

USAF Almanac

Gallery of USAF Weapons

By Susan H.H. Young

Note: Inventory numbers are Total Active Inventory figures as of Sept. 30, 1999.



B-1B Lancer (Ted Carlson)

Bombers

B-1 Lancer

Brief: A long-range multirole bomber capable of flying missions over intercontinental range without refueling, 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, Texas (B-1B).

Production: 104.

Inventory: 93 (B-1B).

Unit Location: Active: Dyess AFB, Texas, 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; Mach 1.2 at altitude; 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 setting permits takeoff from shorter runways and fast base-escape capability for airfields under attack. The fully swept position is used in supersonic flight and for high-subsonic, low-altitude penetration.



B-2 Spirit (Ted Carlson)

The bomber's offensive avionics include forward-looking radar, Moving Target Indicator (MTI), and Terrain-Following Radar (TFR), an extremely accurate Global Positioning System/Inertial Navigation System (GPS/INS), computer-driven avionics, strategic Doppler radar, and a radar altimeter, enabling aircrews to navigate, update mission profiles and 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 1 percent that of a B-52. The ALE-50 provides greater protection against RF threats.

B-1A. This model of the new long-range strategic bomber never went into production. USAF acquired four prototype flight test models 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 a flexibility to deliver a wide range of weapons or to carry additional fuel, as required. The JDAM GPS-guided weapon is currently being added to the

B-1B's list of weapons, 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 radios, and improved computers to support precision weapons, initially the JDAM, followed by the Joint Standoff Weapon (JSOW) and the Joint Air-to-Surface Standoff Missile (JASSM). The Defensive System Upgrade Program will improve aircrew situational awareness and jamming capability.

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. 17, 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 150,000–160,000 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) JDAM 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.

Mounted in pairs within the wing structure are four non-afterburning turbofans, 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 GAMs, the GBU-37 and GBU-38B, 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 delivers full PGM capability, including up to 16 JDAMs on the rotary launcher assemblies, and carriage of the Mk 82 500-lb bomb, cluster munitions, including SFWs, JSOW, JASSM, the GAM-113 hard target penetration munition, the M117 750-lb bomb, and the Mk 62 air-delivered sea mine on a bomb rack assembly. 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).

Extensions of the B-2's conventional capabilities beyond Block 30 configuration are under consideration. The first test B-2 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 perform a variety of missions, carrying 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 160 ft 11 in, height 40 ft 8 in.

Weight: empty approx 188,000 lb, max T-O weight 488,000 lb.

Ceiling: 55,000 ft.

Performance (approx): max level speed 650 mph, range more than 10,000 miles.

Armament: 12 AGM-86B ALCMs or AGM-129A ACMs externally, with provision for eight more ALCMs or gravity weapons internally. Conventional weapons incl AGM-86C CALCMs, bombs up to 2,000 lb, CBU 87/89/97 cluster munitions, and on some aircraft, three to four AGM-142A Have Nap missiles or eight AGM-84 Harpoons in under-wing clusters.

COMMENTARY

A key element of USAF's manned strategic bomber force for well over 40 years, the B-52's still-expanding weapons capability reflects its continuing ability to perform a wide range of missions, including show of force, maritime interdiction, precision strikes, and defense suppression.

The bomber is equipped with an electro-optical 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



B-52H Stratofortress (SrA. Greg L. Davis)

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 updated 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 of the Stratofortress 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 terminals, secure radios, and MIL-STD-1760 interfaces; weapons capability to include naval mines, precision guided weapons, such as Harpoon, AGM-142 Have Nap, and AGM-86C CALCM (a conventional variant of the ALCM); and advanced weapons, such as JASSM, JDAM, JSOW, and WCMD. Installation of a heavy stores adapter beam will standardize aircraft to carry all B-52-certified munitions.

Current plans encompass a force of around 76 aircraft.

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.

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

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

Delivered: November 1975–March 1984.

IOC: October 1977.

Production: 713.

Inventory: 368.

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: Baltimore, Md., Barnes MAP, Mass., Boise Air Terminal, Idaho, Bradley IAP, Conn., W.K. Kellogg Airport, Mich., Willow Grove ARS, Pa. AFRC: Barksdale AFB, La., NAS JRB New Orleans, 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 under-wing 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)



A-10A Thunderbolt II (Guy Aceto)

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 is in the works.

A-10A equipment includes an Inertial Navigation System (INS), Head-Up Display (HUD), NVGs, the Low-Altitude Safety and Targeting Enhancement (LASTE) system for ground collision avoidance, Pavé Penny laser target identification pod, ECM, target penetration aids, self-protection systems, and AGM-65 Maverick and AIM-9 Sidewinder missiles.

OA-10A. Redesignated A-10s, used for Forward Air Control (FAC) 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 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).



AC-130H (Guy Aceto)



F-15B Eagle (Guy Aceto)



F-15C Eagle (Guy Aceto)



F-15E Strike Eagle (Guy Aceto)

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, one 40 mm Bofors cannon with 256 rd, and one Howitzer with 100 rd.

COMMENTARY

AC-130 gunships perform special operations and conventional missions, including CAS, air interdiction, armed reconnaissance, escort, surveillance, and air base defense. Equipment includes a HUD, combined

INS/GPS, and Spectra ceramic armor protection. Self-protection measures for the low-to-medium threat environment include ECM, chaff and flares, and infrared and radar warning receivers.

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 Electro-Optical (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.

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.

F-15 Eagle

Brief: A supersonic, all-weather, extremely 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: 527.

Unit Location: Active: Edwards AFB, Calif., Eglin AFB, Fla., Elmendorf AFB, Alaska, Kadena AB, Japan, Langley AFB, Va., 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., Mountain Home AFB, Idaho, NAS JRB New Orleans, 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

The F-15's superior maneuverability and acceleration, range, weapons, and avionics enable it 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 more than 162 C/Ds are scheduled to receive an APG-63 upgrade, with at least one squadron receiving a later version 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: 204.

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 23,770 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. Future options include JASSM, JDAM, JSOW, and WCMD.

COMMENTARY

F-15E has a strengthened airframe for increased gross weight at takeoff and maneuver at 9gs 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 radar and LANTIRN (Low-Altitude Navigation and Targeting Infrared for Night) pods, with wide-field FLIR. The digital, triple-redundant flight-control system permits automatic terrain following. Other improvements include a ring-laser gyro INS, with GPS capability from 1997. CFTs fitted, adapted to carry ordnance tangentially, to reduce drag.

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: 1,431.

Unit Location: 14 active wings, 28 ANG, and four AFRC units.

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. 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: empty (F100-PW-220) 18,238 lb, (F110-GE-100) 19,020 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 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 and to Bosnia.

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 ever built. Equipment includes a multi-mode radar with a clutter-free look-down capability, advanced radar warning receiver, 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.



F-16B Fighting Falcon (Guy Aceto)



Block 30 F-16D Fighting Falcon (Guy Aceto)



Block 40 F-16CG Fighting Falcon (Guy Aceto)



Block 50 F-16CJ Fighting Falcon (Guy Aceto)

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. 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 countermeasures, ALR-56M advanced radar warning receiver (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 Increased Performance Engines (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-hr airframe, and expanded envelope 9g capability.

