhere in the world. In addition, DMSP satellites provide critical land, sea, and space environment data required by US forces in any operating environment.

DMSP will be replaced by the tri-agency NPOESS late in this decade. NPOESS will consolidate current separate civil and military polar orbiting meteorological satellite systems into a single national program. NPOESS aims to provide increased capability to both civil and military users and avoid over $1.7 billion in costs by consolidating separate, but similar, weather satellite missions.

Block 5D-2. Two operational DMSP Block 5D-2 satellites survey the entire Earth four times a day. DMSP F-15, the last of the Block 5D-2 satellites, was launched in December 1999. The Block 5D-2 spacecraft host one primary sensor, the Operational Linescan System, and a number of secondary sensors to fulfill DOD requirements for weather satellite data.

Block 5D-3. DMSP F-16 was scheduled to launch in early 2001 and will be the first DMSP Block 5D-3 satellite to fly. (DMSP F-15, with a 5D-3 satellite bus but 5D-2 internal components, was launched Dec. 12, 1999, and is officially credited as the first 5D-3 launch.) The DMSP Block 5D-3 satellites have improvements in both the spacecraft bus and sensors that will provide for a longer and more capable mission. Successful flyout of the DMSP Block 5D-3 satellites will help ensure a seamless transition to the NPOESS program.

Defense Satellite Communications System

Brief: A spacecraft traveling in geosynchronous orbit used to transmit SHF high-priority C^2 communication.

Function: Communications satellite.

Operator: AFSPC.

First Launch: 1971 (DSCS II); 1982 (DSCS III); 2000 (DSCS III/SLEP).

IOC: Dec. 13, 1978 (DSCS II).

Constellation: five (III).

Design Life: 10 yr (III).

Launch Vehicle: Atlas II.

Unit Location: Schriever AFB, Colo.

Orbit Altitude: 22,000+ miles in geosynchronous orbit.

Contractor: Lockheed Martin.

Power Plant: solar arrays generating 1,269 watts, decreasing to 980 watts after 10 yr; 1,500 watts (SLEP).

Dimensions: rectangular body 6 ft x 6 ft x 7 ft; 38-ft span with solar arrays deployed.

Weight: 2,580 lb; 2,716 lb (SLEP).

COMMENTARY

Defense Satellite Communications System (DSCS) satellites provide worldwide secure voice high-data-rate transmission, operating in Super-High Frequency. The system is used for high-priority communications, such as the exchange of wartime information between deployed units, battlefield commanders, and defense officials. The military also uses the DSCS to transmit data on space operations and early warning to various systems and users.

DSCS II. No longer on orbit.

DSCS III. The first launch of the more advanced Phase III satellites was in 1982. Ten operational satellites are currently on orbit, with launches continuing until 2003. These satellites are nuclear hardened, can resist jamming, and are equipped with antennas capable of providing low-gain, Earth-field-of-view coverage and steerable, high-gain area coverage.

DSCS III/SLEP. First two of four SLEP–modified DSCS III are currently in orbit. First launched Jan. 21, 2000.

Defense Support Program satellite atop an Inertial upper Stage prior to launch. (NASA photo)

Defense Support Program System

Brief: An early warning spacecraft that travels in geosynchronous orbit and provides alert of possible ballistic missile attack on US forces or homeland.

Function: Strategic and tactical launch detection system.

Operator: AFSPC.

First Launch: November 1970.

IOC: circa 1972.

Constellation: classified.

Design Life: three yr.

Launch Vehicle: Titan IV IUS.

Unit Location: Peterson AFB, Colo.

Orbit Altitude: 22,000+ miles in geosynchronous orbit.

Contractor: TRW, Aerojet.

Power Plant: solar arrays generating 1,485 watts.

Dimensions: diameter 22 ft, height 32 ft 9 in, with solar paddles deployed.

Weight: 5,000 lb (approx).

Performance: orbits at approx 22,000 miles altitude in geosynchronous orbit; uses IR sensors to sense heat from missile and booster plumes against Earth's background.

COMMENTARY

Defense Support Program (DSP) satellites are a key part of North America's early warning system, capable of detecting missile launches, space launches, and nuclear detonations. Warning data is fed to NORAD and US Space Command early warning centers at Cheyenne Mountain AFS, Colo.

Since their first launch DSP satellites have provided an uninterrupted early warning capability to the US. Though not designed to spot and track smaller missiles, the system's capability was demonstrated during the Persian Gulf War, when the satellites provided warnings of Iraqi Scud attacks. Nineteen DSP satellites have been launched by USAF. Procurement will end with No. 23, and the last DSP satellite will be launched in FY03.

Global Positioning System

Brief: A constellation of orbiting space vehicles that provides highly precise and reliable navigation data, 24 hours a day, to military and civilian users around the world. Signals permit calculation of location within 300 feet.

Function: Worldwide navigation satellite.

Operator: AFSPC.

First Launch: Feb. 22, 1978.

IOC: Dec. 9, 1993.

Constellation: 24.

Design Life: six yr (II/IIA); 7.5 yr (IIR).

