



★ 2019 USAF ALMANAC  
**WEAPONS & PLATFORMS**

By Aaron M. U. Church

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## BOMBER AIRCRAFT



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Photo: MSgt, Russ Scaff

### B-1 LANCER

Long-range conventional bomber

**Brief:** The B-1B is a conventional, long-range, supersonic penetrating strike aircraft, derived from the cancelled B-1A. Four B-1A prototypes were developed and tested until 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 top speed to Mach 1.2. B-1B saw first combat over 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, as well as tracking and targeting moving vehicles. Sniper pod was added in 2008. The ongoing integrated battle station (IBS) modification 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 and LOS/BLOS C2, and the Central Integrated Test System (CITS), gives crew real-time diagnostics and simplified troubleshooting. Sustainment Block 16 (IBS) upgrades started in 2016 will be completed fleetwide by 2020. Higher powered jam-resistant GPS is in development. Future upgrades include Fully Integrated Targeting Pod (FITP), Multifunctional Information Distribution System/Joint Tactical Radio System (MIDS/JTRS), airspace-compliant CNS/ATM, updated BLOS cryptography, and bomb rack improvements. Boeing recently proposed a design to add a modular cannon to the weapons bay. The fleet was briefly grounded due to an engine fire and ejection seat malfunction in 2018. It was again grounded in March after inspectors identified issues with the drogue chute system. Successful LRASM tests conducted against a moving vessel paved the way for early adoption in 2019. The B-1B is slated for phase-out circa 2032, in favor of the new B-21 Raider stealth bomber.

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

**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.

**Operator:** AFGSC, AFMC.

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

**Active Variant:** B-1B. Upgraded production version of the B-1A.

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

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

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

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

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

**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 JDAM; 24 AGM-158A JASSM or JASSM-ER.

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

### B-2 SPIRIT

Long-range heavy bomber

**Brief:** The B-2 is a stealthy long-range penetrating nuclear and conventional strike bomber. It is based on a flying wing design combining LO with high aerodynamic efficiency. Spirit entered combat during Allied Force on March 24, 1999, striking Serb targets. Production was completed in three blocks and all aircraft were upgraded to Block 30 standard with AESA radar. AESA paves the way for future advanced weapons integration including the Long-Range Standoff (LRSO) missile and B61-12 bomb. The aircraft's blended fuselage/wing holds two weapons bays capable of holding nearly 60,000 lb in various combinations. Weapons integration includes the improved B61-12 nuclear free-fall bomb, JASSM-ER, GBU-57 Massive Ordnance Penetrator, and future weapons such as GBU-53 SDB II, GBU-56 Laser JDAM, and JDAM-5000. Flexible Strike Package mods will feed GPS data to the bays prerelease to thwart jamming, and are required for B61-12. Phase 2 will allow simultaneous nuclear and conventional loadout for increased flexibility. Significant development includes Defensive Management System-Modernization (DMS-M), AEHF satcom, VLF receiver, LO signature mods, and crash-survivable flight-data memory. DMS-M improves survivability in signal-dense, anti-access, area denial environments, aids situational awareness, and enables real-time threat avoidance. AEHF gives two-way, survivable comms for nuclear missions in A2/AD zones, and VLF-receive adds nuclear C2 redundancy. Ongoing upgrades include Adaptable Communications Suite (ACS) for time-sensitive mission updates, and Link 16-based jam-resistant in-flight retasking. Efforts underway shorten depot maintenance, increase intervals between overhauls, and add airspace-compliant CNS/ATM. USAF plans to add wideband nuclear C2 under the FAB-T program. FY19 begins radar-linked non-GPS guidance for B61-12, which will be fully integrated this year. USAF plans to replace the B-2 with the B-21 Raider, retiring the B-2 about 2032.

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

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

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

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

**Production:** 21.

**Inventory:** 20.

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

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

**Active Variant:**

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

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

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

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

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

**Ceiling:** 50,000 ft.

**Armament:** Nuclear: 16 B61-7, B61-12, B83, or eight 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.

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



Photo: SrA, Malcolm Mayfield

## B-52 STRATOFORTRESS

Long-range heavy bomber

**Brief:** The B-52H is a long-range nuclear/conventional bomber and USAF's only standoff cruise missile carrier. The H model is the last serving variant of the Stratofortress. 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, adding Link 16, and enabling machine-to-machine tasking/retargeting. The first CONECT airframe was redelivered in 2014, and a total of 35 airframes were upgraded as of March 2018. CNS/ATM replaces the B-52's analog systems with digital systems. The Internal Weapons Bay Upgrade enables internal smart weapon carriage. The Conventional Rotary Launcher roughly doubles smart weapon payloads, while reducing drag and increasing range. The upgrade was deployed to combat for the first time in Afghanistan in 2017 and supports transition from CALCM to the AGM-158B JASSM-ER long-range cruise missile. Both CONECT and Weapons Bay Upgrades

are slated for completion fleetwide by 2020. Future weapons include the GBU-54 Laser JDAM. A total of 31 B-52s underwent conventional-only modifications to comply with the New START agreement, completed in 2017. Ongoing development includes replacing obsolescent radar with a reliable, modern, off-the-shelf system, adding low-latency, jam-resistant C2/comms, and upgrading BLOS voice/data capability to preserve current capabilities. New development adds additional airspace compliance mods and begins re-engining efforts to replace the TF33 with a more reliable, efficient, and powerful engine. FY19 funds also launch VLF/LF receiver modernization, ATP color MFDs to provide enhanced situational awareness, and AEHF satcom integration. USAF projects service life to the 2050s with new engines, complementing the B-21 Raider after retirement of the B-1 and B-2.

**Contractor:** Boeing, Harris Corp.

**First Flight:** April 15, 1952 (YB-52 prototype); July 20, 1960 (B-52H).

**Delivered:** May 9, 1961-Oct. 26, 1962 (B-52H).

**IOC:** May 1961 (B-52H).

**Production:** 744 (incl 102 B-52H).

**Inventory:** 75.

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

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

**Active Variants:**

- B-52H. Longer-range development of the original B-52A, with more efficient turbofan engines.

**Dimensions:** Span 185 ft, length 159.3 ft, height 40.7 ft.

**Weight:** Max T-O 488,000 lb.

**Power Plant:** Eight Pratt & Whitney TF33-P-3 turbofans, each 17,000 lb thrust.

**Performance:** Speed 650 mph, range 10,000+ miles.

**Ceiling:** 50,000 ft.

**Armament:** Nuclear: 12 AGM-86B ALCMs externally, and eight ALCMs or gravity weapons internally. 12 AGM-158 JASSM externally, and eight JASSM(ER)/MALD/MALD-J internally (upgraded aircraft). 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.

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



Photo: SrA. Betty Chevallier



Photo: SrA. Zachary Bumpus

## A-10 THUNDERBOLT II

Attack, Close Air Support, Forward Air Control

**Brief:** The A-10 "Warthog" is a CAS aircraft effective against armored surface/maritime targets and additionally tasked with interdiction, Forward Air Controller-Airborne (FAC-A), CSAR, and Strike Control & Reconnaissance. A-10C is an upgraded variant of the original A-10A. It adds precision engagement, color cockpit MFDs, hands-on throttle and stick, digital stores management, improved fire-control, GPS-guided weapons, Litening/Sniper pods, advanced data links, and integrated sensors. A-10C debuted in combat 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 a titanium cockpit tub protects the pilot. Current development includes advanced IFF and open architecture software to allow quick integration of future weapons and sensors. Software is continuously updated in response to emerging operational requirements, including advanced weapons integration, situational awareness, targeting, navigation, comm, and cyber security under the A-10 Operational Flight Program (OFP). Lightweight Airborne Recovery System/Combat Survivor Evader Locator (LARS/CSEL) upgrades enhance the A-10's ability to locate and aid recovery of downed aircrew. The last of 278 aircraft were upgraded with Helmet Mounted Cueing System (HMCS) in 2015, and FY19 funds would restart wing replacement for 109 airframes not upgraded under the original program and convert surplus F-15 external tanks to increase endurance and permit unhindered cannon reloading. Other ongoing upgrades include HMCS improvements, ATP improvements, and airspace compliance mods. USAF reversed retirement and plans to retain the fleet until 2030.

**Contractor:** Fairchild Republic (Lockheed Martin).

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

**Delivered:** October 1975-March 1984.

**IOC:** October 1977 (A-10A); 2007 (A-10C).

**Production:** 713.

**Inventory:** 281.

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

**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.

**Active Variant:**

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

**Dimensions:** Span 57.5 ft, length 53.3 ft, height 14.7 ft.

**Weight:** Max T-O 51,000 lb.

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

**Performance:** Speed 518 mph, range 800 miles.

**Ceiling:** 45,000 ft.

**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.

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

## F-15 EAGLE

Air superiority fighter

**Brief:** The F-15 Eagle was the world's dominant, supersonic, all-weather, day/night air superiority fighter for more than 30 years. F-15C/Ds began replacing F-15A/Bs in 1979 and offered superior maneuverability, acceleration, range, weapons, and avionics. The C/D incorporates internal EW countermeasures and an added 2,000 lb of internal fuel (with provision for CFTs). The aircraft accounted for 34 of 37 USAF air-to-air kills during its 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 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. A total of 214 aircraft will be upgraded to partner with the F-22. Major development includes EPAWSS and infrared search and track (IRST). USAF plans to procure 100 belly-mounted IRST pods to discreetly detect, track, and engage air targets. Ongoing upgrades include advanced data links to enhance interoperability with fifth generation aircraft, safety-critical forward fuselage longeron replacements, Multifunctional Information Distribution System/Joint Tactical Radio System (MIDS/JTRS), and new digital cockpit displays to fully exploit AESA capabilities (common with the F-15E). MIDS/JTRS will enable higher capacity, jam-resistant Link 16 networking. FY19 begins FAA-mandated airspace integration mods and jam-resistant Mode 5-compliant IFF. European Deterrence Initiative funding keeps F-15C/Ds at RAF Lakenheath to boost allied air superiority. Wing replacement testing is underway and SLEP/re-winging is needed to reach 2045. USAF announced plans to purchase up to 144 new-build F-15EX to replace legacy airframes and augment the limited F-22 fleet, starting in FY20.

**Contractor:** McDonnell Douglas (now Boeing), BAE Systems (EPAWSS), Raytheon (AESA), Rockwell Collins (MIDS/JTRS).

**First Flight:** July 27, 1972 (F-15A); Feb. 26, 1979 (F-15C).

**Delivered:** 1974-79 (F-15A/B); 1979-85 (F-15C/D).

**IOC:** September 1975 (F-15A/B); 1979 (F-15C/D).

**Production:** 874.

**Inventory:** 212 (F-15C); 23 (F-15D).

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

**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, La.; Portland Arpt., Ore.; RAF Lakenheath, UK.

**Active Variants:**

• F-15C. Upgraded version of the single-seat F-15A.

• F-15D. Upgraded version of the two-seat F-15B.

**Dimensions:** Span 42.8 ft, length 63.8 ft, height 18.7 ft.

**Weight:** Max T-O 68,000 lb.

**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.

**Performance:** F-15C: speed Mach 2.5, ferry range 2,878 miles (3,450 miles with CFTs and three external tanks).

**Ceiling:** 60,000 ft.

**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. In a one-time test, an Eagle has successfully launched an anti-satellite missile.

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



Photo: SSGT. Clayton Cupit

## F-15E STRIKE EAGLE

**Multirole fighter**

**Brief:** F-15E is an upgraded two-seat, all-weather F-15 capable of deep interdiction/attack, tactical nuclear delivery, and air-to-air combat. Strike Eagle is capable of sustaining nine Gs throughout the flight envelope. It first saw combat in 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. The "Dragon's Eye" SAR pod fielded in 2009 provides all-weather surveillance/reconnaissance capability. F-15Es are equipped with Link 16 and ARC-210 BLOS satcom. The Strike Eagle is undergoing major avionics modernization, centered on the new APG-82(V)1 AESA radar. The Eagle Passive/Active Warning Survivability System (EPAWSS) is a second major effort to replace its obsolete self-defense suite. Ongoing avionics upgrades include a new central computer and cockpit displays (in common with the F-15C/D), jam-resistant Link 16, Mode 5 IFF, Joint Helmet Mounted Cueing System (JHMCS) upgrades, ATP improvements, and airspace compliance mods. Ongoing developments include AESA integration, EPAWSS, and MIDS/JTRS to enable higher capacity, jam-resistant Link 16 networking. The F-15E completed JASSM-ER integration in 2018, and future weapons include SDB II. FY19 begins anti-jam tactical UHF radio to support NORTHCOM's air sovereignty missions and FAA-mandated ADS-B.

**Contractor:** McDonnell Douglas (now Boeing), BAE Systems (EPAWSS), Raytheon (AESA).

**First Flight:** Dec. 11, 1986.

**Delivered:** April 1988-2004.

**IOC:** September 1989.

**Production:** 236.

**Inventory:** 218.

**Operator:** ACC, AFMC, USAF.

**Aircraft Location:** Eglin AFB, Fla.; Mountain Home AFB, Idaho; Nellis AFB, Nev.; RAF Lakenheath, UK; Seymour Johnson AFB, N.C.

**Active Variant:**

• F-15E. All-weather strike aircraft derived from the F-15C/D.

**Dimensions:** Span 42.8 ft, length 63.8 ft, height 18.5 ft.

**Weight:** Max T-O 81,000 lb.

**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.

**Performance:** Speed Mach 2.5, ferry range 2,400 miles with CFTs and three external tanks.

**Ceiling:** 50,000 ft.

**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) and ECM pods.

**Accommodation:** Pilot and WSO on ACES II zero/zero ejection seats.



Photo: TSgt. Gregory Brook

## F-16 FIGHTING FALCON

**Multirole fighter**

**Brief:** The F-16 is a multirole fighter capable of air-to-air, CAS, SEAD, interdiction, FAC-A, tactical nuclear delivery, and all-weather strike. The "Viper" comprises 50 percent of USAF's fighter fleet and is among the most maneuverable fighters ever built. The F-16 is capable of carrying the majority of PGMs in the inventory and is USAF's primary SEAD platform. In USAF service, the F-16 saw its first combat in 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. Most upgrades are managed in Pre-Block (Blocks 25/30/32) and Post-Block (Blocks 40/42/50/52) tranches. The fleet has recently been cockpit-standardized with a new color MFD, modular mission computer, Helmet Mounted Integrated Targeting (HMIC), and Link 16. Automatic Ground Collision Avoidance System (A-GCAS) was added in 2014, and future efforts include adding air collision avoidance and merging the two systems. Development of the similar Hybrid Flight Control Computer/A-GCAS for Pre-Block aircraft equipped with analog flight-control systems will pave the way for A-GCAS installation fleetwide by 2022. Ongoing upgrades include SLEP, AESA radar retrofits, MIDS/JTRS to enable higher capacity, jam-resistant Link 16 networking, Aggressor capability improvements, and low-cost mods. USAF completed the first depot-level SLEP to extend fatigue life to 10,000 hours or beyond in April 2018. AESA radar upgrades NORAD alert aircraft to counter cruise missile threats and includes additional capability improvements. Development includes mission computer, sensor, radar, and self-defensive suite capability enhancements, HFLCC/A-GCAS, comm modernization, fourth/fifth gen fighter network capabilities, airspace compliance mods (ADS-B), and digital RWR. JASSM-ER integration is nearing completion. Lockheed is shifting support work and future production for foreign customers from Fort Worth, Texas, to Greenville, S. C., to make way for ramped-up F-35 production.

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

**First Flight:** Dec. 8, 1976 (full-scale development); June 19, 1984 (F-16C).

**Delivered:** January 1979 (F-16A); July 13, 1984-2005 (F-16C/D).

**IOC:** 1980, (F-16A); 1981 (Block 25-32); 1989 (Block 40/42); 1994 (Block 50/52).

**Production:** 2,206.

**Inventory:** 787 (F-16C); 154 (F-16D).

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

**Aircraft Location:** Aviano AB, Italy; Edwards AFB, Calif.; Eglin AFB, Fla.; Eielson AFB, Alaska; 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 from Maryland), Minnesota, New Jersey, Ohio, Oklahoma, South Carolina, South Dakota, Texas, Vermont, Wisconsin.

**Active Variants:**

• 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. Optimized for night/all-weather attack.
- F-16CJ Block 50/52. Optimized for SEAD with long-range radar, engines, and weapons.

**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.

**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).

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

**Ceiling:** 50,000 ft.

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

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



Photo: SrA. John Linzmeier/ANG

## F-22 RAPTOR

Air superiority/multirole fighter

**Brief:** The F-22 is a stealthy, penetrating, air dominance and multirole attack fighter 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 enable great maneuverability. Features include six LCD color cockpit displays, APG-77 radar, EW system with RWR and missile launch detection, JTIDS, IFF, 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 Program (RAMP), Software Increment 3.2B, and tactical capability improvements. RAMP is adding AIM-9X-capable launch rails, more durable LO, as well as structural and wiring fixes. 3.2B software will add high resolution ground mapping SAR, threat geolocation, EA capability, and integration of SDB I, AIM-120D, and AIM-9X. TACLink-16 will be fielded with 3.2B and enable data link transmit capability between F-22 and legacy aircraft. Five 3.2B-modified test aircraft began operational testing in 2018 alongside fleetwide concurrent mods. Talon SPITBALL selects a new Helmet Mounted Display and Cueing System (HMDCS) to fully utilize advanced weapons such as AIM-9X. Additional upgrades include engine safety, performance, and maintainability mods and structural life extension to 8,000 hours. FY19 begins crypto mods, Mode 5 IFF tactical improvements, and sensor upgrades to retain lethality to 2025 and beyond. Several F-22s were damaged in 2018 incidents including a gear-up aborted take-off at NAS Fallon, Nev., on April 13; a runway excursion at JB Elmendorf-Richardson on Oct. 10, and Hurricane Michael. Tyndall-based aircraft were semi-permanently relocated to other F-22 bases following the hurricane and training temporarily moved to Eglin.

**Contractor:** Lockheed Martin, Boeing.

**First Flight:** Sept. 7, 1997.

**Delivered:** April 9, 1997 (prototype); Oct. 23, 2002-May 2, 2012.

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

**Production:** 195.

**Inventory:** 186.

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

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

**Active Variant:**

- F-22A. Fifth generation air dominance fighter.

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

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

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

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

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

**Armament:** One internal M61A2 20 mm gun (480 rds); two AIM-9 Sidewinders 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.

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



Photo: ATC Lillian Miller

## F-35 LIGHTNING II

Multirole fighter

**Brief:** The F-35 is a stealthy, penetrating, multirole, all-weather fighter/attack aircraft. Lightning II is a joint/multinational program intended to provide a highly common family of strike fighters for all US services and close allies. USAF's F-35A will replace F-16 and A-10 fleets with a stealth platform capable of penetrating advanced enemy air defenses and striking targets at will. An Israeli Air Force F-35I "Adir" made the type's combat debut, purportedly striking Iranian targets in Syria in May 2018. The F-35A carries up to 18,000 lb of weapons on 10 stations, including two internal bays (for maximum stealth) and six additional wing, fuselage (or centerline) mounted pylons. The Marine Corps declared IOC in 2015, followed by USAF in 2016 (using the first Block 31 software-upgraded aircraft). The Navy F-35C attained IOC Feb. 28, 2019. F-35 development, production, and operational use are concurrent, requiring rolling retrofit of earlier airframes. USAF began ongoing Block 31 software upgrades in 2015, and launched Block 3F updates in 2018. Block 31 improves the baseline Block 2B software, adding 89 percent of the code needed for full-combat capability. Block 3F is in operational testing. It will enable full combat capability, adding a range of precision guided munitions. Block 4 development will add new weapons (including SDB II) and sensors, improve the F-35's EW and maritime strike capabilities, and integrate nuclear weapons beyond 2020. Current combat capabilities include interdiction, basic CAS, and limited SEAD. The F-35 began initial operational test and evaluation in late 2018 and will continue through at least late summer. Continuous Capability Development and Delivery (C2D2), also known as Block 4, develops future capabilities and corrects early production deficiencies discovered during concurrent production/testing. FY19 funding procures 48 F-35As, and long-lead items for 48 aircraft in FY20. Full-rate production is planned for April 2019.

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

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

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

**IOC:** Aug. 2, 2016 (Hill AFB, Utah).

**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:** 155 (USAF).

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

**Aircraft Location:** Edwards AFB, Calif.; Eglin AFB, Fla.; Hill AFB, Utah; Luke AFB, Ariz.; Nellis AFB, Nev.; future locations include Burlington Arpt., Vt.;

Dannelly Field, Ala.; Eielson AFB, Alaska; RAF Lakenheath, UK; Truax Field, Wis.; Tyndall AFB, Fla.; others TBD.

