

★ USAF & USSF ALMANAC 2021 WEAPONS & PLATFORMS

By Aaron M. U. Church



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BOMBER AIRCRAFT



Senior Airman Tristian Day



Staff Sgt. Sadie Colbert

B-1B LANCER

Long-range conventional bomber

Brief: The B-1B is a conventional, long-range, supersonic penetrating strike aircraft, derived from the canceled B-1A. The B-1A first flew on Dec. 23, 1974, and four prototypes were developed and tested before the program was canceled in 1977. The Reagan administration revived the program as the B-1B in 1981, adding 74,000 lb of usable payload, improved radar, and reduced radar cross section, although speed was reduced to Mach 1.2. Its three internal weapons bays can each carry different weapons, and the aircraft's blended wing/body and variable-geometry wing permit long-range/loiter time. Offensive avionics include terrain following SAR and a fully-integrated Sniper ATP to track and target moving vehicles. B-1B made its combat debut over Iraq during Desert Fox in 1998. USAF completed Integrated Battle Station (IBS) upgrades fleetwide in September 2020. The three-part program begun in 2012 was the most comprehensive refresh in the bomber's history. IBS included Vertical Situation Display (VSD) for a digital glass cockpit, Fully Integrated Data Link (FIDL) to enhance targeting/LOS/BLOS C2, and Central Integrated Test System (CITS) for real-time simplified troubleshooting. A total of 62 aircraft were upgraded. Development includes Multifunctional Information Distribution System/ Joint Tactical Radio System (MIDS/JTRS) to improve situational awareness and retargeting abilities, updated BLOS cryptography to sustain connectivity, and bomb rack safety improvements. FY21 continues accelerated ADS-B/Mode 5 IFF mod to bring the fleet into compliance with current airspace standards by 2022. Structural and reliability issues due to prolonged combat CAS resulted in the stand-up of a depot-level Structural Repair Line in 2020, and shifting the fleet to a strike-only role. Efforts are underway to expand weapon carriage via internal bay expansion and external hardpoints, potentially enabling carriage of large hypersonic or multiple 5,000 lb-class freefall weapons. Phased replacement by the B-21 is planned by 2032, and FY21 cuts 17 of the least serviceable airframes, four of which will be stored in recallable condition.

Contractor: Boeing (formerly Rockwell International).

First Flight: Oct. 18, 1984 (B-1B).

Delivered: June 1985-May 1988.

IOC: Oct. 1, 1986, Dyess AFB, Texas.

Production: 104.

Inventory: 62.

Operator: AFGSC, AFMC.

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

Active Variant:

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

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

Weight: Max T-O 477,000 lb.

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

Performance: Speed 900+ mph at S-L, range approx. 7,455 miles (further with air refueling).

Ceiling: More than 30,000 ft.

Armament: 84 Mk 82 (500-lb) or 24 Mk 84 (2,000-lb) general-purpose bombs; 84 Mk 62 (500-lb) or eight Mk 65 (2,000-lb) Quickstrike 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, JASSM-ER, or LRASM.

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

B-2 SPIRIT

Long-range heavy bomber

Brief: The B-2 is a stealthy, long-range, penetrating nuclear and conventional strike bomber. It is based on a flying wing design combining LO with high aerodynamic efficiency. The aircraft's blended fuselage/wing holds two weapons bays capable of carrying nearly 60,000 lb in various combinations. Spirit entered combat during Allied Force on March 24, 1999, striking Serbian targets. Production was completed in three blocks, and all aircraft were upgraded to Block 30 standard with AESA radar. Production was limited to 21 aircraft due to cost, and a single B-2 was subsequently lost in a crash at Andersen, Feb. 23, 2008. Ongoing research and development aims to significantly modernize the B-2A to maintain its penetrating strike capability against advanced air defenses and improve fleet availability. Modernization includes avionics and comms, engines, stealth features, and advanced weapons. Adaptable Communications Suite (ACS) will provide time-sensitive mission updates and Link 16-based, jam-resistant, in-flight retasking, while FAB-T will add wideband nuclear C2, and airspace-compliant CNS/ATM. The Defensive Management System upgrade was downsized cutting EW sensors to detect ground threats due to delays. DMS-M improves survivability in signal-dense, anti-access/area denial (A2/D2) environments, aids situational awareness, and enables real-time threat avoidance. RATS will add radar-aided nuclear precision guidance for GPS-denied strike. Additional efforts include low-observable signature improvements to coatings, materials, and radar-absorptive structures such as the radome and engine inlets/exhausts. Flex Strike will feed GPS data to the bays pre-release to thwart jamming (required for B61-12) and a notional Phase 2 could allow simultaneous nuclear and conventional loadout. Other weapons efforts increase loadout, improve hardened/buried target strike, as well as testing and integrating B61-12 guided nuclear bomb, JASSM-ER, GBU-57 Massive Ordnance Penetrator, and eventually GBU-53 SDB II. A total of 12 aircraft are considered deployed in the nuclear deterrent role under the New START agreement. The B-2 is slated for replacement by the B-21 Raider by 2032.

Contractors: Northrop Grumman; Boeing; Vought.

First Flight: July 17, 1989.

Delivered: December 1993-December 1997.

IOC: April 1997, Whiteman AFB, Mo.

Production: 21.

Inventory: 20.

Operator: AFGSC, AFMC, ANG (associate).

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

Active Variant:

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

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

Weight: Max T-O 336,500 lb.

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

Performance: Speed high subsonic, range 6,900 miles (further with air refueling).

Ceiling: 50,000 ft.

Armament: Nuclear: 16 B61-7, B61-12, B83, or eight B61-11 bombs (on rotary launchers). Conventional: 80 Mk 62 (500-lb) sea mines, 80 Mk 82 (500-lb) bombs, 80 GBU-38 JDAMs, or 34 CBU-87/89 munitions (on rack assemblies); or 16 GBU-31 JDAMs, 16 Mk 84 (2,000-lb) bombs, 16 AGM-154 JSOWs, 16 AGM-158 JASSMs, or eight GBU-28 LGBs.

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



Senior Airman Tessa B. Corrick

B-52 STRATOFORTRESS

Long-range heavy bomber

Brief: The B-52H is a long-range nuclear/conventional bomber and USAF's primary standoff cruise missile carrier. The YB-52 prototype first flew on April 15, 1952, and Strategic Air Command declared IOC with the B-52A on June 19, 1955. The H model is now the last serving variant of the Stratofortress. Multimission capabilities include long-range precision strike, CAS, air interdiction, defense suppression, and maritime surveillance utilizing both Litening and Sniper targeting pods. The B-52 is undergoing major upgrades to replace key obsolescent systems. Combat Network Communications Technology (CONNECT) replaces cockpit displays and comms, adds Link 16, and enabling machine-to-machine tasking/retargeting. The Internal Weapons Bay Upgrade enables internal carriage of smart weapons, with the Conventional Rotary Launcher roughly doubling advanced weapon payloads, reducing drag, and increasing range. CRL transitions from CALCM to the AGM-158B JASSM-ER long-range cruise

missile. Some 31 B-52s were modified to prevent their nuclear use under the New START agreement, and a total of 36 aircraft are currently "deployed" nuclear platforms under the treaty. Major development includes AESA radar, and replacing the TF33 engines with a more modern and efficient power plant. Future upgrades include VLF/LF receiver modernization, ATP color MFDs to enhance targeting and situational awareness, and AEHF SATCOM integration. Ongoing mods include Tactical Data Link to add low-latency, jam-resistant C2/comms in conjunction with CONECT, and GPS updates. USAF expects to award an engine replacement contract in June 2021, and both CONECT and weapons bay upgrades are slated for completion this year. AESA radar is slated for introduction in 2026. Upgraded B-52 will eventually complement the B-21 Raider after retirement of the B-1 and B-2, potentially serving into the 2050s.

Contractor: Boeing.

First Flight: July 20, 1960 (B-52H).

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

IOC: May 1961 (B-52H).

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

Inventory: 76.

Operator: AFGSC, AFMC, AFRC.

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

Active Variants:

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

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

Weight: Max T-O 488,000 lb.

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

Performance: Speed 650 mph, range 8,800 miles (further with air refueling).

Ceiling: 50,000 ft.

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

Conventional: AGM-86C/D CALCMs, Mk 62 sea mines, Mk 82/84 bombs, CBU-87/89 cluster bombs, CBU-103/104/105 WCMDs, GBU-31/38 JDAMs, AGM-158A JASSMs, and GBU-10/12/28 LGBs, MALD, and MALD-J jammer variant.

Accommodation: Two pilots, navigator, radar navigator, and EWO on upward/downward ejection seats.

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FIGHTER & ATTACK AIRCRAFT



Ethan Wagner/USAF



Staff Sgt. Sergio Gamboa

AT-6 WOLVERINE

Light attack/armed reconnaissance

Brief: The AT-6E is a turboprop light attack/armed reconnaissance aircraft developed from the T-6 primary trainer. Wolverine incorporates the A-10C's mission computer, the F-16's Hands-On-Throttle Stick, HMCS, and a digital glass cockpit with three color MFDs for integrated navigation, sensor, and weapon's management/delivery. The aircraft can carry a wide array of air-to-ground weapons on six wing pylons in addition to a centerline-mounted MX-15D EO/IR sensor for targeting and tactical ISR. The AT-6 is equipped with LINK-16/SADL data links, real-time FMV/ROVER for integration with ground forces, and tactical VHF/UHF/SATCOMS. The type was originally proposed for USAF's Light Attack/Armed Reconnaissance (LAAR) requirement which fell prey to budget cuts a decade ago. The service launched a renewed effort in 2017, kicking off the Light Attack Experiment (OA-X) which evaluated rapidly procurable off-the-shelf CAS/ISR platforms to relieve pressure on existing fleets. USAF opted to procure two AT-6 Wolverines (in addition to an equal number of AFSOC A-29 Super Tucanos) to continue experimentation with a rapidly procurable, exportable, light CAS/ISR aircraft following the end of phase two trials in 2018. The AT-6s will continue that effort, moving to Nellis to develop secure-tactical networking for U.S./partner-nation COIN integration dubbed "AEROnet." The first aircraft was handed over to USAF on Feb. 17, for joint-industry/USAF airworthiness certification and testing with Beechcraft in Wichita.

Contractor: Beechcraft/Textron Aviation Defense (formerly Raytheon); Lockheed Martin (mission systems), Esterline (glass cockpit), L3/Harris (sensors).

First Flight: Sep. 10, 2009 (AT-6).

Delivered: Feb. 17, 2021-present.

IOC: N/A.

Production: Three (planned).

Inventory: N/a.

Operator: ACC.

Aircraft Location: Wichita, Kan. Planned: Nellis.

Active Variants:

•AT-6E Wolverine. Light attack/armed reconnaissance variant of the T-6A.

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

Weight: Max T-O 10,000 lb.

Power Plant: One Pratt & Whitney Canada PT6A-68D turboprop 1,600 shp.

Performance: Speed 360 mph, range 1,700 miles (with four external tanks), mission endurance 4.5 hr (7.5 hr ferry).

Ceiling: 31,000 ft.

Armament: Wide-array of laser/inertial-guided PGMs as well as laser-guided rockets (APKWS), AGM-114 Hellfire, and/or .50 cal gun on six wing-mounted hardpoints.

Accommodation: Two pilots on Martin Baker MK16LA zero/zero ejection seats.

A-10 THUNDERBOLT II

Attack, close-air support, forward air control

Brief: The A-10 "Warthog" is a specialized CAS aircraft tasked with interdiction, Forward Air Controller-Airborne (FAC-A), CSAR, and Strike Control & Reconnaissance. It combines a heavy, diverse weapons load with low-level maneuverability, a large combat radius, and long loiter time over the battlefield. The A-10 is capable of carrying up to 16,000 lb of ordnance in addition to its 30 mm cannon which can destroy heavy armor while protecting the pilot in a titanium-armored cockpit. The prototype YA-10A first flew on May 10, 1972, winning USAF's A-X competition for a new attack aircraft. The A-10A development aircraft first flew Feb. 15, 1975, and A-10As

were delivered between October 1975 and March 1984. USAF declared IOC in October 1977. The fleet was modernized under the Precision Engagement Program, resulting in the A-10C which first flew at Eglin in 2005. The A-10C adds color cockpit MFDs, a Helmet Mounted Cueing System (HMCS), hands-on throttle and stick, digital stores management, improved fire-control, GPS-guided weapons, Litening/Sniper pods, advanced data links, and integrated sensors. The A-10C debuted in combat during Iraqi Freedom in 2007. With NVGs and targeting pods, the A-10C can operate under 1,000-ft ceilings at night. The Operational Flight Program (OFP) continuously updates the A-10's software to integrate advanced weapons and add situational awareness, targeting, navigation, comms, and cyber security improvements. Ongoing mods include HMCS improvements, cockpit display replacement to eliminate analog instruments and add hi-resolution target tracking, SDB-1 integration, directional audio threat cueing, ARC-210 UHF/VHF comm modernization, and Ethernet to enable EW upgrades. An initial 173 aircraft were re-winged, and Boeing received a follow-on contract to re-wing up to 112 additional aircraft through FY30. USAF plans to retain the fleet through 2030 or beyond, and Congress denied the Air Force's request to retire 44 airframes in FY21.

Contractors: Fairchild Republic (Lockheed Martin); Boeing (re-wing).

First Flight: Jan. 20, 2005 (A-10C).

Delivered: 2006-2012 (A-10C).

IOC: September 2007 (A-10C).

Production: 713.

Inventory: 281.

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

Aircraft Location: Barksdale AFB, La.; Boise Air Terminal, Idaho; Davis-Monthan AFB, Ariz.; Eglin AFB, Fla.; Fort Wayne Arpt., Ind.; Martin State Arpt., Md.; Moody AFB, Ga.; Nellis AFB, Nev.; Osan AB, South Korea; Selfridge ANG, Mich.; Whiteman AFB, Mo.

Active Variant:

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

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

Weight: Max T-O 51,000 lb.

Power Plant: Two GE Aviation TF34-GE-100 turboprops, each 9,065 lb thrust.

Performance: Speed 518 mph, range 800 miles (further with air refueling).

Ceiling: 45,000 ft.

Armament: One internally mounted 30 mm, seven-barrel GAU-8/A cannon (1,174 rd of high-explosive incendiary (HEI) or HEI/armor-piercing incendiary); four AIM-9 Sidewinders, AGM-65 Mavericks, laser-guided rockets, most free-fall or guided air-to-surface weapons in USAF inventory, and ECM pods.

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

F-15 EAGLE

Air superiority fighter

Brief: The F-15 Eagle has been the world's dominant, supersonic, all-weather, day/night air-superiority fighter for more than 40 years. The F-15A first flew on July 27, 1972, and F-15A/Bs were delivered between 1974 and 1979, attaining IOC in September 1975. F-15C/Ds began replacing F-15A/Bs in 1979, offering superior maneuverability, acceleration, range, weapons, and avionics. The C/D incorporates internal EW countermeasures and an added 2,000 lb of internal fuel (with provision for CFTs). The aircraft accounted for 34 of 37 USAF air-to-air kills during its combat debut in Desert Storm. The final 43 production aircraft received the F-15E's APG-70 radar, and the subsequent Multistage Improvement Program enhanced its tactical capabilities. USAF received the first APG-63(V)3 AESA-modified F-15 in 2010, but comprehensive modernization, including Eagle Passive/Active Warning Survivability System (EPAWSS), was curtailed with the FY20 decision to replace the fleet with up to 144 new-build F-15EXs. The fleet averages 8,400 flying hours and suffers performance-limiting structural problems requiring wing/forward fuselage SLEP of 128 airframes



Senior Airman Matthew Seefeldt

through FY24. DOD European Deterrence Initiative funds continue to retain F-15C/Ds at Lakenheath to augment allied air superiority due to tensions with Russia.

Contractors: Boeing (previously McDonnell Douglas).