Launch Vehicle: Delta II.

Unit Location: Schriever AFB, Colo.

Orbit Altitude: 12,636 miles (IIA); 12,532 miles (IIR).

Contractor: Boeing and Lockheed Martin.

Power Plant: solar arrays generating 700 watts (II/IIA); 1,136 watts (IIR).

Dimensions: II/IIA: body 8 ft x 8 ft x 12 ft, incl solar arrays 11 ft x 19 ft ; IIR: body 8 ft x 6 ft x 10 ft, span incl solar arrays 37 ft.

Weight: 2,174 lb (IIA); 2,370 lb (IIR) on orbit.

Performance: GPS satellites orbit the Earth every 12 hr, emitting continuous navigation signals. The signals are so accurate that time can be figured to within one-millionth of a second, velocity within a fraction of a mile per hour, and location to within a few feet. Receivers are used in aircraft, ships, and land vehicles and can also be handheld.

COMMENTARY

The 24 satellites of the Navstar Global Positioning System (GPS) provide 24-hour navigation services, including accurate, three-dimensional (latitude, longitude, and altitude) position, velocity, and precise time; passive, all-weather operation; continuous real-time information; support to an unlimited number of users and areas. Support to civilian users was enhanced May 1, 2000, when signals previously available to military users only were opened to civilians. Concern over potential enemy use of GPS is being addressed under the Navwar and GPS modernization efforts; future GPS satellites will have two jam-resistant channels for military-only use, as well as two new civilian-only channels. There are currently 27 satellites on orbit: five Block II, 18 IIA, and four IIR.

Mapping, aerial refueling and rendezvous, precision guidance, and SAR operations are just a few examples of the many GPS applications.

Milstar Satellite Communications System

Brief: A satellite communications system that provides secure, jam-resistant worldwide C^2 communications for tactical and strategic forces in all levels of conflict, linking command authorities to ground forces, ships, submarines, and aircraft.

Function: Communications satellite.

Operator: AFSPC.

First Launch: Feb. 7, 1994.

IOC: July 1997 (Milstar I).

Constellation: three (three spares).

Design Life: 10 yr.

Launch Vehicle: Titan IV/Centaur.

Unit Location: Schriever AFB, Colo.

Orbit Altitude: 22,300 miles.

Contractor: Lockheed Martin.

Power Plant: solar arrays generating almost 5,000 watts.

Dimensions: length 51 ft, width 116 ft (with full solar array extension).

Weight: 10,000 lb.

Performance: The constellation will consist of three satellites in low-inclined geosynchronous orbit, providing worldwide coverage between 65° north and 65° south latitude.

COMMENTARY

Milstar is a joint-service communications system that provides secure, jam-resistant EHF communications. Operated by the 50th Space Wing, the constellation will link command authorities with a wide variety of resources, including ships, submarines, aircraft, and ground stations.

Currently serving tactical as well as strategic forces, the final three Milstar satellites (to be launched between 2001 and 2002) will include low-data-rate and

medium-data-rate payloads able to transmit higher data rates to highly mobile forces.

MILSATCOM Polar System
Brief: Satellite that provides secure, survivable communications, supporting peacetime, contingency, and wartime operations in the North Pole region.
Function: Communications satellite.
Operator: AFSPC.
First Launch: late 1997.
IOC: 1997.
Constellation: three.
Design Life: host satellite dependent.
Launch Vehicle: not available
Unit Location: Schriever AFB, Colo.
Orbit Altitude: 25,300 miles.
Contractor: classified.
Power Plant: 410 watts consumed by payload (power from host solar array).
Dimensions: numerous items integrated throughout host.
Weight: 470 lb (payload).
COMMENTARY
USAF deployed a modified EHF payload on a host polar-orbiting satellite, providing an interim cheaper alternative to Milstar to ensure protected polar communications capability. Two further satellites are under development, with payload availability scheduled for 2003 and 2004.

Space Based Infrared System
Brief: Advanced surveillance system for missile warning, missile defense, battlespace characterization, and technical intelligence. System includes two main components: High with satellites in GEO and Highly Elliptical Orbit; and Low with satellites in LEO.
Function: Infrared space surveillance.
Operator: AFSPC.
First Launch: (planned) High GEO: FY04; Low: FY06.
IOC: TBD
Constellation: High: five GEO sats, two Highly Elliptical Orbit sensors; Low: (preliminary) 24 LEO sats.
Design Life: not available
Launch Vehicle: TBD
Unit Location: Buckley AFB, Colo.
Orbit Altitude: High at approx 22,300 miles; Low at 60–300 miles.
Contractor: Lockheed Martin (High); TRW and Spectrum Astro for preliminary system designs (Low).
Power Plant: not available
Dimensions: not available
Weight: not available
COMMENTARY
The follow-on to the DSP is the Space Based Infrared System **(SBIRS).** SBIRS is an integrated "system of systems" including a High component (satellites in GEO and sensors hosted on satellites in Highly Elliptical Orbit) and a Low component (satellites in LEO), as well as ground assets. It is being fielded in four increments. Increment 1 consolidates all DSP ground processing in one CONUS master control station at Buckley AFB, Colo. Increment 2 fields the High component starting in FY04. Increment 3 fields the Low component starting in FY06. Increment 4 will optimize the entire system and define requirements for further deployment. The High component is in the EMD phase of development, through a Lockheed Martin team, including Aerojet, Honeywell, and Northrop Grumman. The Low component should complete the program definition phase in early FY02. Two SBIRS Low program definition and risk reduction contracts were awarded to TRW and Spectrum Astro in August 1999.