Block 50/52 F-16C/Ds have MSIP Stage III improvements, which also show up in selected retrofits of Block 25s. These aircraft incorporate the latest cockpit control and display technology, including a wide-angle HUD. Weapons improvements include multishot AMRAAM compatibility.

F-16C/Ds had earlier acquired interim HARM capability for Suppression of Enemy Air Defenses (SEAD) missions in conjunction with the now-retired F-4G Wild Weasels. When carrying the AN/ASQ 213 HARM Targeting System (HTS), the Block 50/52 F-16 has the ability to autonomously locate enemy threat radars and launch HARM missiles at them in the range known mode. An updated version of the HTS is being worked on.

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 midlife update codevelopment and coproduction effort with the European participating government of the F-16 Multinational Fighter Program. Other improvements to be incorporated include Joint Helmet Mounted Cueing System, AIM-9X, Link 16 Data Link, and improved weapons capabilities.

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

F-16CJ designated aircraft are equipped with HARM for SEAD. Thirty additional F-16CJs were requested in the FY00 budget.

F-22 Raptor

Brief: High-technology follow-on for the F-15C. An all-weather fighter that combines a highly 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 (anticipated first production representative test aircraft).

IOC: December 2005.

Production: 339 (planned).

Inventory: two 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 (CIP) 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 will also receive one static test and one fatigue test airframe.

A decision taken toward the end of 1999 to keep the F-22 in development means the next six F-22s will be production representative test aircraft for use in follow-on testing of avionics, stealthiness, and weapons delivery systems. The third test Raptor flew March 6, and the fourth, the first to be equipped with the full integrated avionics suite, is expected to be flying in summer 2000. A production decision will depend on critical avionics flight testing milestones being achieved by the end of 2000.

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.

First Flight: June 18, 1981.

Delivered: 1982–summer 1990.

IOC: October 1983.

Production: 59.

Inventory: 56.

Unit Location: Holloman AFB, N.M.

Contractor: Lockheed Martin.

Power Plant: two General Electric F404-GE-F1D2 non-afterburning 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 non-afterburning 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 recently 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. Currently undergoing modification to provide a single, optimal LO configuration, adverse weather capability via advanced weapons, and to maintain the fleet through its service life.



F-22 Raptor (F-22 Team Photo)



F-117A Nighthawk (Guy Aceto)

Joint Strike Fighter

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

Operator: ACC for USAF.

First Flight: TBD

Delivery: 2005 (anticipated first production).

IOC: 2010 (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: The concept demonstration phase of the program commenced in November 1996 with competitive contract awards to Lockheed Martin and Boeing. This phase will feature flying concept demonstrators and concept-unique ground and flight demonstrations. Both Lockheed Martin and Boeing will demonstrate commonality and modularity, STOVL hover and transition, and low-speed handling qualities. 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 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 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: Attack laser.

Operator: ACC.

First Flight: 2003.

Delivered: to be completed by 2009 (planned).

IOC: FY07 (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

Air Combat Command will 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 57.5 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 4.9-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 feet wide and 6 feet thick, which provides all-weather air surveillance and C³ 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), C³.

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.

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

In high operational demand, the E-3 Airborne Warning and Control System (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 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 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 (ESM), 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. Radar system improvements will permit AWACS aircraft operating in the pulse-Doppler mode to detect smaller, stealthier targets. IOC for these improvements scheduled for this year.

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, C².

Operator: ACC.

First Flight: December 1988.

Delivered: May 1996–present.

IOC: Dec. 18, 1997.

Production: 14 (planned).

Inventory: five.

Unit Location: Robins AFB, Ga.

Contractor: Northrop Grumman.

Power Plant: four Pratt & Whitney TF33-102C turbofans, 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 an all-weather, round-the-clock system comprising an airborne E-8C aircraft (equipped with a multimode radar) and US Army mobile ground stations. The radar subsystem features a multimode, side-looking, phased-array radar with MTI as the primary mode. The radar can interleave MTI with Synthetic Aperture Radar (SAR) and Fixed Target Indicator (FTI) imagery. Joint STARS directs attack on targets,



E-3C Sentry (Guy Aceto)



E-8C Joint STARS (Guy Aceto)



RC-135W Rivet Joint (Ted Carlson)

in real time, via a secure, jam-resistant digital data link to broadcast data to ground forces.

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). As a result of their success, the system's original role was expanded to include bomb-damage assessment, SEAD, and the detection of mobile missile launchers and their decoys.

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 four production Joint STARS 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 version of the WC-135, modified 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 feet 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 feet. 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: 22.

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 V 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 providing near-real-time data updates via the Tactical Information Broadcast System (TIBS) and JTIDS on enemy air defense systems to crews of F-16 HTS aircraft. The aircraft's recon systems are continuously upgraded to keep pace with new threats.

RQ-1A Predator

Brief: A medium-altitude, long-endurance Unmanned Aerial Vehicle, flown remotely by a rated

officer. 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: Six air vehicles.

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.

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 has already demonstrated its 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 real-time transmissions of video images to the ground control station. System upgrades are under way to expand capability.

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: TBD

IOC: TBD

Production: decision in FY01.

Inventory: TBD

Unit Location: TBD

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 will permit ground commanders to switch among radar, IR, and visible wavelengths as required. Navigation is by GPS/INS. It 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 after a precautionary standdown.

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).

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.

COMMENTARY

The U-2 is capable of collecting multisensor photo,



RQ-1A Predator (Guy Aceto)



RQ-4A Global Hawk (Ted Carlson)



U-2 Dragon Lady (Guy Aceto)



WC-130H Hercules (Ted Carlson)

electro-optic, infrared, and radar imagery, as well as performing other types of intelligence functions. Current upgrades to its sensors, airframe, and cockpit will extend the U-2's usefulness well into this century.

U-2R (single-seat) and **U-2RT** (two-seat) aircraft are single-engine, high-altitude reconnaissance aircraft, derived from the original version that had a key role in the Cuban Missile Crisis of 1962. This model is 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 designations for U-2Rs that were re-engineered with the General Electric F118-101, a derivative of the engine used in the B-2 bomber, providing improved performance and supportability. The Air Force accepted the first U-2S in October 1994, and conversion of the entire fleet of 31 single-seat U-2s and four two-seat trainers was completed in 1999.

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: 10 (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. Ten weather-capable versions of the latest C-130 model ordered, powered by four Allison AE2100D3 turboprops. First 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, C³ 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 were developed as the National Emergency Airborne Command Post (NEACP), now the National Airborne Operations Center (NAOC). The E-4B fleet provides a survivable C³ platform capable of supporting the National Command Authority throughout the full threat spectrum, including sustained operations in a nuclear environment.

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. 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). Triband radomes also house 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 tying into 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.

E-9

Brief: Airplane used for low-altitude, over-the-horizon data gathering during missile tests and for sea

surveillance in order to keep boats out of the Gulf Test Range during tests.

Function: Electronic surveillance.

Operator: ACC.

First Flight: (Prototype Dash 8) June 20, 1983.

Delivered: 1988.

IOC: circa 1988.

Production: two.

Inventory: zero (two, Primary Aircraft Inventory).

Unit Location: Tyndall AFB, Fla.

Contractor: de Havilland of Canada.

Power Plant: two Pratt & Whitney Canada PW120A turboprops, each 2,000 shp. (No military designation on these engines).

