

# Gallery of Weapons

By Aaron M. U. Church

## 2017 USAF Almanac



### B-1 Lancer

TSgt. Richard Ebensberger/USAF

#### BOMBER AIRCRAFT

##### ■ B-1 LANCER

**Brief:** Long-range penetrating bomber capable of delivering the largest weapon load of any aircraft in the Air Force inventory.

##### COMMENTARY

The B-1A was initially proposed as a replacement for the B-52, and four prototypes were developed and tested before program cancellation in 1977. The program was revived in 1981 as the B-1B. The vastly upgraded aircraft added 74,000 lb of usable payload, improved radar, and reduced radar cross section, but cut speed to Mach 1.2. B-1B saw first combat in Iraq during Desert Fox in 1998. Its three internal weapons bays hold a substantial payload, allowing different weapons in each bay. The bomber's blended wing/body configuration, variable-geometry design, and turbofan engines provide long range and loiter time. Offensive avionics include SAR for terrain-following and tracking and targeting moving vehicles. Sniper pod was added in 2008. The ongoing integrated battle station modifications is the most comprehensive refresh in the bomber's history. The three-part upgrade includes the Vertical Situation Display (VSD), which adds a digital cockpit, Fully Integrated Data Link (FIDL) to enhance targeting, command and control, and Central Integrated Test System (CITS), giving aircrew real-time aircraft diagnostics and simplifying maintenance and troubleshooting. FIDL includes Link 16 and Joint Range Extension data link, enabling permanent secure LOS/BLOS/C2. It also adds Ethernet to enable rapid airborne retargeting. Ongoing life extension efforts will stretch service life to 2040. The first Sustainment Block 16 airframe was redelivered to Ellsworth AFB, S.D., in May

2016. FY17 funds support development of higher powered Military Code (M-Code) jam-resistant GPS interface. B-1s resumed Pacific presence rotations to Guam in 2016.

##### EXTANT VARIANT(S)

• B-1B. Upgraded production version of the canceled B-1A.

**Function:** Long-range conventional bomber.

**Operator:** AFGSC, AFMC.

**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:** 62.

**Aircraft Location:** Dyess AFB, Texas; Edwards AFB, Calif.; Eglin AFB, Fla.; Ellsworth AFB, S.D.

**Contractor:** Boeing (formerly Rockwell), Harris Corp.

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

**Accommodation:** Pilot, copilot, and two WSOs (offensive and defensive), on ACES II zero/zero ejection seats.

**Dimensions:** Span 137 ft (spread forward) to 79 ft (swept aft), length 146 ft, height 34 ft.

**Weight:** Max T-O 477,000 lb.

**Ceiling:** More than 30,000 ft.

**Performance:** Speed 900+ mph at S-L, range intercontinental.

**Armament:** 84 Mk 82 (500-lb) or 24 Mk 84 (2,000-lb) general-purpose bombs; 84 Mk 62 (500-lb) or eight Mk 65 (2,000-lb) Quick Strike naval mines; 30 CBU-87/89 cluster bombs or 30 CBU-103/104/105 WCMDs; 24 GBU-31 or 15 GBU-38 JDAMs/GBU-54 LJDAM; 24 AGM-158A JASSM or JASSM-ER.

##### ■ B-2 SPIRIT

**Brief:** Stealthy, long-range nuclear and conventional strike bomber.

##### COMMENTARY

The B-2 is a flying wing that combines LO stealth design with high aerodynamic efficiency. Spirit entered combat against Serb targets during Allied Force on March 24, 1999. B-2 production was completed in three successive blocks and all aircraft were upgraded to Block 30 standards with AESA radar. AESA paves the way for future advanced weapons integration including Long-Range Standoff (LRSO) missile and B61-12 bomb. The aircraft's smoothly blended "fuselage" holds two weapons bays capable of carrying nearly 60,000 lb of weapons in various combinations. New EHF satcom and high-speed computer upgrade recently entered full production. Both are part of the Defensive Management System-Modernization (DMS-M), FY16 began production funding for a new VLF receiver to provide redundancy, and FY17 starts include radio cryptographic modernization for UHF/VHF comms, and a new Adaptable Communications Suite (ACS) to provide time-sensitive mission data, targeting, intelligence, and C2 updates. AEHF comms will provide two-way, survivable communications for nuclear missions in A2/AD environments. Weapons integration includes the improved GBU-57 Massive Ordnance Penetrator, JASSM-ER, and future weapons such as GBU-53 SDB II, GBU-56 Laser JDAM, JDAM-5000, and LRSO. Flexible Strike Package mods will feed GPS data to the weapons bays, allowing prerelease guidance to thwart jamming. Phase 2 will allow nuclear and conventional weapons to be

All inventory numbers are total active inventory figures as of Sept. 30, 2016.



## B-2 Spirit

A1C Arielle Vasquez/USAF

carried simultaneously to increase flexibility. USAF plans to add wideband nuclear C2 under the FAB-T program. Efforts are underway to increase fleet availability, shorten depot-level maintenance, and increase intervals between overhauls. Service life is projected to 2058.

### EXTANT VARIANT(S)

• B-2A. Production aircraft upgraded to Block 30 standards.

**Function:** Long-range heavy bomber.

**Operator:** AFGSC, AFMC, ANG (associate).

**First Flight:** July 17, 1989.

**Delivered:** December 1993-December 1997. (Test asset redelivered as combat capable, July 2000.)

**IOC:** April 1997, Whiteman AFB, Mo.

**Production:** 21.

**Inventory:** 20.

**Aircraft Location:** Edwards AFB, Calif.; Whiteman AFB, Mo.

**Contractor:** Northrop Grumman, Boeing, Vought.

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

**Accommodation:** Two pilots, on ACES II zero-zero ejection seats.

**Dimensions:** Span 172 ft, length 69 ft, height 17 ft.

**Weight:** Max T-O 336,500 lb.

**Ceiling:** 50,000 ft.

**Performance:** Speed high subsonic, estimated unrefueled range 5,000 miles.

**Armament:** Nuclear: 16 B61-7 or B83, or 8 B61-11 bombs (on rotary launchers). Conventional: 80 Mk 62 (500-lb) sea mines, 80 Mk 82 (500-lb) bombs, 80 GBU-38 JDAMs, or 34 CBU-87/89 munitions (on rack assemblies); or 16 GBU-31 JDAMs, 16 Mk 84 (2,000-lb) bombs, 16 AGM-154 JSOWs, 16 AGM-158 JASSMs, or eight GBU-28 LGBs.

### ■ B-52 STRATOFORTRESS

**Brief:** Long-range bomber capable of free-fall nuclear or conventional weapon delivery or cruise missile carriage.

### COMMENTARY

The B-52H is the last serving variant of the Stratofortress. It first flew in 1960, and 102 were delivered between May 1961 and October 1962. The aircraft is USAF's only nuclear cruise missile carrier. Multimission capabilities include long-range precision strike, CAS, air interdiction, defense suppression, and maritime surveillance. Litening and Sniper targeting pods have been added. The overall B-52 System Improvements project is replacing key obsolescent components. The Combat Network Communications Technology (CONNECT) program is replacing cockpit displays and comms and enabling machine-to-machine tasking/retargeting. The first CONNECT airframe was redelivered in 2014. CNS/ATM replaces the

B-52's analog systems with digital systems. The Internal Weapons Bay Upgrade enables internal smart weapon carriage. The first six Conventional Rotary Launchers were delivered under the accelerated program in 2016. The CRL roughly doubles smart weapon payloads, while reducing drag and increasing range. The upgrade supports transition from CALCM to the AGM-158B JASSM-ER long-range cruise missile. Future weapons include the GBU-54 Laser JDAM. Thirty B-52s are undergoing conventional weapon-only modifications to comply with the New START nuclear arms reduction agreement. FY17 efforts will replace the bomber's obsolescent radar with a reliable, modern, off-the-shelf system, add low-latency, jam-resistant C2/comms, and upgrade BLOS voice/data capability to preserve current capabilities.

### EXTANT VARIANT(S)

• B-52H. Dual-capable nuclear and conventional bomber.

**Function:** Long-range heavy bomber.

**Operator:** AFGSC, AFMC, AFRC.

**First Flight:** April 15, 1952 (YB-52 prototype); 1960 (B-52H).

**Delivered:** 1955-October 1962.

**IOC:** June 19, 1955 (B-52A); May 1961 (B-52H).

**Production:** 744.

**Inventory:** 76.

**Aircraft Location:** Barksdale AFB, La.; Edwards AFB, Calif.; Minot AFB, N.D.

**Contractor:** Boeing, Harris.

**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 EWO on upward/downward ejection seats.

## Acronyms and Abbreviations

<b>A2/AD</b>	anti-access, area denial	<b>Comint</b>	communications intelligence	<b>INS</b>	inertial navigation system	<b>ROVER</b>	Remotely Operated Video Enhanced Receiver
<b>ACTD</b>	Advanced Concept Technology Demonstration	<b>CONUS</b>	continental US	<b>IOC</b>	initial operational capability	<b>RPA</b>	remotely piloted aircraft
<b>AE</b>	aeromedical evacuation	<b>CSAR</b>	combat search and rescue	<b>IR</b>	infrared	<b>RWR</b>	radar warning receiver
<b>AEHF</b>	Advanced Extremely High Frequency	<b>CSO</b>	combat systems officer	<b>ISR</b>	intelligence, surveillance, and reconnaissance	<b>SAR</b>	synthetic aperture radar
<b>AESA</b>	active electronically scanned array	<b>DV</b>	distinguished visitors	<b>JASSM</b>	Joint Air-to-Surface Standoff Missile	<b>satcom</b>	satellite communications
<b>AGM</b>	air-to-ground missile	<b>EA</b>	electronic attack	<b>JDAM</b>	Joint Direct Attack Munition	<b>SDB</b>	Small Diameter Bomb
<b>AIM</b>	air intercept missile	<b>ECM</b>	electronic countermeasures	<b>JSOW</b>	Joint Standoff Weapon	<b>SEAD</b>	suppression of enemy air defenses
<b>ALCM</b>	Air Launched Cruise Missile	<b>EELV</b>	Evolved Expendable Launch Vehicle	<b>JSUPT</b>	Joint Specialized Undergraduate Pilot Training	<b>SHF</b>	super high frequency
<b>AMRAAM</b>	Advanced Medium-Range Air-to-Air Missile	<b>EHF</b>	extremely high frequency	<b>JTIDS</b>	Joint Tactical Information Distribution System	<b>shp</b>	shaft horsepower
<b>ASIP</b>	Airborne Signals Intelligence Payload	<b>Elint</b>	electronic intelligence	<b>LANTIRN</b>	Low-Altitude Navigation and Targeting Infrared for Night	<b>Sigint</b>	signals intelligence
<b>ATP</b>	advanced targeting pod	<b>EO</b>	electro-optical	<b>LCD</b>	liquid crystal display	<b>S-L</b>	sea level
<b>BLOS</b>	beyond line of sight	<b>ER</b>	extended range	<b>LF</b>	low frequency	<b>SLEP</b>	service life extension program
<b>BLU</b>	bomb live unit	<b>EW</b>	electronic warfare	<b>LGB</b>	laser guided bomb	<b>SOF</b>	special operations forces
<b>BM</b>	battle management	<b>EWO</b>	electronic warfare officer	<b>LJDAM</b>	Laser Joint Direct Attack Munition	<b>START</b>	Strategic Arms Reduction Treaty
<b>C2</b>	command and control	<b>FAB-T</b>	Family of Advanced Beyond Line of Sight Terminals	<b>LO</b>	low observable	<b>STOL</b>	short takeoff and landing
<b>C3</b>	command, control, and communications	<b>FLIR</b>	forward-looking infrared	<b>LOS</b>	line of sight	<b>TACAN</b>	tactical air navigation to be determined
<b>CALCM</b>	Conventional Air Launched Cruise Missile	<b>FMV</b>	full-motion video	<b>LRIP</b>	low-rate initial production	<b>TBD</b>	to be determined
<b>CAS</b>	close air support	<b>FY</b>	Fiscal Year	<b>MALD</b>	Miniature Air Launched Decoy	<b>TF/TA</b>	terrain-following/terrain-avoidance
<b>CBU</b>	cluster bomb unit	<b>FYDP</b>	Future Years Defense Program	<b>Masint</b>	measurement and signature intelligence multifunction display	<b>T-O</b>	takeoff
<b>CEM</b>	combined effects munition	<b>GATM</b>	Global Air Traffic Management	<b>MFD</b>	multifunction display	<b>UHF</b>	ultrahigh frequency
<b>CEP</b>	circular error probable	<b>GBU</b>	guided bomb unit	<b>N/A</b>	not available	<b>USAFA</b>	US Air Force Academy
<b>CFT</b>	conformal fuel tank	<b>GCS</b>	ground control station	<b>NVG</b>	night vision goggles	<b>VHF</b>	very high frequency
<b>CNS/ATM</b>	communications, navigation, surveillance/air traffic management	<b>HARM</b>	High-speed Anti-Radiation Missile	<b>PGM</b>	precision guided munition	<b>VLF</b>	very low frequency
		<b>HE</b>	high-explosive	<b>PSP</b>	Precision Strike Package	<b>WCMD</b>	Wind-Corrected Munitions Dispenser
		<b>HUD</b>	head-up display			<b>WSO</b>	weapon systems officer
		<b>IFF</b>	identification, friend or foe				
		<b>IIR</b>	imaging infrared				



**B-52 Stratofortress**

A1C Arielle Vasquez/USAF

**Dimensions:** Span 185 ft, length 159.3 ft, height 40.7 ft.  
**Weight:** Max T-O 488,000 lb.  
**Ceiling:** 50,000 ft.  
**Performance:** Speed 650 mph, range 10,000+ miles.  
**Armament:** Nuclear: 12 AGM-86B ALCMs externally, and eight ALCMs or gravity weapons internally. Conventional: AGM-86C/D CALCMs, Mk 62 sea mines, Mk 82/84 bombs, CBU-87/89 cluster bombs, CBU-103/104/105 WCMDs, GBU-31/38 JDAMs, AGM-158A JASSMs, and GBU-10/12/28 LGBs, MALD, and MALD-J jammer variant.

**Function:** Attack.  
**Operator:** ACC, AFMC, PACAF, ANG, AFRC.  
**First Flight:** Feb. 15, 1975 (preproduction).  
**Delivered:** October 1975-March 1984.  
**IOC:** October 1977 (A-10A); 2007 (A-10C).  
**Production:** 713.  
**Inventory:** 283.  
**Aircraft Location:** Barksdale AFB, La.; Boise Air Terminal, Idaho; Davis-Monthan AFB, Ariz.; Eglin AFB, Fla.; Fort Wayne Arpt., Ind.; Martin State Arpt., Md.; Moody AFB, Ga.; Nellis AFB, Nev.; Osan AB, South Korea; Selfridge ANGB, Mich.; Whiteman AFB, Mo.  
**Contractor:** Fairchild Republic (Lockheed Martin).

of internal fuel (with provision for CFTs). The aircraft accounted for 34 of 37 USAF air-to-air kills during combat debut in Desert Storm. The final 43 production aircraft received the F-15E's APG-70 radar, and the Multistage Improvement Program enhanced tactical capabilities. The F-15C/D is undergoing vital improvements, including new AESA radar and self defenses, needed to survive and fight in future, contested airspace. The first APG-63(V)3 AESA-modified F-15 was delivered in 2010, and the Eagle Passive/Active Warning Survivability System (EPAWSS) engineering development contract was awarded in 2016. EPAWSS initially replaces the current, obsolete system. A second phase will add a towed decoy/angled countermeasure capability. A total of 214 aircraft will be upgraded to augment the limited F-22 fleet. Additional upgrades include jam-resistant Mode 5-compliant IFF and higher capacity, jam-resistant Link 16. Development includes infrared search and track (IRST) to discreetly detect, track, and engage air targets, and advanced data links to enhance interoperability with fifth generation aircraft. New digital cockpit displays will fully exploit AESA capabilities (common with the F-15E). USAF is seeking to rewire the fleet to extend its service life to 2045. The service reduced retirements over the FYDP to support increased European deployments.

## FIGHTER & ATTACK AIRCRAFT

### ■ A-10 THUNDERBOLT II

**Brief:** Twin-engine aircraft designed for CAS against a wide range of ground targets, including tanks and armored vehicles.

#### COMMENTARY

The A-10C is an A-10A with precision engagement modifications, including color cockpit MFDs, hands-on throttle and stick, digital stores management, improved fire-control system, GPS guided weapons, Litening/Sniper pods, advanced data links, and integrated sensors. A-10C deployed to combat for the first time in 2007. It combines a large, diverse weapons payload, long loiter times, austere airfield capability, maneuverability, and wide combat radius. Using night vision and targeting pods, it is capable of operating under 1,000-ft ceilings in darkness. The aircraft has 11 hardpoints for up to 16,000 lb of ordnance. Its 30 mm gun can destroy heavy armor, and its titanium cockpit tub protects the pilot. Current upgrades include advanced IFF and open architecture software to allow quick integration of future weapons and sensors. The last of 278 aircraft were upgraded with Helmet Mounted Cueing System (HMCS) in 2015, and USAF is pursuing wing replacement beyond the initial 173 aircraft program ending in FY16. Integration of the Advanced Precision Kill Weapon System (AP-KWS) recently added carriage of 98 low-collateral, laser guided rockets, immediately arming A-10s in combat over Iraq and Syria. USAF reversed early retirement plans in favor of retaining the A-10 in service until 2022. FY17 funds support Lightweight Airborne Recovery System/Combat Survivor Evader Locator (LARS/CSEL) upgrades to enhance the A-10's ability to locate and aid recovery of downed aircrew.

**Power Plant:** Two General Electric TF34-GE-100 turbofans, each 9,065 lb thrust.  
**Accommodation:** Pilot on ACES II zero/zero ejection seat.  
**Dimensions:** Span 57.5 ft, length 53.3 ft, height 14.7 ft.  
**Weight:** Max T-O 51,000 lb.  
**Ceiling:** 45,000 ft.  
**Performance:** Speed 518 mph, range 800 miles.  
**Armament:** One 30 mm, seven-barrel GAU-8/A Gatling gun (1,174 rd), straight high-explosive incendiary (HEI), or anti-armor HE/armor-piercing incendiary (API). Combat mix incl various types of free-fall or guided bombs such as Mk 82, Mk 84, GBU-10/12/38, CBU-87, laser guided rockets, various WCMDs, illumination rockets/flares, AGM-65 Mavericks, and AIM-9 Sidewinders.

### ■ F-15 EAGLE

**Brief:** Supersonic, highly maneuverable, all-weather fighter designed to swiftly gain and maintain combat air superiority.

#### COMMENTARY

The F-15 was the world's dominant air superiority fighter for more than 30 years. F-15C/Ds began replacing F-15A/Bs in 1979 and offered superior maneuverability and acceleration, range, weapons, and avionics. It incorporates internal EW countermeasures and an added 2,000 lb

#### EXTANT VARIANT(S)

- F-15C/D. Upgraded version of the original F-15A/B air superiority fighter.
- Function:** Air superiority fighter.  
**Operator:** ACC, AFMC, PACAF, USAF, ANG.  
**First Flight:** July 27, 1972 (F-15A).  
**Delivered:** November 1974-79 (F-15A/B); 1979-85 (F-15C/D).  
**IOC:** September 1975.  
**Production:** 874.  
**Inventory:** 212 (F-15C); 24 (F-15D).  
**Aircraft Location:** Barnes Arpt., Mass.; Eglin AFB, Fla.; Fresno ANGB, Calif.; Jacksonville Arpt., Fla.; Kadena AB, Japan; Klamath Falls (Kingsley Field), Ore.; NAS JRB New Orleans,



**A-10 Thunderbolt II**

A1C Giovanni Sims/USAF

#### EXTANT VARIANT(S)

- A-10C. Upgraded version of the A-10A ground attack aircraft.



**F-15E Strike Eagle**

Ann. Daniel Snider/USAF

La.; Portland Arpt., Ore.; RAF Lakenheath, UK.  
**Contractor:** McDonnell Douglas (now Boeing), BAE Systems (EPAWSS), Raytheon (AESA).  
**Power Plant:** Two Pratt & Whitney F100-PW-220 turbofan engines, each 23,450 lb thrust; or two P&W F100-PW-229 turbofan engines with afterburners, each 29,000 lb thrust.  
**Accommodation:** Pilot (C); two pilots (D) on ACES II zero/zero ejection seats.  
**Dimensions:** Span 42.8 ft, length 63.8 ft, height 18.7 ft.  
**Weight:** Max T-O 68,000 lb.  
**Ceiling:** 60,000 ft.  
**Performance:** F-15C: speed Mach 2.5, ferry range 2,878 miles (3,450 miles with CFTs and three external tanks).  
**Armament:** One internally mounted M61A1 20 mm six-barrel cannon (940 rd); four AIM-9 Sidewinders and four AIM-120 AMRAAMs, or eight AIM-120s, carried externally.

#### ■ F-15E STRIKE EAGLE

**Brief:** Heavily modified two-seat dual-role F-15 designed for all-weather deep interdiction and attack as well as air-to-air combat.

#### COMMENTARY

F-15E is an upgraded heavyweight, multirole F-15 capable of sustaining nine Gs throughout the flight envelope. It entered combat during Desert Storm in 1991. F-15E's large, varied load of precision weapons and 20 mm cannon gives it potent ground attack capability. Radar guided and IR-homing missiles give it an additional air-to-air capability. Its advanced cockpit controls and displays include a wide-field-of-view HUD and helmet mounted cockpit-cueing, and its avionics permit all-weather day/night engagement. The F-15E carries LANTIRN, Sniper, and Litening ATPs on dedicated pylons. A SAR pod provides surveillance/reconnaissance capability. The aircraft are equipped with Link 16 and ARC-210 BLOS satcom. Ongoing upgrades include new APG-82(V)1 AESA radar and Eagle Passive/Active Warning Survivability System (EPAWSS) to replace its obsolete self-defense suite. The combined EPAWSS engineering development contract for all F-15 variants was awarded in 2016. USAF increased development, test, and evaluation funding for FY17 to support EPAWSS, AESA integration, new central computer and cockpit displays (in common with the F-15C/D), jam-resistant Link 16, Mode 5 IFF, and passive IR search and track (IRST). Fatigue testing is underway to determine SLEP requirements to reach 2035 or beyond.

#### EXTANT VARIANT(S)

- F-15E. Multirole fighter aircraft derived from the F-15.

**Function:** Multirole fighter.  
**Operator:** ACC, AFMC, USAF.  
**First Flight:** Dec. 11, 1986.  
**Delivered:** April 1988-2004.  
**IOC:** September 1989.  
**Production:** 236.  
**Inventory:** 220.  
**Aircraft Location:** Eglin AFB, Fla.; Mountain Home AFB, Idaho; Nellis AFB, Nev.; RAF Lakenheath, UK; Seymour Johnson AFB, N.C.  
**Contractor:** McDonnell Douglas (now Boeing), BAE Systems (EPAWSS), Raytheon (AESA).  
**Power Plant:** Two Pratt & Whitney F100-PW-220, each 23,450 lb thrust; or two F100-PW-229 turbofans with afterburners, each 29,000 lb thrust.

**Accommodation:** Pilot and WSO on ACES II zero/zero ejection seats.  
**Dimensions:** Span 42.8 ft, length 63.8 ft, height 18.5 ft.  
**Weight:** Max T-O 81,000 lb.  
**Ceiling:** 50,000 ft.

**Performance:** Speed Mach 2.5, ferry range 2,400 miles with CFTs and three external tanks.  
**Armament:** One internally mounted M61A1 20 mm six-barrel cannon (500 rd); four AIM-9 Sidewinders and four AIM-120 AMRAAMs or eight AIM-120s; most air-to-surface weapons in USAF inventory (nuclear and conventional).

#### ■ F-16 FIGHTING FALCON

**Brief:** Highly maneuverable multirole fighter proven in air-to-air combat, SEAD, and air-to-surface attack.

#### COMMENTARY

The F-16 comprises 50 percent of USAF's fighter fleet and is among the most maneuverable fighters ever built. It is a lightweight fighter capable of carrying the majority of PGMs. The F-16 entered combat during the 1991 Gulf War. The F-16C/D was introduced in 1984, at Block 25. It featured cockpit, airframe, and core avionics upgrades and added the increased-range APG-68 radar and AMRAAM. Block 30/32 added next stage improvements, new engines, and weapons including HARM. Block 40/42 delivered in 1988 introduced the LANTIRN pod, enabling automatic terrain following and high-speed night/all-weather penetration. It also introduced wide-angle HUD, increased takeoff weight, expanded flight envelope, and higher G limits. Block 50/52 delivered in 1991 is optimized for SEAD, employing HARM and a longer range radar. It added the updated F110-GE-129 and F100-PW-229 engines, upgradable cockpit, Sniper/Litening ATPs, and ROVER to coordinate with strike controllers. Blocks 40 through 52 were cockpit-standardized with a new color MFD, modular mission computer,



**F-16 Fighting Falcon**

Helmet Mounted Integrated Targeting (HMIT), and Link 16. Block 30/32 aircraft are still undergoing mods. Automatic Ground Collision Avoidance System (A-GCAS) was added in 2014. Future efforts include adding air collision avoidance and merging the two systems, as well as developing a similar system that is compatible with early block, analog flight-control systems. SLEP development efforts to extend fatigue life beyond 10,000 hours began in 2016. FY17 funds support modifying AESA radar retrofits to allow NORAD alert aircraft to counter cruise missile threats. JASSM-ER integration and high-capacity, secure, and civil-compliant comm/data link mods are ongoing.

#### EXTANT VARIANT(S)

- F-16C/D Block 30/32. Multinational Staged Improvement Program II upgraded with new engines, flown by ANG, AFRC, and test and aggressor units.
- F-16CG Block 40/42. Aircraft optimized for night and all-weather attack.
- F-16CJ Block 50/52. Aircraft optimized for SEAD with new long-range radar, engines, and weapons.

