

# Gallery of Weapons

By Aaron M. U. Church

## 2018 USAF Almanac



B-1 Lancer

A1C Gerald Willis

### BOMBER AIRCRAFT

#### ■ B-1 LANCER

**Mission brief:** Conventional, long-range, supersonic penetrating strike.

#### COMMENTARY

The B-1A was initially proposed as a replacement for the B-52, and four prototypes were developed and tested before program cancellation in 1977. The program was revived in 1981 as the B-1B. The vastly upgraded aircraft added 74,000 lb of usable payload, improved radar, and reduced radar cross section, but cut speed to Mach 1.2. B-1B saw first combat in Iraq during Desert Fox in 1998. Its three internal weapons bays hold a substantial payload, allowing different weapons in each bay. The bomber's blended wing/body configuration, variable-geometry design, and turbofan engines provide long range and loiter time. Offensive avionics include SAR for terrain-following, 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, command and control, and the Central Integrated Test System (CITS), which gives aircrew real-time aircraft diagnostics and simplifies maintenance and troubleshooting. FIDL includes Link 16 and Joint Range Extension data link, enabling permanent secure LOS/BLOS/C2. It also adds Ethernet to enable rapid airborne retargeting. Ongoing efforts will stretch the B-1's service life to 2040. The first Sustain-

ment Block 16 (IBS) airframe was completed in May 2016, and 29 airframes were complete as of mid-2017. Fleetwide upgrade will be complete by 2020. Higher powered Military Code (M-Code) jam-resistant GPS interface is in development. Future upgrades include replacing the laptop interface with Fully Integrated Targeting Pod (FITP), Mode 5 IFF, Multifunctional Information Distribution System/ Joint Tactical Radio System (MIDS/JTRS), airspace-compliant CNS/ATM, updated BLOS comm-cryptography, and bomb rack payload and safety improvements.

#### EXTANT VARIANT(S)

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

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

**Operator:** AFGSC, AFMC.

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

**Delivered:** June 1985-May 1988.

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

**Production:** 104.

**Inventory:** 62.

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

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

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

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

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

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

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

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

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

#### ■ B-2 SPIRIT

**Mission brief:** Stealthy, long-range penetrating nuclear and conventional strike against high-value targets.

#### COMMENTARY

The B-2 is a flying wing that combines LO stealth design with high aerodynamic efficiency. Spirit entered combat against Serb targets during Allied Force on March 24, 1999. B-2 production was completed in three successive blocks and all aircraft were upgraded to Block 30 standards with AESA radar. AESA paves the way for future advanced weapons integration—B61-12 bomb. The aircraft's smoothly blended "fuselage" holds two weapons bays capable of carrying nearly 60,000 lb of weapons in various combinations. Fleetwide comm upgrades include an EHF satcom, high-speed computer, which is part of the Defensive Management System-Modernization (DMS-M), as well as upgrading BLOS voice/data reliability to preserve current capabilities. FY18 funds continue VLF receive-only capability to

All inventory numbers are total active inventory figures as of Sept. 30, 2017.



B-2 Spirit

TSgt. Andy Kin

provide redundancy and upgradable nuclear C2, and continues Adaptable Communications Suite (ACS) mods to provide time-sensitive mission data, targeting, intelligence, and C2 updates. AEHF comms will provide two-way, survivable communications for nuclear missions in A2/AD environments. Weapons integration includes the improved 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 weapons bays, allowing prerelease guidance to thwart jamming and are required for B61-12 integration. Phase 2 will allow nuclear and conventional weapons to be carried simultaneously to increase flexibility. USAF plans to add wideband nuclear C2 under the FAB-T program. Efforts are underway to increase fleet availability, shorten depot-level maintenance, and increase intervals between overhauls. New FY18 efforts include airspace-compliant CNS/

ATM, crash-survivable flight-data memory, and advanced MOP/B61 integration. Service life is planned through 2032.

**EXTANT VARIANT(S)**

- B-2A. Production aircraft upgraded to Block 30 standards.
- Function:** Long-range heavy bomber.
- Operator:** AFGSC, AFMC, ANG (associate).
- First Flight:** July 17, 1989.
- Delivered:** December 1993–December 1997. (Test asset redelivered as combat capable, July 2000.)
- IOC:** April 1997, Whiteman AFB, Mo.
- Production:** 21.
- Inventory:** 20.
- Aircraft Location:** Edwards AFB, Calif.; Whiteman AFB, Mo.
- Contractor:** Northrop Grumman, Boeing, Vought.
- Power Plant:** Four General Electric F118-GE-100 turbofans, each 17,300 lb thrust.
- Accommodation:** Two pilots, on ACES II zero/zero ejection seats.

**Dimensions:** Span 172 ft, length 69 ft, height 17 ft.  
**Weight:** Max T-O 336,500 lb.  
**Ceiling:** 50,000 ft.  
**Performance:** Speed high subsonic, estimated unrefueled range 5,000 miles.  
**Armament:** Nuclear: 16 B61-7, 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.

■ **B-52 STRATOFORTRESS**

**Mission brief:** Long-range strike with nuclear and/or conventional freefall weapons or standoff cruise missiles.

**COMMENTARY**

The B-52H is the last serving variant of the Stratofortress and USAF's only nuclear cruise missile carrier. Multimission capabilities include long-range precision strike, CAS, air interdiction, defense suppression, and maritime surveillance. Litening and Sniper targeting pods have been added. The overall B-52 System Improvements project is replacing key obsolescent components. The Combat Network Communications Technology (CONNECT) program is replacing cockpit displays and comms and enabling machine-to-machine tasking/retargeting. The first CONNECT airframe was redelivered in 2014. CNS/ATM replaces the B-52's analog systems with digital systems. The Internal Weapons Bay Upgrade enables internal smart weapon carriage. The Conventional Rotary Launcher roughly doubles smart weapon payloads, while reducing drag and increasing range. The upgrade

**Acronyms and Abbreviations**

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



**B-52 Stratofortress**

SSgt. Michael Battles

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. Thirty B-52s are undergoing conventional weapon-only modifications to comply with the New START nuclear arms reduction agreement. Ongoing development efforts include 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 analysis to potentially replace the TF33 with a more reliable, efficient, and powerful engine. USAF projects service life to the 2050s with new engines.

**EXTANT VARIANT(S)**

- B-52H. Longer-range development of the original B-52A, with more efficient turbofan engines.  
**Function:** Long-range heavy bomber.  
**Operator:** AFGSC, AFMC, AFRC.  
**First Flight:** April 15, 1952 (YB-52 prototype); 1960 (B-52H).  
**Delivered:** May 1961-October 1962 (B-52H).  
**IOC:** May 1961 (B-52H).  
**Production:** 744 (incl 102 B-52H).  
**Inventory:** 75.  
**Aircraft Location:** Barksdale AFB, La.; Edwards AFB, Calif.; Minot AFB, N.D.  
**Contractor:** Boeing, Harris.  
**Power Plant:** Eight Pratt & Whitney TF33-P-3 turbofans, each 17,000 lb thrust.  
**Accommodation:** Two pilots, side by side, plus navigator, radar navigator, and EWO on upward/downward ejection seats.  
**Dimensions:** Span 185 ft, length 159.3 ft, height 40.7 ft.  
**Weight:** Max T-O 488,000 lb.  
**Ceiling:** 50,000 ft.  
**Performance:** Speed 650 mph, range 10,000+ miles.  
**Armament:** Nuclear: 12 AGM-86B ALCMs externally, and eight ALCMs or gravity weapons internally. Conventional: AGM-86C/D CALCMs, Mk 62 sea mines, Mk 82/84 bombs, CBU-87/89 cluster bombs, CBU-103/104/105 WCMDs, GBU-31/38 JDAMs, AGM-158A JASSMs, and GBU-10/12/28 LGBs, MALD, and MALD-J jammer variant.

**FIGHTER & ATTACK AIRCRAFT**

**■ A-10 THUNDERBOLT II**

**Mission brief:** CAS against a wide range of

armored surface/maritime targets, interdiction, Forward Air Controller-Airborne (FAC-A), CSAR, and Strike Control & Reconnaissance.

**COMMENTARY**

The A-10C is an A-10A with precision engagement modifications, including color cockpit MFDs, hands-on throttle and stick, digital stores management, improved fire-control system, GPS-guided weapons, Litening/Sniper pods, advanced data links, and integrated sensors. A-10C deployed to combat for the first time in 2007. It combines a large, diverse weapons payload, long loiter times, austere airfield capability, maneuverability, and wide combat radius. Using night vision and targeting pods, it is capable of operating under 1,000-ft ceilings in darkness. The aircraft has 11 hardpoints for up to 16,000 lb of ordnance. Its 30 mm gun can destroy heavy armor, and its titanium cockpit tub protects the pilot. Current upgrades include advanced IFF and open architecture software to allow quick integration of future weapons and sensors. Software is continuously updated in response to emerging operational requirements, including advanced weapons integration, situational awareness, targeting, navigation, comm, and cockpit upgrades under the A-10 Operational Flight Program (OFP). The last of 278 aircraft were upgraded with Helmet Mounted Cueing System (HMCS) in 2015, and USAF is pursuing wing replacement beyond the initial 173 aircraft program, originally slated for completion in FY16. Integration of the Advanced Precision Kill Weapon System (APKWS) recently added carriage of 98 low-collateral damage, laser guided rockets, immediately arming A-10s in combat over Iraq and Syria. USAF reversed early retirement plans in favor of retaining the A-10 in service until 2030. Ongoing 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. FY18 begins FAA airspace compliance upgrades required by 2020.

**EXTANT VARIANT(S)**

- A-10C. Upgraded version of the A-10A ground attack aircraft.  
**Function:** Attack.  
**Operator:** ACC, AFMC, PACAF, ANG, AFRC.  
**First Flight:** Feb. 15, 1975 (preproduction).  
**Delivered:** October 1975-March 1984.  
**IOC:** October 1977 (A-10A); 2007 (A-10C).  
**Production:** 713.  
**Inventory:** 283.  
**Aircraft Location:** Barksdale AFB, La.; Boise Air Terminal, Idaho; Davis-Monthan AFB, Ariz.; Eglin AFB, Fla.; Fort Wayne Arpt., Ind.; Martin State Arpt., Md.; Moody AFB, Ga.; Nellis AFB, Nev.; Osan AB, South Korea; Selfridge ANGB, Mich.; Whiteman AFB, Mo.  
**Contractor:** Fairchild Republic (Lockheed Martin).  
**Power Plant:** Two General Electric TF34-GE-100 turbofans, each 9,065 lb thrust.  
**Accommodation:** Pilot on ACES II zero/zero ejection seat.  
**Dimensions:** Span 57.5 ft, length 53.3 ft, height 14.7 ft.  
**Weight:** Max T-O 51,000 lb.  
**Ceiling:** 45,000 ft.  
**Performance:** Speed 518 mph, range 800 miles.  
**Armament:** One 30 mm, seven-barrel GAU-8/A Gatling gun (1,174 rd), straight high-explosive incendiary (HEI), or anti-armor HE/armor-piercing incendiary (API). Combat mix incl various types of free-fall or guided bombs such as Mk 82, Mk 84, GBU-10/12/38, CBU-87, laser guided rockets, various WCMDs, illumination rockets/flares, AGM-65 Mavericks, and AIM-9 Sidewinders.

**■ F-15 EAGLE**

**Mission brief:** Supersonic, all-weather, day/night, air-superiority.

**COMMENTARY**

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



**A-10 Thunderbolt II**

SrA. Trevor McBride



## F-15E Strike Eagle

TSgt. Mathew Plew

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 future, contested airspace. The first APG-63(V)3 AESA-modified F-15 was delivered in 2010, and the Eagle Passive/Active Warning Survivability System (EPAWSS) engineering development contract was awarded in 2016. EPAWSS initially replaces the current, obsolete system. A second phase will add a towed decoy/angled countermeasure capability. A total of 214 aircraft will be upgraded to augment the limited F-22 fleet. FY18 launches infrared search and track (IRST), advanced data links to enhance interoperability with fifth generation aircraft, safety-critical forward fuselage longeron replacements, and Multifunctional Information Distribution System/Joint Tactical Radio System (MIDS/JTRS). USAF plans to procure 100 IRST pods to discreetly detect, track, and engage air targets, while MIDS/JTRS will enable higher capacity, jam-resistant Link 16 networking. Additional upgrades include jam-resistant Mode 5-compliant IFF and new digital cockpit displays to fully exploit AESA capabilities (common with the F-15E).

### EXTANT VARIANT(S)

- F-15C/D. Upgraded version of the original F-15A/B.

**Function:** Air superiority fighter.

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

**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).

**Aircraft Location:** Barnes Arpt., Mass.; Eglin AFB, Fla.; Fresno ANGB, Calif.; Jacksonville Arpt., Fla.; Kadana AB, Japan; Klamath Falls (Kingsley Field), Ore.; NAS JRB New Orleans, La.; Portland Arpt., Ore.; RAF Lakenheath, UK. **Contractor:** McDonnell Douglas (now Boeing), BAE Systems (EPAWSS), Raytheon (AESA), Rockwell Collins (MIDS/JTRS).

**Power Plant:** Two Pratt & Whitney F100-PW-220 turbofan engines, each 23,450 lb thrust; or two P&W F100-PW-229 turbofan engines with afterburners, each 29,000 lb thrust.

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

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

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

**Ceiling:** 60,000 ft.

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

**Armament:** One internally mounted M61A1 20 mm six-barrel cannon (940 rd); four AIM-9 Sidewinders and four AIM-120 AMRAAMs, or eight AIM-120s, carried externally.

### ■ F-15E STRIKE EAGLE

**Mission brief:** All-weather deep interdiction/attack, tactical nuclear delivery, and air-to-air combat.

### COMMENTARY

F-15E is an upgraded two-seat heavyweight, multirole F-15 capable of sustaining nine Gs throughout the flight envelope. It entered combat during Desert Storm in 1991. F-15E's large, varied load of precision weapons and 20 mm cannon gives it potent ground attack capability. Radar-guided and IR-homing missiles give it an additional air-to-air capability. Its advanced cockpit controls and displays include a wide-field-of-view HUD and helmet mounted cockpit-cueing, and its avionics permit all-weather day/night engagement. The F-15E carries LANTIRN, Sniper, and Litening ATPs on dedicated pylons. A SAR pod provides surveillance/reconnaissance capability. The aircraft are equipped with Link 16 and ARC-210 BLOS satcom. Ongoing upgrades include new APG-82(V)1 AESA radar and Eagle Passive/Active Warning Survivability System (EPAWSS) to replace its obsolete self-defense suite. The combined EPAWSS engineering development contract for all F-15 variants was awarded in 2016. Ongoing developments include AESA integration, EPAWSS, a new central computer and cockpit displays (in common with the F-15C/D), jam-resistant Link 16, Mode 5 IFF, ATP improvements, and airspace compliance mods. FY18 launches MIDS/JTRS to enable higher capacity, jam-resistant Link 16 networking, and Joint Helmet Mounted Cueing System (JHMCS) upgrades. Future weapons include SDB II. Fatigue testing is underway to determine SLEP requirements to reach 2035 or beyond.

### EXTANT VARIANT(S)

- F-15E. Fighter aircraft derived from the F-15.

**Function:** Multirole fighter.

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

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

**Delivered:** April 1988-2004.

**IOC:** September 1989.

**Production:** 236.

**Inventory:** 218.

**Aircraft Location:** Eglin AFB, Fla.; Mountain



## F-16 Fighting Falcon

Home AFB, Idaho; Nellis AFB, Nev.; RAF Lakenheath, UK; Seymour Johnson AFB, N.C.

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

**Power Plant:** Two Pratt & Whitney F100-PW-220, each 23,450 lb thrust; or two F100-PW-229 turbofans with afterburners, each 29,000 lb thrust.

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

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

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

**Ceiling:** 50,000 ft.

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

**Armament:** One internally mounted M61A1 20 mm six-barrel cannon (500 rd); four AIM-9 Sidewinders and four AIM-120 AMRAAMs or eight AIM-120s; most air-to-surface weapons in USAF inventory (nuclear and conventional) and ECM pods.

### ■ F-16 FIGHTING FALCON

**Mission brief:** Multirole air-to-air and surface attack, CAS, SEAD, interdiction, FAC-A, tactical nuclear delivery, and all-weather precision strike.

### COMMENTARY

The F-16 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. The F-16 entered combat during the 1991 Gulf War. The F-16C/D was introduced in 1984, at Block 25. It featured cockpit, airframe, and core avionics upgrades and added the increased-range APG-68 radar and AMRAAM. Block 30/32 added next stage improvements, new engines, and weapons including HARM. Block 40/42 delivered in 1988 introduced the LANTIRN pod, enabling automatic terrain following and high-speed night/all-weather penetration. It also introduced wide-angle HUD, increased takeoff weight, expanded flight envelope, and higher G limits. Block 50/52 delivered in 1991 is optimized for SEAD, employing HARM and a longer range radar. It added the updated F101-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 (Block 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 (HMIT), 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



TSgt. Gregory Brook

the similar Hybrid Flight Control Computer/A-GCAS for Pre-Block aircraft equipped with analog flight-control systems will conclude in 2018, paving 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. Depot-level SLEP extending fatigue life to 10,000 hours or beyond will start in 2019. 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, and fourth/fifth gen fighter network capabilities. JASSM-ER integration is slated for completion in 2018. New starts include HFLCC/A-GCAS, mandated airspace compliance mods, comm modernization, and digital RWR. FY18 funds add two F-16 training squadrons to address pilot shortage.

#### EXTANT VARIANT(S)

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



F-22 Raptor

SSgt. Edward Eagerton

**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:** 786 (F-16C); 155 (F-16D).  
**Aircraft Location:** Aviano AB, Italy; Edwards AFB, Calif.; Eglin AFB, Fla.; Eielson AFB, Alaska; Hill AFB, Utah; Holloman AFB, N.M.; Homestead ARB, Fla.; Kunsan AB, South Korea; Luke AFB, Ariz.; Misawa AB, Japan; NAS JRB Fort Worth, Texas; Nellis AFB, Nev.; Osan AB, South Korea; Shaw AFB, S.C.; Spangdahlem AB, Germany; and ANG in Alabama, Arizona, Colorado, District of Columbia (flying out of Maryland), Minnesota, New Jersey, Ohio, Oklahoma, South Carolina, South Dakota, Texas, Vermont, Wisconsin.  
**Contractor:** General Dynamics (now Lockheed Martin), Northrop Grumman (radar).  
**Power Plant:** Block 40: one General Electric F110-GE-100 (29,000 lb thrust); Block 42: one Pratt & Whitney F100-PW-220 (24,000 lb thrust); Block 50: one F110-GE-129 (29,000 lb thrust); Block 52: one F100-PW-229 (29,000 lb thrust).  
**Accommodation:** Pilot (C); two pilots (D) on ACES II zero/zero ejection seats.  
**Dimensions:** Span 32.8 ft, length 49.3 ft, height 16.7 ft.  
**Weight:** F-16C: empty (F100-PW-229) 18,591 lb, (F110-GE-129) 18,917 lb; gross, with external load (Block 40/42) 42,000 lb.  
**Ceiling:** 50,000 ft.  
**Performance:** Speed Mach 2, ferry range 2,002+ miles.