Accommodation: three: pilot, copilot, and systems operator.

Dimensions: span 85 ft, length 73 ft, height 24 ft 7 in.

Weight: gross 34,500 lb fully fueled.

Ceiling: 25,000 ft.

Performance: max speed at 25,000 ft 245 mph, loiter time 5 hr.

COMMENTARY

E-9A is a highly modified Boeing Canada (de Havilland) DHC-8 Dash 8M-100 aircraft. Two are operated by the 475th Weapons Evaluation Group as airborne platform telemetry relay aircraft. Each is equipped with a sensor suite that includes an AN/APS-128D sea surveillance radar in a ventral radome and a five-beam, electronically steerable, 75-square-foot, phased-array telemetry antenna in a starboard-side fuselage fairing, capable of automatically detecting, tracking, and relaying data simultaneously from five pairs of distinct targets traveling at speeds of Mach 5 or more.

EC-18

Brief: A heavily modified Boeing 707 used to gather telemetry and other data 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) are modified former commercial Boeing 707-320 transports. Replacing 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 expanding ARIA mission, including DoD and NASA space and missile programs.

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 Com-

mand 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.



EC-9 (Ted Carlson)



EC-18 (USAF photo)



EC-130E ABCCC (TSgt. Lance Cheung)



EC-130E Commando Solo (Ted Carlson)



EC-130H Compass Call (Ted Carlson)

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: 15.

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 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.

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: ARIA 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 USAF; **EC-135J/P** by PACAF; and **EC-135K** by TAC. **EC-135Ns** 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 USSTRATCOM'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. Only one E-model now functions as telemetry data recording and relay station to supplement land and marine telemetry stations that support DoD and NASA space and missile programs. Specialist equipment includes 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 is modified to include all of the instrumentation subsystems installed as a 30,000-lb modular package.

Tanker Aircraft

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 4.5 in, length 181 ft 7 in, height 58 ft 1 in.

Weight: gross 590,000 lb.

Ceiling: 42,000 ft.



KC-10A Extender (Ted Carlson)



KC-135E Stratotanker (Ted Carlson)

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.

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, AMC, PACAF, USAFE, ANG, AFRC.

First Flight: August 1956.

Delivered: January 1957-66.

IOC: June 1957, Castle AFB, Calif.

Production: 732.

Inventory: 547.

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 57 passengers.

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

Weight: empty 119,231 lb, gross 322,000 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 com-



KC-135R Stratotanker (SSgt. Randy Mallard)



HC-130P (TSgt. Cary Humphries)

mercial 707 aircraft but was designed to military specifications, incorporating different structural details and materials. The KC-135 fuel tankage is 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 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 are capable of refueling SR-71s. The program continues. Ongoing modernization programs are extending KC-

135 capability and operational utility well into this century. The lower wing skin was renewed, adding 27,000 flying hours to the aircraft. The Pacer CRAG avionics modernization program permits operation by a three-person flight crew. Several avionics upgrades are under way that will significantly improve systems reliability and maintainability. Under the Pacer CRAG program, the entire fleet will be fitted with improved cockpit and navigation suites, including color weather radar, reduced vertical separation minimums equipment, and integrated INS/GPS. 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/HC-130

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: MC-130P: 28; HC-130N/P: 29.

Unit Location: Active: Eglin AFB, Fla., Kadena AB, Japan, Kirtland AFB, N.M., Moody AFB, Ga., Patrick AFB, Fla., RAF Mildenhall, UK. ANG: Anchorage, Alaska, Francis S. Gabreski IAP, N.Y., Moffett Federal Airfield, Calif. AFRC: Eglin and Patrick AFBs, Fla., Portland IAP, Ore.

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

Since initial introduction, Combat Shadow aircraft have served a wide range of roles and missions. They are currently dedicated to special operations missions, conducting single-ship or formation in-flight refueling of SOF helicopters in a low-threat to selected medium-threat environment. During Desert Storm, they provided air refueling of SOF helicopters over friendly and hostile territory as well as psychological operations and leaflet drops.

MC-130P. (Formerly HC-130N/P.) Modified with new secure communications, self-contained inertial navigation and countermeasures systems, and NVG-compatible lighting. NVG low-level flights use minimal lighting and communications-out procedures. Additional modifications include 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. Fifteen have been fitted with an in-flight refueling receptacle to extend their range indefinitely.

HC-130. Tankers serving with active, ANG, and AFRC search-and-rescue units retain the HC-130 designation.

Strategic Transports

C-5 Galaxy

Brief: A heavy-lift, air refuelable cargo transport for massive strategic airlift over long ranges, including outside 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., Kelly AFB, Texas, Travis AFB, Calif. ANG: Stewart IAP, N.Y. AFRC: Dover AFB, Del., Kelly AFB, Texas, 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. 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, and the C-5A fleet has incorporated the avionics subsystems developed for the C-5B.

C-5B is generally similar to the C-5A but embodies 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 outside space cargo for NASA by extending the cargo bay and modifying the aft doors.

All USAF Galaxies 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 effort including a re-engining effort 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, AMC, AFRC.

First Flight: Sept. 15, 1991.

Delivered: June 1993–present.

IOC: Jan. 17, 1995.

Production: 134 minimum planned.

Inventory: 55.

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 40,400 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 8 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 air-drop outsize cargo in the tactical environment.

C-17A completed its full flight test program in June



C-5B Galaxy (TSgt. Brad Fallin)



C-17 Globemaster III (Ted Carlson)



C-141B (SOLL) Starlifter (SrA. Greg L. Davis)

1995. It 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 multi-function 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 non-tanker duties.

Function: Passenger and cargo airlifter.

Operator: ACC, AFMC, AMC, PACAF, ANG.

First Flight: May 1961.

Delivered: 1961–62.

IOC: circa 1961.

Production: 48, plus five WC/TC-135s.

Inventory: five.

Unit Location: Andrews AFB, Md., Edwards AFB, Calif., Hickam AFB, Hawaii, Offutt AFB, Neb.

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: The workhorse of 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: 155.

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.

C-141A entered service with MAC in April 1965, and 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 realize the aircraft's full payload potential. 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, is assigned to AFRC's 452nd Air Mobility Wing, March ARB, Calif. ANG and AFRC are slated to get 63 of these glass-cockpit transports.

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, USAF, AFRC.

First Flight: August 1968.

Delivered: August 1968–February 1975.

IOC: circa 1968.

Production: 24.

Inventory: 23.

Unit Location: Andrews AFB, Md., Chievres AB, Belgium, 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. Two C-9As also provide 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, PACAF.

First Flight: Oct. 27, 1972 (Super King Air 200).

Delivered: 1974–late 1980s.

IOC: circa 1974.

Production: 88.

Inventory: 32.

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 updated 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 turboprop aircraft acquired to provide airlift for high-ranking government and DoD officials.

Function: Operational support airlift; special air missions.



C-9 Nightingale (Ted Carlson)



C-12 Huron (Ted Carlson)



C-20 Gulfstream III (MSgt. Joe Cupido)



C-21 (Ted Carlson)



C-22 (Ted Carlson)

Operator: AMC, USAF.
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 turboprops, each 11,400 lb thrust; C-20H: two Rolls Royce–Tay MK611-8 turboprops, 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 USAF's Special Air Mission 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, USAF, 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, Texas, Scott AFB, Ill., Stuttgart, Germany, Wright–Patterson AFB, Ohio, Yokota AB, Japan.