First Flight: Feb. 26, 1979 (F-15C).

Delivered: 1979-85 (F-15C/D).

IOC: 1979 (F-15C/D).

Production: 874.

Inventory: 211 (F-15C); 23 (F-15D).

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

Aircraft Location: Barnes Arpt., Mass.; Eglin AFB, Fla.; Fresno ANGB, Calif.; Jacksonville Arpt., Fla.; Kadena AB, Japan; Klamath Falls (Kingsley Field), Ore.; NAS JRB New Orleans, La.; Portland Arpt., Ore.; RAF Lakenheath, U.K.

Active Variants:

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

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

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

Weight: Max T-O 68,000 lb.

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

Performance: Speed Mach 2.5, ferry range 2,878 miles (3,450 miles with CFTs and three external tanks; further with air refueling).

Ceiling: 60,000 ft.

Armament: One internally mounted M61A1 20 mm six-barrel cannon (940 rd); four AIM-9 Sidewinders and four AIM-120 AMRAAMs, or eight AIM-120s; in a one-time test, an Eagle successfully launched an anti-satellite missile.

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



Tech. Sgt. Matthew Plew

F-15E STRIKE EAGLE

Multirole fighter

Brief: F-15E is an upgraded, two-seat, all-weather F-15 capable of deep interdiction/attack, tactical nuclear delivery, and air-to-air combat. Strike Eagle is capable of sustaining nine Gs throughout the flight envelope. It first saw combat in Desert Storm in 1991. F-15E's large, varied load of precision weapons and 20 mm cannon gives it potent ground-attack capability. Radar-guided and IR-homing missiles give it an additional air-to-air capability. Its advanced cockpit controls and displays include a wide-field-of-view HUD and helmet mounted cockpit-cueing, and its avionics permit all-weather day/night engagement. The F-15E carries LANTIRN, Sniper, and Litening ATPs on dedicated pylons. The "Dragon's Eye" SAR pod fielded in 2009 provides all-weather surveillance/reconnaissance capability. F-15Es are equipped with Link 16 and BLOS SATCOM. The Strike Eagle is undergoing major avionics modernization, centered on

the new APG-82(V)1 AESA radar slated for fleetwide install by FY24. Eagle Passive/Active Warning Survivability System (EPAWSS) is a second major effort to replace its obsolete self-defense suite. Software is continuously updated on a two-to-three-year cycle integrating new mission capabilities as part of the Operational Flight Program in tandem with the F-15C/D. Ongoing avionics upgrades include Suite 9 software, AESA electronic countermeasure protection, standardizing APG-82 radar configurations, MIDS/ JTRS to enable higher capacity, jam-resistant Link 16, and anti-jam UHF satcom. Future enhancements include AESA-compatible large-area digital displays for improved targeting and fratricide prevention, mountable IRST to discreetly engage air targets, and Data Transfer Module replacement to improve flight planning and debrief. F-15E became the first type certified to deliver the future B61-12 guided nuclear freefall bomb on June 8, 2020, as well as the GBU-53/B SDB II StormBreaker on Sept. 23, 2020.

Contractors: Boeing (previously McDonnell Douglas); BAE Systems (EPAWSS); Raytheon (AESA).

First Flight: Dec. 11, 1986.

Delivered: April 1988-2004.

IOC: September 1989.

Production: 236.

Inventory: 218.

Operator: ACC, AFMC, USAF.

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

Active Variant:

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

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

Weight: Max T-O 81,000 lb.

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

Performance: Speed Mach 2.5, range 2,762 miles with CFTs and three external tanks (further with air refueling).

Ceiling: 50,000 ft.

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

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



Tech. Sgt. John McNeil

F-15EX EAGLE II

Air superiority fighter

Brief: F-15EX is the most advanced Eagle variant based on the F-15QA as a replacement for the legacy F-15C/D. The Eagle II is the first USAF F-15 to boast digital fly-by-wire flight controls, Large Area Display (LAD) glass-cockpit, and incorporate APG-82 AESA radar, Joint Helmet Mounted Cueing System (JHMCS), and EPAWSS self-defensive suite from the outset. The aircraft pioneers Open Mission System (OMS) software to enable rapid upgrades and capability enhancement, as well as the latest Suite 9.1 software in common with upgraded legacy aircraft. F-15EX promises higher speed, longer range, increased payload (including two additional weapon stations), and lower operating costs than previous variants. Due to insufficient F-22 procurement, the F-15C/D fleet has continued flying beyond its designed service life, posing a serious risk of structural failure. Similar infrastructure, support, and training requirements will permit existing F-15 units to quickly transition to the F-15EX. The F-15EX incorporates two-seats enabling future crew/mission expansion. FY21 efforts focus on integrating F-15EX-unique software into the next Suite 9.2 build, ramping up production capability, preparing the two initial aircraft for flight testing, and continuing capability enhancement such as passive IRST targeting for highly contested engagements. USAF awarded Boeing a \$1.2 billion contract for the first eight of up to 144 new-build F-15EX on July 13, 2020,

and FY21 funds procure an additional 12 aircraft. Two aircraft are slated for delivery in FY21, followed by six more in 2023, and upwards of 76 over the next five years. Aircraft serial number 20-0001 made the type's first flight from St. Louis Lambert Intl. Airport on Feb. 2 and was delivered to Eglin Mar. 11. The first jet will conduct accelerated developmental testing with AFMC while the second will fly operational tests with ACC.

Contractors: Boeing; BAE Systems (EPAWSS); Raytheon (AESA).

First Flight: Feb. 2, 2021.

Delivered: Mar. 11, 2021-present.

IOC: 2023 (planned).

Production: Two.

Inventory: N/A.

Operator: ACC, AFMC. Planned: ANG.

Aircraft Location: Eglin AFB, Fla. Planned: Klamath Falls (Kingsley Field) and Portland Arpt., Ore.

Active Variant:

•F-15EX. Future F-15C/D replacement based on the F-15QA developed for Qatar.

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

Weight: Max T-O 81,000 lb.

Power Plant: Two General Electric F100-PW-229 turbofans with afterburners, each 29,000 lb thrust.

Performance: Speed Mach 2.5, range approx. 2,762 miles (air refuelable).

Ceiling: 60,000 ft.

Armament: One internally mounted M61A1 20 mm six-barrel cannon (500 rd); combination of up to 12 AIM-9 Sidewinders or AIM-120 AMRAAMs, or combination of up to 24 air-to-ground munitions.

Accommodation: Pilot and (optional) second aircrew member on ACES 5 zero/zero ejection seats.



Senior Airman Mary Begy

F-16 FIGHTING FALCON

Multirole fighter

Brief: The F-16 is a lightweight, multirole fighter capable of air-to-air, CAS, SEAD, interdiction, FAC-A, tactical nuclear delivery and all-weather strike missions. The "Viper" makes up roughly half the fighter inventory, carries the majority of PGMs in service, and is one of the most maneuverable fighters ever built. The prototype YF-16 first flew Feb. 2, 1974, competing in the USAF Lightweight Fighter competition. After selection, F-16A flew on Dec. 8, 1976, followed by the two-seat F-16B on Aug. 8, 1977. Deliveries began in August 1978, and USAF declared F-16A IOC in October 1980. F-16C/D deliveries began at Block 25 in 1984, adding the APG-68 radar and AMRAAM missile as well as cockpit, airframe, and avionics improvements. Block 30/32 added the HARM missile and more powerful engines, and Block 40/42 introduced the terrain following LANTIRN pod and wide-angle HUD for high-speed night/all-weather penetration. These airframes boasted higher take-off weight and G-limits and an expanded flight envelope starting in 1988. Block 50/52 was introduced to replace the F-4G in the "Wild Weasel" SEAD-role mounting the HARM missile, longer-range radar, and even higher performance engines. The F-16 entered combat during Desert Storm in 1991 and scored its sole air-to-air kill during Southern Watch on Dec. 27, 1992. Most upgrades are managed in Pre-Block (Blocks 25-32) and Post-Block (Blocks 40-52) tranches. The fleet is now cockpit-standardized with color MFD, modular mission computer, Helmet Mounted Integrated Targeting (HMIT), and Link 16. The Operational Flight Program (OPF) continuously updates the F-16's software. Iteration 7.2+ debuted in 2020

introduced JASSM-ER and enhanced AMMRAM, as well as cockpit workload and weapon accuracy and lethality improvements. The fleet is undergoing significant combat system modernization centered on the new AN/APG-83 AESA radar. ANG alert aircraft pioneered full operational capability with AESA in 2020, following urgent efforts to combat cruise missile threats. A total of 330 Post-Block aircraft will be upgraded through FY25, and also receive digital RWR (as part of a notional, fully-integrated EW suite), as well as mission computer and cockpit display upgrades. Development is focused on these follow-on upgrades, as well as Automatic Ground Collision Avoidance System (A-GCAS) for Pre-Block aircraft. Ongoing mods also include SLEP, MIDS/JTRS for higher capacity, jam-resistant Link 16, Aggressor improvements, Mode 5 IFF, and A-GCAS.

Contractors: Lockheed Martin (previously General Dynamics); Northrop Grumman (AESA).

First Flight: June 19, 1984 (F-16C).

Delivered: July 13, 1984-2005 (F-16C/D).

IOC: 1981 (Block 25-32); 1989 (Block 40/42); 1994 (Block 50/52).

Production: 2,206.

Inventory: 781 (F-16C); 155 (F-16D).

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

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

Active Variants:

•F-16C/D Block 30/32. Multinational Staged Improvement Program II upgraded with new engines, flown by ANG, AFRC, and test/aggressor units.

•F-16CG Block 40/42. Optimized for night/all-weather attack.

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

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

Weight: Max T-O 37,500 lb (Block 30/32); 42,300 lb (Block 40/42); 48,000 lb (Block 50/52).

Power Plant: GE Aviation F110-GE-100, 29,000 lb thrust (Block 30); Pratt & Whitney F100-PW-220, 24,000 lb thrust (Block 32/42); F110-GE-129, 29,000 lb thrust (Block 50); F100-PW-229, 29,000 lb thrust (upgraded Block 42, Block 52).

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

Ceiling: 50,000 ft.

Armament: One M61A1 20 mm cannon (500 rd); up to six AIM-9 Sidewinder or AIM-120 AMRAAMs air-to-air missiles, most air-to-surface weapons in USAF inventory (nuclear and conventional).

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



Senior Airman Mary Begy

F-22 RAPTOR

Air superiority/multirole fighter

Brief: The F-22 is a stealthy, penetrating, air dominance, and multirole attack fighter built for day, night, and adverse weather, full-spectrum operations. The world's most advanced fighter, it combines stealth, supercruise, and high maneuverability. Its integrated avionics and data links permit simultaneous multitarget engagement. Advanced flight controls and thrust-vectoring, high-performance engines enable high maneuverability. Features include six LCD color cockpit displays, APG-77 AESA radar, EW system with RWR and missile launch detection, JTIDS, IFF, and INS/GPS navigation. The prototype YF-22 first flew as part of

USAF's Advanced Tactical Fighter competition on Sept. 29, 1990, followed by the flight of the first F-22 test aircraft in 1997. The Raptor flew its first operational sortie during Noble Eagle in 2006 and debuted in combat striking Islamic State ground targets during Inherent Resolve in 2014. The F-22 program uses an "agile" modernization strategy to rapidly and continuously develop, test, and field incremental improvements. Significant efforts include the Reliability, Availability, and Maintainability Program (RAMP), Software Increment 3.2B, and tactical capability improvements. RAMP is adding AIM-9X-capable launch rails, more durable LO, as well as structural and wiring fixes. 3.2B software is the highest priority update, adding high-resolution ground mapping SAR, threat geolocation, EA capability, and integration of SDB I, AIM-120D, and AIM-9X. Link-16 (previously TACLink-16) will bundle transmit and receive capability with legacy aircraft via Multifunctional Information Distribution System/Joint Tactical Radio System (MIDS/JTRS) with initial fielding in FY22. Five 3.2B-modified aircraft began operational testing in 2018, and fleetwide rollout is planned through FY23. A fielding decision on sensor upgrades to preserve "first-shot, first-kill" advantage against advanced threats will follow a flight demo, now planned for late FY21. Additional efforts include engine safety, performance, and maintainability mods, crypto mods, Mode 5 IFF tactical improvements, and GPS-denied navigation capability. USAF completed structural life-extension mods in 2020, pushing the fleet's projected service life to 8,000 hours. The service is now evaluating the possibility of a Mid-Life Upgrade Program to increase survivability and lethality. An F-22 was destroyed in a crash at the Eglin Test and Training Range on May 15, 2020.

Contractors: Lockheed Martin; Boeing (production partner).

First Flight: Sept. 7, 1997.

Delivered: Oct. 23, 2002-May 2, 2012.

IOC: Dec. 15, 2005.

Production: 195.

Inventory: 186.

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

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

Active Variant:

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

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

Weight: Max T-O 83,500 lb.

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

Performance: Speed Mach 2 with supercruise capability, ferry range 1,850+ miles with two external wing fuel tanks (further with air refueling).

Ceiling: Above 50,000 ft.

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

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

F-35 LIGHTNING II

Multirole fighter

Brief: The F-35 Lightning II is a multirole, stealthy, penetrating, all-weather fighter/attack family of tactical aircraft produced by the multinational Joint Strike Fighter program. USAF's conventional F-35A is complemented by the F-35B short takeoff and vertical landing (STOVL) version for USMC, and the carrier-capable F-35C for the Navy. The X-35 demonstrator first flew on Oct. 24, 2000, winning the go-ahead for the F-35A which first flew in developmental form in 2006. Lightning II is planned to replace the A-10 and F-16, offering better penetrating capability against advanced A2/AD threats to strike heavily defended targets. USAF's F-35A can carry up to 22,000 lb of weapons on 10 stations: two internal bays for stealth, and/or six wing and fuselage pylons for max loadout. An Israeli Air Force F-35I "Adir" drew first blood, hitting Iranian targets in Syria in May 2018, followed by USAF's initial combat deployment for Inherent Resolve in 2019. Development, production, and operations are pursued concurrently, requiring rolling retrofits to standardize the fleet. Block 3i software upgrades improved upon the baseline Block 2B software, adding 89 percent of the code needed for full-combat capability as a bridge to Block 3F. The current production/retrofit Block 3F software delivers full combat capability and adds a range of precision guided munitions. FY21 transitions to the next Block 4 iteration dubbed Continuous Capability Development and Delivery (C2D2). Block 4 will correct deficiencies discovered in concurrent development/testing and add B61-12 and SDB II weapons capability, sensors, improved EW, and maritime strike. USAF is holding to a lower delivery rate until Block 4 produc-



Airman First Class Zachary Rufus

tion to minimize retrofit costs. Fielded F-35As are capable of interdiction, basic CAS, and limited SEAD. FY21 funds procure 60 F-35As (including 12 congressionally added aircraft) and begins Block 4 and structural mods to upgrade capabilities of early production. Completion of operational testing has slipped to at least mid-2021, delaying full-rate production and cost-saving multiyear block buys. USAF also accepted eight jets ordered by Turkey after that country was expelled from the program, having potentially compromised the F-35's technical advantage by exposing its stealth secrets to Russia. F-35s suffered two landing accidents in 2020 including an excess-speed incident at Eglin, exacerbated by flight control software, helmet display, and oxygen system problems. The first two PACAF F-35s were delivered to Eielson on April 21, 2020.

Contractors: Lockheed Martin; BAE Systems; Northrop Grumman; Pratt & Whitney (engine).

First Flight: Dec. 15, 2006.

Delivered: April 2011-present.

IOC: Aug. 2, 2016.

Production: Planned: 1,763 (USAF F-35As).

Inventory: 239 (USAF).

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

Aircraft Location: Burlington ANGB, Vt.; Edwards AFB, Calif.; Eglin AFB, Fla.; Eielson AFB, Alaska; Hill AFB, Utah; Luke AFB, Ariz.; Nellis AFB, Nev. Planned: Dannelly Field, Ala.; RAF Lakenheath, U.K.; Truax Field, Wis.; Tyndall AFB, Fla.