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

#### ■ F-22 RAPTOR

**Mission brief:** Stealthy, penetrating air dominance, multirole attack.

#### COMMENTARY

The F-22 is built for day, night, and adverse weather full-spectrum operations. The world's most advanced fighter, it combines stealth, supercruise, high maneuverability, and integrated avionics. Its integrated avionics and data links permit simultaneous multitarget engagement. Advanced flight controls and thrust vectoring high-performance engines lend great maneuverability. Features include six LCD color cockpit displays, APG-77 radar, EW system with RWR and missile launch detector, JTIDS, IFF system, laser gyroscope inertial reference, and GPS. The Raptor flew its first operational sortie during Noble Eagle in 2006 and debuted in combat during Inherent Resolve over Iraq and Syria in 2014. Four aircraft successfully employed 1,000-lb JDAMs against ISIS ground targets during the aircraft's first combat sortie. Ongoing upgrades include the Reliability, Availability, and Maintainability Maturation Program (RAMMP), software Increment 3.1, and tactical capability improvements. These collectively retrofit combat-coded F-22s with enhanced ground attack, air-to-air engagement, and networking. RAMMP is adding AIM-9X-capable launch rails, urgent needs such as the Automatic Back-Up Oxygen System (ABOS), and reliability enhancements. The 3.2B software package will add high resolution ground mapping SAR, threat geolocation, EA capability, and integration of SDB I, AIM-120D, and AIM-9X. Five test aircraft are modified to 3.2 standards to begin operational testing in FY18 followed by fleetwide concurrent mods. Additional upgrades include engine safety, performance and maintainability mods, phase two structural mods to extend fleet life, improved ISR and comms, and harmonizing training airframes to combat-coded specifications. FY18 launches TACLINK-16 development to enable data link transmit capability between F-22 and legacy aircraft.

#### EXTANT VARIANT(S)

- F-22A. Fifth generation air dominance fighter.
- Function:** Multirole fighter.  
**Operator:** ACC, AFMC, AFRC (associate), PACAF, ANG.  
**First Flight:** Sept. 7, 1997.  
**Delivered:** April 9, 1997 (prototype); Oct. 23, 2002 (first production representative aircraft)-May 2, 2012.



F-35A Lightning II

SSgt. Kate Thornton

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

**Production:** 195.

**Inventory:** 187.

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

**Contractor:** Lockheed Martin, Boeing.

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

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

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

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

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

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

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

## ■ F-35 LIGHTNING II

**Mission brief:** Stealthy, multirole, all-weather air-to-air and surface attack including direct attack on the most heavily defended ground targets.

### COMMENTARY

The F-35 is a joint and multinational program aimed at fielding an affordable, highly common family of strike fighters. USAF's F-35A will replace F-16 and A-10 fleets with a stealthy, multirole fighter capable of penetrating advanced enemy air defenses and striking targets at will. The F-35A carries up to 18,000 lb of weapons on 10 stations, including four internal bays (for maximum stealth) and six additional wing- and fuselage- (or centerline) mounted pylons. USAF received its first production aircraft—AF-7—in 2008. FY18 funding supports procurement of 46 F-35As, and long-lead items for 48 aircraft in FY19. Full-rate production is planned for April 2019. The Marine Corps declared F-35 IOC in 2015. USAF reached IOC at Hill on Aug. 2, 2016, with the first aircraft upgraded with Block 31 software. Block 31 improves the baseline Block 2B software, adding 89 percent of the code needed for full-combat capability. The Block 3F software, expected in 2018, will enable full combat capability, adding a range of precision guided munitions. Block 4 development will eventually add new weapons and sensors, improve the F-35's EW capabilities, and integrate nuclear weapons beyond 2020. Current combat capabilities include interdiction, basic CAS, and limited SEAD. The start of full-initial operational testing is being delayed due to software immaturity and other issues, until late 2018 or early 2019. Oxygen system retrofits will be added fleetwide following a series of pilot-reported hypoxic incidents in 2017. Ongoing retrofits correct deficiencies including structural issues discovered during early concurrent production/testing. F-35As deployed for the first time to both Europe and the Pacific in 2017 and conducted their first live-fire air-to-air weapons shot employing the AIM-120.

### EXTANT VARIANT(S)

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



**AC-130J Ghost Rider**

SrA. Ryan Conroy

**Function:** Multirole fighter.

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

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

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

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

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

**Inventory:** 119 (USAF).

**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.; others TBD.

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

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

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

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

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

**Ceiling:** 50,000 ft.

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

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

## SPECIAL OPERATIONS AIRCRAFT

### ■ AC-130J GHOST RIDER

**Mission brief:** CAS, air interdiction, and armed reconnaissance for troops in contact, convoy escort, point defense, and urban operations.

### COMMENTARY

The AC-130J is a next generation gunship based on a significantly modified MC-130J, fitted with a modular precision strike package, and wing-mounted weapon racks. The AC-130J is designed to provide ground forces with a persistent direct-fire platform for urban operations. PSP includes a mission management console, robust communications suite, two EO/IR sensors, advanced fire-control equipment, PGM delivery capability, and trainable cannons. Initial Block 10 aircraft include fully integrated digital avionics cockpit, GPS/INS, integrated defensive systems, color weather radar, and PSP. Block 20 configuration adds a 105 mm gun, laser guided SDB (tested for the first time in 2016), a side-mounted pilot tactical display, and Large Aircraft Infrared Countermeasures

(LAIRCM). Airframes are delivered as MC-130Js for subsequent modification as gunships. The prototype flew its first post-conversion flight in 2014, but was declared a loss after departing controlled flight during developmental testing at Eglin. The first Block 20 was delivered to Hurlburt for operational testing in July 2016 and achieved IOC Sept. 30, 2017. AFSOC dropped early deployment due to integration problems discovered in operational testing. Block 20 upgrades will address the shortcomings. A total of nine MC-130Js have been or are currently undergoing conversion and FY18 funds convert five more. Future upgrades include a high-energy laser weapon planned for initial integration in 2021, air-launched RPAs to provide below-the-cloud targeting data for all-weather strike, and integration of laser guided Hellfire missiles. FY18 funds procure initial radio frequency countermeasures kits to detect, locate, and respond to threats as well as PSP improvements.

### EXTANT VARIANT(S)

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

**Function:** Attack.

**Operator:** AFSOC.

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

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

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

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

**Inventory:** Eight.

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

**Contractor:** Lockheed Martin.

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

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

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

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

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

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

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

### ■ AC-130U SPOOKY

**Mission brief:** CAS, air interdiction, and armed reconnaissance for troops in contact, convoy escort, strike coordination, overwatch, and point defense.

### COMMENTARY

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

modified with gun systems, electronic and EO sensors, fire-control systems, enhanced navigation, sophisticated comms, defensive systems, and in-flight refueling capability. All AC-130U weapons can be subordinated to the APQ-180 digital fire-control radar, FLIR, or all-light-level television (ALLTV) for adverse weather attack operations. Rockwell converted the initial 13 AC-130Us between 1994 and 95, and Boeing more recently converted four more, all dubbed "Spooky" in reference to the early AC-47D gunship. The command retired a single nonstandard AC-130U in 2015, before halting phaseout. AFSOC is retaining 16 legacy AC-130Us and accelerating center wing box replacements to extend serviceability and meet high operational demands until replaced by AC-130Js. Recent upgrades include Enhanced Situational Awareness (ESA) program mods to provide near real-time intel and data fusion of threat detection, avoidance, geolocation, and adversary-emitter identification, and replacing 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 the obsolete and increasingly rare 40 mm weapons. The service plans to remanufacture some 80,000 40 mm rounds with a safer, more reliable fuze. All AC-130Us serve with the 1st Special Operations Wing at Hurlburt.

#### EXTANT VARIANT(S)

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

**Function:** Attack.

**Operator:** AFSOC.

**First Flight:** 1967.

**Delivered:** 1968-present.

**IOC:** 1996.

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

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

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

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

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

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

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

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

**Ceiling:** 25,000 ft.

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

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

#### ■ AC-130W STINGER II

**Mission brief:** CAS, air interdiction, and armed reconnaissance for troops in contact, convoy escort, strike coordination, overwatch, and point defense.

#### COMMENTARY

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

#### EXTANT VARIANT(S)

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

**Function:** Attack, armed reconnaissance.

**Operator:** AFSOC.

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

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

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

**Production:** 12 (converted).

**Inventory:** 12.

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

**Contractor:** Lockheed Martin.

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

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

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

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

**Ceiling:** 28,000 ft.

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

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

#### ■ C-145 SKYTRUCK

**Mission Brief:** STOL multipurpose utility and SOF proficiency training.

#### COMMENTARY

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

#### EXTANT VARIANT(S)

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

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

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

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

**Delivered:** 2009-2013.

**IOC:** N/A.

**Production:** 16.

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

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

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

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

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

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

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

**Ceiling:** 25,000 ft.

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

#### ■ C-146 WOLFHOUND

**Mission brief:** Flexible, responsive operational movement of special operations teams and supplies into prepared, and semiprepared airfields worldwide.

#### COMMENTARY

The German-built Dornier 328 regional airliner 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



C-146 Skytruck

Samuel King/USAF



MC-130H Combat Talon II

AIC Joseph Pick

Iridium communications suite, troop/cargo-capable cabin, casualty evacuation capability, NVG compatibility, and STOL austere operations enhancements. The aircraft first deployed in support of USAFRICOM operations in 2011. FY18 funds support navigation enhancements to permit ops in GPS-degraded environments.

**EXTANT VARIANT(S)**

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

**Function:** Multimission mobility.

**Operator:** AFSOC.

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

**Delivered:** 2011-2017.

**IOC:** N/A.

**Production:** 20 (converted).

**Inventory:** 20, USSOCOM-owned.

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

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

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

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

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

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

**Ceiling:** 31,000 ft.

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

**■ CV-22 OSPREY**

**Mission brief:** Long-range, high-speed infiltration, exfiltration, and resupply of special operations in hostile, denied, and politically sensitive areas.

**COMMENTARY**

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

enhancements. The Silent Knight TF/TA radar will replace the current radar with a stealthier, low-altitude night/all-weather navigation radar. Europe-based CV-22s will shift to Spangdahlem, with the planned closure of Mildenhall. USAF is standing-up a Pacific-based presence at Yokota. An additional airframe ordered in 2016 will complete CV-22 deliveries by Feb. 2020.

**EXTANT VARIANT(S)**

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

**Function:** Multimission lift.

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

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

**Delivered:** January 2007-present.

**IOC:** 2009.

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

**Inventory:** 50.

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

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

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

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

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

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

**Ceiling:** 25,000 ft.

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



E-3 Sentry

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

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

**Mission brief:** Covert day, night, and adverse weather infiltration, exfiltration, and resupply of special operations forces in hostile or denied territory, air-drop resupply, rotary wing aerial refueling, and psyops.

**COMMENTARY**

The MC-130 is a special operations mobility aircraft, primarily used to conduct infiltration, resupply, and exfiltration of SOF. MC-130Hs are equipped with TF/TA radars, precision navigation systems using INS/GPS, and electronic and IR countermeasures for self-protection. All models are capable of aerial refueling as a receiver and supplier. Aircraft are capable of airdrop, using Joint Precision Airdrop System, and operating from austere and unmarked strips. The original MC-130E were converted from C-130E airframes in the mid-1960s. The retiring MC-130Ps (previously HC-130N/P) are a specialized aerial refueling version designed to support SOF and were delivered in the mid-1980s. MC-130Hs were converted from base-model C-130H to supplement the existing Combat Talon I and Combat Shadow fleets in the late 1980s and early 1990s. MC-130Hs have integrated glass cockpit and a modernized pod-based aerial refueling system. Ongoing MC-130H mods include center wing replacement, new mission computers, GPS upgrades, permanent Sigint installation, threat warning upgrades, and new lightweight armor. The MC-130P was fully replaced by the MC-130J, with the last California ANG airframes retiring in 2017. MC-130Hs from Kirtland consolidated



CV-22 Osprey

AIC Keifer Bowes





SSgt. Michael Battles



E-4B

SSgt. Nicole Leidhom

to Hurlburt in 2016; Kadena is retaining several H models only until its MC-130Js achieve TF/TA capability.

#### EXTANT VARIANT(S)

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

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

**Operator:** AFSOC, ANG.

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

**Delivered:** Initially 1966.

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

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

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

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

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

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

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

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

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

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

**Ceiling:** 33,000 ft.

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

#### ■ MC-130J COMMANDO II

**Mission brief:** Covert day, night, and adverse weather infiltration, exfiltration, and resupply of special operations forces in hostile or denied territory, air-drop resupply, rotary wing aerial refueling, and psyops.

#### COMMENTARY

MC-130J is a specialized tanker variant of the C-130J, for clandestine intrusion into hostile areas to provide air refueling of SOF helicopters and CV-22s. MC-130J enables infiltration, exfiltration, and resupply. Mods include fully integrated INS/GPS, color cockpit LCDs, NVG lighting, HUDs, integrated defensive systems, digital moving map display, EO/IR system, dual secure voice/data satcom, enhanced cargo handling, and extended-life wings. MC-130Js have secondary leaflet and rubber raiding craft aerial delivery roles for psyops and littoral ingress/egress. Crew is smaller than legacy models, but includes CSO/auxiliary flight deck stations

to handle aerial refueling (otherwise performed by the flight engineer). Loadmasters handle remaining flight engineer/comms functions. The aircraft was redesignated from Combat Shadow II to Commando II in March 2012 and is replacing the MC-130P. European-based MC-130Js will move from Mildenhall to Spangdahlem as part of overall force structure adjustments. FY18 funding supports procurement of five airframes and installation of an initial two Radio Frequency Countermeasure (RFCM) EW kits to detect, locate, and respond to emerging threats. The MC-130J currently lacks terrain-following/terrain-avoidance (TF/TA) capability. 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 FY18 funds support installation of two TF/TA radars for flight testing.

#### EXTANT VARIANT(S)

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

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

**Operator:** AETC, AFSOC.

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

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

**IOC:** 2011.

**Production:** 57 (planned).

**Inventory:** 37.

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

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

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

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

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

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

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

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

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

#### ■ U-28A

**Mission brief:** Manned, fixed-wing tactical ISR and targeting in support of special operations.

#### COMMENTARY

The U-28A is a modified Pilatus PC-12 employed on worldwide special operations missions. Mods include advanced radio-communications suite, aircraft survivability equipment, EO sensors, and advanced navigation systems. The USSOCOM-owned aircraft are operated by AFSOC as a nonstandard fleet. AFSOC first employed the

aircraft during Enduring Freedom in Afghanistan and Iraqi Freedom. Ongoing upgrades include sensor, self-defense, and navigation mods to enable ops in GPS-degraded environments and compliance with FAA mandates. Multispectral Targeting System installation includes FMV, EO-IR, IR real-time video, and laser designator installation on an additional two aircraft in FY18. New Advanced Threat Warning (ATW) includes missile, hostile fire, and laser warning. Urgent infrared suppression mods are ongoing. 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 ops in Iraq and Syria.

#### EXTANT VARIANT(S)

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

**Function:** Tactical reconnaissance.

**Operator:** AFSOC, AFRC.

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

**Delivered:** From 2006.

**IOC:** N/A.

**Production:** 36 (converted).

**Inventory:** 28 (USSOCOM-owned).

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

**Contractor:** Pilatus Aircraft Ltd.

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

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

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

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

**Ceiling:** 30,000 ft.

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

## ISR/BM/C3 AIRCRAFT

### ■ CHALLENGER CL-600 COMBAT FLIGHT INSPECTION

**Mission brief:** Flight inspection of forward air base navigation aids and terminal procedures to enable combat flying operations.

#### COMMENTARY

The Challenger is long-range, twin-engine executive jet built by Canadair (now Bombardier), equipped with specialized instrumentation for the Combat Flight Inspection (CFIN) role. The three-aircraft fleet is owned by the Federal Aviation Administration and operated by USAF to certify that airbase NAVAIDs 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



Greg Davis/USAF

## E-8 JSTARS

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 conduct flight check 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. FY18 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.

### EXTANT VARIANT(S)

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

**Function:** Combat Flight Inspection.

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

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

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

**IOC:** Circa 2010.

**Production:** N/A.

**Inventory:** Three, FAA-owned.

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

**Contractor:** Canadair (Bombardier).

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

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

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

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

**Ceiling:** 45,000 ft.

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

### ■ E-3 SENTRY

**Mission brief:** All-weather air and maritime surveillance, command and control, battle management, target, threat, and emitter detection, classification, and tracking.

### COMMENTARY

The Sentry airborne warning and control system (AWACS) is a heavily modified Boeing 707-320B capable of surveilling airspace in excess of 200 miles from surface to stratosphere. AWACS coordinates theater air operations in direct subordination to joint/combined air and space operations centers. It can simultaneously conduct C2, BM, and target detection/tracking. E-3Bs were upgraded to Block 30/35 standards

in 2001. USAF is equipping the aircraft with interim IFF to keep 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. Recent evaluations revealed shortcomings in the E-3G's ability to fuse on and off-board data, cyber security vulnerabilities, and diminished maritime surveillance capabilities compared to previous versions, delaying operational certification by approximately two years. DRAGON (Diminishing Manufacturing Sources Replacement of Avionics for Global Operations and Navigation) upgrades add a digital cockpit and next-generation CNS/GATM. The first of 24 upgraded airframes was delivered to Tinker on Jan. 9, 2017. Ongoing upgrades include Internet protocols to enable shortened, digitized kill-chains to hit time-sensitive targets, and low-cost structural and flight control mods. Future upgrades include the Multifunctional Information Distribution System/Joint Tactical Radio System (MIDS/JTRS). Six airframes are undergoing Block 40/45 modification under LRIP, and the first was redelivered in 2014. USAF is upgrading 18 more under full-rate production. Seven AWACS slated for divestiture will be retained to FY19 due to operational demand. FY18 new starts include radar mods to improve processing in response to a critical, classified requirement.

### EXTANT VARIANT(S)

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

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

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

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

**Delivered:** March 1977-84.

**IOC:** 1977.

**Production:** 31.

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

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

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

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

**Accommodation:** Four flight crew, 13-19 mis-

sion specialists.

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

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

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

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

### ■ E-4 NATIONAL AIRBORNE OPERATIONS CENTER

**Mission brief:** Survivable, worldwide, enduring nuclear and operational C3 in support of the National Military Command System (NMCS).