Contractor: Raytheon.

Power Plant: two AlliedSignal TFE731-2 turboprops, 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-1 turboprops, 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, or TPE331-12UAR, each 1,119 shp.

Accommodation: crew of two; 19–20 passengers.

Dimensions: span 57 ft, length 59 ft 4 in, height 16 ft 8 in.

Weight: empty 9,494 lb, gross 16,000 lb.

Ceiling: 26,700 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 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, are replacing C-137B/Cs. 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–January 1999.

IOC: Dec. 9, 1998.

Production: two.

Inventory: two.

Unit Location: Andrews AFB, Md.

Contractor: Gulfstream.

Power Plant: two BMW–Rolls Royce BR710A1-10 turbofans, each 14,900 lb thrust.



C-26 (Ted Carlson)



C-32 (Robert F. Dorr)



C-37A (Robert F. Dorr)



C-38A (Robert F. Dorr)



C-130H Hercules (Guy Aceto)

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

The C-37A, along with the C-32, is a replacement for the VC-137B/C aircraft. It can conduct simultaneous diplomatic missions with secure communications. Capable of operations at any suitable civilian or military airfield in the world.

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: May 1998.

IOC: 1998.

Production: two.

Inventory: two.

Unit Location: Andrews AFB, Md.

Contractor: Tracor (Israel Aircraft Industries Ltd).

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

Accommodation: three 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 produced by IAI and supported worldwide by Galaxy Aerospace. The first two aircraft are operated by ANG's 201st AS. It replaced existing 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 paratropping of troops and equipment into hostile areas.

Function: Inter- and intratheater airlift.

Operator: ACC, AETC, AFSOC, AMC, PACAF, USAF, ANG, AFRC.

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

Delivered: December 1956–present.

IOC: circa 1958.

Production: more than 2,200.

Inventory: 530.

Unit Location: Active: Dyess AFB, Texas, Eglin AFB, Fla., Elmendorf AFB, Alaska, Hurlburt Field, Fla., Kirtland AFB, N.M., Little Rock AFB, Ark., Moody AFB, Ga., Pope AFB, N.C., Ramstein AB, Germany, Yokota AB, Japan. ANG: 25 units. AFRC: 10 units.

Contractor: Lockheed Martin.

Power Plant: (C-130H) four Rolls Royce–Allison T56-A-15 turboprops, each 4,500 shp.

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

Continuing in production, the C-130 Hercules transport aircraft first flew 45 years ago 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. Six were modified in 1961 as **JC-130Bs** for air-snatch satellite recovery. 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 the next century.

Other modifications include a Self-Contained Navigation System (SCNS), with an integrated communications/navigation management suite, GPS capability, and a state-of-the-art autopilot that incorporates a Ground Collision Avoidance System.

C-130H is generally similar to the E model but has updated turboprops, a redesigned outer wing, updated avionics, and other, minor, improvements; delivery began in July 1974. More than 350 C-130Hs and derivatives were ordered for active and reserve units of the US services. 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. Seven **LC-130Hs**, modified with wheel-ski gear, are operated by ANG's 109th AW, Schenectady County Airport, N.Y., in support of Arctic and Antarctic operations. Two former USN LC-130Rs are being modified to LC-130H standard for delivery to the 109th AW later this year. Two **DC-130Hs** were modified for UAV control duties.

C-130J. This newest model features a three-crew flight operation system, 6,000 shp Rolls Royce–Allison AE 2100D engines, digital avionics and mission computers, enhanced performance, and improved reliability and maintainability.

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: two.

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 remaining Air Force One, tail #27000, entered service Aug. 4, 1972.

CV-22 Osprey

Brief: A tiltrotor, 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: 2004 (planned).

Production: 50 (planned).

Inventory: 50 (planned).

Unit Location: TBD

Contractor: Bell/Boeing.

Power Plant: two Allison T406-AD-400 turboshafts, each 6,150 shp.

Accommodation: four flight crew, 18 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: normal mission weight, VTO 47,500 lb; gross, STO 60,500 lb.

Ceiling: 26,000 ft.

Performance: max cruising speed in helicopter mode 115 mph, in airplane mode 316 mph.

COMMENTARY



LC-130H Hercules (Guy Aceto)



C-130J Hercules (Guy Aceto)



C-137C Stratoliner (Ted Carlson)

Development of this variant of the Marine Corps MV-22 is continuing. It is expected to fulfill the Air Force special operations requirement for high-speed, long-range Vertical/Short Takeoff and Landing (V/STOL) aircraft capable of low-visibility, clandestine penetration/extraction of denied areas in adverse weather.

CV-22 is based on Bell's XV-15. It is designed typically to carry troops or cargo over a 575-mile combat radius at 265 mph. Self-deployment range will be 2,860 miles with one air refueling.

The CV-22 will be shipboard compatible and air refueling capable. Equipment will include a fully integrated precision navigation suite, with GPS and INS; FLIR; terrain-following/terrain-avoidance radar; digital map display; and NVG-compatible cockpit displays. The electronic warfare suite will include radar and missile warning receivers, radar and infrared missile jammers, and flare/chaff dispensers. The communica-

tions suite will include secure UHF, VHF (AM and FM), and SATCOM radios.

Four Full-Scale Development (FSD) aircraft had flown by the end of 1991. Flight testing resumed in April 1993, following the incorporation of numerous design changes. The first CV-22 is expected to begin initial operational test and evaluation at Kirtland AFB, N.M., in spring 2002.

MC-130E/H Combat Talon

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

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

Specially modified C-130 transports, these aircraft are equipped with in-flight refueling equipment, terrain following/terrain avoidance radar, INS/GPS, and a high-speed aerial delivery system. These systems are used to locate small drop zones and deliver people or equipment with greater accuracy and at higher speeds than is possible with a standard C-130. The aircraft can penetrate hostile airspace at low altitudes, at night, and in adverse weather.

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

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.



MC-130H Combat Talon II (MSgt. Val Gempis)

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, Texas, 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, tankers, such as the KC-10 and KC-135, and the B-52 (through FY00).

T-1A. The swept-wing T-1A is a version of the Beech 400A, with military avionics, used for Specialized Undergraduate Pilot Training (SUPT). Structural enhancements provide for a large number of landings per flight hour, increased bird strike resistance, and an additional fuselage fuel tank. GPS is being retrofitted.

T-3 Firefly

Brief: A propeller-driven aircraft that was used by the Air Force to screen pilot candidates.

Function: Primary screener.

Operator: AETC.

First Flight: July 4, 1993.

Delivered: Feb. 25, 1994–January 1996.

IOC: March 1994.

Production: 113.

Inventory: 110.

Unit Location: not applicable

Contractor: Slingsby; Northrop.

Power Plant: Textron Lycoming AEIO-540-D4A5 engine, 260 hp.

Accommodation: two, side by side.

Dimensions: span 34 ft 9 in, length 24 ft 9 in, height 7 ft 9 in.

Weight: empty 1,780 lb, gross 2,550 lb.

Ceiling: 19,000 ft.

Performance: max level speed 155 mph, range with max fuel, 65 percent power at 8,000 ft 469 miles.