**Active Variants:**

- 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.

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

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

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

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

**Ceiling:** 50,000 ft.

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

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

## SPECIAL OPERATIONS AIRCRAFT



Photo: SMSgt. John Rohrer

### AC-130J GHOSTRIDER

Attack

**Brief:** The AC-130J is a CAS, air interdiction, and armed reconnaissance platform optimized for convoy escort, point defense, and supporting urban combat. The next generation gunship is based on a highly modified MC-130J, fitted with a modular precision strike package and wing-mounted weapons. The AC-130J is designed to provide ground forces 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. The initial Block 10 was superseded by the Block 20, adding a 105 mm gun, laser guided SDB, side-mounted pilot tactical display, and Large Aircraft Infrared Countermeasures (LAIRCM). Airframes are delivered as MC-130Js and modified to gunship standards. The airframe is then upgraded and managed in common with the HC/MC-130J, receiving Block 8.1 avionics upgrades (including airspace compliance) along with the baseline C-130J. The first Block 20 was delivered to Hurlburt for operational testing in 2016 and deemed operationally effective for most CAS/interdiction taskings in April 2018. Post-initial operational test upgrades will result in Block 20+/30 configuration. Significant mods include software updates to improve gun accuracy, wing-mounted Hellfire and GUB-69 Small Glide Munitions, a permanent CSO cockpit workstation, EW/self-defensive upgrades, and added bubble-type observation windows. The first Block 30 aircraft was delivered for testing March 12, 2019. FY19 launches a multiyear contract for 23 combined AC/MC-130J airframes and funds delivery/conversion of five airframes. Development includes a high-energy laser weapon planned for integration in 2021, radio frequency countermeasures to detect, locate, and respond to threats, and PSP and EO/IR sensor improvements. FY19 adds enhanced all-weather strike capability and sensors testing to enable through-cloud engagement.

**Contractor:** Lockheed Martin.

**First Flight:** Jan. 31, 2014.

**Delivered:** July 29, 2015-present.

**IOC:** Sept. 30, 2017.

**Production:** 12 (37 to be converted from new-build MC-130Js).

**Inventory:** 12.

**Operator:** AFSOC.

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

**Active Variants:**

- 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.
- AC-130J Ghost Rider Block 30. Production aircraft with post operational test upgrades.

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

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

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

**Performance:** Speed 416 mph, range 3,000 miles (further with air refueling).

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

**Armament:** Trainable 30 mm GAU-23/A cannon; 105 mm cannon; PGMs including pylon-mounted GBU-39 SDB, AGM-114 Hellfire, and ramp-mounted AGM-176 Griffin.

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



Photo: A1C Tiffany Emery

### AC-130U SPOOKY

Attack

**Brief:** AC-130U is a gunship-modified C-130H optimized for CAS, interdiction, armed reconnaissance, convoy escort, strike coordination, overwatch, and point defense. Spooky is modified with 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 between 1994 and 95, and Boeing converted four more, all dubbed "Spooky" in honor of early AC-47D gunship. The command retired a single nonstandard AC-130U in 2015 and held the fleet at 16 aircraft until restarting phaseout in FY18. USAF is continuing center wing box replacements to extend service life and meet high operational demands until the fleet can be fully replaced by the AC-130J. Recent upgrades include Enhanced Situational Awareness (ESA) mods to provide near real-time intel and data fusion of threat detection, avoidance, geolocation, and adversary-emitter identification. AFSOC also replaced obsolescent mission computers and EO/IR sensors with a new high-definition suite; GPS updates are ongoing. AC-130Us are undergoing center wing box replacement/structural mods in common with the C-130H fleet. AC-130U is the only DOD platform equipped with increasingly rare 40 mm weapons. The service is remanufacturing some 80,000 40 mm rounds with a safer, more reliable fuse. All AC-130Us serve with the 1st Special Operations Wing at Hurlburt.

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

**First Flight:** 1967.

**Delivered:** 1968-present.

**IOC:** 1996.

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

**Inventory:** 10 (AC-130U).

**Operator:** AFSOC.

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

**Active Variant:**

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

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

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

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

**Performance:** Speed 300 mph, range 1,300 miles (further with air refueling).

**Ceiling:** 25,000 ft.

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

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



Photo: SSgt. Keith James



Photo: A1C Joel Miller

## C-145 SKYTRUCK

Foreign training and light mobility

**Brief:** The C-145 is a STOL multipurpose utility and SOF proficiency training aircraft based on the Polish-built PZL Mielec M-28 Skytruck. The high-wing STOL aircraft features 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. The aircraft 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, supplying surplus aircraft to several partners, including NATO ally Estonia. C-145s now provide aircrew proficiency for combat aviation advisors.

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

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

**Delivered:** 2009-2013.

**IOC:** N/A.

**Production:** 16.

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

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

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

**Active Variants:**

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

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

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

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

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

**Ceiling:** 25,000 ft.

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



Photo: A1C Joel Miller

## C-146 WOLFHOUD

Multimission mobility

**Brief:** The C-146 provides flexible, responsive airlift for special operations teams operating from austere and semiprepared airfields worldwide. Wolfhound is based on the German-built Dornier 328 regional airliner and 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 austere airstrips. 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 in 2011. FY19 funds support navigation enhancements to permit ops in GPS-degraded environments.

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

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

## AC-130W STINGER II

Attack, armed reconnaissance

**Brief:** The AC-130W is a gunship-modified C-130H optimized for CAS, interdiction, armed reconnaissance, convoy escort, strike coordination, overwatch, and point defense. AC-130Ws also provide strike coordination, nontraditional ISR, and C2. PSP mod includes a mission management console, communications suite, and flight deck hardware. Airframes are significantly modified with improved navigation, threat detection, countermeasures, comms, and a standoff Precision Strike Package. The aircraft is entirely separate from the retired AC-130H Spectre. The airframes were originally converted as MC-130W Combat Spear for SOF infiltration/exfiltration and in-flight refueling. They were redesignated Dragon Spear with the addition of the roll on/roll off PSP, filling a need for more gunships in 2010. The aircraft was redesignated AC-130W Stinger II after further enhancements in 2012. AC-130J will eventually replace the AC-130W fleet, which averages more than 24 years. Recent upgrades include Enhanced Situational Awareness (ESA) for near real-time intel and data fusion including threat detection, avoidance, geolocation, and adversary-emitter identification. SDB was added in 2012, and AFSOC is retrofitting the fleet with a 105 mm gun in common with the AC-130U/J fleets. Weapons integration includes Laser Guided SDB (LSDB), and GBU-69B Small Glide Munition, which SOCOM is pursuing instead of continued Hellfire integration. Recent enhancements include IR suppression to cut engine heat signatures and other low-cost mods. A single aircraft will be modified with a high-energy laser (in place of the 30 mm gun) to develop future AC-130J armament.

**Contractor:** Lockheed Martin.

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

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

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

**Production:** 12 (converted).

**Inventory:** 10.

**Operator:** AFSOC.

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

**Active Variant:**

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

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

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

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

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

**Ceiling:** 28,000 ft.

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

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

**Delivered:** 2011-2017.  
**IOC:** N/A.  
**Production:** 20 (converted).  
**Inventory:** 20, USSOCOM-owned.  
**Operator:** AFSOC.  
**Aircraft Location:** Cannon AFB, N.M.; Duke Field, Fla.  
**Active Variant:**  
 • C-146A. Preowned civil Dornier 328 modified for SOF airlift.  
**Dimensions:** Span 69.6 ft, length 68.8 ft, height 23.8 ft.  
**Weight:** Max T-O 30,843 lb.  
**Power Plant:** Two Pratt & Whitney 119C turboprops, 2,150 shp.  
**Performance:** Speed 335 mph, range 2,070 miles (2,000 lb cargo).  
**Ceiling:** 31,000 ft.  
**Accommodation:** Crew: two pilots, one loadmaster. Load: 27 passengers; up to four litters; max cargo 6,000 lb.



Photo: Sr.A. Joseph Pick

## CV-22 OSPREY

Multimission lift

**Brief:** 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 in hostile, denied, and politically sensitive areas. 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 cabin lighting, color helmet mounted displays, IR searchlight, lightweight ballistic armor, EW upgrades, avionics, self-defensive improvements, weapons integration, and ISR and situational awareness enhancements. Silent Knight TF/TA radar will replace the current radar with a stealthier, low-altitude, night/all-weather navigation radar. Development includes improving rapid, long-distance self-deployment capabilities and reducing engine dust/debris ingestion. Future plans call for a trainable, helmet-cued, self-defense weapon with a 360-degree field of fire. Europe-based CV-22s will shift from RAF Mildenhall to Spangdahlem and a permanent Pacific-based unit is standing up at Yokota. The final CV-22 under the current multiyear contract is slated for delivery by December 2022.

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

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

**Delivered:** January 2007-present.

**IOC:** 2009.

**Production:** 51 planned (CV-22; incl three replacements).

**Inventory:** 50.

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

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

**Active Variant:**

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

**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.

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

**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.

**Ceiling:** 25,000 ft.

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

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

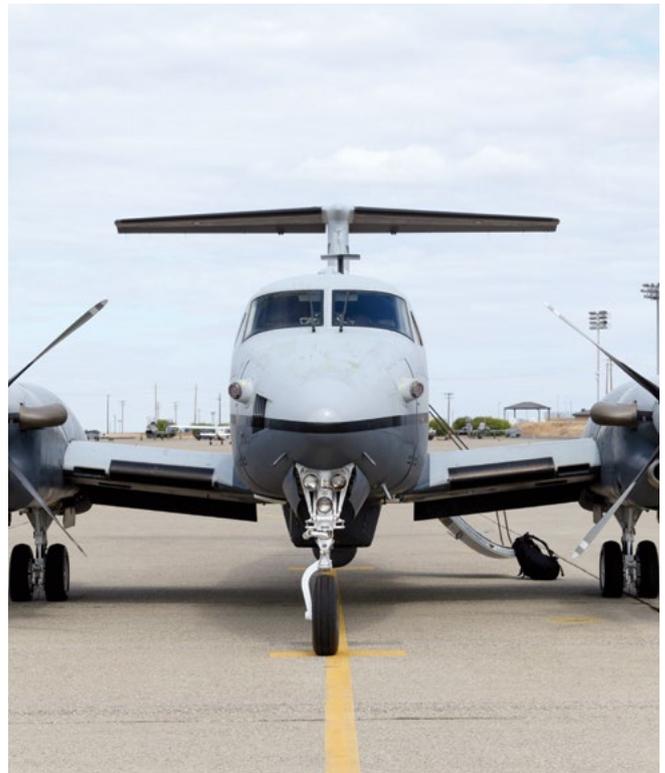


Photo: AIC Ramon Adelen

## MC-12W LIBERTY

Tactical ISR

**Brief:** The MC-12W is a manned, medium/low-altitude tactical ISR, Sigint, and targeting platform based on the Beechcraft King Air 350. The MC-12W is capable of complete ISR collection, processing, analysis, and dissemination. The aircraft provides targeting data and tactical ISR direct to special operations ground forces. 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, and ex-USAF aircraft operated by USSOCOM are designated MC-12W/Javaman III. The Oklahoma ANG acquired 13 airframes to form a dedicated SOF support mission, deploying for the first time to Afghanistan in 2016. FY19 funds install navigation enhancements to permit ops in GPS-degraded environments, IR suppression to improve survivability, and an improved high-definition EO/IR sensor. Upgrade priorities include updated engines and five-bladed propellers to improve performance and cut noise-signature. Nine aircraft require "Slim Fast" mods to consolidate mission systems and interface, reducing weight to improve aircraft performance. A high-fidelity roll-on/roll-off EO/IR sensor is needed fleet-wide to meet COCOM requirements, in addition to safety and short/austere airfield situational awareness improvements.

**Contractor:** Beechcraft, L3 Technologies.

**First Flight:** April 2009.

**Delivered:** From April 2009.

**IOC:** June 2009.

**Production:** 42.

**Inventory:** 13.

**Operator:** ANG.

**Aircraft Location:** Will Rogers ANGB, Okla.

**Active Variant:**

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

**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).

**Power Plant:** Two Pratt & Whitney Canada PT6A-60A turboprops, each 1,050 shp.

**Performance:** Speed 359 mph, range 1,725 miles (350) and 2,760 miles (350ER).

**Ceiling:** 35,000 ft.

**Accommodation:** Two pilots and two sensor operators.



Photo: John Inggle/USAF



Photo: SrA. Lane T. Plummer

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

Special operations airlift/aerial refueling

**Brief:** The MC-130H is a special operations tanker/mobility aircraft based on the C-130H. Its primary missions are covert day, night, and adverse-weather infiltration, exfiltration, and resupply of special operations forces in hostile or denied territory. They also provide air-drop resupply, rotary wing aerial refueling, and psyops. MC-130H are equipped with TF/TA radar, precision navigation systems using INS/GPS, and electronic and IR countermeasures for self-protection. All models are fitted with wing-mounted external fuel tanks and drogue refueling pods to refuel HH-60 and CV-22, and can also receive fuel inflight. Aircraft are capable of airdrop using Joint Precision Airdrop System and operating from austere and unmarked strips. MC-130Es were converted from C-130E airframes in the mid-1960s. The MC-130P (previously HC-130N/P) delivered in the mid-1980s was a specialized aerial refueling version designed to support SOF. MC-130Hs were converted from base-model C-130H to supplement existing Combat Talon I and Combat Shadow fleets in the late 1980s and early 1990s. MC-130H have integrated glass cockpit and a modernized pod-based aerial refueling system. Ongoing mods include center wing replacement, GPS upgrades, permanent Sigint installation, datalink integration, new lightweight armor, digital propeller control system and flight data recorders, and airspace compliance mods. Kadena is retaining a squadron of H models until its MC-130J squadron achieves TF/TA capability. The last MC-130Ps retired in 2017, and a final airframe flew to Sheppard for use as a maintenance trainer in March 2018.

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

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

**Delivered:** Initially 1966.

**IOC:** 1986 (MC-130N/P); June 30, 1993 (MC-130H).

**Production:** 24 new-build MC-130Hs.

**Inventory:** 16 (MC-130H); one (MC-130P).

**Operator:** AFSOC, ANG.

**Aircraft Location:** Hurlburt Field, Fla.; Kadena AB, Japan; Sheppard AFB, Texas (MC-130P).

**Active Variant:**

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

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

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

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

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

**Fuel Capacity:** 63,000 lb (81,120 lb with additional internal tanks) at 310 gpm; 80-160 gpm (MC-130N/P).

**Ceiling:** 33,000 ft.

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

## MC-130J COMMANDO II

Special operations airlift/aerial refueling

**Brief:** The MC-130J is a special operations tanker/mobility aircraft based on the C-130J. Its primary missions are covert day, night, and adverse weather infiltration, exfiltration, and resupply of special operations forces in hostile or denied territory. They also provide air-drop resupply, rotary wing aerial refueling, and psyops. MC-130J are fitted with wing-mounted external fuel tanks and drogue refueling pods to refuel HH-60 and CV-22, and can also receive fuel inflight. 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. Combat Shadow II was redesignated Commando II in reference to the WWII C-47 in 2012. The type fully replaced the legacy MC-130P in 2017. FY19 funds advance procurement of six airframes under a multiyear contract and nine SOF-specific aircraft mods. Funds cover LRIP and installation of five Radio Frequency Countermeasure (RFCM) EW kits to detect, locate, and respond to emerging threats, and auxiliary crew station upgrades to better operate SOF-unique systems. Development includes critical terrain-following/terrain-avoidance (TF/TA) radar, secure, networked voice/data BLOS comms, and mission tracking/threat ID. 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. IOC is slated for 2021, and FY19 funds support installing TF/TA radar on a third aircraft for flight testing. Europe-based MC-130Js will move from RAF Mildenhall to Spangdahlem.

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

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

**Delivered:** Sept. 29, 2011-present.

**IOC:** 2011.

**Production:** 57 (planned).

**Inventory:** 37.

**Operator:** AETC, AFSOC.

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

**Active Variant:**

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

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

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

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

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

**Fuel Capacity:** 61,360 lb at 150-300 gpm (100 gpm dual, simultaneous refueling).

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

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



Photo: AIC Joel Miller

## U-28A

Tactical ISR

**Brief:** The U-28A is a manned, tactical ISR and targeting platform based on the Pilatus PC-12. It is employed worldwide in support of special operations ground forces. Mods include advanced radio-comms suite, 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. The fleet includes 28 operational and eight training aircraft. Two aircraft were lost to fatal mishaps in Djibouti in 2012 and at Cannon in 2017. Ongoing upgrades include sensor, self-defense, and navigation mods to enable ops in GPS-degraded environments and comply with FAA airspace mandates. Multispectral Targeting System installation includes FMV, EO-IR, IR real-time video, and co-aligned laser designator. New Advanced Threat Warning (ATW) includes missile, hostile fire, and laser warning. Urgent infrared suppression mods are ongoing, and FY19 adds Enhanced Ground Proximity Warning in response to mishaps including the 2012 accident. U-28 EQ+ mods enable deployment of two additional high-definition FMV-equipped aircraft for extended stand-off "find, fix, finish" capabilities in support of counter-ISIS ops.

**Contractor:** Pilatus Aircraft Ltd.

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

**Delivered:** From 2006.

**IOC:** N/A.

**Production:** 36 (converted).

**Inventory:** 34 (USSOCOM-owned).

**Operator:** AFSOC, AFRC.

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

**Active Variant:**

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

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

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

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

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

**Ceiling:** 30,000 ft.

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

## ISR/BM/C3 AIRCRAFT



Photo: Stefano Benedetto

## CHALLENGER CL-600 COMBAT FLIGHT INSPECTION

Combat Flight Inspection.

**Brief:** Challenger is a modified, long-range executive-class jet equipped with specialized instrumentation for Combat Flight Inspection (CFIN). The three-aircraft fleet is owned by the Federal Aviation Administration and operated by USAF to certify that airbase NAVAIDs (Navigational Aids) such as TACAN, VOR, and ILS, as well as approach/departure procedures are safe and meet applicable standards before all-weather combat flight operations can begin. USAF has lacked a fully organic CFIN capability since retiring the C-29A and handing flight inspection over to the FAA in 1991. The FAA and USAF jointly funded replacing the aging and range-limited C-29A, and USAF procured a single airframe in FY09. Due to the high-risk environment, Air Force Flight Standards Agency Det. 1 crews

from Will Rogers ANGB conduct flight checks in combat theaters, as well as forward locations including Antarctica. In addition to combat ops, the fleet is tasked with inspecting US, allied, and partner-nation facilities overseas. FY19 funds support procurement and maintenance of military-specific equipment required for CFIN, including secure anti-jam radios, IFF, Mode 4/5 transponders, and self-defensive suites for protection during forward-deployed operations.

**Contractor:** Canadair (Bombardier).

**First Flight:** Nov. 8, 1978.

**Delivered:** 2009 (USAF procured airframe).

**IOC:** Circa 2010.

**Production:** N/A.

**Inventory:** Three (FAA-owned).

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

**Aircraft Location:** Will Rogers ANGB, Okla.; various locations overseas.

**Active Variant:**

- CL-600-2B16. CL-600 with uprated turbofans and winglets, equipped for the CFIN role.

**Dimensions:** Span 61.8 ft, length 68.4 ft, height 20.6 ft.

**Weight:** Max T-O 40,125 lb.

**Power Plant:** Two General Electric CF34 turbofans, each 9,140 lb thrust.

**Performance:** speed Mach 0.83, range 3,915 miles.

**Ceiling:** 45,000 ft.

**Accommodation:** Two pilots and one flight inspection technician.



Photo: AIC Matthew Seefeldt

## E-3 SENTRY

Battle management/early warning/C2

**Brief:** The E-3 airborne warning and control system (AWACS) is a heavily modified Boeing 707-320B. It is tasked with all-weather, air and maritime surveillance, command and control, battle management, target, threat, and emitter detection, classification, and tracking. The aircraft is 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 it 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. Ongoing upgrades include an urgent operational requirement to shorten kill-chains on time-sensitive targets, modernizing airborne moving target indication, and add high-speed jam-resistant Link 16. Electronic Protection (EP) will improve radar processing in response to a classified requirement. FY19 launches "bridge capability" upgrades to enable the E-3G to meet requirements until replacement in the early 2040s and accelerates airspace compliance mods. A single airframe will enter Block 40/45 upgrade and three aircraft will be redelivered in FY19, bringing the total upgraded fleet to 24. Seven AWACS are slated for divestiture this year.