Active Variants:

•F-35A. Conventional takeoff and landing (CTOL) variant for the Air Force.

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

Weight: Max T-O 70,000 lb.

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

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

Ceiling: 50,000 ft.

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

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



F-117 NIGHTHAWK

Attack

Brief: The F-117 was the world's first operational stealth aircraft, designed to expand USAF's ability to strike critical, heavily defended targets. Its small radar signature, LO technologies, and advanced targeting system allowed the aircraft to penetrate dense threat environments and deliver precision weapons against heavily defended, high-value targets with pinpoint accuracy. Primary missions included precision attack, air interdiction, SEAD, and special operations. The type was first publicly acknowledged in November 1988, and conducted its first operational deployment during Just Cause over Panama in 1989. Highly classified F-117A development and manufacture

Airman 1st Class John Strong II

began simultaneously in November 1978, using many parts transferred or modified from existing aircraft. The F-117As were first stationed at Tonopah Test Range in Nevada to conduct test flying before transferring operationally to Holloman in 1992. A single aircraft was shot down in combat over Serbia on March 27, 1999, and the F-117 fleet was officially retired on April 22, 2008. The remaining airframes entered climate-controlled storage at Tonopah, with several being maintained in flyable condition for the Air Force Flight Test Center. F-117s have recently reemerged, notably supporting several exercises in 2020 and operating more frequently and openly alongside Aggressor aircraft at Nellis and MCAS Miramar. USAF has acknowledged a need for more advanced, threat-representative training and recently reactivated the 65th Aggressor Squadron at Nellis with early F-35As to enhance fifth-generation combat training.

Contractors: Lockheed Martin.

First Flight: June 18, 1981.

Delivered: 1982-summer 1990.

IOC: October 1983.

Production: 59.

Inventory: N/A.

Operator: AFMC.

Aircraft Location: Tonopah Test Range, Nev.

Active Variants:

•F-117A. First-generation stealth attack aircraft.

Dimensions: span 43.3 ft, length 65.9 ft, height 12.4 ft.

Weight: max gross 52,500 lb.

Weight: Max T-O 70,000 lb.

Power Plant: two General Electric F404-GE-F1D2 nonafterburning turbojets, each 9,040 lb thrust.

Performance: Speed 0.9 Mach, mission radius unrefueled (5,000-lb weapons load) 656 miles.

Ceiling: 35,000 ft.

Armament: Full internal carriage of a variety of tactical weapons, incl laser- and GPS-guided 2,000-lb munitions.

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

SPECIAL OPERATIONS AIRCRAFT



Sierra Nevada Corp.

A-29 SUPER TUCANO

Light attack

Brief: The A-29 Super Tucano is a turboprop light attack/armed reconnaissance aircraft designed by Embraer in Brazil and built under license by Sierra Nevada Corp. USAF has long sought a cost-effective, manned light CAS/tactical ISR platform for operations in permissive counter-insurgency type scenarios. The A-29 was initially a contender for the Air Force's Light Attack/Armed Reconnaissance (LAAR) requirement for approximately 100 aircraft which fell prey to budget cuts a decade ago. The service launched a renewed effort in 2017, kicking off the Light Attack Experiment (OA-X) to rapidly evaluate off-the-shelf CAS/ISR platforms to relieve pressure on existing, higher-cost fleets such as the A-10 and F-16. A fatal A-29 crash abruptly ended the flight segment of evaluations at Holloman on June 22, 2018. Trials, however, yielded sufficient data for USAF to opt for two AT-6Bs and two (later increased to three) A-29s. The AT-6s assigned to ACC at Nellis will support tactics development and testing, while the A-29s slated for AFSOC will form the basis of a Combat Aviation Advisor and SOF-support capability. USSOCOM is simultaneously looking to replace its AFSOC-operated U-28A fleet with as many as 75 enhanced capability "armed overwatch" aircraft. Congress, however, banned funding the effort through FY23 pending study and justification. AETC's 81st Fighter Squadron also operated the A-29 as part of the Train, Advise, Assist Command-Air (TAAC-Air) training of Afghan Air Force crews at Moody. USAF handed-off training to the AAF, graduating its final class of pilots

in November 2020. A total of 13 countries operate the A-29 world-wide. All three AFSOC aircraft are slated for delivery in 2021.

Contractor: Sierra Nevada Corp.

First Flight: June 2, 1999.

Delivered: Feb. 23, 2021-present.

IOC: N/A.

Production: Three (planned).

Inventory: N/A.

Operator: AETC (AAF); Planned: AFSOC.

Aircraft Location: Moody AFB, Ga. Planned: Hurlburt Field, Fla.

Active Variants:

•A-29 Super Tucano. License-built version of the Embraer EMB-314 light attack aircraft.

Dimensions: Span 36.5 ft, length 37.3 ft, height 13 ft.

Weight: Max T-O 11,905 lb.

Power Plant: One Pratt & Whitney Canada PT6A-68C turboprop, 1,604 shp.

Performance: Speed 368 mph, range 1,900 miles (with wing-mounted external tanks).

Ceiling: 35,000 ft.

Armament: Two internal wing-mounted .50-caliber machine guns (200 rd each), up to 3,714 lb of external weapons on four wing and one centerline station.

Accommodation: Two aircrew on Martin Baker MK10 zero/zero ejection seats.



Senior Airman Dennis Spain

AC-130J GHOSTRIDER

Attack

Brief: The AC-130J is a CAS, air interdiction, and armed reconnaissance platform optimized for convoy escort, point defense, and supporting urban combat. The AC-130J is designed to provide ground forces a persistent direct-fire platform and deployed to combat for the first time in Afghanistan in June 2019. The next-generation gunship is based on a highly modified MC-130J, retrofit after delivery with a modular precision strike package, wing-mounted weapons, and gunship-specific systems. Airframes are upgraded and managed in common with the HC/MC-130J, receiving Block 8.1 avionics upgrades along with the baseline C-130J. SOF-specific enhancements are rapidly developed and integrated in response to operational requirements. PSP includes a dual mission management console, robust communications suite, two EO/IR sensors, advanced fire-control equipment, PGM delivery capability, and trainable cannons. Block 20 added/retrofitted a 105 mm gun, laser guided SDB, side-facing pilot tactical HUD, and Large Aircraft Infrared Countermeasures (LAIRCM). The configuration was deemed operationally effective for most taskings in 2018. Upgrades based on initial operational testing resulted in the Block 20+/30 configuration which improved gun accuracy, hardened GPS, and added wing-mounted Hellfire missiles and ramp-deployed GBU-69 Small Glide Munitions. The first Block 30 was delivered for testing in 2019. Development includes a high-energy laser weapon planned for demonstration in 2022, radio frequency countermeasures (RFCM) to detect, locate, and respond to threats, mission networking, IR suppression, PSP and EO/IR sensor improvements, and HF/VHF/UHF/SATCOM suite modernization. FY21 funds delivery/conversion of five airframes and continues the multiyear contract for 23 combined AC/MC-130J airframes. Enhanced all-weather strike capability and sensors are aimed at adding future through-cloud engagement. AFSOC announced plans to shift AC-130J formal training from Hurlburt to Kirtland starting in FY22.

Contractor: Lockheed Martin, Sierra Nevada Corp (RFCM).

First Flight: Jan. 31, 2014.

Delivered: July 29, 2015-present.

IOC: Sept. 30, 2017.

Production: 20 (37 to be converted from new-build MC-130Js).

Inventory: 20.

Operator: AFSOC.

Aircraft Location: Hurlburt Field, Fla. Planned: Kirtland AFB, N.M.

Active Variants:

•AC-130J Ghost Rider Block 20. Production standard gunship with additional 105 mm gun.

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

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

Weight: Max T-O 164,000 lb.

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

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

Ceiling: 28,000 ft.

Armament: Trainable 30 mm GAU-23/A cannon; 105 mm cannon; up to eight wing pylon-mounted GBU-39 SDB or AGM-114 Hellfire, and aft-firing GBU-69B Small Glide Munition and AGM-176 Griffin deployed from 10 Common Launch Tubes integrated into the aircraft's ramp/door.

Accommodation: Two pilots, CSO, WSO, sensor operator, loadmaster, and three gunners.



Senior Airman Mary Begy

AC-130W STINGER II

Attack, armed reconnaissance

Brief: The AC-130W is a gunship-modified C-130H optimized for CAS, interdiction, armed reconnaissance, convoy escort, strike coordination, overwatch, and point defense. AC-130Ws also provide strike coordination, nontraditional ISR, and C2. PSP mod includes a mission management console, communications suite, and flight-deck hardware. Airframes are significantly modified with improved navigation, threat detection, countermeasures, comms, and a standoff Precision Strike Package. The aircraft is entirely distinct from the retired AC-130H Spectre and AC-130U Spooky. The airframes were originally converted as MC-130W Combat Spear for SOF infiltration/exfiltration and in-flight refueling and redesignated Dragon Spear with the addition of the roll on/roll off PSP in 2010. The aircraft was rebranded AC-130W Stinger II after further enhancements in 2012. AC-130J will eventually replace the AC-130W fleet, which averages more than 26 years old. Upgrades include Enhanced Situational Awareness (ESA) for near real-time intel and data fusion including threat detection, avoidance, geolocation, and adversary-emitter identification, IR suppression, and the 105 mm gun (in common with the AC-130U/J). An AC-130W showcased the type's ability to conduct maritime strike/overwatch in a live-fire demo with Navy air and surface assets operating in the Persian Gulf in 2020. AFSOC plans to retire the fleet by 2023 and four airframes are slated for retirement in FY21.

Contractor: Lockheed Martin.

First Flight: Circa 2006 (Combat Spear).

Delivered: November 2010 (Dragon Spear).

IOC: 2010 (Dragon Spear).

Production: 12 (converted).

Inventory: 10.

Operator: AFSOC.

Aircraft Location: Cannon AFB, N.M.

Active Variant:

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

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

Weight: Max T-O 155,000 lb.

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

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

Ceiling: 28,000 ft.

Armament: 105 mm cannon, 30 mm GAU-23/A Bushmaster II chain gun; PGMs, incl GBU-39 SDB, GBU-69B Small Glide Munition, and AGM-176A Griffin.

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



Courtesy photo

C-145 SKYTRUCK

Foreign training and light mobility

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

Contractor: PZL Mielec (Lockheed Martin/Sikorsky subsidiary).

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

Delivered: 2009-2013.

IOC: N/A.

Production: 16.

Inventory: Five, USSOCOM-owned.

Operator: AFSOC, AFRC (associate).

Aircraft Location: Duke Field, Fla.

Active Variant:

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

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

Weight: Max T-O 16,534 lb.

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

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

Ceiling: 25,000 ft.

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

C-146 WOLFHOUND

Multimission mobility

Brief: The C-146 provides flexible, responsive airlift for special operations teams operating from austere and semiprepared airfields worldwide. Wolfhound is based on the German-built Dornier 328 regional airliner and was purchased by USSOCOM, modified by Sierra Nevada Corp., and designated C-146. The aircraft are operated by AFSOC as a nonstandard fleet providing direct support to SOF teams worldwide, often from austere airstrips. Modifications include ARC-231, PRC-117, and Iridium communications suite, troop/cargo-capable cabin, casualty evacuation capability, NVG compatibility, and STOL/austere operations enhancements. The aircraft first deployed in support of USAFRICOM in 2011. Recent upgrades include navigation enhancements to permit ops in GPS-degraded environments.



Staff Sgt. Joseph Pick

Contractors: Fairchild-Dornier; Sierra Nevada Corp.
First Flight: December 1991 (Dornier 328).
Delivered: 2011-2017.
IOC: N/A.

Production: 20 (converted).
Inventory: 20 (USSOCOM-owned).
Operator: AFSOC.
Aircraft Location: Cannon AFB, N.M.; Duke Field, Fla.
Active Variant:

•C-146A. Preowned civil Dornier 328 modified for SOF airlift.
Dimensions: Span 69.6 ft, length 68.8 ft, height 23.8 ft.
Weight: Max T-O 30,843 lb.
Power Plant: Two Pratt & Whitney 119C turboprops, 2,150 shp.
Performance: Speed 335 mph, range 2,070 miles (2,000 lb cargo).
Ceiling: 31,000 ft.
Accommodation: Two pilots, one loadmaster. Load: 27 passengers; up to four litters; max cargo 6,000 lb.



Staff Sgt. Mackenzie Mendez

CV-22 OSPREY

Multimission lift

Brief: The CV-22 is a medium-lift, vertical takeoff and landing (VTOL) tilt-rotor, primarily used for clandestine long-range, all-weather penetration to insert, recover, and support SOF teams in hostile, denied, and politically sensitive areas. Derived from the V-22, which flew in prototype form on March 19, 1989, 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. The CV-22 can conduct shipboard and austere forward operations. It is capable of operating in nuclear, biological, and chemical (NBC) warfare conditions. CV-22s first deployed to Africa in November 2008 and debuted in combat in Iraq in 2009. AFSOC is retrofitting the CV-22 to Block 20 standards, in common with USMC MV-22s. Mods include new cabin lighting, color helmet mounted displays, IR searchlight, lightweight ballistic armor, EW upgrades, avionics, self-defensive improvements, weapons integration, and ISR and situational awareness enhancements. A CV-22 at Eglin completed the first test flight of the Silent Knight TF/TA radar June 23, 2020. AFSOC plans to complete fleetwide retrofit of the stealthier, low-altitude, night/all-weather navigation radar by FY25. Priority development includes improving the Osprey's rapid, long-distance self-deployment capabilities, and modifying nacelles to improve maintainability, engine IR suppression, and reduce dust/debris ingestion. Integration of a ventral-mounted 7.62 mm minigun will eventually give pilots a helmet-cued, 360-degree field of defensive fire to complement the ramp-mounted weapon. Hurlburt took delivery of the 400th joint service-production aircraft on June 22, 2020. USAF is slated to receive its final airframe under the current multiyear contract in 2022.

Contractors: Boeing; Bell Helicopter Textron.
First Flight: February 2000 (CV-22).
Delivered: Sept. 19, 2005-present.
IOC: 2009.

Production: 51 planned (CV-22; incl three replacements).
Inventory: 50.
Operator: AETC, AFSOC, ANG (associate).
Aircraft Location: Cannon AFB, N.M.; Hurlburt Field, Fla.; Kirtland AFB, N.M.; RAF Mildenhall, U.K.; Yokota AB, Japan.
Active Variant:
 •CV-22B. Air Force special operations variant of the V-22 Osprey.
Dimensions: Span 84.6 ft, length 57.3 ft, height 22.1 ft, rotor diameter 38 ft.
Weight: Max vertical T-O 52,870 lb; max rolling T-O 60,500 lb.
Power Plant: Two Rolls-Royce-Allison AE1107C turboshafts, each 6,200 shp.
Performance: Cruise speed 277 mph, combat radius 575 miles with one internal auxiliary fuel tank, self-deploy 2,100 miles with one in-flight refueling.
Ceiling: 25,000 ft.
Armament: One ramp-mounted .50-caliber machine gun. Planned: One belly mounted forward firing GAU-17 7.62 mm minigun.
Accommodation: Two pilots, two flight engineers.
Load: 24 troops seated, 32 troops on floor, or 10,000 lb cargo.