COMMENTARY

T-3A. Selected in April 1992 to replace the T-41

Mescalero, the fully aerobatic T-3A was used from March 1994 by AETC at Hondo Airport, Texas, and from January 1995 by the US Air Force Academy to screen prospective pilots prior to SUPT. However, USAF suspended operations in the T-3 in July 1997 to determine the cause of several unplanned engine stoppages that led to the deaths of three students and three instructors over a three-year period. On Oct. 9, 1999, the Air Force announced that it was permanently grounding its T-3As. Divestiture options are under consideration.

T-6A Texan II

Brief: A single-engine turboprop aircraft that will 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: from FY00 (planned).

IOC: FY01 (planned).

Production: USAF 372, USN 339 (planned).

Inventory: one.

Unit Location: USAF: Columbus AFB, Miss., Laughlin, Randolph, and Sheppard AFBs, Texas, Moody AFB, Ga., Vance AFB, Okla. Navy: NAS Corpus Christi, Texas, NASs Whiting and Pensacola, Fla.

Contractor: Raytheon.

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 4 in, length 33 ft 3 in, height 10 ft 6 in.

Weight: empty (approx) 4,900 lb; gross 6,500 lb.

Ceiling: 31,000 ft.

Performance: max speed 368 mph.

COMMENTARY

Winner of the Joint Primary Aircraft Training System (JPATS) competition, Raytheon's Beech/Pilatus PC-9 Mk II is based on the Swiss Pilatus PC-9 aircraft, modified to include a strengthened fuselage, upgraded engine, more fuel, pressurized cockpit, larger, bird-resistant canopy, and new digital avionics. The JPATS will replace USAF's T-37Bs and USN's T-34Cs and their associated ground-based training systems.

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, Texas, 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 currently is 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 will replace the T-37B with the new T-6A Texan II.

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.



T-1 Jayhawk (Ted Carlson)



T-6A Texan II (Ted Carlson)



T-37 Tweet (Guy Aceto)



T-38 Talon (Guy Aceto)

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, Texas, 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.

COMMENTARY

Most of the T-38s in service are used by AETC for advanced student training. 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, coupled with the reduction in the T-38's workload through introduction of the T-1A, the service life of the T-38s should extend to 2020.

T-38A. Almost identical 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 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 (IFF).

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

T-43

Brief: A medium-range, swept-wing jet aircraft equipped with modern 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, Texas.

Contractor: Boeing.

Power Plant: two Pratt & Whitney JT8D-9 turbopfans, 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 the most advanced USAF operational aircraft of that time, including celestial, radar, and inertial navigation systems, a Long-Range Aid to Navigation (LORAN) system, and other radio systems. All remaining aircraft are in the AETC inventory.

UV-18 Twin Otter

Brief: Modified utility transport used for parachute jump training.

Function: Paratroop.

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.



T-43 (Guy Aceto)



UV-18 Twin Otter (Ted Carlson)

Helicopters

HH/MH-60G Pave Hawk

Brief: Specially outfitted heavy-lift helicopters used by Air Force Special Operations Forces for infiltration and exfiltrations as well as combat search-and-rescue missions.

Function: SOF heavy-lift helicopter.

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

First Flight: October 1974.

Delivered: 1982–present.

IOC: circa 1982.

Production: 102.

Inventory: 99.

Unit Location: HH-60G at 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-



HH-60G Pave Hawk (Ted Carlson)



MH-53M Pave Low IV (TSgt. Cary Humphries)

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

Ninety-eight Black Hawk helicopters were modified to HH-60G Pave Hawk configuration, with aerial refueling capability and internal auxiliary fuel. Configuration varies between aircraft, but both versions are equipped with an integrated navigation system using GPS, INS, and Doppler, with input to a flight path–vectored FLIR. Both have unsecure VHF and secure FM, HF, UHF, and satellite communications.

Further modifications include an integral rescue hoist and an External Stores Support System (ESSS) for weapons and additional fuel. Pave Hawk capabilities permit rapid-response, long-range/loiter mission profiles requiring a broad scale of payload possibilities.

HH-60G. Used by active duty, ANG, and AFRC air rescue units for combat search-and-rescue and various mission-support activities worldwide. Planned upgrades include a revised communications, navigation, and integrated EW combat search-and-rescue capability.

MH-60G. Until recently operated by AFSOC's 16th SOW, these aircraft were transferred to ACC units.

MH-53 Pave Low

Brief: Specially outfitted heavy-lift helicopters used by Air Force Special Operations Forces for infiltration as well as combat search-and-rescue 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: 44.

Unit Location: AETC: Kirtland AFB, N.M. AFSOC: 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. Enhanced version equipped with a nose-mounted FLIR, an integrated digital avionics suite that includes terrain-following and terrain-avoidance radar, GPS, INS, Doppler, secure communications,



UH-1N Iroquois (Guy Aceto)

armor plating, and an ECM suite with radar and IR missile jammers, flare/chaff dispensers, radar warning receivers, and missile launch detectors.

MH-53M. MH-53J helicopters upgraded to Pave Low IV standard, delivered from 1999. Modifications include the capacity to integrate on-board EW systems with off-board, over-the-horizon intelligence, and an upgraded weapons systems computer. A Service Life Extension Program (SLEP) upgraded the aircraft's hydraulics, wiring, and basic airframe structure for increased gross weight, and a shipboard fold/compatibility modification has been undertaken.

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 some standard USAF equipment.

UH-1 Iroquois

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

Function: Utility helicopter.

Operator: AETC, AFSC, AFSPC, AMC, PACAF.

First Flight: circa 1956.

Delivered: from September 1970.

IOC: circa 1970.

Production: 79.

Inventory: 63.

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 remain in the inventory for missile site support duties with AFSPC and for administrative 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.

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.



AGM-129 (Guy Aceto)

Contractor: Boeing.

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

Guidance: AGM-86B: inertial plus 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. When launched in large numbers, its ability to dilute enemy defenses improves the capability of manned aircraft to penetrate to major 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. Boeing is currently under contract to convert 322 Bs to conventional configuration, the first of which was delivered November 1999.

AGM-86D. The last 50 of the 322 CALCM conversions will be to AGM-86D standard, with a Lockheed Martin AUP-3(M) hard target penetrating warhead. Final delivery expected mid-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 awarded a contract in 1987 for technology transfer leading to second-source capability for this advanced system, which is deployed on B-52H aircraft.

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.



AGM-86C (SSgt. Jim Howard)

COMMENTARY

Minuteman continues to play a key role 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 current version, 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 deployed 550 in 10 squadrons.

A single re-entry vehicle configuration has been demonstrated, and planned for, in accordance with strategic arms control negotiations. A total of 500 Minuteman IIIs will be based at Minot AFB, N.D.; F.E. Warren AFB, Wyo.; and Malmstrom AFB, when START II is ratified.

All 150 missiles that were at Grand Forks AFB have been transferred to Malmstrom AFB and emplaced in converted MM II silos.

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 standby power systems, repair of launch facilities, and installation of updated, survivable communications equipment and new command-and-control consoles to enhance immediate communications. USAF also plans to modify Minuteman IIIs to accept the warheads taken from deactivated Peacekeeper missiles following implementation of the START II treaty.

LGM-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: Martin Marietta.