Aerial Targets

MQM-107 Streaker
Brief: A jet-powered, variable speed, recoverable target drone.
Function: Aerial target.
Operator: ACC.
First Flight: not available
Delivered: from 1984 (B).
IOC: 1987.
Production: 70 (B); 221 (D); 78 (E).
Inventory: 44 (D); 78 (E).
Unit Location: Tyndall AFB, Fla.
Contractor: Raytheon (D model); Marconi (formerly Tracor) (E model).
Power Plant: initially on D model, one Teledyne CAE 373-8 engine, 950 lb thrust; MQM-107Ds delivered since 1989 have 950 lb thrust TRI 60-5 turbojets. Microturbo TRI 60-5 engine, 1,061 lb thrust or TCAE 373-8B (E model).
Guidance and Control: analog or digital, for both ground control and preprogrammed flight (D model); high–G autopilot provisions; digital autopilot and remote control by the Gulf Range Drone Control Upgrade System (GRDCUS), a multifunction C^2 multilateration system (E model).
Dimensions: length 18 ft 1 in, body diameter 1 ft 3 in, span 9 ft 10 in.
Weight: max launch weight (excl booster) 1,460 lb.
Performance: operating speed 207–630 mph, operating height 50–40,000 ft, endurance 2 hr 15 min.
COMMENTARY
MQM-107D. A third-generation version of the MQM-107 Streaker, it is a recoverable, variable-speed target drone used for research, development, test, and evaluation and the Weapon System Evaluation Program.
MQM-107E. Improved performance follow-on to the MQM-107D. In operational service, it replaces the MQM-107D and expands the flight envelope.

***BQM-34** Firebee* (Nathan Leong)

BQM-34 Firebee
Brief: A jet-powered, variable speed, recoverable target drone.
Function: Aerial target.
Operator: ACC.
First Flight: 1951; 1958 (BQM-34A).
Delivered: from 1951.
IOC: circa 1951.
Production: 1,800+.
Inventory: 49.
Unit Location: Tyndall AFB, Fla.
Contractor: Teledyne Ryan.
Power Plant: one General Electric J85-GE-100 turbojet, 2,850 lb thrust.
Guidance and Control: remote-control methods incl choice of radar, radio, active seeker, and automatic navigator developed by Teledyne Ryan; the current model of the BQM-34A is configured to accommodate the GRDCUS, which allows multiple targets to be flown simultaneously.
Dimensions: length 22 ft 11 in, body diameter 3 ft 1 in, span 12 ft 11 in.
Weight: launch weight 2,500 lb.
Performance: max level speed at 6,500 ft 690 mph, operating height range 10 ft to more than 60,000 ft, max range 796 miles, endurance (typical configuration) 30 min.
COMMENTARY
More than 1,800 of these jet target vehicles have been delivered to USAF since initial development of the **BQM-34A** in the 1950s.
Current BQM-34As, with an upgraded General Electric J85-100 engine that provides a thrust-to-weight ratio of 1:1, enables this version to offer higher climb rates and 6 G maneuvering capability. A new microprocessor flight-control system provides a prelaunch and in-flight self-test capability. Used for weapon system evaluation.

QF-4
Brief: A converted, remotely piloted F-4 Phantom fighter used for full-scale training or testing.
Function: Aerial target.
Operator: ACC.
First Flight: August 1993.
IOC: not available
Inventory: 72.
Unit Location: Tyndall AFB, Fla. (detachment at Holloman AFB, N.M.)
Contractor: Marconi (formerly Tracor).
Power Plant: two General Electric J79-GE-17 turbojets, each with approx 17,000 lb thrust with afterburning.
Guidance and Control: remote-control methods incl the GRDCUS (Tyndall) and the Drone Formation and Control System (Holloman); will also accommodate the triservice Target Control System currently under development.
Dimensions: length 63 ft, height 16 ft 6 in, wingspan 38 ft 5 in.
Weight: mission operational weight 49,500 lb.
Performance: max speed Mach 2+, ceiling 55,000 ft, range (approx) 500 miles.
COMMENTARY
The F-4 was selected as the source aircraft for the replacement of the QF-106 Full-Scale Aerial Target (FSAT) when the F-106 inventory was depleted. The QF-4 provides for a larger operational performance envelope (maneuvering) and greater payload capability compared with its predecessors. A complement of 326 F-4E, F-4G, and RF-4C aircraft have been identified for conversion to FSATs. ■

QF-4E (Ted Carlson)