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

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

**Delivered:** March 1977-84.

**IOC:** 1977.

**Production:** 31.

**Inventory:** 11 (E-3B); three (E-3C); 17 (E-3G).

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

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

**Active Variants:**

- 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.

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

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

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

**Performance:** Speed 360 mph, range 5,000+ miles (air refuelable).

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

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



Photo: Yasuo Okasaki/USAF

## E-4 NATIONAL AIRBORNE OPERATIONS CENTER

**Nuclear command and control**

**Brief:** 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 in support of the National Military Command System (NMCS). It is hardened against the effects of nuclear explosions, including electromagnetic pulse (EMP). Comm and data processing capabilities include EHF Milstar satcom, six-channel International Maritime Satellite, and a triband radome houses the 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, replacing the VLF/LF transmitter, and upgrading CNS/ATM with civil compliant systems. USAF is drafting requirements to replace E-4B with a more modern platform, while DOD is looking to combine both the Navy's E-6B Mercury and USAF E-4B into a single commonly configured "Survivable Airborne Operations Center" (SAOC) fleet. Airframes are viable to 2039, but phaseout of commercial 747-200s hampers sustainment beyond 2020.

**Contractor:** Boeing, Rockwell, Raytheon (FAB-T).

**First Flight:** June 13, 1973 (E-4A); June 10, 1978 (E-4B).

**Delivered:** December 1974-1985.

**IOC:** December 1974 E-4A; January 1980 E-4B.

**Production:** Four.

**Inventory:** Four.

**Operator:** AFGSC.

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

**Active Variant:**

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

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

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

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

**Performance:** Speed 602 mph, range 7,130 miles 12hr normal endurance, 72 hr with air refueling.

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

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



Photo: SSgt. Michael Battles

## E-8 JSTARS

**Command and control/ISR**

**Brief:** E-8C is a ground moving target indication (GMTI), airborne battlefield management/command and control platform. Its primary mission is providing theater commanders with 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 more recent refinements have enabled human-target tracking. Target data is transmitted via datalink to ground stations or other aircraft. USAF halted modernization funds and retired the program's testbed aircraft in 2015. Ongoing mods include networking for classified information sharing between CENTCOM coalition partners (CENTRIX), and new Emergency Locating Transmitters. FY19 launches Secure Common Data Link (SDL) to enable LOS networking with Common Ground Stations. The service canceled plans to replace the E-8 with a more affordable business-class airframe, and now plans to upgrade and retain JSTARS through the mid-2020s. USAF is evaluating system requirements for numerous disaggregated platforms. USAF conducted depot maintenance on a single E-8 in 2018 in an effort to supplement contractor support and increase fleetwide availability.

**Contractor:** Northrop Grumman, Raytheon.

**First Flight:** December 1988.

**Delivered:** May 1996-2005.

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

**Production:** 18.

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

**Operator:** ANG.

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

**Active Variants:**

- E-8C. Block 20 upgraded JSTARS platform based on the Boeing 707-300.
- TE-8A. Crew training aircraft based on the E-8.

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

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

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

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

**Ceiling:** 42,000 ft.

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



Photo: MSGt. Scott Wilcox

## E-9A WIDGET

### Range control

**Brief:** 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. The aircraft support operations in the 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. The fleet operates in concert with three drone recovery vessels and two patrol boats to clear waterways and airspace of civil traffic before live-fire testing or hazardous military activities commence. It also provides tracking and assistance with recovering targets. The aircraft can remotely initiate destruction of damaged or malfunctioning aerial target drones.

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

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

**Delivered:** 1988.

**IOC:** June 1988.

**Production:** Two.

**Inventory:** Two.

**Operator:** ACC.

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

**Active Variant:**

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

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

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

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

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

**Ceiling:** 30,000 ft.

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



Photo: SSgt. Benjamin Gonsier

## E-11A BATTLEFIELD AIRBORNE COMMUNICATIONS NODE

### Communications relay

**Brief:** 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 comm and data links. It provides joint range extension, BLOS C2, and Internet protocol-based data transfer between dissimilar systems. E-11A was fielded to meet an urgent operational need for BLOS relay 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 fleet was designated E-11A after USAF purchased the first previously leased

aircraft in 2011. 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. Development includes Protected Tactical Waveform (PTW) to thwart adversary jamming in A2/AD environments. FY19 transitions E-11A from contingency funding to a long-term program of record. The current support contract awarded in January 2018 funded continued ops through January 2019. USAF is also seeking to acquire a fifth airframe for conversion to E-11A standards.

**Contractor:** Northrop Grumman, Bombardier.

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

**Delivered:** Dec. 2008-Aug. 30, 2012.

**IOC:** Circa 2011.

**Production:** Four.

**Inventory:** Four.

**Operator:** ACC.

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

**Active Variant:**

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

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

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

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

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

**Ceiling:** 51,000 ft.

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



Illustration: Gulfstream

## EC-37B COMPASS CALL

### EW/EA

**Brief:** The EC-37B is a next generation, tactical jamming platform tasked with disruption of enemy C3, radar, and navigation. It will also offer offensive counterinformation, EA, and SEAD support. The aircraft is based on the ultra-long-range Gulfstream G550 business aircraft and adapted from the Navy's special mission configuration. USAF awarded L3 Technologies a contract on Sept 7, 2017, to replace the EC-130H in the tactical EA role and transplant its "Compass Call" systems to a more modern and survivable aircraft. USAF added procurement of two EC-37B airframes to the existing Compass Call program in FY17. The program, originally dubbed "EC-X" will "re-host" upgraded EC-130H mission equipment directly to the EC-37 with nearly 70 percent remaining unchanged. The first aircraft was purchased in FY17, followed by a second in FY18. FY19 funds procure a third. USAF plans to procure and modify 10 aircraft at a rate of one aircraft per year. The upgraded Baseline 3 Compass Call package will include the Advanced Radar Countermeasure System (ARCS) and other significant capability enhancements. The new platform will be faster, more economical, capable of higher altitude operations, and more survivable than the current EC-130H. Modification of the first aircraft is ongoing, and USAF plans to field the first two in 2023.

**Contractor:** Gulfstream Aerospace (airframe), BAE Systems, L3 Technologies (mission equipment).

**First Flight:** N/A.

**Delivered:** N/A.

**IOC:** 2023 (planned).

**Production:** Two.

**Inventory:** 10 (planned).

**Operator:** ACC (planned).

**Aircraft Location:** Davis-Monthan AFB, Ariz. (planned).

**Active Variant:**

- EC-37B. Military Electronic Attack version of the Gulfstream G550.

**Dimensions:** Span 93.5 ft, length 96.4 ft, height 25.8 ft.  
**Weight:** Max T-O 90,500 lb.  
**Power Plant:** Two BR710C4-11 turbofans, each 15,385 lb thrust.  
**Performance:** Speed 600 mph, range 6,300 miles.  
**Ceiling:** 51,000 ft.  
**Accommodation:** TBD.



Photo: TSgt. Jonahntan Hehnlly

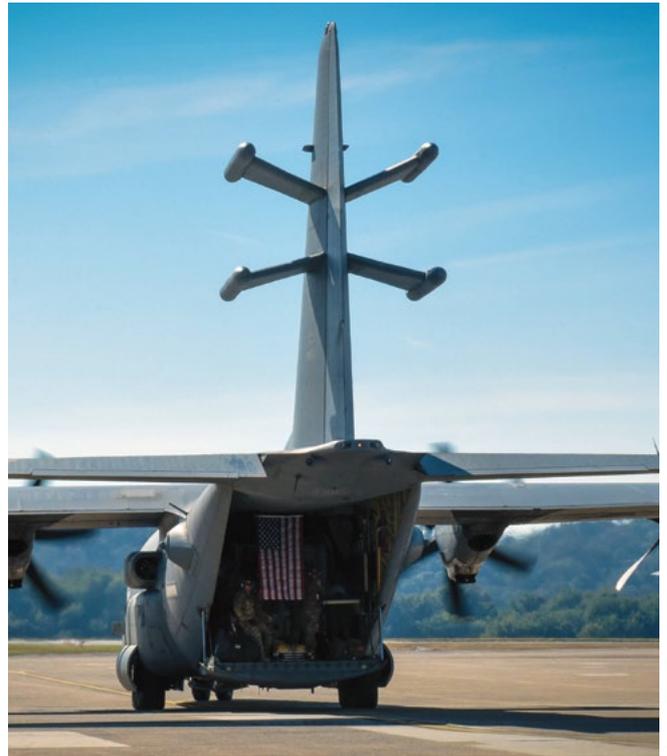


Photo: Sr.A. Rachel Loftis

## EC-130H COMPASS CALL

Electronic warfare

**Brief:** The EC-130H is a modified C-130H designed to disrupt enemy C3 and limit adversary coordination and force management. Tasks include tactical jamming/disruption of communications, radar, and navigation, offensive counterinformation, EA, and SEAD support. The fleet has been deployed near-constantly since the beginning of combat operations in Afghanistan in 2001. The aircraft was designed to be easily updated and modified. All aircraft have been retrofitted to Block 35 standards and are aerial refuelable. Mission equipment upgrades occur approximately every three years to ensure continued protection and effectiveness against evolving threats. Baseline 2 mods are ongoing, and the Baseline 3 configuration, including the Advanced Radar Countermeasure System (ARCS) and other significant capability enhancements, is slated for fielding in 2020. USAF is procuring the EC-37B to replace the EC-130H, but funding delays required extending the current fleet. EC-130H is undergoing center wing box replacement/structural mods (in common with the C-130H fleet). Some 70 percent of the EC-130H's mission equipment will be directly "cross-decked" to the EC-37B, and ongoing system upgrades includes counter-radar/counter satellite navigation, third generation Special Purpose Emitter Array (SPEAR), and adaptive EA to quickly react to emerging threats. Airframe improvements include digital glass cockpits, Mode 5 IFF, and airspace compliant CNS/ATM. Ten primary mission aircraft are supplemented by two backups, two attrition reserves, and one system integration testbed.

**Contractor:** Lockheed Martin, BAE Systems, L3 Technologies.

**First Flight:** 1981.

**Delivered:** 1982.

**IOC:** 1983; Block 35 from 2011.

**Production:** (Converted).

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

**Operator:** ACC, AFMC.

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

**Active Variant:**

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

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

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

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

**Performance:** Speed 300 mph at 20,000 ft, unrefueled range 2,295 miles seven hr normal endurance (air refuelable).

**Ceiling:** 25,000 ft.

**Accommodation:** 13 - Two pilots, navigator, two EWOs; flight engineer, mission crew supervisor (cryptologic), four cryptologic linguists, acquisition operator, and airborne maintenance technician.

## EC-130J COMMANDO SOLO/SUPER J

Psychological warfare/special operations airlift

**Brief:** The EC-130J is the Air Force's primary psychological warfare platform, providing military information support operations (MISO) and civil affairs broadcast. Roles include offensive counterinformation radio, television, and military communications broadcast, EA (or SOF mobility), depending on variant. Commando Solo conducted psychological operations in almost every US contingency since 1980. The EC-130J Commando Solo is equipped with radio and color television broadcast equipment for psychological warfare, enhanced navigation, and self-protection. 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 on top of their special operations mobility SOF-FLEX (Special Operations Flexible) mission. SOF-FLEX includes personnel and cargo airdrop, combat offload, and infiltration/exfiltration. USAF is working to develop an Operational Flight Program Block upgrade cycle for the EC-130J's mission specific equipment, and the airframe is undergoing Block 8.1 upgrades in tandem with the baseline C-130J. The Removable Airborne MISO Systems (RAMS), digital broadcast, and RF countermeasures integration/testing are ongoing. RAMS is based on the Army's Fly Away Broadcast System and will allow all aircraft to be de-modified to a SOF multimission configuration. All variants are operated by the ANG's 193rd Special Operations Wing. Low-cost mods include safety, reliability, parts obsolescence, and smaller capability improvements.

**Contractor:** Lockheed Martin, Raytheon.

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

**Delivered:** 2003.

**IOC:** 2004.

**Production:** Seven.

**Inventory:** Three (Commando Solo); four (Super J).

**Operator:** ANG.

**Aircraft Location:** Harrisburg Arpt., Pa.

**Active Variants:**

- 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.

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

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

**Power Plant:** Four Rolls-Royce-Allison AE2100D3 turboprops, each 4,637 shp.

**Performance:** Speed 335 mph cruise, range 2,645 miles (air refuelable).

**Ceiling:** 28,000 ft.

**Accommodation:** Two pilots, flight systems officer, mission systems officer; two loadmasters, five electronic communications systems (CS) operators.



Photo: Charles Haymond

## OC-135 OPEN SKIES

Observation/treaty verification

**Brief:** The OC-135 is a modified WC-135B used for arms control treaty observation and imagery collection over nations 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 acquiring and certifying a digital camera suite to replace obsolete and difficult to maintain wet-film cameras. The upgrade aligns capabilities to a presidential directive and initial installation is planned for 2019. Planned upgrades include FAA-compliant CNS/ATM. USAF is seeking to replace the unreliable and performance-limited OC-135B with two "small airliner class" aircraft that will permit full access across the Russian Federation.

**Contractor:** Boeing.

**First Flight:** 1993.

**Delivered:** 1993-96.

**IOC:** October 1993.

**Production:** Three.

**Inventory:** Two.

**Operator:** ACC.

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

**Active Variant:**

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

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

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

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

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

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

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



Photo: SrA, Sean Campbell

## RC-26 CONDOR

Tactical ISR

**Brief:** The RC-26 is a modified Fairchild Metro 23 tasked with counternarcotics, manned tactical ISR, disaster response, and civil support missions. It is equipped with specialized digital cameras, IR video, and communications equipment, to enable domestic and international anti-trafficking. The aircraft has a secondary role providing real-time video streaming to responders following hurricanes, wildfires, and other disasters. In the fire-support role, aircraft sensors can detect and accurately identify fires from up to three miles away. An extensive communications suite allows communications from 29 to 960 MHz including provisions for plugged-in

800 MHz handheld radio and airphones. The Air Force originally planned to divest the fleet in FY15, but is looking to add several airframes and reinstate RC-26 as a permanent program of record. The fleet is currently split between three different configurations including six Block 25R, five Block 20, and two non-mission equipped C-26As. RC-26 aircraft assisted with wildfire support in the northwestern US and damage assessment after Hurricane Florence in 2018. Ongoing upgrades include airspace compliance mods to meet FAA mandates.

**Contractor:** Fairchild (airframe), Elbit Systems (avionics upgrade).

**First Flight:** 1990.

**Delivered:** C-26 first delivered 1989.

**IOC:** N/A.

**Production:** 11.

**Inventory:** 11.

**Operator:** ANG.

**Aircraft Location:** Des Moines Aprt., Iowa; Ellington Field, Texas; Fairchild AFB, Wash.; Fresno Yosemite Aprt., Calif.; Hancock Field, N.Y.; Jacksonville Aprt., Fla.; Key Field, Miss.; Kirtland AFB, N.M.; Montgomery Regional Aprt., Ala.; Truax Field, Wis.; Tucson Aprt., Ariz.; Yeager Aprt., W.Va.

**Active Variants:**

- C-26A. Non-missionized general utility aircraft.

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

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

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

**Power Plant:** Two Garrett TPE331-12UAR-701 turboprops, each 1,100 shp.

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

**Ceiling:** 25,000 ft.

**Accommodation:** Two pilots, one navigator-mission systems operator.



Photo: Josh Plugger/USAF

## RC-135S COBRA BALL

Electronic reconnaissance

**Brief:** The RC-135S gathers measurement and signature intelligence (Masint) on missile-associated signatures and tracks during boost and re-entry. Cobra Ball superseded Rivet Ball and Rivet Amber in 1969 and collects both optical and electronic data on ballistic missile activity. Its specialized equipment includes wide-area IR sensors, long-range optical cameras, and an advanced communications suite. Reconnaissance data is used to assess missile threats, evaluate missile performance, characterize adversary missiles, and analyze weapons testing and technology. Data also supports treaty verification and theater ballistic missile nonproliferation. It can deploy anywhere in the world in 24 hours and provide on-scene EO reconnaissance. Continuous baseline upgrades keep the fleet viable through 2040, and aircraft are currently undergoing Baseline 5 mods (similar to Rivet Joint Baseline 11/12). Flexible funding permits rapid, variant-specific mods in response to emerging/evolving threats. Ongoing upgrades include Wideband Global Satellite reachback, improved operator interface, Rivet Joint COMINT suite integration, and new intercom.

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

**First Flight:** N/A.

**Delivered:** October 1969-November 2000.

**IOC:** Circa 1972.

**Production:** Converted.

**Inventory:** Three.

**Operator:** ACC.

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

**Active Variant:**

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

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

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

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

**Performance:** Speed 517+ mph, range 3,900 miles, farther with air refueling.

**Ceiling:** 45,000 ft.

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



Photo: Airwolfhound

## RC-135U COMBAT SENT

Electronic reconnaissance

**Brief:** The RC-135U is tasked with strategic reconnaissance of adversary air defenses and technical intelligence (Techint) gathering on radar/emitter systems. The aircraft collects and examines data on airborne, land, and naval radar systems, providing strategic analysis for National Command Authorities and combatant forces. Combat Sent was fielded in 1970 to fill a critical need for scientific and technical data collection on adversary radar threats and defenses. Its distinctive antenna 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 the effective design, programming, and reprogramming of RWRs (radar warning receivers), jammers, decoys, anti-radiation missiles, and threat simulators DOD-wide. Continuous baseline upgrades keep the fleet viable through 2040, and aircraft are currently undergoing Baseline 5 mods (similar to Rivet Joint Baseline 12). Flexible funding permits rapid variant-specific mods in response to emerging/evolving threats. Ongoing upgrades include wideband satcom reachback, integration of Rivet Joint's Comint suite, improved operator interface, new intercom, and capability enhancement for dense signal environments.

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

**First Flight:** N/A.

**Delivered:** 1971-74.

**IOC:** 1971.

**Production:** Converted.

**Inventory:** Two.

**Operator:** ACC.

**Aircraft Location:** Offutt AFB, Neb.; forward operating locations: Al Udeid AB, Qatar; NSF Diego Garcia, UK; Eielson AFB, Alaska; Kadena AB, Japan; RAF Mildenhall, UK; NSA Souda Bay, Greece.

**Active Variant:**

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

**Dimensions:** Span 135 ft, length 140 ft, height 42 ft.

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

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

**Performance:** Cruise speed 517 mph, range 4,140 miles 8 hr normal endurance, 24 hr crew endurance (air refuelable).

**Ceiling:** 42,000 ft.

**Accommodation:** Flight crew: two pilots, two navigators, three airborne systems engineers; mission crew: 10 EW officers, six or more electronic, technical, mission-area specialists.



Photo: 2nd Lt. Andrew Nystrom

## RC-135V/W RIVET JOINT

Electronic reconnaissance

**Brief:** The RC-135V/W is tasked with real-time electronic and signals intelligence-gathering, analysis, and dissemination in support of theater and strategic-level commanders. The extensively modified C-135s 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. Continuous baseline upgrades keep the fleet viable through 2040 and drive standards for Combat Sent/Cobra Ball. Flexible funds permit rapid, variant-specific mods in response to emerging/evolving threats. Ongoing Baseline 11/12 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, and compliant CNS/ATM. Baseline 12 efforts also include modernized operator interface, improved dense signal environment capabilities, increased signal bandwidth/exploitation, add operator 3-D maps, and integrate RC-135 with Distributed Common Ground Station (DCGS). The Royal Air Force operates three RC-135W "Airseeker" aircraft, which are co-manned by USAF/RAF personnel. USAF will shift forward deployed RC-135s from RAF Mildenhall to Fairford starting in 2023 to consolidate infrastructure.

**Contractor:** Boeing (original airframe), L3 Technologies (systems integrator).

**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).

**Operator:** ACC, AFMC.

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

**Active Variants:**

• RC-135V/W Rivet Joint. Standoff 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.

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

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

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

**Performance:** Speed 500+ mph, range 3,900 miles (air refuelable).

**Ceiling:** 50,000 ft.

**Accommodation:** Flight crew: three pilots, two navigators; mission crew: three EW officers, 14 intelligence operators, four airborne maintenance technicians (six additional, if required).