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

LGM-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 former Minuteman III silos, Peacekeeper is a four-stage ICBM that carries up to 10 independently targetable re-entry vehicles. It is more accurate, carries more warheads, and has greater 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.



LGM-30G



LGM-118A

Delivered: from 1956.

IOC: April 1976 (AIM-7F).

Production: not available

Inventory: classified.

Contractor: Raytheon/Hughes; General Dynamics.

Power Plant: Hercules Mk 58 Mod 0 boost-sustain rocket motor.

Guidance: AIM-7M: monopulse semi-active 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 service.

AIM-7M is a monopulse version of Sparrow, aimed at reducing cost and improving performance in the ECM and look-down clutter regions. It began opera-

tional service in FY83. This version equips USAF F-15s and remaining F-16s (ADF).

AIM-7R is designed to improve missile performance against sophisticated ECM by means of a new infrared (IR) seeker added to the guidance and control section, incorporated in a multimode seeker.

AIM-7s and AIM-9s (see below) equipped with telemetry packages in place of warheads are used in a program initiated by the USAF Air Warfare Center and linked with industry, to develop passive missile-warning systems for USAF tactical aircraft.

AIM-9 Sidewinder

Brief: A supersonic, short-range, heat-seeking air-to-air missile carried by fighter aircraft, having a high-explosive warhead and a passive infrared guidance system.

Function: Air-to-air missile.

First Flight: September 1953.

Delivered: 1983–98 (AIM-9M current operational variant).

IOC: circa 1983 (AIM-9M).

Production: not available

Inventory: not available

Contractor: Raytheon/Loral.

Power Plant: Thiokol Mk 36 Mod 11 solid-propellant rocket motor.

Guidance: solid-state passive IR homing guidance.

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 is an improved version of AIM-9L with all-aspect intercept capability. 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 with an order for approximately 1,280 missiles.

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

AIM-9X provides the next step in the continuing evolution of the AIM-9 infrared family of short-range air-to-air missiles. This joint Navy and Air Force program was derived from a jointly funded demonstration and validation contract. The current 60-month EMD contract was awarded to Hughes (now Raytheon) in December 1996. AIM-9X is in developmental flight test phase of EMD and successfully completed its fourth guided firing, directly hitting a target drone March 31.

The AIM-9X incorporates new 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-22, and potentially JSF aircraft.

AIM-120 AMRAAM

Brief: A new-generation radar-guided, all-weather,

Tactical Missiles and Weapons

AIM-7 Sparrow

Brief: A 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).



AIM-7 Sparrow (Guy Aceto)



AIM-9 Sidewinder (top), AIM-120 AMRAAM (bottom) (Guy Aceto)

beyond-visual-range air-to-air missile carried by fighters, with high capability to attack low-altitude targets. Pilot may aim and fire several Advanced Medium-Range Air-to-Air Missiles simultaneously at multiple targets and perform evasive maneuvers.

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 replacement for the AIM-7 Sparrow, the AIM-120 AMRAAM equips USAF's F-15, F-16, 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 (EP) capability, increased maximum launch range, a reduced-smoke motor, and improved maintenance and handling.

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

AIM-120B/C are upgraded variants of the AIM-120 and are reprogrammable. 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 IIR-guided air-to-surface missile carried by fighters and designed for use in close air support, 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: not available

Inventory: classified.

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 Per-



AGM-88 HARM (Guy Aceto)



AGM-65 Maverick (Guy Aceto)

sian 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 TV Maverick, which can be used only in daylight and clear-weather conditions. This version has an Imaging-Infrared (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 with significant reliability, maintainability, and performance improvements over the AGM-65B seeker.

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 all-weather, over-the-horizon, anti-ship

missile system, carried by bombers, with a low-level, sea-skimming cruise trajectory, active radar guidance, and high-explosive warhead. Used for attack on warships.

Function: Air-to-surface anti-ship missile.

First Flight: March 1974 (for USN).

Delivered: from 1977 (USN).

IOC: circa 1985 (USAF).

Production: USAF none.

Inventory: classified.

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-surface missile now 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-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: not available

Inventory: classified.

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 8.5 in, body diameter 10 in, wingspan 3 ft 8.5 in.

Weight: 807 lb.

Performance: cruising speed supersonic, altitude limits S/L to 40,000 ft, range more than 10 miles.

COMMENTARY

This 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 to be used in current operations. HARMs now 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. USAF is updating older AGM-88Bs 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 USAF, 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: approx 600.

Inventory: classified.

Contractor: Boeing.

Guidance: TV or IIR seeker, or DME transponder.

Warhead: Mk 84 bomb (2,000-lb unitary), 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. Currently in production with a Mk 84 warhead.

AGM-130C. Currently in production with a 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 a conventional precision strike capability.

Function: Air-to-surface guided missile.

First Flight: 1990.

Delivered: 1992.

IOC: June 1992.

Production: approx 250.

Inventory: classified.

Contractor: Rafael (Israel).

Power Plant: solid-propellant rocket motor.

Guidance: inertial, with data link, TV, or IIR homing.

Warhead: high-explosive, 750-lb-class blast/fragmentation or 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

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.

Inventory: TBD

Contractor: Raytheon.

Guidance: INS/GPS.

Dimensions: length 13 ft 4 in.

Weight: 1,065 lb.

Performance: range: low-altitude launch 17 miles, high-altitude launch 40+ miles.

COMMENTARY

Long-range, INS/GPS-guided, standoff air-to-ground weapon designed to attack a variety of soft and armored area targets 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 standoff 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 threshold on F-16 Block 50 aircraft and objective on B-1B, F-15E, and F-16 Block 30/40.

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

AGM-154B. The BLU-108 variant providing anti-arm 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.

CBU-97 Sensor Fuzed Weapon

Brief: The CBU-97 SFW is an anti-armor cluster munition to be used by fighters and bombers for multiple kills per pass.

Function: Wide-area cluster munition.

First Flight: circa 1990.

Delivered: from 1994.

IOC: 1997.

Production: 5,000.

Inventory: TBD

Contractor: Textron Systems.

Guidance: IR sensors in each warhead search for

targets, then detonate over them.

Dimensions: length 92 in; diameter 16 in.

Weight: 927 lb.

Performance: delivers 40 lethal projectiles.

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 projectiles that, upon being thrown out, seek out their target and deliver a warhead. 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 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 is increasing the footprint.

CBU-105. USAF plans to retrofit its inventory of SFWs with the Wind-Corrected Munitions Dispenser tail kit. The WCMD 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: classified.

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. Fifty initially produced for Allied Force, with additional inventory requested in FY00 and FY01 budgets.

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: semi-active laser.

Dimensions: length 14 ft 2 in.

Weight: 2,350 lb.

COMMENTARY

GBU-24A/B. This is an air-to-ground weapon equipped



AGM-130 (TSgt. Mike Amons)



AGM-142 Have Nap (TSgt. Mike Amons)



AGM-154 JSOW (Guy Aceto)



CBU-97 (SrA. Jeff Fitch)



GBU-15 (Guy Aceto)

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 and is in production for foreign military sales.

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: not available

Inventory: classified.

Contractor: Lockheed Martin.

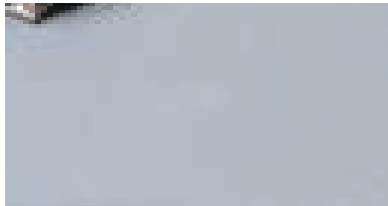
Guidance: semi-active laser.