Airman 1st Class Dennis Spain

EC-130J COMMANDO SOLO/SUPER J

Psychological warfare/special operations airlift

Brief: The EC-130J is the Air Force's primary psychological warfare platform, providing military information support operations (MISO) and civil affairs broadcast. Roles include offensive counterinformation radio, television, and military communications broadcast, EA (or SOF mobility), depending on variant. EC-130J and legacy Commando Solo variants have conducted psychological operations in almost every US contingency since 1980. The EC-130J Commando Solo is equipped with radio and color television broadcast equipment for psychological warfare, enhanced navigation, and self-protection including Large Aircraft IR Countermeasures (LAIRCM) to counter MANPAD threats. With transition to the EC-130J, USAF added a new, secondary mission resulting in a second variant. Three heavily modified EC-130J Commando Solo aircraft serve as a standard broadcasting station for psychological warfare operations. Four EC-130Js, dubbed Super J, perform secondary, low-cost EA on top of their special operations mobility SOF-FLEX (Special Operations Flexible) mission. SOF-FLEX includes personnel and cargo airdrop, combat offload, and infiltration/exfiltration. USAF is working to develop an Operational Flight Program Block upgrade cycle for the EC-130J's mission specific equipment, and the airframe is undergoing Block 8.1 upgrades in tandem with the base-line C-130J. SOCOM is currently funding accelerated development, testing and fielding of the Multi-Mission Platform-Heavy (MMP-H) digital broadcast system which will allow all aircraft to be de-modified to a SOF multimission configuration. MMP-H enables standoff radio, television, UHF/VHF, and cellular broadcast against denied threats from up to 175 miles away. The fleet is receiving Link 16 networking to integrate with other SOF assets, and critical needs include acquiring Communication EA Surveillance and Reconnaissance (CEASAR) and Long-Range Broadcast System (LRBS) pods for the four remaining non-equipped aircraft.

Contractors: Lockheed Martin; Raytheon.
First Flight: April 5, 1996 (C-130J).
Delivered: Oct. 17, 1999-2006.
IOC: 2004.
Production: Seven.
Inventory: Three (Commando Solo); four (Super J).
Operator: ANG.
Aircraft Location: Harrisburg Arpt., Pa.
Active Variants:
 •EC-130J Commando Solo. Modified C-130J used for broadcast and psyops.
 •EC-130J Super J. Modified C-130J used for SOF mobility and psyops.

Dimensions: Span 132.6 ft, length 97.8 ft, height 38.8 ft.
Weight: Max T-O 164,000 lb.
Power Plant: Four Rolls-Royce-Allison AE2100D3 turboprops, each 4,637 shp.
Performance: Speed 335 mph cruise, range 2,645 miles (air refuelable).
Ceiling: 28,000 ft.
Accommodation: Two pilots, flight systems officer, mission systems officer; two loadmasters, five electronic communications systems (CS) operators.



Master Sgt. Andrew LaMoreaux

MC-12W LIBERTY

Tactical ISR

Brief: The MC-12W is a manned, medium/low-altitude tactical ISR, SIGINT, and targeting platform based on the Beechcraft King Air 350ER (Extended Range). It was hastily developed under Project Liberty to meet an urgent operational need for manned battlefield ISR and deployed to Iraq and Afghanistan in less than a year in 2009. MC-12W is capable of complete ISR collection, processing, analysis, and dissemination. The aircraft provides targeting data and tactical ISR direct to special operations ground forces. Specialized equipment includes FMV, laser designation, SIGINT, advanced BLOS connectivity, and advanced SATCOM. ACC passed 20 airframes to USSCOM in 2015, and the Oklahoma ANG formed a dedicated SOF support mission with the remaining aircraft, deploying for the first time to Afghanistan in 2015. The ANG is seeking mission critical capability improvements including Link 16, adding a SAR sensor for ground moving target tracking in poor visibility, operator display upgrades, a second FMV sensor, and a high-fidelity roll-on/roll-off EO/IR sensor to meet COCOM requirements.

Contractors: Beechcraft; L3Harris (EO/IR sensors).

First Flight: April 28, 2009.

Delivered: April 2009-2012.

IOC: June 2009.

Production: 42.

Inventory: 13.

Operator: ANG.

Aircraft Location: Will Rogers ANGB, Okla.

Active Variant:

•MC-12W. Modified Beechcraft King Air 350ER equipped for battlefield ISR and targeting.

Dimensions: Span 57.9 ft, length 46.7 ft, height 14.3 ft.

Weight: Max T-O 16,500 lb.

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

Performance: Speed 359 mph, range 2,760 miles.

Ceiling: 35,000 ft.

Accommodation: Two pilots, two sensor operators.

MC-130H COMBAT TALON II

Special operations airlift/aerial refueling

Brief: The MC-130H is a special operations tanker/mobility aircraft based on the C-130H. Its primary missions are covert day, night, and adverse-weather infiltration, exfiltration, and resupply of special operations forces in hostile or denied territory. They also provide air-drop resupply, rotary wing aerial refueling, and psyops. MC-130Hs are equipped with TF/TA radar, precision navigation systems using INS/GPS, and electronic and IR countermeasures for self-protection. All models are fitted with wing-mounted external fuel tanks and drogue refueling pods to refuel HH-60 and CV-22, and can also receive fuel in-flight. Aircraft are capable of airdrop using the Joint Precision Airdrop System and operating from austere and unmarked strips. The original MC-130Es were converted in the mid-1960s, followed by the MC-130P (previously HC-130N/P), which were delivered in the mid-1980s and retired in 2017. MC-130Hs were converted from base-



Airman 1st Class Blake Wiles

model C-130H to supplement the Combat Talon I and Combat Shadow fleets in the late 1980s and early 1990s. MC-130H have integrated glass cockpit and a modernized pod-based aerial refueling system. Kadena's final MC-130H transferred to Hurlburt Dec. 4, 2019, handing off to the MC-130J after 24 years forward-based in the Indo-Asia Pacific region.

Contractors: Lockheed Martin (airframe); Boeing.

First Flight: 1984.

Delivered: 1991-1994.

IOC: June 30, 1993.

Production: 24.

Inventory: 16.

Operator: AFSOC.

Aircraft Location: Hurlburt Field, Fla.

Active Variant:

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

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

Weight: Max T-O 155,000 lb.

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

Performance: Speed 300 mph, range 3,105 miles.

Fuel Capacity: Approx. 63,000 lb (81,120 lb with additional internal tanks) at up to 450 gpm.

Ceiling: 33,000 ft.

Accommodation: Two pilots, navigator, EWO, flight engineer, two loadmasters. Load: 77 troops, 52 paratroops, or 57 litters.



Capt. Renee Douglas

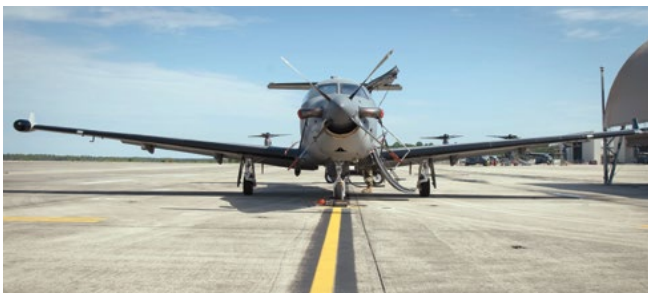
MC-130J COMMANDO II

Special operations airlift/aerial refueling

Brief: The MC-130J is a special operations tanker/mobility aircraft based on the C-130J and designated Commando II (previously Combat Shadow II) in honor of the WWII C-47. Its primary missions are covert day, night, and adverse weather infiltration, exfiltration, and resupply of special operations forces in hostile or denied territory. They also provide air-drop resupply, rotary wing aerial refueling, and psyops. MC-130J are fitted with wing-mounted external fuel tanks and drogue refueling pods to refuel HH-60 and CV-22, and can also receive fuel in-flight. Specialized systems include fully integrated INS/GPS, color cockpit LCDs, NVG lighting, HUDs, integrated defensive systems including LAIRCM, 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. FY21 funds procure four airframes under a follow-on multiyear contract through FY22. Funds continue Radio Frequency Countermeasure (RFCM) installation to detect, locate, and respond to emerging threats, as well as Airborne Mission Networking (AbMN), which gives aircrew a common air/ground picture to better manage complex workloads. MC-130J was pulled out of the baseline C-130J Block 7/8.1 upgrade to fund SOF-specific requirements, but will receive Link 16 and CSO station upgrades separately. Development includes HF/VHF/UHF SATCOM Communications Modernization, and USSCOM plans to issue a multiyear Silent Knight TF/TA radar production contract in FY21. The TF/TA radar is housed in a second, small radome between the nose and cockpit giving the MC-130J low-level nighttime/adverse weather penetrating capability to fully replace the legacy MC-130H. Other mods include defensive systems upgrade, lightweight armor, and variable-speed drogue to refuel diverse aircraft types during a single sortie. FY21 begins Link 16 mods.

Contractors: Lockheed Martin (airframe); Boeing; Sierra Nevada Corp. (RFCM).
First Flight: April 20, 2011.
Delivered: Sept. 29, 2011-present.
IOC: Dec. 7, 2012.
Production: 57 (planned).
Inventory: 51.
Operator: AETC, AFSOC.
Aircraft Location: Cannon AFB, N.M.; Kadena AB, Japan; Kirtland AFB, N.M.; RAF Mildenhall, U.K.
Active Variant:
 •MC-130J. New-build aircraft based on the standard-length fuselage C-130J.
Dimensions: Span 132.6 ft, length 97.8 ft, height 38.8 ft.
Weight: Max T-O 164,000 lb.
Power Plant: Four Rolls-Royce AE2100D3 turboprops, each 4,591 shp.
Performance: Speed 416 mph, range 3,000 miles (further with air refueling).
Fuel Capacity: 61,360 lb at 150-300 gpm (100 gpm dual, simultaneous refueling).
Ceiling: 28,000 ft with 42,000-lb payload.
Accommodation: Two pilots, CSO, two loadmasters. Load: 42,000 lb of cargo/personnel (see C-130J for configurations).



Airman 1st Class Blake Wiles

U-28A DRACO

Tactical ISR

Brief: The U-28A is a manned, tactical ISR and targeting platform based on the Pilatus PC-12. The USSOCOM-owned aircraft are operated by AFSOC as a nonstandard fleet. It is employed worldwide in support of special operations ground forces, humanitarian efforts, and search and rescue. AFSOC first employed the aircraft during Enduring Freedom in Afghanistan and Iraqi Freedom. Mission equipment includes advanced radio-comms suite, IR suppression, missile, hostile fire, and laser warning, EO sensors, remote SIGINT, and advanced navigation systems. The primary Multispectral Targeting System includes FMV, EO-IR, IR real-time video, and co-aligned laser designator. U-28 EQ+ mods added high-definition, FMV to six EQ/PC-12 configured aircraft for extended standoff "find, fix, finish" capabilities in support of counter-ISIS ops. FY21 funds Enhanced Ground Proximity Warning to prevent flight-into-terrain accidents, improved BLOS SATCOM connectivity, continues navigation mods to enable ops in GPS-degraded environments, as well as FAA airspace compliance upgrades. USSOCOM sought to replace the fleet with 75 "armed overwatch" aircraft capable of tactical ISR and light CAS but was denied congressional funds through FY23 pending study and justification. Two aircraft were lost to fatal mishaps in Djibouti in 2012 and at Cannon in 2017, and Congress authorized FY21 funds for a loss replacement.

Contractor: Pilatus Aircraft Ltd.
First Flight: May 31, 1991 (PC-12).
Delivered: 2006-present.
IOC: June 2006.
Production: 36.
Inventory: 30 (U-28A); five (PC-12) (both USSOCOM-owned).
Operator: AFSOC, AFRC.
Aircraft Location: Cannon AFB, N.M.; Hurlburt Field, Fla.
Active Variant:
 •U-28A. Special operations variant of the civilian Pilatus PC-12.
 •PC-12. Converted civilian Pilatus PC-12 equipped for SOF support/training.
Dimensions: Span 53.3 ft, length 47.3 ft, height 14 ft.
Weight: Max T-O 10,935 lb.
Power Plant: Single Pratt & Whitney PT6A-67B, 1,200 shp.
Performance: Speed 253 mph, range 1,725 miles.
Ceiling: 30,000 ft.
Accommodation: Two pilots, CSO, tactical systems officer; up to nine passengers or 3,000 lb cargo (configuration dependent).

COMMAND, CONTROL, COMMUNICATION/BATTLE MANAGEMENT AIRCRAFT



Stefano Benedetto

C-143B COMBAT FLIGHT INSPECTION

Combat flight inspection

Brief: The C-143B is a modified Bombardier Challenger CL-600 long-range, executive-class jet equipped with specialized instrumentation for Combat Flight Inspection (CFIN). The three-aircraft fleet is owned by the Federal Aviation Administration and operated by FAA/USAF to certify that air base NAVAIDs (Navigational Aids) such as TACAN, VOR, and ILS, as well as approach/departure procedures are safe and meet applicable standards before all-weather flight operations can begin. USAF has lacked a fully organic CFIN capability since retiring the C-29A and handing flight inspection over to the FAA in 1991. The FAA and USAF jointly funded replacing the aging and range-limited C-29A, and USAF procured a single airframe in FY09. Due to the high-risk environment, Air Force Flight Standards Agency Det. 1 crews from Will Rogers ANGB conduct flight checks in combat theaters, as well as forward locations including Antarctica. In addition to combat ops, the fleet is tasked with inspecting CONUS and OCONUS, and dual U.S.-partner-nation facilities. USAF 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. FY21 launches Large Aircraft IR Countermeasures (LAIRCM) upgrades to improve self-defensive capabilities against MANPADs/small arms fire. An initial two aircraft will be upgraded with Block 40 LAIRCM, with a potential for additional airframes to be upgraded later.

Contractor: Canadair (Bombardier).
First Flight: Nov. 8, 1978.
Delivered: 2009.
IOC: Circa 2010.
Production: N/A.
Inventory: Three (FAA-owned).
Operator: AMC, AFRC (associate).
Aircraft Location: Will Rogers ANGB, Okla.
Active Variant:
 • C-143B. CL-600-2B16 with uprated turbofans and winglets, equipped for the CFIN role.
Dimensions: Span 61.8 ft, length 68.4 ft, height 20.6 ft.
Weight: Max T-O 40,125 lb.
Power Plant: Two GE Aviation CF34 turbofans, each 9,140 lb thrust.
Performance: speed Mach 0.83, range 3,915 miles.
Ceiling: 45,000 ft.
Accommodation: Two pilots, flight inspection technician.

E-3 SENTRY

Battle management/early warning/C2

Brief: The E-3 Airborne Warning and Control System (AWACS) is a heavily modified Boeing 707-320B tasked with all-weather, air and maritime surveillance, command and control, battle management, target, threat, and emitter detection, classification, and tracking. The aircraft is capable of surveilling airspace in excess of a 250-mile radius 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. Block 40/45 aircraft are redesignated E-3G. The upgrade is the most comprehensive enhancement to date and improves tracking/identification, system reliability, and life-cycle cost. Mods include open-architecture computing, operator workload reduction, new consoles, improved electronic support measures (ESM), and passive surveillance capability. DRAGON (Diminishing manufacturing sources Replacement of Avionics for Global Operations and Navigation) upgrades add a digital cockpit and next-generation CNS/GATM. Four USAF aircraft are slated for DRAGON in FY21 and mods are slated for completion fleetwide by 2027. Development includes efforts aimed at shortening the kill chains for time-sensitive targets, modernizing airborne moving target indication, adding high-speed jam-resistant Link 16 as well as fourth-to-fifth generation connectivity (to integrate F-22 and F-35). Additional



Staff Sgt. Justin Parsons

efforts accelerate install of Mode 5 IFF (for airspace compliance ahead of DRAGON), Electronic Protection (EP) to improve radar processing for classified requirements, advanced BLOS satcom/second-generation NATO UHF, and anti-jam GPS. Eight airframes will begin upgrade to Block 40/45 standards in FY21, and the single airframe will be redelivered. A total of 31 aircraft will be upgraded to Block 40/45 through 2024. NATO recently elected to modernize its 14 E-3As similarly to USAF's Block 40/45 standard, extending its fleet through 2035.

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

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

Delivered: March 1977-1984.

IOC: 1977; July 28, 2014 (Block 40/45).

Production: 31.

Inventory: 11 (E-3B); one (E-3C); 23 (E-3G).