Photo: SSgt. Jeffrey Schultze

## U-2 DRAGON LADY

High-altitude reconnaissance

**Brief:** The U-2 is the Air Force's only manned strategic high-altitude, long-endurance ISR platform. Roles include Sigint, Imint, and Masint collection. U-2 can carry a variety of advanced optical, multispectral, EO/IR, SAR, Sigint, and other payloads simultaneously. It was initially designed in the 1950s and further developed into the U-2R in the late 1960s. Current U-2s date to the 1980s when production was reopened for the larger, more capable TR-1. S model conversions began in 1994, and all current aircraft are Block 20 configured, featuring glass cockpits, 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. U-2's modular payload and open system architecture allow rapid fielding of new sensors. Congress stipulated RQ-4 Block 30 achieve sensor parity with the U-2 before the latter can be retired. U-2s comprise 50 percent of the high-altitude ISR fleet and they are heavily tasked, pushing retirement to 2022 or beyond. Future funds are limited to

flight safety and sustainment unless critical to national security. Ongoing development and integration now include Payload Block 20.1 upgrades, stellar navigation, modular mission systems, RPA C2, GPS refresh, helmet/pressure suit, avionics, egress, and flight safety/airspace compliance mods. Payload Block 20.1 includes ASARS development, integration, and testing as well as multispectral sensor, EW system, Optical Bar Camera, and Sigint package upgrades. Block improvements also include defensive systems, data links (Link-16/IFDL, MADL), and avionics upgrades.

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

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

**Delivered:** 1955-October 1989.

**IOC:** Circa 1956.

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

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

**Operator:** ACC.

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

**Active Variants:**

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

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

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

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

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

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

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



Photo: Bo Joyner/USAF

## WC-130J

Weather reconnaissance

**Brief:** The WC-130J "Weatherbird" is a modularly configurable C-130J equipped with specialized modular systems to penetrate tropical and winter storms, capture meteorological data, and aid severe weather forecasting. Early WC-130Bs entered service in 1959, followed by the WC-130E in 1962, and WC-130H in 1964. The WC-130J began replacing legacy variants in 1999, though several H models remain in service with the Puerto Rico ANG. All WC-130Js are operated by AFRC's 53rd Weather Reconnaissance Squadron "Hurricane Hunters" at Keesler. Mission equipment includes pod-mounted Stepped-Frequency Microwave Radiometer (SFMR) for monitoring surface winds and precipitation rates, parachute-deployed GPS dropsondes to gather vertical atmospheric profiles, and palletized operator stations/equipment. WC-130Js are optionally equipped with two external wing tanks, as well as an internal auxiliary fuel tank to increase range and endurance. Crews include an added aerial weather reconnaissance officer/flight director and weather system specialist/loadmaster. Aircraft are capable of penetrating tropical cyclones from up to 10,000 ft to as low as 500 ft. The fleet primarily monitors oceanic weather over the Atlantic, Central Pacific, Caribbean, and Gulf of Mexico. Airframes are modernized in line with the baseline C-130J fleet, including Block 8.1 upgrades, airspace compliance mods, and enhanced service-life center wing sections.

**Contractor:** Lockheed Martin.

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

**Delivered:** September 1999-September 2005.

**IOC:** October 2006.

**Production:** 10.

**Inventory:** 10.

**Operator:** AFRC.

**Aircraft Location:** Keesler AFB, Miss.

**Active Variant:**

- WC-130J. Weather reconnaissance version of C-130J.

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

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

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

**Performance:** Speed 417 mph; range with 35,000 lb payload 1,841 miles (3,000+ miles with external/auxiliary tanks).

**Ceiling:** With max payload, 26,000 ft.

**Accommodation:** Crew: two pilots, aerial reconnaissance weather officer, loadmaster/dropsonde operator. Load: palletized weather systems.



Photo: Susan Romano/USAF

## WC-135 CONSTANT PHOENIX

Air sampling and collection

**Brief:** WC-135's primary mission is nuclear test monitoring, airborne radiological sampling, and arms control treaty verification. Airframes are either a modified C-135B or EC-135C Looking Glass equipped with air sampling and collection equipment. The aircraft primarily support monitoring under the 1963 Limited Nuclear Test Ban Treaty. Air sampling WB-29s detected debris from the Soviet Union's first atomic test in 1949, and subsequent aircraft have monitored weapons tests, including recent North Korean activity, as well as nuclear disasters including Chernobyl and Fukushima. The WC-135's sampling and 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 podded particulate sampler/Radiation Monitoring and Analysis System (RMAS) detects radiation contact and the Directional Gamma Sensor System (DGSS) guides the crew toward the plume for collection. The Whole Air Collection System (WACS) captures and stores radioactive samples from the aircraft's bleed-air system. An integrated control system permits real-time mission system interface and monitors internal and external radiation-levels for safety and analysis. USAF deemed replacing the aging fleet to be more cost-effective than re-engineering and modernization. FY19 funds will convert three KC-135R tankers into WC-135Rs, based on the same sensor suite, starting in September 2019.

**Contractor:** Boeing.

**First Flight:** 1965.

**Delivered:** 1965-96.

**IOC:** December 1965.

**Production:** Converted. 2020 (WC-135R) planned.

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

**Operator:** ACC.

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

**Active Variants:**

- WC-135C. Modified EC-135C equipped for radiological monitoring and air sampling.
- WC-135R. Modified KC-135R tankers, planned to replace the aging WC-135C/W fleet.
- WC-135W. Modified C-135B equipped for radiological monitoring and air sampling.

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

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

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

**Performance:** Speed 403 mph, range 4,600 miles (air refuelable).

**Ceiling:** 40,000 ft.

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

## TANKER AIRCRAFT



Photo: Sr.A. Kevin Tanenbaum

### HC-130J COMBAT KING II

Aerial refueling/airlift

**Brief:** The HC-130J is tasked with helicopter in-flight refueling support for CSAR/ personnel recovery, tactical C2, and pararescue (PJ) deployment. It replaces legacy HC-130N/Ps and is based on the USMC's KC-130J tanker. It adds 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/flame dispensers. USAF plans to standardize HC/AC/MC-130J block upgrades, and current efforts bring all HC-130Js to a common standard. Ongoing upgrades include avionics Block 8.1 (in common with the C-130J fleet), Lightweight Airborne Radio System (LARS), integrated situational awareness (including SADL, Blue Force Tracker, etc.), Joint Precision Aerial Delivery System (JPADS), wireless intercom, Advanced Threat Warning (ATW), roll-on/roll-off RF countermeasures, and paratroop door improvements. Mode 5 IFF and CNS/ATM upgrades will be fielded ahead of cycle to meet FAA deadlines. LARS transitions to the new 406 MHz distress frequency and improves timely location of aircraft, vessels, and personnel. ATW and RF countermeasures add the latest self-defensive capability for recovery operations in contested environments. FY19 funding supports production of two aircraft including a combat loss replacement. USAF expects to complete fleet recap by 2023. The California ANG's 129th Rescue Wing received its first HC-130J on April 5, 2018, beginning transition from the MC-130P.

**Contractor:** Lockheed Martin.

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

**Delivered:** Sept. 24, 2010-present.

**IOC:** 2013.

**Production:** 37 (planned).

**Inventory:** 24.

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

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

**Active Variants:**

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

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

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

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

**Performance:** Speed 363.4 mph at S-L, range 4,000+ miles (air refuelable).

**Ceiling:** 33,000 ft.

**Fuel Capacity:** 61,360 lb at 150-300 gpm (100 gpm dual, simultaneous refueling).

**Accommodation:** Flight crew: two pilots, CSO, two loadmasters.



Photo: SSgt. Edward Eagerton

### HC-130N/P KING

Aerial refueling/airlift

**Brief:** The HC-130N/P is tasked with helicopter in-flight refueling support for CSAR/personnel recovery, tactical C2, pararescue (PJ) deployment, and forward area refueling point missions. It conducts operations to

austere airfields and denied territory for expeditionary, all-weather ops. 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/flame 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 HC-130Ns were diverted from storage to replace increasingly unserviceable HC-130Ps at Patrick. The base's final HC-130P retired in August 2017, and conversion to the HC-130J is slated for late 2019. Ongoing efforts focus on center wing box replacement/structural mods (in common with the C-130H fleet).

**Contractor:** Lockheed Martin.

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

**Delivered:** 1965-circa 1993.

**IOC:** 1986.

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

**Inventory:** Six (HC-130N); three (HC-130P).

**Operator:** ANG, AFRC.

**Aircraft Location:** Francis S. Gabreski Arpt., N.Y.; Patrick AFB, Fla.

**Active Variants:**

• HC-130N. C-130H model modified with new center wing and aerial refueling capability.

• HC-130P. Similar to HC-130N; initially fit with specialized radome for Fulton recovery system.

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

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

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

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

**Ceiling:** 33,000 ft.

**Fuel Capacity:** 73,000 lb at 160 gpm (80 gpm dual, simultaneous refueling).

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



Photo: SSgt. Erica Rodriguez

### KC-10 EXTENDER

Aerial refueling/airlift

**Brief:** The KC-10 is a multirole tanker/transport capable of aeromedical evacuation, based on the McDonnell Douglas DC-10-30CF. The aircraft is 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/drogue system allowing it to refuel a wide variety of US and allied aircraft, including the CV-22 tilt-rotor, within the same mission. The aircraft has three large fuel tanks under the cargo floor and an air refueling operator's station recessed into the aft fuselage. It is refuelable by boom-equipped tankers. Ongoing mods include modernized navigation, surveillance, and air traffic management (CNS/ATM) in line with FAA mandates, and advanced Mode 5 IFF. Modifications extend service life through 2045, though full divestiture is planned by 2024. USAF is working to resolve widespread reliability problems with the fleet's egress equipment after an escape slide/raft failed to deploy following an aborted takeoff in 2018.

**Contractor:** McDonnell Douglas (now Boeing).

**First Flight:** April 1980.

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

**IOC:** August 1982.

**Production:** 60.

**Inventory:** 59.

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

**Aircraft Location:** JB McGuire-Dix-Lakehurst, N.J.; Travis AFB, Calif.

### Active Variant:

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

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

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

**Power Plant:** Three General Electric CF6-50C2 turbofans, each 52,500 lb thrust.

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

**Ceiling:** 42,000 ft.

**Fuel Capacity:** 356,000+ lb. at 1,100 gpm (boom), 470 gpm (drogue).

**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.



Photo: Yasuo Osakabe/USAF

## KC-46 PEGASUS

Aerial refueling/airlift

**Brief:** The KC-46A is a heavily modified Boeing 767-200ER multirole passenger/cargo-tanker equipped with flying boom and probe/drogue refueling capability. It is also equipped for aeromedical evacuation. KC-46 incorporates the 787's state-of-the-art cockpit, a fly-by-wire boom, remote boom-operator's station, advanced self-defensive suite including Large Aircraft IR Countermeasures (LAIRCM), RWR, tactical situational awareness, comm relay hosting, and nuclear/chem/bio hardening. In 2011 Boeing was awarded a contract for 179 KC-46A tankers, the first increment (KC-X) to replace about half of USAF's KC-135R fleet. Compared to the 50-year-old KC-135, the KC-46A has more fuel capacity, improved efficiency, and enhanced cargo and AE capability. Like the KC-10, it employs an advanced refueling boom and independently operating hose/drogue system. The program's provisioned 767-2C prototype (minus refueling boom) flew in late 2014 and received FAA type-certification in December 2017. The full-up KC-46A flew for the first time from Everett, Wash., Sept. 25, 2015. USAF accepted its first production KC-46 from Boeing on Jan. 10, 2019. The airframe is slated to launch operational testing this year. The service awarded LRIP contracts for 19 aircraft in 2016, a follow-on Lot 3 contract for 15 aircraft in 2017, and a further 18 aircraft in 2018. Japan is the launch international customer and signed for its second of four planned aircraft in December 2018. FY19 funds support Lot 5 purchase of 15 tankers, while the FY20 budget proposal would fund 12 aircraft. Eighteen airframes are slated for delivery ahead of planned IOC, which has slipped due to problems with the boom, remote vision system, and electrostatic compatibility. McConnell received its first KC-46 on Jan. 25, 2019, followed by the first delivery to Altus on Feb. 8, 2019. Boeing plans to deliver three aircraft a month through the end of the year. Pease is slated to receive the first ANG KC-46 late this year.

**Contractor:** Boeing.

**First Flight:** Dec. 28, 2014 (provisioned 767-2C prototype); Sept. 25, 2015 (KC-46A).

**Delivered:** December 2018-present.

**IOC:** TBD.

**Production:** 179 (planned).

**Development and test fleet:** Six (KC-46A); two (provisioned 767-2C).

**Operator:** AFMC, AMC, Boeing.

**Aircraft Location:** Altus AFB, Okla.; Edwards AFB, Calif.; McConnell AFB, Kan.; Paine Field, Wash. Planned: JB McGuire-Dix-Lakehurst, N.J.; Pease ANGB, N.H.; Seymour Johnson AFB, N.C.; Travis AFB, Calif.; others TBD.

### Active Variant:

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

**Dimensions:** Span 156 ft, length 165.5 ft, height 52.8 ft.

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

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

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

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

**Fuel Capacity:** 212,299 lb., max transfer load 207,672 lb at 1,200 gpm (boom), 400 gpm (drogue).

**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.



Photo: TSgt. Mary Greenwood

## KC-135 STRATOTANKER

Aerial refueling/airlift

**Brief:** The KC-135 is an aerial tanker capable of simultaneous cargo and AE missions and has been the mainstay of the USAF tanker fleet for more than 60 years. It is based on the C-135; similar in size and appearance to the commercial 707 aircraft but designed to military specifications. The current KC-135R variant first flew in October 1982 and redeliveries began in July 1984. Twenty were modified with the Multipoint Refueling System (MPRS), allowing the use of hose/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. A small number of McConnell-based aircraft are also receiver-capable, incorporating a forward-fuselage slipway. Upgrades include a modernized digital flight deck. 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. A total of 38 aircraft are slated for upgrade in 2019. Fleet service life is projected out to 2040. USAF successfully tested a modular Large-Aircraft IR Countermeasures (LAIRCM) pod to track/jam IR missiles for high-threat mission in 2018. LAIRCM IOC is slated for FY19. New starts include replacing obsolete long-distance oceanic satellite tracking/C2, and adding real-time cockpit threat situational awareness.

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

**First Flight:** August 1956.

**Delivered:** January 1957-65.

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

**Production:** 732.

**Inventory:** 344 (KC-135R); 54 (KC-135T).

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

**Aircraft Location:** Altus AFB, Okla.; Beale AFB, Calif.; Fairchild AFB, Wash.; Grissom ARB, 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, New York, Ohio, Pennsylvania, Tennessee, Utah, Washington, Wisconsin. Planned: Ramstein AB, Germany.

### Active Variants:

• 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.

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

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

**Power Plant:** Four CFM International CFM56-2 (USAF designation F108) turbofans, each 21,634 lb thrust.

**Performance:** Speed 530 mph at 30,000 ft, range 1,500 miles with 150,000 lb transfer fuel, up to 11,015 miles for ferry mission.

**Ceiling:** 50,000 ft.

**Fuel Capacity:** Max transfer load 200,000 lb at 1,100 gpm (boom), 450 gpm (MPRS pods).

**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.



## AIRLIFT AIRCRAFT



Photo: 2nd Lt. Ashlyn Paulson

### C-5 GALAXY

Strategic airlift

**Brief:** The C-5 is USAF's largest airlifter and one of the world's largest aircraft, capable of lifting unusually large/heavy cargo over intercontinental ranges. It is also able to 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 between 1969 and 1973 and underwent major wing modifications to extend their service lives. All but one C-5A (converted to C-5M) are retired. The C-5B first flew in 1985 incorporating all C-5A improvements including strengthened wings, uprated turbofans, color weather radar, and triple INS. The first C-5B was delivered in January 1986, and some were equipped with defensive systems. Two C-5As were modified to carry outsize space cargo and redesignated C-5C. The combined Avionics Modernization Program (AMP)—completed in 2011—and Reliability Enhancement and Re-engineering Program (RERP), resulted in the C-5M Super Galaxy. Upgraded aircraft incorporate new GE CF6-80C2 (F138-GE-100) turbofans with 20 percent increased thrust, along with avionics, structural, and reliability fixes. Lockheed redelivered the last of 52 upgraded C-5Ms on Aug 2, 2018. A total of 49 B models, two C models, and the single C-5A were converted. Ongoing mods include a new weather radar and mission computer, improved Large Aircraft IR Countermeasures (LAIRCM), and lavatory redesign to fix corrosion issues. C-5s continue to suffer nose landing-gear malfunctions. AMC is replacing key mechanical components and limiting "kneeling" to reduce wear. FY19 funds begin CNS/ATM upgrades, and ADSB will be installed fleetwide to meet FAA airspace requirements by 2020.

**Contractor:** Lockheed Martin.

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

**Delivered:** 1969-1987 (C-5A); 1986-89 (C-5B); 1989-91 (C-5C); 2009-2018 (C-5M).

**IOC:** September 1970 (C-5A); February 2014 (C-5M).

**Production:** 131.

**Inventory:** 50 (C-5M); two (C-5M-SCM).

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

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

**Active Variants:**

- C-5M. Super Galaxy incorporating AMP and RERP.
- C-5M-SCM. Super Galaxy converted from C-5C to carry large NASA cargo.

**Dimensions:** Span 222.8 ft, length 247.8 ft, height 65.1 ft.

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

**Power Plant:** Four General Electric F138-GE-100 turbofans, each 50,580 lb thrust.

**Performance:** Speed 518 mph, range 5,524 miles with 120,000 lb of cargo.

**Ceiling:** 45,000 ft.

**Accommodation:** Crew: two pilots, two flight engineers, three loadmasters. Load: 81 troops and 36 standard pallets, max 285,000 lb; incl seven MRAP vehicles, six AH-64 Apache helicopters, four M2 Bradley fighting vehicles, or two M1 Abrams main battle tanks.



Photo: SSgt. David Owsianka

### C-12 HURON

Light airlift

**Brief:** C-12 is tasked with multimission passenger and priority light-cargo airlift, medevac, embassy, and test support. The family of aircraft includes military versions of the Beechcraft King Air B200 and 1900C aircraft (C-12J). Flight decks and cabins are pressurized for high-altitude flight. The C-12D incorporates a cargo door with an integral airstair, high flotation landing gear, structural improvements, and optional external wingtip tanks. Both C-12C and C-12D are deployed to US embassies worldwide and incorporate earlier three-bladed propellers. The C-12F incorporated uprated engines, four-bladed propellers, and an increased service ceiling. The C-12J is a completely different aircraft based on the Beechcraft 1900C commuter airliner with a large, aft cargo door. C-12Js are operated by PACAF in support of US Forces Japan 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.

**Contractor:** Beechcraft.

**First Flight:** Oct. 27, 1972 (Super King Air 200), March 1, 1990 (1900C).

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

**IOC:** Circa 1974.

**Production:** 88 (incl all variants).

**Inventory:** 13 (C-12C); six (C-12D); three (C-12F); four (C-12J).

**Operator:** AFMC, PACAF.

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

**Active Variants:**

- C-12C. C-12As retrofit with PT6A-41 engines.
- C-12D. C-12 with an enlarged cargo door and strengthened wings.
- C-12F. C-12 with uprated PT6A-42 engines, eight-passenger seating, and AE capability.
- C-12J. Military version of the Beechcraft Model 1900C commuter airliner.

**Dimensions:** Span 54.5 ft, length 43.8 ft, height 15 ft (C/D/F); span 54.5 ft, length 57 ft, height 15 ft (J).

**Weight:** Max T-O 15,000 lb (F); 16,710 lb (J).

**Power Plant:** Pratt & Whitney Canada PT6A-41 (C/D) or PT6A-42 (F) turbo-props, each 850 shp; PT6A-65B turboprops, each 1,173 shp.

**Performance:** Speed 300 mph (C/D) 336 mph (F) range 2,271 miles; 284 mph, range 1,669 miles (J).

**Ceiling:** 31,000 ft (C/D); 35,000 ft (F); 25,000 ft (J).

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



Photo: MSgt. Joey Swatford

### C-17 GLOBEMASTER III

Tactical/strategic airlift

**Brief:** C-17 is a heavy-lift strategic transport capable of direct tactical delivery of all classes of military cargo. It is the US military's core airlift asset, capable of operating 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 airdrop outsize 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 Block 20 standard during depot maintenance. 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. Priority upgrades include HUD replacement and airspace compliance mods to meet FAA's 2020 deadline. Development includes Fixed Installation Satellite Antenna (FISA) to enable high-bandwidth BLOS data/comms, a roll-on/roll-off C2 capsule (replacing the "Silver Bullet") for in-flight conferencing, and real time in cockpit (RTIC) air-to-ground comms to increase SA during airdrop and tactical ops. USAF is considering options to increase the C-17 fleet to meet operational demand, though production ceased in 2015. The North Carolina ANG received its first C-17s in April 2018, and AFRC's 911th AW is also currently transitioning to the C-17.