Dimensions: span 5 ft 6 in, length 13 ft 11 in.

Weight: 2,170 lb.



GBU-24 (Guy Aceto)



GBU-27 (SSgt. Michael Rivera)



GBU-28 (SrA. Jeffrey Allen)

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 FY99.

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: not available

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, a new bunker-busting weapon was developed for Desert Storm for use against deeply buried, hardened command-and-control facilities. Four of the laser-guided GBU-28 weapons were used in 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.



GBU-31 JDAM (Guy Aceto)



Joint Air-to-Surface Standoff Missile (TSgt. Mike Ammons)

EGBU-28. Integrates GPS/INS guidance into the existing GBU-28 laser seeker to provide adverse weather capability and improved target location. Entered production in FY98.

GBU-31/32 Joint Direct Attack Munition

Brief: A joint USAF/Navy INS/GPS-guided 1,000- or 2,000-lb 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: 1997-present.

IOC: 1998.

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

Inventory: not available

Contractor: Boeing.

Dimensions: Mk 84 with JDAM 152.7 in; BLU-109 with JDAM 148.6 in; Mk 83 with JDAM 119.5 in.

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

Performance: 42.9 ft CEP with GPS; 99 ft CEP with INS only.

COMMENTARY

JDAM is designed to provide USAF and USN with highly accurate, autonomous, all-weather, conventional bombing capability. While still aboard the launch aircraft, JDAM can be continually updated with 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-1, B-2, B-52, F-15E, F-16, F-22, F-117A, F/A-18, and AV-8B.

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. Under development.

Joint Air-to-Surface Standoff Missile

Brief: An advanced weapon designed to be able 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 a precision, long-range weapon to hold high-value targets at risk. The missile will use an IR seeker for terminal guidance, with GPS/INS for midcourse and back-up terminal guidance. Engineering and Manufacturing Development 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.

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 (planned).

IOC: FY00 (planned).

Production: 40,000 (planned).

Inventory: TBD

Contractor: Lockheed Martin.

Dimensions: length 17 in, diameter 15 in.

Weight: 100 lb.

Performance: range, about eight miles.

COMMENTARY

USAF plans to modify 40,000 standard tactical munition dispensers with guidance kits to compensate for wind drift on downward flight from high altitudes. WCMD kits will each have an INS guidance unit, movable tail fins that pop out in flight, and a signal processor. A WCMD tail kit will be fitted on dispensers that will carry mines, cluster bomblets, or anti-armor submunitions. Successful flight testing began in February 1996. DoD plans to integrate WCMD on threshold aircraft B-52 and F-16. Objective aircraft: B-1, F-15E, F-22, and F-117.

FIM-92 Stinger

Brief: A man-portable Surface-to-Air Missile designed to defend airfields against low-flying attacking aircraft.

Function: Surface-to-air missile.

First Flight: August 1973.
Delivered: from 1980.
IOC: 1984 (USAF).
Production: not available
Inventory: not available
Contractor: Raytheon (Hughes).
Power Plant: solid-propellant rocket motor.
Guidance: IR homing guidance.
Warhead: high-explosive blast fragmentation, weighing 6.6 lb.
Dimensions: length 5 ft, body diameter 2.7 in, wingspan 5.5 in.
Weight: launch weight 35.2 lb.
Performance: range 1.86 miles.

COMMENTARY

First developed as a man-portable, tube-launched SAM for the US Army, Stinger has been employed since 1984 by air personnel in South Korea to provide base defense against high-speed, low-level ground-attack aircraft.

Rapier

Brief: A 24-hour, highly mobile SAM unit designed to defend airfields against high-speed, low-level air threats.
Function: Surface-to-air missile.
First Flight: 1986.
Delivered: 1986.
IOC: circa 1986.
Production: 32.
Inventory: 32.

Contractor: British Aerospace (now Mahr BAe Dynamics).
Power Plant: IMI two-stage solid-propellant rocket motor.

Guidance: surveillance radar and command to line-of-sight guidance. Optional Blindfire radar or optical target tracking, depending on conditions.

Warhead: semi-armor-piercing, with impact fuze.
Dimensions: length 7 ft 4 in, body diameter 5 in, wingspan 1 ft 3 in.

Weight: approx 94 lb.
Performance: max speed more than Mach 2, range 4 miles.

COMMENTARY

British-built Rapier missile systems, deployed previously to protect USAF bases in the UK and Turkey, have mostly been returned to the US and redeployed to the services. Under a similar agreement, the government of Turkey operates 14 US-owned fire units for the defense of US air bases in that country.

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 (MLV II) 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., in February 1992; first Atlas II Centaur configuration was launched in January 1995.

Atlas III. 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 IIA, and a dual engine, stretched Centaur for the upcoming IIIB. The first Atlas IIIA flight is scheduled for mid-2000.

Atlas V. See EELV below.

Centaur

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

Function: High-energy upper stage.

Operator: commercial (AFSPC oversight).

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

IOC: 1966.

Launches Scheduled: one (FY00); one (FY01).

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

Contractor: Lockheed Martin.

Power Plant: for Atlas IIA/AS configuration, two Pratt & Whitney RL10A-4-1 liquid oxygen/liquid hydrogen rocket engines, each 22,300 lb thrust; for Atlas IIIA, one RL10A-4-1 engine; for Atlas IIIB, one or two RL10A-4-2 engines, each 22,300 lb thrust; 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 command-and-control 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 G-prime modified upper stage, with high-energy cryogenic propellants and multiple restart capability, is used 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.

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 II).

IOC: 1989 (Delta II).

Launches Scheduled: three (FY00); five (FY01).

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 solid rocket motors, 100,270 lb thrust (sea level). Delta III stage 1: Boeing RS-27A liquid-propellant engine, 237,000 lb thrust; stage 2: Pratt & Whitney RL10B-2 engine, 20,500 lb thrust; stage 3: Thiokol Star 48B (modified).

Dimensions: Delta II: length 130 ft, diameter 8 ft; bulbous payload fairing, max diameter 10 ft. Delta III: length 130 ft, diameter 10 ft; payload fairing, diameter 13 ft.

Launch Weight: 511,190 lb.

Performance: Delta II: up to 11,100 lb to near Earth orbit, up to 4,010 lb to Geosynchronous Transfer Orbit (GTO), up to 2,000 lb to Geosynchronous Earth Orbit (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 25 operational GPS satellites have been launched.

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 into the next century 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 will increase GTO capacity to 8,930 lb. Notable features include a cryogenically propelled single-engine upper stage, bigger and more powerful strap-on solid rocket motors than Delta II, and a larger composite fairing to house bigger payloads.

Evolved Expendable Launch Vehicle

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. Replaces current Delta II, Atlas II, Titan II, and Titan IV launch vehicles.

Function: Medium/heavy expendable launch vehicle.

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; Feb. 10, 1992 (Atlas IA); December 1993 (Atlas IIAS); FY00 (Atlas III).

IOC: September 1959.

Launches Scheduled: two (FY00); three (FY01).

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, 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 IIA 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 AFB. Atlas IIIA will be able to lift up to 9,920 lb into GTO from Cape Canaveral.