### COMMENTARY

The E-4B is a highly survivable flying C3 center enabling national leaders to direct nuclear and conventional forces, execute emergency war orders, and coordinate civil response actions. It is hardened against the effects of nuclear explosions, including electromagnetic pulse (EMP). Comm and data processing capabilities include EHF Milstar satellite, six-channel International Maritime Satellite, and a triband radome houses 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, which will enter full production in 2018. Other developments include 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 exploring the possibility of combining both the Navy's E-6B Mercury and USAF E-4B into a single, commonly configured nuclear C2 fleet. Airframes are viable to 2039, but phaseout of commercial 747-200s hampers sustainment beyond 2020. Two airframes were badly damaged by a tornado at Offutt, and Boeing is under contract to return them to operational use by the end of 2018.

### EXTANT VARIANT(S)

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

**Function:** Nuclear command and control.

**Operator:** AFGSC.

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

**Delivered:** December 1974-85.

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

**Production:** Four.

**Inventory:** Four.

**Aircraft Location:** Offutt AFB, Neb.  
**Contractor:** Boeing, Rockwell, Raytheon (FAB-T).  
**Power Plant:** Four General Electric CF6-50E2 turbofans, each 52,500 lb thrust.  
**Accommodation:** Up to 112 flight crew and mission crew.  
**Dimensions:** Span 195.7 ft, length 231.3 ft, height 63.4 ft.  
**Weight:** Max T-O 800,000 lb.  
**Ceiling:** Above 30,000 ft.  
**Performance:** Speed 602 mph, range 7,130 miles 12hr normal endurance, 72 hr with air refueling.

### ■ E-8 JSTARS

**Mission brief:** Ground moving target indication, (GMTI), airborne battlefield management/command and control.

#### COMMENTARY

E-8C primarily provides theater commanders ground surveillance data to support tactical operations. E-8 evolved from the Army/Air Force Joint Surveillance Target Attack Radar System program. The first two aircraft deployed for Desert Storm while still under development, and early airframes were eventually retrofitted to Block 20 production standards, featuring more powerful computers, an Internet protocol local area network, and BLOS connectivity. JSTARS is equipped with a canoe-shaped radome under the forward fuselage housing a 24-ft-long side-looking phased array radar antenna. It can locate, classify, and track vehicles at distances exceeding 124 miles, and more recent refinements enable human-target tracking. Target data is transmitted via data link to ground stations or other aircraft. USAF halted modernization funds and retired the program's testbed aircraft in 2015. Ongoing mods include networking for classified information sharing between CENTCOM coalition partners (CENTRIX), and new Emergency Locating Transmitters. FY18 funds support CENTRIX fleetwide, with four mods in 2018. The service issued a request for proposals to replace the E-8 with a more affordable business-class airframe with an anticipated IOC of FY24. New plans call for upgrading JSTARS through the mid-2020s until a new platform, or several disaggregated platforms are identified.

#### EXTANT VARIANT(S)

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

**Function:** C2/ISR.  
**Operator:** ANG.  
**First Flight:** December 1988.  
**Delivered:** May 1996-2005.  
**IOC:** Dec. 18, 1997.  
**Production:** 18.  
**Inventory:** 16 (E-8C); one (TE-8).  
**Aircraft Location:** Robins AFB, Ga.  
**Contractor:** Northrop Grumman, Raytheon.  
**Power Plant:** Four Pratt & Whitney TF33-102C turbojets, each 19,200 lb thrust.  
**Accommodation:** Flight crew: four; mission crew: 15 Air Force and three Army operators (can be augmented according to mission).  
**Dimensions:** Span 145.8 ft, length 152.9 ft, height 42.5 ft.  
**Weight:** Max T-O 336,000 lb.  
**Ceiling:** 42,000 ft.  
**Performance:** Speed 584 mph (optimal orbit), range nine hr normal endurance, longer with air refueling.

### ■ E-9A WIDGET

**Mission brief:** Airborne surveillance and telemetry-relay in support of testing and range clearance.

#### COMMENTARY

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

#### EXTANT VARIANT(S)

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

commuter airliner.  
**Function:** Range control.  
**Operator:** ACC.  
**First Flight:** June 1983 (De Havilland Canada Dash 8).  
**Delivered:** 1988.  
**IOC:** June 1988.  
**Production:** Two.  
**Inventory:** Two.  
**Aircraft Location:** Tyndall AFB, Fla.  
**Contractor:** De Havilland Canada, now Bombardier (airframe), Sierra Nevada Corp (conversion).  
**Power Plant:** Two Pratt & Whitney PW-120A turboprop engines, each 1,800 shp.  
**Accommodation:** Crew: two pilots; two mission operators.  
**Dimensions:** Span 39.5 ft, length 48.6 ft, height 12.2 ft.  
**Weight:** Max T-O 34,500 lb.  
**Ceiling:** 30,000 ft.  
**Performance:** Speed 280 mph, range 1,000 miles.

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

**Mission brief:** Tactical communications and data relay.

#### COMMENTARY

The E-11A is a modified Bombardier Global Express 6000/BD-700-1A10 business jet equipped with specialized communications relay equipment to translate between tactical data links, provide joint range extension, BLOS C2, and Internet protocol-based data transfer between dissimilar systems. It was fielded to meet an urgent operational need for BLOS communications relay capability between ground troops and other airborne platforms. The system entered combat in Afghanistan in 2008 and enables troops to overcome the limitations of LOS comms in rugged terrain. The 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. The service is seeking to extend operations and possibly acquire the E-11A as a long-term program, as well as adding an additional EQ-4B. The current support contract awarded in July 2017 funds continued ops through January 2019.

#### EXTANT VARIANT(S)

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

**Function:** Communications relay.  
**Operator:** ACC.  
**First Flight:** Oct. 6, 2003 (BD-700).  
**Delivered:** Dec. 2008-Aug. 30, 2012.  
**IOC:** Circa 2011.  
**Production:** Four.  
**Inventory:** Four.  
**Aircraft Location:** Kandahar Airfield, Afghanistan.  
**Contractor:** Northrop Grumman, Bombardier.  
**Power Plant:** Two Rolls Royce BR710A2-20 turbofans, each 14,750 lb thrust.  
**Accommodation:** Flight crew: two; mission crew: N/A.  
**Dimensions:** Span 94 ft, length 99 ft 5 in, height 25 ft 6 in.  
**Weight:** Max T-O 99,500 lb.  
**Ceiling:** 51,000 ft.  
**Performance:** Speed Mach 0.88, range 6,900 miles.



E-11A Battlefield Airborne Communications Node

Capt. Keenan Kunst

## EC-130J Commando Solo

SrA. Rachel Loftis/ANG



### ■ EC-130H COMPASS CALL

**Mission brief:** Tactical jamming/disruption of enemy C2, communications, radar, and navigation; offensive counterinformation, EA, and SEAD support.

#### COMMENTARY

The EC-130H is a modified C-130H designed to disrupt enemy C3 and limit adversary coordination essential for force management. The fleet has been deployed near-constantly since the beginning of combat operations in Afghanistan in 2001. 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 will continue through mid-2018, and the Baseline 3 configuration including the Advanced Radar Countermeasure System (ARCS) and other significant capability enhancements is slated for fielding in 2020. Delays fielding a replacement airframe due to funding instability require extending the EC-130H fleet. EC-130Hs are undergoing center wing box replacement/structural mods (in common with the C-130H fleet). Ongoing development includes counter-radar/countersatellite navigation, and ongoing upgrades include installation of digital glass cockpits, Mode 5-compliant IFF, CNS/ATM for congested airspace, and adaptive EA to enable quick reaction to emerging threats. Ten primary mission aircraft are supplemented by two backups, two attrition reserves, and one systems integration test bed. USAF awarded L3 Technologies a contract to rehost the EC-130H's systems on a more modern and survivable aircraft on Sept. 7, 2017. Dubbed EC-X, the fleet will be based on the Gulfstream G550 Airborne Early Warning platform, also recently selected by the Navy for range support.

#### EXTANT VARIANT(S)

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

**Function:** EW.

**Operator:** ACC.

**First Flight:** 1981.

**Delivered:** 1982.

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

**Production:** (Converted).

**Inventory:** 15 (EC-130H).

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

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

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

**Accommodation:** Two pilots, navigator, two EWOs; flight engineer, mission crew supervi-

sor (cryptologic experienced), four cryptologic linguists, acquisition operator, and airborne maintenance technician.

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

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

**Ceiling:** 25,000 ft.

**Performance:** Speed 300 mph at 20,000 ft, unrefueled range 2,295 miles seven hr normal endurance, longer with air refueling.

### ■ EC-130J COMMANDO SOLO/SUPER J

**Mission brief:** Offensive counterinformation broadcast on radio, television, and military communications bands, electronic attack, or SOF mobility, depending on variant.

#### COMMENTARY

The EC-130J is the Air Force's primary psychological warfare platform, providing military information support operations (MISO) and civil affairs broadcast. Commando Solo aircraft conducted psychological operations in almost every US war or contingency operation since 1980. The EC-130J Commando Solo is equipped with radio and color television broadcast equipment for psychological warfare, enhanced navigation, self-protection, and an aerial refueling receptacle. With transition to the EC-130J, USAF added a new, secondary mission resulting in a second variant. Three heavily modified EC-130J Commando Solo aircraft serve as a standard broadcasting station for psychological warfare operations. Four EC-130Js, dubbed Super J, perform secondary, low-cost EA role on top of their special operations mobility (SOFFLEX) mission. SOFFLEX includes personnel and cargo airdrop, combat offload, and infiltration/exfiltration. FY18 funding supports updates to three legacy aircraft to make them multimission capable, and procurement of all but the last seven Removable Airborne MISO Systems (RAMS). RAMS is based on the Army's Fly Away Broadcast System and will allow the Super J to supplement Commando Solo. All variants are operated by the ANG's 193rd Special Operations Wing. Development of digital broadcast capability and RF countermeasures are ongoing. Low-cost mods include safety, reliability, obsolescence, and smaller capability improvements.

#### EXTANT VARIANT(S)

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

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

**Function:** Psychological warfare/special operations airlift.

**Operator:** ANG.

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

## RC-26 Condor



**Delivered:** 2003.

**IOC:** 2004.

**Production:** Seven.

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

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

**Contractor:** Lockheed Martin, Raytheon.

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

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

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

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

**Ceiling:** 28,000 ft.

**Performance:** Speed 335 mph cruise, range 2,645 miles.

### ■ MC-12W LIBERTY

**Mission brief:** Tactical medium/low-altitude ISR in direct support of special operations ground forces.

#### COMMENTARY

The MC-12W is a manned 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 ground forces with targeting data and other tactical ISR. Specialized equipment includes FMV, laser designation, various sensors, BLOS connectivity, and satcom. An initial seven King Air 350s were modified with FMV, a ROVER compatible LOS satcom data link, limited Sigint, and basic BLOS connectivity. An additional 30 extended-range King Air 350s were modified, adding enhanced FMV with laser designator, improved Sigint, and increased bandwidth BLOS. The sensor-equipped C-12s were acquired to augment RPA systems operating in Southwest Asia and entered combat in both Iraq and Afghanistan in 2009. ACC divested its 33-strong MC-12 fleet in 2015, 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. FY18 funds support navigation enhancements to permit ops in GPS-degraded environments.

#### EXTANT VARIANT(S)

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

**Function:** Tactical reconnaissance.

**Operator:** ANG.

**First Flight:** April 2009.

**Delivered:** From April 2009.



SrA. Sean Campbell



RC-135 V/W Rivet Joint

SSgt. Michael Battles

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

■ **OC-135 OPEN SKIES**

**Mission brief:** Observation and imagery gathering in support of international arms control treaty compliance verification.

**COMMENTARY**

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 currently vetting requirements for an eventual replacement aircraft.

**EXTANT VARIANT(S)**

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

**Function:** Observation.  
**Operator:** ACC.  
**First Flight:** 1993.  
**Delivered:** 1993-96.  
**IOC:** October 1993.  
**Production:** Three.  
**Inventory:** Two.  
**Aircraft Location:** Offutt AFB, Neb.  
**Contractor:** Boeing.  
**Power Plant:** Four Pratt & Whitney TF33-P-5 turboprops, each 16,050 lb thrust.  
**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.  
**Dimensions:** Span 131 ft, length 135 ft, height 42 ft.  
**Weight:** Max T-O 297,000 lb.  
**Ceiling:** 50,000 ft (basic C-135).  
**Performance:** Speed 500+ mph, range 3,900 miles.

■ **RC-26 CONDOR**

**Mission brief:** Counternarcotics, manned tactical ISR, disaster response, civil support.

**COMMENTARY**

The RC-26 is a modified Fairchild Metro 23 with specialized digital cameras, IR video, and communications equipment, primarily used for domestic and international anti-trafficking operations. The aircraft has a secondary role providing real-time video streaming to disaster relief personnel following hurricanes, wildfires, and other disasters. In the fire-support role, aircraft sensors are able to 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 plugging in 800 MHz handheld radios, and air phone capabilities. The Air Force originally planned to divest the fleet in FY15, but FY18 funds support adding several airframes and reinstating 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 Harvey in 2017.

**EXTANT VARIANT(S)**

- C-26A. Non-missionized general utility aircraft.
- RC-26B. Surveillance version of Fairchild C-26.

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

**Accommodation:** Two pilots, one navigator-mission systems operator.  
**Dimensions:** Span 57 ft, length 59.5 ft, height 16.6 ft.  
**Weight:** Max T-O 16,500 lb.  
**Ceiling:** 25,000 ft.  
**Performance:** Speed 334 mph, range 2,070 miles.

■ **RC-135S COBRA BALL**

**Mission brief:** Measurement and signature intelligence (Masint) gathering on ballistic missile flights.

**COMMENTARY**

The RC-135S monitors missile-associated signatures and tracks missiles during boost and re-entry phases. 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 levels. 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 12). Flexible funding permits rapid, variant-specific mods in response to emerging/evolving threats. Ongoing upgrades include Wideband Global Satellite reachback connectivity, new airborne tracking system, improved operator interface, liquid cooling system, Rivet Joint Comint suite integration, and capabilities enhancements for operations in dense signal environments.

**EXTANT VARIANT(S)**

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

**Function:** Electronic reconnaissance.  
**Operator:** ACC.  
**First Flight:** N/A.  
**Delivered:** October 1969-November 2000.  
**IOC:** Circa 1972.  
**Production:** Converted.  
**Inventory:** Three.  
**Aircraft Location:** Offutt AFB, Neb.  
**Contractor:** Boeing (original airframe), L3 Technologies.  
**Power Plant:** Four CFM International F108-CF-201 turboprops, each 21,600 lb thrust.  
**Accommodation:** Flight crew: two pilots, navigator. Mission crew: three EWOs; two airborne systems engineers, two airborne mission specialists.

**Dimensions:** Span 131 ft, length 135 ft, height 42 ft.  
**Weight:** Max T-O 297,000 lb.  
**Ceiling:** 45,000 ft.  
**Performance:** Speed 517+ mph, range 3,900 miles, farther with air refueling.

#### ■ RC-135U COMBAT SENT

**Mission brief:** Strategic reconnaissance of adversary air defense and technical intelligence (Techint) gathering on radar/emitter systems.

#### COMMENTARY

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

#### EXTANT VARIANT(S)

- RC-135U Combat Sent. Modified C-135 equipped for radar emissions analysis.  
**Function:** Electronic reconnaissance.  
**Operator:** ACC.  
**First Flight:** N/A.  
**Delivered:** 1971-74.  
**IOC:** April 17, 1970.  
**Production:** Converted.  
**Inventory:** Two.  
**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.  
**Contractor:** Boeing (original airframe), L3 Technologies, Textron.  
**Power Plant:** Four CFM International F108-

- CF-201 turbopfans, each 21,600 lb thrust.  
**Accommodation:** Flight crew: two pilots, two navigators, three airborne systems engineers; mission crew: 10 EW officers, six or more electronic, technical, mission area specialists.  
**Dimensions:** Span 135 ft, length 140 ft, height 42 ft.  
**Weight:** Max T-O 322,500 lb.  
**Ceiling:** 42,000 ft.  
**Performance:** Cruise speed 517 mph, range 4,140 miles 8 hr normal endurance, 24 hr crew endurance with air refueling.

#### ■ RC-135V/W RIVET JOINT

**Mission brief:** Real-time electronic and signals intelligence gathering, analysis, and dissemination in support of theater and strategic-level commanders.

#### COMMENTARY

The RC-135V/W is an extensively modified C-135 performing worldwide reconnaissance missions to detect, identify, and geolocate signals throughout the electromagnetic spectrum. Rivet Joint is mostly used to exploit electronic battlefield intelligence and deliver near real-time ISR information to tactical forces, combatant commanders, and National Command Authorities. Onboard capabilities encompass rapid search, detection, measurement, identification, demodulation, geolocation, and fusion of data from potentially thousands of electronic emitters. 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. Recent efforts include modernized operator interface, improved dense signal environment capabilities, increased signal bandwidth/exploitation, and operator station 3-D maps. FY18 funds integrate RC-135 into the Air Force's Distributed Common Ground Station (DCGS). Britain received the last of three RC-135W to fill an urgent capability gap under the Airseeker program on June 7, 2017. USAF/RAF personnel co-crew the combined 20-aircraft operational fleet on missions of common interest.

#### EXTANT VARIANT(S)

- RC-135V/W Rivet Joint. Self-contained standoff airborne Sigint variant of the C-135.
- TC-135W. Training version of the operational aircraft.



U-2 Dragon Lady

- NC-135W. Rivet Joint systems integration testbed operated by AFMC.  
**Function:** Electronic reconnaissance.  
**Operator:** ACC, AFMC.  
**First Flight:** N/A.  
**Delivered:** Circa 1973-99. Continuous equipment updates.  
**IOC:** Circa 1973.  
**Production:** Converted.  
**Inventory:** Eight (RC-135V); nine (RC-135W); three (TC-135W); one (NC-135W).  
**Aircraft Location:** Offutt AFB, Neb.; Kadena AB, Japan; RAF Mildenhall, UK; RAF Waddington, UK (USAF co-manned).  
**Contractor:** Boeing (original airframe), L3 Technologies (systems integrator).  
**Power Plant:** Four CFM International F108-CF-201 turbopfans, each 21,600 lb thrust.  
**Accommodation:** Flight crew: three pilots, two navigators; mission crew: three EW officers, 14 intelligence operators, four airborne maintenance technicians, and up to six more, depending on mission.  
**Dimensions:** Span 131 ft, length 135 ft, height 42 ft.  
**Weight:** Max T-O 297,000 lb.  
**Ceiling:** 50,000 ft.  
**Performance:** Speed 500+ mph, range 3,900 miles, further with air refueling.