**Contractor:** McDonnell Douglas (now Boeing).

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

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

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

**Production:** 257.

**Inventory:** 222.

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

**Aircraft Location:** Altus AFB, Okla.; Dover AFB, Del.; 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.; Travis AFB, Calif.; Wright-Patterson AFB, Ohio; and ANG in Hawaii (associate), Mississippi, North Carolina, West Virginia, and New York. Planned: Pittsburgh Arpt., Pa.

**Active Variant:**

• C-17A. Long-range airlifter.

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

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

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

**Ceiling:** 45,000 ft.

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

**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.



Photo: Greg Davis/USAF

## C-21 LEARJET

Light airlift

**Brief:** The C-21 is a militarized Learjet 35 used for passenger and priority light-cargo airlift and aeromedical transport. It is equipped with color weather radar, TACAN, and HF/VHF/UHF radios. It provides medium-range operational support for time-sensitive movement of people and cargo throughout the US and the European Theater, including AE missions if required. USAF awarded a \$32.2 million contract for CNS/ATM upgrades in May 2017. Ongoing upgrades support modifying 19 aircraft with modern digital systems including new weather radar, GPS, flight management system, satellite-updating real-time flight information, digital black boxes, and ADS-B and Mode 5 transponder to comply with FAA mandates. Funds additionally cover low-cost flight safety, reliability, and maintainability mods as needed. The 200th AS at Peterson flew the ANG's last C-21 mission in June 2018 and AMC is consolidating the US-based fleet to Scott.

**Contractor:** Bombardier (previously Gates Learjet), Global Aviation Technolo-

gies (CNS/ATM upgrade).

**First Flight:** January 1973.

**Delivered:** April 1984-October 1985.

**IOC:** April 1984.

**Production:** 84.

**Inventory:** 18.

**Operator:** AMC, USAFE.

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

**Active Variant:**

• C-21A. Military version of the Learjet 35A.

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

**Weight:** Max T-O 18,300 lb.

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

**Performance:** Speed 530 mph at 41,000 ft, range 2,306 miles.

**Ceiling:** 45,000 ft.

**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.



Photo: SSgt. Tony Harp

## C-32A "AIR FORCE TWO" / C-32B

VIP transport

**Brief:** The C-32A provides dedicated vice presidential and DV airlift. C-32B is tasked with politically sensitive crisis-mobility. Both types were acquired as a commercial Boeing 757s. Aircraft assigned to the 89th Airlift Wing at Andrews fly under the call sign "Air Force Two" during vice presidential missions, but additionally serve the first lady, 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 discreet, rapid, global airlift in support of government crisis response efforts. The C-32's modern flight deck avionics are upgradable, and current programs include nitrogen fuel-tank inerting and commercial wideband global satcom, and interior cabin refurbishment, with an aircraft better able to augment the VC-25 fleet, with better range, capacity, and more capable C2/comms. DOD is looking at possibly replacing the C-32, E-4B, and Navy E-6B Mercury with a single platform.

**Contractor:** Boeing.

**First Flight:** Feb. 11, 1998 (C-32A).

**Delivered:** June-December 1998.

**IOC:** 1998.

**Production:** Six.

**Inventory:** Four (C-32A); two (C-32B).

**Operator:** AMC, ANG.

**Aircraft Location:** JB Andrews, Md.; JB McGuire-Dix-Lakehurst, N.J.

**Active Variants:**

• C-32A. Presidential support-configured commercial Boeing 757-200 airliner.

• C-32B. Commercial Boeing 757-200 tasked with global crisis response airlift.

**Dimensions:** Span 124.6 ft, length 155.2 ft, height 44.5 ft.

**Weight:** Max T-O 255,000 lb.

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

**Performance:** Speed 530 mph, range 6,325 miles.

**Ceiling:** 42,000 ft.

**Accommodation:** Crew: 16 (varies with mission). Load: up to 45 passengers.



Photo: AIC Christopher Quail

## C-37 GULFSTREAM V

VIP transport

**Brief:** The C-37 family provides worldwide special air mission and DV support, consisting of military versions of the 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 adds 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. The fleet has an average 28,000 flying hours of remaining service life. USAF issued a request for proposal in FY18 for procurement of as many as 40 additional C-37Bs to backfill the retired C-20 fleet. The service also recently selected a C-37 variant for its' EC-130 Compass Call replacement and is evaluating several derivatives for C2 and ISR roles.

**Contractor:** Gulfstream Aerospace.

**First Flight:** USAF October 1998.

**Delivered:** October 1998.

**IOC:** Dec. 9, 1998.

**Production:** 12.

**Inventory:** Nine (C-37A); three (C-37B).

**Operator:** AMC, PACAF, USAFE.

**Aircraft Location:** Chièvres, Belgium; JB Andrews, Md.; JB Pearl Harbor-Hickam, Hawaii; MacDill AFB, Fla.; Ramstein AB, Germany.

**Active Variants:**

- C-37A. Military version of the Gulfstream V.
- C-37B. Military version of the Gulfstream G550.

**Dimensions:** Span 93.5 ft, length 96.4 ft, height 25.8 ft.

**Weight:** Max T-O 90,500 lb.

**Power Plant:** Two BMW/Rolls-Royce BR710A1-10 turbopans, each 14,750 lb thrust (A); two BR710C4-11 turbopans, each 15,385 lb thrust (B).

**Performance:** Speed 600 mph, range 6,300 miles.

**Ceiling:** 51,000 ft.

**Accommodation:** Crew: five; up to 12 passengers (A); 14 passengers (B).



Photo: SMSgt. Kevin Wallace

## C-40 CLIPPER

VIP transport

**Brief:** The C-40 is a medium-range DV airlift aircraft based on the commercial Boeing 737-700. It is used to transport senior military commanders, Cabinet officials, and members of Congress, as well as performing other 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. Recent mods include nitrogen fuel tank inerting for the C-40C and commercial wideband satcom for the C-40B, to ensure leader's secure top-secret voice, data, and video links. Further mods

include navigation, and air traffic management compliance, and low-cost sustainment upgrades. The fleet is designed for a 30-year service life, with an average of 22 years remaining.

**Contractor:** Boeing.

**First Flight:** April 14, 1999 (USN C-40A).

**Delivered:** 2002-2007.

**IOC:** Feb. 28, 2003.

**Production:** 11.

**Inventory:** Four (C-40B); seven (C-40C).

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

**Aircraft Location:** JB Andrews, Md.; JB Pearl Harbor-Hickam, Hawaii; Ramstein AB, Germany; Scott AFB, Ill.

**Active Variants:**

- 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.

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

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

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

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

**Ceiling:** 41,000 ft.

**Accommodation:** Crew: 10 (varies by model/mission). Load: up to 89 passengers (B); up to 111 (C).



Photo: Amn. Alexis Wade/ANG

## C-130H HERCULES

Tactical airlift

**Brief:** The C-130H is an all-purpose theater transport that performs diverse roles, including tactical and inter-theater airlift and airdrop support, AE, aerial spraying, aerial firefighting, and humanitarian support. 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 updated engines, redesigned outer wing, improved pneumatic systems, new avionics, improved radar, and NVG lighting. C-130Hs are being replaced by the C-130J. USAF is upgrading ANG Modular Airborne Fire Fighting Systems (MAFFS)-equipped C-130Hs with the same eight-bladed propellers and engine upgrades as the LC-130H to enhance performance and safety. The first modified airframe was redelivered to the Wyoming ANG in January 2018. WC-130Hs are operated by the Puerto Rico ANG and could be equipped with palletized mission equipment for tropical storm data collection. Ongoing upgrades include critical center wing box replacement, Mode 5 IFF, as well as the C-130H Avionics Modernization Program (previously Viability and Airspace Access Program). Increment 1 will add new CNS/ATM to bring a total of 166 C-130H in compliance with US and international airspace rules. Increment 2 will add terrain awareness and warning, new flight management, and modern MFDs.

**Contractor:** Lockheed Martin.

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

**Delivered:** 1974-96.

**IOC:** Circa 1974.

**Production:** 1,202 (C-130H).

**Inventory:** 176 (C-130H); five (WC-130H).

**Operator:** ANG, AFRC, AFSOC.

**Aircraft Location:** Dobbins ARB, Ga.; Little Rock AFB, Ark.; Maxwell AFB, Ala.; Minneapolis-St. Paul Arpt./ARS, Minn.; Patrick AFB, Fla.; Peterson AFB, Colo. (MAFFS); Youngstown ARS, Ohio (Aerial Spray); and ANG in Arkansas, Connecticut, Delaware, Georgia, Illinois, Kentucky, Minnesota, Missouri, Montana, Nevada (MAFFS), Ohio, Puerto Rico (WC-130), Texas, West Virginia, Wyoming (MAFFS).

#### Active Variants:

- C-130H Hercules. Updated version of the legacy C-130.
  - WC-130H. Dual-capable weather reconnaissance/airlift version of C-130H.
- 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.  
**Power Plant:** Four Allison T56-A-15, or Rolls-Royce T56 3.5 turboprops, each 4,591 shp.  
**Performance:** Speed 366 mph; range with 35,000 lb payload 1,496 miles.  
**Ceiling:** With max payload, 23,000 ft.  
**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.



Photo: SrA. Donald Hudson

## C-130J SUPER HERCULES

### Tactical airlift

**Brief:** The C-130J is the redesigned, current production version of the C-130 all-purpose theater transport. Missions include tactical and inter-theater airlift, airdrop, AE, wildfire suppression using the Modular Airborne Fire Fighting System (MAFFS), and humanitarian relief. The aircraft first deployed in combat in Southwest Asia in 2004. The Super Hercules features three-crew flight operations, more powerful engines, composite six-blade propellers, and 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. Block 8.1's Mode 5 IFF and air traffic management upgrades will be fielded ahead of cycle to meet the FAA's 2020 compliance deadline. Airframes delivered since 2009 incorporate enhanced service life center wings, and four of 21 contracted early production airframes will be retrofitted in 2019. The current multiyear contract procures 29 USAF C-130J-variants between FY19 and FY23 at a production rate of 16 aircraft per year.

**Contractor:** Lockheed Martin.

**First Flight:** April 5, 1996.

**Delivered:** February 1999-present.

**IOC:** October 2006.

**Production:** 396+.

**Inventory:** 125.

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

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

#### Active Variants:

- C-130J Super Hercules. Current production version.
  - C-130J-30 Super Hercules. Stretched version capable of accommodating larger loads.
- 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).  
**Power Plant:** Four Rolls-Royce AE2100D3 turboprops, each 4,700 shp.  
**Performance:** Speed 417 mph (J), 410 mph (J-30); range with 35,000 lb payload 1,841 miles (J), 2,417 miles (J-30).  
**Ceiling:** With max payload, 26,000 ft (J), 28,000 (J-30).  
**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).



Photo: Capt. David Price/ANG

## LC-130H SKIBIRD

### Arctic support/tactical airlift

**Brief:** The LC-130H is a ski-equipped Arctic-support derivative of the C-130H. It is capable of direct resupply of Antarctic research stations and high-arctic radar sites utilizing ice and snowpack runways. The LC-130H fleet supports the National Science Foundation's (NSF) Antarctic research, ferrying much of the material, provisions, and personnel between Christchurch, New Zealand, and McMurdo Station, Antarctica. The aircraft also provide ongoing support to the remote Amundsen-Scott South Pole Station. USAF began augmenting the Navy's "Operation Deep Freeze" with the C-124 in 1956. C-130s began Antarctic support in 1959, operating without skis until the initial ski-borne deployment of the C-130D in January 1960. By 1975, the New York ANG's 109th AW operated USAF's only ski-equipped LC-130 supporting Distant Early Warning sites in the high-Arctic. The unit began augmenting Navy LC-130s during Deep Freeze in 1988, before taking over primary responsibility in 1999. Lockheed Martin delivered three new NSF-funded aircraft in 1995-96. The remaining six ex-LC-130s were acquired from the Navy. LC-130s have been upgraded with digital displays and flight management systems, multifunction radar, modernized comms, and a single air data computer. LC-130s are upgraded along with the baseline C-130H fleet, including center wing box replacement, Mode 5 IFF, as well as the C-130H Avionics Modernization Program adding airspace-compliant CNS/ATM. Ice Pod experiments utilizing an aft, externally mounted sensor suite to record ice composition and density began in 2015. The pod includes radar, laser, and optical sensors. USAF began testing new eight-bladed NP-2000 propellers to increase take-off performance by 20 percent and replace the dwindling stock of JATO (Jet-Assisted Takeoff) rockets in 2008. Seven of the 10 aircraft have now been upgraded with new propellers and engine enhancements. The research season ending in February 2019 marked the first time all participating LC-130s were equipped with NP-2000 propellers.

**Contractor:** Lockheed Martin.

**First Flight:** 1957 (ski-equipped C-130).

**Delivered:** 1974-96.

**IOC:** January 1960 (C-130D).

**Production:** N/A.

**Inventory:** 10.

**Operator:** ANG.

**Aircraft Location:** Stratton ANGB, N.Y.

#### Active Variants:

- LC-130H Skibird. Arctic support variant with wheel-ski gear and eight-bladed propellers.
- Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.; Nose Ski 10 ft by six ft wide, main gear skis 12 ft by six ft wide.  
**Weight:** Max T-O 155,000 lb; max payload 45,000 lb.  
**Power Plant:** Four Rolls-Royce T56 3.5 turboprops, each 4,591 shp.  
**Performance:** Speed 366 mph; range with 35,000 lb payload 1,496 miles.  
**Ceiling:** With max payload, 23,000 ft.  
**Accommodation:** Crew: two pilots, navigator, flight engineer, loadmaster; Load: up to 92 passengers or 74 litters; six cargo pallets, 16 Container Delivery System (CDS) bundles, or any combination up to max weight.



Photo: TSgt. Danielle Hopkins/ANG

## VC-25 AIR FORCE ONE

Presidential airlift

**Brief:** 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 operated by the Presidential Airlift Group of the 89th Airlift Wing at JB Andrews. The VC-25A fleet has four years' estimated service life remaining and requires a life extension/block upgrade to remain viable until replaced by the VC-25B (based on Boeing's modernized 747-8 Intercontinental). Block mods including protected satcom, chillers, nitrogen generation system, weather radar, digital/voice data, and network upgrades slated for completion by mid-2020. SLEP is accomplished during regular depot maintenance. Flight deck upgrades include digital avionics, compliant CNS/ATM, Mode 5 IFF, Advisory Vertical Navigation, and other pilot situational awareness aids. USAF issued Boeing a \$3.9 billion presidential aircraft replacement contract to modify two undelivered commercial 747-8s to VC-25B standards on Feb. 20, 2018. The company plans to deliver the aircraft in 2024. The current specification excludes aerial refueling capabilities to reduce program cost.

**Contractor:** Boeing.

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

**Delivered:** August-December 1990.

**IOC:** Dec. 8, 1990.

**Production:** Two VC-25A; two VC-25B (planned).

**Inventory:** Two (VC-25A).

**Operator:** AMC.

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

**Active Variants:**

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

•VC-25B. Next generation presidential aircraft based on the Boeing 747-8 Intercontinental.

**Dimensions:** Span 195.8 ft, length 231.8 ft, height 63.4 ft (A); span 224.5 ft, length 250.2 ft, height 63.4 ft (B).

**Weight:** Max T-O 833,000 lb (A); max T-O 987,000 lb (B).

**Power Plant:** Four General Electric CF6-80C2B1 turbofans, each 56,700 lb thrust (A); four General Electric GENx-2B turbofans, each 66,500 lb thrust (B).

**Performance:** Speed 630 mph, range 7,800 miles, further with air refueling (A); speed 660 mph, range 8,900 miles (B).

**Ceiling:** 45,100 ft.

**Accommodation:** Crew: 26; Load: up to 102 passengers (A); unk (B).

advanced INS/GPS/Doppler navigation systems, satcom, and secure/anti-jam communications, and 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 Block 162 upgrades include Avionics Communications Suite Upgrade as well as replacing obsolete systems and standardizing HH-60G and loss-replacement aircraft configurations. Obsolescence mods include color weather radar, improved TACAN, new RWR, auto direction finding, and digital intercoms. ACSU upgrades will wrap up in 2020, followed by fleetwide standardization in 2024. Ongoing mods include safety/survivability, situational awareness, mission avionics, and operational loss replacement. FY19 funds Hostile Fire Indicator (HFI) to pinpoint and engage threats including rocket propelled grenade and small arms, as well as missile warning and countermeasures to support operations in Afghanistan, Iraq, and Syria. Additional upgrades include sensor turret to enhance situational awareness in low-visibility condition, and data links to provide real-time access to ISR data gleaned by offboard assets for improved situational awareness. 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. Two engineering development HH-60Ws are undergoing final construction. LRIP approval and first flight are both expected in 2019. A total of nine HH-60Ws will support developmental testing at Eglin. USAF plans to procure 112 new-HH-60Ws through 2029. The last HH-60s assigned to RAF Lakenheath departed for Aviano on May 15, 2018, to better support contingencies in Africa and Europe.

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

**First Flight:** October 1974.

**Delivered:** 1982-present.

**IOC:** 1982.

**Production:** 112 (HH-60G); 21 (HH-60U); 112 (HH-60W) (planned).

**Inventory:** 102 (HH-60G); three (HH-60U).

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

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

**Active Variants:**

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

• HH-60U. Converted surplus UH-60L.

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

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

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

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

**Performance:** Speed 184 mph; range 580 miles (air refuelable).

**Ceiling:** 14,000 ft.

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

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

## HELICOPTERS



Photo: S/A. Greg Nash

### HH-60 PAVE HAWK

Personnel recovery/medium lift

**Brief:** The HH-60G Pave Hawk is an armed all-weather day/night CSAR helicopter derived from the UH-60 Blackhawk. Additional missions include casualty/medical evacuation, disaster and humanitarian response, firefighting, and combat/utility support. The HH-60G is equipped with



Photo: Yasuo Osakabe/USAF

### UH-1 HUEY/IROQUOIS

Light lift/training

**Brief:** The UH-1N aircraft initially provided search and rescue capabilities before replacing earlier Huey variants in the ICBM field security and support role. UH-1Ns also provide administrative lift to US National Capital Region and PACAF officials from JB Andrews and Yokota respectively, and support aircrew survival training at Fairchild. The TH-1H fleet provides Air Force

helicopter pilot training at Fort Rucker. USAF converted all single-engine UH-1H models to 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. Ongoing TH-1H upgrades include FAA-compliant CNS/ATM. USAF awarded Boeing the \$2.4 billion UH-1N Replacement Program contract on Sept 24, 2018. Boeing will integrate mission specific systems onto the commercial Leonardo/Agusta-Westland AW-139 to produce up to 84 MH-139s. Operational testing could begin as early as this year. Contract delays pushed initial fielding to 2021 or later.

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

**First Flight:** April 1969 (UH-1N).

**Delivered:** September 1970-1974; November 2005-2013 (TH-1H).

**IOC:** October 1970; circa 2009 (TH-1H).

**Production:** 28 (TH-1H); 79 (USAF UH-1Ns).

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

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

**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.

**Active Variants:**

- 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.

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

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

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

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

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

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

**Accommodation:** Crew: two pilots, flight engineer; Load: six to 13 passengers (depending on fuel, equipment, and atmospheric conditions) or up to six litters or, without seats, bulky, oversize cargo (N).

**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.

**Active Variant:**

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

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

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

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

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

**Ceiling:** 41,000 ft.

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



Photo: Amn. Shelby Pruitt

## T-6 TEXAN II

Primary trainer

**Brief:** The T-6 is a joint Air Force/Navy undergraduate pilot trainer developed as the Joint Primary Aircraft Training System. The aircraft is based on the 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, with an expected service life of 21 years. Ongoing mods include airspace compliant avionics, improved canopy fracture system, and updated training aids. FY19 funds development of a crash-survivable flight data recorder and future plans would add controlled flight into terrain avoidance. AETC suspended all T-6 flights in early 2018 following a series of hypoxia-like incidents linked to the aircraft's onboard oxygen generating system (OBOGS). The service is improving maintenance and inspections and seeks to retrofit the fleet with a redesigned system. USAF evaluated the armed AT-6 Wolverine variant during the second phase of its light attack experiment at Holloman in 2018, evaluating rapidly procurable light CAS/ISR systems.