**Function:** Multirole fighter.

**Operator:** ACC, AETC, AFMC, PACAF, USAF, ANG, AFRC.

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

**Delivered:** January 1979-2005.

**IOC:** October 1980, Hill AFB, Utah.

**Production:** 2,206.

**Inventory:** 793 (F-16C); 156 (F-16D).

**Aircraft Location:** Aviano AB, Italy; Edwards AFB, Calif.; Eglin AFB, Fla.; Eielson AFB, Alaska; Hill AFB, Utah; Holloman AFB, N.M.; Homestead ARB, Fla.; Kunsan AB, South Korea; Luke AFB, Ariz.; Misawa AB, Japan; NAS JRB Fort Worth, Texas; Nellis AFB, Nev.; Osan AB, South Korea; Shaw AFB, S.C.; Spangdahlem AB, Germany; and ANG in Alabama, Arizona, Colorado, District of Columbia (flying out of Maryland), Minnesota, New Jersey, Ohio, Oklahoma, South Carolina, South Dakota, Texas, Vermont, Wisconsin.

**Contractor:** General Dynamics (now Lockheed Martin), Northrop Grumman (radar).

**Power Plant:** Block 40: one General Electric F110-GE-100 (29,000 lb thrust); Block 42: one Pratt & Whitney F100-PW-220 (24,000 lb thrust); Block 50: one F110-GE-129 (29,000 lb thrust); Block 52: one F100-PW-229 (29,000 lb thrust).

**Accommodation:** Pilot (C); two pilots (D) on ACES II zero/zero ejection seats.

**Dimensions:** Span 32.8 ft, length 49.3 ft, height 16.7 ft.

**Weight:** F-16C: empty (F100-PW-229) 18,591 lb, (F110-GE-129) 18,917 lb; gross, with external load (Block 40/42) 42,000 lb.



SrA. Areca T. Bell/USAF

**Ceiling:** 50,000 ft.

**Performance:** Speed Mach 2, ferry range 2,002+ miles.

**Armament:** One M61A1 20 mm cannon (500 rd); up to six air-to-air missiles, AGMs, and ECM pods externally.

### ■ F-22 RAPTOR

**Brief:** Fifth generation, multirole fighter designed to penetrate advanced air defenses and achieve air dominance.

### COMMENTARY

The F-22 is built for day, night, and adverse weather full-spectrum operations. The world's most advanced fighter, it combines stealth, supercruise, high maneuverability, and integrated avionics. Its integrated avionics and data links permit simultaneous multitarget engagement. Advanced flight controls and thrust vectoring high-performance engines lend great maneuverability. Features include six LCD color cockpit displays, APG-77 radar, EW system with RWR and missile launch detector, JTIDS, IFF system, laser gyroscope inertial reference, and GPS. The Raptor flew its first operational sortie during Noble Eagle in 2006 and debuted in combat during Inherent Resolve over Iraq and Syria in 2014. Four aircraft successfully employed 1,000-lb JDAMs against ISIS ground targets during the aircraft's first combat sortie. Ongoing upgrades include the Reliability, Availability, and Maintainability Maturation Program (RAMMP), software Increment 3.1, and tactical capability improvements, which collectively retrofit combat-coded F-22s with enhanced ground attack, air-to-air, and networking. RAMMP is adding AIM-9X-capable launch rails, and the next software package will add high resolution ground mapping SAR, threat geolocation, EA capability, and integration of SDB I, AIM-120D, and AIM-9X. Five test aircraft are modified to 3.2 standards to begin operational testing in FY17, and fleetwide mods are slated to begin FY18. Additional upgrades include engine safety, performance, and maintainability mods, phase two structural upgrades to extend fleet life, and improved ISR and comms. USAF is exploring options to improve situational awareness and targeting with development of the Raptor Helmet Mounted Display and Cueing System (RHMDCS) and to upgrade training airframes to combat-coded specifications.

### EXTANT VARIANT(S)

- F-22A. Fifth generation air dominance fighter.
- Function:** Multirole air dominance fighter.
- Operator:** ACC, AFMC, AFRC (associate), PACAF, ANG.
- First Flight:** Sept. 7, 1997.



SrA. Alex Fox Echols III/USAF

### F-22 Raptor

**Delivered:** 2002 (first production representative aircraft).

**IOC:** Dec. 15, 2005.

**Production:** 195.

**Inventory:** 187.

**Aircraft Location:** Edwards AFB, Calif.; JB Elmendorf-Richardson, Alaska; JB Langley-Eustis, Va.; JB Pearl Harbor-Hickam, Hawaii; Nellis AFB, Nev.; Tyndall AFB, Fla.

**Contractor:** Lockheed Martin, Boeing.

**Power Plant:** Two Pratt & Whitney F119-PW-100 turbofans, each 35,000 lb thrust.

**Accommodation:** Pilot on ACES II zero/zero ejection seat.

**Dimensions:** Span 44.5 ft, length 62 ft, height 16.6 ft.

**Weight:** Max T-O 83,500 lb.

**Ceiling:** Above 50,000 ft.

**Performance:** Speed Mach 2 with supercruise capability, ferry range 1,850+ miles with two external wing fuel tanks.

**Armament:** One internal M61A2 20 mm gun (480 rds); two AIM-9 Sidewinders stored inside internal weapons bays; six AIM-120 AMRAAMs (air-to-air loadout) or two AIM-120s and two GBU-32 JDAMs (air-to-ground loadout) in main internal weapons bay.

### ■ F-35 LIGHTNING II

**Brief:** Stealthy, next generation, joint service strike aircraft.

### COMMENTARY

The F-35 is a joint and multinational program aimed at fielding an affordable, highly common family of next generation strike fighters. USAF's F-35A will replace F-16 and A-10 fleets with a stealthy, multirole fighter capable of penetrating advanced enemy air defenses and striking targets at will. The F-35A carries up to 18,000 lb of weapons on 10 stations, including four internal bays (for maximum stealth) and six additional wing-mounted pylons. The service



### F-35A Lightning II

R. Nial Bradshaw/USAF

received its first production aircraft—AF-7—in 2008. USAF most recently awarded LRIP Lot 9 and Lot 10 covering delivery of 85 F-35As to the service through 2020. The Marine Corps declared F-35 IOC in 2015. USAF reached IOC at Hill AFB, Utah, on Aug. 2, 2016, with the first aircraft upgraded with Block 3I software. Block 3I improves the baseline Block 2B software, adding 89 percent of the code needed for full combat capability. The Block 3F software, in testing, will enable full combat capability, adding a range of precision guided munitions. Fiscal 2017 launches Block 4 development to add new weapons and sensors, improve the F-35's EW capabilities, and integrate nuclear weapons beyond 2020. A fuel system flaw partially grounded the fleet last year, but jets were cleared to resume interim flight until depot-level mods are completed. Lockheed Martin delivered the 100th F-35A to Luke AFB, Ariz., on Aug. 26, 2016, and FY17 funding supports procurement of 43 F-35As.

### EXTANT VARIANT(S)

- F-35A. Conventional takeoff and landing (CTOL) variant for the Air Force.
- F-35B. Short takeoff and vertical landing (STOVL) variant for USMC.
- F-35C. Carrier-capable variant for Navy.

**Function:** Multirole fighter.

**Operator:** ACC, AETC, AFMC, AFRC. Planned: PACAF, USAF, ANG.

**First Flight:** Dec. 15, 2006 (F-35A prototype).

**Delivered:** April 2011 (first production aircraft).

**IOC:** Aug. 2, 2016.

**Production:** Planned: 1,763 USAF (F-35A); 680 Navy and Marine Corps (F-35B/C); unspecified number to development partners and foreign military sales customers.

**Inventory:** 96 (USAF).

**Aircraft Location:** Edwards AFB, Calif.; Eglin AFB, Fla.; Hill AFB, Utah; Luke AFB, Ariz.; Nellis AFB, Nev.; future locations include Burlington Arpt., Vt.; Eielson AFB, Alaska; RAF Lakenheath, UK; others TBD.

**Contractor:** Lockheed Martin, BAE Systems, Northrop Grumman, Pratt & Whitney.

**Power Plant:** F-35A: one Pratt & Whitney F135-PW-100, 40,000 lb thrust.

**Accommodation:** Pilot on Martin Baker MK16 zero/zero ejection seat.

**Dimensions:** Span 35 ft, length 51.4 ft, height 14.4 ft.

**Weight:** Max T-O 70,000 lb.

**Ceiling:** 50,000 ft.

**Performance:** Speed Mach 1.6 with full internal weapons load, range 1,380 miles.

**Armament:** F-35A: one 25 mm GAU-22/A cannon; standard internal loadout: two AIM-120 AMRAAMs and two GBU-31 JDAMs.

## SPECIAL OPERATIONS AIRCRAFT

### ■ AC-130J GHOSTRIDER

**Brief:** Modified MC-130J armed with side-firing weapons, low-yield PGMs, and sensors optimized for CAS and air interdiction, specifically suited to urban operations.

#### COMMENTARY

The AC-130J is a next generation gunship based on a significantly modified MC-130J, fitted with a modular PSP, and wing-mounted weapon racks. The AC-130J is designed to provide ground forces with a persistent direct-fire platform for urban operations. PSP includes a mission management console, robust communications suite, two EO/IR sensors, advanced fire-control equipment, PGM delivery capability, and trainable cannons. Initial Block 10 aircraft include fully integrated digital avionics cockpit, GPS/INS, integrated defensive systems, color weather radar, and PSP. Block 20 configuration adds a 105 mm gun, laser guided SDB, a side-mounted pilot tactical display, and Large Aircraft Infrared Countermeasures (LAIRCM). Airframes are delivered as MC-130Js for subsequent modification as gunships. The prototype flew its first post-conversion flight in 2014, but was declared a loss after departing controlled flight during developmental testing at Eglin AFB, Fla. The first Block 20 was delivered to Hurlburt Field, Fla., in July 2016 and began live-fire evaluation of the 105 mm cannon and Laser Guided SDB (LSDB). Block 20 operational testing at Hurlburt will continue through mid-2017. Four MC-130Js are undergoing conversion and FY17 funds convert four more. Future upgrades include a high-energy laser weapon, air-launched RPAs to provide below-the-cloud targeting data for all-weather strike, and integration of laser guided Hellfire missiles.

#### EXTANT VARIANT(S)

- AC-130J Ghost rider Block 10. Prototype gunship based on the MC-130J.
- AC-130J Ghost rider Block 20. Production standard gunship with additional 105 mm gun.

**Function:** Attack.

**Operator:** AFSOC.

**First Flight:** April 5, 1996 (basic C-130J).

**Delivered:** From 2014 (prototype).

**IOC:** 2017 (planned).

**Production:** Four (37 to be converted from new-build MC-130Js).

**Inventory:** Three.

**Aircraft Location:** Hurlburt Field, Fla.

**Contractor:** Lockheed Martin.

**Power Plant:** Four Rolls Royce AE 2100D3 turboprops, each 4,700 shp.

**Accommodation:** Two pilots, two CSOs, three gunners (four, with inclusion of 105 mm gun).

**Dimensions:** Span 132.6 ft, length 97.7 ft, height 39.1 ft.

**Weight:** Max T-O 164,000 lb.

**Ceiling:** 28,000 ft., 42,000 lb payload.

**Performance:** Speed 416 mph, range 3,000 miles.

**Armament:** Trainable 30 mm GAU-23/Acannon; 105 mm cannon; PGMs.

### ■ AC-130U SPOOKY

**Brief:** Modified C-130H armed with side-firing weapons and sensors optimized for precision night and all-weather CAS, long-endurance interdiction, and armed reconnaissance.

#### COMMENTARY

AC-130U is a gunship-configured C-130H



modified with gun systems, electronic and EO sensors, fire-control systems, enhanced navigation, sophisticated comms, defensive systems, and in-flight refueling capability. All AC-130U weapons can be subordinated to the APQ-180 digital fire-control radar, FLIR, or all-light-level television (ALLTV) for adverse weather attack operations. Rockwell converted the initial 13 AC-130Us in 1994-95, and Boeing more recently converted four more, all dubbed "Spooky" in reference to the early AC-47D gunship. The command retired a single nonstandard AC-130U in 2015, before halting phaseout. AFSOC is retaining 16 legacy AC-130Us and accelerating center wing box replacements to extend serviceability and meet high operational demands until replaced by AC-130Js. Ongoing upgrades include Enhanced Situational Awareness (ESA) program mods to provide near real-time intel and data fusion of threat detection, avoidance, geolocation, and adversary-emitter identification. Other upgrades include replacing obsolescent mission computers and EO/IR sensors with a new high-definition suite, and GPS updates. All AC-130Us serve with the 1st Special Operations Wing at Hurlburt Field, Fla.

#### EXTANT VARIANT(S)

- AC-130U Spooky II. Third generation gunship based on C-130H.

**Function:** Attack.

**Operator:** AFSOC.

**First Flight:** 1967.

**Delivered:** 1968-present.

**IOC:** 1996.

**Production:** 43, incl four more recent conversions.

**Inventory:** 16 (AC-130U).

**Aircraft Location:** Hurlburt Field, Fla.

**Contractor:** Lockheed Martin (airframe), Boeing (formerly Rockwell).

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

**Accommodation:** Two pilots, navigator, fire-control officer, EWO; flight engineer, TV operator, IR detection set operator, loadmaster, four aerial gunners.

**Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.5 ft.

**Weight:** Gross 155,000 lb.

**Ceiling:** 25,000 ft.

**Performance:** Speed 300 mph, range 1,300 miles.

**Armament:** One 25 mm Gatling gun, plus one 40 mm and one 105 mm cannon.

### ■ AC-130W STINGER II

**Brief:** Modified C-130H variant primarily de-

signed for armed overwatch, reconnaissance, and direct ordnance delivery to support ground troops.

#### COMMENTARY

The AC-130W is a C-130H significantly modified with improved navigation, threat detection, countermeasures, comms, and a standoff Precision Strike Package. The aircraft performs armed overwatch, CAS, and reconnaissance over friendly positions for threat prevention. AC-130Ws also provide strike coordination, nontraditional ISR, and C2. PSP mod includes a mission management console, communications suite, and flight deck hardware. The airframes were originally converted as MC-130W Combat Spear for SOF infiltration/exfiltration and in-flight refueling. Aircraft were redesignated Dragon Spear with the addition of the roll on/roll off PSP to fill a need for more gunships in 2010. The aircraft was redesignated AC-130W Stinger II after further enhancements in 2012. New AC-130Js will eventually replace the AC-130Ws, which average more than 24 years old. Ongoing upgrades include Enhanced Situational Awareness (ESA) program mods to provide near real-time intel and data fusion capability, including threat detection, avoidance, geolocation, and adversary-emitter identification. SDB was added in 2012, and all aircraft are slated for retrofit with a 105 mm gun in common with the AC-130U/J fleets. Ongoing weapons integration includes Hellfire and Laser Guided SDB (LSDB). Future development include enhanced IR suppression to reduce engine heat signatures. A single aircraft will be modified with a high-energy laser (in place of the 30 mm gun) to develop future AC-130J armament.

#### EXTANT VARIANT(S)

- AC-130W Stinger II. Converted MC-130W armed with PSP and PGMs.

**Function:** Attack, armed reconnaissance.

**Operator:** AFSOC.

**First Flight:** Circa 2006 (Combat Spear).

**Delivered:** November 2010 (Dragon Spear).

**IOC:** 2010 (Dragon Spear).

**Production:** 12 (converted).

**Inventory:** 12.

**Aircraft Location:** Cannon AFB, N.M.

**Contractor:** Lockheed Martin.

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

**Accommodation:** Two pilots, two CSOs, flight engineer, two special mission aviators.

**Dimensions:** Span 132.6 ft, length 98.8 ft, height 38.5 ft.

**Weight:** Max T-O 155,000 lb.

**Ceiling:** 28,000 ft.

**Performance:** Speed 300 mph, range 2,875 miles.

**Armament:** 30 mm GAU-23/A Bushmaster II chain gun; PGMs, incl GBU-39 SDB and AGM-176A Griffin, 105 mm cannon (planned).

#### ■ C-145 SKYTRUCK

**Brief:** Militarized STOL multipurpose utility aircraft used for foreign internal defense and light SOF mobility missions.

#### COMMENTARY

The C-145 is a version of the Polish-built PZL Mielec M-28 Skytruck high-wing STOL aircraft with nonretractable landing gear for austere operations. USSOCOM assets are operated by AFSOC as a nonstandard fleet initially supporting small combat teams. The aircraft first deployed in 2011 to Afghanistan. It is reconfigurable for 2,400 lb of cargo airdrop, casualty evacuation, CSAR, and humanitarian missions. C-145As later shifted to partnership capacity building Aviation Foreign Internal Defense (AvFID) missions. AFSOC now uses contract aircraft to provide partner countries with more tailored assistance and opted to cut the fleet from 16 to the current five aircraft in 2015. C-145s now provide aircrew proficiency for combat aviation advisors.

#### EXTANT VARIANT(S)

• C-145A. Militarized civilian M-28 Skytruck used for SOF support and training.

**Function:** Foreign training and light mobility.

**Operator:** AFSOC, AFRC (associate).

**First Flight:** July 1993 (PZL M-28).

**Delivered:** From 2009.

**IOC:** N/A.

**Production:** 16.

**Inventory:** Five, USSOCOM-owned.

**Aircraft Location:** Duke Field, Fla.

**Contractor:** PZL Mielec (Sikorsky subsidiary).

**Power Plant:** Two Pratt & Whitney PT6A-65B turboprops, 1,100 shp.

**Accommodation:** Crew: two pilots, one loadmaster. Load: 16 passengers or 10 paratroopers; up to four litters; max cargo 5,000 lb.

**Dimensions:** Span 72.3 ft, length 43 ft, height 16.1 ft.

**Weight:** Max T-O 16,534 lb.

**Ceiling:** 25,000 ft.

**Performance:** Speed 256.5 mph, range 1,161.5 miles.

#### ■ C-146 WOLFHOUND

**Brief:** Militarized commuter airliner that provides flexible and responsive mobility support to SOF worldwide.

#### COMMENTARY

The German-built Dornier 328 was purchased

by USSOCOM, modified by Sierra Nevada Corp., and designated C-146. The aircraft are operated by AFSOC as a nonstandard fleet providing direct support to SOF teams worldwide, often from semiprepared airfields. Modifications include ARC-231, PRC-117, and Iridium communications suite, troop/cargo-capable cabin, casualty evacuation capability, NVG compatibility, and STOL austere operations enhancements. The aircraft first deployed in support of USAFRICOM operations in 2011.

#### EXTANT VARIANT(S)

• C-146A. Preowned civil Dornier 328 modified for SOF airlift.

**Function:** Multimission mobility.

**Operator:** AFSOC.

**First Flight:** December 1991 (Do 328).

**Delivered:** From 2011.

**IOC:** N/A.

**Production:** 20 (converted).

**Inventory:** USSOCOM-owned.

**Aircraft Location:** Cannon AFB, N.M.; Duke Field, Fla.; forward operating locations worldwide.

**Contractor:** Fairchild-Dornier, Sierra Nevada Corp.

**Power Plant:** Two Pratt & Whitney 119C turboprops, 2,150 shp.

**Accommodation:** Crew: two pilots, one loadmaster. Load: 27 passengers; up to four litters; max cargo 6,000 lb.

**Dimensions:** Span 69.6 ft, length 68.8 ft, height 23.8 ft.

**Weight:** Max T-O 30,843 lb.

**Ceiling:** 31,000 ft.

**Performance:** Speed 335 mph, range 2,070 miles (2,000 lb cargo).

#### ■ CV-22 OSPREY

**Brief:** Long-range, multimission tilt-rotor designed to combine the vertical capability of a helicopter with the speed of a fixed wing aircraft.

#### COMMENTARY

The CV-22 is a medium-lift vertical takeoff and landing (VTOL) tilt-rotor, primarily used for clandestine long-range, all-weather penetration to insert, recover, and support SOF teams. USAF CV-22Bs are equipped with a fully integrated precision TF/TA radar navigation, digital cockpit management system, FLIR, integrated NVG/HUD, digital map system, robust self-defense systems, and secure anti-jam comms. CV-22 can conduct shipboard and austere forward operations. It is capable of operating in nuclear, biological, and chemical (NBC) warfare conditions. It deployed to Africa in November 2008 and first saw combat in Iraq in 2009. AFSOC is retrofitting the CV-22 to Block 20 standards, in common with USMC MV-22s. Mods include new



CV-22 Osprey

A1C Joseph Pick/USAF

cabin lighting, color helmet mounted displays, IR searchlight, lightweight ballistic armor, EW upgrades, and situational awareness enhancements. The Silent Knight TF/TA radar (common to the MC-130J) will replace the current radar with a stealthier, low-altitude night/all-weather navigation radar. Europe-based CV-22s will shift to Spangdahlem AB, Germany, with the planned closure of RAF Mildenhall, UK. New ANG associate units formed to jointly operate aircraft at Hurlburt Field, Fla., and Kirtland AFB, N.M. USAF plans to establish a Pacific-based presence at Yokota AB, Japan, and the final production aircraft is slated for delivery in 2017.

#### EXTANT VARIANT(S)

• CV-22B. Air Force special operations variant of the V-22 Osprey.

**Function:** Multimission lift.

**Operator:** AETC, AFSOC, ANG (associate).

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

**Delivered:** January 2007-present.

**IOC:** 2009.

**Production:** 50 planned (CV-22; incl two replacements).

**Inventory:** 49.

**Aircraft Location:** Cannon AFB, N.M.; Hurlburt Field, Fla.; Kirtland AFB, N.M.; RAF Mildenhall, UK. Planned: Spangdahlem AB, Germany. Yokota AB, Japan.

**Contractor:** Boeing, Bell Helicopter Textron.

**Power Plant:** Two Rolls Royce-Allison AE1107C turboshafts, each 6,200 shp.

**Accommodation:** Crew: two pilots; two flight engineers. Load: 24 troops seated, 32 troops on floor, or 10,000 lb cargo.

**Dimensions:** Span 84.6 ft, length 57.3 ft, height 22.1 ft, rotor diameter 38 ft.

**Weight:** Max vertical T-O 52,870 lb; max rolling T-O 60,500 lb.

**Ceiling:** 25,000 ft.

**Performance:** Cruise speed 277 mph, combat radius 575 miles with one internal auxiliary fuel tank, self-deploy 2,100 miles with one in-flight refueling.

**Armament:** One .50-caliber machine gun on ramp.

#### ■ MC-130P/H COMBAT SHADOW/COMBAT TALON II

**Brief:** Modified C-130 tasked with day, night, and adverse weather special operations force insertion and air-drop resupply and rotary wing aerial refueling.

#### COMMENTARY

The MC-130 is a special operations mobility aircraft, primarily used to conduct infiltration, resupply, and exfiltration of SOF. MC-130E/Hs are equipped with TF/TA radars, precision navigation systems using INS/GPS, and electronic and IR countermeasures for self-protection.



C-146 Wolfhound

TSgt. Samuel King Jr./USAF



MC-130J Commando II

SrA. Peter Reft/USAF



E-3 Sentry

All models are capable of aerial refueling as a receiver and supplier. Aircraft are capable of airdrop, using Joint Precision Airdrop System, and operating from austere and unmarked strips. Fourteen MC-130E were converted from C-130Es. MC-130Ps (previously HC-130N/P) are a specialized aerial refueling version designed to support SOF and were delivered in the mid-1980s. MC-130H were converted from base-model C-130H to supplement the existing Combat Talon I and Combat Shadow fleets in the late 1980s and early 1990s. MC-130Hs have integrated glass cockpit and a modernized pod-based aerial refueling system. Ongoing MC-130H mods include center wing replacement, new mission computers, GPS upgrades, permanent Sigint installation, threat warning upgrades, and new lightweight armor. AFSOC is replacing the MC-130P with the new MC-130J, and the California ANG is the variant's sole remaining user. MC-130Hs from Kirtland AFB, N.M., consolidated to Hurlburt Field, Fla., in 2016, and Kadena AB, Japan, is retaining several H models only until its MC-130Js achieve TF/TA capability.

#### EXTANT VARIANT(S)

- MC-130P Combat Shadow. SOF support and aerial refueling tanker fielded in 1986.
- MC-130H Combat Talon II. SOF support and aerial refueling tanker fielded in 1991.

**Function:** Special operations airlift/aerial refueling.

**Operator:** AFSOC, ANG.

**First Flight:** Circa 1965 MC-130E; 1984 MC-130H.

**Delivered:** Initially 1966.

**IOC:** 1986 MC-130P; 1991 MC-130H.

**Production:** 22 new-build MC-130Hs.

**Inventory:** Four (MC-130P); 17 (MC-130H).

**Aircraft Location:** Hurlburt Field, Fla.; Kadena AB, Japan; Moffett Field, Calif. (MC-130P).

**Contractor:** Lockheed Martin (airframe), Boeing.

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

**Accommodation:** MC-130H crew: two pilots, navigator, EWO; flight engineer, two loadmasters. MC-130H load: 77 troops, 52 paratroops, or 57 litters.

**Dimensions:** Span 132.6 ft, height 38.5 ft, length 99.8 ft.

**Weight:** Max T-O 155,000 lb.

**Ceiling:** 33,000 ft.

**Performance:** Speed 290 mph, range 4,000+ miles (MC-130P); speed 300 mph, range 3,105 miles (MC-130H).

#### ■ MC-130J COMMANDO II

**Brief:** Modified C-130J optimized for low-level clandestine operations, aerial refueling

of rotary wing aircraft, and resupply of special operations forces.

#### COMMENTARY

MC-130J is a specialized tanker variant of the C-130J, for clandestine intrusion into hostile areas to provide air refueling of SOF helicopters and CV-22s. MC-130J enables infiltration, exfiltration, and resupply. Mods include fully integrated INS/GPS, color cockpit LCDs, NVG lighting, HUDs, integrated defensive systems, digital moving map display, EO/IR system, dual secure voice/data satcom, enhanced cargo handling, and extended-life wings. MC-130Js have secondary leaflet and rubber raiding craft aerial delivery roles for psyops and littoral ingress/egress. Crew is smaller than legacy models, but includes CSO/auxiliary flight deck stations to handle aerial refueling (otherwise performed by the flight engineer). Loadmasters handle remaining flight engineer/comms functions. The aircraft was redesignated from Combat Shadow II to Commando II in March 2012 and is replacing the MC-130P. European-based MC-130Js will move from RAF Mildenhall, UK, to Spangdahlem AB, Germany, as part of overall force structure adjustments. FY17 funding supports procurement of six airframes. Ongoing upgrades include new Radio Frequency Countermeasure (RFCM) EW system. The MC-130J currently lacks terrain-following/terrain-avoidance (TF/TA) capability. An MC-130J completed several test sorties with experimental winglets to explore potential efficiency enhancements in 2016. Development and integration of the Silent Knight TF/TA radar will enable low-level nighttime and adverse weather flight with low probability of detection to fully replace legacy platforms.