#### ■ U-2 DRAGON LADY

**Mission brief:** Strategic and tactical high-altitude/long endurance Sigint, Imint, and Masint collection.

#### COMMENTARY

The U-2 is the Air Force's manned high-altitude ISR platform, capable of carrying multiple, simultaneous intelligence sensors. U-2 can carry a variety of advanced optical, multispectral EO/IR, SAR, Sigint, and other payloads. U-2 was initially designed in the 1950s and further developed as the U-2R in the late 1960s. Current U-2s date to the 1980s when production was reopened to produce the larger and more capable TR-1. S model conversions began in 1994, and all current aircraft are Block 20 configured, featuring a glass cockpit, digital autopilot, modernized EW system, and updated data links. Sensor upgrades include the ASARS-2A SAR sensor, SYERS-2A multispectral EO/IR imagery system, and enhanced Airborne Signals Intelligence Payload (ASIP). The legacy optical bar camera is still in use, providing broad-area synoptic imagery coverage. U-2's modular payload and open system architecture allow new sensors to be rapidly fielded to meet emerging needs. USAF planned to start retiring the fleet in FY16 due to budget constraints. Congress stipulated the RQ-4 Block 30 achieve sensor parity with



RC-135U Combat Sent

Airwolfhound photo



MSgt. John Gordinier

the U-2 before the fleet is phased out, initially delaying retirement to FY19. U-2s are heavily tasked meeting operational demands, and retirement would reduce high altitude ISR capacity by 50 percent, prompting USAF to delay retirement to 2022 or beyond. Future funds were limited to flight safety and sustainment, unless critical to national security. Ongoing upgrades now include ASARS development, integration, and testing, as well as multi-spectral sensor, EW system, Optical Bar Camera, and Sigint package upgrades. Additional improvements include defensive systems, data links, and avionics, as well as flight safety and airspace compliance mods.

#### EXTANT VARIANT(S)

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

**Function:** High-altitude reconnaissance.  
**Operator:** ACC.  
**First Flight:** Aug. 4, 1955 (U-2); October 1994 (U-2S).  
**Delivered:** 1955-October 1989.  
**IOC:** Circa 1956.  
**Production:** 35 (T/U-2S).  
**Inventory:** 27 (U-2); four (TU-2 trainers).  
**Aircraft Location:** Beale AFB, Calif.; permanent forward operating locations worldwide.  
**Contractor:** Lockheed Martin, Northrop Grumman (ASIP), Raytheon (ASARS), UTC Aerospace (SYERS/Optical Bar Camera).  
**Power Plant:** General Electric F118-GE-101 turbojet.  
**Accommodation:** Pilot (U-2S); two pilots (TU-2S) on RQ201 zero/zero ejection seats.  
**Dimensions:** Span 105 ft, length 63 ft, height 16 ft.  
**Weight:** Max T-O 40,000 lb.  
**Ceiling:** Above 70,000 ft.  
**Performance:** Speed 410 mph, range 7,000+ miles.

#### ■ WC-135 CONSTANT PHOENIX

**Mission brief:** Nuclear test monitoring, airborne radiological sampling, and arms control treaty verification.

#### COMMENTARY

The WC-135 is 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.

#### EXTANT VARIANT(S)

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

**Function:** Air sampling and collection.  
**Operator:** ACC.  
**First Flight:** 1965.  
**Delivered:** 1965-96.  
**IOC:** December 1965.  
**Production:** Converted.  
**Inventory:** One (WC-135C); one (WC-135W).  
**Aircraft Location:** Offutt AFB, Neb.  
**Contractor:** Boeing.  
**Power Plant:** Four Pratt & Whitney TF33-P-5 turbofans, each 16,050 lb thrust.  
**Accommodation:** Seating for 33, incl cockpit crew.  
**Dimensions:** Span 131 ft, length 140 ft, height 42 ft.  
**Weight:** Max T-O 300,500 lb.  
**Ceiling:** 40,000 ft.  
**Performance:** Speed 403 mph, range 4,600 miles, further with air refueling.

## TANKER AIRCRAFT

### ■ HC-130J COMBAT KING II

**Mission brief:** Helicopter in-flight refueling support for CSAR/ personnel recovery ops, tactical C2, and pararescue (PJ) deployment.

#### COMMENTARY

The HC-130J aircraft replaces legacy HC-130N/Ps and is based on the USMC's KC-130J tanker. It adds an enhanced service life wing, improved cargo handling system, refueling receptacle, EO/IR sensor, flight deck CSO console, and dual satcom. Features include integrated INS/GPS, NVG-compatible lighting, FLIR, radar/missile warning receivers, and chaff/flare dispensers. Plans call for continuous common block upgrades for the combined HC/AC/MC-130J fleet, and current efforts bring all HC-130Js to a common standard. Block 8.1 upgrades, which include Link 16, civil GPS and data link, flight management mods, advanced IFF, special mission interface, and

satellite-updating real-time flight information are undergoing development and integration. Block tw8.1 is expected to enter operational testing in 2018 (see C-130J for details). Mode 5 IFF and CNS/ATM upgrades will be fielded ahead of cycle to meet FAA compliance deadlines, in line with the baseline C-130J. Urgent operational upgrades improve situational awareness adding SADL, blue-force tracker, modernized tactical comms, and add Joint Precision Aerial Delivery System (JPADS). FY18 starts advanced threat warning upgrades and roll-on/roll-off RF countermeasures for combat-deployed aircraft. Both the HC-130J and legacy fleet are receiving variable-speed drogue mods to refuel diverse aircraft types during a single sortie. FY18 funding supports production of two aircraft, and USAF expects to complete fleet recap by 2023. Alaska received the first ANG HC-130J, handed over to the 176th Wing at Elmendorf on June 1, 2017.

#### EXTANT VARIANT(S)

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

**Function:** Aerial refueling/airlift.  
**Operator:** ACC, AETC, ANG. Planned: AFRC.  
**First Flight:** July 29, 2010.  
**Delivered:** Sept. 24, 2010-present.  
**IOC:** 2013.  
**Production:** 37 (planned).  
**Inventory:** 20.  
**Aircraft Location:** Davis-Monthan AFB, Ariz.; JB Elmendorf-Richardson, Alaska; Kirtland AFB, N.M.; Moody AFB, Ga. Planned: Francis S. Gabreski Arpt., N.Y.; Patrick AFB, Fla.  
**Contractor:** Lockheed Martin.  
**Power Plant:** Four Rolls Royce AE2100D3 turboprops, each 4,591 shp.  
**Accommodation:** Flight crew: two pilots, CSO, two loadmasters.  
**Fuel Capacity:** 61,360 lb at 150-300 gpm (100 gpm dual, simultaneous refueling).  
**Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.  
**Weight:** Max T-O 164,000 lb.  
**Ceiling:** 33,000 ft.  
**Performance:** Speed 363.4 mph at S-L, range 4,000+ miles, further with air refueling.

### ■ HC-130N/P KING

**Mission brief:** Helicopter in-flight refueling support for CSAR/ personnel recovery ops, tactical C2, and pararescue (PJ) deployment.

#### COMMENTARY

The HC-130N/P conducts operations to austere airfields and denied territory for expeditionary, all-weather personnel recovery operations including airdrop, helicopter air-to-air refueling, and forward area refueling point missions. Secondary roles include humanitarian assistance, disaster response, security cooperation/aviation



An HC-130J Combat King II refuels two HH-60 Pavé Hawks

SR.A. Kevin Tanenbaum



**HC-130N King**

SSgt. Edward Eagerton/ANG

advisory, emergency medical evacuation, non-combatant evacuation, and spaceflight support for NASA. Features include integrated GPS/INS navigation package, NVG lighting, FLIR, radar/missile warning receivers, chaff/flare dispensers, and data-burst communications. Both models suffer airworthiness, maintainability, and operational limitations and are being replaced by HC-130J. Corrosion issues forced early retirement of a significant part of the remaining fleet. Serviceable 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) and variable-speed drogue to enable refueling of differing aircraft types during a single sortie. The last Active Duty HC-130N/P retired in 2016, and the Alaska ANG retired its final legacy aircraft in 2017, re-equipping with the HC-130J.

**EXTANT VARIANT(S)**

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

**Function:** Aerial refueling/airlift.

**Operator:** ANG, AFRC.

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

**Delivered:** 1965-circa 1993.

**IOC:** 1986.

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

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

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

**Contractor:** Lockheed Martin.

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

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

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

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

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

**Ceiling:** 33,000 ft.

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

■ **KC-10 EXTENDER**

**Mission brief:** Aerial refueling, cargo/passenger airlift, or aeromedical transport.

**COMMENTARY**

The KC-10 is a modified McDonnell Douglas

DC-10-30CF and USAF's largest air refueling aircraft. It is simultaneously capable of tanker and cargo roles, enabling it to support worldwide fighter deployments. The aircraft employs an advanced aerial refueling boom and hose and drogue system, allowing it to refuel a wide variety of US and allied aircraft, including the CV-22 tiltrotor, within the same mission. It is refuelable by boom-equipped tankers. The aircraft has three large fuel tanks under the cargo floor, an air refueling operator's station, aerial refueling boom and integral hose reel/drogue unit, a receiver refueling receptacle, and military avionics. Ongoing mods include modernized navigation, surveillance, and air traffic management (CNS/ATM). Advanced Mode 5 IFF integration is ongoing. Modifications extend service life through 2045.

**EXTANT VARIANT(S)**

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

**Function:** Aerial refueling/airlift.

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

**First Flight:** April 1980.

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

**IOC:** August 1982.

**Production:** 60.

**Inventory:** 59.

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

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

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

**Accommodation:** Crew: two pilots, flight engineer, boom operator; AE crew: two flight nurses, three medical technicians; other crew depending



**KC-135 Stratotanker**

on mission. Load: up to 75 people and 17 pallets or 27 pallets—a total of nearly 170,000 lb.

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

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

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

**Ceiling:** 42,000 ft.

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

■ **KC-46 PEGASUS**

**Mission brief:** All weather boom/drogue aerial refueling, cargo/passenger airlift, and aeromedical evacuation in support of tactical and strategic ops.

**COMMENTARY**

The KC-46A is a heavily modified Boeing 767-200ER multirole cargo-tanker equipped with flying boom and probe-and-drogue refueling capability. KC-46 incorporates the 787's state-of-the-art cockpit, 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) toward replacing USAF's KC-135R fleet. Compared to the 50-year-old KC-135, the KC-46A will have enhanced capabilities, including more fuel capacity, improved efficiency, and enhanced cargo and AE capability. Like the KC-10, it will employ both an advanced refueling boom and independently operating hose and drogue system. The program's provisioned 767-2C prototype (without refueling boom) flew



**KC-10 Extender**

MSGt. Mark Olsen





Maj. Jon Quinlan



Marian Lockhart/Boeing

in late 2014, receiving FAA type-certification in December 2017. The full-up KC-46A flew for the first time from Everett, Wash., Sept. 25, 2015. Boeing flew the first KC-46 slated for delivery to USAF on Dec. 5, 2017. Operational testing is scheduled to begin in 2018. Higher than expected stress loads encountered during C-17 refueling-compatibility trials forced a limited boom redesign before clearance for LRIP. The service awarded LRIP contracts for 19 aircraft in 2016, and a follow-on Lot 3 contract for 15 tankers in 2017. FY18 funds support Lot 4 purchase of 15 tankers. Eighteen airframes are slated for delivery ahead of planned IOC, which has slipped due to boom problems and electrostatic compatibility issues.

#### EXTANT VARIANT(S)

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

**Function:** Aerial refueling/airlift.

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

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

**Delivered:** TBD.

**IOC:** TBD.

**Production:** 179 (planned).

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

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

**Contractor:** Boeing.

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

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

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

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

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

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

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

#### ■ KC-135 STRATOTANKER

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

#### COMMENTARY

The KC-135 has been the mainstay of the USAF tanker fleet for some 50 years. It is similar in size and appearance to commercial 707 aircraft

#### KC-46 Pegasus

but designed to military specifications. The current KC-135R variant first flew in October 1982 and deliveries began in July 1984. Twenty were modified with the Multipoint Refueling System (MPRS), allowing the use of hose-and-drogue pods on each wing to simultaneously refuel two NATO or US Navy aircraft. Non-MPRS modified KC-135s use a single drogue adapter attached to the boom. Upgrades include a modernized digital flight deck. New Global Air Traffic Management upgrades were completed in 2011. Link 16 capability was also added to a limited number of aircraft. KC-135Ts are upgraded and sustained alongside the KC-135R fleet under common programs. USAF plans to modify 395 aircraft with Block 45 upgrades through 2026. These include additional glass cockpit display for engine instrumentation, a radar altimeter, advanced autopilot, and flight director to replace obsolescent systems. Fleet service life is projected out to 2040. Ongoing development includes a modular, Large-Aircraft IR Countermeasures (LAIRCM) pod to track and jam IR missiles, fittable for high-threat missions. LAIRCM IOC is slated for FY19.

#### EXTANT VARIANT(S)

- KC-135R. Re-engined KC-135A/Es fitted with CFM turbofan engines.

- KC-135T. Former KC-135Qs, able to carry different fuels in wing and fuselage tanks.

**Function:** Aerial refueling/airlift.

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

**First Flight:** August 1956.

**Delivered:** January 1957-65.

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

**Production:** 732.

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

**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.

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

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

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

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

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

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

**Ceiling:** 50,000 ft.

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

## AIRLIFT AIRCRAFT

### ■ C-5 GALAXY

**Mission brief:** Long-range strategic airlift and outsized cargo transport.

#### COMMENTARY

The C-5 is USAF's largest airlifter and one of the world's largest aircraft. It can carry unusually heavy cargo over intercontinental ranges. It can take off and land in relatively short distances and taxi on standard surfaces, if required. The Galaxy's front and rear cargo doors permit simultaneous drive-through loading/unloading. A total of 81 C-5As were delivered and underwent major wing modifications to extend their service lives. All but one C-5A (converted to C-5M) have now been retired. The C-5B first flew in 1985 and embodies all C-5A improvements, including improved turbofans, color weather radar, and triple INS. The first C-5B was delivered in January 1986, and some were equipped with defensive systems before eventual conversion to C-5M standards. Two C-5As were modified to carry outsized space cargo and redesignated C-5C. USAF was upgrading the C-5 fleet through a combination of the Avionics Modernization Program (AMP)—completed in 2011—and Reliability Enhancement and Re-engining Program (RERP), which is ongoing. Upgraded aircraft are designated C-5M Super Galaxy and incorporate new GE CF6-80C2 (F138-GE-100) turbofans, with 200 percent increased thrust, along with avionics and structural reliability fixes. USAF plans to modernize 52 C-5s to C-5M standards, including 49 B models, two C models, and the single C-5A. FY18 funds support CNS/ATM upgrades aided by a new core mission computer and weather radar. Other mods include modernized large aircraft IR countermeasures (LAIRCM) and lavatory redesign to address leaking/corrosion issues. Aircraft at Dover AFB, Del., were briefly grounded in July 2017, following a series of nose landing-gear malfunctions. AMC is replacing key mechanical components and limiting aircraft "kneeling" to reduce component wear. Two backup aircraft will be restored to the primary fleet to meet current demand.

#### EXTANT VARIANT(S)

- C-5A. Basic model delivered between 1969 and 1973.
- C-5B. Improved aircraft with strengthened wings and improved engines and avionics.
- C-5C. Modified C-5As capable of carrying outside NASA space cargo.
- C-5M. Super Galaxy, including AMP and RERP modified legacy C-5s.
- C-5M-SCM. Super Galaxy converted from C-5C to carry large NASA cargo.

**Function:** Strategic airlift.

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

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

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

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

**Production:** 131.

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

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

**Contractor:** Lockheed Martin.

**Power Plant:** Four General Electric TF39-GE-1C turbofans, each 43,000 lb thrust; (A/B/C) four General Electric F138-GE-100 turbofans, each 50,580 lb thrust.

**Accommodation:** Crew: two pilots, two flight engineers, three loadmasters. Load: 81 troops and 36 standard pallets, max 270,000 lb. (A/B/C); 285,000 lb (M); incl seven MRAP vehicles, six AH-64 Apache helicopters, four M2 Bradley fighting vehicles, or two M1 Abrams main battle tanks.

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

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

**Ceiling:** 45,000 ft.

**Performance:** Speed 518 mph, range 2,473 miles with max payload (plus additional 575 miles after offload) (A/B/C); 5,524 miles with 120,000 lb of cargo (M).

#### ■ C-12 HURON

**Mission brief:** Multimission passenger and priority light-cargo airlift, medevac, embassy and test support.

#### COMMENTARY

The C-12 family includes a series of military versions based on 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.

#### EXTANT VARIANT(S)

- 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 capacity, and AE litter accommodation.
- C-12J. Military version of the Beechcraft Model 1900C commuter airliner.

**Function:** Light airlift.

**Operator:** AFMC, PACAF.

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

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

**IOC:** Circa 1974.

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

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

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

**Contractor:** Beechcraft.

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

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

**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).

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

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

#### ■ C-17 GLOBEMASTER III

**Mission brief:** Heavy-lift strategic airlift and direct tactical delivery of all classes of military cargo.

#### COMMENTARY

C-17 is the US military's core airlifter. It is able to operate on small, austere airfields (3,500 ft by 90 ft) previously limited to C-130s. It is the only aircraft able to directly deliver or air-drop outside cargo into a tactical environment and is the first military transport to feature full digital fly-by-wire control. Boeing delivered the 223rd and final USAF aircraft on Sept. 12, 2013, and the final international aircraft on Nov. 29, 2015. Fleetwide Block 16 avionics and weather radar mods were completed in 2015, and all aircraft



#### C-17 Globemaster III

will be upgraded to the final Block 20 production standard through regular programmed depot maintenance cycles. Block 20 retrofits include some 60 programs to bring early production aircraft to a common configuration. Ongoing mods include next generation Large Aircraft Infrared Countermeasures (LAIRCM) to combat the proliferation of man portable air defenses, next generation CNS/GATM, Mode 5 IFF, dynamic retasking, and structural, safety, and sustainment mods. Priority upgrades include HUD replacement, BLOS comms, and inert gas generation system efficiency and safety upgrades. Additional FY18 starts include Fixed Installation Satellite Antenna (FISA) and roll-on/roll-off C2 capsule to enable in-flight DOD and government agency conferencing, as well as real time in cockpit (RTIC) air-to-ground comms for increased SA during airdrop and tactical ops. FISA enables high-bandwidth BLOS data/comms, and a total of 23 aircraft are already equipped. Funds support 84 additional mods.

#### EXTANT VARIANT(S)

- C-17A. Long-range airlifter.

**Function:** Tactical/strategic airlift.

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

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

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

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

**Production:** 223.

**Inventory:** 222.

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

**Contractor:** Boeing.

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

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

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

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

**Ceiling:** 45,000 ft.



C-5M Super Galaxy

SrA. Zachary Cacia



TSgt. Jodi Martinez

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

### ■ C-21 LEARJET

**Mission brief:** Passenger and priority light-cargo airlift and aeromedical transport.

#### COMMENTARY

The C-21 is a militarized Learjet 35 equipped with color weather radar, TACAN, and HF/VHF/UHF radios. It provides operational support for time-sensitive movement of people and cargo throughout the US and the European Theater, including AE missions if required. 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, Mode 5 transponder, and satellite-updating real-time flight information to comply with FAA standards.