**Contractor:** Beechcraft/Textron Aviation Defense (formerly Raytheon).

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

**Delivered:** May 2000-May 2010.

**IOC:** May 2000.

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

**Inventory:** 444 (USAF).

**Operator:** AETC, USN.

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

**Active Variants:**

- T-6A. Joint service primary training aircraft, based on the Pilatus PC-9.
- T-6B. Navy-only variant.
- AT-6 Wolverine. Experimental light attack/armed reconnaissance variant.

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

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

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

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

**Ceiling:** 31,000 ft.

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

## TRAINER AIRCRAFT



Photo: AIC Keith Holcomb

## T-1 JAYHAWK

Advanced trainer

**Brief:** The T-1A is a military version of the Beechcraft 400A business jet used in the advanced phase of JSUPT for tanker/transport pilot and CSO training pipelines. The 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. USAF awarded a \$156 million Avionics Modernization Program (AMP) contract to replace the type's obsolescent flight deck with a commercial glass cockpit on April 4, 2018. The service is working to return the last of 39 aircraft severely damaged in a hailstorm at Laughlin to flying status. The fleet's estimated 18,000 flying-hour service life keeps it structurally airworthy to 2032.

**Contractor:** Beechcraft (airframe), Field Aerospace/Rockwell Collins (AMP).





Photo: TSgt. Mary Greenwood



Photo: Mike Kaplan/USAF

## T-38 TALON

Advanced trainer

**Brief:** The T-38 was the first supersonic trainer aircraft and primarily serves AETC's advanced JSUPT fighter/bomber tracks and Introduction to Fighter Fundamentals. The aircraft is used to teach supersonic techniques, aerobatics, 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. Sustainment measures include replacement of major engine components to improve reliability and maintainability. Full fleet replacement is not projected until 2034. T-38s were designed for 7,000 flying hours and many have surpassed 20,000 hours. Pacer Classic III is the type's third structural renewal effort and the most intensive in its history. It replaces major longerons, bulkheads/formers, intakes, internal skins, and structural floors on 180 high-risk T-38Cs. The first airframe was redelivered in 2015. Additional upgrades include wing replacement, digital avionics, replacement HUD, VHF nav/comms, airspace compliance, and safety mods. Approximately 50 T-38s will not be modified with ADS-B ahead of FAA's 2020 compliance deadline. USAF is fielding the next generation Boeing T-X aircraft with initial capability in 2024. USAF awarded Boeing/SAAB a \$9.2 billion T-X contract to replace the T-38 on Sept. 20, 2018. The service plans to buy between 350 and 475 of the new trainers.

**Contractor:** Northrop Grumman.

**First Flight:** April 1959.

**Delivered:** 1961-72 (T-38A); 2002-07 (T-38C).

**IOC:** March 1961.

**Production:** 1,187.

**Inventory:** 53 (T-38A); six (AT-38B); 442 (T-38C).

**Operator:** ACC, AETC, AFGSC, AFMC.

**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; JB Langley-Eustis, Va.; Vance AFB, Okla.; Whiteman AFB, Mo.

**Active Variants:**

- 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.

**Dimensions:** Span 25.3 ft, length 46.3 ft, height 12.8 ft.

**Weight:** Max T-O 12,093 lb.

**Power Plant:** Two General Electric J85-GE-5 turbojets, each 2,900 lb thrust with afterburning.

**Performance:** Speed 812 mph, range 1,093 miles.

**Ceiling:** Above 55,000 ft.

**Accommodation:** Two pilots, in tandem, on Martin Baker MK16T zero/zero ejection seats.

## T-53 KADET II

Trainer

**Brief:** The T-53 is the military designated civilian Cirrus SR20, primarily serving USAFA's Powered Flight Program, conducting some 12,600 annual training and competition-flying hours. The aircraft is dubbed "Kadet" in reference to the Boeing/Stearman PT-17, which was the USAAF's mainstay primary training aircraft during WWII. 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.

**Contractor:** Cirrus.

**Delivered:** 2012.

**Inventory:** 24.

**Operator:** AETC.

**Aircraft Location:** USAFA, Colo.

**Active Variant:** • T-53A. Military designated Cirrus SR20.

**Dimensions:** Span 38.3 ft, length 26 ft, height 8.9 ft.

**Weight:** Max T-O 3,050 lb.

**Power Plant:** One Continental IO-360-ES six-cylinder, fuel-injected, air-cooled engine, 200 hp.

**Performance:** Speed 178 mph, range 690 miles.

**Ceiling:** 17,500 ft.

**Accommodation:** Two, side-by-side, plus three passengers.



Photo: Mike Kaplan/USAF

## UV-18 TWIN OTTER

Utility

**Brief:** The UV-18 is a military variant of the civilian De Havilland DHC-6 Twin Otter. It serves USAFA supporting various parachuting and 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.

**Contractor:** De Havilland Canada.

**First Flight:** May 1965 (commercial version).

**Delivered:** 1977 (two); 1982 (one).

**IOC:** 1977.

**Production:** Three.

**Inventory:** Three.

**Operator:** AETC.

**Aircraft Location:** USAFA, Colo.

**Active Variant:**

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

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

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

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

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

**Ceiling:** 25,000 ft.

**Accommodation:** Crew: two pilots; Load: up to 20 passengers/parachutists.

## FULL-SCALE AERIAL TARGETS



Photo: TSgt. Perry Aston

### QF-16 FULL-SCALE AERIAL TARGET

**Full-scale aerial target**

**Brief:** QF-16 is a manned/unmanned aerial target and threat simulator serving missile/weapons development, testing, validation, and training. QF-16s began replacing the dwindling and obsolescent QF-4 Full-Scale Aerial Target (FSAT) starting in 2015, through the type's retirement in December 2017. QF-16s are capable of manned or "not under live local operator" (NULLO) control operations. The first of 13 LRIP QF-16s was delivered to Tyndall in early 2015. Boeing is under contract to deliver 121 converted airframes in five production lots through April 2021. FY19 funds procure 48 conversions. ACC declared IOC with 15 operational aircraft in 2016, and ongoing operational testing includes a comprehensive cyber security evaluation. Recent efforts include developing new EA pods and software to more accurately replicate adversary capabilities and tactics, ground control improvements, threat realism improvements, preliminary development of two-seat trainer, and future F-16 block conversions. QF-16 deliveries to hurricane-ravaged Tyndall have continued despite damage to the base, with the 18th FSAT arriving in October 2018.

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

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

**Delivered:** February 2015-present.

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

**Production:** 126 (planned).

**Inventory:** 12 (QF-16A); 20 (QF-16C).

**Operator:** ACC.

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

**Active Variants:**

- 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.

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

**Weight:** F-16A: empty (F100-PW-200) 16,285 lb; F-16C: empty (F110-GE-100) 18,238 lb.

**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.

**Performance:** Speed Mach 2, ferry range 2,000+ miles.

**Ceiling:** 50,000 ft.

**Defensive Systems:** Chaff/flares; EA pods: ALQ-188, ALQ-167.

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

## REMOTELY PILOTED AIRCRAFT



Photo: J. M. Eddins Jr./USAF

### MQ-9 REAPER

**Attack/armed reconnaissance**

**Brief:** 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 permissive environments. 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. A 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. MQ-9 is retrofitted under a flexible acquisition structure, which can rapidly change to meet demand. Current efforts include the new DAS-4 high-definition EO/IR sensor to improve targeting accuracy, fuselage checks to improve system cooling, bandwidth-efficient data links, enhanced JDAM targeting, and more modular weapons interface software. Long-term fixed programs include Block 5 aircraft/Block 30 GCS, and Extended Range Reaper which 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. USAF plans to upgrade the entire fleet to ER standards, comprising 165 Block 1 and 136 Block 5 aircraft. FY19 funding supports Block 5, Lynx SAR, reliability and maintainability mods, ER kits, and capability upgrades, as well as procuring 29 new-build MQ-9s

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

**First Flight:** February 2001.

**Delivered:** November 2003-present.

**IOC:** October 2007; 2015 (ER).

**Production:** 346 (planned).

**Inventory:** 251.

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

**Aircraft Location:** Cannon AFB, N.M.; Creech AFB, Nev.; Eglin AFB, Fla.; Ellington Field, Texas; Fort Drum, N.Y.; Fort Huachuca, Ariz.; Hancock Field, N.Y.; Hector Arpt., N.D.; Holloman AFB, N.M.; March ARB, Calif.; Nellis AFB, Nev., and deployed locations worldwide. Planned: Tyndall AFB, Fla.; Whiteman AFB, Mo.

**GCS Location:** Cannon AFB, N.M.; Creech AFB, Nev.; Battle Creek ANGB, Mich.; Davis-Monthan AFB, Ariz.; Des Moines Arpt., Iowa; Ellington Field, Texas; Ellsworth AFB, S.D.; Fort Smith Arpt., Ark.; Hancock Field, N.Y.; Hector Arpt., N.D.; Holloman AFB, N.M.; Horsham AGS, Pa.; Hurlburt AFB, Fla.; March ARB, Calif.; Springfield-Beckley Arpt., Ohio. Planned: Niagara Falls Arpt., N.Y.; Shaw AFB, S.C.; Tyndall AFB, Fla.; Whiteman AFB, Mo.

**Active Variants:**

- 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.

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

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

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

**Performance:** Cruise speed 230 mph, range 1,150 miles, endurance 27 hr;

34 hr (ER).

**Ceiling:** 50,000 ft.

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

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



Photo: SSgt. Ramon Adelman

## RQ-4 GLOBAL HAWK

High-altitude reconnaissance

**Brief:** The Global Hawk is a long-endurance, high-altitude, “deep look” ISR platform. It complements satellite and manned strategic ISR and is capable of generating imagery ISR, SIGINT, and ground moving target indication (GMTI), depending on variant. 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. The Block 10 debuted in combat in 2001 before delivery of the first production aircraft and was retired in 2011. Block 20 aircraft were initially delivered as an imagery intelligence (Imint) platform incorporating the Enhanced Integrated Sensor Suite (EISS). Five airframes were subsequently converted to EQ-4B communications relay platforms with the Battlefield Airborne Communications Node (BACN), and four 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. It incorporates AESA and SAR to simultaneously gather stationary target imagery as well as detect and track moving ground targets and cruise missiles. Payload integration and mods include upgrading the Block 30’s Airborne Signals Intelligence Payload (ASIP), adding more reliable and capable EO camera, enlarging onboard data storage, adding new IP-based comms, and upgraded SATCOM reach-back. A universal payload adapter enables carriage of several U-2-unique sensors including the MS-117 and SYERS II EO sensors, and wet-film Optical Bar Camera. Two Block 30s have been retrofitted with the MS-117 and are slated for an Operational Utility Evaluation in early 2019. A total of six sensor packages will be delivered through 2020 as part of congressionally mandated efforts to reach sensor parity with the U-2. FY19 funds also support Enhanced Weather Capability including weather radar and anti-icing, FAA-mandated airspace compliant Mode 5/ADS-B, increased data storage, and sense and avoid technology. Northrop Grumman retrofitted and redelivered an additional BACN-equipped EQ-4B on July 19, 2018, restoring the fleet to four airframes.

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

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

**Delivered:** August 2003-present.

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

**Production:** 45 (USAF).

**Inventory:** 34; four (Block 20); 19 (Block 30); 11 (Block 40).

**Operator:** ACC, AFMC.

**Aircraft Location:** Beale AFB, Calif. (Block 30); Edwards AFB, Calif.; Grand Forks AFB, N.D. (Block 20/40); forward operating locations: Ali Al Salem AB, Kuwait (EQ-4B); Andersen AFB, Guam; NAS Sigonella, Italy; Yokota AB, Japan.

**Active Variants:**

- 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.

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

**Weight:** Max T-O 32,250 lb; max payload 3,000 lb.

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

**Performance:** Speed 356.5 mph, range 10,000 miles, endurance 32+ hr (24 hr on-station loiter at 1,200 miles).

**Ceiling:** 60,000 ft.

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



Photo: USAF

## RQ-170 SENTINEL

Unmanned surveillance and reconnaissance

**Brief:** RQ-170 is an unmanned, stealthy, penetrating, day/night tactical ISR platform. 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 and the 30th Reconnaissance Squadron at Tonopah Test Range. An RQ-170 over Iran crashed and was captured during a mission in 2011. Iran allegedly reverse-engineered a copy of the aircraft, which the Israeli Air Force reported shooting down during an engagement inside Israeli territory on Feb. 10, 2018.

**Contractor:** Lockheed Martin.

**Operator:** ACC.

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

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

**Known Active Variant:**

- RQ-170. No data available.

**Dimensions:** Span 65.6 ft, length 14.75 ft.

## STRATEGIC WEAPONS



Photo: SSgt. Roidan Carlson

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

Strategic air-to-surface cruise missile

**Brief:** The AGM-86 is a low-level, penetrating nuclear or conventional strike weapon for use against strategic surface targets. ALCM’s 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. The conventional, GPS-guided 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 awarded

Lockheed Martin and Raytheon technology maturation and risk-reduction contracts for the LR50 in 2017 and plans to field the nuclear missile by the late 2020s, possibly followed by a conventional derivative thereafter.

**Contractor:** Boeing.  
**First Flight:** June 1979 (full-scale development).  
**Delivered:** 1981-1986.  
**IOC:** December 1982 (B); January 1991 (C); November 2001 (D).  
**Production:** 1,715.  
**Inventory:** 546.  
**Operator:** AFGSC.  
**Unit Location:** Andersen AFB, Guam (conventional only); Barksdale AFB, La.; Minot AFB, N.D.  
**Active Variants:**

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

**Dimensions:** Span 12 ft, length 20.8 ft, body diameter 2 ft.  
**Weight:** 3,150 lb.  
**Power Plant:** Williams/Teledyne CAE F107-WR-10 turbofan, 600 lb thrust.  
**Performance:** Speed 550 mph (B), high subsonic (C/D); range 1,500+ miles (B), 690 miles (C/D).  
**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).  
**Estimated Yield:** W80-1 warhead: five-150 kilotons (preselectable).  
**Integration:** B-52H.

## B61 THERMONUCLEAR BOMB

Air-to-surface thermonuclear bomb

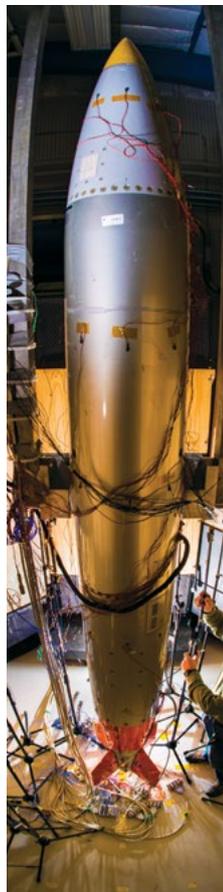


Photo: Randy Montoya/Sandia Labs, DOE

**Brief:** B61 is an air-dropped battlefield/tactical nuclear weapon. It is the B-2's primary strategic weapon and equips both the F-16 and F-15E in the forward-deployed, allied extended deterrent role. 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 B61 Mod 12 Life Extension Program (LEP). Production engineering work began in 2016. B61-12 will consolidate the B61-3, -4, -7, and -10 weapons into a single, standardized configuration. USAF and the National Nuclear Security Administration qualification flight testing, completed June 9, 2018, included 31 inert test drops and greatly exceeded required performance. These drops validated nonnuclear components such as arming/fire control, guidance, and spin-rocket motors, and software. B61-12 completed its final design review in September 2018 and was approved for production in October. The LEP upgrades/refurbishes the warhead and aims to improve the safety, security, and reliability of the weapon through 2040. B61-12 also adds a guided tail kit, making it the first precision guided weapon of its type. Improved accuracy will permit higher effectiveness at lower yields. The first production example is scheduled for completion in March 2020. The upgraded weapon is cleared to begin operational testing in mid-2019, and integration is planned for the B-2, F-15E, F-16, and F-35A.

**Contractor:** Los Alamos National Laboratory (weapon), Boeing (B61-12 tail kit).  
**Delivered:** 1966.  
**IOC:** 1968.  
**Production:** N/A.  
**Inventory:** Approx 500.  
**Operator:** AFMC, USAF.  
**Deployed locations:** Aviano AB, Italy; Büchel AB, Germany; Ghedi AB, Italy; Incirlik AB, Turkey; Kleine Brogel AB, Belgium; Volkel AB, Netherlands.

### Active Variant:

• B61. Supersonic-droppable free-fall thermonuclear weapon.  
**Dimensions:** Length 11 ft 8 in., diameter 1 ft 1 in.  
**Weight:** 700 lb; 825 lb (B61-12).  
**Performance:** N/A.  
**Guidance:** None (B61 Mod 1 to 11); N/A (B61 Mod 12).  
**Warhead:** One B61 -3, -4, -7, -10, or -11.  
**Estimated Yield:** 0.3 kilotons, 1.5 kilotons, 10 kilotons, 50 kilotons (preselectable).  
**Integration:** B-2A, F-15E, and F-16C/D; NATO: F-16A/B Mid-Life Upgrade (MLU), and Panavia Tornado IDS/GR.4. Planned: B-21, F-35A.



Photo: SSgt. Jonathan Snyder

## LGM-30 MINUTEMAN III

Strategic surface-to-surface ballistic missile

**Brief:** Minuteman is a three-stage solid-propellant nuclear deterrent ICBM housed in a survivable underground silo. Minuteman III became operational in 1970, providing improved range, rapid retargeting, and the capability to place up to three re-entry vehicles on three targets with a high accuracy. It is the sole remaining US land-based ICBM. Ongoing mods include updated warhead fuses, networking, and cryptography upgrades. FY18 began the Launch Control Center Block Upgrade (LCCBU), which replaces key hardware, software, comms, and environmental control systems in the crew capsule, as well as starting new missile site-security and video situational awareness upgrades. Guidance and propulsion upgrades and modernized re-entry vehicles extend service life to 2030. New efforts include developing a replacement to the current, obsolete airborne launch system fielded aboard the Navy's E-6B Mercury aircraft. Launch Control Center AEHF integration is slated for IOC in FY19. AFGSC initially deployed 550 missiles, later reducing that number to 400 based at Malmstrom, Minot, and F.E. Warren. AFGSC completed reducing its deployed ICBMs to a single-warhead configuration in 2014, under limits imposed by the New START agreement. USAF awarded Boeing and Northrop Grumman technology maturation and risk-reduction contracts on Aug. 21, 2017, to begin replacing Minuteman with a future Ground-Based Strategic Deterrent (GBSD).

**Contractor:** Boeing, General Electric, Lockheed Martin, Northrop Grumman (formerly Orbital ATK)  
**First Flight:** February 1961.  
**Delivered:** 1962-1978.  
**IOC:** December 1962, Malmstrom AFB, Mont.  
**Production:** 1,800.  
**Inventory:** 400.  
**Operator:** AFGSC.  
**Unit Location:** F. E. Warren AFB, Wyo.; Malmstrom AFB, Mont.; Minot AFB, N.D.  
**Active Variant:**

- LGM-30G. Current Minuteman III variant.

**Dimensions:** Length 59.9 ft, diameter 5.5 ft.  
**Weight:** 79,432 lb.  
**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: Orbital ATK refurbished SR73 solid-propellant motor, 34,400 lb thrust.  
**Performance:** Speed at burnout approx 15,000 mph, range 6,000+ miles.  
**Guidance:** Inertial guidance system.  
**Re-entry Vehicle:** One Mk 21 RV; one to three Mk 12/12A MIRVs.  
**Warhead:** One W87 or up to three W78 enriched uranium thermonuclear weapons.

## LONG-RANGE STANDOFF WEAPONS



Photo: Raytheon

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

Aircraft decoy; close-in radar jammer

**Brief:** MALD is a programmable, low-cost, modular, autonomous flight vehicle that mimics US or allied aircraft to confuse enemy Integrated Air Defense Systems (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 in-flight retargeting capabilities and is integrating GPS-Aided Inertial Navigation System (GAINS II) to improve navigational accuracy in GPS-denied environments. An upgraded Jammer variant dubbed "MALD-X" successfully demonstrated future, low-level flight capabilities, improved EW payloads, and enhanced data links in 2018. MALD-X aims to establish USAF's future baseline and serve as the basis for a new Navy variant. USAF awarded a MALD-J contract option for Lot 10 production in 2016 and a follow-on Lot 11 contract for 250 weapons in 2018.

**Contractor:** Raytheon.

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

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

**IOC:** 2015 (MALD-J).

**Active Variants:**

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

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

**Weight:** Less than 300 lb.

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

**Guidance:** GPS/INS.

**Integration:** B-52H, F-16C.



Photo: USAF

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

Guided air-to-surface glide bomb

**Brief:** JSOW is a joint USAF-Navy family of medium-range, GPS/INS guided, standoff air-to-ground glide 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. 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.