Operator: ACC, PACAF, AFRC (associate).

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

Active Variants:

•E-3B. Block 30/35 upgraded aircraft.

•E-3C. Block 30/35 upgraded aircraft with additional advanced capabilities.

•E-3G. Block 40/45 upgraded aircraft.

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

Weight: Max T-O 335,000 lb.

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

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

Ceiling: Above 35,000 ft.

Accommodation: Two pilots, navigator, flight engineer, 13-19 mission specialists.

E-4 NATIONAL AIRBORNE OPERATIONS CENTER

Nuclear command and control

Brief: The E-4B is a highly survivable flying C3 center enabling national leaders to direct nuclear and conventional forces, execute emergency war orders, and coordinate civil response actions in support of the National Military Command System (NMCS). It is hardened against the effects



Senior Airman Benjamin Cooper

of nuclear detonations, including electromagnetic pulse (EMP). Comms and data processing capabilities include EHF Milstar satcom, six-channel International Maritime Satellite, and a triband radome houses the SHF communications antenna. All aircraft underwent Block 1 upgrades, enhancing electronic and communications infrastructure with commercial off-the-shelf (COTS) systems. Ongoing upgrades include replacing Milstar data links with AEHF-compatible FAB-T, replacing the VLF/LF transmitter, and starting in FY21 replacing legacy SHF with Survivable Super High Frequency (SSHF) enabling uninterrupted, jam-resistant nuclear C2 fleetwide by 2023. E-4B airframes are viable to approximately 2033, but phaseout of commercial 747-200s hampers continued sustainment. USAF plans to replace the E-4B with the Survivable Airborne Operations Center (SAOC) and issued a request to industry for development of up to four, potentially used, but similarly sized commercial-derivative airframes in December 2020. Changes to acquisition strategy delayed initial solicitations, but the service aims to issue a development contract by late 2021.

Contractors: Boeing; Raytheon (FAB-T); L3Harris (SSHF).

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

Delivered: December 1974-1985.

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

Production: Four.

Inventory: Four.

Operator: AFGSC.

Aircraft Location: Offutt AFB, Neb.

Active Variant:

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

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

Weight: Max T-O 800,000 lb.

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

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

Ceiling: Above 30,000 ft.

Accommodation: Two pilots, navigator, flight engineer, up to 110 battle staff/mission crew.

E-8 JSTARS

Command and control/ISR

Brief: E-8C is a ground moving target indication (GMTI), airborne battle-field management/command and control platform. Its primary mission is providing theater commanders with ground surveillance data to support tactical operations. E-8 evolved from the Army/Air Force Joint Surveillance Target Attack Radar System (JSTARS) program. The aircraft made its first radar-equipped test flight in December 1988, and the first two aircraft deployed for Desert Storm while the system was still under development. Early airframes were eventually retrofit 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 and ships at distances exceeding 124 miles, and more recent refinements added human-target tracking. Target data is transmitted via data link to ground stations or other aircraft. USAF began efforts to improve fleetwide availability starting in FY18, aiming to simultaneously have six aircraft deployable by 2022. Obsolescence and depot flow continue to hinder this goal. USAF dropped plans to replace JSTARS with a modern, business-class aircraft pursuing the Advanced Battle Management System (ABMS) instead. ABMS would disaggregate JSTARS functions among several platforms, instead of fielding a direct replacement. The service extended JSTARS through the mid-2020s, and Congress blocked retirement until ABMS offers equal or better capability. Ongoing upgrades include Secure Common Data



Staff Sgt. Trevor McBride

Link (SDL) for LOS networking to Common Ground Stations and FY21 launches UHF/VHF SATCOM modernization. USAF aims to re-engine the fleet with refurbished JT8D-219 turbofans as a cost-effective interim solution to improve performance and reliability.

Contractors: Northrop Grumman; Raytheon.

First Flight: April 1, 1988.

Delivered: March 22, 1996-March 23, 2005.

IOC: Dec. 18, 1997.

Production: 18.

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

Operator: ANG.

Aircraft Location: Robins AFB, Ga.

Active Variants:

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

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

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

Weight: Max T-O 336,000 lb.

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

Performance: Speed 584 mph (optimal orbit), range 11 hr normal endurance (longer with air refueling).

Ceiling: 42,000 ft.

Accommodation: Two pilots, navigator, flight engineer, 15 Air Force/three Army mission crew (mission dependent).



Staff Sgt. Bennie Davis III

E-9A WIDGET

Range control

Brief: The E-9A is a modified DHC-8 commuter aircraft that provides air-to-air telemetry support for weapons testing, target drone operations, and range clearance. The aircraft supports operations at the Eglin Test and Training Range over the Gulf of Mexico and provides telemetry for weapons system evaluation at Holloman and the Utah Test and Training Range. Mission modifications 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 com-

mence. It also provides tracking and assistance with recovering targets. The aircraft can remotely initiate destruction of damaged or malfunctioning aerial target drones. FY21 funds are limited to low-cost sustainment and development upgrades.

Contractors: Bombardier (formerly De Havilland Canada); Sierra Nevada Corp. (conversion).

First Flight: June 1983 (DHC-8).

Delivered: 1988.

IOC: June 1988.

Production: Two.

Inventory: Two.

Operator: ACC.

Aircraft Location: Tyndall AFB, Fla.

Active Variant:

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

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

Weight: Max T-O 34,500 lb.

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

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

Ceiling: 30,000 ft.

Accommodation: Two pilots, two mission operators.



Senior Airman Bryan Guthrie

E-11A BATTLEFIELD AIRBORNE COMMUNICATIONS NODE

Communications relay

Brief: The E-11A is a modified, Bombardier Global Express 6000/BD-700-1A10 business jet equipped with specialized communications relay equipment to translate between tactical comm and data links. It provides joint range extension, BLOS C2, and internet protocol-based data transfer between dissimilar systems. E-11A was fielded to meet an urgent operational need for BLOS air-to-ground relay. The system entered combat in Afghanistan in 2008 and enables troops to overcome comm limitations 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, though USAF is seeking to fully replace the EQ-4B with E-11As. The combined BACN fleet has provided near-constant coverage in theater, surpassing 100,000 flying hours in 2019. A single aircraft crashed north of Kandahar Airfield, Afghanistan, on Jan. 27, 2020, killing both aircrew. Northrop Grumman was awarded a \$3.6 billion five-year support contract on Jan. 21, which also includes funding for research, development and testing, as well as the integration of future payloads. Ongoing upgrades include adding military GPS to operate in higher-end threat environments, fourth- to fifth-gen. gateway (to relay data between advanced and legacy fleets), Link 16, advanced navigation, and flight safety, reliability, and performance improvements. FY21 launches self-defensive/survivability improvement and procurement of six additional airframes at a rate of one aircraft per year.

Contractors: Bombardier, Northrop Grumman (integration and support).

First Flight: August 2007.

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

IOC: Circa 2011.

Production: Four (nine planned).

Inventory: Three.

Operator: ACC.

Aircraft Location: Kandahar Airfield, Afghanistan.

Active Variant:

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

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

Weight: Max T-O 99,500 lb.
Power Plant: Two Rolls-Royce BR710A2-20 turbofans, each 14,750 lb thrust.
Performance: Speed Mach 0.88, range 6,900 miles.
Ceiling: 51,000 ft.
Accommodation: Two pilots.



Gulfstream

EC-37B COMPASS CALL

EW/EA

Brief: The EC-37B is a next-generation, tactical jamming platform tasked with disruption of enemy C3, radar, and navigation. It will also offer offensive counterinformation, EA, and SEAD support. The aircraft is based on the ultra-long-range Gulfstream G550 business aircraft and adapted from the Navy's special mission configuration. USAF awarded L3 Technologies a contract on Sept. 7, 2017, to replace the EC-130H in the tactical EA role and transplant its "Compass Call" systems to a more modern aircraft. The program, originally dubbed "EC-X" will "re-host" upgraded EC-130H mission equipment directly to the EC-37 with nearly 70 percent remaining unchanged. EC-37B is faster, more economical, capable of higher altitude operations, and more survivable than the EC-130H. Upgrades will allow it to conduct standoff jamming/EA from greater distance for attacks against A2/AD targets. The first aircraft was purchased in FY17, followed by a second in FY18. Congress accelerated the program by funding two airframes in FY19, and USAF plans to procure and modify one aircraft a year through FY25. The first five aircraft are receiving the EC-130H's upgraded Baseline 3 package, including Advanced Radar Countermeasure System (ARCS) and other significant capability enhancements. FY21 procures the sixth airframe, which will be the first delivered with the future Baseline 4 configuration slated for deployment in 2026. Air Combat Command plans to field the first five EC-37Bs in 2023.

Contractors: Gulfstream Aerospace (airframe); BAE Systems; L3 Harris (mission equipment).

First Flight: N/A.

Delivered: 2023 (planned).

IOC: 2023 (planned).

Production: Four (two currently in modification).

Inventory: 10 (planned).

Operator: ACC (planned).

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

Active Variant:

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

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

Weight: Max T-O 90,500 lb.

Power Plant: Two BR710C4-11 turbofans, each 15,385 lb thrust.

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

Ceiling: 51,000 ft.

Accommodation: Two pilots; TBD.

EC-130H COMPASS CALL

Electronic warfare

Brief: The EC-130H is a modified C-130H designed to disrupt enemy C3 and limit adversary coordination and force management. Tasks include tactical jamming/disruption of communications, radar, and navigation, offensive counterinformation, EA, and SEAD support. The fleet has been deployed near-constantly since the beginning of combat operations in Afghanistan in 2001. The aircraft was designed to be easily updated and modified. All aircraft have been retrofitted to Block 35 standards and are aerial refuelable. Mission equipment upgrades occur approximately every three years to ensure continued protection and effectiveness against evolving threats. Baseline 2 mods are ongoing, and the Baseline 3 configuration, including the Advanced Radar Countermeasure System (ARCS) and other significant capability enhancements, is slated for fielding in 2023. Baseline 4 will be fielded on the next-generation EC-37B platform in 2026. Some 70



Sgt. Miranda A. Loera

percent of the EC-130H's mission equipment will be directly cross-decked to the EC-37B. Funding delays required extending the EC-130H with center wing box replacement/structural mods (in common with the C-130H fleet) and upgrades include digital glass cockpits, Mode 5 IFF/airspace compliant CNS/ATM, and color weather radar. Ongoing system upgrades include counter-radar/counter satellite navigation, third-generation Special Purpose Emitter Array (SPEAR), and adaptive EA to quickly react to emerging threats. Ten primary mission aircraft are supplemented by two backups, two attrition reserves, and one system integration testbed. ACC retired the last Baseline 1 configured aircraft Jan. 15, 2020.

Contractors: Lockheed Martin; BAE Systems (mission equipment); L3Harris (integration and sustainment).

First Flight: 1981.

Delivered: March 19, 1982-unk.

IOC: 1983; Block 35 from 2011.

Production: (Converted).

Inventory: 11 (EC-130H).

Operator: ACC.

Aircraft Location: Davis-Monthan AFB, Ariz.

Active Variant:

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

Dimensions: Span 132.6 ft, length 99 ft, height 38 ft. Weight: Max T-O 155,000 lb.

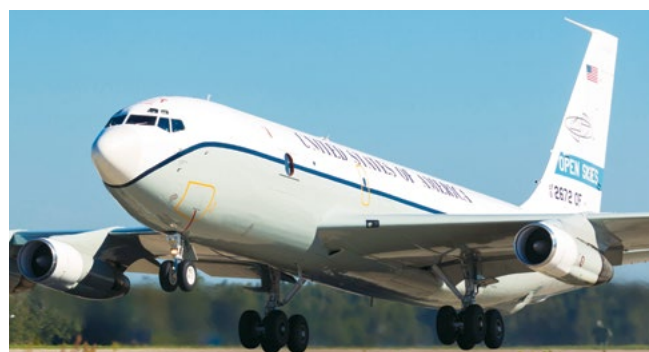
Power Plant: Four Allison T56-A-15 turboprops, each 4,910 shp.

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

Ceiling: 25,000 ft.

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

INTELLIGENCE, SURVEILLANCE, RECONNAISSANCE AIRCRAFT



Dmitry Terekhov

OC-135 OPEN SKIES

Observation/treaty verification

Brief: The OC-135 is a modified WC-135B used for arms control treaty observation and imagery collection over nations party to the 1992 Open Skies Treaty. Specialized mission equipment includes side-looking synthetic aperture radar, infrared line scanning devices, video camera, and framing and panoramic optical cameras installed in the rear of the aircraft. The two oblique KS-87E framing cameras permit photography from approximately 3,000-ft altitude, and one KA-91C panoramic allows

for wide sweep photography from approximately 35,000 ft. Ongoing efforts include installing digital camera suite on the remaining aircraft and replacing obsolete and difficult to maintain wet-film cameras. The U.S. State Department declared Russia in violation of the Open Skies Treaty for preventing access to Kaliningrad and the border with Georgia, resulting in no USAF sorties in 2018. After resuming flights in 2019, the U.S. withdrew from the treaty Nov. 22, 2020, citing continued Russian breaches. USAF canceled efforts to replace the fleet with more modern aircraft by 2022, pending direction on whether the U.S. will re-enter the treaty.

Contractor: Boeing.
First Flight: 1993.
Delivered: 1993-96.
IOC: October 1993.
Production: Three.
Inventory: Two.
Operator: ACC.
Aircraft Location: Offutt AFB, Neb.
Active Variant:
 -OC-135B. Modified C-135 equipped for photo reconnaissance/treaty verification.
Dimensions: Span 131 ft, length 135 ft, height 42 ft.
Weight: Max T-O 297,000 lb.
Power Plant: Four Pratt & Whitney TF33-P-5 turbofans, each 16,050 lb thrust.
Performance: Speed 500+ mph, range 3,900 miles.
Ceiling: 50,000 ft.
Accommodation: Three pilots, two navigators, three sensor maintenance technicians; Defense Threat Reduction Agency mission crew: mission commander, deputy, four sensor operator/translators, flight follower; total seating: 35, incl space for foreign country representatives.



Margo Wright/USAF

RC-26 CONDOR

Tactical ISR

Brief: The RC-26 is a modified Fairchild Metro 23 tasked with counter-narcotics, manned tactical ISR, disaster response, and civil support missions. USAF selected the C-26 to fulfill a joint ANG and Army National Guard airlift requirement in 1988, subsequently modifying the airframes to the RC-26 configuration. The aircraft is equipped with specialized digital cameras, IR video, and communications equipment to enable domestic and international anti-trafficking. The aircraft has a secondary role providing real-time video streaming to responders following hurricanes, wildfires, and other disasters. In the fire-support role, aircraft sensors can detect fires at up to 80 miles and accurately map them from up to 3 miles away. An extensive communications suite allows communications from 29 to 960 MHz including provisions for plugged-in 800 MHz handheld radio and airphones. The fleet is currently split between six Block 25R and five Block 20 configured aircraft. ANG priorities include bringing the fleet to a common standard with updated mission management, integrated comms, and upgraded antennas. Critical needs include adding SAR to enable all-weather ground moving target tracking, LOS/BLOS-secure FMV downlinks, avionics modernization, and five-bladed propellers to increase range and short-field performance. Ongoing upgrades include airspace compliance mods to meet FAA mandates. The ANG was barred from divesting the platform starting in FY20 unless it demonstrates the fleet's missions can be performed by other assets. RC-26s notably supported wildfire fighting efforts in California, and law enforcement activities during civil unrest in several U.S. cities in 2020.