#### EXTANT VARIANT(S)

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

**Function:** Light airlift.  
**Operator:** AMC, USAF, ANG.  
**First Flight:** January 1973.  
**Delivered:** April 1984–October 1985.  
**IOC:** April 1984.  
**Production:** 84.  
**Inventory:** 22.

**Aircraft Location:** JB Andrews, Md.; Peterson AFB, Colo.; Ramstein AB, Germany; Scott AFB, Ill.  
**Contractor:** Bombardier (previously Gates Learjet), Global Aviation Technologies (CNS/ATM upgrade).

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

**Accommodation:** Crew: two pilots; AE crew: flight nurse, two medical technicians (adjusted as required). Load: eight passengers and 3,153 lb cargo; one litter or five ambulatory patients.  
**Dimensions:** Span 39.5 ft, length 48.6 ft, height 12.2 ft.

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

**Ceiling:** 45,000 ft.

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

### ■ C32A "AIR FORCE TWO"/C-32B

**Mission brief:** Dedicated vice presidential and distinguished visitor (DV) airlift, or politically sensitive crisis-mobility, depending on variant.



SSgt. Tony Harp/ANG

### C-32 "Air Force Two"

#### COMMENTARY

The C-32A was acquired as a commercial Boeing 757 and primarily provides vice presidential airlift under the call sign Air Force Two. Aircraft assigned to the 89th Airlift Wing at Andrews, 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 discrete, rapid, global airlift in support of government crisis response efforts. The C-32's modern flight deck avionics are upgradable, and new developments include nitrogen fuel-tank inerting and commercial wideband satcom mods. FY18 funds support commercial WGS integration as well as CNS/ATM upgrades to meet future airspace standards. FY18 launches an analysis of alternatives to eventually replace the type with an aircraft better equipped to backup the VC-25 fleet, including better range and capacity, as well as more capable C2/comms.

#### EXTANT VARIANT(S)

- C-32A. Presidential support-configured commercial Boeing 757-200 airliner.
- C-32B. Commercial Boeing 757-200 tasked with global crisis response airlift.

**Function:** VIP transport.

**Operator:** AMC, ANG.

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

**Delivered:** June–December 1998.

**IOC:** 1998.

**Production:** Six.

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

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

**Contractor:** Boeing.

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

**Accommodation:** Crew: 16 (varies with mission).

**Load:** up to 45 passengers.

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

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

**Ceiling:** 42,000 ft.

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

### ■ C-37 GULFSTREAM V

**Mission brief:** Worldwide special air missions and DV support.

#### COMMENTARY

The C-37 family consists of military versions of ultra-long-range Gulfstream business aircraft. The C-37A is based on the Gulfstream V and equipped with separate VIP and passenger areas, secure global voice and data communications suites, enhanced weather radar, autopilot, and advanced HUD. The C-37B 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 service is seeking to procure three additional C-37Bs to fill the shortfall left following retirement of the C-20 fleet.

#### EXTANT VARIANT(S)

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

**Function:** VIP transport.

**Operator:** AMC, PACAF, USAF.

**First Flight:** USAF October 1998.

**Delivered:** October 1998.

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

**Production:** 12.

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

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



C-12 Huron

USAF



### C-130H Hercules

SMSgt. Charles Delano/ANG

**Contractor:** Gulfstream Aerospace.  
**Power Plant:** Two BMW/Rolls Royce BR710A1-10 turbofans, each 14,750 lb thrust (A); two BR710C4-11 turbofans, each 15,385 lb thrust (B).  
**Accommodation:** Crew: five; up to 12 passengers (A); 14 passengers (B).  
**Dimensions:** Span 93.5 ft, length 96.4 ft, height 25.8 ft.  
**Weight:** Max T-O 90,500 lb.  
**Ceiling:** 51,000 ft.  
**Performance:** Speed 600 mph, range 6,300 miles.

### ■ C-40 CLIPPER

**Mission brief:** Medium-range DV airlift, operational support.

### COMMENTARY

The C-40 is based on the commercial Boeing 737-700 and is used to transport senior military commanders, Cabinet officials, and members of Congress, as well as performing other operational support missions. C-40Bs are equipped with an office-in-the-sky arrangement, including clear and secure voice/data communication and broadband data/video. C-40Cs lack the advanced communications suite, are VIP configured with sleep accommodations, and are reconfigurable to carry 42 to 111 passengers. Both versions have modern avionics, integrated GPS and flight management system/electronic flight instrument system, and HUD. Each aircraft has auxiliary fuel tanks and managed passenger communications. Ongoing mods include nitrogen fuel tank inerting for the C-40C and commercial wideband satcom for the C-40B, to ensure leader's secure top-secret voice, data, and video links. Additional mods include navigation, and air traffic management compliance, and low-cost sustainment upgrades. The fleet is designed for a 30-year service life, with 23 years remaining. FY18 adds new crew rest seats.

### EXTANT VARIANT(S)

- C-40B. Military version of the Boeing 737-700 with added winglets.
- C-40C. VIP configured Boeing 737-700 with added winglets, but lacking advanced comms.

**Function:** VIP transport.  
**Operator:** AMC, PACAF, USAF, ANG, AFRC.  
**First Flight:** April 14, 1999 (USN C-40A).  
**Delivered:** 2002-2007.  
**IOC:** Feb. 28, 2003.  
**Production:** 11.  
**Inventory:** Four (C-40B); seven (C-40C).  
**Aircraft Location:** JB Andrews, Md.; JB Pearl Harbor-Hickam, Hawaii; Ramstein AB, Germany; Scott AFB, Ill.  
**Contractor:** Boeing.  
**Power Plant:** Two General Electric CFM56-7 turbofans, each 27,000 lb thrust.

**Accommodation:** Crew: 10 (varies by model/mission). Load: up to 89 passengers (B); up to 111 (C).  
**Dimensions:** Span 117.4 ft, length 110.3 ft, height 41.2 ft.  
**Weight:** Max T-O 171,000 lb.  
**Ceiling:** 41,000 ft.  
**Performance:** Speed 530 mph, range 5,750 miles.

### ■ C-130H HERCULES

**Mission brief:** Medium-range tactical airlift, polar support, airborne firefighting, aerial spray, humanitarian relief, and medevac.

### COMMENTARY

The C-130H is an all-purpose theater transport that performs diverse roles, including tactical and intertheater airlift and airdrop support, Arctic resupply, AE, aerial spraying, aerial firefighting, and humanitarian missions. The H model improved on the C-130E and was delivered starting in 1965, with the current, more advanced models delivered starting in 1974. Improvements included uprated engines, redesigned outer wing, improved pneumatic systems, new avionics, improved radar, and NVG lighting. C-130Hs are being replaced by the C-130J. The New York ANG operates the small fleet of LC-130H for Polar support. The LC-130H had been upgraded with eight-bladed propellers, digital displays and flight management systems, multifunction radar, modernized comms, and a single air data computer. USAF is seeking to upgrade ANG Modular Airborne Fire Fighting systems (MAFFS) equipped with C-130Hs with the same eight-bladed propellers and engine upgrades to enhance performance and safety. The first modified airframe was redelivered to the Wyoming ANG in January 2018. WC-130Hs



### VC-25 Air Force One

are operated by the Puerto Rico ANG and are 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 minimum of 170 C-130H and six LC-130H in compliance with US and international airspace rules. Increment 2 will add terrain awareness and warning, new flight management, and modern MFDs. C-130H concluded Active Duty service with the last two aircraft departing Yokota on Oct. 26, 2017.

### EXTANT VARIANT(S)

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

**Function:** Tactical airlift.  
**Operator:** ANG, AFRC.  
**First Flight:** August 1954 (C-130A).  
**Delivered:** 1974-96.  
**IOC:** Circa 1974.  
**Production:** 1,202 (C-130H).  
**Inventory:** 188 (C-130H); 10 (LC-130H); seven (WC-130H).  
**Aircraft Location:** Dobbins ARB, Ga.; Little Rock AFB, Ark.; Maxwell AFB, Ala.; Minneapolis-St. Paul Arpt./ARS, Minn.; Peterson AFB, Colo.; Pittsburgh Arpt., Pa.; Youngstown ARS, Ohio; and ANG in Arkansas, Connecticut, Delaware, Georgia, Illinois, Kentucky, Minnesota, Missouri, Montana, Nevada, New York (LC-130), North Carolina, Ohio, Puerto Rico (WC-130), Texas, West Virginia, Wyoming.



### C-37 Gulfstream V

SrA. Neshia Humes



Yasuo Osakabe/USAF

**Contractor:** Lockheed Martin.

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

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

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

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

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

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

## ■ C-130J SUPER HERCULES

**Mission brief:** Medium-range tactical airlift, precision airdrop, airborne firefighting, weather reconnaissance, humanitarian relief, and medevac.

### COMMENTARY

The C-130J is the upgraded, current production version of the C-130 all-purpose theater transport. Missions include tactical and intertheater airlift, airdrop, AE, weather reconnaissance, wildfire suppression using the Modular Airborne Fire Fighting System (MAFFS), and humanitarian relief. The aircraft first deployed in combat in Southwest Asia in 2004. AFRC's "Hurricane Hunters" at Keesler operate the only WC-130Js, which are equipped with palletized equipment to measure tropical and winter storms. The Super Hercules features a three-crew flight operations system, more powerful engines, composite six-blade propeller system, 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 is slated to begin operational testing in 2018. Mode 5 IFF and air traffic management upgrades will be fielded ahead of cycle to meet FAA compliance deadlines. Airframes delivered since 2009 incorporate enhanced service life center wings, and FY18 funds retrofit two early airframes to the same standard. The current multiyear contract ending in FY18 includes 29 USAF C-130Js. The first PACAF-assigned C-130J arrived at Yokota on March 6, 2017.



C-130J Super Hercules

Maj. Marnee Losurdo

### EXTANT VARIANT(S)

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

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

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

**Function:** Tactical airlift.

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

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

**Delivered:** February 1999-present.

**IOC:** October 2006.

**Production:** 330+.

**Inventory:** 110 (C-130J); 10 (WC-130J).

**Aircraft Location:** Dyess AFB, Texas; Keesler AFB, Miss. (WC-130J); Little Rock AFB, Ark.; Ramstein AB, Germany; Yokota AB, Japan; and ANG in California, Kentucky, Rhode Island. Planned: Maryland.

**Contractor:** Lockheed Martin.

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

**Accommodation:** Crew: two pilots, loadmaster. Load: up to 92 combat troops or 64 paratroopers or 74 litters or six cargo pallets or 16 Container Delivery System (CDS) bundles or any combination of these up to max weight (J); 128 combat troops or 92 paratroopers or 97 litters or eight pallets or 24 CDS bundles or any combination of these up to max weight (J-30). **Dimensions:** Span 132.6 ft, length 97.8 ft, height 38.8 ft.; J-30 length 112.8 ft.

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

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

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

## ■ VC-25 AIR FORCE ONE

**Mission brief:** Presidential air transport, executive C2.

### COMMENTARY

The VC-25 is a specially configured Boeing 747-200B equipped for airlifting the President and his entourage. VC-25s operate under the call sign Air Force One when the President is aboard, and SAM (Special Air Mission) during non-presidential flights. Aircraft are equipped with staff work areas, a conference room, a general seating area, and an executive office. Communications capability includes worldwide secure and clear communications, data links, and a full self-defensive suite. The fleet is operated by the Presidential Airlift Group of the 89th Airlift Wing at Andrews. Ongoing mods include nitrogen fuel tank inerting, commercial

wideband satcom, and service life extension. USAF plans to replace VC-25s with a modified version of Boeing's latest 747-8 Intercontinental. The fleet has five years' estimated service life remaining and requires a life extension/block upgrade to remain viable until replacement aircraft are fielded. 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. Flightdeck upgrades include digital avionics, compliant CNS/ATM, Mode 5 IFF, Advisory Vertical Navigation, and other pilot situational awareness aids. USAF announced plans to acquire and modify two unpurchased 747-8s, stored by Boeing in new condition. The company is conducting initial design and risk reduction work to modify the aircraft, originally planned for delivery starting in 2024. The current plan excludes aerial refueling capability on cost grounds. It is unclear whether purchasing existing aircraft will speed delivery.

### EXTANT VARIANT(S)

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

**Function:** Presidential airlift.

**Operator:** AMC.

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

**Delivered:** August-December 1990.

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

**Production:** Two.

**Inventory:** Two.

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

**Contractor:** Boeing.

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

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

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

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

**Ceiling:** 45,100 ft.

**Performance:** Speed 630 mph, range 7,800 miles, further with air refueling.

## HELICOPTERS

### ■ HH-60 PAVE HAWK

**Mission brief:** Armed all-weather day/night CSAR, casualty/medical evacuation, disaster and humanitarian response, firefighting, and combat/utility support.

### COMMENTARY

The HH-60G Pave Hawk is a highly modified Black Hawk helicopter equipped with advanced INS/GPS/Doppler navigation systems, satcom,



## HH-60 Pave Hawk

SSgt. Benjamin Gonsier

and secure/anti-jam communications. It is fitted with a personnel locating system (PLS) that aids location of survivor's radio. It includes automatic flight control, NVG lighting, FLIR, engine/rotor blade anti-ice system, in-flight refueling probe, additional fuel tanks, and an integral rescue hoist. Combat enhancements include a full self-defensive suite and two miniguns or .50-caliber guns. Ongoing 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. FY18 funds procure initial FLIR/Laser Radar turret to enhance situational awareness in low visibility condition, and added mods include over-the-horizon comms for long-range ops in remote areas, and a rotor brake for shipboard operations. USAF plans to replace the HH-60G with the new HH-60W Combat Rescue Helicopter (CRH). The more powerful helicopter will improve hot weather/high-altitude performance and feature an enlarged cabin and longer range. Nine HH-60Ws will begin developmental testing at Eglin in 2018, and the first of 112 new-build helicopters is planned for delivery in 2019. HH-60s assigned to Lakenheath began relocating to Aviano to better support contingencies in Africa and Europe.

### EXTANT VARIANT(S)

- HH-60G. Modified UH-60 helicopter equipped for CSAR.
- HH-60U. Converted surplus UH-60L.
- HH-60W. Developmental next generation Combat Rescue Helicopter.

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

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

**First Flight:** October 1974.

**Delivered:** 1982-present.

**IOC:** 1982.

**Production:** 115.

**Inventory:** 97 (HH-60G); three (HH-60U).

**Aircraft Location:** 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.; RAF Lakenheath, UK. Planned: Aviano AB, Italy.

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

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

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

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

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

**Ceiling:** 14,000 ft.

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

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

### ■ UH-1 HUEY/IROQUOIS

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

### COMMENTARY

The UH-1N aircraft initially provided search and rescue capabilities before replacing earlier Huey variants in the ICBM field security and support role. UH-1Ns provide administrative lift to US National Capital Region and PACAF officials from 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 launched the UH-1N Replacement Program in 2016 to recapitalize the fleet with up to 84 off-the-shelf helicopters suitable for mission-specific modification. Competitive contract award is planned for 2018, with operational testing beginning as early as FY19. Procurement delays have pushed initial fielding to 2021 or later.

### EXTANT VARIANT(S)

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

**Function:** Light lift/training.

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

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

**Delivered:** September 1970-1974 (UH-1N, incl ex-USN airframes).

**IOC:** October 1970.

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

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

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

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

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

**Accommodation:** Crew: two pilots, flight engineer; load: 6 to 13 passengers (depending on fuel, equipment, and atmospheric conditions) or up to six litters or, without seats, bulky, oversized cargo (N).

**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.

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

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

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

## TRAINER AIRCRAFT

### ■ T-1 JAYHAWK

**Mission Brief:** Multi-engine advanced jet pilot/navigator training and CSO training support.

### COMMENTARY

The T-1A is a military version of the Beechcraft 400A used in the advanced phase of JSUPT for students selected to fly tanker or transport aircraft, as well as CSOs. 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. FY18 funds support modern avionics proof-of-concept mods to 15 initial aircraft. USAF expects to return the last of 39 aircraft severely damaged in a hailstorm at Laughlin AFB to flying status by September 2018. The fleet's estimated 18,000 flying-hour service life keeps it structurally airworthy to 2032.

#### EXTANT VARIANT(S)

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

**Function:** Advanced trainer.

**Operator:** AETC.

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

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

**IOC:** January 1993.

**Production:** 180.

**Inventory:** 178.

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

**Contractor:** Beechcraft.

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

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

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

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

**Ceiling:** 41,000 ft.

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

#### ■ T-6 TEXAN II

**Mission Brief:** Lead-in pilot training.

#### COMMENTARY

The T-6 is a joint Air Force/Navy trainer developed under the Joint Primary Aircraft Training System program, based on Swiss Pilatus PC-9. Mods include a strengthened fuselage, zero/zero ejection seats, upgraded engine, increased fuel capacity, pressurized cockpit, bird-resistant canopy, and digital avionics with sunlight-readable LCDs. The tandem student and instructor positions are interchangeable, including single-pilot operation from either seat. The T-6 is fully aerobatic and features an anti-G system. USAF production completed in 2010, with an expected service life of 21 years. Ongoing mods include airspace compliant avionics, improved canopy fracture initiation system, replacement of unavailable components, and updated training aids. AETC suspended all T-6 flights in February 2018 following a series of hypoxia-like incidents, preliminarily linked to the aircraft's oxygen generating system. USAF evaluated an armed version of the aircraft alongside several other types as part of the OA-X light attack experiment at Holloman in 2017. The AT-6 Wolverine will participate in a follow-on evaluation alongside the A-29 Super Tucano at Holloman in 2018, aimed at possible rapid acquisition of a highly interoperable, light CAS/ISR platform.

#### EXTANT VARIANT(S)

• T-6A. Joint service primary training aircraft, based on the Pilatus PC-9.



T-1A Jayhawk

Lt. Col. Russell Hopkinson



T-6 Texan II

A1C James Crow

• T-6B. Navy-only variant.  
• AT-6 Wolverine. Experimental light attack/armed reconnaissance variant.

**Function:** Primary trainer.

**Operator:** AETC, USN.

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

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

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

**Inventory:** 444 (USAF).

**Aircraft Location:** USAF: Columbus AFB, Miss.; Laughlin AFB, JBASA-Randolph, and Sheppard AFB, Texas; Vance AFB, Okla.

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

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

**Accommodation:** Two pilots, in tandem, on Martin Baker MK16LA zero/zero ejection seats.  
**Dimensions:** Span 33.5 ft, length 33.4 ft, height 10.7 ft.