**Contractor:** Raytheon.

**First Flight:** December 1994.

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

**IOC:** 2000 (USAF).

**Active Variants:**

- 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.

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

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

**Guidance:** GPS/INS.

**Warhead:** See variants above.

**Integration:** B-1, B-2, B-52, F-15E, and F-16. Planned: F-35A.



Photo: Lockheed Martin/USAF

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

Air-to-surface cruise missile

**Brief:** JASSM is a joint USAF-Navy autonomous precision cruise missile for use against heavily defended or high-value targets at standoff range. It can attack fixed, relocatable, and moderately hardened/buried targets. The base-variant is a stealthy low-cost airframe equipped with GPS/INS guidance and imaging IR terminal seeker. It is integrated on most fighter and bomber types and is planned for the 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. The variant reached full operational capability on the F-15E in 2018, and is planned for use on all fighter/bomber platforms. It is currently undergoing integration on both the F-16C/D and the B-52H (both internal and external-pylon carriage). Full-rate production of the ER began the same year and JASSM production shifted to ER-only in FY16. Total planned production includes 2,034 JASSM and 2,866 JASSM-ER. Lockheed Martin is developing the Long-Range Anti-Ship Missile (LRASM) variant for both the Air Force and Navy. LRASM was successfully tested on the B-1B last year and will be fielded early in 2019. FY19 funds support procurement of 360 JASSM-ER and 12 LRASM.

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

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

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

**IOC:** September 2003; December 2014 (ER variant); 2018 (LRASM).

**Active Variants:**

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

**Dimensions:** Length 14 ft.

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

**Performance:** Speed subsonic, range 200+ miles (baseline), 500+ miles (ER).

**Guidance:** GPS/INS and imaging IR terminal seeker.

**Warhead:** 1,000-lb class penetrator (JASSM); 1,000-lb blast fragmentation (LRASM).

**Integration:** (JASSM) B-1B, B-2, B-52H, F-15E, and F-16 Block 40-52; planned: F-35A. (JASSM-ER) B-1B, F-15E; planned: B-2A, B-52H, F-16, and F-35A; (LRASM) B-1B.

## AIR-TO-AIR MISSILES



Photo: SrA, Omar Bernard

### AIM-9 SIDEWINDER

Air-to-air missile

**Brief:** Sidewinder is an IR-guided short-range, supersonic air-to-air missile. It was developed by the Navy for fleet air defense and adapted for USAF fighters. Early versions were used extensively in the Vietnam War. The AIM-9M is a joint Navy-USA, all-altitude, all-aspect intercept missile. It has improved defense against IR countermeasures, background discrimination, and reduced-smoke rocket motor. 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 for high off-boresight capability. 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. AIM-9X production includes 67 converted AIM-9Ms, 1,093 Block 1, and a planned 2,859 Block II (including the newly developed Block II-plus, incorporating enhanced survivability features). FY19 funds procure a combined 256 AIM-9X Block II/II-plus.

**Contractor:** Raytheon, Northrop Grumman (propulsion).

**First Flight:** September 1953.

**Delivered:** AIM-9M 1983; AIM-9X from 2002-2011 (Block I); 2011 to present (Block II); 2017-present (Block II-plus).

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

**Production:** 1,093 (Block I); 2,859 (Block II/Block II+) (planned).

**Active Variants:**

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

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

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

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

**Guidance:** Passive IR homing guidance.

**Warhead:** HE annular blast fragmentation.

**Integration:** F-15C/D/E, F-16C/D, F-22A (AIM-9X). Planned: F-35A.



Photo: A1C Caitlin Russell

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

Air-to-air guided missile

**Brief:** AMRAAM is an active radar-guided, medium-range, supersonic air-to-air missile. It 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 incorporates 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 2014 and was fielded in 2015. The latest variant offers improved range, GPS-assisted guidance, updated data links, and jam resistance, in addition to greater lethality. Ongoing upgrades will further enhance weapon performance and electronic protection. The second phase of the AIM-120D System Improvement Program (SIP II) is in operational testing and will be fielded in early 2020. Cybersecurity testing will conclude in mid-2019. FY19 funds support AIM-120D integration on the F-22 and procures 220 AIM-120D missiles.

**Contractor:** Raytheon, Northrop Grumman, and Nammo Group (propulsion).

**First Flight:** December 1984.

**Delivered:** 1988.

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

**Active Variants:**

- 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.

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

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

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

**Guidance:** Active radar terminal/inertial midcourse.

**Warhead:** HE blast-fragmentation.

**Integration:** F-15C/D/E, F-16C/D, F-22A; planned: F-35A.

## AIR-TO-GROUND WEAPONS



Photo: BAE Systems

### ADVANCED PRECISION KILL WEAPON SYSTEM (APKWS)

Air-to-surface guided rocket

**Brief:** is a low-cost, semi-active laser-guidance system sized to fit the 2.75-in aerial rocket. It is optimized for precision, low-collateral-damage strike against moving or stationary light vehicle and personal targets. Illuminating and white phosphorous rounds are used for target marking by Forward Air Control aircraft. USAF acquired the system as an urgent operational requirement, and it was employed in combat for the first time by an F-16 in June 2016. The weapon employs a mid-body guidance package to convert the standard rocket into a guided weapon. APKWS was already in service with the three other services, and initial weapons were procured from Navy stocks. The rockets are launched from multi-round, reusable pods. FY19 funds procure 7,279 APKWS guidance kits.

**Contractor:** BAE Systems.

**First Flight:** May 2013 (USAF).

**Delivered:** October 2012-present.

**IOC:** N/A.

**Active Variant:**

•APKWS. Semi-active laser guided 2.75-in rocket, adapted for fixed-wing use.

**Dimensions:** Span 9.5 in, length 6.25 ft, diameter 2.75 in.

**Propulsion:** Solid-propellant rocket motor.

**Performance:** Subsonic, range 1.2 to 6.8 miles.

**Guidance:** Semi-active laser.

**Warhead:** HE, white phosphorous, or illuminating round.

**Integration:** A-10, F-16 (tests also conducted on AT-6).



Photo: Raytheon

### AGM-65 MAVERICK

Air-to-surface guided missile

**Brief:** Maverick is a TV-, imaging IR-, or laser-guided standoff air-to-surface



missile employed by fighter/attack aircraft against tanks, vehicles, and air defenses. It was first employed during the Vietnam War and was used extensively in Desert Storm and Iraqi Freedom. 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 imaging IR 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 imaging IR 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. FY19 contingency funds modify 293 legacy missiles to Laser Maverick standards and replenish weapons expended in combat.

**Contractor:** Raytheon, Northrop Grumman (propulsion).

**First Flight:** August 1969.

**Delivered:** August 1972.

**IOC:** February 1973.

**Active Variants:**

- 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. Imaging IR 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.

**Dimensions:** Span 2.3 ft, length 8.2 ft, diameter 12 in.

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

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

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

**Warhead:** 125-lb cone-shaped (B/D/H); 300-lb delayed-fuse penetrator (E/G/K).

**Integration:** A-10C, F-15E, F-16C/D.



Photo: SMSgt. David Lipp/ANG

## AGM-114 HELLFIRE

Air-to-surface guided missile

**Brief:** Hellfire is a low-collateral damage, precision air-to-ground missile with semi-active laser guidance for use against light armor and personnel. Missiles are used on the MQ-9 Reaper. AFSOC dropped previous plans to integrate the weapons onto its AC-130W gunships in favor of the Small Glide Munition. 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. FY19 funds procure 4,338 missiles.

**Contractor:** Lockheed Martin, Northrop Grumman (propulsion).

**First Flight:** Feb. 16, 2000 (USAF).

**Delivered:** March 2016-present.

**IOC:** N/A.

**Active Variant:**

- AGM-114. Numerous subvariants, depending on target and mission requirements.

**Dimensions:** Span 28 in, length 5.33 ft, diameter 17 in.

**Propulsion:** Solid-propellant rocket motor.

**Performance:** Subsonic, range 5+ miles.

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

**Warhead:** Shaped charge and blast fragmentation.

**Integration:** MQ-9.



Photo: Raytheon

## AGM-176 GRIFFIN

Air-to-surface guided missile

**Brief:** Griffin is a light, low-cost, multiservice air-launched weapon with GPS-aided inertial guidance and semi-active laser seeker. The weapon is used for high-precision, low-collateral damage attack against light surface targets. The AGM-176A forms part of the PSP employed on AFSOC's AC-130W Stinger II and AC-130J Ghost rider gunships. Both aircraft employ the aft-firing weapon from ramp-mounted common-launch tubes. The forward-firing AGB-176B is employable on RPAs. USAF issued Raytheon a \$105.2 million contract modification to supply additional Griffin missiles on Jan. 31, 2018.



Photo: Jim Haseltine/USAF

## AGM-88 HIGH-SPEED ANTI-RADIATION MISSILE (HARM)

Air-to-surface anti-radiation missile

**Brief:** HARM is an anti-radiation, air-to-surface missile highly effective against enemy ground radar. AGM-88 is a joint USAF-Navy weapon, carried by SEAD-dedicated F-16Cs. 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-countermeasure performance, and reduced risk of collateral damage. The Navy is further retrofitting its missiles with advanced networking, digital homing, and terminal millimeter-wave radar seeker, resulting in the AGM-88G Advanced Anti-Radiation Guided Missile (AARGM).

**Contractor:** Raytheon.

**First Flight:** April 1979.

**Delivered:** 1982-98.

**IOC:** Circa 1984.

**Active Variants:**

- AGM-88B. Early production variant.
- AGM-88C. Current production variant.
- AGM-88F. Upgraded variant with greater accuracy and precision.

**Dimensions:** Span 3.7 ft, length 13.7 ft, diameter 10 in.

**Propulsion:** Thiokol dual-thrust, solid-propellant rocket motor.

**Performance:** Supersonic, range 30+ miles.

**Guidance:** Proportional with fixed antenna and seeker head in missile nose.

**Warhead:** HE fragmentation.

**Integration:** F-16CJ (Block 50).

**Contractor:** Raytheon.  
**First Flight:** Feb. 16, 2000 (USAF).  
**Delivered:** September 2001.  
**IOC:** N/A.

**Active Variants:**

- AGM-176A. Aft-ejecting missile employed as part of the PSP.
- AGM-176B. Forward-firing variant optimized for light aircraft/RPAs.

**Dimensions:** Length 43 in, diameter 5.5 in.

**Propulsion:** Solid-propellant rocket motor.

**Performance:** Subsonic, range 12 + miles.

**Guidance:** GPS/INS/semi-active laser.

**Warhead:** Blast fragmentation.

**Integration:** AC-130W (A); MQ-9 (B); planned: AC-130J (A).

Illustration: Textron Systems



### CBU-105 SENSOR FUZED WEAPON (SFW)

Wide-area munition

**Brief:** SFW is a tactical area weapon used against massed stationary or moving armor and ground vehicles. The munitions dispenser contains a

payload of 10 BLU-108 submunitions, each containing four skeet-shaped copper projectiles totaling 40 lethal, target-seeking projectiles. The skeet's 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 other self-propelled targets. SFW can be delivered from high altitude and in adverse weather. It debuted in combat in Iraq in 2003. DOD ceased cluster munition procurement in 2007 and has only employed the weapons in combat once since 2003. CBU-105 was the only standard USAF cluster munition that met the less-than-one-percent failure rate previously mandated by DOD for use beyond 2018. DOD has since reversed course, retaining existing weapons for deterrence on the Korean peninsula, but is developing a compliant family of Next Generation Area Attack Weapons (NGAAWs). NGAAW will initially be a 500-lb improved-lethality, anti-personnel/materiel weapon, followed by a second, more potent 2,000-lb high-fragmentation warhead.

**Contractor:** Textron Systems.

**First Flight:** Circa 1990.

**IOC:** 1997.

**Active Variants:**

- CBU-105. CBU-97 with WCMD tail kit.

**Dimensions:** Length 7.7 ft, diameter 15 in.

**Performance:** Delivers 40 lethal projectiles over an area of about 500 ft x 1,200 ft.

**Guidance:** IR sensors in each warhead.

**Integration:** A-10C, B-1B, B-52H, F-15E F-16C/D.

**Performance:** Subsonic, range 5+ miles.

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

**Warhead:** Shaped charge and blast fragmentation.

**Integration:** MQ-9.



### CBU-107 PASSIVE ATTACK WEAPON

Wide-area munition

**Brief:** Passive Attack Weapon is a nonexplosive, kinetic penetrating area weapon for use against sensitive targets. The CBU-107's penetrator rods

limit collateral damage and do not scatter potentially contaminating debris when used against enemy WMD stockpiles. The 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.

**Contractor:** General Dynamics (kinetic energy penetrator payload and canister), Lockheed Martin (WCMD), Textron (tactical munition dispenser kit).

**First Flight:** 2002.

**IOC:** December 2002.

**Active Variant:**

- CBU-107A. Centrifugally dispersed, armor-penetrating weapon.

**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-inch rods (350), 7-inch rods (1,000), and small-nail size (2,400).

**Integration:** B-52, F-15E, F-16C/D.



Photo: SrA, Stormy Archer

### GBU-10/12/49 PAVEWAY II

Air-to-surface guided munition

**Brief:** Paveway II is a laser-guided, free-fall bomb for use against surface targets at short to standoff range. The kit is a folding-wing version of the earlier fixed-wing Paveway I with seeker and reliability improvements. The recent Paveway II Plus adds a modernized, more precise guidance package. 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 from 2,500 ft up to 40,000 ft. USAF is procuring up to 400 GBU-49 to provide the F-35A an interim moving target capability until its Block 3F software is fully fielded. An F-35 dropped the weapon for the first time in a test at Eglin on Nov. 7, 2018.

**Contractor:** Lockheed Martin, Raytheon.

**First Flight:** Early 1970s.

**IOC:** 1976.

**Active Variants:**

- GBU-10. Laser/GPS guided 2,000-lb bomb.
- GBU-12. Laser guided 500-lb bomb.
- GBU-16. Laser guided 1,000-lb bomb.
- GBU-49. Laser/GPS guided 500-lb bomb.

**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).

**Performance:** CEP 29.7 ft, range 9.2 miles (GBU-10); CEP 29.7 ft, range about six miles (GBU-12/49).

**Guidance:** Semi-active laser.

**Warhead:** Mk 84 bomb 2,000 lb (GBU-10); Mk 82 500-lb blast/fragmentation bomb (GBU-12/49).

**Integration:** A-10, B-1B, B-52, F-15E, F-16C/D, MQ-9. Planned: F-35A.

Photo: TSgt, Marvin Lynchard



Photo: MSgt. Carl Clegg

## GBU-24/28 PAVEWAY III

Air-to-surface penetrating glide bomb

**Brief:** Paveway III is a laser guided free-fall bomb for use against surface targets from medium standoff range. The third-generation laser guided seeker/tail kit package 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 initially 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. It entered production in 1999. The GBU-28C adds a more powerful penetrating BLU-122 warhead in addition to the enhanced guidance package. It entered production in 2005 and quantities are purchased as needed to replenish and maintain stockpiles.

**Contractor:** Raytheon.

**First Flight:** GBU-24 in service May 1985.

**IOC:** 1986 (GBU-24); 1991 (GBU-28).

**Active Variants:**

- 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.

**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).

**Guidance:** Semi-active laser.

**Warhead:** BLU-109 2,000-lb bomb (GBU-24); BLU-113 or BLU-122 5,000-lb bombs (GBU-28).

**Integration:** B-52, F-15E, F-16C/D (GBU-24); B-2A, B-52, F-15E (GBU-28).

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. JDAM can also utilize the 500-lb carbon fiber-cased Very Low Collateral Damage Weapon (VLCDW) for sensitive targets. 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. The Advanced 2,000-lb (A2K) BLU-137/B weapon is also being developed for integration onto the F-15E and B-2A. A2K will improve both precision and penetration to strike a wider variety of targets, eventually replacing the BLU-139 bunker buster. JDAM-class weapons are the most frequent air-to-ground munition expended in combat. FY19 continues to maximize production capacity to replenish stocks depleted over Iraq and Syria, procuring 36,000 guidance kits.

**Contractor:** Boeing, Textron, Honeywell.

**First Flight:** Oct. 22, 1996.

**IOC:** 1998.

**Active Variants:**

- 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.

**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.

**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).

**Integration:** A-10C, B-52H, B-2A, B-1B, F-15E, F-16, and F-22A. Planned: MQ-9, F-35A.



Photo: MSgt. Lance Cheung

## GBU-39 SMALL DIAMETER BOMB I

Guided air-to-surface glide bomb

**Brief:** SDB is a low-yield, all-weather precision guided munition designed to limit collateral damage and strike targets from up to 46 miles away. Experimentation began in 2001, in response to an ACC requirement for a miniaturized, precision weapon. Boeing was selected to fully develop and produce the weapon in 2003, and low-rate initial production began in 2005. Its size allows it to be carried in fighters' and bombers' internal weapons bays or to increase overall loadout to enable more independent strikes per sortie. SDB I employs an advanced anti-jam GPS/INS, and target coordinates are loaded on the ground or received from the aircraft 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 I is a priority procurement and FY19 funds procure 6,826 weapons to replenish stocks depleted in combat.

**Contractor:** Boeing.

**First Flight:** May 23, 2003.

**IOC:** Oct. 2, 2006.

**Production:** 24,000 (planned).

**Active Variant:**

- GBU-39/B SDB I. GPS/INS guided 250-lb low-yield bomb.

**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.

**Guidance:** GPS/INS.

**Warhead:** 250-lb class penetrating blast fragmentation munition.

**Integration:** AC-130W, F-15E, F-16, F-22; planned: A-10, AC-130J, B-1, B-52, F-35A, MQ-9.



Photo: Samuel King Jr./USAF

## GBU-31/32/38 JOINT DIRECT ATTACK MUNITION (JDAM)

Air-to-surface guided bomb

**Brief:** JDAM is a GPS/INS guided, autonomous, all-weather surface attack weapon. The joint USAF-Navy program 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



Photo: Raytheon

### GBU-53 STORMBREAKER (SMALL DIAMETER BOMB II)

Guided air-to-surface glide bomb

**Brief:** StormBreaker (formerly SDB II) is a joint USAF-Navy program to develop as a low-yield, precision guided munition capable of striking moving targets in all-weather from up to 46 miles away. Its size allows it to be carried in fighters' and bombers' internal weapons bays or to increase overall loadout to enable more independent strikes per sortie. Several Stormbreakers can be simultaneously released against multiple targets. SDB II adds a millimeter-wave radar, imaging IR, 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. LRIP production began in 2015 and USAF awarded LRIP Lot 4 covering 660 weapons in January 2018. SDB II began operational testing in June 2018, with initial integration planned on the F-15E. Follow-on integration is planned for the F-35A, and FY19 funds support production of up to 1,260 SDB IIs.

**Contractor:** Raytheon.

**First Flight:** 2012.

**IOC:** 2019 (planned).

**Production:** 12,000 (planned).

**Active Variant:**

- GBU-53/B SDB II. Tri-mode guided 250-lb low-yield bomb.

**Dimensions: Bomb:** length 5.75 ft, wingspan 5.6 ft, diameter 7 in.

**Performance:** Near-precision capability at standoff range up to 46 miles.

**Guidance:** Tri-mode seeker millimeter-wave radar, uncooled IIR, and digital semi-active laser.

**Warhead:** 250-lb class penetrating blast fragmentation munition.

**Integration:** Planned: A-10, AC-130W/J, B-1, B-2, B-52, F-15E, F-16, F-22, F-35, MQ-9.



Photo: USAF

### GBU-43 MASSIVE ORDNANCE AIR BLAST (MOAB) BOMB

Massive guided bomb

**Brief:** MOAB is the largest satellite-guided, air-delivered weapon ever employed. It is designed for use against large area, or deeply buried targets, or targets in tunnels or caves. The conventional HE bomb is GPS guided, with fins and inertial gyro for pitch and roll. It was developed by the Air Force Research Laboratory Munitions Directorate at Eglin in only nine weeks to be available for the 2003 Iraq campaign. The weapon was designated Massive Ordnance Air Blast (MOAB) but is unofficially known as "Mother of All Bombs." The weapon is designed for deployment from the ramp of an MC-130 without a parachute. A total of 18,700 lb of the

weapon's 21,000-lb weight is attributed to BLU-120/B warhead. It was used operationally for the first time in April 2017 against an ISIS-occupied cave complex in Afghanistan.