Contractors: Fairchild (airframe); Elbit Systems (avionics upgrade).
First Flight: 1990.
Delivered: March 1989-1996 (delivered as C-26A/B).
IOC: N/A.
Production: 10 (C-26A); 33 (C-26B); 11 (RC-26).
Inventory: 11.
Operator: ANG.
Aircraft Location: Des Moines Aprt., Iowa; Ellington Field, Texas; Fairchild AFB, Wash.; Fresno Yosemite Aprt., Calif.; Key Field, Miss.; Kirtland AFB, N.M.; Montgomery Regional Aprt., Ala.; Truax Field, Wis.; Tucson Aprt., Ariz.; Yeager Aprt., W.Va.
Active Variants:
 -RC-26B. Surveillance version of Fairchild C-26.
Dimensions: Span 57 ft, length 59.5 ft, height 16.6 ft. Weight: Max T-O 16,500 lb.
Power Plant: Two Garrett TPE331-12UAR-701 turboprops, each 1,100 shp.
Performance: Speed 334 mph, range 2,070 miles.
Ceiling: 25,000 ft.
Accommodation: Two pilots, navigator/mission systems operator.



Senior Airman Jacob Skovo-Lane

RC-135S COBRA BALL

Electronic reconnaissance

Brief: The RC-135S gathers measurement and signature intelligence (MA-SINT) on missile-associated signatures and tracks during boost and reentry. 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 the long-range Medium Wave Infrared Array (MIRA) EO/IR sensor suite, all-weather tracking radar, and an advanced communications suite. Reconnaissance data is used to assess missile threats, evaluate missile performance, characterize adversary missiles, and analyze weapons testing and technology. Data also supports treaty verification and theater ballistic missile nonproliferation. It can deploy anywhere in the world in 24 hours and provide on-scene EO reconnaissance. Continuous baseline upgrades keep the fleet viable through 2040, and aircraft are currently undergoing integration and testing of Baseline 6 mods (similar to Rivet Joint Baseline 12). FY20 launched Baseline 7 development, and flexible funding permits rapid, variant-specific mods in response to emerging/evolving threats. Baseline 7 upgrades will include Rivet Joint COMINT suite integration, digital electromagnetic signature direction finding, digital search, and SATCOM-aided target discrimination.

Contractors: Boeing (airframe); L3Harris; Textron Systems.
First Flight: N/A.
Delivered: October 1969-November 2000 (redelivery as RC-135S).
IOC: March 1972 (Cobra Ball II).
Production: Four converted.
Inventory: Three.
Operator: ACC.
Aircraft Location: Offutt AFB, Neb.
Active Variant:
 -RC-135S Cobra Ball. Modified C-135 equipped for MASINT/treaty verification.
Dimensions: Span 131 ft, length 135 ft, height 42 ft.
Weight: Max T-O 297,000 lb.
Power Plant: Four CFM International F108-CF-201 turbofans, each 21,600 lb thrust.
Performance: Speed 517+ mph, range 3,900 miles (farther with air refueling).
Ceiling: 45,000 ft.
Accommodation: Two pilots, navigator, three EWOs, two airborne systems engineers, two airborne mission specialists.



Colin Cooke

RC-135U COMBAT SENT

Electronic reconnaissance

Brief: The RC-135U is tasked with strategic reconnaissance and technical intelligence (TECHINT) gathering on radar/emitter systems. Three Combat Sent aircraft were converted from RC-135Cs in 1970-71 to fill a critical need for data collection on adversary radar threats and defenses. Combat Sent's distinctive chin and wingtip antenna arrays, large cheek fairings, and extended tail contain specialized sensor suites to collect data and analyze airborne, land, and naval radar/emitter systems. Each airframe incorporates a different, tailored sensor suite, and the data gathered is critical to the effective design and programming of RWR (radar warning receivers), jammers, decoys, anti-radiation missiles, and threat simulators. Combat Sent additionally enables strategic analysis for National Command Authorities and combatant forces. The aircraft utilizes radar/solid-state doppler, INS, celestial, and GPS for navigation, and is capable of both operator, automated, and blended signal gathering and analysis. Continuous baseline upgrades keep the fleet viable through 2040, and flexible funding permits rapid variant-specific mods in response to emerging/evolving threats. FY21 focus on completing Baseline 5/6 upgrades (similar to Rivet Joint Baseline 12) including wideband SATCOM reachback, integrating Rivet Joint's COMINT suite, improving operator interface, enhancing antennas and processors, and capability upgrades for dense signal environments.

Contractors: Boeing (airframe); L3Harris; Textron.

First Flight: N/A.

Delivered: May-December 1971 (RC-135U).

IOC: 1971.

Production: Three converted.

Inventory: Two.

Operator: ACC.

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

Active Variant:

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

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

Weight: Max T-O 322,500 lb.

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

Performance: Cruise speed 517 mph, range 4,140 miles, 8-hr normal endurance, 24-hr crew endurance (farther with air refueling). Ceiling: 42,000 ft.

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



Staff Sgt. Benjamin Sutton

RC-135V/W RIVET JOINT

Electronic reconnaissance

Brief: The RC-135V/W is tasked with real-time electronic and signals intelligence-gathering, analysis, and dissemination in support of theater and strategic-level commanders. The extensively modified C-135s detect, identify, and geolocate signals throughout the electromagnetic spectrum. Rivet Joint is mostly used to exploit electronic battlefield intelligence and deliver near-real-time ISR information to tactical forces, combatant commanders, and National Command Authorities. The British Royal Air Force operates three RC-135W Airseeker aircraft, which are co-manned by USAF/

RAF personnel. 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. The fleet recently underwent Baseline 11/12 upgrades, adding new direction finding COMINT, precision ELINT/SIGINT system integration, wideband SATCOMs, enhanced near real-time data dissemination, as well as new steerable beam antenna, improved weather radar, digital cockpit instruments, and compliant CNS/ATM. Baseline 12 added modernized operator interface, improved dense-signal environment capabilities, increased signal bandwidth/exploitation, added operator 3D maps, and integrated RC-135 with Distributed Common Ground Station (DCGS). FY21 efforts focus on upgrading Baseline 11 airframes to Baseline 13, sustaining Baseline 12, and upgrading the aircraft's autopilot. USAF is working to increasingly automate intelligence gathering and employ artificial intelligence and collaboration to speed collection, analysis, and distribution of information. USAF reversed plans to shift forward-deployed RC-135s from RAF Mildenhall to RAF Fairford in 2023.

Contractors: Boeing (airframe); L3Harris (mission systems).

First Flight: N/A.

Delivered: Circa 1973-99 (continuous equipment updates).

IOC: Circa 1973.

Production: Converted.

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

Operator: ACC, AFMC.

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

Active Variants:

•RC-135V/W Rivet Joint. Standoff airborne SIGINT variant of the C-135.

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

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

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

Weight: Max T-O 297,000 lb.

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

Performance: Speed 500+ mph, range 3,900 miles (farther with air refueling).

Ceiling: 50,000 ft.

Accommodation: Three pilots, two navigators, three EWO, 14 intelligence operators, four airborne maintenance technicians (six additional, if required).



Airman 1st Class Luis Ruiz-Vazquez

U-2S DRAGON LADY

High-altitude reconnaissance

Brief: U-2S is the Air Force's only manned, strategic, high-altitude, long-endurance ISR platform and is capable of SIGINT, IMINT, and MASINT collection. The aircraft's modular payload systems allow it to carry a wide variety of advanced optical, multispectral, EO/IR, SAR, SIGINT, and other payloads simultaneously. Its open system architecture also permits rapid fielding of new sensors to counter emerging threats and requirements. The original U-2A first flew on Aug. 4, 1955. The type was further developed into the larger, more capable U-2R which first took flight on Aug. 28, 1967, and was delivered between 1967 and 1968. Current U-2s date to the 1980s when U-2R production was reopened under the designation TR-1 (later returned to U-2R designation in 1992). The TR-1A first flew on Aug. 1, 1981, and was reengineered and modernized starting in 1994, emerging as the U-2S. Current Block 20 U-2S features glass cockpits, digital autopilot, modernized EW system, and updated data links. Its major sensors are the ASARS-2A SAR, SYERS-2A multispectral EO/IR imagery system, and enhanced Airborne Signals Intelligence Payload (ASIP). The legacy optical bar camera is still used to provide broad-area synoptic imagery. The fleet is currently undergoing Block 20.1 upgrades, adding ASARS-2B, next-generation SIGINT, avionics and navigation refresh, and data link (Link-16/ IFDL, MADL) modernization. ASARS-2B significantly improves the U-2's high-altitude, deep-look radar ground mapping, moving target, and maritime capabilities. ASARS-2B will begin flight-testing in FY22, and IOC is expected in FY23. U-2s are also receiving stellar and GPS-denied navigation, quick-change modular mission systems, multispectral sensor, and EW system upgrades. Airframe mods, helmet and pressure suit refresh, and egress improvement are also ongoing. U-2s conducted several

experiments in 2020, including using Artificial Intelligence to operate sensors and augment situational awareness, and using cloud computing to update mission software in-flight. The program continues to prioritize experimental sensors, systems, and software to meet emerging threats and develop networked, next-generation BM/C2.

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

First Flight: October 1994 (U-2S).

Delivered: September 1981-October 1989 (TR-1/U-2R).

IOC: Circa 1981 (U-2R).

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

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

Operator: ACC.

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

Active Variants:

•U-2S. Current variant of the U-2/TR-1.

•TU-2S. A two-seat trainer aircraft originally designated U-2ST.

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

Weight: Max T-O 40,000 lb.

Power Plant: GE Aviation F118-GE-101A turbofan, 17,000 lb thrust.

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

Ceiling: Above 70,000 ft.

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



Grace Simoneau/FEMA

WC-130J

Weather reconnaissance

Brief: The WC-130J "Weatherbird" is a modularly configurable C-130J equipped with specialized systems to penetrate tropical and winter storms, capture meteorological data, and aid severe weather forecasting. Early WC-130Bs entered service in 1959, followed by the WC-130E in 1962, and WC-130H in 1964. The WC-130J began replacing legacy variants in 1999, though several H models remained in service with the Puerto Rico ANG until a fatal crash resulted in the fleet's retirement in 2019. All WC-130Js are operated by AFRC's 53rd Weather Reconnaissance Squadron "Hurricane Hunters" at Keesler. Mission equipment includes a pod-mounted Stepped-Frequency Microwave Radiometer (SFMR) for monitoring surface winds and precipitation rates, parachute-deployed GPS dropsondes to gather vertical atmospheric profiles, and palletized operator stations/equipment. WC-130Js are optionally equipped with two external wing tanks, as well as an internal auxiliary fuel tank to increase range and endurance. Crews include an added aerial weather reconnaissance officer/flight director and weather system specialist/loadmaster. Aircraft are capable of penetrating tropical cyclones from up to 10,000 ft to as low as 500 ft. The fleet primarily monitors oceanic weather over the Atlantic, Central Pacific, Caribbean, and Gulf of Mexico. Airframes are modernized in line with the baseline C-130J fleet, including Block 8.1 upgrades, airspace compliance mods, and enhanced service-life center wing sections. The 2020 hurricane season was the third busiest since 1975, with WC-130Js logging 146 missions monitoring 20 named storms in the Atlantic and two in the Pacific.

Contractor: Lockheed Martin.

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

Delivered: Sept. 30, 1999-September 2005.

IOC: October 2006.

Production: 10.

Inventory: 10.

Operator: AFRC.

Aircraft Location: Keesler AFB, Miss.

Active Variant:

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

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

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

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

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

Ceiling: With max payload, 26,000 ft.

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



Susan Romano/USAF

WC-135 CONSTANT PHOENIX

Air sampling and collection

Brief: WC-135's primary mission is nuclear test monitoring, airborne radiological sampling, and arms control treaty verification. Airframes are either a modified C-135B or EC-135C Looking Glass equipped with air sampling and collection equipment. The aircraft primarily support monitoring under the 1963 Limited Nuclear Test Ban Treaty. Air sampling WB-29s detected debris from the Soviet Union's first atomic test in 1949, and subsequent aircraft have monitored recent weapons tests in North Korea, as well as the Chernobyl and Fukushima nuclear disasters. The WC-135's sampling and collection suite allows mission crew to detect radioactive "clouds" in real time. The collection system uses external flow-through devices to collect particles on filter paper for later analysis. The podded particulate sampler/Radiation Monitoring and Analysis System (RMAS) detects radiation contact, and the Directional Gamma Sensor System (DGSS) guides the crew toward the plume for collection. The Whole Air Collection System (WACS) captures and stores radioactive samples from the aircraft's bleed-air system. An integrated control system permits real-time mission system interface and monitors internal and external radiation-levels for safety and analysis. USAF deemed replacing the aging fleet to be more cost-effective than re-engining and modernization. Conversion of three KC-135R tankers to WC-135R standards began in 2019 utilizing the same sensor suite. The C-130J-mounted Harvester WACS/Particulate Airborne Collection Systems (PACS) augments Constant Phoenix and a modular system deployable on the KC-46 or RPA platform is under development. The sole WC-135C—serial 62-3582—retired on Nov. 16, 2020, and the remaining aircraft will be sustained until the WC-135R enters service in 2022.

Contractor: Boeing.

First Flight: 1965.

Delivered: 1965-96.

IOC: December 1965; 2022 (WC-135R) planned.

Production: Two (WC-135C/W); three (WC-135R) (planned).

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

Operator: ACC.

Aircraft Location: Offutt AFB, Neb.

Active Variants:

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

•WC-135R. Modified KC-135R tankers, planned to replace the aging WC-135C/W fleet.

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

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

Weight: Max T-O 300,500 lb. (WC-135C/W); 322,500 lb. (WC-135R).

Power Plant: Four Pratt & Whitney TF33-P-5 turbofans, each 16,050 lb thrust. (WC-135C/W); Four CFM International CFM56-2 turbofans, each 21,634 lb thrust (WC-135R).

Performance: Speed 403 mph, range 4,600 miles (farther with air refueling) (WC-135C/W); speed 530 mph, range approx. 3,900 miles (farther with air refueling) (WC-135R).

Ceiling: 40,000 ft. (WC-135C/W); 50,000 ft. (WC-135R).

Accommodation: Two pilots, navigator, up to 31 special equipment operators/observers as required.

TANKER AIRCRAFT



Tech. Sgt. Kelly Goonan



Staff Sgt. Dustin Mullen

HC-130J COMBAT KING II

Aerial refueling/airlift

Brief: The HC-130J is tasked with helicopter in-flight refueling support for CSAR/personnel recovery, tactical C2, and pararescue (PJ) deployment. It replaces legacy HC-130N/Ps and is based on the USMC's KC-130J tanker. It adds 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, and integrated situational awareness. Recently added Advanced Threat Warning and RF countermeasures, as well as chaff/flares give the HC-130 the latest self-defensive capability for recovery operations in contested environments. USAF plans to standardize HC/AC/MC-130J block upgrades, and current efforts bring all HC-130Js to a common standard. Ongoing development and upgrades include avionics Block 8.1 (in common with the C-130J fleet), Lightweight Airborne Radio System (LARS), Situational Awareness Capabilities Upgrade (SACU), and wireless intercom to allow comms in/outside the aircraft during ground operations. LARS transitions to the new 406 MHz distress frequency and improves timely location of aircraft, vessels, and personnel. SACU replaces the legacy data link with Link 16, blue force tracking, advanced mission planning, and new displays to enhance secure networking/comms fleet-wide by 2023. The final operational HC-130N/Ps departed Patrick for storage in December 2019 and the 920th Rescue Wing received its first HC-130J on April 2, 2020. A single HC-130J is slated for delivery in FY21 and USAF expects to complete total recap by 2023.

Contractor: Lockheed Martin.

First Flight: July 29, 2010.

Delivered: Sept. 24, 2010-present.

IOC: April 25, 2013.

Production: 39 (planned).

Inventory: 31.

Operator: ACC, AETC, AFRC, ANG.

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

Active Variants:

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

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

Weight: Max T-O 164,000 lb.

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

Performance: Speed 363.4 mph at S-L, range 4,000+ miles (farther with air refueling).