#### EXTANT VARIANT(S)

- MC-130J. New-build aircraft based on the standard-length fuselage C-130J.

**Function:** Special operations airlift/aerial refueling.

**Operator:** AETC, AFSOC.

**First Flight:** April 20, 2011.

**Delivered:** September 2011.

**IOC:** 2011.



U-28A

SrA. Logan Carlson/USAF

**Production:** 57 (planned).

**Inventory:** 35.

**Aircraft Location:** Cannon AFB, N.M.; Kadena AB, Japan; Kirtland AFB, N.M.; RAF Mildenhall, UK. Planned: Spangdahlem AB, Germany.

**Contractor:** Lockheed Martin (airframe), Boeing.

**Power Plant:** Four Rolls Royce AE2100D3 turboprops, each 4,591 shp.

**Accommodation:** Crew: two pilots, CSO; two loadmasters. Load: N/A.

**Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.

**Weight:** Max T-O 164,000 lb.

**Ceiling:** 28,000 ft with 42,000-lb payload.

**Performance:** Speed 416 mph, range 3,000 miles.

#### ■ U-28A

**Brief:** A militarized single-engine turboprop used for tactical airborne ISR support to special operations teams.

#### COMMENTARY

The U-28A is a modified Pilatus PC-12 employed on worldwide special operations missions. Mods include advanced radio-communications suite, aircraft survivability equipment, EO sensors, and advanced navigation systems. The USSOCOM-owned aircraft are operated by AFSOC as a nonstandard fleet. AFSOC first employed the aircraft during Enduring Freedom in Afghanistan and Iraqi Freedom. Ongoing upgrades include Multispectral Targeting System sensor installation on three airframes and Advanced Threat Warning (ATW) system integration fleetwide in response to current threats.

#### EXTANT VARIANT(S)

- U-28A. Special operations variant of the civilian Pilatus PC-12.

**Function:** Tactical reconnaissance.

**Operator:** AFSOC, AFRC.

**First Flight:** Circa 1994 (PC-12).

**Delivered:** 2006.

**IOC:** N/A.

**Production:** 36 (converted).

**Inventory:** 20 (USSOCOM-owned).



SrA. John Linzmeier/USAF



E-8 JSTARS

USAF

**Aircraft Location:** Cannon AFB, N.M.; Hurlburt Field, Fla.

**Contractor:** Pilatus Aircraft Ltd.

**Power Plant:** Single Pratt & Whitney PT6A-67B, 1,200 shp.

**Accommodation:** Two pilots, one CSO, one tactical systems officer.

**Dimensions:** Span 53.3 ft, length 47.3 ft, height 14 ft.

**Weight:** Max T-O 10,935 lb.

**Ceiling:** 30,000 ft.

**Performance:** Speed 253 mph, range 1,725 miles.

## ISR/BM/C3 AIRCRAFT

### ■ E-3 SENTRY

**Brief:** Modified Boeing 707 for all-weather air surveillance, command, and control.

#### COMMENTARY

The Sentry airborne warning and control system (AWACS) is a heavily modified Boeing 707-320B capable of surveilling airspace in excess of 200 miles from surface to stratosphere. AWACS coordinates theater air operations in direct subordination to joint/combined air and space operations centers. It can simultaneously conduct C2, BM, and target detection/tracking. E-3Bs were upgraded to Block 30/35 standards in 2001. USAF is equipping the aircraft with interim IFF to keep the variant airspace-compliant until Block 40/45 upgrade or divestiture. Block 40/45 aircraft are redesignated E-3G. The upgrade is the most comprehensive AWACS enhancement to date and improves tracking/identification, system reliability, and life-cycle cost. Mods include open architecture computing, operator workload reduction, new consoles, improved electronic support measures (ESM), and passive surveillance capability. DRAGON (Diminishing Manufacturing Sources Replacement of Avionics for Global Operations and Navigation) upgrades add a digital cockpit and next generation CNS/GATM. The first of 24 upgraded airframes was delivered to Tinker AFB, Okla., on Jan. 9, 2017. Future upgrades include the Multifunctional Information Distribution System/Joint Tactical Radio System (MIDS/JTRS). Six airframes are undergoing Block 40/45 modification under LRIP, and the first was redelivered in 2014. USAF is upgrading 18 more under full-rate production. Seven AWACS slated for divestiture will be retained to FY19 due to operational demand.

#### EXTANT VARIANT(S)

- E-3B. Block 30/35 upgraded aircraft.
- E-3C. Block 30/35 upgraded aircraft with additional advanced capabilities.
- E-3G. Block 40/45 upgraded aircraft.

**Function:** Battle management/early warning/C2.

**Operator:** ACC, PACAF, AFRC (associate).

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

**Delivered:** March 1977-84.

**IOC:** 1977.

**Production:** 31.

**Inventory:** 16 (E-3B); four (E-3C); 11 (E-3G).

**Aircraft Location:** JB Elmendorf-Richardson, Alaska; Kadena AB, Japan; Tinker AFB, Okla.

**Contractor:** Boeing, Northrop Grumman (radar), Lockheed Martin (computer), Rockwell Collins (DRAGON cockpit upgrade).

**Power Plant:** Four Pratt & Whitney TF33-PW-100A turbopfans, each 21,000 lb thrust.

**Accommodation:** Four flight crew, 13-19 mission specialists.

**Dimensions:** Span 145.8 ft, length 152.9 ft, height 41.8 ft.

**Weight:** Max T-O 335,000 lb.

**Ceiling:** Above 35,000 ft.

**Performance:** Speed 360 mph, range 5,000+ miles.

### ■ E-4 NATIONAL AIRBORNE OPERATIONS CENTER

**Brief:** Militarized Boeing 747 modified as airborne operations and nuclear command and control center.

#### COMMENTARY

The E-4B is a highly survivable flying C3 center enabling national leaders to direct nuclear and conventional forces, execute emergency war orders, and coordinate civil response actions. It is hardened against the effects of nuclear explosions, including electromagnetic pulse (EMP). Comm and data processing capabilities include EHF Milstar satellite, six-channel International Maritime Satellite, and a triband radome houses SHF communications antenna. All aircraft underwent Block 1 upgrades, enhancing electronic and communications infrastructure with commercial off-the-shelf (COTS) systems. Ongoing development includes replacing Milstar data links with AEHF compatible FAB-T. Other developments include replacing the VLF/LF transmitter and CNS/ATM with civil compliant systems. FY17 funds support purchasing the first production Low Frequency Transmit System (LFTS) kit. USAF is drafting requirements to replace E-4B with a more modern platform. Airframes are viable to 2039, but phaseout of commercial 747-200s hampers sustainment beyond 2020. The fleet transferred from ACC to AFGSC in 2016, aligning with its primarily nuclear role.

#### EXTANT VARIANT(S)

- E-4B. Modified Boeing 747-200 equipped as a NAOC.

**Function:** Nuclear command and control.

**Operator:** AFGSC.

**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.

**Aircraft Location:** Offutt AFB, Neb.

**Contractor:** Boeing, Rockwell, Raytheon.

**Power Plant:** Four General Electric CF6-50E2 turbopfans, each 52,500 lb thrust.

**Accommodation:** Up to 112 flight crew and mission crew.

**Dimensions:** Span 195.7 ft, length 231.3 ft, height 63.4 ft.

**Weight:** Max T-O 800,000 lb.

**Ceiling:** Above 30,000 ft.

**Performance:** Speed 602 mph, range 7,130 miles.

### ■ E-8 JSTARS

**Brief:** Modified Boeing 707 for locating, classifying, and tracking moving ground targets.

#### COMMENTARY

E-8C primarily provides theater commanders ground surveillance data to support tactical operations. E-8 evolved from the Army/Air Force Joint Surveillance Target Attack Radar System program. The first two aircraft deployed for Desert Storm while still under development, and early airframes were eventually retrofitted to Block 20 production standards, featuring more powerful computers, an Internet protocol local area network, and BLOS connectivity. JSTARS is equipped with a canoe-shaped radome under the forward fuselage housing a 24-ft-long side-looking phased array radar antenna. It can locate, classify, and track vehicles at distances exceeding 124 miles, and recent refinements enable human-target tracking. Target data is transmitted via data link to ground stations or other aircraft. USAF halted modernization funds and retired the program's T-3 systems integration testbed aircraft in 2015. The service issued a request for proposals to replace the E-8 with a more affordable business-class airframe in late 2016. A contract for 17 aircraft is planned in 2018, with IOC slated for FY24. USAF postponed retiring five aircraft to FY19. Fleetwide retirement depends on full fielding of a replacement.

#### EXTANT VARIANT(S)

- E-8C. Block 20 upgraded JSTARS platform based on the Boeing 707-300.

• TE-8A. Crew training aircraft based on the E-8.

**Function:** Ground surveillance/battle management/C2.

**Operator:** ANG.

**First Flight:** December 1988.



SSgt. Katherine Spessa/USAF

## E-11A Battlefield Airborne Communications Node

**Delivered:** May 1996-2005.

**IOC:** Dec. 18, 1997.

**Production:** 18.

**Inventory:** 16 (E-8C); one (TE-8).

**Aircraft Location:** Robins AFB, Ga.

**Contractor:** Northrop Grumman, Raytheon.

**Power Plant:** Four Pratt & Whitney TF33-102C turbojets, each 19,200 lb thrust.

**Accommodation:** Flight crew: four; mission crew: 15 Air Force and three Army operators (can be augmented according to mission).

**Dimensions:** Span 145.8 ft, length 152.9 ft, height 42.5 ft.

**Weight:** Max T-O 336,000 lb.

**Ceiling:** 42,000 ft.

**Performance:** Speed 584 mph (optimal orbit), range 9 hr normal endurance, longer with air refueling.

### ■ E-9A WIDGET

**Brief:** Modified commuter airliner for test tracking and range clearance.

### COMMENTARY

The E-9A is a modified DHC-8 commuter aircraft that provides air-to-air telemetry support for weapons testing, target drone operations, and range clearance for the vast Eglin Test and Training Range over the Gulf of Mexico. Upgrades include AN/APS-143(V-1) airborne sea surveillance radar, UHF telemetry, and signal relay systems. The E-9 is able to track flying and surface targets. It can detect small watercraft at ranges up to 25 miles and alert range safety personnel to clear the area before live-fire testing. The aircraft can also remotely initiate destruction of damaged or malfunctioning aerial target drones.

### EXTANT VARIANT(S)

- E-9A. Military surveillance version of the DHC-8 commuter airliner.

**Function:** Range control.

**Operator:** ACC.

**First Flight:** June 1983 (De Havilland Canada Dash 8).

**Delivered:** 1988.

**IOC:** June 1988.

**Production:** Two.

**Inventory:** Two.

**Aircraft Location:** Tyndall AFB, Fla.

**Contractor:** De Havilland Canada, now Bombardier (airframe), Sierra Research (conversion).

**Power Plant:** Two Pratt & Whitney PW-120A turboprop engines, each 1,800 shp.

**Accommodation:** Crew: two pilots; two mission operators.

**Dimensions:** Span 39.5 ft, length 48.6 ft, height 12.2 ft.

**Weight:** Max T-O 34,500 lb.

**Ceiling:** 30,000 ft.

**Performance:** Speed 280 mph, range 1,000 miles.

### ■ E-11A BATTLEFIELD AIRBORNE COMMUNICATIONS NODE

**Brief:** Modified business jet equipped for tactical communications and data relay.

### COMMENTARY

The E-11A is a modified Bombardier Global Express 6000/BD-700-1A10 business jet equipped with specialized communications relay equipment to translate between tactical data links, provide joint range extension, BLOS C2, and Internet protocol-based data transfer between dissimilar systems. It was fielded to meet an urgent operational need for BLOS communications relay capability between ground troops and other airborne platforms. The system entered combat in Afghanistan in 2008 and enables troops to overcome the limitations of LOS comms in rugged terrain. The Battlefield Airborne Communications Node (BACN) payload is integrated on a mixed fleet of manned E-11As and unmanned EQ-4B Global Hawks. The combined BACN fleet has provided near-constant coverage in theater. The service is seeking to extend operations and possibly acquire the E-11A as a long-term program.

### EXTANT VARIANT(S)

- E-11A. Modified Bombardier BD-700 equipped with the BACN payload.

**Function:** Communications relay.

**Operator:** ACC.

**First Flight:** Oct. 6, 2003 (BD-700).

**Delivered:** December 2008.

**IOC:** N/A.

**Production:** Four.

**Inventory:** Four.

**Aircraft Location:** Kandahar Airfield, Afghanistan.

**Contractor:** Northrop Grumman, Bombardier.

**Power Plant:** Two Rolls Royce BR710A2-20 turbofans, each 14,750 lb thrust.

**Accommodation:** Flight crew: two; mission crew: N/A.

**Dimensions:** Span 94 ft, length 99 ft 5 in, height 25 ft 6 in.

**Weight:** Max T-O 99,500 lb.

**Ceiling:** 51,000 ft.

**Performance:** Speed Mach 0.88, range 6,900 miles.

### ■ EC-130H COMPASS CALL

**Brief:** Heavily modified C-130H used for electronic warfare missions.

### COMMENTARY

The EC-130H is a modified C-130H designed to disrupt enemy C3 and limit adversary coordination essential for force management. The fleet

has been deployed near-constantly since the beginning of combat operations in Afghanistan in 2001. All aircraft have been retrofitted to Block 35 standards, and all are aerial refuelable. The aircraft was designed to be easily updated and modified. Mission equipment upgrades, such as new IR countermeasures and modernized comms, occur about every three years to ensure continued protection against evolving threats. USAF is replacing the center wing box to meet wing service life expiration. Ongoing development includes counter-radar/countersatellite navigation, and ongoing upgrades include installation of digital glass cockpits. The first two cockpit-upgraded airframes were redelivered to Davis-Monthan AFB, Ariz., in August 2016. USAF requested to retire seven aircraft, converting one as an NEC-130H testbed. The sole TC-130H crew trainer was retired in July 2016. Congress barred fleetwide retirement, citing emergent high-end threats, and required USAF to draft plans to extend or replace the aircraft with a comparable capability.

### EXTANT VARIANT(S)

- EC-130H. Electronic attack variant of the C-130H.

- TC-130H. Aircrew trainer stripped of mission equipment.

**Function:** EW.

**Operator:** ACC.

**First Flight:** 1981.

**Delivered:** 1982.

**IOC:** 1983; Block 30 from February 1999.

**Production:** (Converted).

**Inventory:** 14 (EC-130H).

**Aircraft Location:** Davis-Monthan AFB, Ariz.

**Contractor:** Lockheed Martin.

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

**Accommodation:** Two pilots, navigator, two EWOs; flight engineer, mission crew supervisor (cryptologic experienced), four cryptologic linguists, acquisition operator, and airborne maintenance technician.

**Dimensions:** Span 132.6 ft, length 99 ft, height 38 ft.

**Weight:** Max T-O 155,000 lb.

**Ceiling:** 25,000 ft.

**Performance:** Speed 300 mph at 20,000 ft.

### ■ EC-130J COMMANDO SOLO/SUPER J

**Brief:** Modified C-130 designed for psychological warfare, radio/television broadcast, or SOF mobility, depending on variant.

### COMMENTARY

The EC-130 is the Air Force's primary psychological warfare platform, providing military information support operations (MISO) and civil affairs broadcast. Commando Solo aircraft conducted psychological operations in almost every

US war or contingency operation since 1980. The EC-130J Commando Solo is equipped with radio and color television broadcast equipment for psychological warfare, enhanced navigation, self-protection, and an aerial refueling receptacle. With transition to the EC-130J, USAF added a new, secondary mission resulting in a second variant. Three heavily modified EC-130J Commando Solo aircraft serve as a standard broadcasting station for psychological warfare operations. Four EC-130Js, dubbed Super J, perform secondary, low-cost EA role on top of their special operations mobility (SOFFLEX) mission. SOFFLEX includes personnel and cargo airdrop, combat offload, and infiltration/exfiltration. FY17 funding supports demodification of three Super Js to make them multimission capable, and procurement of three of the seven planned roll-on/roll-off Removable Airborne MISO Systems (RAMS). RAMS is based on the Army's Fly Away Broadcast System and will allow the Super J to supplement Commando Solo. All variants are operated by the ANG's 193rd Special Operations Wing.

#### EXTANT VARIANT(S)

- EC-130J Commando Solo. Modified C-130J used for broadcast and psyops.
- EC-130J Super J. Modified C-130J used for SOF mobility and psyops.

**Function:** Psychological warfare/special operations airlift.  
**Operator:** ANG.  
**First Flight:** April 5, 1996 (C-130J).  
**Delivered:** 2003.  
**IOC:** 2004.  
**Production:** Seven.  
**Inventory:** Three (Commando Solo); four (Super J).  
**Aircraft Location:** Harrisburg Arpt., Pa.  
**Contractor:** Lockheed Martin, Raytheon.  
**Power Plant:** Four Rolls Royce-Allison AE2100D3 turboprops, each 4,637 shp.  
**Accommodation:** Two pilots, flight systems officer, mission systems officer; two loadmasters, five electronic communications systems (CS) operators.  
**Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.  
**Weight:** Max T-O 164,000 lb.  
**Ceiling:** 28,000 ft.  
**Performance:** Speed 335 mph cruise, range 2,645 miles.

#### ■ MC-12W LIBERTY

**Brief:** Militarized commercial twin-engine turboprop used for medium/low-altitude ISR.

#### COMMENTARY

The MC-12W is a manned tactical ISR, Sigint, and targeting platform based on the Beechcraft



MC-12W Liberty

SrA. Tiffany Trojca/USAF

King Air 350. The MC-12W is capable of complete ISR collection, processing, analysis, and dissemination. The aircraft provides ground forces with targeting data and other tactical ISR. Specialized equipment includes FMV, laser designation, various sensors, BLOS connectivity, and satcom. An initial seven King Air 350s were modified with FMV, a ROVER compatible LOS satcom data link, limited Sigint, and basic BLOS connectivity. An additional 30 extended-range King Air 350s were modified, adding enhanced FMV with laser designator, improved Sigint, and increased bandwidth BLOS. The sensor-equipped C-12s were acquired to augment RPA systems operating in Southwest Asia and entered combat in both Iraq and Afghanistan in 2009. ACC divested its 33-strong MC-12 fleet in 2015. The Oklahoma ANG acquired 13 of the airframes to form a dedicated SOF support mission, deploying for the first time to Afghanistan in 2016.

#### EXTANT VARIANT(S)

- MC-12W. Modified Beechcraft King Air equipped for battlefield ISR and targeting.

**Function:** Tactical reconnaissance.  
**Operator:** ANG.  
**First Flight:** April 2009.  
**Delivered:** From April 2009.  
**IOC:** June 2009.  
**Production:** 42.  
**Inventory:** 13.  
**Aircraft Location:** Will Rogers ANGB, Okla.  
**Contractor:** Beechcraft, L3 Communications.  
**Power Plant:** Two Pratt & Whitney Canada PT6A-60A turboprops, each 1,050 shp.  
**Accommodation:** Two pilots and two sensor operators.  
**Dimensions:** Span 57.9 ft, length 46.7 ft, height 14.3 ft.  
**Weight:** Max T-O 15,000 lb (350) and 16,500 lb (350ER).  
**Ceiling:** 35,000 ft.  
**Performance:** Speed 359 mph, range 1,725 miles (350) and 2,760 miles (350ER).

#### ■ OC-135 OPEN SKIES

**Brief:** C-135 variant used for unarmed observation and arms control treaty verification flights.

#### COMMENTARY

The OC-135 is a modified WC-135B used for specialized arms control treaty observation and imagery collection missions over nations that are party to the 1992 Open Skies Treaty. Specialized mission equipment includes side-looking synthetic aperture radar, infrared line scanning devices, video camera, and framing and panoramic optical cameras installed in the rear of the aircraft. The two oblique KS-87E framing cameras permit photography from approximately 3,000-ft altitude, and one KA-91C panoramic allows for wide sweep photography from approximately 35,000 ft. USAF is developing a digital camera suite to replace the increasingly obsolete and difficult to maintain wet-film cameras in compliance with a presidential directive. FY17 funds support testing and certification of a prototype digital imaging suite.

#### EXTANT VARIANT(S)

- OC-135B. Modified C-135 equipped for photo reconnaissance/treaty verification.

**Function:** Observation.  
**Operator:** ACC.  
**First Flight:** 1993.  
**Delivered:** 1993-96.



OC-135 Open Skies

Tim Felce

**IOC:** October 1993.

**Production:** Three.

**Inventory:** Two.

**Aircraft Location:** Offutt AFB, Neb.

**Contractor:** Boeing.

**Power Plant:** Four Pratt & Whitney TF33-P-5 turbofans, each 16,050 lb thrust.

**Accommodation:** Flight crew: two pilots, two navigators, and two sensor maintenance technicians; Defense Threat Reduction Agency mission crew: mission commander, deputy, two sensor operators, and one flight follower; total seating: 35, incl space for foreign country representatives.

**Dimensions:** Span 131 ft, length 135 ft, height 42 ft.

**Weight:** Max T-O 297,000 lb.

**Ceiling:** 50,000 ft (basic C-135).

**Performance:** Speed 500+ mph, range 3,900 miles.

#### ■ RC-26 CONDOR

**Brief:** Modified commuter airliner optimized for counternarcotics/manned ISR.

#### COMMENTARY

The RC-26 is a modified Fairchild Metro 23 with specialized digital cameras, IR video, and communications equipment, primarily used for domestic and international anti-trafficking operations. The aircraft has a secondary role providing real-time video streaming to disaster relief personnel following hurricanes, wildfires, and other disasters. An extensive communications suite allows communications from 29 to 960 MHz, including provisions for plugging in 800 MHz handheld radios, and air phone capabilities. The Air Force originally planned to divest the fleet in FY15, but is funding continued operations.

#### EXTANT VARIANT(S)

- RC-26B. Surveillance version of Fairchild C-26.

**Function:** Counternarcotics/surveillance/C2.  
**Operator:** ANG.  
**First Flight:** 1990.  
**Delivered:** C-26 first delivered 1989.  
**IOC:** N/A.  
**Production:** 11.  
**Inventory:** 11.  
**Aircraft Location:** Des Moines Arpt., Iowa; Ellington Field, Texas; Fairchild AFB, Wash.; Fresno Yosemite Arpt., Calif.; Hancock Field, N.Y.; Jacksonville Arpt., Fla.; Key Field, Miss.; Kirtland AFB, N.M.; Montgomery Regional Arpt., Ala.; Truax Field, Wis.; Tucson Arpt., Ariz.; Yeager Arpt., W.Va.  
**Contractor:** Fairchild (airframe).  
**Power Plant:** Two Garrett TPE331-12UAR-701 turboprops, each 1,100 shp.  
**Accommodation:** Two pilots, one navigator-mission systems operator.



RC-135S Cobra Ball

Josh Plueger/USAF

**Dimensions:** Span 57 ft, length 59.5 ft, height 16.6 ft.

**Weight:** Max T-O 16,500 lb.

**Ceiling:** 25,000 ft.

**Performance:** Speed 334 mph, range 2,070 miles.

#### RC-135S COBRA BALL

**Brief:** Specially equipped C-135 used to gather measurement and signature intelligence (Masint) on ballistic missile flights.

#### COMMENTARY

The RC-135S monitors missile-associated signatures and tracks missiles during boost and re-entry phases to provide reconnaissance for treaty verification and theater ballistic missile nonproliferation. Its specialized equipment includes wide-area IR sensors, long-range optical cameras, and an advanced communications suite. Cobra Ball collects optical and electronic data on ballistic missile activity. It can deploy anywhere in the world in 24 hours and provide on-scene EO reconnaissance. Ongoing upgrades include Wideband Global Satellite reachback connectivity, new airborne tracking system, improved operator interface, liquid cooling system, Rivet Joint Comint suite integration, and capabilities enhancements for operations in dense signal environments.

#### EXTANT VARIANT(S)

- RC-135S Cobra Ball. Modified C-135 equipped for Masint/treaty verification.

**Function:** Electronic reconnaissance.

**Operator:** ACC.

**First Flight:** N/A.

**Delivered:** Circa 1969-99.

**IOC:** Circa 1972.

**Production:** Converted.

**Inventory:** Three.

**Aircraft Location:** Offutt AFB, Neb.

**Contractor:** Boeing (original airframe), L3 Communications.

**Power Plant:** Four CFM International F108-CF-201 turbofans, each 21,600 lb thrust.

**Accommodation:** Flight crew: two pilots, navigator. Mission crew: three EWOs; two airborne systems engineers, two airborne mission specialists.

**Dimensions:** Span 131 ft, length 135 ft, height 42 ft.

**Weight:** Max T-O 297,000 lb.

**Ceiling:** 45,000 ft.

**Performance:** Speed 500+ mph, range 3,900 miles.

#### RC-135U COMBAT SENT

**Brief:** Specially equipped C-135 used to gather technical intelligence (Techint) on adversary radar emitter systems.

#### COMMENTARY

The RC-135U collects and examines data on airborne, land, and naval radar systems, providing strategic analysis for National Command Authorities and combatant forces. Its distinctive antennae arrays on the chin and wing tips, large cheek fairings, and extended tail contain specialized Sigint suites to collect scientific and technical Elint data against air-, land-, and sea-based emitter systems. Each airframe has unique reconnaissance equipment. Combat Sent is critical to effective design, programming, and reprogramming of RWRs as well as jammers, decoys, and anti-radiation missiles and to the development of effective threat simulators. FY17 funds support wideband satcom reachback connectivity, integration of Rivet Joint's Comint suite, improved operator interface, new intercom, and capability enhancement for dense signal environments.

#### EXTANT VARIANT(S)

- RC-135U Combat Sent. Modified C-135 equipped for radar emissions analysis.

**Function:** Electronic reconnaissance.

**Operator:** ACC.

**First Flight:** N/A.

**Delivered:** Circa 1970-78.

**IOC:** Circa 1970s.

**Production:** Converted.

**Inventory:** Two.

**Aircraft Location:** Offutt AFB, Neb.

**Contractor:** Boeing (original airframe), L3 Communications, Textron.

**Power Plant:** Four CFM International F108-CF-201 turbofans, each 21,600 lb thrust.

**Accommodation:** Flight crew: two pilots, two navigators, two airborne systems engineers; mission crew: 10 EW officers, six or more electronic, technical, mission area specialists. **Dimensions:** Span 135 ft, length 140 ft, height 42 ft.