COMMENTARY

Early Atlas launchers were refurbished Atlas ICBMs



Atlas IIAS



Atlas IIA

Operator: commercial (oversight AFSPC).
IOC: 2003 (planned).

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 (Medium): Pratt & Whitney RL10B-2, 9,750 lb thrust. 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 RL10A-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

Engineering and Manufacturing Development (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. Boeing has 19 of the launches and Lockheed Martin nine. 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 FY03.

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.

Launches Scheduled: one (FY00); one (FY01).

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

Contractor: Boeing.

Power Plant: aft-stage solid rocket motor 41,700 lb thrust; forward-stage solid rocket motor 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 solid rocket motor, an interstage, a forward-stage solid rocket motor, 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.

Contractor: Orbital Sciences/Alliant.

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

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.



Delta II



Titan IV



Inertial Upper Stage

Launches Scheduled: one (FY00); none (FY01).
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 900 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.

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 (FY00); one (FY01).

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. Seven 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 into this century.

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 (FY00); three (FY01).

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 solid rocket motors, each 1.8 million lb peak 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-8.5-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 solid rocket motors with 25 percent improved performance. First Titan IVB launch from Cape Canaveral was made successfully Feb. 23, 1997.

Satellite Systems

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 8 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. A total of 19 DSP satellites have been launched by USAF. Procurement will end with No. 23, and the last DSP satellite will be launched in FY03.

Space Based Infrared System

The follow-on to the DSP is the **Space Based Infrared System (SBIRS)**, an advanced program with four primary missions: missile warning, missile defense, technical intelligence, and battlespace characterization. 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 three increments. Increment 1 was expected to consolidate all DSP ground processing in one CONUS Mission Processing Station at Buckley ANGB, Colo., by the end of FY00. Increment 2 fields the High Component starting in FY04, and Increment 3 fields the Low Component starting in FY06. 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.

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: height 12 ft, 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

Defense Meteorological Satellite Program (DMSP) space vehicles have been collecting weather data for US military operations for more than 30 years. In addition to atmospheric data, DMSP satellites provide critical land, sea, and space environmental data for the military.

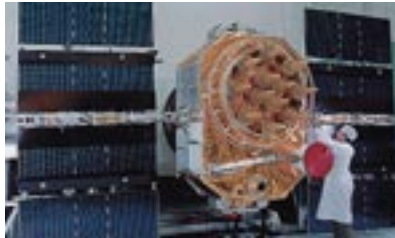
Circa 2008–09, DMSP will be replaced by the follow-on NPOESS. NPOESS will consolidate today's separate civil and military polar orbiting meteorological satellite systems into a single national program.

Block 5D-2. Two operational DMSP Block 5D-2 satellites survey the entire Earth four times a day, using their primary sensor, the Operational Linescan System, to take visual and IR imagery of cloud cover. Military weather forecasters use this imagery to support military operations and to detect developing weather patterns anywhere in the world, helping to identify, locate, and characterize emerging and evolving weather systems.

Block 5D-3. Providing increased capabilities, including improved sensors and a longer life span, the first Block 5D-3 launch is expected this year.



Defense Support Program satellite
(Artist's concept)



Global Positioning System satellite



Milstar Satellite Communications System (Artist's concept)

Defense Satellite Communications System

Brief: A spacecraft traveling in geosynchronous orbit used to transmit SHF high-priority command-and-control 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: 2,550 lb; 2,716 lb (SLEP).

COMMENTARY

Defense Satellite Communications System (DSCS) satellites provide worldwide secure voice high-data-rate transmission, operating in Superhigh 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 are currently in orbit, with launches continuing until 2002. 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 SLEP—modified DSCS III scheduled for launch in FY00.

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

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) velocity and precise time; passive, all-weather operation; continuous real-time information; support to an unlimited number of users and areas; and support to civilian users currently at a slightly less accurate level. Concern over potential enemy use of GPS is being addressed under the Navstar and GPS modernization efforts; new GPS satellites will have two jam-resistant channels for military-only use, as well as two new civilian-only channels. There are currently 28 satellites on orbit: nine Block II, 17 IIA, and two IIR.

Mapping, aerial refueling and rendezvous, geodetic surveys, and search-and-rescue operations are examples of the many GPS applications.

Milstar Satellite Communications System

Brief: A satellite communications system that provides secure, jam-resistant worldwide C² communications for tactical and strategic forces in all levels of conflict, linking command authorities to ground forces, ships, submarines, and aircraft.

COMMENTARY

The 12 satellites of the Milstar Satellite Communications System (MILSTAR) provide secure, jam-resistant worldwide C² communications for tactical and strategic forces in all levels of conflict, linking command authorities to ground forces, ships, submarines, and aircraft.

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COMMENTARY

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 5,000 watts.

Dimensions: 51 ft x 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 last three Milstars (to be launched between 2000 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 launches scheduled for 2003 and 2004.

UHF Follow-On Satellite Systems

Brief: New-generation communications satellites replaced Fleet Satellite Communications System (FLTSATCOM).

Function: Communications satellite.

Operator: US Navy, AFSPC.

First Launch: March 25, 1993.

IOC: Sept. 3, 1993.

Constellation: four primary, four redundant.

Design Life: 14 yr.

Launch Vehicle: Atlas II.

Unit Location: Schriever AFB, Colo., worldwide Navy locations.

Orbit Altitude: 22,300 miles.

Contractor: Hughes.

Power Plant: two deployed three-panel solar arrays generating 2,500–3,800 watts.

Dimensions: deployed length 60 ft 6 in (F-2–F-7); 86 ft (F-8–F-10); diameter 9 ft 6 in.

Weight: 2,600–3,400 lb.

COMMENTARY

New generation of satellites with 39 channels, providing UHF communications. Compatible with the terminals used by the earlier systems. UFO-4 was the first in the series to include an EHF communications package, constituting 20 channels of Milstar-compatible protected connectivity. UFO-8, -9, and -10 will host GBS phase 2 payloads, providing direct broadcast of digital multimedia information to small tactical terminals. A Gapfiller UFO II is planned.

First Flight: not available

Delivered: from 1984 (B).

IOC: 1987.

Production: 70 (B); 221 (D); 78 (E).

Inventory: not available

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 command-and-control 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 (RDT&E) and the Weapon System Evaluation Program.

MQM-107E. Improved performance follow-on to the MQM-107D. In operational service.

BQM-34 Firebee

Brief: A jet-powered, variable speed, recoverable target drone.



MQM-107 Streaker (Guy Aceto)



BQM-34 Firebee (Guy Aceto)

Function: Aerial target.

Operator: ACC.

First Flight: 1951; 1958 (BQM-34A).

Delivered: from 1951.

IOC: circa 1951.

Production: 1,800+.

Inventory: not available

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 uprated General Electric J85-100 engine provide a thrust-to-weight ratio of 1-to-1, enabling this version to offer higher climb rates and 6g 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: not available

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) and will also accommodate the triservice Target Control System currently under development.

Dimensions: length 63 ft, height 16 ft 5.5 in, wing-span 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 331 F-4E, F-4G, and RF-4C aircraft have been allotted for the FSAT conversion program. ■



QF-4 (SrA. Matthew C. Simpson)

Aerial Targets

MQM-107 Streaker

Brief: A jet-powered, variable speed, recoverable target drone.

Function: Aerial target.

Operator: ACC.