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

**Ceiling:** 31,000 ft.

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

#### ■ T-38 TALON

**Mission brief:** Supersonic, advanced jet training, adversary support, pilot proficiency training.

#### COMMENTARY

The T-38 was the first supersonic trainer aircraft and is primarily used by AETC for advanced JSUPT fighter/bomber tracks and Introduction to Fighter Fundamentals. The aircraft is used to teach supersonic techniques, aerobatics, 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. USAF aims to field the next generation T-X aircraft with initial capability in 2024. Full fleet replacement is not projected until 2034, and USAF is extending aircraft. The Pacer Classic III structural renewal effort is the most intensive in the T-38's history, replacing 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 wingset replacement, digital avionics upgrades, replacement HUD, VHF nav/comms, airspace compliance, and safety mods.

#### EXTANT VARIANT(S)

• T-38A. Upgraded version with Pacer Classic I and II mods.

• AT-38B. Armed weapons training version.

• T-38C. Modernized airframes incorporating glass cockpits and upgraded engines.

**Function:** Advanced trainer.

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

**First Flight:** April 1959.

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

**IOC:** March 1961.

**Production:** 1,187.

**Inventory:** 53 (T-38A); six (AT-38B); 444 (T-38C).

**Aircraft Location:** Beale AFB and Edwards AFB, Calif.; Columbus AFB, Miss.; Holloman AFB, N.M.; JB Langley-Eustis, Va.; JBASA-Randolph and Sheppard AFB, Texas; Tyndall AFB, Fla.; Vance AFB, Okla.; Whiteman AFB, Mo.

**Contractor:** Northrop Grumman.

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

**Accommodation:** Two pilots, in tandem, on Martin Baker MK16T zero/zero ejection seats.  
**Dimensions:** Span 25.3 ft, length 46.3 ft, height 12.8 ft.

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

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

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

#### ■ T-53 KADET II

**Mission brief:** Cadet initial flight training, sport/competition aviation.

#### COMMENTARY

The T-53 is the military designated civilian Cirrus SR20, primarily used by USAFA's Powered



**T-38 Talon**

SSgt. Carlin Leslie

Flight Program, which conducts some 12,600 training and competition-flying hours annually. 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.

**EXTANT VARIANT(S)**

• T-53A. Military designated Cirrus SR20.

**Function:** Trainer.

**Operator:** AETC.

**Delivered:** 2012.

**Inventory:** 24.

**Aircraft Location:** USAFA, Colo.

**Contractor:** Cirrus.

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

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

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

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

**Ceiling:** 17,500 ft.

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

■ **UV-18 TWIN OTTER**

**Mission brief:** Utility, cadet parachute jump training.

**COMMENTARY**

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

**EXTANT VARIANT(S)**

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

**Function:** Utility.

**Operator:** AETC.

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

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

**IOC:** 1977.

**Production:** Three.

**Inventory:** Three.

**Aircraft Location:** USAFA, Colo.

**Contractor:** De Havilland Canada.

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

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

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

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

**Ceiling:** 25,000 ft.

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

**REMOTELY PILOTED AIRCRAFT**

■ **MQ-1 PREDATOR**

**Mission brief:** Medium-altitude, long-endurance ISR and limited strike.

**COMMENTARY**

The MQ-1 is a multimission weaponized RPA with near real-time FMV and multispectral targeting with combined laser designator/illuminator and EO/IR sensors. The fully operational system comprises four air vehicles, GCS, satellite link, and about 55 personnel for 24-hour operations. RQ-1 became a fully USAF system in 1996, and the designation was changed to MQ-1 (denoting multimission capability) when it was armed with the Hellfire missile in 2002. USAF forward deploys launch and recovery element (LRE) systems and support personnel for takeoff and landing operations, while the CONUS-based GCSs conduct the mission via extended BLOS satcom data link. USAF received its last MQ-1B in March 2011. The MQ-1 is being replaced by the MQ-9 due to its limited payload, speed, and sensors.

**EXTANT VARIANT(S)**

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

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

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



**MQ-9 Reaper**

**First Flight:** July 1994.

**Delivered:** July 1994 (USAF 1996-March 2011).  
**IOC:** 2005.

**Production:** 268.

**Inventory:** 121.

**GCS Location:** Cannon AFB, N.M.; Creech AFB, Nev.; Hector Arpt., N.D.; Nellis AFB, Nev.; Whiteman AFB, Mo.

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

**Contractor:** General Atomics Aeronautical Systems.

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

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

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

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

**Ceiling:** 25,000 ft.

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

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

■ **MQ-9 REAPER**

**Mission brief:** Medium- to high-altitude unmanned, tactical ISR and light attack.

**COMMENTARY**

The MQ-9B is a medium- to high-altitude, long-endurance hunter-killer RPA, primarily tasked with eliminating time-critical and high-value targets in a permissive combat environment. The MQ-9 fulfills a secondary tactical ISR role utilizing its Multispectral Targeting System-B (MTS-B). The system integrates EO/IR, color/monochrome daylight TV, image-intensified TV, and a laser designator/illuminator. MTS-B provides FMV as separate video streams or fused together, and the MQ-9 employs SAR



**T-53 Kadet II**

Mike Kaplan/USAF





Ilka Cole/USAF

for GBU-38 JDAM targeting. Additional roles include CAS, CSAR, precision strike, armed overwatch, target development/designation, and terminal weapon guidance. MQ-9B debuted in combat in Afghanistan in 2007. The Reaper system comprises three aircraft, GCS, LOS/BLOS satellite and terrestrial data links, support equipment/personnel, and crews for deployed 24-hour operations. Development is underway to incorporate automatic takeoff and landing capability, Counter-Improvised Explosive Device (C-IED), Dismount Detection Radar (DDR), Gorgon Stare wide-area surveillance, missile defense, and other sensor upgrades, weapons integration, and reliability enhancements. MQ-9 is retrofitted under a flexible acquisition structure, which can rapidly change to meet emerging demands. 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. FY18 funding supports Block 5, Lynx SAR, reliability and maintainability mods, ER kits, and capability upgrades, as well as procuring 16 new-build MQ-9s.

#### EXTANT VARIANT(S)

- MQ-9B Reaper Block 1. Air Force version of the General Atomics Predator B.
- MQ-9B Reaper Block 5. Improved, current production Reaper.
- MQ-9B Reaper ER. Extended range MQ-9 with external fuel tanks, longer wings, and other enhancements.

**Function:** Attack/armed reconnaissance.

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

**First Flight:** February 2001.

**Delivered:** November 2003-present.

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

**Production:** 346 (planned).

**Inventory:** 218.

**GCS Location:** Cannon AFB, N.M.; Creech AFB, Nev.; 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.; March ARB, Calif.; Springfield-Beckley Arpt., Ohio.; Planned: Niagara Falls Arpt., N.Y.; Shaw AFB, S.C.; Tyndall AFB, Fla.; Whiteman AFB, Mo.  
**Aircraft Location:** Cannon AFB, N.M.; Creech



A1C Donald Hudson

## RQ-4 Global Hawk

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.

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

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

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

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

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

**Ceiling:** 50,000 ft.

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

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

### ■ RQ-4 GLOBAL HAWK

**Mission brief:** High-altitude, strategic ISR, SIGINT, and ground moving target indication (GMTI), depending on variant.

#### COMMENTARY

The Global Hawk is primarily a long-endurance, high-altitude, "deep look" ISR platform to complement satellite and manned strategic ISR. The weapon system consists of an aircraft with an integrated sensor suite, launch and recovery element (LRE), mission control element (MCE), and communications and mission planning equipment. 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). Four airframes were subsequently converted to EQ-4B communications relay platforms with the Battlefield Airborne Communications Node (BACN), and three remain active. The Block 30 variant is a multi-intelligence platform equipped with EO/IR, SAR, as well as Sigint sensors and has supported combat operations worldwide. The Block 40 ground surveillance platform is equipped with the Multiplatform Radar Technology Insertion Program (MP-RTIP) sensor suite that incorporates AESA and SAR to simultaneously gather stationary target imagery and detect and track moving ground targets as well as cruise missiles. A universal payload adapter enables carriage of several U-2-unique sensors, including the MS-177 electro-optical sensor and wet-film Optical Bar Camera. MS-177 was installed on two Block 30s to support operational testing, which revealed significant electromagnetic

interference issues. A weather-avoidance radar is also undergoing tests, and efforts are underway to address integration issues with both systems. Initial operational capability with the MS-177 is planned for FY18. Development includes an anti-icing system for all-weather operations, Airborne Signals Intelligence Payload (ASIP) increment I Sigint improvement, reliability improvements, airspace compatibility mods, and sense and avoid technology. Northrop Grumman is also building four RQ-4s for South Korea, three for Japan, and five for the NATO's Allied Ground Surveillance program in addition to USAF/Navy production. A total of 43 USAF RQ-4s have been delivered, including 21 Block 30s. The last two aircraft are scheduled for delivery by the end of 2018.

#### EXTANT VARIANT(S)

- EQ-4B Block 20. Battlefield Airborne Communications Node (BACN) comm relay platform.
- RQ-4B Block 30. Multi-intelligence platform equipped with EO/IR and SAR sensors.
- RQ-4B Block 40. AESA and SAR equipped ground moving target indication (GMTI) and battlefield ISR platform.

**Function:** High-altitude reconnaissance.

**Operator:** ACC, AFMC.

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

**Delivered:** August 2003-present.

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

**Production:** 45 USAF; four USN (68 planned); five (NATO).

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

**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; Misawa AB, Japan; NAS Sigonella, Italy; Yokota AB, Japan.

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

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

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

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

**Weight:** Max T-O 32,250 lb; max payload 3,000 lb.  
**Ceiling:** 60,000 ft.

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

### ■ RQ-170 SENTINEL

**Mission brief:** Stealthy, penetrating day/night tactical ISR.

## COMMENTARY

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

## EXTANT VARIANT(S)

- RQ-170. No data available.

**Function:** Unmanned surveillance and reconnaissance.

**Operator:** ACC.

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

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

**Contractor:** Lockheed Martin.

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

## FULL-SCALE AERIAL TARGETS

### ■ QF-16 FULL-SCALE AERIAL TARGET

**Mission brief:** Manned/unmanned aerial target and threat simulator in support of missile/ weapons development, testing, validation, and training.

## COMMENTARY

The QF-16 began replacing the dwindling and obsolescent QF-4 Full-Scale Aerial Target (FSAT) starting in 2015, through the type's retirement in December 2017. Aircraft will primarily support missile and weapon systems development, testing, and evaluation. QF-16s are capable of manned or "not under live local operator" (NULLO) control operations. 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. FY18 funds procure 18 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, preliminary development of two-seat trainer, and future F-16 block conversions. Holloman launched its first operational QF-16 sortie on Feb. 10, 2017.

## EXTANT VARIANT(S)

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

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

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

**Operator:** ACC.

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

**Delivered:** February 2015-present.

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

**Production:** 126 (planned).

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

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

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

**Power Plant:** Block 15: one Pratt & Whitney F100-PW-200 turbofan, 23,830 lb thrust. Block 25: one Pratt & Whitney F100-PW-220 turbofan, 23,830 lb thrust. Block 30: one General



QF-16 Aerial Target

SrA. Solomon Cook

Electric F110-GE-100 turbofan, 28,984 lb thrust.

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

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

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

**Ceiling:** 50,000 ft.

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

## STRATEGIC WEAPONS

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

**Mission brief:** Low-level, penetrating nuclear or conventional strike against surface targets.

## COMMENTARY

ALCM is programmed to conduct strategic attack—nuclear or conventional—on surface targets. Its small radar signature and low-level flight capability enhance the missile's effectiveness. The nuclear AGM-86B was the first production version. A total of 1,715 were delivered through 1986. USAF is to cut inventory to 528. The conventional AGM-86C, called CALCM, was first delivered in 1987, and few remain in the inventory. It was operationally employed for the first time in Desert Storm and widely used in subsequent operations. CALCM is capable of adverse weather, day/night, air-to-surface, accurate, standoff strike capability at ranges greater than 500 miles. Block 1A enhancements offer improved accuracy and increased immunity to electronic jamming. The AGM-86D is CALCM's Block II penetrator version with AUP-3(M) warhead. It provides standoff capability against hardened, deeply buried targets and was successfully used in Afghanistan. ALCM is undergoing a SLEP to stretch its in-service life to 2030 to allow for planned replacement by the Long-Range Standoff (LRSO) missile. USAF awarded Lockheed Martin and Raytheon technology maturation and risk-reduction contracts for the LRSO in 2017 and plans to field the nuclear missile by the late 2020s, possibly followed by a conventional derivative thereafter.

## EXTANT VARIANT(S)

- AGM-86B. Nuclear ALCM variant.
  - AGM-86C. Conventional CALCM variant.
  - AGM-86D. Penetrating CALCM Block II variant.
- Function:** Strategic air-to-surface cruise missile.  
**Operator:** AFGSC.  
**First Flight:** June 1979 (full-scale development).  
**Delivered:** 1981-1986.  
**IOC:** December 1982(B); January 1991 (C); No-

vember 2001 (D).

**Production:** 1,715.

**Inventory:** 1,142.

**Unit Location:** Andersen AFB, Guam (conventional only); Barksdale AFB, La.; Minot AFB, N.D.  
**Contractor:** Boeing.

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

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

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

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

**Weight:** 3,150 lb.

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

### ■ B61 THERMONUCLEAR BOMB

**Mission brief:** Extended nuclear deterrence, tactical/battlefield nuclear attack.

## COMMENTARY

B61 is the primary strategic nuclear weapon for the B-2 bomber and equips both the F-16 and F-15E, providing forward deployed, extended deterrence to allies. The weapon was first delivered in 1966, and the most recent B61 Mod 11 introduced in 1997 adds a ground-penetrating capability, enhancing its destructive effect to destroy buried and hardened targets. The weapon incorporates several preselectable yield options, tailored to mission requirements. Work is underway on the B61 Mod 12 life extension program (LEP). The LEP aims to improve the safety, security, and reliability of the weapon through 2040, adding a new guided tail kit in addition to warhead upgrade/refurbishment. The resulting weapon will be more accurate, allowing reduced yield. Production engineering work began in 2016. B61-12 will consolidate the B61-3, -4, -7, and -10 weapons into a single, standardized configuration. Qualification flight testing is ongoing, and USAF conducted the first of 23 inert test drops utilizing the F-15E and F-16C in 2017. These drops validate nonnuclear components such as arming/fire control, guidance and spin-rocket motors, and software. The first production example is scheduled for delivery in 2020, and integration work is planned on the B-2, F-15E, F-16, and the F-35A starting in 2018.

## EXTANT VARIANT(S)

- B61. Supersonic-droppable free-fall thermonuclear weapon.
- Function:** Air-to-surface thermonuclear bomb.  
**Delivered:** 1966.  
**IOC:** 1968.  
**Production:** N/A.

**Inventory:** Approx 500.

**Deployed locations:** Aviano AB, Italy; Büchel AB, Germany; Ghedi AB, Italy; Incirlik AB, Turkey; Kleine Brogel AB, Belgium; Volkel AB, Netherlands.

**Contractor:** Los Alamos National Laboratory (weapon), Boeing (B61-12 tail kit).

**Guidance:** None (B61 Mod 1 to 11); N/A (B61 Mod 12).

**Warhead:** One B61 -3, -4, -7, -10, or -11.

**Dimensions:** Length 11 ft 8 in., diameter 1 ft 1 in.

**Weight:** 700 lb; 825 lb (B61-12).

**Performance:** N/A.

## ■ LGM-30 MINUTEMAN

**Mission brief:** Survivable, intercontinental, strategic nuclear deterrence.

### COMMENTARY

Minuteman is a three-stage, solid-propellant ICBM housed in an underground silo. Minuteman III became operational in 1970, providing improved range, rapid retargeting, and the capability to place 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 fuzes, networking, and cryptography upgrades. FY18 begins 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. AFGSC initially deployed 550 missiles, later reducing 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).

### EXTANT VARIANT(S)

• LGM-30G. Current Minuteman III variant.

**Function:** Strategic surface-to-surface ballistic missile.

**Operator:** AFGSC.

**First Flight:** February 1961.

**Delivered:** 1962-1978.

**IOC:** December 1962, Malmstrom AFB, Mont.

**Production:** 1,800.

**Inventory:** 400.

**Unit Location:** F. E. Warren AFB, Wyo.; Malmstrom AFB, Mont.; Minot AFB, N.D.

**Contractor:** Boeing, BAE Systems, General Electric, Lockheed Martin, Orbital ATK.

**Propulsion:** Stage 1: Orbital ATK refurbished M55 solid-propellant motor, 202,600 lb thrust; stage 2: Orbital ATK refurbished SR19 solid-propellant motor, 60,721 lb thrust; stage 3: Orbital ATK refurbished SR73 solid-propellant motor, 34,400 lb thrust.

**Guidance:** Inertial guidance system.

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

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

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

**Weight:** 79,432 lb.



## LGM-30 Minuteman III

SrA. Ian Dudley

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

## LONG-RANGE STANDOFF WEAPONS

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

**Mission brief:** Air launched programmable electronic warfare to thwart integrated enemy air defense systems (IADS).

### COMMENTARY

MALD is a low-cost, modular, autonomous flight vehicle that mimics US or allied aircraft to enemy IADS. MALD-J adds radar jamming capability to the basic decoy platform and can operate alone or in concert with other EW platforms. The jammer version is designed as an expendable, close-in jammer to degrade and deny an early warning or acquisition radar's ability to establish a track on strike aircraft. It also maintains the ability to fulfill the basic decoy mission. F-16 or B-52 are lead employment aircraft for MALD. USAF capped procurement in FY12, converting Lot 4 to the MALD-J variant. Plans call for 3,000, of which 2,400 are the jammer version.

### EXTANT VARIANT(S)

• ADM-160B. MALD base decoy variant.

• ADM-160C. MALD-J jammer/decoy variant.

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

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

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

**IOC:** N/A.

**Contractor:** Raytheon.

**Guidance:** GPS/INS.

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

**Weight:** Less than 300 lb.

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

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

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

**Mission brief:** Low-cost, guided glide-missile for precision attack against light/area targets.

### COMMENTARY

JSOW is a joint USAF-Navy family of medium-range, GPS/INS guided, standoff air-to-ground weapons. They are used to attack a variety of soft and armored area targets during day and night and adverse weather conditions. The baseline BLU-97 CEM variant is used against soft and

area targets. The BLU-108 variant provides anti-armor capability. The AGM-154C incorporates an additional imaging IR seeker and is intended for use against hardened, stationary targets. JSOW is integrated onto the B-1, B-2, B-52, F-15E, and F-16, and an F-35C conducted the strike fighter's first drop during integration testing on March 23, 2016. The new AGM-154C-1 variant that adds moving, maritime strike capability to the baseline C variant reached IOC with the Navy in 2016 and will eventually equip the F-35A/C.

### EXTANT VARIANT(S)

• AGM-154A. Baseline BLU-97 CEM variant for soft/area targets.

• AGM-154B. The BLU-108 submunition variant for anti-armor.

• AGM-154C. Imaging IR guided variant for hardened tactical targets.