**Weight:** Max T-O 299,000 lb.

**Ceiling:** 35,000 ft.

**Performance:** Speed 500+ mph, range unlimited with air refueling.



RC-26 Condor

Sgt. Lalita Laksbergs/ARNG



U-2 Dragon Lady

#### RC-135V/W RIVET JOINT

**Brief:** Specially equipped C-135 used to gather real-time electronic and signals intelligence for theater and tactical-level commanders.

#### COMMENTARY

The RC-135V/W is an extensively modified C-135 performing worldwide reconnaissance missions to detect, identify, and geolocate signals throughout the electromagnetic spectrum. Rivet Joint is mostly used to exploit electronic battlefield intelligence and deliver near real-time ISR information to tactical forces, combatant commanders, and National Command Authorities. Onboard capabilities encompass rapid search, detection, measurement, identification, demodulation, geolocation, and fusion of data from potentially thousands of electronic emitters. Current development efforts include new Sigint signal sets and capability upgrades. Ongoing Baseline 11 upgrades include new direction finding Comint, precision Elint/Sigint system integration, wideband satcoms, enhanced near real-time data dissemination, new steerable beam antenna, improved weather radar, digital cockpit instruments, modernized operator interface, and improved dense signal environment capabilities. Planned upgrades include increased signal bandwidth/exploitation, Distributed Common Ground Station (DCGS) interoperability, and operator station 3-D maps. Britain will receive the last of three RC-135W (dubbed Airseeker) in FY17, to fill an urgent capability gap. USAF/RAF personnel co-crew both fleets.

#### EXTANT VARIANT(S)

- RC-135V/W Rivet Joint. Self-contained stand-off airborne Sigint variant of the C-135.

- TC-135W. Training version of the operational aircraft.

- NC-135W. Rivet Joint systems integration testbed operated by AFMC.

**Function:** Electronic reconnaissance.

**Operator:** ACC, AFMC.

**First Flight:** N/A.

**Delivered:** Circa 1973-99. Continuous equipment updates.

**IOC:** Circa 1973.

**Production:** Converted.

**Inventory:** Eight (RC-135V); nine (RC-135W); three (TC-135W); one (NC-135W).

**Aircraft Location:** Offutt AFB, Neb.; Kadana AB, Japan; RAF Mildenhall, UK; RAF Waddington, UK (USAF co-manned).

**Contractor:** Boeing (original airframe), L3 Communications.

**Power Plant:** Four CFM International F108-CF-201 turbofans, each 21,600 lb thrust.

**Accommodation:** Flight crew: three pilots, two navigators; mission crew: three EW of-



SSgt. Robert M. Trujillo/USAF



HC-130J Combat King II

TSgt. Zachary Wolf/USAF

ficers, 14 intelligence operators, four airborne maintenance technicians, and up to six more, depending on mission.

**Dimensions:** Span 131 ft, length 135 ft, height 42 ft.

**Weight:** Max T-O 297,000 lb.

**Ceiling:** 50,000 ft.

**Performance:** Speed 500+ mph, range 3,900 miles.

#### ■ U-2 DRAGON LADY

**Brief:** Manned, single-engine, high-altitude, long endurance ISR aircraft.

#### COMMENTARY

The U-2 is the Air Force's manned high-altitude ISR platform, capable of carrying multiple, simultaneous intelligence sensors. U-2 can carry a variety of advanced optical, multispectral EO/IR, SAR, Sigint, and other payloads. U-2 was initially designed in the 1950s, but current U-2s date to the 1980s when the production was reopened to produce the larger and more capable TR-1. S model conversions began in 1994, and all current aircraft are Block 20 configured, featuring a glass cockpit, digital autopilot, modernized EW system, and updated data links. Sensor upgrades include the ASARS-2A SAR sensor, SYERS-2A multispectral EO/IR imagery system, and enhanced Airborne Signals Intelligence Payload (ASIP). The legacy optical bar camera is still in use, providing broad-area synoptic imagery coverage. U-2's modular payload and open system architecture allow new sensors to be rapidly fielded to meet emerging needs. USAF planned to start retiring the fleet in FY16 due to budget constraints. Congress stipulated the RQ-4 Block 30 achieve sensor parity with the U-2 before the fleet is phased out, delaying retirement to FY19. U-2s are heavily tasked meeting operational demands, and retirement would reduce high altitude ISR capacity by 50 percent. Future funds are limited to flight safety and sustainment, unless critical to national security. Ongoing upgrades include ASARS development, integration, and testing, as well as EO sensor and EW system upgrades, and flight safety and airspace compliance mods. A two-seat TU-2S was destroyed in a crash near Beale AFB, Calif., on Sept. 20, 2016.

#### EXTANT VARIANT(S)

- U-2S. Current variant of the U-2/TR-1.
- TU-2S. A two-seat trainer aircraft originally designated U-2ST.

**Function:** High-altitude reconnaissance.

**Operator:** ACC.

**First Flight:** Aug. 4, 1955 (U-2); 1967 (U-2R); October 1994 (U-2S).

**Delivered:** 1955-October 1989.

**IOC:** Circa 1956.

**Production:** 35 (T/U-2S).

**Inventory:** 27 (U-2); five (TU-2 trainers).

**Aircraft Location:** Beale AFB, Calif.; permanent forward operating locations worldwide.

**Contractor:** Lockheed Martin, Northrop Grumman (ASIP), Raytheon (ASARS), UTC Aerospace (SYERS/Optical Bar Camera).

**Power Plant:** General Electric F118-GE-101 turbojet.

**Accommodation:** Pilot (U-2S); two pilots (TU-2S) on RQ201 zero/zero ejection seats.

**Dimensions:** Span 105 ft, length 63 ft, height 16 ft.

**Weight:** Max T-O 40,000 lb.

**Ceiling:** Above 70,000 ft.

**Performance:** Speed 410 mph, range 7,000+ miles.

#### ■ WC-135 CONSTANT PHOENIX

**Brief:** Modified C-135 that samples particulate and gaseous atmospheric debris to verify international nuclear test ban treaty compliance.

#### COMMENTARY

The WC-135 is either a modified C-135B or EC-135C Looking Glass equipped with air sampling and collection equipment. The air sampling program using the original WB-29 detected debris from the Soviet Union's first atomic test in 1949 and has since monitored both weapons tests and nuclear disasters, including Chernobyl and more recently Fukushima, Japan. The WC-135's primary air-sampling mission supports the Nuclear Test Ban Treaty, and its collection suite allows mission crew to detect radioactive "clouds" in real time. The collection system uses external flow-through devices to collect particles on filter paper for later analysis. The fleet has recently been heavily tasked monitoring increased North Korean nuclear weapons tests.

#### EXTANT VARIANT(S)

- WC-135C. Modified EC-135C equipped for radiological monitoring and air sampling.
- WC-135W. Modified C-135B equipped for radiological monitoring and air sampling.

**Function:** Air sampling and collection.

**Operator:** ACC.

**First Flight:** 1965.

**Delivered:** 1965-96.

**IOC:** December 1965.

**Production:** Converted.

**Inventory:** One (WC-135C); one (WC-135W).

**Aircraft Location:** Offutt AFB, Neb.

**Contractor:** Boeing.

**Power Plant:** Four Pratt & Whitney TF33-P-5 turbofans, each 16,050 lb thrust.

**Accommodation:** Seating for 33, incl cockpit crew.

**Dimensions:** Span 131 ft, length 140 ft, height 42 ft.

**Weight:** Max T-O 300,500 lb.

**Ceiling:** 40,000 ft.

**Performance:** Speed 403 mph, range 4,600 miles.

## TANKER AIRCRAFT

### ■ HC-130J COMBAT KING II

**Brief:** Extended-range C-130J tanker variant designed for personnel recovery in hostile environments, C2, deploying pararescue (PJ), and helicopter in-flight refueling.

#### COMMENTARY

The HC-130J aircraft replaces legacy HC-130N/Ps and is based on the USMC's KC-130J tanker. It adds an enhanced service life wing, improved cargo handling system, refueling receptacle, EO/IR sensor, flight deck CSO console, and dual satcom. Features include integrated INS/GPS, NVG-compatible lighting, FLIR, radar/missile warning receivers, and chaff/flare dispensers. Upgrades would add the Lightweight Airborne Radio System V12 to speed locating isolated personnel and would add the ALQ 213 EW management system to automate/integrate defensive systems. Plans call for continuous common block upgrades for the combined HC/MC-130J fleet. Block 8.1 upgrades which include Link 16, civil GPS and data link, flight management mods, advanced IFF, special mission interface, and satellite-updating real-time flight information are undergoing development and integration. Mode 5 IFF and CNS/ATM upgrades will be fielded ahead of cycle to meet FAA compliance deadlines, in line with the baseline C-130J. USAF awarded two contracts, including a multiyear deal in 2015, covering 14 additional HC-130Js. FY17 funding supports production of three aircraft and USAF expects to complete fleet recap by 2023.

#### EXTANT VARIANT(S)

- HC-130J. C-130J modified for CSAR and aerial refueling.

**Function:** Aerial refueling/airlift.

**Operator:** ACC, AETC. Planned: ANG, AFRC.

**First Flight:** July 29, 2010.

**Delivered:** From 2010.

**IOC:** 2013.

**Production:** 37 (planned).

**Inventory:** 19.

**Aircraft Location:** Davis-Monthan AFB, Ariz.; Kirtland AFB, N.M.; Moody AFB, Ga. Planned: Francis S. Gabreski Arpt., N.Y.; JB Elmendorf-Richardson, Alaska; Patrick AFB, Fla.

**Contractor:** Lockheed Martin.

**Power Plant:** Four Rolls Royce AE2100D3 turboprops, each 4,591 shp.

**Accommodation:** Flight crew: two pilots, CSO, two loadmasters.  
**Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.  
**Weight:** Max T-O 164,000 lb.  
**Ceiling:** 33,000 ft.  
**Performance:** Speed 363.4 mph at S-L, range 4,000+ miles.

#### ■ HC-130N/P KING

**Brief:** Extended-range C-130H tanker variant converted for personnel recovery in hostile environments, deploying pararescue (PJ), and helicopter in-flight refueling.

#### COMMENTARY

The HC-130N/P conducts operations to austere airfields and denied territory for expeditionary, all-weather personnel recovery operations, including airdrop, air-land, helicopter air-to-air refueling, and forward area refueling point missions. Secondary roles include humanitarian assistance, disaster response, security cooperation/aviation advisory, emergency medical evacuation, noncombatant evacuation, and spaceflight support for NASA. Features include integrated GPS/INS navigation package, NVG lighting, FLIR, radar/missile warning receivers, chaff/flare dispensers, and data-burst communications. Both models suffer airworthiness, maintainability, and operational limitations and are being replaced by HC-130J. Corrosion issues forced early retirement of a significant part of the remaining fleet. Serviceable aircraft were diverted from storage to fill an operational gap at Patrick AFB, Fla., until recapitalization with the HC-130J. The last Active Duty HC-130N/P assigned to AETC at Kirtland AFB, N.M., retired Oct. 4, 2016. The Alaska ANG also retired its final HC-130N/P in January 2017, before re-equipping with the HC-130J.

#### EXTANT VARIANT(S)

- HC-130N. C-130H model modified with C-130E radome, new center wing, and aerial refueling capability.
- HC-130P. C-130H modified for CSAR and aerial refueling.

**Function:** Aerial refueling/airlift.

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

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

**Delivered:** From 1965.

**IOC:** 1986.

**Production:** 33 converted N/P models.

**Inventory:** Eight (HC-130N); five (HC-130P).

**Aircraft Location:** Francis S. Gabreski Arpt., N.Y.; Kirtland AFB, N.M.; JB Elmendorf-Richardson, Alaska; Patrick AFB, Fla.



HC-130N/P King SrA. Brandon P. Kallou Sanes/USAF

**Contractor:** Lockheed Martin.

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

**Accommodation:** Two pilots, navigator; flight engineer, airborne comm specialist, two loadmasters, three PJs.

**Dimensions:** Span 132.6 ft, length 98.8 ft, height 38.5 ft.

**Weight:** Max T-O 155,000 lb.

**Ceiling:** 33,000 ft.

**Performance:** Speed 289 mph at S-L, range 4,000+ miles.

#### ■ KC-10 EXTENDER

**Brief:** Modified McDonnell Douglas DC-10 that combines fixed wing aerial refueling and simultaneous passenger, cargo, or aeromedical transport.

#### COMMENTARY

The KC-10 is a modified McDonnell Douglas DC-10-30CF and USAF's largest air refueling aircraft. It is simultaneously capable of tanker and cargo roles, enabling it to support worldwide fighter deployments. The aircraft employs an advanced aerial refueling boom and hose and drogue system, allowing it to refuel a wide variety of US and allied aircraft within the same mission. It is refuelable by boom-equipped tankers. The aircraft has three large fuel tanks under the cargo floor, an air refueling operator's station, aerial refueling boom and integral hose reel/drogue unit, a receiver refueling receptacle, and military avionics. Ongoing mods include modernized navigation, surveillance, and air traffic management (CNS/ATM). Advanced Mode 5 IFF integration is ongoing. Modifications extend service life through 2045.

#### EXTANT VARIANT(S)

- KC-10A. Modified McDonnell Douglas DC-10 designed as a multirole cargo-tanker.

**Function:** Aerial refueling/airlift.

**Operator:** AMC, AFRC (associate).

**First Flight:** April 1980.

**Delivered:** March 1981-April 1990.

**IOC:** August 1982.

**Production:** 60.

**Inventory:** 59.

**Aircraft Location:** JB McGuire-Dix-Lakehurst, 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: two pilots, flight engineer, boom operator; AE crew: two flight nurses, three medical technicians; other crew depending on mission. Load: up to 75 people and 17 pallets or 27 pallets—a total of nearly 170,000 lb.

**Dimensions:** Span 165.4 ft, length 181.6 ft, height 58 ft.

**Weight:** Max T-O 590,000 lb.

**Ceiling:** 42,000 ft.

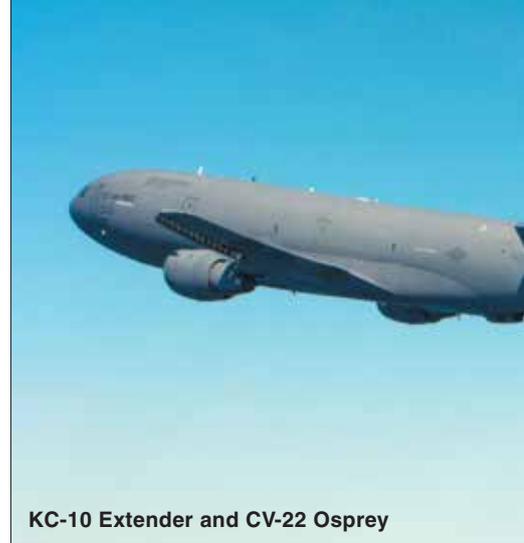
**Performance:** Speed 619 mph, range 11,500 miles, or 4,400 miles with max cargo.

#### ■ KC-46 PEGASUS

**Brief:** Next generation cargo-tanker that will provide fixed wing aerial refueling and simultaneous passenger, cargo, or aeromedical transport.

#### COMMENTARY

The KC-46A is a modified Boeing 767-200ER multirole cargo-tanker equipped with flying boom and probe-and-drogue refueling capabil-



KC-10 Extender and CV-22 Osprey

ity. In 2011 Boeing was awarded a contract for 179 KC-46A tankers, the first increment (KC-X) toward replacing USAF's KC-135R fleet. Compared to the 50-year-old KC-135, the KC-46A will have enhanced capabilities, including more fuel capacity, improved efficiency, and enhanced cargo and AE capability. Like the KC-10, it will employ both an advanced refueling boom and independently operating hose and drogue system. The program's provisioned 767-2C prototype (without refueling boom) flew in late 2014, and the full-up KC-46A flew for the first time from Everett, Wash., Sept. 25, 2015. Japan became the KC-46's first export customer in 2015. Four airframes are supporting developmental testing at Edwards AFB, Calif., and have completed more than 1,000 combined flight test hours to date. Operational testing is scheduled to begin in April 2017. Higher than expected stress loads encountered during C-17 refueling-compatibility trials forced a limited boom redesign before clearance for LRIP. The service awarded LRIP Lot 1 and Lot 2 contracts for seven and 12 aircraft respectively in August 2016 and a follow-on Lot 3 contract for 15 tankers in January 2017. Eighteen airframes are slated for delivery ahead of planned IOC, which slipped six months to January 2018 due to boom mods.

#### EXTANT VARIANT(S)

- KC-46A. Modified Boeing 767 designed as a multirole cargo-tanker.

**Function:** Aerial refueling/airlift.

**Operator:** AFMC; AMC (planned).

**First Flight:** Dec. 28, 2014 (provisioned 767-2C prototype).

**Delivered:** from 2017 (planned).

**IOC:** August 2017 (planned).

**Production:** 179 (planned).

**Inventory:** Two (KC-46A); two (provisioned 767-2C).

**Aircraft Location:** Edwards AFB, Calif.; Paine Field, Wash. Planned: Altus AFB, Okla.; McConnell AFB, Kan.; Pease ANGB, N.H.; others TBD.

**Contractor:** Boeing.

**Power Plant:** Two Pratt & Whitney 4062, each 62,000 lb thrust.

**Accommodation:** 15 crew seats, incl AE crew. Passenger load: 58 or up to 114 for contingency operations. AE load: 58 patients (24 litters and 34 ambulatory). Cargo load: 18 pallet positions, max 65,000 lb.

**Dimensions:** Span 157.7 ft, length 165.5 ft, height 52.8 ft.

**Weight:** Max T-O 415,000 lb.

**Ceiling:** 43,000 ft (767).

**Performance:** (767) cruise speed 530 mph, range 6,500 miles.



A1C Joseph Pick/USAF

## ■ KC-135 STRATOTANKER

**Brief:** Medium-range tanker aircraft capable of cargo and AE support.

### COMMENTARY

The KC-135 has been the mainstay of the USAF tanker fleet for some 50 years. It is similar in size and appearance to commercial 707 aircraft but designed to military specifications. The current KC-135R variant first flew in October 1982 and deliveries began in July 1984. Twenty were modified with the Multipoint Refueling System (MPRS), allowing the use of hose-and-drogue pods on each wing to simultaneously refuel two NATO or US Navy aircraft. Non-MPRS modified KC-135s use a single drogue adapter attached to the boom. Upgrades include a modernized digital flight deck. New Global Air Traffic Management upgrades were completed in 2011. Link 16 capability was also added to a limited number of aircraft. KC-135Ts are upgraded and sustained alongside the KC-135R fleet under common programs. USAF plans to modify 395 aircraft with Block 45 upgrades through 2026. These include additional glass cockpit display for engine instrumentation, a radar altimeter, advanced autopilot, and flight director to replace obsolescent systems. The first Block 45 aircraft was redelivered in 2013, and the 45th aircraft was turned over Jan. 27, 2017. Fleet service life is projected out to 2040.

### EXTANT VARIANT(S)

- KC-135R. Re-engined KC-135A/Es fitted with CFM turbofan engines.
- KC-135T. Former KC-135Qs, able to carry different fuels in wing and fuselage tanks.

**Function:** Aerial refueling/airlift.

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

**First Flight:** August 1956.

**Delivered:** January 1957-65.

**IOC:** June 1957, Castle AFB, Calif.

**Production:** 732.

**Inventory:** 387 (KC-135R); 54 (KC-135T).

**Aircraft Location:** Altus AFB, Okla.; Beale AFB, Calif.; Fairchild AFB, Wash.; Grissom AFB, Ind.; JB Andrews, Md.; Kadena AB, Japan; MacDill AFB, Fla.; March ARB, Calif.; McConnell AFB, Kan.; RAF Mildenhall, UK; Seymour Johnson AFB, N.C.; Tinker AFB, Okla.; and ANG in Alabama, Alaska, Arizona, Hawaii, Illinois, Iowa, Kansas, Maine, Michigan, Mississippi, Nebraska, New Hampshire, New Jersey, Ohio, Pennsylvania, Tennessee, Utah, Washington, Wisconsin. Planned: New York.

**Contractor:** Boeing, Rockwell Collins (Block 45).

**Power Plant:** Four CFM International CFM56-

2 (USAF designation F108) turbofans, each 21,634 lb thrust.

**Accommodation:** Flight crew: two pilots, boom operator, plus navigator, depending on mission; AE crew: two flight nurses, three medical technicians (adjusted for patient needs). Load: 37 passengers, six cargo pallets, max 83,000 lb.

**Dimensions:** Span 130.8 ft, length 136.3 ft, height 41.7 ft.

**Weight:** Max T-O 322,500 lb.

**Ceiling:** 50,000 ft.

**Performance:** Speed 530 mph, range 1,500 miles with 150,000 lb transfer fuel, up to 11,015 miles for ferry mission.

## AIRLIFT AIRCRAFT

### ■ C-5 GALAXY

**Brief:** Air refuelable long-range strategic cargo transport for massive/outsize cargo.

### COMMENTARY

The C-5 is USAF's largest airlifter and one of the world's largest aircraft. It can carry unusually heavy cargo over intercontinental ranges. It can take off and land in relatively short distances and taxi on substandard surfaces, if required. The Galaxy's front and rear cargo doors permit simultaneous drive-through loading/unloading. A total of 81 C-5As were delivered and underwent major wing modifications to extend their service lives but are now being retired. The C-5B first flew in 1985 and embodies all C-5A improvements, including improved turbofans, color weather radar, and triple INS. The first C-5B was delivered in January 1986, and some are equipped with a defensive system. Two C-5As were modified to carry outsize space cargo and redesignated C-5Cs. USAF was upgrading the C-5 fleet through a combination of the Avionics Modernization Program (AMP)—completed in 2011—and Reliability Enhancement and Re-engining Program (RERP), ongoing. Upgraded aircraft are designated C-5M Super Galaxy and incorporate new GE CF6-80C2 (F138-GE-100) turbofans, with 200 percent increased thrust, along with avionics and structural reliability fixes. USAF plans to modernize 52 C-5s to C-5M standards, including 49 B models, two C models, and one C-5A. The final C-5B departed for conversion to Super Galaxy standards in January 2017. FY17 funds support CNS/ATM upgrades aided by a new core mission computer and weather radar. Other mods include modernized IR countermeasures and lavatory redesign to address leaking/corrosion issues.

### EXTANT VARIANT(S)

- C-5A. Basic model delivered between 1969 and 1973.
- C-5B. Improved aircraft with strengthened wings and improved engines and avionics.



C-5M Galaxy

SSgt. Timothy Moore/USAF

- C-5C. Modified C-5As capable of carrying outsize NASA space cargo.
- C-5M. Super Galaxy, including AMP and RERP modified legacy C-5s.
- C-5M-SCM. Super Galaxy converted from C-5C to carry large NASA cargo.

**Function:** Strategic airlift.

**Operator:** AFMC, AMC, AFRC.

**First Flight:** June 30, 1968 (C-5A); June 6, 2006 (C-5M).

**Delivered:** October 1969-April 1989.

**IOC:** September 1970.

**Production:** 131.

**Inventory:** Five (C-5A); four (C-5B); one (C-5C); 37 (C-5M); one (C-5M-SCM).

**Aircraft Location:** Dover AFB, Del.; JBSA-Lackland, Texas; Travis AFB, Calif.; Westover ARB, Mass.

**Contractor:** Lockheed Martin.

**Power Plant:** Four General Electric TF39-GE-1C turbofans, each 43,000 lb thrust; (C-5M) four General Electric F138-GE-100 turbofans.

**Accommodation:** Crew: two pilots, two flight engineers, three loadmasters. Load: 81 troops and 36 standard pallets, max 270,000 lb. There is no piece of Army combat equipment the C-5 can't carry.

**Dimensions:** Span 222.9 ft, length 247.1 ft, height 65.1 ft.

**Weight:** Max T-O 840,000 lb.

**Ceiling:** 45,000 ft.

**Performance:** Speed 518 mph, range 2,473 miles with max payload (plus additional 575 miles after offload).

### ■ C-12 HURON

**Brief:** Militarized civil twin-engine turboprops used for diplomatic/special duties, light passenger/cargo airlift, and test support.

### COMMENTARY

The C-12 family includes a series of military versions based on the Beechcraft King Air A200 and 1900C aircraft. Flight decks and cabins are pressurized for high-altitude flight. The most common variant incorporates a cargo door with an integral airstair. Both C-12C and C-12D aircraft are deployed to US embassies worldwide. The C-12J is a completely different aircraft, based on the Beechcraft 1900C commuter airliner. C-12Js are operated by PACAF and can transport two litters or 10 ambulatory patients in the AE role. C-12Js incorporate extensive avionics upgrades, including three MFDs, integrated GPS, flight management systems, autopilot, VHF/UHF radios, and weather radar. Current updates encompass basic safety, reliability, and maintainability mods.

### EXTANT VARIANT(S)

- C-12C. C-12As retrofit with PT6A-41 engines.
- C-12D. C-12 with enlarged cargo doors and strengthened wings.



### C-17 Globemaster III

Heide Couch/USAF

- C-12F. C-12 with uprated PT6A-42 engines, eight passenger capacity, and AE litter accommodation.

- C-12J. Military version of the Beechcraft Model 1900C commuter airliner.

**Function:** Light airlift.

**Operator:** AFMC, PACAF.

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

**Delivered:** 1974-late 1980s.

**IOC:** Circa 1974.

**Production:** 88.

**Inventory:** 16 (C-12C); six (C-12D); three (C-12F); four (C-12J).

**Aircraft Location:** Edwards AFB, Calif.; Holloman AFB, N.M.; JB Elmendorf-Richardson, Alaska; Yokota AB, Japan; various US embassies.

**Contractor:** Beechcraft.

**Power Plant:** (C-12J) two Pratt & Whitney Canada PT6A-65B turboprops, each 1,173 shp.

**Accommodation:** Crew: two pilots; load: (C-12J) up to 19 passengers or 3,500 lb cargo.

**Dimensions:** (C-12J) Span 54.5 ft, length 57 ft, height 15 ft.

**Weight:** (C-12J) max T-O 16,710 lb.

**Ceiling:** (C-12J) 25,000 ft.

**Performance:** (C-12J) speed 284 mph, range 1,669 miles.

### ■ C-17 GLOBEMASTER III

**Brief:** Heavy-lift, air refuelable cargo aircraft capable of both strategic airlift and direct tactical delivery of all classes of military cargo.