**Contractor:** AFRL, Dynetics.

**First Flight:** March 11, 2003.

**IOC:** April 2003.

**Active Variant:**

- GBU-43/B. GPS guided 21,000-lb bomb.

**Guidance:** GPS/INS.

**Warhead:** BLU-120/B 18,700-lb HE.

**Dimensions:** Length 30 ft, diameter 3.3 ft.

**Integration:** MC-130H.



Photo: MSGt. Caycee Watson/ANG

### GBU-54 LASER JOINT DIRECT ATTACK MUNITION (LJDAM)

Air-to-surface guided bomb

**Brief:** LJDAM is a GPS/INS guided, autonomous, all-weather attack weapons for use against fixed and moving targets. It is a joint USAF-Navy development that combines a laser guidance kit with the GPS/INS-based navigation of the 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.

**Contractor:** Boeing.

**First Flight:** 2005.

**IOC:** 2008.

**Active Variant:**

- GBU-54 Laser JDAM. Laser/GPS/INS guided 500-lb bomb.

**Dimensions:** Length (with JDAM and warhead) approx 8 ft.

**Performance:** Range up to 15 miles.

**Guidance:** GPS/INS with laser.

**Warhead:** Mk 82 500-lb munition.

**Integration:** F-15E, F-16.

### GBU-57 MASSIVE ORDNANCE PENETRATOR

Massive PGM



Photo: USAF

**Brief:** MOP is a GPS-guided, earth-penetrating strike weapon for use against hard and deeply buried targets. It was developed and tested through a USAF and Defense Threat Reduction Agency partnership in 2004, and is now managed by AFGSC. Flight testing was conducted from 2008 to 2010, when the program transitioned to USAF. A B-2 successfully test-dropped the GBU-57 in 2014, 2015, and 2016. Several B-2s completed a total of four test drops at White Sands Missile Range, N.M., in 2017 validating the effectiveness of mods made under the Enhanced Threat Response IV upgrade. MOP proved effective, clearing the way for potential early fielding, though the Air Force's recommendation is classified. The service is currently validating requirements to expand the weapon's capabilities further. USAF issued a \$20.9 million contract in FY18 to procure an undisclosed number of additional GBU-57 for delivery through July 2020.

**Contractor:** Boeing.

**First Flight:** Classified.

**IOC:** 2011.

**Operator:** AFGSC.

**Active Variant:**

• GBU-57B. GPS-guided 30,000-lb penetrating weapon.

**Guidance:** GPS.

**Warhead:** 5,740-lb HE.

**Dimensions:** length 20.5 ft, diameter 31.5 in.

**Integration:** B-2A (tests also conducted on the B-52).

## SATELLITE SYSTEMS



Illustration: USAF

### ADVANCED EXTREMELY HIGH FREQUENCY (AEHF) SATELLITE SYSTEM

Communications

**Brief:** AEHF provides global, secure, protected, and jam-resistant military communications. It 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. Launch of SV-4 was originally slated for Oct. 17, 2017, but an issue with the system's power regulator prompted USAF to delay launch a year to enable a hardware fix. Successful launch of SV-4 on Oct 17, 2018, paves the way for full operational capability. SV-5 is slated for launch June 27, 2019, and SV-6 is planned for launch in 2020.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Operator/Location:** AFSPC; Schriever AFB, Colo.

**First Launch:** August 2010.

**IOC:** 2015.

**Design Life:** 14 yr.

**Launch Vehicle:** Atlas V.

**Constellation:** Four.

**Active Satellites:**

- 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. Launched in 2018, on orbit, in testing.

**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.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Power:** Solar arrays generating 20,000 watts.



Illustration: USAF

### DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)

Space and Earth environmental data collection

**Brief:** DMSP is tasked with environmental data collection for worldwide,

military weather forecasting. It provides timely and high-quality weather information to strategic and tactical combat units worldwide. DMSP 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 sensors 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 was stored awaiting a launch decision to replace DMSP-19. DMSP-17 ultimately assumed the failed satellite's coverage and DMSP-20 went on permanent display at Los Angeles AFB, Calif. USAF is considering requirements for a follow-on system. The service awarded Ball Aerospace a \$255.4 million development contract for the Weather System Follow-On-Microwave (WSF-M) as an eventual replacement for DMSP in November 2018.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Operator/Location:** National Oceanic and Atmospheric Administration; NOAA Operations Facility, Suitland, Md.

**First Launch:** May 23, 1962.

**IOC:** 1965.

**Design Life:** Five yr (Block 5D-3).

**Launch Vehicle:** Delta IV; Atlas V.

**Constellation:** Five low Earth orbit (LEO).

**Active Satellites:**

- Block 5D-2. Launched 1982 to 1997; one active (DMSP-14).
- Block 5D-3. Improved spacecraft bus and sensors for longer, more capable missions.

**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.

**Orbit Altitude:** Approx 527 miles.

**Power:** Solar arrays generating 1,200-1,300 watts.



Illustration: USAF

### DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS)

Communications

**Brief:** DSCS provides high-priority wartime and strategic SHF communications between high-level leadership and deployed forces and ships worldwide. Satellites enable high-data rate, secure, nuclear-hardened, jam-resistant military comms. In addition to joint service command and control, interagency users include the National Command Authority, White House Communications Agency, and Diplomatic Telecommunications Service. The last of 14 DSCS IIIs launched in 2003. AFSPC inactivated 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. WGS began augmenting DSCS in 2007 and will gradually replace the constellation.

**Contractor:** Lockheed Martin.

**Operator/Location:** AFSPC; Schriever AFB, Colo.

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

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

**Design Life:** 10 yr (III).  
**Launch Vehicle:** Atlas II, NSSL, Space Shuttle Atlantis (two satellites, 1985).  
**Constellation:** Five (III); 14 deployed/six operational.  
**Active Satellites:**  
 • DSCS III. Current base on orbit variant.  
 • DSCS III. SLEP. Upgrade configuration of last four satellites launched.  
**Dimensions:** Rectangular body 6x6x7ft, 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.  
**Orbit Altitude:** 22,000+ miles in geosynchronous orbit.  
**Power:** Solar arrays generating 1,269 watts, decreasing to 980 watts after 10 yr; 1,500 watts (SLEP).



Illustration: DOD

## DEFENSE SUPPORT PROGRAM (DSP)

Strategic and tactical launch detection

**Brief:** DSP provides ballistic missile early warning and is a key part of North American and theater early warning systems. It is capable of detecting missile launches and nuclear detonations and was initially meant to watch the Soviet military. It was used extensively in the 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 in early 2016. SBIRS is integrated with DSP, augments its role, and is designed to eventually replace the constellation on orbit.

**Contractor:** Northrop Grumman (formerly TRW), Aerojet.  
**Operator/Location:** AFSPC; Buckley AFB, Colo.  
**First Launch:** November 1970.  
**IOC:** Circa 1972.

**Design Life:** Three-year requirement and five-year goal.  
**Launch Vehicle:** Titan IV with inertial upper stage; Delta IV Heavy NSSL.  
**Constellation:** 23 deployed/five operational.

**Active Satellites:**  
 • Block 5. Most current on-orbit version.  
**Dimensions:** Diameter 22 ft, height 32.8 ft, with paddles deployed.  
**Weight:** Approx 5,200 lb.  
**Performance:** Uses IR sensors to sense heat from missile and booster plumes against Earth's background.  
**Orbit Altitude:** Geosynchronous at 22,000+ miles.  
**Power:** Solar arrays generating 1,485 watts.

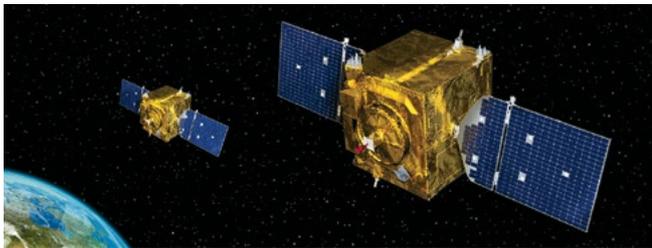


Illustration: USAF

## GEOSYNCHRONOUS SPACE SITUATIONAL AWARENESS PROGRAM (GSSAP)

Situational awareness/orbital tracking

**Brief:** GSSAP supplies space-based tracking and characterization of

manmade objects in geosynchronous orbit, aiding safety and enabling avoidance. They are the "neighborhood watch" satellites augmenting 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. The satellites themselves operate in near-geosynchronous orbit to effectively monitor objects and aid in preventing collisions in space. GSSAP carries EO/IR sensors and are able to maneuver to observe objects at close range. They can track objects without the weather and atmospheric disruptions that affect ground-based systems. Two GSSAP satellites were launched in 2014 and attained IOC in 2015. Two more replenishment satellites launched Aug. 19, 2016, and became operational Sept. 12, 2017. Construction of a fifth and sixth satellite is underway for launch aboard the AFSPC-8 mission planned for 2020.

**Contractor:** Orbital ATK.  
**Operator/Location:** AFSPC; Schriever AFB, Colo.  
**First Launch:** July 28, 2014.  
**IOC:** Sept. 29, 2015.  
**Launch Vehicle:** Delta IV.  
**Constellation:** Four spacecraft.  
**Active Satellites:**  
 • GSSAP 1. Launched in 2014; on orbit, active.  
 • GSSAP 2. Launched in 2014, on orbit, active.  
 • GSSAP 3. Launched in 2016, on orbit, active.  
 • GSSAP 4. Launched in 2016, on orbit, active.  
**Orbit Altitude:** 22,300 miles, above geosynchronous.  
**Power:** Solar panels.



Illustration: DOD

## GLOBAL POSITIONING SYSTEM (GPS)

Worldwide navigation, timing, and velocity data

**Brief:** GPS supplies space-based military and civil radio-positioning for geolocation, navigation, and timing. It is a fundamental enabler of precision bombing, CSAR, mapping, and rendezvous. It provides accurate and uninterrupted 3-D (latitude, longitude, and altitude) position, velocity, and time data. GPS Block IIA first launched in 1990. The Air Force decommissioned the final Block IIA, launched to replace original GPS Block I series in 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 launched from Cape Canaveral 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 newest satellites will add capabilities including nuclear detonation detection and search and rescue. SpaceX was awarded its first National Security Space 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. USAF awarded three companies production readiness contracts for vehicle 11 and is looking to competitively award a 22-satellite production contract (with added capability) to a single bidder. A reserve Block IIA satellite launched in 1993 was reactivated on March 3, 2018, to replace an unusable Block IIR satellite launched in 2001. The first GPS III satellite dubbed "Vespucci" successfully launched on Dec. 23, 2018, and is undergoing on-orbit checks. Three additional satellites are slated for launch through 2020. Planned improvements include a steerable, high-power anti-jam capability.

**Contractor:** Boeing (II, IIA, IIF), Lockheed Martin (IIR, IIR-M, IIIA).  
**Operator/Location:** AFSPC; Schriever AFB, Colo.  
**First Launch:** Feb. 22, 1978.  
**IOC:** Dec. 9, 1993.  
**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).  
**Constellation:** 31 spacecraft (not including decommissioned or on-orbit spares).  
**Active Satellites:**

- GPS Block IIA. Launched 1990 to 1997. One reactivated in 2018.
- GPS Block IIR. Launched 1997 to 2004; 11 active.
- GPS Block IIR-M. Launched in 2005 to 2009; seven active.
- GPS Block IIF. Launched in 2010 to 2016; 12 active.
- GPS Block IIIA/IIIF. New generation launched in 2018; one in on-orbit checkout.

**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.  
**Orbit Altitude:** 10,988 miles.  
**Power:** Solar panels generating 700 watts (II/IIA); 1,136 watts (IIR/IIR-M); up to 2,900 watts (IIF).



Illustration: Lockheed Martin

## SPACE BASED INFRARED SYSTEM (SBIRS)

Space-based surveillance/missile warning

**Brief:** SBIRS provides advanced space surveillance and missile warning, battlespace characterization, and technical intelligence gathering. It 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. The 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 launched on Jan. 19, 2018. GEO-5 and GEO-6 will be based on a modernized spacecraft and will be launched earlier than planned, in 2021 and 2022 respectively. These satellites will replace the oldest two on orbit. USAF canceled the final two GEO satellites and is shifting funds to the Evolved Space Based Infrared Systems (E-SBIRS).



Illustration: USAF

## MILSTAR SATELLITE COMMUNICATIONS SYSTEM (MILSTAR)

Communications

**Brief:** Milstar is the joint-service backbone of strategic-tactical DOD communications. It provides encrypted, secure, anti-jam communications around the world and uses cross-linked satellites, eliminating the need for ground relay stations. Block I satellites incorporate a low data rate payload capable of transmitting 75-2,400 bps over 192 EHF channels. Block II satellites carry both the low data rate payload and a medium data rate payload capable of transmitting 4,800 bps to 1.5 Mbps over 32 channels, allowing larger data to be passed more quickly. Interoperable terminals allow third-party land/sea-based units to upload data in real time to cruise missiles or other compatible weapons. Milstar provides continuous coverage between 65 degrees north, and 65 degrees south latitude. The systems utilize multiple-redundant command and control for high survivability. The last of six satellites launched in 2003. AEHF will eventually replace Milstar as DOD's primary satcom and is fully back-compatible with Milstar.

**Contractor:** Lockheed Martin, Boeing, Northrop Grumman (formerly TRW).  
**Operator/Location:** AFSPC; Schriever AFB, Colo.  
**First Launch:** Feb. 7, 1994.  
**IOC:** July 1997 (Milstar I).  
**Design Life:** 10 yr.  
**Launch Vehicle:** Titan IV/Centaur.  
**Constellation:** Five: two Milstar I; three Milstar II.  
**Active Satellites:**

- Block I. Milstar I satellites launched 1994-95.
- Block II. Milstar II satellites launched 1999-2003.

**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.  
**Orbit Altitude:** Geosynchronous at 22,000+ miles.  
**Power:** Solar arrays generating 8,000 watts.  
**Orbit Altitude:** Geosynchronous at 22,000+ miles.  
**Power:** Solar arrays generating 1,485 watts.

**Contractor:** Lockheed Martin, Northrop Grumman.  
**Operator/Location:** AFSPC; Buckley AFB, Colo.  
**First Launch:** GEO 1, May 2011.  
**IOC:** HEO 1, Dec. 5, 2008. (Increment 1, Dec. 8, 2001).  
**Launch Vehicle:** Atlas V (GEO). Planned: Delta, Falcon 9.  
**Constellation:** Four GEO sats, three HEO sensors (hosted).  
**Active Satellites/Payloads:**

- SBIRS HEO-1. Payload operational in 2008; active.
- SBIRS HEO-2. Payload operational in 2009; active.
- 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.
- SBIRS GEO-4. Launched in 2018; active.

**Dimensions:** 7 x 6.3 x 19.7 ft (GEO).  
**Weight:** 5,603 lb (GEO on orbit).  
**Orbit Altitude:** Geosynchronous and high elliptical.  
**Power:** Solar array, 2,435 watts (GEO), batteries.



Illustration: Boeing

## SPACE BASED SPACE SURVEILLANCE (SBSS)

Orbital surveillance and object identification

**Brief:** SBSS is designed to track, characterize, measure, and collect optical signatures of Earth-orbiting objects including space vehicles and debris.

The Missile Defense Agency originally launched SBSS as a technology demonstrator to classify and track ballistic missiles in mid-course flight, before handing it over to AFSPC in 2011. SBSS primarily uses a trainable, ground-controlled Space-Based Visible Sensor to track targets without repositioning. Potential high-end and even kinetic space threats from China and Russia have pushed orbital domain awareness to the top of AFSPC's priority list. AFSPC is working to extend SBSS service life and task one of its experimental Operationally Responsive Space satellites to cover a four-year gap in coverage before it can launch a follow-on spacecraft in 2021. ORS-5 launched Aug. 26, 2017, and is equipped with an optical sensor to provide rapid, continuous scanning to detect movement in geosynchronous orbit. SBSS works in concert with an array of networked, ground-based sensors including the Space Fence wide area search and surveillance system under construction on Kwajalein Atoll in the Marshall Islands.

**Contractor:** Boeing (system integration, ground segment, operations, and sustainment), Ball Aerospace (satellite).

**Operator/Location:** AFSPC; Schriever AFB, Colo.

**First Launch:** Sept. 25, 2010.

**IOC:** Aug. 17, 2012.

**Design Life:** Seven yr.

**Launch Vehicle:** Minotaur IV.

**Constellation:** One LEO satellite; one LEO augmentation satellite.

**Active Satellites:**

- SBSS Block 10. Launched in 2010; active.
- ORS-5. Experimental satellite launched in 2017 to augment SBSS; active.

**Dimensions:** Height approx 10 ft; 10 x 3.2 ft, plus solar panels.

**Weight:** Approx 2,273 lb.

**Orbit Altitude:** 390 miles, sun-synchronous orbit.

**Power:** Solar arrays and batteries generating 750 watts.

## WIDEBAND GLOBAL SATCOM (WGS) SATELLITE

Communications



Photo: Courtesy

**Brief:** WGS provides worldwide high-capacity communications for deployed air, land, and sea forces. The system is designed to augment and then replace DSCS X-band frequency service. It also augments the one-way Global Broadcast Service Joint Program Ka-band frequency capabilities and provides 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. 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. SV-10 successfully launched on March 15, 2019.

**Contractor:** Boeing.

**Operator/Location:** AFSPC; Schriever AFB, Colo.

**First Launch:** October 2007.

**IOC:** April 16, 2008.

**Design Life:** 14 yr.

**Launch Vehicle:** Atlas V, Delta IV.

**Constellation:** Seven satellites.

**Active Satellites:**

- SV-1. Block I, launched in 2007; active.
- SV-2. Block I, launched in 2009; active.
- SV-3. Block I, launched in 2009; active.
- SV-4. Block II, launched in 2009; active.
- SV-5. Block II, launched in 2013; active.
- SV-6. Block II, launched in 2013; active.
- SV-7. Block II follow-on, launched in 2015; active.
- SV-8. Block II follow-on, launched in 2016; active.
- SV-9. Block II follow-on, launched in 2017; active.

**Dimensions:** Based on Boeing 702 Bus.

**Weight:** 13,000 lb at launch.

**Performance:** Approx 10 times the capability of a DSCS satellite.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Power:** Solar arrays generating 9,934 watts.



Photo: Boeing

## X-37B ORBITAL TEST VEHICLE

Orbital test

**Brief:** X-37B is an unmanned experimental Orbital Test Vehicle (OTV) aimed at developing and maturing a reusable space-launch capability and conducting classified, extended on-orbit missions/experiments. NASA launched the X-37 program in 1999, with the intention of building two demonstrators to validate technologies for both launch/on-orbit flight, and reentry/landing. Only the Approach and Landing Test Vehicle (ALTV) was built before NASA handed over the program to DARPA, which completed ALTV captive-carry/drop testing with the subscale X-40A in 2006. The X-37B is based on NASA's notional OTV and is boosted into low Earth orbit atop a standard Atlas V launch vehicle for long-endurance space missions. The vehicle autonomously re-enters the atmosphere upon command from a ground control station, and it recovers conventionally to the runway. X-37 launches from Cape Canaveral and lands at either Cape Canaveral or Vandenberg. Development includes advanced guidance, navigation and controls, avionics, thermal-resistant materials, propulsion, and autonomous control systems. The program's two test vehicles have successfully completed four orbital missions. The first mission (OTV-1) launched in 2010 and remained on orbit 224 days. The OTV-2 and OTV-3 missions launched in 2011 and 2012, and remained on orbit 468 days and 674 days, respectively. The OTV-4 mission remained aloft for 718 days and made the craft's first landing at Cape Canaveral on March 25, 2017. The OTV-5 mission marked the type's first launch atop a SpaceX Falcon 9 on Sept. 7, 2017.

**Contractor:** Boeing.

**Operator:** AFSPC.

**First Launch:** April 22, 2010.

**IOC:** N/A.

**Launch Vehicle:** Atlas V, Falcon 9.

**Production:** Two.

**Inventory:** Two.

**Operational Location:** Cape Canaveral AFS, Fla. (launch/landing); Vandenberg AFB, Calif. (landing).

**Active Variant:**

- X-37B. DARPA/USAF-developed Orbital Test Vehicles.

**Dimensions:** Span 14 ft, length 29.25 ft, height 9.5 ft.

**Weight:** 11,000 lb at launch.

**Propulsion:** Single liquid-propellant rocket motor.

**Endurance:** 718+ days on orbit.

**Orbit Altitude:** Low-Earth Orbit (LEO) at 110-500 miles.

**Power:** Gallium arsenide solar cells with lithium-ion batteries.

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