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

**First Flight:** December 1994.

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

**IOC:** 2000 (USAF).

**Contractor:** Raytheon.

**Guidance:** GPS/INS.

**Warhead:** See variants above.

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

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

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

**Mission brief:** Precision attack against heavily defended or high-value targets at extended, standoff range.

### COMMENTARY

JASSM is a joint USAF-Navy autonomous precision strike weapon. It can attack both fixed and relocatable targets, including moderately hardened buried targets. The base variant is a stealthy low-cost airframe equipped with GPS/INS guidance and imaging IR terminal seeker. The base variant 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 and planned for use on all fighter/bomber platforms. 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 a new anti-shipping variant, dubbed



## AGM-158 JASSM

SrA. Kedesha Pennant

Long-Range Anti-Ship Missile (LRASM), for both the Air Force and Navy. LRASM will be fielded on the B-1B in 2018. FY18 funds support procurement of 360 JASSM-ER and 15 LRASM.

### EXTANT VARIANT(S)

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

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

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

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

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

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

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

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

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

**Dimensions:** Length 14 ft.

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

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

## AIR-TO-AIR MISSILES

### ■ AIM-9 SIDEWINDER

**Mission brief:** IR-guided short-range, supersonic engagement of air-to-air targets.

### COMMENTARY

Sidewinder was developed by the Navy for fleet air defense and adapted by USAF for fighter aircraft use. Early versions were used extensively in the Vietnam War. The AIM-9M is a joint Navy-USAF, all-altitude, all-aspect 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. 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 capabil-

ity. 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). FY18 funds procure a combined 310 AIM-9X Block II/II-plus.

### EXTANT VARIANT(S)

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

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

**First Flight:** September 1953.

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

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

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

**Guidance:** Passive IR homing guidance.

**Warhead:** HE annular blast fragmentation.

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

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

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

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

**Mission brief:** Active radar-guided, medium-range, supersonic engagement of air-to-air targets.

### COMMENTARY

AMRAAM is a joint USAF-Navy follow-on to the AIM-7 Sparrow with launch-and-maneuver capability. The AIM-120B is an upgraded, reprogrammable variant of the original missile. The AIM-120C 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 undergoing operational testing will further enhance weapon performance and electronic protection. FY18 funds procure 205 AIM-120D missiles.

### EXTANT VARIANT(S)

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



## AIM-9X Sidewinder

improved range, lethality, and jam-resistance.

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

**First Flight:** December 1984.

**Delivered:** 1988.

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

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

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

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

**Warhead:** HE blast fragmentation.

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

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

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

## AIR-TO-GROUND WEAPONS

### ■ AGM-65 MAVERICK

**Mission brief:** TV-, imaging IR-, or laser guided standoff air-to-surface attack.

### COMMENTARY

Maverick was first employed during the Vietnam War and was used extensively in Desert Storm and Iraqi Freedom. It is employed by fighter/attack aircraft against tanks, vehicles, and air defenses. AGM-65B is a launch-and-leave, EO/TV guided missile, equipped with "scene magnification" TV allowing acquisition of small/distant targets. Fielded in 1986, AGM-65D employs an 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. FY18 funds modify 91 legacy missiles to Laser Maverick standards and replenish weapons expended in ongoing combat.

### EXTANT VARIANT(S)

- AGM-65B. A launch-and-leave EO TV seeker variant.
- AGM-65D. Adverse weather B variant.
- AGM-65E. Laser guided version heavyweight penetrator variant.
- AGM-65G. Imaging IR seeker heavyweight penetrator variant.



SrA. John Linzmeier



SrA. Cheyenne Powers

- AGM-65H. Upgraded B variant.
- AGM-65K. Modified EO TV seeker G variant.
- AGM-65L. Laser guided EO TV seeker variant for fast moving targets.

**Function:** Air-to-surface guided missile.  
**First Flight:** August 1969.  
**Delivered:** August 1972.  
**IOC:** February 1973.  
**Contractor:** Raytheon, Orbital ATK (propulsion).  
**Propulsion:** Two-stage solid-propellant rocket motor.  
**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).  
**Dimensions:** Span 2.3 ft, length 8.2 ft, diameter 12 in.  
**Performance:** Supersonic, range 20 miles.  
**Integration:** A-10C, F-15E, F-16C/D.

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

**Mission brief:** Tactical anti-radar air-to-surface attack.

#### COMMENTARY

HARM is a joint USAF-Navy weapon, highly effective against enemy ground radar, and carried by USAF F-16Cs dedicated to the SEAD mission. AGM-88B is equipped with erasable and electronically programmable read-only memory, permitting in-field changes to missile memory. The AGM-88C is the current production model with a more lethal warhead. Raytheon began a HARM Control Section Mod (HCSM) in 2013 to convert current models to more precise AGM-88Fs incorporating improved GPS/INS guidance, anti-countermeasure performance, and reduced risk of collateral damage.

#### EXTANT VARIANT(S)

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

**Function:** Air-to-surface anti-radiation missile.  
**First Flight:** April 1979.  
**Delivered:** 1982-98.  
**IOC:** Circa 1984.  
**Contractor:** Raytheon.  
**Propulsion:** Thiokol dual-thrust, solid-propellant rocket motor.  
**Guidance:** Proportional with fixed antenna and seeker head in missile nose.  
**Warhead:** HE fragmentation.  
**Dimensions:** Span 3.7 ft, length 13.7 ft, diameter 10 in.  
**Performance:** Supersonic, range 30+ miles.

### AGM-65 Maverick

#### ■ AGM-114 HELLFIRE

**Mission brief:** Low-collateral damage air-to-ground attack against armor and personnel targets.

#### COMMENTARY

Hellfire is a precision missile utilizing semi-active laser guidance. Missiles are used on the MQ-9 Reaper, and AFSOC aims to integrate the weapons onto its AC-130W gunships. Hellfire is procured through the Army, and numerous variants are utilized based on overseas contingency demands. An MQ-1 Predator successfully fired an AGM-114 for the first time in February 2000. The combo was employed in combat for the first time in Afghanistan on Oct. 7, 2001. USAF is working to integrate the latest AGM-114R, which replaces several types with a single, multitarget weapon, onto the MQ-9.

#### EXTANT VARIANT(S)

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

**Function:** Air-to-surface guided missile.  
**First Flight:** Feb. 16, 2000 (USAF).  
**Delivered:** September 2001-present.  
**IOC:** N/A.  
**Contractor:** Lockheed Martin, Orbital ATK (propulsion).  
**Propulsion:** Solid-propellant rocket motor.  
**Guidance:** EO TV guidance system (B/H/K); IIR seeker (D/G); laser seeker (E).  
**Warhead:** Shaped charge and blast fragmentation.  
**Dimensions:** Span 28 in, length 5.33 ft, diameter 17 in.  
**Performance:** Subsonic, range 5+ miles.  
**Integration:** MQ-1, MQ-9; planned: AC-130W/J.

#### ■ AGM-176 GRIFFIN

**Mission brief:** High-precision, low-collateral attack against light surface targets.

#### COMMENTARY

Griffin is a light, low cost, multiservice air-launched weapon with GPS-aided inertial guidance and semi-active laser seeker. The AGM-176A forms part of the PSP employed on AFSOC's AC-130W 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.

#### EXTANT VARIANT(S)

- AGM-176A. Aft-ejecting missile employed as part of the PSP.
- AGM-176B. Forward-firing variant optimized

for light aircraft/RPAs.

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

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

**Delivered:** September 2001.

**IOC:** N/A.

**Contractor:** Raytheon.

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

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

**Warhead:** Blast fragmentation.

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

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

**Integration:** AC-130W (A); MQ-1, MQ-9 (B); planned: AC-130J (A).

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

**Mission brief:** Anti-armor attack against multiple moving and stationary land combat vehicles per pass.

#### COMMENTARY

SFW is a tactical munitions dispenser with a payload of 10 BLU-108 submunitions, each containing four skeet projectiles, totaling 40 lethal, target-seeking projectiles. The skeet's 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. It can be delivered from high altitude and in adverse weather. It debuted in combat in Iraq in 2003. CBU-105 is the only standard USAF cluster munition that meets the less-than-one-percent failure rate mandated by DOD for use beyond 2018.

#### EXTANT VARIANT(S)

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

**Function:** Wide-area munition.

**First Flight:** Circa 1990.

**IOC:** 1997.

**Contractor:** Textron Systems.

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

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

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

#### ■ CBU-107 PASSIVE ATTACK WEAPON

**Mission brief:** Minimized collateral damage attack against nonhardened area targets.

#### COMMENTARY

Passive Attack Weapon glides toward its target after release. Before impact, its inner chamber begins to rotate, and projectiles are ejected in rapid succession by centrifugal force, penetrating targets within a 200-ft radius. The weapon contains various-size, penetrating projectiles but no explosive. Full production was completed in six months. The weapon was used during Iraqi Freedom.

#### EXTANT VARIANT(S)

- CBU-107A. Centrifugally dispersed, armor-penetrating weapon.

**Function:** Wide-area munition.

**First Flight:** 2002.

**IOC:** December 2002.

**Contractor:** General Dynamics (kinetic energy penetrator payload and canister), Lockheed Martin (WCMD), Textron (tactical munition dispenser kit).

**Guidance:** Via WCMD.

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

**Performance:** Delivers a high-speed volley of nearly 4,000 metal projectiles in three sizes from a single canister; projectiles: 15-inch rods (350), 7-inch rods (1,000), and small-nail size (2,400).

#### ■ GBU-10/12/49 PAVEWAY II

**Mission brief:** Laser guided free-fall attack against surface targets at short standoff range.

#### COMMENTARY

The Paveway II kit is a folding wing version of the earlier, fixed wing Paveway I, with seeker and reliability improvements. GBU-10 is the Paveway II seeker and tail kit mounted on a 2,000-lb general-purpose bomb and primarily used against nonhardened targets. It is, however, capable of penetration. The GBU-12 uses a 500-lb bomb body and is primarily used against stationary armored targets. GBU-49 is also a 500-lb body, but adds GPS guidance for all-weather precision delivery. The weapons can be employed from 2,500 ft up to 40,000 ft.

#### EXTANT VARIANT(S)

- GBU-10. Laser/GPS guided 2,000-lb bomb.

- GBU-12. Laser guided 500-lb bomb.

- GBU-49. Laser/GPS guided 500-lb bomb.

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

**First Flight:** Early 1970s.

**IOC:** 1976.

**Contractor:** Lockheed Martin, Raytheon.

**Guidance:** Semi-active laser.

**Warhead:** Mk 84 bomb 2,000 lb (GBU-10); Mk 82 500-lb blast/fragmentation bomb (GBU-12/49).

**Dimensions:** Span 5.5 ft, length approx 14.8 ft,



USAF

#### A CBU-105 Sensor Fuzed Weapon deploys BLU-108 submunitions against armored targets.

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).

#### ■ GBU-24/28 PAVEWAY III

**Mission brief:** Laser guided, free-fall attack against high-value targets from medium standoff range and any altitude.

#### COMMENTARY

Paveway III is the third generation laser guided seeker/tail kit package. Its advanced guidance enables greater precision over Paveway II, and its high-lift airframe enables longer glide slopes for greater standoff employment. It can be dropped from low, medium, or high altitude and is effective against a broad range of high-value targets. GBU-24 is fitted to a 2,000-lb bomb body, with a BLU-109 penetrating warhead. GBU-28 variants are large 5,000-lb class air-to-ground penetrators developed for use against

Iraq's deeply buried, hardened C2 facilities. The GBU-28B adds GPS/INS guidance to the existing laser seeker for all-weather targeting and entered production in 1999. The GBU-28C adds a more powerful penetrating BLU-122 warhead in addition to the enhanced guidance package and entered production in 2005.

#### EXTANT VARIANT(S)

- GBU-24. Laser guided 2,000-lb penetrating bomb.

- GBU-28B/B. Laser/GPS/INS guided 5,000-lb penetrating bomb.

- GBU-28C/B. Laser/GPS/INS guided 5,000-lb improved penetrating bomb.

**Function:** Air-to-surface penetrating glide bomb.

**First Flight:** GBU-24 in service May 1985.

**IOC:** 1986 (GBU-24); 1991 (GBU-28).

**Contractor:** Raytheon.

**Guidance:** Semi-active laser.

**Warhead:** BLU-109 2,000-lb bomb (GBU-24); BLU-113 or BLU-122 5,000-lb bombs (GBU-28).

**Dimensions:** Span 6.7 ft, length 14.4 ft, diameter 18 in (GBU-24); length approx 20 ft, diameter 15 in (GBU-28).

**Performance:** Range more than 11 miles (GBU-24); range more than 5.75 miles (GBU-28).

#### ■ GBU-31/32/38 JOINT DIRECT ATTACK MUNITION (JDAM)

**Mission brief:** GPS/INS guided highly accurate, autonomous, all-weather conventional attack against surface targets.

#### COMMENTARY

JDAM is a joint USAF-Navy program that upgrades the existing inventory of general-purpose bombs by integrating them with a GPS/INS guidance kit to provide accurate all-weather attack from medium/high altitudes. The weapons acquire targeting information from the aircraft's avionics system. After release, an inertial guidance kit directs the weapon, aided by periodic GPS updates. JDAM seeker/tail kits can be mounted on general-purpose or penetrating warheads in each weight class. A JDAM kit is under development for the 5,000-lb BLU-113 penetrating weapon, slated for integration and flight testing on the F-15E. 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.



GBU-38 Joint Direct Attack Munition

SrA. J. T. Armstrong

FY18 funds maximize production capacity to replenish stocks depleted in combat over Iraq and Syria.

#### EXTANT VARIANT(S)

- GBU-31. GPS/INS guided 2,000-lb GP, or BLU-109 penetrating weapon.
- GBU-32. GPS/INS guided 1,000-lb GP, or BLU-110 penetrating weapon.
- GBU-38. GPS/INS guided 500-lb GP, or BLU-111 penetrating weapon.

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

**First Flight:** Oct. 22, 1996.

**IOC:** 1998.

**Contractor:** Boeing, Textron, Honeywell.

**Guidance:** GPS/INS.

**Warhead:** 2,000-lb Mk 84/BLU-109 (GBU-31); 1,000-lb Mk 83/BLU-110 (GBU-32); 500-lb Mk 82/BLU-111 (GBU-38).

**Dimensions:** Span 25 in (GBU-31), 19.6 in (GBU-32), 14 in (GBU-38); length (with JDAM and warhead) approx 12 ft (GBU-31), 10 ft (GBU-32), 7.8 ft (GBU-38).

**Performance:** Range up to 15 miles, CEP with GPS 16.4 ft, CEP with INS only 98 ft.

#### ■ GBU-39 SMALL DIAMETER BOMB I

**Mission brief:** Standoff precision guided munition.

#### COMMENTARY

SDB is a low-yield, all-weather precision guided munition designed to limit collateral damage and strike targets from up to 46 miles away. 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 major procurement priority and FY18 funds support maximizing SDB I production capacity to replenish stocks depleted in combat over Iraq and Syria.

#### EXTANT VARIANT(S)

- GBU-39/B SDB I. GPS/INS guided 250-lb low-yield bomb.

**First Flight:** May 23, 2003.

**IOC:** Oct. 2, 2006.

**Production:** 24,000 (planned).

**Contractor:** Boeing.

**Guidance:** GPS/INS.

**Warhead:** 250-lb class penetrating blast fragmentation munition.

**Dimensions:** Bomb: length 6 ft, width 7.5 in; BRU-61/A carriage (four bombs) length 12 ft, width 16 in, height 16 in.

**Performance:** Near-precision capability at standoff range up to 46 miles.

**Integration:** AC-130W, B-1B, B-2A, F-15E, F-16, F-22; planned: F-35A, MQ-9.

#### ■ GBU-39 SMALL DIAMETER BOMB II

**Mission brief:** Standoff precision guided munition.

#### COMMENTARY:

SDB is a low-yield, all-weather precision guided munition designed to limit collateral damage and



**GBU-24 Paveway III**

USAF

strike targets from up to 46 miles away. Its size allows it to be carried in fighters' and bombers' internal weapons bays or to increase overall loadout to enable more independent strikes per sortie. Several SDBs can be simultaneously released against multiple targets. SDB II is a joint USAF-Navy program to attack moving targets from standoff range in all weather. SDB II adds a millimeter-wave radar, 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. Low-rate initial production began in 2015. SDB II is in operational testing, and initial integration onto the F-15E is planned for the end of 2018. Follow-on integration is planned for the F-35A. FY18 funds support production of 406 SDB IIs to expand combat capabilities.

#### EXTANT VARIANT(S)

- GBU-53/B SDB II. Tri-mode guided 250-lb low-yield bomb.

**First Flight:** 2012.

**IOC:** 2019 (planned).

**Production:** 12,000 (planned).

**Contractor:** Raytheon.

**Guidance:** Tri-mode seeker millimeter-wave radar, uncooled IIR, and digital semi-active laser.

**Warhead:** 250-lb class penetrating blast fragmentation munition.

**Dimensions:** Bomb: length 5.75 ft, wingspan 5.6 ft, diameter 7 in.

**Performance:** Near-precision capability at standoff range up to 46 miles.

**Integration:** Planned: A-10, AC-130W/J, B-1, B-2, B-52, F-15E, F-16, F-22, F-35.

#### GBU-43 MASSIVE ORDNANCE AIR BLAST (MOAB) BOMB

**Mission brief:** Destruction of large area or deeply buried targets.

#### COMMENTARY

MOAB is the largest satellite guided, air-delivered weapon ever employed. The conventional HE bomb is GPS guided, with fins and inertial gyro for pitch and roll. It was developed in only nine weeks to be available for the 2003 Iraq campaign and given the name Massive Ordnance Air Blast (MOAB) but was unofficially

known as "Mother of All Bombs." The weapon is designed for deployment from the ramp of an MC-130 without a parachute. It provides the power to attack large area targets or enemy hidden in tunnels or caves. A total of 18,700 lb of the weapon's 21,000-lb weight is attributed to BLU-120/B warhead. It was used operationally for the first time in April 2017 against ISIS-occupied cave complex in Afghanistan.

#### EXTANT VARIANT(S)

- GBU-43/B. GPS guided 21,000-lb bomb.

**Function:** Massive guided bomb.

**Guidance:** GPS/INS.

**Warhead:** BLU-120/B 18,700-lb HE.

**Dimensions:** Length 30 ft, diameter 3.3 ft.

**Integration:** MC-130H.

#### ■ GBU-54 LASER JOINT DIRECT ATTACK MUNITION (LJDAM)

**Mission brief:** Laser and GPS/INS guided, highly accurate, autonomous, all-weather conventional attack against fixed and moving targets.

#### COMMENTARY

LJDAM 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.

#### EXTANT VARIANT(S)

- GBU-54 Laser JDAM. Laser/GPS/INS guided 500-lb bomb.