### COMMENTARY

C-17 is the US military's core airlifter. It is able to operate on small, austere airfields (3,500 ft by 90 ft) previously limited to C-130s. It is the only aircraft able to directly deliver or air-drop outside cargo into a tactical environment and is the first military transport to feature full digital fly-by-wire control. Boeing delivered the 223rd and final USAF aircraft on Sept. 12, 2013, and the final international aircraft on Nov. 29, 2015. Fleetwide Block 16 avionics and weather radar mods were completed in 2015, and all aircraft will be upgraded to the final Block 20 production standard through regular programmed depot maintenance cycles. Block 20 retrofits include some 60 programs to bring early production aircraft to a common configuration. Ongoing mods include next generation Large Aircraft Infrared Countermeasures (LAIRCM) to combat the proliferation of man portable air defenses, next generation CNS/GATM, Mode 5 IFF, dynamic retasking, and structural, safety, and sustainment mods. Ongoing development includes the C-17 Advanced Technology Demonstration (ATD), which is testing high efficiency engines and drag-reduction devices to improve

economy; next generation BLOS comms and GPS; and HUD replacement.

### EXTANT VARIANT(S)

- C-17A. Long-range airlifter.

**Function:** Tactical/strategic airlift.

**Operator:** AETC, AMC, PACAF, ANG, AFRC.

**First Flight:** Sept. 15, 1991.

**Delivered:** June 1993-September 2013.

**IOC:** Jan. 17, 1995.

**Production:** 223.

**Inventory:** 222.

**Aircraft Location:** Allen C. Thompson Field-Jackson-Evers Arpt., Miss.; Altus AFB, Okla.; Dover AFB, Del.; Eastern West Virginia Arpt., W.Va.; JB Charleston, S.C.; JB Elmendorf-Richardson, Alaska; JB Lewis-McChord, Wash.; JB McGuire-Dix-Lakehurst, N.J.; JB Pearl Harbor-Hickam, Hawaii; March ARB, Calif.; Stewart ANGB, N.Y.; Travis AFB, Calif.; Wright-Patterson AFB, Ohio.

**Contractor:** Boeing.

**Power Plant:** Four Pratt & Whitney F117-PW-100 turbofans, each 40,440 lb thrust.

**Accommodation:** Flight crew: two pilots, loadmaster; AE crew: two flight nurses, three medical technicians (altered as required). Load: 102 troops/paratroops; 36 litter and 54 ambulatory patients; 18 pallet positions; max payload 170,900 lb.

**Dimensions:** Span 169.8 ft, length 174 ft, height 55.1 ft.

**Weight:** Max T-O 585,000 lb.

**Ceiling:** 45,000 ft.

**Performance:** Speed 518 mph at 25,000 ft, range 2,760 miles with 169,000 lb payload.

### ■ C-20 GULFSTREAM

**Brief:** Twin-engine executive airlift asset for transporting high-ranking government officials.

### COMMENTARY

C-20A/B transport DOD and other government officials worldwide. The C-20B, delivered in 1988, has specialized mission communications equipment and a revised interior. The



### C-20B Gulfstream

C-20H, equipped with advanced technology flight management systems and upgraded Rolls Royce engines, was acquired in 1992. Specialized features include GPS, vertical separation equipment, GATM, and traffic collision avoidance system (TCAS). The Air Force is divesting the C-20B and C-20H aircraft, due to the limited life remaining on the airframes.

### EXTANT VARIANT(S)

- C-20B. Modified and upgraded Gulfstream III aircraft.

- C-20H. Modified Gulfstream IV SP aircraft.

- C-20K. Modified Gulfstream III comm integration testbed.

**Function:** VIP transport.

**Operator:** AMC, USAFE.

**First Flight:** December 1979.

**Delivered:** September 1983-89.

**IOC:** Circa 1983.

**Production:** N/A.

**Inventory:** Three (C-20B); two (C-20H).

**Aircraft Location:** JB Andrews, Md.; Ramstein AB, Germany.

**Contractor:** Gulfstream.

**Power Plant:** Two Rolls Royce Spey MK511-8 turbofans (C-20B), each 11,400 lb thrust; two Rolls Royce Tay MK611-8 turbofans (C-20H), each 13,850 lb thrust.

**Accommodation:** Crew: two pilots, flight engineer, communications system operator, flight attendant. Load: 12 passengers.

**Dimensions:** Span 77.8 ft, length 83.1 ft (B), 88.3 ft (H), height 24.5 ft.

**Weight:** Max T-O 69,700 lb (B), 74,600 lb (H).

**Ceiling:** 45,000 ft.

**Performance:** Speed 576 mph, range 4,250 miles (B), 4,850 miles (H).

### ■ C-21 LEARJET

**Brief:** Light airlift asset capable of cargo, passenger, and aeromedical transport.

### COMMENTARY

The C-21 is a militarized Learjet 35 equipped



### C-12 Huron

Yasuo Okabe/USAF



MSgt. Kevin Wallace/USAF

with color weather radar, TACAN, and HF/VHF/UHF radios. It provides operational support for time-sensitive movement of people and cargo throughout the US and the European Theater, including AE missions if required. Ongoing upgrades support modifying 19 aircraft with modern digital systems, including new weather radar, GPS, flight management system, Mode 5 transponder, and satellite-updating real-time flight information to comply with FAA standards.

#### EXTANT VARIANT(S)

- C-21A. Military version of the Learjet 35A.  
**Function:** Light airlift.  
**Operator:** AMC, USAF, ANG.  
**First Flight:** January 1973.  
**Delivered:** April 1984-October 1985.  
**IOC:** April 1984.  
**Production:** 84.  
**Inventory:** 24.  
**Aircraft Location:** JB Andrews, Md.; Peterson AFB, Colo.; Ramstein AB, Germany; Scott AFB, Ill.  
**Contractor:** Bombardier (previously Gates Learjet).  
**Power Plant:** Two AlliedSignal TFE731-2 turbofans, each 3,500 lb thrust.  
**Accommodation:** Crew: two pilots; AE crew: flight nurse, two medical technicians (adjusted as required). Load: eight passengers and 3,153 lb cargo; one litter or five ambulatory patients.  
**Dimensions:** Span 39.5 ft, length 48.6 ft, height 12.2 ft.  
**Weight:** Max T-O 18,300 lb.  
**Ceiling:** 45,000 ft.  
**Performance:** Speed 530 mph at 41,000 ft, range 2,306 miles.

#### ■ C-32B/C-32A AIR FORCE TWO

**Brief:** Commercial aircraft used for dedicated vice presidential and distinguished visitor (DV) airlift.

#### COMMENTARY

The C-32A was acquired as a commercial Boeing 757 and primarily provides vice presidential airlift under the call sign Air Force Two. Aircraft assigned to the 89th Airlift Wing at JB Andrews, Md., additionally serve the first lady, the vice president, and Congress and Cabinet officials. The cabin is divided into sections including a worldwide clear and secure voice and data communications suite, first-class cabin, two business-class cabins, center galley, lavatories, fully enclosed stateroom, and a conference and staff area. The C-32B provides DOD rapid, global airlift in support of government crisis response efforts. The C-32's modern flight deck avionics are upgradable, and new developments include nitrogen fuel-tank inerting



C-32 Air Force Two

MSgt. Kevin Wallace/USAF

and commercial wideband satcom mods. FY17 funds support commercial WGS integration as well as CNS/ATM upgrades to meet future airspace standards.

#### EXTANT VARIANT(S)

- C-32A. Presidential support-configured commercial Boeing 757-200 airliner.
- C-32B. Commercial Boeing 757-200 tasked with global crisis response airlift.  
**Function:** VIP transport.  
**Operator:** AMC, ANG.  
**First Flight:** Feb. 19, 1982 (USAF Feb. 11, 1998).  
**Delivered:** June-December 1998.  
**IOC:** 1998.  
**Production:** Six.  
**Inventory:** Four (C-32A); two (C-32B).  
**Aircraft Location:** JB Andrews, Md.; JB McGuire-Dix-Lakehurst, N.J.  
**Contractor:** Boeing.  
**Power Plant:** Two Pratt & Whitney PW2040 turbofans, each 41,700 lb thrust.  
**Accommodation:** Crew: 16 (varies with mission). Load: up to 45 passengers.  
**Dimensions:** Span 124.6 ft, length 155.2 ft, height 44.5 ft.  
**Weight:** Max T-O 255,000 lb.  
**Ceiling:** 42,000 ft.  
**Performance:** Speed 530 mph, range 6,325 miles.

#### ■ C-37 GULFSTREAM V

**Brief:** Modified business jet used for worldwide special air missions and DV support.

#### COMMENTARY

The C-37 family consists of military versions of ultra-long-range Gulfstream business aircraft. The C-37A is based on the Gulfstream V and equipped with separate VIP and passenger areas, secure global voice and data communications suites, enhanced weather radar, autopilot, and advanced HUD. The C-37B incorporates directional IR countermeasures for self-defense and the advanced Honeywell Plane-View flight deck. Ongoing mods include commercial wideband satcom, to ensure senior leaders access to secure data and voice networks, and FAA-required CNS/ATM updates.

#### EXTANT VARIANT(S)

- C-37A. Military version of the Gulfstream V.
- C-37B. Military version of the Gulfstream G550.  
**Function:** VIP transport.  
**Operator:** AMC, PACAF, USAF.  
**First Flight:** USAF October 1998.  
**Delivered:** From October 1998.  
**IOC:** Dec. 9, 1998.  
**Production:** 10 (C-37A); three (C-37B).  
**Inventory:** Nine (C-37A); three (C-37B).

**Aircraft Location:** Chievres, Belgium; JB Andrews, Md.; JB Pearl Harbor-Hickam, Hawaii; MacDill AFB, Fla.

**Contractor:** Gulfstream.  
**Power Plant:** Two BMW/Rolls Royce BR710A1-10 turbofans, each 14,750 lb thrust.  
**Accommodation:** Crew: five. Load: up to 12 passengers.  
**Dimensions:** Span 93.5 ft, length 96.4 ft, height 25.8 ft.  
**Weight:** Max T-O 90,500 lb.  
**Ceiling:** 51,000 ft.  
**Performance:** Speed 600 mph, range 6,300 miles.

#### ■ C-40 CLIPPER

**Brief:** Commercial-based aircraft used primarily for medium-range DV airlift.

#### COMMENTARY

The C-40 is based on the commercial Boeing 737-700 and is used to transport senior military commanders, Cabinet officials, and members of Congress and to perform other operational support missions. C-40Bs are equipped with an office-in-the-sky arrangement, including clear and secure voice/data communication and broadband data/video. C-40Cs lack the advanced communications suite, are VIP configured with sleep accommodations, and are reconfigurable to carry 42 to 111 passengers. Both versions have modern avionics, integrated GPS and flight management system/electronic flight instrument system, and HUD. Each aircraft has auxiliary fuel tanks and managed passenger communications. Ongoing mods include nitrogen fuel tank inerting for the C-40C and commercial wideband satcom on the C-40B, to ensure leader's secure top-secret voice, data, and video links. Additional mods include navigation, and air traffic management compliance, and low-cost sustainment upgrades. The fleet is designed for a 30-year service life, with 23 years remaining.

#### EXTANT VARIANT(S)

- C-40B. Military version of the Boeing 737-700 with added winglets.
- C-40C. VIP configured Boeing 737-700 with added winglets, but lacking advanced comms.  
**Function:** VIP transport.  
**Operator:** AMC, PACAF, USAF, ANG, AFRC.  
**First Flight:** USN C-40A: April 14, 1999.  
**Delivered:** 2002.  
**IOC:** N/A.  
**Production:** 11.  
**Inventory:** Four (C-40B); seven (C-40C).  
**Aircraft Location:** JB Andrews, Md.; JB Pearl Harbor-Hickam, Hawaii; Ramstein AB, Germany; Scott AFB, Ill.  
**Contractor:** Boeing.

**Power Plant:** Two General Electric CFM56-7 turbofans, each 27,000 lb thrust.

**Accommodation:** Crew: 10 (varies with model and mission). Load: up to 89 passengers (C-40B); up to 111 (C-40C).

**Dimensions:** Span 117.4 ft, length 110.3 ft, height 41.2 ft.

**Weight:** Max T-O 171,000 lb.

**Ceiling:** 41,000 ft.

**Performance:** Speed 530 mph, range 5,750 miles.

### ■ C-130H HERCULES

**Brief:** Medium-range tactical airlifter capable of operating from unimproved airstrips and providing intertheater support.

### COMMENTARY

The C-130H is an all-purpose theater transport that performs diverse roles, including tactical and intertheater airlift and airdrop support, Arctic resupply, AE, aerial spraying, aerial firefighting, and humanitarian missions. The H model improved on the C-130E and was delivered starting in 1965, with the current, more advanced models delivered starting in 1974. Improvements included uprated engines, redesigned outer wing, improved pneumatic systems, new avionics, improved radar, and NVG lighting. The last C-130E retired in FY15, and C-130Hs are being replaced by the C-130J. The New York ANG operates the small fleet of LC-130H for Antarctic support. The LC-130H had been upgraded with eight-bladed propellers, digital displays and flight management systems, multifunction radar, modernized comms, and a single air data computer. WC-130Hs are operated by the Puerto Rico ANG and are equipped with palletized mission equipment for tropical storm data collection. Ongoing upgrades include C-130H Avionics Modernization Program (previously Viability and Airspace Access Program). It will bring legacy aircraft in compliance with international airspace, navigation, and communications rules, as well as critical center wing box replacement to 54 airframes.

### EXTANT VARIANT(S)

- C-130H Hercules. Updated legacy C-130 version.
- LC-130H Skibird. Arctic support variant with wheel-ski gear.
- WC-130H. Weather reconnaissance version of C-130H.

**Function:** Tactical airlift.

**Operator:** AMC, PACAF, ANG, AFRC.

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

**Delivered:** 1974-96.

**IOC:** Circa 1974.

**Production:** 308.

**Inventory:** 217 (C-130H); 10 (LC-130H); seven (WC-130H).

**Aircraft Location:** Dobbins ARB, Ga.; Little Rock AFB, Ark.; Maxwell AFB, Ala.; Minneapolis-St. Paul Arpt./ARS, Minn.; Peterson AFB, Colo.; Pittsburgh Arpt., Pa.; Yokota AB, Japan;

Youngstown ARS, Ohio; and ANG in Alaska, Arkansas, Connecticut, Delaware, Georgia, Illinois, Kentucky, Minnesota, Missouri, Montana, Nevada, New York, North Carolina, Ohio, Puerto Rico, Texas, West Virginia, Wyoming.

**Contractor:** Lockheed Martin.

**Power Plant:** Four Allison T56-A-15 turboprops, each 4,591 shp.

**Accommodation:** Crew: two pilots, navigator, flight engineer, loadmaster. Load: up to 92 combat troops or 64 paratroopers or 74 litters or six cargo pallets or 16 Container Delivery System (CDS) bundles or any combination of these up to max weight for each version.

**Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.; J-30 length 112.8 ft.

**Weight:** Max T-O 155,000 lb; max payload 42,000 lb.

**Ceiling:** With max payload, 23,000 ft.

**Performance:** Speed 366 mph; range with 35,000 lb payload 1,496 miles.

### ■ C-130J SUPER HERCULES

**Brief:** Medium-range tactical airlifter capable of operating from unimproved airstrips and providing intertheater support.

### COMMENTARY

The C-130J is the upgraded, current production version of the C-130 all-purpose theater transport. Missions include tactical and intertheater airlift and airdrop support, AE, weather reconnaissance, wildfire suppression using the Modular Airborne Firefighting System (MAFFS), and humanitarian relief. The aircraft first deployed in combat in Southwest Asia in 2004. AFRC's "Hurricane Hunters" at Keesler AFB, Miss., operated the only WC-130Js, which are equipped with palletized equipment to measure tropical and winter storms. The Super Hercules features a three-crew flight operations system, more powerful engines, composite six-blade propeller system, digital avionics, and mission computers. The C-130J can fly faster, higher, and farther than earlier C-130s. The C-130J-30 variant features a 15-foot longer "stretched" fuselage. The combined fleet is sustained via block upgrades. USAF is combining the future Block 7/8.1 upgrades to reduce modification down time. Block 7 includes Link 16, new flight management systems, civil GPS, and a special mission processor. Block 8.1 adds improved LOS data link and BLOS comms, improved precision navigational aids, enhanced covert lighting, replaces UHF comms with satcoms, and updates mission planning systems. Mode 5 IFF and air traffic management upgrades will be fielded ahead of cycle to meet FAA compliance deadlines. The current multiyear contract includes 29 USAF C-130Js. FY17 funds support production of three aircraft, including one operational loss replacement.

### EXTANT VARIANT(S)

- C-130J Super Hercules. Current production version.



### C-130 Hercules

- C-130J-30 Super Hercules. Stretched version capable of larger payloads.
- WC-130J. Weather reconnaissance version of C-130J.

**Function:** Tactical airlift.

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

**First Flight:** April 1996.

**Delivered:** February 1999-present.

**IOC:** October 2006.

**Production:** 330+.

**Inventory:** 107 (C-130J); 10 (WC-130J).

**Aircraft Location:** Dyess AFB, Texas; Keesler AFB, Miss.; Little Rock AFB, Ark.; Ramstein AB, Germany; and ANG in California, Kentucky, Rhode Island. Planned: Maryland.

**Contractor:** Lockheed Martin.

**Power Plant:** Four Rolls Royce AE2100D3 turboprops, each 4,700 shp.

**Accommodation:** Crew: two pilots, loadmaster. Load: up to 92 combat troops or 64 paratroopers or 74 litters or six cargo pallets or 16 Container Delivery System (CDS) bundles or any combination of these up to max weight (J); 128 combat troops or 92 paratroopers or 97 litters or eight pallets or 24 CDS bundles or any combination of these up to max weight (J-30).

**Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.; J-30 length 112.8 ft.

**Weight:** Max T-O 155,000 lb (J), 164,000 lb (J-30); max payload 42,000 lb (J), 44,000 lb (J-30).

**Ceiling:** With max payload, 26,000 ft (J), 28,000 (J-30).

**Performance:** Speed 417 mph (J), 410 mph (J-30); range with 35,000 lb payload 1,841 miles (J), 2,417 miles (J-30).

### ■ VC-25 AIR FORCE ONE

**Brief:** Modified Boeing 747 used for presidential air transport.

### COMMENTARY

The VC-25 is a specially configured Boeing 747-200B equipped for airlifting the President and his entourage. VC-25s operate under the call sign Air Force One when the President is aboard, and SAM (Special Air Mission) during non-presidential flights. Aircraft are equipped with staff work areas, a conference room, a general seating area, and an executive office. Communications capability includes worldwide secure and clear communications, data links, and a full self-defensive suite. The fleet is



C-40B Clipper

SMSGt. Kevin Wallace/USAF



SSgt. Edward Eagerton/ANG

operated by the Presidential Airlift Group at the 89th Airlift Wing, JB Andrews, Md. Ongoing mods include nitrogen fuel tank inerting, commercial wideband satcom, and service life extension. USAF plans to replace VC-25s with a modified version of Boeing's latest 747-8 intercontinental airliner. The fleet has five years' estimated service life remaining and requires a life extension/block upgrade to remain viable until replacement aircraft are fielded. Required mods include protected satcom, chillers, nitrogen generation system, weather radar, digital/voice data, and network upgrades. SLEP efforts will be accomplished during regular depot maintenance starting in FY17. Boeing is conducting initial design and risk reduction work to modify two 747-8 replacement aircraft, planned for delivery starting in 2024.

#### EXTANT VARIANT(S)

- VC-25A. Specially configured presidential support version of the Boeing 747-200B.

**Function:** Presidential airlift.

**Operator:** AMC.

**First Flight:** First flown as Air Force One Sept. 6, 1990.

**Delivered:** August-December 1990.

**IOC:** Circa 1990.

**Production:** Two.

**Inventory:** Two.

**Aircraft Location:** JB Andrews, Md.

**Contractor:** Boeing.

**Power Plant:** Four General Electric CF6-80C2B1 turbofans, each 56,700 lb thrust.

**Accommodation:** Crew: 26; load: up to 76 passengers.

**Dimensions:** Span 195.7 ft, length 231.8 ft, height 63.4 ft.

**Weight:** Max T-O 833,000 lb.

**Ceiling:** 45,100 ft.

**Performance:** Speed 630 mph, range 7,800 miles.

## HELICOPTERS

### ■ HH-60 PAVE HAWK

**Brief:** Armed CSAR variant of the UH-60 Black Hawk capable of medevac, disaster, and humanitarian response and other support missions.

#### COMMENTARY

The HH-60G Pave Hawk is a highly modified



TSgt. Matt Hecht/ANG

### VC-25 Air Force One

Black Hawk helicopter equipped with advanced INS/GPS/Doppler navigation systems, satcom, and secure/anti-jam communications. It is fitted with a personnel locating system (PLS) that aids location of survivor's radio. It includes automatic flight control, NVG lighting, FLIR, engine/rotor blade anti-ice system, in-flight refueling probe, additional fuel tanks, and an integral rescue hoist. Combat enhancements include a full self-defensive suite and two miniguns or .50-caliber guns. Ongoing fleet upgrades include color weather radar, improved TACAN, new RWR, auto direction finding, and digital intercoms. Future upgrades include new FLIR/Laser Radar turret to enhance situational awareness in low visibility condition, over-the-horizon comms for long-range ops in remote areas, and a rotor brake for shipboard operations. The first Army surplus UH-60L converted as an operational loss replacement was delivered June 28, 2016. The converted airframes will help restore the fleet to 112 aircraft. USAF plans to replace the HH-60G with the new HH-60W Combat Rescue Helicopter (CRH). The more powerful helicopter will improve hot weather/high-altitude performance and feature an enlarged cabin and longer range. Nine HH-60Ws will begin developmental testing at Eglin AFB, Fla., in 2018. The first of 112 new-build helicopters is planned for delivery in 2019, and FY17 funds support procurement of five test aircraft.

#### EXTANT VARIANT(S)

- HH-60G. Modified UH-60 helicopter equipped for CSAR.

- HH-60U. Converted surplus UH-60L.

- HH-60W. Developmental next generation Combat Rescue Helicopter.

**Function:** Personnel recovery/medium lift.

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

**First Flight:** October 1974.

**Delivered:** From 1982.

**IOC:** Circa 1982.

**Production:** 115.

**Inventory:** 98 (HH-60G); three (HH-60U).

**Aircraft Location:** Davis-Monthan AFB, Ariz.;



HH-60 Pave Hawk SSgt. Ryan Callaghan/USAF

Eglin AFB, Fla.; Francis S. Gabreski Arpt., N.Y.; JB Elmendorf-Richardson, Alaska; Kadena AB, Japan; Kirtland AFB, N.M.; Moffett Field, Calif.; Moody AFB, Ga.; Nellis AFB, Nev.; Patrick AFB, Fla.; RAF Lakenheath, UK.

**Contractor:** Sikorsky (Lockheed Martin).

**Power Plant:** Two General Electric T700-GE-700/701C turboshafts, each 1,560-1,940 shp.

**Accommodation:** Crew: two pilots, flight engineer, gunner. Load: mission dependent.

**Dimensions:** Rotor diameter 53.6 ft, overall length 64.7 ft, height 16.7 ft.

**Weight:** Max T-O 22,000 lb.

**Ceiling:** 14,000 ft.

**Performance:** Speed 184 mph; range 580 miles.

**Armament:** Two 7.62 mm miniguns or two .50-caliber machine guns.

### ■ UH-1 HUEY/IROQUOIS

**Brief:** Utility helicopter for missile field security, pilot training, and executive airlift.

#### COMMENTARY

The UH-1N aircraft initially provided search and rescue capabilities before replacing UH-1Hs in the ICBM field security and support role. UH-1Ns provide administrative lift to US National Capital Region and PACAF officials from JB Andrews, Md., and Yokota AB, Japan, respectively, and support aircrew survival training at Fairchild AFB, Wash. The TH-1H fleet provides Air Force helicopter pilot training at Fort Rucker, Ala. USAF converted all single-engine UH-1H models to twin-engine TH-1H variants, extending their service lives by at least 20 years. With termination of the earlier Common Vertical Lift Support Program (CVLSP), AFGSC is modifying its UH-1N with NVG-compatible cockpit, upgraded sensors, and safety and sustainment improvements to bridge the gap to a replacement helicopter. USAF launched the UH-1N Replacement Program in 2016 to recapitalize the fleet with up to 84 off-the-shelf helicopters suitable for mission-specific modification. Competitive contract award is planned for 2018, with operational testing beginning as early as FY19.



UH-1 Huey/Iroquois SrA. David Owsianka/USAF



**T-1 Jayhawk**

USAF

**EXTANT VARIANT(S)**

- TH-1H. Modified twin-engine version of UH-1H used for flight training.
- UH-1N. Military version of the Bell 212 used for utility support and light lift.

**Function:** Light lift/training.

**Operator:** AETC, Air Force District of Washington, AFGSC, AFMC, PACAF.

**First Flight:** 1956 (UH-1A).

**Delivered:** From September 1970 (UH-1N).

**IOC:** Circa 1970.

**Production:** 28 (TH-1H); 63 (UH-1N).

**Inventory:** 28 (TH-1H); 63 (UH-1N).

**Aircraft Location:** Eglin AFB, Fla.; Fairchild AFB, Wash.; F. E. Warren AFB, Wyo.; Fort Rucker, Ala.; JB Andrews, Md.; Kirtland AFB, N.M.; Malmstrom AFB, Mont.; Minot AFB, N.D.; Yokota AB, Japan.

**Contractor:** Bell Helicopter, Lockheed Martin (TH-1H prime).

**Power Plant:** TH-1H: one Honeywell T53-L-703 turboshaft, 1,800 shp. UH-1H: one Lycoming T53-L-13B turboshaft, 1,400 shp. UH-1N: two Pratt & Whitney Canada T400-CP-400 turbo-shafts, 1,290 shp.

**Accommodation:** UH-1N crew: two pilots, flight engineer; load: up to 13 passengers (depending on fuel and atmospheric conditions) or up to six litters or, without seats, bulky, oversize cargo.

**Dimensions:** TH-1H: rotor diameter 48 ft, length 57 ft, height 13 ft. UH-1N: rotor diameter 48 ft, length 57.1 ft, height 12.8 ft.