KC-10 EXTENDER

Aerial refueling/airlift

Brief: The KC-10 is a multirole tanker/transport capable of aeromedical evacuation, based on the McDonnell Douglas DC-10-30CF. The aircraft is USAF's largest air-refueling aircraft. It is simultaneously capable of tanker and cargo roles, enabling it to support worldwide fighter deployments. The aircraft employs an advanced aerial refueling boom and hose/drogue system allowing it to refuel a wide variety of U.S. and allied aircraft, including the CV-22 tilt-rotor, within the same mission. The aircraft has three large fuel tanks under the cargo floor and an air-refueling operator's station recessed into the aft fuselage. It is refuelable by boom-equipped tankers. Ongoing mods include modernized navigation, surveillance, and air traffic management (CNS/ATM) to bring the fleet into compliance with

FAA mandates, and advanced Mode 5 IFF. The fleet amassed more than 2.3 million flying hours before the first three tankers retired in 2020, the first of which arrived for storage at Davis Monthan July 13. USAF targeted fleet reduction to 40 aircraft in FY21, but Congress directed the service maintain at least 50 aircraft to provide sufficient tanker support due to shortfalls with the KC-46. Congress further directed USAF maintain a least 38 KC-10s through FY22, and 26 through FY23 before divesting the fleet in 2024.

Contractors: McDonnell Douglas (now Boeing); Collins Aerospace (CNS/ATM).

First Flight: April 1980.

Delivered: March 1981-April 1990.

IOC: August 1982.

Production: 60.

Inventory: 56.

Operator: AMC, AFRC (associate).

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

Active Variant:

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

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

Weight: Max T-O 590,000 lb.

Power Plant: Three GE Aviation CF6-50C2 turbofans, each 52,500 lb thrust.

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

Ceiling: 42,000 ft.

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

Accommodation: Two pilots, flight engineer, boom operator; AE crew: two flight nurses, three medical technicians; other crew depending on mission.

Load: Up to 75 people and 17 pallets or 27 pallets up to approx. 170,000 lb.



USAF

KC-46 PEGASUS

Aerial refueling/airlift

Brief: The KC-46A is a heavily modified Boeing 767-200ER multirole passenger/cargo-tanker equipped with flying boom and probe/drogue refueling capability using the Wing Air Refueling Pod (WARP) system. It is also equipped for aeromedical evacuation. KC-46 incorporates the 787's state-of-the-art cockpit, a fly-by-wire boom, remote boom-operator's station, advanced self-defensive suite including Large Aircraft IR Countermeasures (LAIRCM), RWR, tactical situational awareness, comms relay hosting, and nuclear/chem/bio hardening. In 2011 Boeing was awarded a contract for 179 KC-46A tankers, the first increment (KC-X), to replace about half of USAF's KC-135R fleet. Compared to the 50-year-old KC-135, the KC-46A has more fuel capacity, improved efficiency, and enhanced cargo and AE capability. Like the KC-10, it employs an advanced refueling boom and independently operating hose/drogue system. The program's provisioned 767-2C prototype (minus refueling boom) flew on Dec. 28, 2014, and received FAA type-certification in December 2017. USAF accepted its first production KC-46 from Boeing on Jan. 10, 2019. The service awarded LRIP contracts for 19 aircraft in 2016, a follow-on Lot 3 contract for 15 aircraft in 2017, 18 aircraft in 2018, 15 in 2019, and 12 in the most recent Lot 6 contract issued Jan. 12, 2021. FY21 funds support Lot 7 purchase of 15

tankers. The first KC-46 built for a launch international customer, Japan, flew on Feb. 9, 2021. The Japan Air Self-Defense Force plans to buy up to six tankers through FY24. The KC-46 completed developmental testing and entered operational testing in 2019, though planned IOC and full-rate production has slipped to FY24 or later due to remaining deficiencies with the boom and remote vision system. AMC began employing KC-46 for noncombat refueling of a limited number of types starting in 2021. Pease received its 12th aircraft, completing its fleet Feb. 5, 2021.

Contractor: Boeing.
First Flight: Sept. 25, 2015 (KC-46A).
Delivered: December 2018-present.
IOC: FY24 (planned).
Production: 179 (planned).
Inventory: 52 (KC-46A).

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

Active Variant:
 •KC-46A. Modified Boeing 767 designed as a multirole cargo tanker.
Dimensions: Span 156 ft, length 165.5 ft, height 52.8 ft.
Weight: Max T-O 415,000 lb.
Power Plant: Two Pratt & Whitney PW4062, each 62,000 lb thrust.
Performance: Speed 650 mph, range 7,350 miles (farther with air refueling).
Ceiling: 43,000 ft.
Fuel Capacity: 212,299 lb., max transfer load 207,672 lb at 1,200 gpm (boom), 400 gpm (drogue).

Accommodation: Two pilots, boom operator, and up to 12 additional crew; 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.



KC-135 STRATOTANKER

Aerial refueling/airlift

Brief: The KC-135 is an aerial tanker capable of simultaneous cargo and AE missions and has been the mainstay of the USAF tanker fleet for more than 60 years. The C-135 family is similar in appearance to the commercial 707 but designed to unique military specifications and first flew on Aug. 31, 1956. The KC-135A fleet was delivered between June 1957 and January 1965, reaching IOC at Castle AFB, Calif., in 1957. KC-135s were re-engined under two separate but concurrent programs and redelivered as the KC-135E and finally the current KC-135R beginning in July 1984. Twenty KC-135Rs received Multipoint Refueling System (MPRS) hose/drogue pods on each wing to simultaneously refuel two NATO or Navy aircraft. (Standard KC-135s can use a single drogue adapter attached to the boom). A small number of McConnell-based aircraft are also receiver-capable, incorporating a forward-fuselage receptacle. KC-135s can be equipped with a podded Large-Aircraft IR Countermeasures (LAIRCM) system to track/jam IR missiles for high-threat missions. Modern features include a digital flight deck, Global Air Traffic Management upgrades completed in 2011, and Link 16 on a limited number of upgraded aircraft. USAF plans to modify 395 aircraft with Block 45 upgrades: additional glass cockpit display for engine instrumentation, a radar altimeter, advanced autopilot, and modern flight director at a rate of 38 aircraft per year through 2026. FY21 begins replacement of obsolete long-distance oceanic satellite tracking/C2 through FY24, and adding a rudder position indicator to increase crew awareness and prevent accidents like the fatal crash in Kyrgyzstan in 2013. FY21 also launches prototyping/development of modern, secure UHF SATCOM for enhanced worldwide voice/data coverage. Congress barred USAF from retiring serviceable KC-135s through FY23 to bridge a capacity shortfall from KC-46 delays. USAF plans to retain the fleet

10 years beyond its planned service life, keeping some jets in service to at least 2050. Three KC-135s are undergoing conversion to WC-135R standards to replace Constant Phoenix.

Contractors: Boeing; Rockwell Collins (Block 45).
First Flight: Aug. 4, 1982 (KC-135R).
Delivered: July 1984-June 9, 2005 (KC-135R).
IOC: June 1957.
Production: 732 (420 converted to KC-135R).
Inventory: 224 (KC-135R); 54 (KC-135T).
Operator: AETC, AFMC, AMC, PACAF, USAF, ANG, AFRC.
Aircraft Location: Altus AFB, Okla.; Beale AFB, Calif.; Fairchild AFB, Wash.; Grissom ARB, Ind.; JB Andrews, Md.; Kadena AB, Japan; MacDill AFB, Fla.; March ARB, Calif.; McConnell AFB, Kan.; RAF Mildenhall, U.K.; Seymour-Johnson AFB, N.C.; Tinker AFB, Okla.; and ANG in Alabama, Alaska, Arizona, Hawaii, Illinois, Iowa, Kansas, Maine, Michigan, Mississippi, Nebraska, New Jersey, New York, Ohio, Pennsylvania, Tennessee, Utah, Washington, Wisconsin.

Active Variants:
 •KC-135R. Re-engined KC-135A fitted with CFM turbofan engines.
 •KC-135T. Reengined former KC-135Qs, able to carry different fuels in wing and fuselage tanks.
Dimensions: Span 130.8 ft, length 136.3 ft, height 41.7 ft.
Weight: Max T-O 322,500 lb.
Power Plant: Four CFM International CFM56-2 (USAF designation F108) turbofans, each 21,634 lb thrust.
Performance: Speed 530 mph at 30,000 ft, range 1,500 miles with 150,000 lb transfer fuel, up to 11,015 miles for ferry missions.
Ceiling: 50,000 ft.
Fuel Capacity: Max transfer load 200,000 lb at 1,100 gpm (boom), 450 gpm (MPRS pods).
Accommodation: Two pilots, navigator, boom operator, AE crew: two flight nurses, three medical technicians (adjusted as needed);
Load: 37 passengers, six cargo pallets, max 83,000 lb.

AIRLIFT AIRCRAFT

C-5 GALAXY

Strategic airlift

Brief: The C-5 is USAF's largest airlifter and one of the world's largest aircraft, capable of lifting unusually large/heavy cargo over intercontinental ranges. It is also able to take off and land in relatively short distances, and taxi on substandard surfaces if required. The Galaxy's front and rear cargo doors permit simultaneous drive-through loading/unloading. The aircraft's unique upper deck is split between the flight deck with galley and crew rest area forward of the wing and a troop compartment seating 75 passengers and a second gallery/lavatory aft of the wing. The C-5A first flew on June 30, 1968, and a total of 81 were delivered between 1969 and 1973 reaching IOC in September 1970. C-5As underwent major wing modifications to extend their service lives and all but one (converted to C-5M) are now retired. The C-5B first flew in 1985 and was delivered between 1986 and 1989. C-5Bs incorporated all C-5A improvements including strengthened wings, uprated turbofans, color weather radar, triple INS, and defensive systems (on some aircraft). Two C-5As were modified for outside space cargo and redelivered as C-5Cs in 1989 and 1990. The combined Avionics Modernization Program (AMP)—completed in 2011—and Reliability Enhancement and Re-engining Program (RERP), resulted in the C-5M Super Galaxy. Upgraded aircraft incorporate new



Senior Master Sgt. Vincent DeGroot/ANG

Roland Balik/USAF

engines with 20 percent increase in thrust, as well as avionics, structural, and reliability fixes. A total of 49 B models, two C models, and a single C-5A were converted. Ongoing mods include CNS/ATM upgrades, improved Large Aircraft IR Countermeasures (LAIRCM) to counter MANPAD threats, a lavatory redesign to address corrosion, new mission computers, and an off-the-shelf weather radar. AMC is replacing key nose landing gear components and limiting "kneeling" to reduce wear following a spate of malfunctions. The combined fleet logged more than 32,000 flying hours over more than 7,000 sorties in FY20 alone.

Contractor: Lockheed Martin; Collins Aerospace and Honeywell (CNS/ATM, weather radar/mission computer).

First Flight: June 6, 2006 (C-5M).

Delivered: Feb. 9, 2009-Aug. 2, 2018 (C-5M).

IOC: Feb. 21, 2014 (C-5M).

Production: 131 (52 converted to C-5M).

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

Operator: AMC, AFRC.

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

Active Variants:

- C-5M. Super Galaxy converted from C-5A/B, incorporating AMP and RERP.
- C-5M-SCM. Super Galaxy converted from C-5C to carry large NASA/space cargo.

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

Weight: Max T-O 840,000 lb.

Power Plant: Four GE Aviation F138-GE-100 (CF6-80C2) turbofans, each 50,580 lb thrust.

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

Ceiling: 45,000 ft.

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

Operator: AFMC, PACAF.

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

Active Variants:

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

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

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

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

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

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

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



Senior Airman James Fritz

C-17 GLOBEMASTER III

Tactical/strategic airlift

Brief: C-17 is a heavy-lift, strategic transport capable of direct tactical delivery of all classes of military cargo. It is the U.S. military's core airlift asset, capable of operating on small, austere airfields (3,500 ft by 90 ft) previously limited to C-130s. It is the only aircraft able to directly deliver or airdrop outside cargo into a tactical environment and it 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. Block 16 avionics and weather radar mods were completed in 2015. Block 20 upgrades included some 60 programs to bring early production aircraft to a common configuration, and Block 21 including Mode 5 IFF and airspace compliance were completed fleetwide in 2020. Ongoing mods include next-generation Large Aircraft Infrared Countermeasures (LAIRCM) to combat the proliferation of man-portable air defenses, as well as structural, safety, and sustainment mods. FY21 begins fleetwide HUD replacement through FY28, and development includes enhanced high-bandwidth BLOS voice/data SATCOMS and roll-on/roll-off C2 capsule (replacing the "Silver Bullet") for in-flight conferencing. The C-17 fleet surpassed 4 million combined flying hours during a flight from Charleston, Jan. 15, 2021.

Contractor: Boeing (previously McDonnell Douglas).

First Flight: Sept. 15, 1991.

Delivered: June 1993-September 2013.

IOC: Jan. 17, 1995.

Production: 257.

Inventory: 222.

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

Aircraft Location: Altus AFB, Okla.; Dover AFB, Del.; JB Charleston, S.C.; JB Elmendorf-Richardson, Alaska; JB Lewis-McChord, Wash.; JB McGuire-Dix-Lakehurst, N.J.; JB Pearl Harbor-Hickam, Hawaii; March ARB, Calif.; Pittsburgh Arpt., Pa.; Travis AFB, Calif.; Wright-Patterson AFB, Ohio; and ANG in Hawaii (associate), Mississippi, North Carolina, West Virginia, and New York.

Active Variant:

- C-17A. Long-range airlifter.

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

Weight: Max T-O 585,000 lb.

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

Ceiling: 45,000 ft.

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



Justin Connaher/USAF

C-12 HURON

Light airlift

Brief: C-12 is tasked with multimission passenger and priority light-cargo airlift, medevac, as well as diplomatic and flight-test support. The family of aircraft includes military versions of the Beechcraft King Air and 1900C (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 U.S. 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 U.S. Forces Japan and can transport two litters or 10 ambulatory patients in the AE role. C-12Js incorporate extensive avionics upgrades, including three MFDs, integrated GPS, flight management systems, autopilot, VHF/UHF radios, and weather radar. Current updates encompass basic safety, reliability, and maintainability mods.

Contractor: Beechcraft.

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

Delivered: 1974-mid 1990s.

IOC: Circa 1974.

Production: 30 (C-12A/C); six (C-12D); 46 (C-12F); four (C-12J).

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

lb payload (farther with air refueling).

Accommodation: Two pilots, loadmaster; AE crew: Two flight nurses, three medical technicians (mission dependent).

Load: 102 troops/paratroopers; 36 litter and 54 ambulatory patients; 18 pallets up to max payload 170,900 lb.



Arie Church

C-21

Light airlift

Brief: The C-21 is a militarized Learjet 35 used for passenger and priority light-cargo airlift and aeromedical transport. It is equipped with color weather radar, TACAN, and HF/VHF/UHF radios. It provides medium-range operational support for time-sensitive movement of people and cargo throughout the U.S. and the European theater, including AE missions if required. Ongoing efforts include the C-21 Avionics Upgrade Program (AUP), which replaces the analogue cockpit with a modern glass cockpit with digital systems, including a new weather radar, GPS, flight management system, satellite-updating real-time flight information, digital black boxes, and ADS-B/Mode 5 transponder. USAF added BLOS comms concurrently with AUP to save costs. Fleetwide installs were slated for completion in 2020 with BLOS mods stretching through May 2021. The first C-21 retrofit with enlarged aft-fuselage "delta fins" was redelivered to AMC in November 2020. The modification improves low-speed stability and control, eliminates approach/landing flight restrictions, and is slated for fleetwide completion in October 2021.

Contractors: Bombardier (previously Gates Learjet); Avcon Industries (delta fin mods).

First Flight: January 1973.

Delivered: April 1984–October 1985.

IOC: April 1984.

Production: 84.

Inventory: 19.

Operator: AMC, USAFE.

Aircraft Location: Ramstein AB, Germany; Scott AFB, Ill.

Active Variant:

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

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

Weight: Max T-O 18,300 lb.

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

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

Ceiling: 45,000 ft.