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

**First Flight:** 2005.

**IOC:** 2008.

**Contractor:** Boeing.

**Guidance:** GPS/INS with laser.

**Warhead:** Mk 82 500-lb munition.

**Dimensions:** Length (with JDAM and warhead) approx 8 ft.

**Performance:** Range up to 15 miles.

#### ■ GBU-57 MASSIVE ORDNANCE PENETRATOR

**Mission brief:** Massive, GPS-guided, earth-



TSgt. Robert Cloys

### GBU-54 Laser JDAM

penetrating strike against hard and deeply buried targets.

#### COMMENTARY

MOP was developed and tested through a USAF and Defense Threat Reduction Agency partnership in 2004. Flight testing was conducted from 2008 to 2010, when the program transitioned to USAF. 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.

#### EXTANT VARIANT(S)

- GBU-57B. GPS guided 30,000-lb penetrating weapon.

**Function:** Massive PGM.

**Guidance:** GPS.

**Warhead:** 5,300-lb HE.

**Dimensions:** length 20.5 ft, diameter 31.5 in.

## SATELLITE SYSTEMS

### ■ ADVANCED EXTREMELY HIGH FREQUENCY (AEHF) SATELLITE SYSTEM

**Mission brief:** Global, secure, protected, and jam-resistant military communication.

#### COMMENTARY

AEHF is replacing existing Milstar satellites and operates at a much higher capacity and data rate. It offers secure, anti-jam tactical and strategic communications around the world. AEHF uses cross-linked satellites, eliminating the need for ground relay stations. The program is a collaboration with Canada, the Netherlands, and the United Kingdom. The AEHF system achieved IOC in 2015. Launch of SV-4 was slated for Oct. 17, 2017, but an issue with the system's power regulator prompted USAF to delay launch to 2018 to enable a hardware fix. Launch of SV-4 will pave the way for full operational capability.

#### EXTANT SYSTEMS

- AEHF SV-1. Launched in 2010, on orbit and operational.

- AEHF SV-2. Launched in 2012, on orbit and operational.
- AEHF SV-3. Launched in 2013, on orbit and operational.
- AEHF SV-4. Planned for launch in 2018.

**Function:** Communications.

**Operator:** AFSPC.

**First Launch:** August 2010.

**IOC:** 2017 (planned).

**Constellation:** Four.

**Design Life:** 14 yr.

**Launch Vehicle:** Atlas V.

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Power:** Solar arrays generating 20,000 watts.

**Dimensions:** Length 31 ft, width 98 ft (with full solar array extension).

**Weight:** 13,400 lb.

**Performance:** 24-hr low, medium, and extended data rate connectivity from 65 north to 65 south latitude worldwide.

### ■ DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)

**Mission brief:** Environmental data collection for worldwide, military weather forecasting.

#### COMMENTARY

DMSP provides timely and high-quality weather information to strategic and tactical combat units worldwide. It uses operational linescan sensor to image cloud cover in visible and thermal IR and analyze cloud patterns. It is equipped with microwave imagers and sounders and a suite of space environment sensors that provide critical land, sea, and space environment data. Block 5D-3 improved spacecraft bus and 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.

#### EXTANT VARIANT(S)

- Block 5D-2. Launched 1982 to 1997; one active (DMSP-14).

- Block 5D-3. Improved spacecraft bus and sensors for longer, more capable missions.

**Function:** Space and Earth environmental data collection.

**Operator:** National Oceanic and Atmospheric Administration (NOAA).

**First Launch:** May 23, 1962.

**IOC:** 1965.

**Constellation:** Six low Earth orbit (LEO).

**Design Life:** Five yr (Block 5D-3).

**Launch Vehicle:** Delta IV; Atlas V.

**Operational Location:** NOAA Satellite Operations Facility, Suitland, Md.

**Orbit Altitude:** Approx 527 miles.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Power:** Solar arrays generating 1,200-1,300 watts.

**Dimensions:** Length 25 ft (with array deployed), width 4 ft.

**Weight:** 2,545 lb, incl 772-lb sensor; 2,270 lb with 592-lb sensor payload.

**Performance:** Polar orbits; covers Earth in about 6 hr; primary sensor scans 1,800-mile-wide area.

### ■ DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS)

**Mission brief:** Long-haul, high-data rate, secure, nuclear-hardened, jam-resistant military communication.

#### COMMENTARY

DSCS provides high-priority wartime and strategic SHF communications between high-level leadership and deployed forces and ships worldwide. 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.

#### EXTANT VARIANT(S)

- DSCS III. Current base on orbit variant.

- DSCS III. SLEP. Upgrade configuration of last four satellites launched.

**Function:** Communications.

**Operator:** AFSPC.

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

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

**Constellation:** Five (III); 14 deployed/seven operational.

**Design Life:** 10 yr (III).

**Launch Vehicle:** Atlas II and EELV.

**Operational Location:** Schriever AFB, Colo.

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

**Contractor:** Lockheed Martin.



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

**Dimensions:** Rectangular body 6 x 6 x 7 ft, 38-ft span with solar arrays deployed.

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

**Performance:** Employs six independent SHF transponder channels for secure voice and high-rate data communications.

#### ■ DEFENSE SUPPORT PROGRAM (DSP)

**Mission brief:** Ballistic missile early warning.

#### COMMENTARY

DSP is a key part of North American and theater early warning systems. It is capable of detecting missile launches and nuclear detonations and was originally aimed at the Soviet military. It was used extensively in 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.

#### EXTANT VARIANT(S)

- Block 5. Most current on-orbit version.

**Function:** Strategic and tactical launch detection.

**Operator:** AFSPC.

**First Launch:** November 1970.

**IOC:** Circa 1972.

**Constellation:** Classified.

**Design Life:** Three-year requirement and five-year goal.

**Launch Vehicle:** Titan IV with inertial upper stage; Delta IV Heavy EELV.

**Operational Location:** Buckley AFB, Colo.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Contractor:** Northrop Grumman (formerly TRW), Aerojet.

**Power:** Solar arrays generating 1,485 watts.

**Dimensions:** Diameter 22 ft, height 32.8 ft, with solar paddles deployed.

**Weight:** Approx 5,200 lb.

**Performance:** Uses IR sensors to sense heat from missile and booster plumes against Earth's background.

#### ■ GEOSYNCHRONOUS SPACE SITUATIONAL AWARENESS PROGRAM (GSSAP)

**Mission brief:** Space-based tracking and characterization of manmade objects in geosynchronous orbit to aid safety and avoidance.

#### COMMENTARY

GSSAPs are "neighborhood watch" satellites that augment the legacy Space Based Space Surveillance (SBSS) system. SBSS tracks and classifies manmade objects in low Earth orbit, and GSSAP extends this coverage to geosynchronous orbit. Two GSSAP satellites were launched in 2014 and attained IOC 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 future launch. The satellites operate in near-geosynchronous orbit to effectively monitor objects and aid in preventing collisions in space. GSSAP carry EO/IR sensors

and are able to maneuver to observe objects at close range and can track objects without the weather and atmospheric disruptions affecting ground systems.

#### EXTANT VARIANT(S)

- GSSAP 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.

**Operator:** AFSPC.

**First Launch:** July 28, 2014.

**IOC:** Sept. 29, 2015.

**Constellation:** Four spacecraft.

**Launch Vehicle:** Delta IV.

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** 22,300 miles, above geosynchronous.

**Contractor:** Orbital ATK.

**Power:** Solar panels.

#### ■ GLOBAL POSITIONING SYSTEM (GPS)

**Mission brief:** Space-based radio-positioning for geolocation, navigation, and timing.

#### COMMENTARY

GPS is a fundamental contribution to precision bombing, CSAR, mapping, and rendezvous. It provides accurate and uninterrupted 3-D (latitude, longitude, and altitude) position, velocity, and time data. GPS is a military system, but provides service to civil users as well. 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 deployed since 2010 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. The first launch was pushed back from 2014 to a tentative 2018 target. 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.

#### EXTANT VARIANT(S)

- GPS Block IIR. Launched 1997 to 2004; 12 active.

- GPS Block IIR-M. Launched in 2005 to 2009; seven active.

- GPS Block IIF. Launched in 2010 to 2016; 12 active.

- GPS Block IIIA. Future generation expected to launch in 2018.

**Function:** Worldwide navigation, timing, and velocity data.

**Operator:** AFSPC.

**First Launch:** Feb. 22, 1978.

**IOC:** Dec. 9, 1993.

**Constellation:** 31 spacecraft (not including decommissioned or on-orbit spares).

**Design Life:** 7.5 yr (II/IIA); 7.5 yr (IIR/IIR-M); 12 yr (IIF); 15 yr (IIIA).

**Launch Vehicle:** Delta II, Delta IV, Falcon 9 (planned).

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** 10,988 miles.

**Contractor:** Boeing (II, IIA, IIF), Lockheed Martin (IIR, IIR-M, IIIA).

**Power:** Solar panels generating 700 watts (II/IIA); 1,136 watts (IIR/IIR-M); up to 2,900 watts (IIF).

**Dimensions:** (IIR/IIR-M) 5 x 6.3 x 6.25 ft, span incl solar panels 38 ft; (IIF) 9.6 x 6.5 x 12.9 ft, span incl solar panels 43.1 ft.

**Weight:** On orbit, 2,370 lb (IIR/IIR-M); 3,439 lb (IIF).

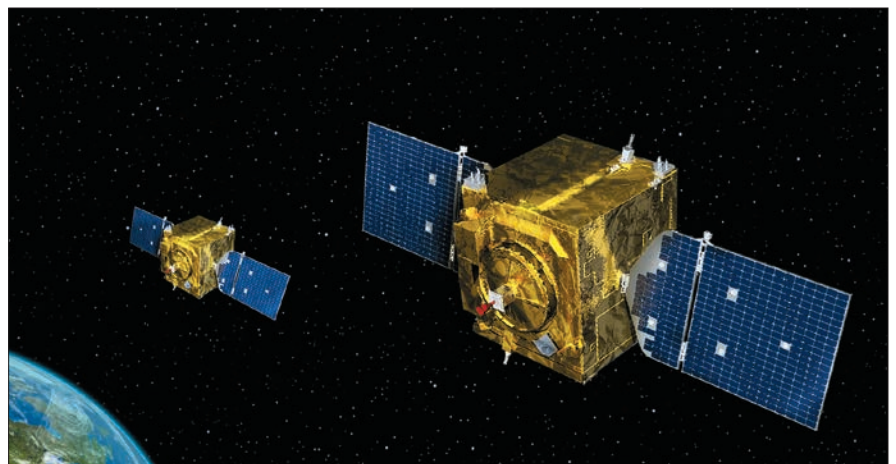
**Performance:** Orbits the Earth every 12 hr, emitting continuous signals, providing time to within one-millionth of a second, velocity within a fraction of a mile per hour, and location to within a few feet.

#### ■ MILSTAR SATELLITE COMMUNICATIONS SYSTEM (MILSTAR)

**Mission brief:** Global, satellite-based secure, protected, and jam-resistant military communications.

#### COMMENTARY

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



Geosynchronous Space Situational Awareness Program

USAF illustration

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 utilizes multiple-redundant command and control for highly survivable capability. 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.

#### EXTANT VARIANT(S)

- Block I. Milstar I satellites launched 1994-95.
- Block II. Milstar II satellites launched 1999-2003.

**Function:** Communications.

**Operator:** AFSPC.

**First Launch:** Feb. 7, 1994.

**IOC:** July 1997 (Milstar I).

**Constellation:** Five: two Milstar I; three Milstar II.

**Design Life:** 10 yr.

**Launch Vehicle:** Titan IV/Centaur.

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Contractor:** Lockheed Martin, Boeing, Northrop Grumman (formerly TRW).

**Power:** Solar arrays generating 8,000 watts.

**Dimensions:** Length 51 ft, width 116 ft with full solar array extension.

**Weight:** 10,000 lb.

**Performance:** Milstar I sats have low data rate (LDR) payload, transmitting 75 to 2,500 bps of data over 192 channels in EHF range; Milstar II sats have both LDR and medium data rate (MDR) payloads, transmitting 4,800 bps to 1.5 Mbps over 32 channels.

#### ■ SPACE BASED INFRARED SYSTEM (SBIRS)

**Mission brief:** Advanced space surveillance and missile warning, battlespace characterization, and technical intelligence gathering.

#### COMMENTARY

SBIRS is the follow-on to the Defense Support Program satellite. The system includes IR sensor payloads on host satellites in highly elliptical orbit (HEO), two IR sensors each on dedicated satellites in geosynchronous Earth orbit (GEO), and ground assets. HEO sensor detects launch of submarine-launched ballistic

missiles (SLBMs) from the North Pole region and can be tasked for other IR detection missions. GEO scanning IR sensor performs the strategic missile warning mission, global technical intelligence, and initial phase for the strategic missile defense mission, providing two times the revisit rate and three times the sensitivity of DSP. USAF announced plans to allow civil use of SBIRS data to aid weather prediction, Arctic ice monitoring, and wildfire tracking. GEO-3 launched into orbit Jan. 20, 2017, after delays to validate the performance of its liquid apogee engine. GEO-4 launched on Jan. 19, 2018. The next two GEO satellites are under contract and will eventually replace the oldest two on orbit. USAF announced plans to shift funding from SBIRS to developing the Evolved Space Based Infrared Systems (E-SBIRS) after the launch of both vehicles.

#### EXTANT SYSTEM(S)

- 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.

**Function:** Space surveillance.

**Operator:** AFSPC.

**First Launch:** GEO 1, May 2011.

**IOC:** HEO1, Dec. 5, 2008. (Increment 1, Dec. 8, 2001).

**Constellation:** Four GEO sats, three HEO sensors (hosted).

**Design Life:** N/A.

**Launch Vehicle:** GEO, Atlas V.

**Operational Location:** Buckley AFB, Colo.

**Orbit Altitude:** Geosynchronous and high elliptical.

**Contractor:** Lockheed Martin, Northrop Grumman.

**Power:** Solar array, 2,435 watts (GEO).

**Dimensions:** GEO 7 x 6.3 x 19.7 ft.

**Weight:** 5,603 lb (GEO on orbit).

#### ■ SPACE BASED SPACE SURVEILLANCE (SBSS)

**Mission brief:** Space-based tracking, characterization, and measurement of orbital vehicles and debris.

#### COMMENTARY

SBSS is designed to track and collect optical signatures of Earth-orbiting objects, including space debris, from a space-based platform. 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.

#### EXTANT SYSTEM(S)

- SBSS Block 10. Launched in 2010; active.
- ORS-5. Experimental satellite launched in 2017 to augment SBSS; active.

**Function:** Orbital surveillance and object identification.

**Operator:** AFSPC.

**First Launch:** Sept. 25, 2010.

**IOC:** Aug. 17, 2012.

**Constellation:** One LEO satellite; one LEO augmentation satellite.

**Design Life:** Seven yr.

**Launch Vehicle:** Minotaur IV.

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** 390 miles, sun-synchronous orbit.

**Contractor:** Boeing (system integration, ground segment, operations, and sustainment), Ball Aerospace (satellite).

**Power:** Solar arrays and batteries generating 750 watts.

**Dimensions:** Height approx 10 ft; 10 x 3.2 ft, plus solar panels.

**Weight:** Approx 2,273 lb.

#### ■ WIDEBAND GLOBAL SATCOM (WGS) SATELLITE

**Mission brief:** High-capacity satellite-based communications for deployed air, land, and sea forces.

#### COMMENTARY

WGS is designed to provide worldwide communications coverage for tactical and fixed users and to augment and then replace DSCS X-band frequency service. Augments the one-way Global Broadcast Service Joint Program Ka-band frequency capabilities. WGS satellites also provide a new high-capacity two-way Ka-band frequency service. Block I includes: SV-1 (Pacific region), SV-2 (Middle East), and SV-3 (Europe and Africa). Block II satellites are modified to better support the airborne ISR mission and include: SV-4 (Indian Ocean) and SV-5 and SV-6, purchased by Australia in 2013. The US is partnering with Canada, Denmark, Luxembourg, the Netherlands, and New Zealand on Block II follow-on sats SV-7 to SV-10. SV-7 launched in 2015. SV-8 launched into orbit on Dec. 7, 2016, and SV-9 launched March 18, 2017. All four satellites are expected to be aloft and operational by 2019. USAF recently contracted industry to develop



Space Based Infrared System

Lockheed Martin illustration

anti-jamming capability for tactical users and is reviewing alternatives to eventually replenish the constellation with three additional satellites or develop a follow-on system.

**EXTANT VARIANT(S)**

- Block I. Satellites SV-1 to SV-3; launched 2007 to 2009; active.
- Block II. Satellites SV-4 to SV-9; launched 2009 to 2017; active.

**Function:** Communications.

**Operator:** AFSPC.

**First Launch:** October 2007.

**IOC:** April 16, 2008.

**Constellation:** Seven satellites.

**Design Life:** 14 yr.

**Launch Vehicle:** Atlas V, Delta IV.

**Operational Location:** Schriever AFB, Colo.

**Orbit Altitude:** Geosynchronous at 22,000+ miles.

**Contractor:** Boeing.

**Power:** Solar arrays generating 9,934 watts.

**Dimensions:** Based on Boeing 702 Bus.

**Weight:** 13,000 lb at launch.

**Performance:** Approx 10 times the capability of a DSCS satellite.

■ **X-37B ORBITAL TEST VEHICLE**

**Mission brief:** Reusable, unmanned, launch/reentry space platform.

**COMMENTARY**

X-37B is an experimental Orbital Test Vehicle (OTV) aimed at developing and maturing a reusable space-launch capability and conducting classified 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. X-37B is the first reusable orbiter since the Space Shuttle program and is capable of much longer missions because it is unmanned. 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) blasted off in 2010 lasting 224 days. The OTV-2 and OTV-3 missions launched in 2011 and 2012, extending X-37's record time on orbit to 468 days and 674 days, respectively. The most recent OTV-4 mission remained aloft for 718 days and made the craft's first landing back at Cape Canaveral on March 25, 2017.

**EXTANT VARIANT(S)**

- X-37A. NASA-developed Approach and Landing Test Vehicle used for atmospheric drop testing.
- X-37B. DARPA/USAF-developed Orbital Test Vehicles.

**Function:** Orbital test.

**Operator:** AFSPC.

**First Launch:** April 22, 2010.

**IOC:** N/A.



**X-37B Orbital Test Vehicle**

DOD/ULA

**Launch Vehicle:** Atlas V.

**Production:** Two.

**Inventory:** Two.

**Operational Location:** Cape Canaveral AFS, Fla. (launch/landing); Vandenberg AFB, Calif. (landing).

**Orbit Altitude:** Low-Earth Orbit (LEO) at 110-500 miles.

**Contractor:** Boeing.

**Propulsion:** Single liquid-propellant rocket motor.

**Power:** Gallium arsenide solar cells with lithium-ion batteries.

**Dimensions:** Span 14 ft, length 29.25 ft, height 9.5 ft.

**Weight:** 11,000 lb at launch.

**Endurance:** 718+ days on orbit.

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**A Wideband Global SATCOM satellite atop a ULA Delta IV rocket**

ULA