**Weight:** Max gross 10,500 lb.

**Ceiling:** 15,000 ft (10,000 ft with 10,000+ lb).

**Performance:** (UH-1N) speed 149 mph, range 300+ miles.

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

**TRAINER AIRCRAFT**

■ **T-1 JAYHAWK**

**Brief:** Medium-range, twin-engine jet trainer for pilot and CSO training.

**COMMENTARY**

The T-1A is a military version of Beechcraft 400A used in the advanced phase of JSUPT for students selected to fly tanker or transport aircraft, as well as CSOs. Cockpit seats an instructor and two students. Mods include UHF/VHF radios, INS, TACAN, airborne detection finder, increased bird-strike resistance, and an additional fuselage fuel tank. CSO training aircraft also incorporate GPS-driven SAR and simulated RWR, as well as a second student and instructor station. Upgrade efforts are focused on avionics modernization and include new MFD and terrain collision avoidance systems. FY17

funds support avionics proof-of-concept mods to 15 initial aircraft. Service life of 18,000 flying hours is estimated to keep the T-1 structurally airworthy to 2032.

**EXTANT VARIANT(S)**

- T-1A. Military trainer version of Beechcraft 400A.

**Function:** Advanced trainer.

**Operator:** AETC.

**First Flight:** Sept. 22, 1989 (Beechcraft 400A).

**Delivered:** Jan. 17, 1992-July 1997.

**IOC:** January 1993.

**Production:** 180.

**Inventory:** 178.

**Aircraft Location:** Columbus AFB, Miss.; Laughlin AFB and JBSA-Randolph, Texas; Vance AFB, Okla.; NAS Pensacola, Fla.

**Contractor:** Beechcraft.

**Power Plant:** Two Pratt & Whitney Canada JT15D-5B turboprops, each 2,900 lb thrust.

**Accommodation:** Three pilots, two side by side, one to the rear.

**Dimensions:** Span 43.5 ft, length 48.4 ft, height 13.9 ft.

**Weight:** Max T-O 16,100 lb.

**Ceiling:** 41,000 ft.

**Performance:** Speed 538 mph, range 2,555 miles.

■ **T-6 TEXAN II**

**Brief:** Single-engine turboprop primary trainer.

**COMMENTARY**

The T-6 is a joint Air Force/Navy trainer developed under the Joint Primary Aircraft Training System program, based on Swiss Pilatus PC-9. Mods include a strengthened fuselage, zero/zero ejection seats, upgraded engine, increased fuel capacity, pressurized cockpit, bird-resistant canopy, and digital avionics with sunlight-readable LCDs. The tandem student and instructor positions are interchangeable, including single-pilot operation from either seat. The T-6 is fully aerobatic and features an anti-G system. USAF production completed in 2010,



**T-6 Texan II**

with an expected service life of 21 years. Ongoing mods include airspace compliant avionics, improved canopy fracture initiation system, replacement of unavailable components, and updated training aids.

**EXTANT VARIANT(S)**

- T-6A. Joint service primary training aircraft, based on the Pilatus PC-9.
- T-6B. Navy-only variant.

**Function:** Primary trainer.

**Operator:** AETC, USN.

**First Flight:** July 15, 1998.

**Delivered:** From May 2000 (operational aircraft).

**IOC:** November 2001.

**Production:** Planned: 452 (USAF); 328 (USN).

**Inventory:** 444 (USAF).

**Aircraft Location:** USAF: Columbus AFB, Miss.; Laughlin AFB, JBSA-Randolph, and Sheppard AFB, Texas; Vance AFB, Okla. Navy: NAS Corpus Christi, Texas; NAS Pensacola, Fla.; NAS Whiting, Fla.

**Contractor:** Beechcraft Defense (formerly Raytheon).

**Power Plant:** One Pratt & Whitney Canada PT6A-68 turboprop, 1,100 shp.

**Accommodation:** Two pilots, in tandem, on Martin Baker MK16LA zero/zero ejection seats.

**Dimensions:** Span 33.5 ft, length 33.4 ft, height 10.7 ft.

**Weight:** Basic 6,500 lb.

**Ceiling:** 31,000 ft.

**Performance:** Speed 320 mph, range 1,035 miles.

■ **T-38 TALON**

**Brief:** Twin-engine, supersonic advanced jet trainer.

■ **T-38 TALON**

**Brief:** Twin-engine, supersonic advanced jet trainer.

**COMMENTARY**

The T-38 was the first supersonic trainer aircraft and is primarily used by AETC for advanced JSUPT fighter/bomber tracks and Introduction to Fighter Fundamentals. The aircraft is used to teach supersonic techniques, aerobatics,



**UV-18 Twin Otter**

SrA.Chris Massey/USAF



SrA. Ariel D. Partlow/USAF

formation, night and instrument flying, and cross-country/low-level navigation. The T-38 is also used by the USAF Test Pilot School to train test pilots and flight-test engineers and by ACC and AFGSC as a companion trainer to maintain pilot proficiency. ACC uses regenerated T-38s as dedicated aggressor aircraft for F-22 training. T-38Bs are equipped with a gunsight and centerline hardpoint for mounting external stores including ECM pod/practice bomb dispensers. Aircraft were redesignated T-38Cs after avionics modernization that added a glass cockpit and HUD, color MFDs, mission computer, integrated INS/GPS, and reshaped air intakes. T-38Cs were delivered from 2002 to 2007. Sustainment measures include replacement of major engine components to improve reliability and maintainability. Full fleet replacement is not projected until 2034, and USAF is additionally extending aircraft. The structural renewal effort is the most intensive in the T-38's history, replacing major longerons, bulkheads/formers, intakes, internal skins, and structural floors. The first airframe was redelivered in 2015. Additional upgrades include wingset replacement, digital avionics upgrades, replacement HUD, VHF nav/comms, airspace compliance, safety, and low-cost mods. USAF aims to field the next generation T-X aircraft with initial capability in 2024.

#### EXTANT VARIANT(S)

- T-38A. Upgraded version with Pacer Classic I and II mods.
- AT-38B. Armed weapons training version.
- T-38C. Modernized airframes incorporating glass cockpits and upgraded engines.

**Function:** Advanced trainer.  
**Operator:** ACC, AETC, AFGSC, AFMC.  
**First Flight:** April 1959.  
**Delivered:** 1961-72 (T-38A).  
**IOC:** March 1961.  
**Production:** More than 1,100.  
**Inventory:** 53 (T-38A); six (AT-38B); 445 (T-38C).  
**Aircraft Location:** Beale AFB and Edwards AFB, Calif.; Columbus AFB, Miss.; Holloman AFB, N.M.; JB Langley-Eustis, Va.; JBSA-Randolph and Sheppard AFB, Texas; Tyndall AFB, Fla.; Vance AFB, Okla.; Whiteman AFB, Mo.  
**Contractor:** Northrop Grumman.  
**Power Plant:** Two General Electric J85-GE-5 turbojets, each 2,900 lb thrust with afterburning.  
**Accommodation:** Two pilots, in tandem, on Martin Baker MK16T zero/zero ejection seats.  
**Dimensions:** Span 25.3 ft, length 46.3 ft, height 12.8 ft.  
**Weight:** Max T-O 12,093 lb.  
**Ceiling:** Above 55,000 ft.  
**Performance:** Speed 812 mph, range 1,093 miles.



T-38 Talon

MSgt. Burt Traynor/USAF

#### ■ T-53

**Brief:** Military designated sport aircraft.

#### COMMENTARY

The T-53 is the military designated civilian Cirrus SR20, primarily used by USAFA's Powered Flight Program. It is an all-composite monoplane with advanced avionics and safety features that include GPS, Cirrus Airframe Parachute System, integrated fuselage roll cage, cuffed wing design, and other active and passive safety systems standard on Cirrus aircraft. T-53s are designed for 12,000 flying hours. Upgrades are limited to FAA-mandated airworthiness compliance mods and simulator updates.

#### EXTANT VARIANT(S)

- T-53A. Military designated Cirrus SR20.

**Function:** Trainer.  
**Operator:** AETC.  
**Delivered:** 2012.  
**Inventory:** 24.  
**Aircraft Location:** USAFA, Colo.  
**Contractor:** Cirrus.  
**Power Plant:** One Continental IO-360-ES six-cylinder, fuel-injected, air-cooled engine, 200 hp.  
**Accommodation:** Two, side by side, plus three passengers.  
**Dimensions:** Span 38.3 ft, length 26 ft, height 8.9 ft.  
**Weight:** Max T-O 3,050 lb.  
**Ceiling:** 17,500 ft.  
**Performance:** Speed 178 mph, range 690 miles.

#### ■ UV-18 TWIN OTTER

**Brief:** Modified utility transport used for parachute jump training.

#### COMMENTARY

The UV-18 is a military variant of the civilian De Havilland DHC-6 Twin Otter. It is used at USAFA to support various parachuting activities and perform general utility missions. Special use includes supporting the Air Force Academy parachute team, Wings of Blue. Upgrades are limited to FAA-mandated airworthiness compliance mods.

#### EXTANT VARIANT(S)

- UV-18B. Military variant of the DHC-6 Twin Otter.

**Function:** Utility.  
**Operator:** AETC.  
**First Flight:** May 1965 (commercial version).  
**Delivered:** 1977 (two); 1982 (one).  
**IOC:** 1977.  
**Production:** Three.  
**Inventory:** Three.  
**Aircraft Location:** USAFA, Colo.  
**Contractor:** De Havilland Canada.

**Power Plant:** Two Pratt & Whitney Canada PT6A-27 turboprops, each 620 shp.

**Accommodation:** Crew: two pilots; load: up to 20 passengers.

**Dimensions:** Span 65 ft, length 51.9 ft, height 18.7 ft.

**Weight:** Max T-O 12,500 lb.

**Ceiling:** 25,000 ft.

**Performance:** Speed 210 mph, range 806 miles.

## REMOTELY PILOTED AIRCRAFT

#### ■ MQ-1 PREDATOR

**Brief:** Medium-altitude, long-endurance RPA, with ISR and strike capability.

#### COMMENTARY

The MQ-1 is a multimission weaponized RPA with near real-time FMV and multispectral targeting with combined laser designator/illuminator and EO/IR sensors. The fully operational system comprises four air vehicles, GCS, satellite link, and about 55 personnel for 24-hour operations. RQ-1 became a fully USAF system in 1996, and the designation was changed to MQ-1 (denoting multimission capability) when it was armed with the Hellfire missile in 2002. USAF forward deploys launch and recovery element (LRE) systems and support personnel for takeoff and landing operations, while the CONUS-based GCSs conduct the mission via extended BLOS satcom data link. USAF received its last MQ-1B in March 2011, but continues to fund GCS and airframe mods. The service is also integrating the advanced Airborne Cueing and Exploitation System Hyperspectral Sensor (ACES HY) to fill ISR shortfalls. USAF is increasingly relying on contractors to operate MQ-1s for nonkinetic ISR support. The MQ-1 is being replaced by the MQ-9, and USAF plans to retire the fleet by 2018.

#### EXTANT VARIANT(S)

- MQ-1B. Armed version of the General Atomics Predator.



MQ-1 Predator

SSgt. Stacy Jonsgaard/USAF



A1C James Thompson/USAF

## MQ-9 Reaper

**Function:** Armed reconnaissance/target acquisition.

**Operator:** ACC, AFMC, AFSOC, ANG.

**First Flight:** July 1994.

**Delivered:** July 1994 (USAF from 1996)-2011.

**IOC:** 2005.

**Production:** 268 air vehicles.

**Inventory:** 129.

**GCS Location:** Cannon AFB, N.M.; Creech AFB, Nev.; Davis-Monthan AFB, Ariz.; Ellington Field, Texas; Hector Arpt., N.D.; Holloman AFB, N.M.; Nellis AFB, Nev.; Springfield-Beckley Arpt., Ohio.; Whiteman AFB, Mo.

**Aircraft Location:** Cannon AFB, N.M.; Creech AFB, Nev.; Fort Polk Airfield, La.; Fort Huachuca, Ariz.; Hector Arpt., N.D.; Holloman AFB, N.M.; Whiteman AFB, Mo., and deployed locations worldwide.

**Contractor:** General Atomics Aeronautical Systems.

**Power Plant:** One Rotax 914F turbo engine.

**Accommodation:** GCS: pilot, sensor operator.

**Dimensions:** Span 55 ft, length 27 ft, height 6.9 ft.

**Weight:** Max T-O 2,250 lb.

**Ceiling:** 25,000 ft.

**Performance:** Speed 84-135 mph, range 770 miles, max endurance 40 hr.

**Armament:** Two AGM-114 Hellfire missiles.

### ■ MQ-9 REAPER

**Brief:** Medium- to high-altitude hunter-killer RPA.

#### COMMENTARY

The MQ-9B is a medium- to high-altitude, long-endurance hunter-killer RPA, primarily tasked with eliminating time-critical and high-value targets in a permissive combat environment. The MQ-9 fulfills a secondary tactical ISR role utilizing its Multispectral Targeting System-B (MTS-B). The system integrates EO/IR, color/monochrome daylight TV, image-intensified TV, and a laser designator/illuminator. MTS-B provides FMV as separate video streams or fused together, and the MQ-9 employs SAR for GBU-38 JDAM targeting. Additional roles include CAS, CSAR, precision strike, armed overwatch, target development/designation, and terminal weapon guidance. MQ-9B debuted in combat in Afghanistan in 2007. The Reaper system comprises three aircraft, GCS, LOS/BLOS satellite and terrestrial data links, support equipment/personnel, and crews for deployed 24-hour operations. Development is underway to incorporate automatic takeoff and landing capability, Counter-Improvised Explosive

Device (C-IED), Dismount Detection Radar (DDR), Gorgon Stare wide-area surveillance, missile defense, and other sensor upgrades, weapons integration, and reliability enhancements. The Extended Range Reaper reached IOC and entered combat in 2015. Reaper ER adds external fuel tanks, a four-bladed propeller, engine alcohol/water injection, heavyweight landing gear, longer wings and tail surfaces, and other enhancements to Block 1 aircraft. Production shifted from MQ-9 Block 1 to Block 5 aircraft in 2015, and 12 of the planned 155 airframes have been delivered. Block 5 incorporates improved electrical system and avionics bay, new radio and encrypted data links, digital engine control, high definition video, lighter bomb racks, upgraded software, and the new Block 30 GCS. Block 5 aircraft/Block 30 GCS fielding is planned for early FY17, with production running through FY21.

#### EXTANT VARIANT(S)

- MQ-9B Reaper Block 1. Air Force version of the General Atomics Predator B.

- MQ-9B Reaper Block 5. Improved, current production Reaper.

- MQ-9B Reaper ER. Extended range MQ-9 with external fuel tanks, longer wings, and other enhancements.

**Function:** Attack/armed reconnaissance.

**Operator:** ACC, AFMC, AFSOC, ANG.

**First Flight:** February 2001.

**Delivered:** November 2003.

**IOC:** October 2007.

**Production:** 346 (planned).

**Inventory:** 188.

**GCS Location:** Cannon AFB, N.M.; Creech AFB, Nev.; Des Moines Arpt., Iowa; Ellsworth AFB, S.D.; Fort Smith Arpt., Ark.; Hancock Field, N.Y.; Holloman AFB, N.M.; March ARB, Calif. Planned: Niagara Falls Arpt., N.Y.; Shaw AFB, S.C.

**Aircraft Location:** Cannon AFB, N.M.; Creech AFB, Nev.; Eglin AFB, Fla.; Fort Drum, N.Y.; Hancock Field, N.Y.; Holloman AFB, N.M.; March ARB, Calif.; Nellis AFB, Nev., and deployed locations worldwide.

**Contractor:** General Atomics Aeronautical Systems, L3 Communications, Raytheon.

**Power Plant:** One Honeywell TPE331-10GD turboprop, max 900 shp.

**Accommodation:** GCS: pilot, sensor operator.

**Dimensions:** Span 66 ft, length 36 ft, height 12.5 ft.

**Weight:** Max T-O 10,500 lb.

**Ceiling:** 50,000 ft.

**Performance:** Cruise speed 230 mph, range 1,150 miles, endurance 27 hr; 34 hr (ER).

**Armament:** Combination of AGM-114 Hellfires, GBU-12/49 Paveway IIs, and GBU-38 JDAMs.

### ■ RQ-4 GLOBAL HAWK

**Brief:** High-altitude, long-range, long-endurance RPA sensor platform.

#### COMMENTARY

The Global Hawk is primarily a long-endurance, high altitude, "deep look" ISR platform to complement satellite and manned strategic ISR. The weapon system consists of an aircraft with an integrated sensor suite, launch and recovery element (LRE), mission control element (MCE), and communications and mission planning equipment. Block 20 aircraft were initially delivered as an imagery intelligence (Imint) platform incorporating the Enhanced Integrated Sensor Suite (EISS). Four airframes were subsequently converted to EQ-4B communications relay platforms with the Battlefield Airborne Communications Node (BACN), and three remain active. The Block 30 variant is a multi-intelligence platform equipped with EO/IR, SAR, as well as Sigint sensors and has supported combat operations worldwide. The Block 40 ground surveillance platform is equipped with the Multiplatform Radar Technology Insertion Program (MP-RTIP) sensor suite that incorporates AESA and SAR to simultaneously gather stationary target imagery and detect and track moving ground targets as well as cruise missiles. USAF reversed its FY13 decision to divest the Block 30 fleet, electing to instead retire the U-2 in 2019. Congress stipulated the RQ-4 demonstrate sensor parity with the U-2 before divestment. The developmental universal payload adapter will enable carriage of several U-2-unique sensors, including the MS-177 electro-optical sensor and wet-film Optical Bar Camera. Initial sensor capability is planned circa 2017. Planned improvements include weather-avoidance radar and anti-icing system for all-weather operations, Airborne Signals Intelligence Payload (ASIP) increment I Sigint improvement, reliability improvements, and airspace compatibility mods.

#### EXTANT VARIANT(S)

- EQ-4B Block 20. Battlefield Airborne Communications Node (BACN) comm relay platform.

- RQ-4B Block 30. Multi-intelligence platform equipped with EO/IR and SAR sensors.
- RQ-4B Block 40. AESA and SAR equipped ground moving target indication (GMTI) and battlefield ISR platform.

**Function:** High-altitude reconnaissance.

**Operator:** ACC, AFMC.

**First Flight:** Feb. 28, 1998.

**Delivered:** From 1995 (ACTD versions).

**IOC:** August 2011 (Block 30); Aug. 29, 2016 (Block 40).

**Production:** 33.

**Inventory:** Three (Block 20); 19 (Block 30); 11 (Block 40).

**Aircraft Location:** Beale AFB, Calif.; Grand Forks AFB, N.D. (Block 40). Forward operating locations: Andersen AFB, Guam; Misawa AB, Japan; NAS Sigonella, Italy.

**Contractor:** Northrop Grumman, Raytheon, L3 Communications.

**Power Plant:** One Rolls Royce-North American F137-RR-100 turbofan, 7,600 lb thrust.

**Accommodation:** One LRE pilot, one MCE pilot, one MCE sensor operator.

**Dimensions:** Span 130.9 ft, length 47.6 ft, height 15.3 ft.

**Weight:** Max T-O 32,500 lb.

**Ceiling:** 60,000 ft.

**Performance:** Speed 356.5 mph, range 10,000 miles.

## ■ RQ-170 SENTINEL

**Brief:** Low-observable RPA.

### COMMENTARY

Although the RQ-170 was still under development and test, USAF employed it in Southwest Asia for Enduring Freedom. The RPA was developed in response to DOD's call for additional RPA support for combatant commanders. USAF publicly acknowledged the aircraft after photos appeared in foreign news media of operations over Afghanistan in 2009. The type is operated by the 432nd Wing at Creech AFB, Nev., and the 30th Reconnaissance Squadron at Tonopah Test Range, Nev. An RQ-170 strayed into Iranian airspace, crashed, and was captured during a mission in 2011.

### EXTANT VARIANT(S)

- RQ-170. No data available.

**Function:** Unmanned surveillance and reconnaissance.

**Operator:** ACC.

**GCS Location:** Creech AFB, Nev.; Tonopah Test Range, Nev.

**Aircraft Location:** Tonopah Test Range, Nev.; deployed worldwide.

**Contractor:** Lockheed Martin.



RQ-4 Global Hawk

TSgt. Christopher Boitz/USAF

## FULL-SCALE AERIAL TARGETS

### ■ QF-4 PHANTOM II

**Brief:** Regenerated F-4 Phantom IIs converted as aerial targets to support missile testing.

### COMMENTARY

The QF-4 became USAF's Full-scale Aerial Target (FSAT) system in 1997 and was primarily used to support missile and weapon systems development, testing, and evaluation. The majority of flights were conducted with a safety pilot in the cockpit to facilitate air combat training and evaluation. For live-shot weapons tests or training, QF-4s flew in the "not under live local operator" (NULLO) control configuration, equipped with explosive charges to terminate flight if damaged, and 16 to 20 kills were conducted annually. Retired F/RF-4 airframes were refurbished and converted to drone configuration by BAE Systems, with installation of drone specific equipment including remote control, missile telemetry and scoring, and safe flight-termination systems. The final QF-4 was converted from an RF-4C and delivered in November 2013. QF-16s began replacing QF-4s in 2015. Holloman AFB, N.M., launched the final unmanned QF-4 sortie Aug. 17, 2016, ahead of the aircraft's retirement on Dec. 21, 2017. The remaining airframes will be used as ground targets.

### EXTANT VARIANT(S)

- QF-4E. Converted from F-4E stocks, delivered starting in 2000 to 2008.

- QF-4G. Converted from retired F-4G airframes, delivered 1997 to 2000.

- QRF-4C. Converted from RF-4C stocks, delivered 2008 to 2013.

**Function:** Full-scale aerial target.

**Operator:** ACC.

**First Flight:** June 30, 1967 (F-4E).

**Delivered:** 1997.

**IOC:** 1997.

**Production:** 317.

**Inventory:** 13.

**Aircraft Location:** Holloman AFB, N.M.

**Contractor:** Boeing (previously McDonnell Douglas), BAE Systems.

**Power Plant:** Two General Electric J79-GE-17G afterburning turbojets, each 17,900 lb thrust.

**Accommodation:** Safety pilot (optional) on Martin Baker MK7 zero/zero ejection seat.

**Dimensions:** Span 38 ft 15 in, length 63 ft 1 in, height 16 ft 6 in.

**Weight:** Max T-O 62,000 lb.

**Ceiling:** 60,000 ft.

**Performance:** Speed 1,600 mph, range 1,300 miles.



QF-4 Phantom II

R. Nial Bradshaw/USAF

### ■ QF-16 FULL-SCALE AERIAL TARGET

**Brief:** Regenerated F-16s converted as aerial targets to support missile testing.

### COMMENTARY

The QF-16 began replacing the dwindling and obsolescent QF-4 Full-scale Aerial Target (FSAT) starting in FY15. Aircraft will primarily support missile and weapon systems development, testing, and evaluation. QF-16s are capable of manned or "not under live local operator" (NULLO) control operations. Boeing completed six conversions to support testing. QF-16 completed developmental testing in October 2013 and initial operational testing in September 2014, culminating in an AIM-9X live operational test shot to validate the QF-16's missile scoring system. The first LRIP QF-16s was delivered to Tyndall AFB, Fla., in early 2015. Boeing is under contract to deliver 62 converted airframes in three production lots through October 2017. ACC declared IOC with 15 operational aircraft on Sept. 23, 2016, and full operational capability is planned for late 2017. Current efforts include developing new EA pods and software to more accurately replicate adversary capabilities and tactics, ground control improvements, preliminary development of two-seat trainer, and future F-16 block conversions. Holloman AFB, N.M., launched its first operational QF-16 sortie on Feb. 10, 2017.

### EXTANT VARIANT(S)

- QF-16A/B. Converted from retired F-16A/B Block 15.

- QF-16C/D. Converted from retired F-16C/D Block 25 and Block 30.

**Function:** Full-scale aerial target.

**Operator:** ACC.

**First Flight:** May 4, 2012.

**Delivered:** February 2015.

**IOC:** Sept. 23, 2016.

**Production:** 126 (planned).

**Inventory:** seven (QF-16A); 10 (QF-16C).

**Aircraft Location:** Tyndall AFB, Fla. Planned: Holloman AFB, N.M.

**Contractor:** Lockheed Martin (previously General Dynamics), Boeing.

**Power Plant:** Block 15: one Pratt & Whitney F100-PW-200 turbofan, 23,830 lb thrust.

Block 25: one Pratt & Whitney F100-PW-220 turbofan, 23,830 lb thrust. Block 30: one General Electric F110-GE-100 turbofan, 28,984 lb thrust.

**Accommodation:** Safety pilot (optional) on ACES II zero/zero ejection seat.

**Dimensions:** Span 32.8 ft, length 49.3 ft, height 16.7 ft.



### QF-16 Full-Scale Aerial Target

Sara Vidoni/USAF

**Weight:** F-16A: empty (F100-PW-200) 16,285 lb; F-16C: empty (F110-GE-100) 18,238 lb.  
**Ceiling:** 50,000 ft.  
**Performance:** Speed Mach 2, ferry range 2,000+ miles.

## STRATEGIC WEAPONS

### ■ AGM-86 AIR LAUNCHED CRUISE MISSILE (ALCM)

**Brief:** Nuclear or conventional armed small, air launched, subsonic air vehicle.

#### COMMENTARY

ALCM is programmed to conduct strategic attack—nuclear or conventional—on surface targets. Its small radar signature and low-level flight capability enhance the missile's effectiveness. The nuclear AGM-86B was the first production version. A total of 1,715 were delivered through 1986. USAF is to cut inventory to 528 and consolidate it at Minot AFB, N.D. The conventional AGM-86C, called CALCM, was first delivered in 1987, and few remain in the inventory. It was operationally employed for the first time in Desert Storm and widely used in subsequent operations. CALCM is capable of adverse weather, day/night, air-to-surface, accurate, standoff strike capability at ranges greater than 500 miles. Block 1A enhancements offer improved accuracy and increased immunity to electronic jamming. The AGM-86D is CALCM's Block II penetrator version with AUP-3(M) warhead. It provides standoff capability against hardened, deeply buried targets and was successfully used in Afghanistan. ALCM is undergoing a SLEP to stretch its in-service life to 2030 to allow for planned replacement by the Long-Range Standoff (LRSO) missile. USAF released a request for proposal for the LRSO in 2016 and plans to field the nuclear missile by the late 2020s, possibly followed by a conventional derivative thereafter.

#### EXTANT VARIANT(S)

- AGM-86B. Nuclear ALCM variant.
- AGM-86C. Conventional CALCM variant.
- AGM-86D. Penetrating CALCM Block II variant.

**Function:** Strategic air-to-surface cruise missile.  
**Operator:** AFGSC.  
**First Flight:** June 1979 (full-scale development).  
**Delivered:** From 1981.  
**IOC:** December 1982, Griffiss AFB, N.Y.  
**Production:** 1,715.  
**Unit Location:** Andersen AFB, Guam (conventional only); Barksdale AFB, La.; Minot AFB, N.D.  
**Contractor:** Boeing.  
**Power Plant:** Williams/Teledyne CAE F107-WR-10 turbofan, 600 lb thrust.

**Guidance:** Inertial plus Terrain Contour Matching (B); inertial plus GPS (C/D).

**Warhead:** W80-1 nuclear (B), blast/fragmentation conventional (C), hard target penetrating warhead (D).

**Dimensions:** Span 12 ft, length 20.8 ft, body diameter 2 ft.

**Weight:** 3,150 lb.

**Performance:** Speed 550 mph (B), high subsonic (C/D); range 1,500+ miles (B), 690 miles (C/D).

### ■ B61 THERMONUCLEAR BOMB

**Brief:** Air-dropped nuclear freefall weapon.

#### COMMENTARY

B61 is the primary strategic nuclear weapon for the B-2 bomber and equips both the F-16 and F-15E, providing forward deployed, extended deterrence to allies. The weapon was first delivered in 1966, and the most recent B61 Mod 11 introduced in 1997 adds a ground-penetrating capability, enhancing its destructive effect to destroy buried and hardened targets. The weapon incorporates several preselectable yield options, tailored to mission requirements. Work is underway on the next B61 Mod 12 life extension program (LEP), which entered developmental testing in 2012. The LEP aims to improve the safety, security, and reliability of the weapon through 2040, adding a new guided tail kit in addition to warhead upgrade/refurbishment. USAF completed inert, developmental test drops in 2015, and production engineering work was scheduled to begin in 2016. B61-12 will consolidate the B61-3, -4, -7, and -10 weapons into a single, standardized configuration. The first production example is scheduled for delivery in 2020, and integration work is planned on the B-2, F-15E, F-16, and the F-35A starting in 2018.

#### EXTANT VARIANT(S)

- B61. Current supersonic-droppable freefall thermonuclear weapon.
- B61 Mod 12. Upgraded, life-extended B61 with precision guided tail kit assembly.

**Function:** Air-to-surface thermonuclear bomb.  
**Delivered:** From 1966.  
**IOC:** N/A.  
**Contractor:** Los Alamos National Laboratory (weapon), Boeing (B61-12 tail kit).  
**Guidance:** None (B61 Mod 1 to 11); N/A (B61 Mod 12).  
**Warhead:** One B61 -3, -4, -7, -10, or -11.  
**Dimensions:** Length 11 ft 8 in., diameter 1 ft 1 in.  
**Weight:** 700 lb.  
**Performance:** N/A.

### ■ LGM-30 MINUTEMAN

**Brief:** Silo-launched, solid-fuel ICBM capable of delivering up to three thermonuclear warheads.



### B61 Thermonuclear Bomb

#### COMMENTARY

Minuteman is a three-stage, solid-propellant ICBM housed in an underground silo. Minuteman III became operational in 1970, providing improved range, rapid retargeting, and the capability to place three re-entry vehicles on three targets with a high accuracy. It is the sole remaining US land-based ICBM. Major life extension program ensures viability to 2020. Ongoing mods, including updated warhead fuzes, guidance and propulsion upgrades, and modernized re-entry vehicles would extend that to 2030. AFGSC initially deployed 550, later reducing toward 400 based at Malmstrom AFB, Mont., Minot AFB, N.D., and F. E. Warren AFB, Wyo. AFGSC completed reducing its deployed ICBMs to a single warhead in 2014, under limits imposed by the New START agreement. USAF issued a request for proposal to replace Minuteman with a future Ground Based Strategic Deterrent (GBSD) in 2016.

#### EXTANT VARIANT(S)

- LGM-30G. Current Minuteman III variant.

**Function:** Strategic surface-to-surface ballistic missile.  
**Operator:** AFGSC.  
**First Flight:** February 1961.  
**Delivered:** 1962–December 1978.  
**IOC:** December 1962, Malmstrom AFB, Mont.  
**Production:** 1,800.  
**Inventory:** 406.  
**Unit Location:** F. E. Warren AFB, Wyo.; Malmstrom AFB, Mont.; Minot AFB, N.D.  
**Contractor:** Boeing, BAE Systems, General Electric, Lockheed Martin, Orbital ATK.  
**Propulsion:** Stage 1: Orbital ATK refurbished M55 solid-propellant motor, 202,600 lb thrust; stage 2: Orbital ATK refurbished SR19 solid-propellant motor, 60,721 lb thrust; stage 3:



LGM-30 Minuteman MSgt. Lorenzo Gaines/USAF



USAF

Orbital ATK refurbished SR73 solid-propellant motor, 34,400 lb thrust.

**Guidance:** Inertial guidance system.

**Re-entry Vehicle:** One Mk 21 RV; one to three Mk 12/12A MIRVs.

**Warhead:** One (currently) to three 300 kiloton W87 enriched uranium thermonuclear weapons.

**Dimensions:** Length 59.9 ft, diameter 5.5 ft.

**Weight:** 79,432 lb.

**Performance:** Speed at burnout approx 15,000 mph, range 6,000+ miles.

## LONG-RANGE STANDOFF WEAPONS

### ADM-160 MINIATURE AIR LAUNCHED DECOY (MALD)

**Brief:** Air launched programmable electronic warfare platform designed to thwart enemy integrated air defense systems (IADS).

#### COMMENTARY

MALD is a low-cost, modular, autonomous flight vehicle that mimics US or allied aircraft to enemy IADS. MALD-J adds radar jamming capability to the basic decoy platform and can operate alone or in concert with other EW platforms. The jammer version is designed as an expendable, close-in jammer to degrade and deny an early warning or acquisition radar's ability to establish a track on strike aircraft. It also maintains the ability to fulfill the basic decoy mission. F-16 or B-52 are lead employment aircraft for MALD. USAF capped procurement in FY12, converting Lot 4 to the MALD-J variant. Plans call for 3,000, of which 2,400 are the jammer version. USAF demonstrated a new data link in 2014 to potentially enable in-flight retargeting. Operational testing revealed material durability problems with both variants and navigational accuracy problems with MALD-J in GPS degraded/denied environments. Both platforms are considered operationally effective, and software development efforts are underway to address shortcomings. USAF awarded a MALD-J contract option for Lot 10 production in 2016.

#### EXTANT VARIANT(S)

- ADM-160B. MALD base decoy variant.
- ADM-160C. MALD-J jammer/decoy variant.

**Function:** Aircraft decoy; close-in radar jammer.

**First Flight:** 1999 (MALD); 2009 (MALD-J).

**Delivered:** From September 2012 (MALD-J).

**IOC:** N/A.

**Contractor:** Raytheon.

**Guidance:** GPS/INS.

**Dimensions:** Span 5.6 ft (extended), length 9.3 ft.

**Weight:** Less than 300 lb.



A1C Micaiah Anthony/USAF

### ADM-160 Miniature Air Launched Decoy

**Performance:** Range up to 575 miles, endurance 90 minutes (50 minutes on-station loiter).

### AGM-154 JOINT STANDOFF WEAPON (JSOW)

**Brief:** Low-cost glide weapon.

#### COMMENTARY

JSOW is a joint USAF and Navy family of medium-range, GPS/INS guided, standoff air-to-ground weapons. They are used to attack a variety of soft and armored area targets during day and night and adverse weather conditions. The baseline BLU-97 CEM variant is used against soft and area targets. The BLU-108 variant provides anti-armor capability. The AGM-154C incorporates an additional imaging IR seeker and is intended for use against hardened, stationary targets. JSOW is integrated onto the B-1, B-2, B-52, F-15E, and F-16, and an F-35C conducted the strike fighter's first drop during integration testing on March 23, 2016. The new AGM-154C-1 variant that adds moving, maritime strike capability to the baseline C variant reached IOC with the Navy in 2016 and will eventually equip the F-35A/C.

#### EXTANT VARIANT(S)

- AGM-154A. Baseline BLU-97 CEM variant for soft/area targets.
- AGM-154B. The BLU-108 submunition variant for anti-armor.
- AGM-154C. Imaging IR guided variant for hardened tactical targets.

**Function:** Air-to-surface guided missile.

**First Flight:** December 1994.

**Delivered:** 2000-05 (USAF).

**IOC:** 2000 (USAF).

**Contractor:** Raytheon.

**Guidance:** GPS/INS.

**Warhead:** See variants above.

**Dimensions:** length 13.3 ft, diameter 13 in.

**Performance:** range 13.8 miles low altitude, 73 miles high altitude.

### AGM-158 JOINT AIR-TO-SURFACE STANDOFF MISSILE (JASSM)

**Brief:** Advanced weapon designed to precisely attack heavily defended targets at extended, standoff range.

#### COMMENTARY

JASSM is a joint USAF-Navy autonomous precision strike weapon. It can attack both fixed and relocatable targets, including moderately hardened buried targets. The base variant is a stealthy low-cost airframe equipped with GPS/INS guidance and IIR terminal seeker. The base variant is integrated on the B-1B, B-2, B-52H, F-15E, and F-16 Block 50. Planned integra-

tion includes F-16 Block 40 and F-35A. The JASSM-Extended Range (JASSM-ER) version uses same baseline body but a new engine and fuel system that increases range to more than 500 miles. The ER variant was cleared for combat use on the B-1B in 2015 and is planned for integration on the B-52H, F-15E, all F-16 blocks, and the F-35A. Full rate production of the ER began the same year and JASSM production shifted to ER-only in FY16. Lockheed Martin surpassed 2,000 weapons delivered in 2016. Lockheed Martin is developing a new anti-shipping variant, dubbed Long-Range Anti-Ship Missile (LRASM), for both the Air Force and Navy. Initial integration is planned on the B-1B in 2019.

#### EXTANT VARIANT(S)

- AGM-158A JASSM. Base variant.
- AGM-158B JASSM-ER. Extended-range variant.
- AGM-158C LRASM. Long-Range Anti-Ship Missile based on JASSM.

**Function:** Air-to-surface guided weapon.

**First Flight:** April 8, 1999.

**Delivered:** Through FY19 (planned).

**IOC:** September 2003; December 2014 (ER variant).

**Contractor:** Lockheed Martin, Raytheon, Honeywell.

**Power Plant:** Teledyne Technologies J402 turbojet (JASSM); Williams Intl. F107-WR-105 turbofan (JASSM-ER).

**Guidance:** GPS/INS and IIR terminal seeker.

**Warhead:** 1,000-lb class penetrator.

**Dimensions:** Length 14 ft.

**Performance:** 1,000-lb dual mode penetrator/blast-fragmentation warheads; range 200+ miles (baseline), 500+ miles (ER).

## AIR-TO-AIR MISSILES

### AIM-9 SIDEWINDER

**Brief:** Short-range, supersonic, IR guided air-to-air missile.

#### COMMENTARY

Sidewinder was developed by the Navy for fleet air defense and adapted by USAF for fighter aircraft use. Early versions were used extensively in the Vietnam War. The AIM-9M is a joint Navy-USAF, all-altitude, all-aspect, launch-and-leave intercept missile. It has improved defense against IR countermeasures, background discrimination, and reduced-smoke rocket motor. It first flew in 1978. AIM-9X is the newest jointly funded variant. It employs passive IR tracking, jet-vane steering for increased maneuverability, and Joint Helmet-Mounted

Cueing System (JHMCS) compatibility. The current production AIM-9X Block 2 was cleared for full rate production in September 2015, and an F-35A conducted its first live-fire with the weapon in early 2016. Ongoing development includes control actuation, IR counter-countermeasures, improved lock-after-launch, added partial/degraded cue capability, and improved small target acquisition and surface attack capability. FY17 funds procure 287 AIM-9X and several developmental AIM-9X Block II-plus with enhanced aircraft survivability features.

#### EXTANT VARIANT(S)

- AIM-9M. Early variant.
- AIM-9M-9. Expanded anti-countermeasure capability variant.
- AIM-9X. Newest, highly maneuverable, JHMCS compatible variant.

**Function:** Air-to-air missile.

**First Flight:** September 1953.

**Delivered:** AIM-9M from 1983; AIM-9X 2002-2011 (Block I); 2011 to present (Block II).

**IOC:** Circa 1983 (9M); 2003 (9X).

**Contractor:** Raytheon, Orbital ATK (propulsion).

**Propulsion:** Mk 36 Mod 11 (9M); Orbital ATK Mk 139 solid-propellant rocket motor (9X).

**Guidance:** Passive IR homing guidance.

**Warhead:** HE annular blast fragmentation.

**Dimensions:** Span 2.1 ft, length 9.4 ft, diameter 5 in.

**Performance:** Speed Mach 2+, range 10+ miles.

#### ■ AIM-120 ADVANCED MEDIUM-RANGE AIR-TO-AIR MISSILE (AMRAAM)

**Brief:** Supersonic, medium-range, active radar guided air-to-air missile.

#### COMMENTARY

AMRAAM is a joint USAF-Navy follow-on to the AIM-7 Sparrow with launch-and-maneuver capability. The AIM-120B is an upgraded, reprogrammable variant of the original missile. The AIM-120C incorporated smaller control surfaces for internal carriage on F-22 and F-35 and a high-angle off-boresight (HOBS) launch capability. AIM-120D completed operational testing in July 2014 and was fielded in January 2015. The latest variant offers improved range, GPS-assisted guidance, updated data links, and jam resistance, in addition to greater lethality. Ongoing upgrades undergoing operational testing will further enhance weapon performance and electronic protection. FY17 funds procure 256 AIM-120D missiles.

#### EXTANT VARIANT(S)

- AIM-120B. Upgraded, reprogrammable variant of AIM-120A.
- AIM-120C. Production variant optimized for the F-22/F-35.
- AIM-120D. Latest variant with GPS guidance, improved range, lethality, and jam-resistance.

**Function:** Air-to-air guided missile.

**First Flight:** December 1984.

**Delivered:** From 1988.

**IOC:** September 1991; July 2015 (120D).

**Contractor:** Raytheon, Orbital ATK and Nammo Group (propulsion).

**Propulsion:** Boost-sustain solid-propellant rocket motor.

**Guidance:** Active radar terminal/inertial mid-course.

**Warhead:** HE blast fragmentation.

**Dimensions:** Span 1.7 ft, length 12 ft, diameter 7 in.

**Performance:** Supersonic, range 20+ miles.



AGM-65 Maverick

Capt. Amber House/USAF

## AIR-TO-GROUND WEAPONS

### ■ AGM-65 MAVERICK

**Brief:** A tactical, TV-, IIR-, or laser guided standoff air-to-surface missile.

#### COMMENTARY

Maverick was first employed during the Vietnam War and was used extensively in Desert Storm and Iraqi Freedom. It is employed by the A-10 and F-16 against tanks, vehicles, and air defenses. AGM-65B is a launch-and-leave, EO/TV guided missile, equipped with "scene magnification" TV allowing acquisition of small/distant targets. Fielded in 1986, AGM-65D employs an IIR seeker for all-weather day/night use. The AGM-65E is laser guided with a heavyweight penetrator warhead. The AGM-65G fielded in 1989 combines an IIR seeker, software to track larger targets, with a heavyweight penetrator warhead, digital autopilot, and a pneumatic actuation system. The AGM-65H is an upgraded B variant that recently completed tracker upgrades. The AGM-65K is a modified G variant, replacing IR guidance with EO TV guidance, and is also undergoing a tracker upgrade. The AGM-65L is the newest EO TV/semiactive-laser seeker equipped, Laser Maverick, designed to strike high-speed moving targets. FY17 funds modify 244 legacy missiles to Laser Maverick standards and replenish weapons expended in ongoing combat.

#### EXTANT VARIANT(S)

- AGM-65B. A launch-and-leave EO TV seeker variant.
- AGM-65D. Adverse weather B variant.
- AGM-65E. Laser guided version heavyweight penetrator variant.
- AGM-65G. IIR seeker heavyweight penetrator variant.
- AGM-65H. Upgraded B variant.
- AGM-65K. Modified EO TV seeker G variant.
- AGM-65L. Laser guided EO TV seeker variant for fast moving targets.

**Function:** Air-to-surface guided missile.

**First Flight:** August 1969.

**Delivered:** From August 1972.

**IOC:** February 1973.

**Contractor:** Raytheon, Orbital ATK (propulsion).

**Propulsion:** Two-stage sustain thrust solid-propellant rocket motor.

**Guidance:** EO TV guidance system (B/H/K); IIR seeker (D/G); laser seeker (E).

**Warhead:** 125-lb cone-shaped (B/D/H); 300-lb delayed-fuse penetrator (E/G/K).

**Dimensions:** Span 2.3 ft, length 8.2 ft, diameter 12 in.

**Performance:** Supersonic, range 20 miles.

### ■ AGM-88 HIGH-SPEED ANTI-RADIATION MISSILE (HARM)

**Brief:** Tactical anti-radar air-to-surface missile.

#### COMMENTARY

HARM is a joint USAF-Navy weapon, highly effective against enemy ground radar, and carried by USAF F-16CJs dedicated to the SEAD mission. AGM-88B is equipped with erasable and electronically programmable read-only memory, permitting in-field changes to missile memory. The AGM-88C is the current production model with a more lethal warhead. Raytheon began a HARM Control Section Mod (HCSM) in 2013 to convert current models to more precise AGM-88Fs incorporating improved GPS/INS guidance, anti-counter measure performance, and reduced risk of collateral damage.

#### EXTANT VARIANT(S)

- AGM-88B. Early production variant.
- AGM-88C. Current production variant.
- AGM-88F. Upgraded variant with greater accuracy and precision.

**Function:** Air-to-surface anti-radiation missile.

**First Flight:** April 1979.

**Delivered:** 1982-98.

**IOC:** Circa 1984.

**Contractor:** Raytheon.

**Propulsion:** Thiokol dual-thrust, solid-propellant rocket motor.

**Guidance:** Proportional with fixed antenna and seeker head in missile nose.

**Warhead:** HE fragmentation.

**Dimensions:** Span 3.7 ft, length 13.7 ft, diameter 10 in.

**Performance:** Supersonic, range 30+ miles.

### ■ AGM-114 HELLFIRE

**Brief:** Laser guided, low-collateral, air-to-ground anti-armor/anti-personnel missile.

#### COMMENTARY

Hellfire is a precision missile utilizing semi-active laser guidance. Missiles are used on the MQ-1 Predator and MQ-9 Reaper, and AFSOC aims to integrate the weapons onto its AC-130W gunships. Hellfire is procured through the Army, and numerous variants are utilized based on overseas contingency demands. An MQ-1 Predator successfully fired an AGM-114 for the first time in February 2000. The combo was employed in combat for the first time in Afghanistan on Oct. 7, 2001. USAF is working to integrate the latest AGM-114R, which replaces several types with a single, multitarget weapon, onto the MQ-9. The Army had to divert missiles to the Air Force to replace stocks severely depleted by combat over Iraq and Syria. FY17 funds support procurement of 1,536 missiles.

## EXTANT VARIANT(S)

• AGM-114. Numerous subvariants, depending on target and mission requirements.

**Function:** Air-to-surface guided missile.

**First Flight:** Feb. 16, 2000 (USAF).

**Delivered:** September 2001-present.

**IOC:** N/A.

**Contractor:** Lockheed Martin, Orbital ATK (propulsion).

**Propulsion:** Solid-propellant rocket motor.

**Guidance:** EO TV guidance system (B/H/K); IIR seeker (D/G); laser seeker (E).

**Warhead:** Shaped charge and blast fragmentation.

**Dimensions:** Span 28 in, length 5.33 ft, diameter 17 in.

**Performance:** Subsonic, range 5+ miles.

## ■ AGM-176 GRIFFIN

**Brief:** GPS and inertial guided air-to-ground missile with semi-active laser seeker for highly accurate, low-collateral attack.

## COMMENTARY

Griffin is a light, low cost, multiservice air-launched weapon with GPS-aided inertial guidance and semi-active laser seeker. The AGM-176A forms part of the PSP employed on AFSOC's AC-130W Dragon Spear, and AC-130J Ghost Rider gunships. The AGM-176B is employable on RPAs.

## EXTANT VARIANT(S)

• AGM-176A. Aft-ejecting missile employed as part of the PSP.

• AGM-176B. Forward-firing variant optimized for light aircraft/RPAs.

**Function:** Air-to-surface guided missile.

**First Flight:** Feb. 16, 2000 (USAF).

**Delivered:** September 2001.

**IOC:** N/A.

**Contractor:** Raytheon.

**Propulsion:** Solid-propellant rocket motor.

**Guidance:** GPS/INS/semi-active laser.

**Warhead:** Blast fragmentation.

**Dimensions:** Length 43 in, diameter 5.5 in.

**Performance:** Subsonic, range 12 + miles.

## ■ CBU-105 SENSOR FUZED WEAPON (SFW)

**Brief:** Anti-armor munition capable of destroying multiple moving and stationary land combat vehicles per pass.

## COMMENTARY

SFW is a tactical munitions dispenser with a payload of 10 BLU-108 submunitions, each containing four skeet projectiles, totaling 40 lethal, target-seeking projectiles. The skeet's



AGM-114 Hellfire A1C Christian Clausen/USAF



## AGM-88 High-speed Anti-Radiation Missile (HARM)

Jim Haseltine/courtesy USAF

active laser and passive IR sensors can detect a vehicle's shape and IR signature; if no target is detected, the warhead detonates at a preset time. Primary targets are massed tanks, armored personnel carriers, and self-propelled targets. CBU-105 is a basic gravity-type 1,000-lb SFW with a WCMD tail kit. It can be delivered from high altitude and in adverse weather. It debuted in combat in Iraq in 2003. CBU-105 is the only standard USAF cluster munition that meets the less-than-one-percent failure rate mandated by DOD for use beyond 2018.

## EXTANT VARIANT(S)

• CBU-105. CBU-97 with WCMD tail kit.

**Function:** Wide-area munition.

**First Flight:** Circa 1990.

**IOC:** 1997.

**Contractor:** Textron Systems.

**Guidance:** IR sensors in each warhead.

**Dimensions:** Length 7.7 ft, diameter 15 in.

**Performance:** Delivers 40 lethal projectiles over an area of about 500 ft x 1,200 ft.

## ■ CBU-107 PASSIVE ATTACK WEAPON

**Brief:** Area munition used to inflict minimal collateral and environmental damage attacking nonhardened surface targets.

## COMMENTARY

Passive Attack Weapon glides toward its target after release. Before impact, its inner chamber begins to rotate, and projectiles are ejected in rapid succession by centrifugal force, penetrating targets within a 200-ft radius. The weapon contains various-size, penetrating projectiles but no explosive. Full production was completed in six months. The weapon was used during Iraqi Freedom.

## EXTANT VARIANT(S)

• CBU-107A. Centrifugally dispersed, armor-penetrating weapon.

**Function:** Wide-area munition.

**First Flight:** 2002.

**IOC:** December 2002.

**Contractor:** General Dynamics (kinetic energy penetrator payload and canister), Lockheed Martin (WCMD), Textron (tactical munition dispenser kit).

**Guidance:** Via WCMD.

**Dimensions:** Length 7.7 ft, diameter 15 in.

**Performance:** Delivers a high-speed volley of nearly 4,000 metal projectiles in three sizes from a single canister; projectiles: 15 in rods (350), 7 in rods (1,000), and small-nail size (2,400).

## ■ GBU-10/12/49 PAVEWAY II

**Brief:** Laser guided free-fall bomb used for targets at short standoff range.

## COMMENTARY

The Paveway II kit is a folding wing version of the earlier, fixed wing Paveway I, with seeker and reliability improvements. GBU-10 is the Paveway II seeker and tail kit mounted on a 2,000-lb general-purpose bomb and primarily used against nonhardened targets. It is, however, capable of penetration. The GBU-12 uses a 500-lb bomb body and is primarily used against stationary armored targets. GBU-49 is also a 500-lb body, but adds GPS guidance for all-weather precision delivery. The weapons can be employed from 2,500 ft up to 40,000 ft.

## EXTANT VARIANT(S)

• GBU-10. Laser/GPS guided 2,000-lb bomb.

• GBU-12. Laser guided 500-lb bomb.

• GBU-49. Laser/GPS guided 500-lb bomb.

**Function:** Air-to-surface guided munition.

**First Flight:** Early 1970s.

**IOC:** 1976.

**Contractor:** Lockheed Martin, Raytheon.

**Guidance:** Semi-active laser.

**Warhead:** Mk 84 bomb 2,000 lb (GBU-10); Mk 82 500-lb blast/fragmentation bomb (GBU-12/49).

**Dimensions:** Span 5.5 ft, length approx 14.8 ft, diameter 18 in (GBU-10); span 4.4 ft, length 10.8 ft, diameter 11-18 in (GBU-12/49).



**GBU-43/B Massive Ordnance Air Blast (MOAB) Bomb**

Courtesy Eglin AFB, Fla.

**Performance:** CEP 29.7 ft, range 9.2 miles (GBU-10); CEP 29.7 ft, range about six miles (GBU-12/49).

#### ■ GBU-24/28 PAVEWAY III

**Brief:** Advanced laser guided free-fall bomb used against high-value targets from medium standoff range and any altitude.

#### COMMENTARY

Paveway III is the third generation laser guided seeker/tail kit package. Its advanced guidance enables greater precision over Paveway II, and its high-lift airframe enables longer glide slopes for greater standoff employment. It can be dropped from low, medium, or high altitude and is effective against a broad range of high-value targets. GBU-24 is fitted to a 2,000-lb bomb body, with a BLU-109 penetrating warhead. GBU-28 variants are large 5,000-lb class air-to-ground penetrators developed for use against Iraq's deeply buried, hardened C2 facilities. The GBU-28B adds GPS/INS guidance to the existing laser seeker for all-weather targeting and entered production in 1999. The GBU-28C adds a more powerful penetrating BLU-122 warhead in addition to the enhanced guidance package and entered production in 2005.

#### EXTANT VARIANT(S)

- GBU-24. Laser guided 2,000-lb penetrating bomb.
- GBU-28B/B. Laser/GPS/INS guided 5,000-lb penetrating bomb.
- GBU-28C/B. Laser/GPS/INS guided 5,000-lb improved penetrating bomb.

**Function:** Air-to-surface penetrating glide bomb.

**First Flight:** GBU-24 in service May 1985.

**IOC:** 1986 (GBU-24); 1991 (GBU-28).

**Contractor:** Raytheon.

**Guidance:** Semi-active laser.

**Warhead:** BLU-109 2,000-lb bomb (GBU-24); BLU-113 or BLU-122 5,000-lb bombs (GBU-28).

**Dimensions:** Span 6.7 ft, length 14.4 ft, diameter 18 in (GBU-24); length approx 20 ft, diameter 15 in (GBU-28).

**Performance:** Range more than 11 miles (GBU-24); range more than 5.75 miles (GBU-28).

#### ■ GBU-31/32/38 JOINT DIRECT ATTACK MUNITION (JDAM)

**Brief:** GPS/INS guided family of weapons designed for highly accurate, autonomous, all-weather conventional attack.

#### COMMENTARY

JDAM is a joint USAF-Navy program that upgrades the existing inventory of general-purpose bombs by integrating them with a GPS/INS guidance kit to provide accurate all-weather

attack from medium/high altitudes. The weapons acquire targeting information from the aircraft's avionics system. After release, an inertial guidance kit directs the weapon, aided by periodic GPS updates. JDAM seeker/tail kits can be mounted on general-purpose or penetrating warheads in each weight class. A JDAM kit is under development for the 5,000-lb BLU-113 penetrating weapon, slated for integration and flight testing on the F-15E. FY17 funds support priority procurement of more than 30,000 JDAM variants to replenish depleted stocks.

#### EXTANT VARIANT(S)

- GBU-31. GPS/INS guided 2,000-lb GP, or BLU-109 penetrating weapon.
- GBU-32. GPS/INS guided 1,000-lb GP, or BLU-110 penetrating weapon.
- GBU-38. GPS/INS guided 500-lb GP, or BLU-111 penetrating weapon.

**Function:** Air-to-surface guided bomb.

**First Flight:** Oct. 22, 1996.

**IOC:** 1998.

**Contractor:** Boeing, Textron, Honeywell.

**Guidance:** GPS/INS.

**Warhead:** 2,000-lb Mk 84/BLU-109 (GBU-31), 1,000-lb Mk 83/BLU-110 (GBU-32), 500-lb Mk 82/BLU-111 (GBU-38).

**Dimensions:** Span 25 in (GBU-31), 19.6 in (GBU-32), 14 in (GBU-38); length (with JDAM and warhead) approx 12 ft (GBU-31), 10 ft (GBU-32), 7.8 ft (GBU-38).

**Performance:** Range up to 15 miles, CEP with GPS 16.4 ft, CEP with INS only 98 ft.

#### ■ GBU-39 SMALL DIAMETER BOMB I/II

**Brief:** Standoff precision guided munition.

#### COMMENTARY

SDB is a low-yield, all-weather precision guided munition designed to limit collateral damage and strike targets from up to 46 miles away. Its size allows it to be carried in fighters' and bombers' internal weapons bays or to increase overall load-out to enable more independent strikes per sortie. SDB I employs an advanced anti-jam GPS/INS and acquires target coordinates before release. Several SDBs can be simultaneously released against multiple targets. The weapon was first employed by an F-15E over Iraq in 2006. SDB II is a joint USAF-Navy program to attack moving targets from standoff range in all weather. SDB II adds a millimeter-wave radar, IIR, and semi-active laser packaged into a tri-mode seeker. The bomb is retargetable after release. Improvements include reduced susceptibility to countermeasures and network-enablement through Link 16/UHF data links. SDB II is in operational testing and is slated to begin live drops from the F-15E in 2017. SDB I is a major procurement priority, and funds



**GBU-31 Joint Direct Attack Munition**

support acquisition of 4,507 weapons.

#### EXTANT VARIANT(S)

- GBU-39/B SDB I. GPS/INS guided 250-lb low-yield bomb.
- GBU-53/B SDB II. Tri-mode guided 250-lb low-yield bomb.

**First Flight:** May 23, 2003 (guided SDB I); 2012 (SDB II).

**IOC:** Oct. 2, 2006.

**Production:** 24,000 (planned) (SDB I); 12,000 (planned) (SDB II).

**Contractor:** Boeing (SDB I), Raytheon (SDB II).

**Guidance:** GPS/INS (SDB I); Tri-mode seeker millimeter-wave radar, uncooled IIR, and digital semi-active laser (SDB II).

**Warhead:** 250-lb class penetrating blast fragmentation munition.

**Dimensions:** Bomb: length 6 ft, width 7.5 in; BRU-61/A carriage (four bombs) length 12 ft, width 16 in, height 16 in.

**Performance:** Near-precision capability at standoff range up to 46 miles.

#### ■ GBU-43 MASSIVE ORDNANCE AIR BLAST (MOAB) BOMB

**Brief:** Massive weapon designed to destroy large area or buried targets.

#### COMMENTARY

MOAB is the largest satellite guided, air-delivered weapon ever employed. The conventional HE bomb is GPS guided, with fins and inertial gyro for pitch and roll. It was developed in only nine weeks to be available for the 2003 Iraq campaign and given the name Massive Ordnance Air Blast (MOAB) but was unofficially known as "Mother of All Bombs." The weapon is designed for deployment from the ramp of a C-130 without a parachute. It provides the power to attack large area targets or enemy hidden in tunnels or caves. A total of 18,700 lb of the weapon's 21,000-lb weight is attributed to BLU-120/B warhead. Used operationally for the first time in April 2017 against ISIS-occupied cave complex in Afghanistan.

#### EXTANT VARIANT(S)

- GBU-43/B. GPS guided 21,000-lb bomb.

**Function:** Massive guided bomb.

**Guidance:** GPS/INS.

**Warhead:** BLU-120/B 18,700-lb HE.

**Dimensions:** Length 30 ft, diameter 3.3 ft.

#### ■ GBU-54 LASER JOINT DIRECT ATTACK MUNITION (LJDAM)

**Brief:** GPS/INS guided weapon equipped with additional laser seeker for highly accurate, autonomous, all-weather conventional attack against fixed and moving targets.



TSGt. James Hodgman/USAF



TSGt. Dana Rosso/USAF

### GBU-39 Small Diameter Bomb

#### COMMENTARY

LJDAM is a joint USAF-Navy development that combines a laser guidance kit with the GPS/INS-based navigation of existing GBU-38 JDAM. The current LJDAM is a dual mode 500-lb guided weapon capable of attacking moving targets with precision. It was developed as an urgent operational need, and testing was completed in less than 17 months. It was first delivered in May 2008 and deployed in combat in Iraq three months later. Boeing is also developing GBU-31 and GBU-32 variants.

#### EXTANT VARIANT(S)

- GBU-54 Laser JDAM. Laser/GPS/INS guided 500-lb bomb.

**Function:** Air-to-surface guided bomb.

**First Flight:** 2005.

**IOC:** 2008.

**Contractor:** Boeing.

**Guidance:** GPS/INS with laser.

**Warhead:** Mk 82 500-lb munition.

**Dimensions:** Length (with JDAM and warhead) approx 8 ft.

**Performance:** Range up to 15 miles.

#### ■ GBU-57 MASSIVE ORDNANCE PENETRATOR

**Brief:** Massive, GPS guided, earth-penetrating weapon used against hard and deeply buried targets.

#### COMMENTARY

MOP was developed and tested through a USAF and Defense Threat Reduction Agency partnership in 2004. Flight testing was conducted from 2008 to 2010, when the program transitioned to USAF. Boeing received the contract in 2009 for B-2A bomber integration, which was completed in 2011. A B-2 successfully test-dropped the GBU-57 in 2014 and 2015. Recent tests proved the effectiveness of several enhancements and cleared the way for continued testing and potential early fielding, though the Air Force's recommendation is classified.

#### EXTANT VARIANT(S)

- GBU-57B. GPS guided 5,300-lb penetrating weapon.

**Function:** Massive PGM.

**Guidance:** GPS.

**Warhead:** 5,300-lb HE.

**Dimensions:** length 20.5 ft, diameter 31.5 in.

## SATELLITE SYSTEMS

#### ■ ADVANCED EXTREMELY HIGH FREQUENCY (AEHF) SATELLITE SYSTEM

**Brief:** Constellation providing global, secure,

protected, and jam-resistant military communication.

#### COMMENTARY

AEHF is replacing existing Milstar satellites and operates at a much higher capacity and data rate. It offers secure, anti-jam tactical and strategic communications around the world. AEHF uses cross-linked satellites, eliminating the need for ground relay stations. The program is a collaboration with Canada, the Netherlands, and the United Kingdom. The AEHF system achieved IOC in 2015. SV-4 is scheduled to launch in 2017, paving the way for full operational capability.

#### EXTANT SYSTEMS

- AEHF SV-1. Launched in 2010, on orbit and operational.

- AEHF SV-2. Launched in 2012, on orbit and operational.

- AEHF SV-3. Launched in 2013, on orbit and operational.

- AEHF SV-4. Planned for launch in 2017.

**Function:** Communications.

**Operator:** AFSPC.

**First Launch:** August 2010.

**IOC:** 2017 (planned).

**Constellation:** Four.

**Design Life:** 14 years.

**Launch Vehicle:** Atlas V.

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Power:** Solar arrays generating 20,000 watts.

**Dimensions:** Length 31 ft, width 98 ft (with full solar array extension).

**Weight:** 13,400 lb.

**Performance:** 24-hr low, medium, and extended data rate connectivity from 65 north to 65 south latitude worldwide.

#### ■ DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)

**Brief:** Satellite constellation used to collect air, land, sea, and space environmental data in support of worldwide military operations.

#### COMMENTARY

DMSP provides timely and high-quality weather information to strategic and tactical combat units worldwide. It uses operational linescan sensor to image cloud cover in visible and thermal IR and analyze cloud patterns. It is equipped with microwave imagers and sounders and a suite of space environment sensors that provide critical land, sea, and space environment data. Block 5D-3 improved spacecraft bus and sen-

sors for longer and more capable missions. Six operational DMSP satellites now survey the entire Earth four times a day. The oldest operational satellite, DMSP-13, suffered an apparent electrical short and exploded, creating a cloud of debris in space in 2015. DMSP-19 most recently launched in 2014. The vehicle subsequently suffered a power failure in early 2016, rendering it uncontrollable. Data from the craft remains usable until its orbit decays. Congress canceled the DMSP program before the final spacecraft (DMSP-20) could be launched. DMSP-20 is in storage awaiting a decision to launch it as a replacement to DMSP-19 or to dispose of the vehicle. USAF is also considering requirements for a follow-on system.

#### EXTANT VARIANT(S)

- Block 5D-2. Launched 1982 to 1997; one active (DMSP-14).

- Block 5D-3. Improved spacecraft bus and sensors for longer, more capable missions.

**Function:** Space and Earth environmental data collection.

**Operator:** National Oceanic and Atmospheric Administration (NOAA).

**First Launch:** May 23, 1962.

**IOC:** 1965.

**Constellation:** Six low Earth orbit (LEO).

**Design Life:** Five yr (Block 5D-3).

**Launch Vehicle:** Delta IV; Atlas V.

**Operational Location:** NOAA Satellite Operations Facility, Suitland, Md.

**Orbit Altitude:** Approx 527 miles.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Power:** Solar arrays generating 1,200-1,300 watts.

**Dimensions:** Length 25 ft (with array deployed), width 4 ft.

**Weight:** 2,545 lb, incl 772-lb sensor; 2,270 lb with 592-lb sensor payload.

**Performance:** Polar orbits; covers Earth in about 6 hr; primary sensor scans 1,800-mile-wide area.

#### ■ DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS)

**Brief:** Joint service satellite system providing high-capacity communications for deployed air, land, and sea forces.

#### COMMENTARY

DSCS is the workhorse of US military's SHF communications system. It provides military communications to troops in the field and commanders worldwide. The last of 14 DSCS IIIs launched in 2003. AFSPC deactivated its two oldest DSCS satellites, B-12 in July 2014 and DSCS-10 in June 2015. B-12 exceeded its designed lifespan by 12 years. The final

four DSCS satellites received SLEP before launch, providing higher power amplifiers, more sensitive receivers, and increased antenna connection options. The satellites also carry a single channel transponder to disseminate emergency action and force direction messages to nuclear-capable forces.

#### EXTANT VARIANT(S)

- DSCS III. Current base on orbit variant.
- DSCS III. SLEP. Upgrade configuration of last four satellites launched.

**Function:** Communications.

**Operator:** AFSPC.

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

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

**Constellation:** Five (III); 14 deployed/seven operational.

**Design Life:** 10 yr (III).

**Launch Vehicle:** Atlas II and EELV.

**Operational Location:** Schriever AFB, Colo.

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

**Contractor:** Lockheed Martin.

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

**Dimensions:** Rectangular body 6 x 6 x 7 ft, 38-ft span with solar arrays deployed.

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

**Performance:** Employs six independent SHF transponder channels for secure voice and high-rate data communications.

#### ■ DEFENSE SUPPORT PROGRAM (DSP)

**Brief:** Ballistic missile early warning spacecraft in geosynchronous orbit, guarding US forces and the US homeland against attack.

#### COMMENTARY

DSP is a key part of North American and theater early warning systems. It is capable of detecting missile launches and nuclear detonations and was originally aimed at the Soviet military. It was used extensively in 1991 Gulf War to detect Iraqi theater missile launches against coalition forces and allies in the region. The 23rd and final DSP satellite launched in December 2007. Block 5 is the latest variant and is more survivable than predecessors. It includes a medium wavelength IR sensor for more mission utility and accommodates 6,000 detectors. Nine Block 5 satellites were deployed between 1989 and 2007. Control of the constellation was consolidated to the new Block 10 Mission Control Station at Buckley AFB, Colo., in early 2016.

#### EXTANT VARIANT(S)

- Block 5. Most current on-orbit version.

**Function:** Strategic and tactical launch detection.

**Operator:** AFSPC.

**First Launch:** November 1970.

**IOC:** Circa 1972.

**Constellation:** Classified.

**Design Life:** Three-year requirement and five-year goal.

**Launch Vehicle:** Titan IV with inertial upper stage; Delta IV Heavy EELV.

**Operational Location:** Buckley AFB, Colo.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Contractor:** TRW (now Northrop Grumman), Aerojet.

**Power:** Solar arrays generating 1,485 watts.

**Dimensions:** Diameter 22 ft, height 32.8 ft, with solar paddles deployed.



**Defense Support Program** USAF illustration

**Weight:** Approx 5,200 lb.

**Performance:** Uses IR sensors to sense heat from missile and booster plumes against Earth's background.

#### ■ GEOSYNCHRONOUS SPACE SITUATIONAL AWARENESS PROGRAM (GSSAP)

**Brief:** Space-based platform to track and characterize manmade objects in geosynchronous orbit to aid safety and avoidance.

#### COMMENTARY

GSSAP are "neighborhood watch" satellites that augment the legacy Space Based Space Surveillance (SBSS) system. SBSS tracks and classifies manmade objects in low Earth orbit, and GSSAP extends this coverage to geosynchronous orbit. Two GSSAP satellites were launched in 2014 and attained IOC on Sept. 29, 2015. The satellites operate in near-geosynchronous orbit to effectively monitor objects and aid in preventing collisions in space. GSSAP carry EO/IR sensors and are able to maneuver to observe objects at close range and can track objects without the weather and atmospheric disruptions affecting ground systems.

#### EXTANT VARIANT(S)

- GSSAP. Launched 2014; two active.

**Operator:** AFSPC.

**First Launch:** July 28, 2014.

**IOC:** Sept. 29, 2015.

**Constellation:** Two spacecraft.

**Launch Vehicle:** Delta IV.

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** 22,300 miles, above geosynchronous.

**Contractor:** Orbital Sciences Corp.

**Power:** Solar panels.

#### ■ GLOBAL POSITIONING SYSTEM (GPS)

**Brief:** Space-based radio-positioning constellation providing highly accurate worldwide location, velocity, and timing services to military and civilian users.

#### COMMENTARY

GPS is a fundamental contribution to precision bombing, CSAR, mapping, and rendezvous. Provides accurate 3-D (latitude, longitude, and altitude) position, velocity, and time data in an uninterrupted way. GPS Block IIA first launched in 1990. The Air Force decommissioned the final Block IIA, launched to replace original GPS Block I series, on Aug. 26, 2016. GPS Block IIR and IIR-M (modernized) included 21 vehicles launched between 2005 and 2009. Modernization upgrades included two new signals, enhanced encryption, anti-jamming

capabilities, and a second civil signal. GPS Block IIF is a follow-on to IIR-M. Upgrades include extended design life, faster processors, and improved anti-jam and accuracy, with a new military signal and a second and third dedicated civil signal. The last of 12 GPS IIF satellites deployed since 2010 launched from Cape Canaveral AFS, Fla., on Feb. 5, 2016. The next generation GPS Block IIIA currently in production is expected to improve accuracy, availability, integrity, and resistance to jamming. The first launch was pushed back from 2014 to a tentative 2017 target. SpaceX was awarded its first GPS launch contract to launch the second GPS IIIA on its Falcon 9 booster in May 2018. USAF recently contracted Lockheed Martin to build GPS IIIA vehicles nine and 10 for expected launch in 2022.

#### EXTANT VARIANT(S)

- GPS Block IIA. Launched 1990 to 1997; final satellite retired in 2016.

- GPS Block IIR. Launched 1997 to 2004; 12 active.

- GPS Block IIR-M. Launched in 2005 to 2009; seven active.

- GPS Block IIF. Launched in 2010 to 2016; 11 active, one recently launched.

- GPS Block IIIA. Future generation expected to launch in 2017.

**Function:** Worldwide navigation, timing, and velocity data.

**Operator:** AFSPC.

**First Launch:** Feb. 22, 1978.

**IOC:** Dec. 9, 1993.

**Constellation:** 31 spacecraft.

**Design Life:** 7.5 yr (II/IIA); 7.5 yr (IIR/IIR-M); 12 yr (IIF); 15 yr (IIIA).

**Launch Vehicle:** Delta II, Delta IV, Falcon 9 (planned).

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** 10,988 miles.

**Contractor:** Boeing (II, IIA, IIF), Lockheed Martin (IIR, IIR-M, IIIA).

**Power:** Solar panels generating 700 watts (II/IIA); 1,136 watts (IIR/IIR-M); up to 2,900 watts (IIF).

**Dimensions:** (IIR/IIR-M) 5 x 6.3 x 6.25 ft, span incl solar panels 38 ft; (IIF) 9.6 x 6.5 x 12.9 ft, span incl solar panels 43.1 ft.

**Weight:** On orbit, 2,370 lb (IIR/IIR-M); 3,439 lb (IIF).

**Performance:** Orbits the Earth every 12 hr, emitting continuous signals, providing time to within one-millionth of a second, velocity within a fraction of a mile per hour, and location to within a few feet.

#### ■ MILSTAR SATELLITE COMMUNICATIONS SYSTEM (MILSTAR)

**Brief:** Joint service satcom constellation that provides global, secure, protected, and jam-resistant military communications.

#### COMMENTARY

Milstar is the backbone of strategic-tactical DOD communications. It provides secure, anti-jam communications around the world and uses cross-linked satellites, eliminating the need for ground relay stations. Offers 24-hours-a-day capability. The last of six satellites launched in 2003. AEHF will eventually replace Milstar as the DOD's primary satcom.

#### EXTANT VARIANT(S)

- Block I. Milstar I satellites launched 1994-95.

- Block II. Milstar II satellites launched 1999-2003.

**Function:** Communications.  
**Operator:** AFSPC.  
**First Launch:** Feb. 7, 1994.  
**IOC:** July 1997 (Milstar I).  
**Constellation:** Five: two Milstar I; three Milstar II.  
**Design Life:** 10 yr.  
**Launch Vehicle:** Titan IV/Centaur.  
**Operational Location:** Schriever AFB, Colo.  
**Orbit Altitude:** Geosynchronous at 22,000+ miles.  
**Contractor:** Lockheed Martin, Boeing, TRW (now Northrop Grumman).  
**Power:** Solar arrays generating 8,000 watts.  
**Dimensions:** Length 51 ft, width 116 ft with full solar array extension.  
**Weight:** 10,000 lb.

**Performance:** Milstar I sats have low data rate (LDR) payload, transmitting 75 to 2,500 bps of data over 192 channels in EHF range; Milstar II sats have both LDR and medium data rate (MDR) payloads, transmitting 4,800 bps to 1.5 Mbps over 32 channels.

### ■ SPACE BASED INFRARED SYSTEM (SBIRS)

**Brief:** Advanced space surveillance and missile warning system, capable of battlespace characterization and technical intelligence gathering.

#### COMMENTARY

SBIRS is the follow-on to the Defense Support Program satellite. The system includes IR sensor payloads on host satellites in highly elliptical orbit (HEO), two IR sensors each on dedicated satellites in geosynchronous Earth orbit (GEO), and ground assets. HEO sensor detects launch of submarine-launched ballistic missiles (SLBMs) from the North Pole region and can be tasked for other IR detection missions. GEO scanning IR sensor performs the strategic missile warning mission, global technical intelligence, and initial phase for the strategic missile defense mission, providing two times the revisit rate and three times the sensitivity of DSP. USAF announced plans to allow civil use of SBIRS data to aid weather prediction, Arctic ice monitoring, and wildfire tracking. GEO-3 launched into orbit Jan. 20, 2017, after delays to validate the performance of its liquid apogee engine. GEO-4 is slated to launch in 2017. The next two GEO satellites are under contract and will eventually replace the oldest two on orbit. SBIRS Control was consolidated to the new Block 10 Mission Control Station at Buckley AFB, Colo., in early 2016.

#### EXTANT SYSTEM(S)

- SBIRS HEO-1. Payload operational in 2008; currently active.
- SBIRS HEO-2. Payload operational in 2009; active.



Milstar

USAF illustration



### Space Based Infrared System

USAF illustration

- SBIRS HEO-3. Payload operational in 2015; active.
- SBIRS GEO-1. Launched in 2011; active.
- SBIRS GEO-2. Launched in 2013; active.
- SBIRS GEO-3. Launched in 2017; active.

**Function:** Space surveillance.

**Operator:** AFSPC.

**First Launch:** GEO 1, May 2011.

**IOC:** HEO 1, Dec. 5, 2008. (Increment 1, Dec. 8, 2001).

**Constellation:** Four GEO sats, three HEO sensors (hosted).

**Design Life:** N/A.

**Launch Vehicle:** GEO, Atlas V.

**Operational Location:** Buckley AFB, Colo.

**Orbit Altitude:** Geosynchronous and high elliptical.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Power:** Solar array, 2,435 watts (GEO).

**Dimensions:** GEO 7 x 6.3 x 19.7 ft.

**Weight:** 5,603 lb (GEO on orbit).

### ■ SPACE BASED SURVEILLANCE SYSTEM (SBSS)

**Brief:** Satellite constellation used to track, characterize, and measure orbital vehicles and hazardous orbital debris.

#### COMMENTARY

SBSS is designed to track and collect optical signatures of Earth-orbiting objects, including space debris, from a space-based platform. AFSPC is working to extend SBSS service life to cover a potential four-year gap in coverage before it can launch a follow-on spacecraft in 2021—the earliest date based on projected funding.

#### EXTANT SYSTEM(S)

- SBSS Block 10. Launched in 2010; active.
- Function:** Space surveillance and object identification.
- Operator:** AFSPC.
- First Launch:** Sept. 25, 2010.
- IOC:** Aug. 17, 2012.
- Constellation:** One LEO satellite.
- Design Life:** Seven yr.
- Launch Vehicle:** Minotaur IV.
- Operational Location:** Schriever AFB, Colo.
- Orbit Altitude:** 390 miles, sun-synchronous orbit.
- Contractor:** Boeing (system integration, ground segment, operations, and sustainment), Ball Aerospace (satellite).
- Power:** Solar arrays and batteries generating 750 watts.
- Dimensions:** Height approx 10 ft; 10 x 3.2 ft, plus solar panels.
- Weight:** Approx 2,273 lb.

### ■ WIDEBAND GLOBAL SATCOM (WGS) SATELLITE

**Brief:** Satellites providing high-capacity communications for deployed air, land, and sea forces.

#### COMMENTARY

WGS is designed to provide worldwide communications coverage for tactical and fixed users and to augment and then replace DSCS X-band frequency service. Augments the one-way Global Broadcast Service Joint Program Ka-band frequency capabilities. WGS satellites also provide a new high-capacity two-way Ka-band frequency service. Block I includes: SV-1 (Pacific region), SV-2 (Middle East), and SV-3 (Europe and Africa). Block II satellites are modified to better support the airborne ISR mission and include: SV-4 (Indian Ocean) and SV-5 and SV-6, purchased by Australia in 2013. The US is partnering with Canada, Denmark, Luxembourg, the Netherlands, and New Zealand on Block II follow-on sats SV-7 to SV-10. SV-7 launched on July 23, 2015, and became operational that October. SV-8 launched into orbit on Dec. 7, 2016, and SV-9 launched March 18, 2017. All four satellites are expected to be aloft and operational by 2019. USAF recently contracted industry to develop anti-jamming capability for tactical users and is reviewing alternatives to eventually replenish the constellation with three additional satellites or develop a follow-on system.

#### EXTANT VARIANT(S)

- Block I. Satellites SV-1 to SV-3; launched 2007 to 2009; active.
  - Block II. Satellites SV-4 to SV-8; launched 2009 to 2016; active.
- Function:** Communications.
- Operator:** AFSPC.
- First Launch:** October 2007.
- IOC:** April 16, 2008.
- Constellation:** Seven satellites.
- Design Life:** 14 yr.
- Launch Vehicle:** Atlas V, Delta IV.
- Operational Location:** Schriever AFB, Colo.
- Orbit Altitude:** Geosynchronous at 22,000+ miles.
- Contractor:** Boeing.
- Power:** Solar arrays generating 9,934 watts.
- Dimensions:** Based on Boeing 702 Bus.
- Weight:** 13,000 lb at launch.
- Performance:** Approx 10 times the capability of a DSCS satellite.

Aaron M. U. Church is a freelance writer in Grand Forks, N.D. He is a former *Air Force Magazine* senior editor.