Accommodation: Two pilots; AE crew: Flight nurse, two medical technicians (mission dependent). **Load:** eight passengers, 3,153 lb cargo; one litter or five ambulatory patients (AE role).

C-32

VIP transport

Brief: The C-32A provides dedicated vice presidential and DV airlift. C-32B is tasked with politically sensitive crisis-mobility. Both types were acquired as commercial Boeing 757s. Aircraft assigned to the 89th Airlift Wing at Andrews fly under the call sign "Air Force Two" during vice presidential missions, but additionally serve the First Lady, Congress, and Cabinet officials. The cabin is divided into sections, including a worldwide clear and secure voice and data communications suite, first-class cabin, two business-class cabins, center galley, lavatories, fully enclosed stateroom, and a conference and staff area. The C-32B provides DOD discreet, rapid, global airlift in support of government crisis response efforts. The C-32's modern flight deck is designed to be easily upgraded, and the fleet recently underwent a full interior cabin refurbishment to more closely match the VC-25 fleet. Ongoing mods include installation of four, fully reclining crew rest seats to enable missions longer than the current 16-hour limit without pre-positioning relief crews. FY21 launches wide-band SATCOM upgrades as part of AMC's Senior Leader Communication Modernization



Philip Ulmer/ANG

effort across the executive fleets. The fleet has an average of nine years' life remaining, and DOD completed analysis in FY20 to potentially replace the C-32, E-4B, and Navy E-6B Mercury with a common airframe.

Contractor: Boeing.

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

Delivered: June–December 1998.

IOC: 1998.

Production: Six.

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

Operator: AMC, ANG.

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

Active Variants:

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

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

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

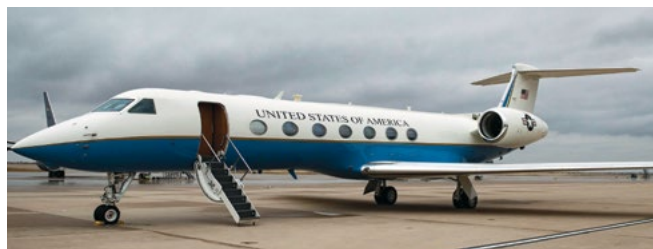
Weight: Max T-O 255,000 lb.

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

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

Ceiling: 42,000 ft.

Accommodation: Two pilots, up to 14 cabin and maintenance crew (varies with mission). **Load:** Up to 45 passengers.



Airman 1st Class Breanna Klemm

C-37 GULFSTREAM

VIP transport

Brief: The C-37 family provides worldwide special air mission and DV support, consisting of military versions of the ultra-long-range Gulfstream business aircraft. The C-37A is based on the Gulfstream V and is equipped with separate VIP and passenger areas, secure global voice and data communications suites, enhanced weather radar, autopilot, and advanced HUD. The C-37B, first delivered in 2004, is based on the G550 and adds directional IR countermeasures for self-defense and the advanced Honeywell Plane-View flight deck. Ongoing mods include commercial wideband SATCOM, to ensure senior leaders' access to secure data and voice networks, and FAA-required CNS/ATM updates. The fleet has an average 28,000 flying hours of remaining service life. USAF issued a request for proposal in FY18 for procurement of as many as 40 additional C-37Bs to backfill the now-retired C-20 fleet. FY21 launches wideband SATCOM upgrades as part of the Senior Leader Communication Modernization effort across USAF's executive fleets. A total of 15 aircraft will be modified to ensure redundant, survivable and secure/top-secret voice, data, and video conferencing for uninterrupted worldwide C2. USAF took delivery of its fourth C-37B in 2019, a fifth on March 25, 2020, and awarded Gulfstream a \$127.4 million contract for two additional aircraft for delivery by September 2021.

Contractor: Gulfstream Aerospace.

First Flight: October 1998 (C-37A).

Delivered: Oct. 14, 1998–present.

IOC: Dec. 9, 1998.

Production: 16 (planned).

Inventory: 10 (C-37A); five (C-37B).

Operator: AMC, PACAF, USAF.

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

Active Variants:

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

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

Weight: Max T-O 90,500 lb.

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

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

Ceiling: 51,000 ft.

Accommodation: Two pilots, flight attendant, crew chief.

Load: Up to 12 passengers (A); 14 passengers (B).



Tech. Sgt. Caitla Ararhood

C-130H HERCULES

Tactical airlift

Brief: The C-130H is an all-purpose theater transport that performs diverse roles, including tactical and inter-theater airlift and airdrop, AE, aerial spraying, aerial firefighting, and humanitarian support. The developmental YC-130A first flew in August 1954 with the C-130A entering USAF service in 1956. The H model improved on the later C-130E and was delivered starting in 1965, with delivery of the current, more advanced models 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. Ongoing upgrades include critical center wing box replacement, electronic propeller controls/engine efficiency mods, NP2000 propellers, and the C-130H Avionics Modernization Program (previously Viability and Airspace Access Program). USAF is upgrading 55 aircraft, including Modular Airborne Fire Fighting Systems (MAFFS)-equipped airframes, with eight-bladed NP2000 propellers to enhance performance and safety. The service eventually aims to retrofit the entire fleet. AMP increment 1, concluding in FY21, adds new CNS/ATM to bring the fleet into compliance with international airspace rules. Increment 2 will add terrain awareness and warning, new flight management, and modern MFDs starting in FY22. USAF announced plans to cut 24 ANG airframes in FY21, but Congress barred the service from cutting solely ANG tails or reducing the total tactical airlift fleet below 230 aircraft.

Contractor: Lockheed Martin, L3Harris (AMP Increment 2), Collins Aerospace (AMP/NP2000).

First Flight: 1965 (C-130H).

Delivered: March 1965 onward (C-130H1); April 1975-96 (current C-130H2/H3).

IOC: Circa 1974.

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

Inventory: 167.

Operator: ANG, AFRC, AFSOC.

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

Active Variant:

•C-130H Hercules. Updated late-production version of the legacy C-130.

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

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

Power Plant: Four Allison T56-A-15, or Rolls-Royce T56 3.5 turboprops, each 4,591 shp.

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

Ceiling: With max payload, 23,000 ft.

Accommodation: 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.

C-130J SUPER HERCULES

Tactical airlift

Brief: The C-130J is the redesigned, current production version of the C-130 all-purpose theater transport. Missions include tactical and inter-theater airlift, airdrop, AE, wildfire suppression using the Modular Airborne Fire Fighting System (MAFFS), and humanitarian relief. The aircraft first deployed to combat in Southwest Asia in 2004. The Super Hercules features three-crew flight operations, more powerful engines, composite



Courtesy

C-40 CLIPPER

VIP transport

Brief: The C-40 is a medium-range DV airlift aircraft based on the commercial Boeing 737-700. It is used to transport senior military commanders, Cabinet officials, and members of Congress, as well as performing other support missions. C-40A is a long-range medium airlift aircraft capable of operating in passenger, cargo, or split passenger/cargo "combi" configuration developed for and operated by the Navy. 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. All 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. The fleet is designed for a 30-year service life, with an average of 21 years remaining. Recent mods include commercial wideband SATCOM for the C-40B. FY21 launches wide-band SATCOM upgrades as part of AMC's Senior Leader Communication Modernization effort across the executive fleets. A total of 11 aircraft will be modified to ensure redundant, survivable and secure/top-secret voice, data, and video conferencing for uninterrupted worldwide C2.

Contractor: Boeing, L3Harris (Wideband SATCOM).

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

Delivered: 2002-2007.

IOC: Feb. 28, 2003.

Production: 11.

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

Operator: AFMC, AMC, ANG, AFRC.

Aircraft Location: JB Andrews, Md.; Scott AFB, Ill.

Active Variants:

- C-40A. Military cargo/passenger "combi" version of the Boeing 737-700C, with forward fuselage cargo door.
- C-40B. VIP military-configured Boeing 737-700 with advanced comms.
- C-40C. Passenger-configured Boeing 737-700, lacking advanced comms.

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

Weight: Max T-O 171,000 lb.

Power Plant: Two GE Aviation CFM56-7 turboprops, each 27,000 lb thrust.

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

Ceiling: 41,000 ft.

Accommodation: Two pilots, up to eight cabin and maintenance crew (varies by model/mission); **Load:** Up to 121 passengers or 40,000 lb cargo, or 70 passengers and three pallets in "combi" configuration (A); up to 89 passengers (B); up to 111 passengers (C).



Yasuo Osakabe/USAF



Courtesy

six-blade propellers, and digital avionics and mission computers. The C-130J can fly faster, higher, and farther than the C-130H. The C-130J-30 variant features a 15-foot longer "stretched" fuselage. The combined fleet is sustained via block upgrades. USAF combined Block 7/8.1 upgrades to reduce modification downtime. Block 7 includes Link 16, new flight management systems, civil GPS, and a special mission processor. Block 8.1 adds improved LOS data link and BLOS comms, improved precision navigational aids, enhanced covert lighting, replaces UHF comms with SATCOMS, and updates mission planning systems. Block 8.1's Mode 5 IFF and air traffic management upgrades were successfully fielded ahead of cycle to meet the FAA's 2020 compliance deadline. Airframes delivered since 2009 incorporate enhanced service life center wings, and five of the 23 early production airframes programmed will be retrofitted in 2021. The current multiyear contract procures 29 USAF C-130J-variants between FY19 and FY23 at a production rate of 16 aircraft per year. ANG units in Georgia, Texas, Kentucky, and West Virginia were selected to transition from the legacy C-130H to the C-130J starting in 2021, while Maryland will retain its A-10 mission instead of transitioning as previously planned.

Contractor: Lockheed Martin.

First Flight: April 5, 1996.

Delivered: February 1999-present.

IOC: October 2006.

Production: 2,600+ worldwide, 134 (USAF).

Inventory: 134.

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

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

Active Variants:

- C-130J Super Hercules. Current production version.
- C-130J-30 Super Hercules. Stretched version capable of accommodating larger loads.

Dimensions: Span 132.6 ft, length 97.8 ft, height 38.8 ft.; J-30 length 112.8 ft. Weight: Max T-O 155,000 lb (J), 164,000 lb (J-30); max payload 42,000 lb (J), 44,000 lb (J-30).

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

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

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

Accommodation: 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).

LC-130H SKIBIRD

Arctic support/tactical airlift

Brief: The LC-130H is a ski-equipped, Arctic-support derivative of the C-130H. It is capable of direct resupply of Antarctic research stations and high-arctic radar sites utilizing ice and snowpack runways. The LC-130H fleet supports the National Science Foundation's (NSF) Antarctic research, ferrying much of the material, provisions, and personnel between Christchurch, New Zealand, and McMurdo Station, Antarctica. The aircraft also provide ongoing support to the remote Amundsen-Scott South Pole Station. USAF began augmenting the Navy's "Operation Deep Freeze" with the C-124 in 1956. C-130s began Antarctic support in 1959, operating without skis until the initial ski-borne deployment of the C-130D in January 1960. By 1975, the New York ANG's 109th AW operated USAF's only ski-equipped LC-130 supporting Distant Early Warning

sites in the high-Arctic. The unit began augmenting Navy LC-130s during Deep Freeze in 1988, before taking over primary responsibility in 1999. Three aircraft were converted from ex-Navy LC-130Rs, and the NSF funded an additional three new-build aircraft in 1995-96. LC-130s have been upgraded with eight-bladed NP-2000 propellers to increase take-off performance, digital cockpit displays and flight management systems, multifunction radar, modernized comms, and a single air data computer. LC-130s are upgraded along with the baseline C-130H fleet, including center wing box replacement, Mode 5 IFF, as well as the C-130H Avionics Modernization Program which enters Increment 2 in FY22. Ice Pod experiments utilizing an aft, externally mounted sensor suite to record ice composition and density began in 2015. The pod includes radar, laser, and optical sensors. Required upgrades include NVG-compatible flight deck, secure BLOS data link, and increased reliability commercial SATCOM. The research season ending in February 2020 accomplished more than 200 missions airlifting 2,097 personnel and 1.5 million tons of cargo to and from the continent. Congress is pressing USAF to recapitalize the LC-130 (likely with C-130J) in line with its other special-mission C-130 fleets.

Contractor: Lockheed Martin.

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

Delivered: 1974-96.

IOC: Circa October 1984.

Production: 10.

Inventory: 10.

Operator: ANG.

Aircraft Location: Stratton ANGB, N.Y.

Active Variants:

- LC-130H Skibird. Arctic support variant with wheel-ski gear and eight-bladed propellers.

Dimensions: Span 132.6 ft, length 97.8 ft, height 38.8 ft.; Nose Ski 10 ft by six ft wide, main gear skis 12 ft by six ft wide.

Weight: Max T-O 155,000 lb; max payload 45,000 lb.

Power Plant: Four Rolls-Royce T56 3.5 turboprops, each 4,591 shp.

Performance: Speed 366 mph; range with 35,000 lb payload 1,636 miles (with engine upgrades).

Ceiling: With max payload, 23,000 ft.

Accommodation: Two pilots, navigator, flight engineer, loadmaster;

Load: Up to 92 passengers or 74 litters; six cargo pallets, 16 Container Delivery System (CDS) bundles, or any combination up to max weight.



Andrew Park/USAF

VC-25 AIR FORCE ONE

Presidential airlift

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

communications and a full suite of strategic C2 comm/data links. The aircraft also has a full self-defensive suite. The fleet is operated by the Presidential Airlift Group of the 89th Airlift Wing at JB Andrews. The VC-25A fleet has two years' estimated service life remaining and required recent life-extension/block upgrades to remain viable until replaced by the VC-25B (based on Boeing's modernized 747-8 Intercontinental). FY21 launches wideband SATCOM upgrades as part of AMC's Senior Leader Communication Modernization effort across the executive fleets. USAF issued Boeing a \$3.9 billion presidential aircraft replacement contract to modify two undelivered commercial 747-8s to VC-25B standards on Feb. 20, 2018. Work is underway modifying the airframes and delivery is slated for 2024, though specifications exclude an aerial refueling capability to reduce program cost. The current VC-25A fleet is planned for retirement by the end of 2025.

Contractor: Boeing.
First Flight: Sept. 6, 1990 (VC-25A).
Delivered: August-December 1990.
IOC: Dec. 8, 1990; planned 2024 (VC-25B).
Production: Two VC-25A; two VC-25B (undergoing modification).
Inventory: Two (VC-25A); two (VC-25B).
Operator: AMC.
Aircraft Location: JB Andrews, Md.
Active Variants:

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

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

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

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

Power Plant: Four GE Aviation CF6-80C2B1 turbofans, each 56,700 lb thrust (A); four GE Aviation GEnx-2B turbofans, each 66,500 lb thrust (B).

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

Ceiling: 45,100 ft.

Accommodation: Two pilots, navigator, flight engineer, up to 22 cabin and maintenance crew; **Load:** Up to 102 passengers (A); TBD (B).

Contractor: Lockheed Martin Sikorsky; Sierra Nevada Corp. (DVE).

First Flight: October 1974.

Delivered: 1982-1998 (HH-60G); 2019-present (HH-60U).

IOC: 1982.

Production: 112 (HH-60G); 19 (HH-60U) (21 planned).

Inventory: 104 (HH-60G); three (HH-60U).

Operator: ACC, AETC, AFMC (HH-60U), PACAF, USAF, ANG, AFRC.

Aircraft Location: Aviano AB, Italy; Davis-Monthan AFB, Ariz.; Eglin AFB, Fla.; Francis S. Gabreski Arpt., N.Y.; JB Elmendorf-Richardson, Alaska; Kadena AB, Japan; Kirtland AFB, N.M.; Moffett Field, Calif.; Moody AFB, Ga.; Nellis AFB, Nev.; Patrick AFB, Fla.

Active Variants:

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

•HH-60U. Converted surplus UH-60L combat-loss replacements.

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

Weight: Max T-O 22,000 lb.

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

Performance: Speed 184 mph; range 580 miles (farther with air refueling).

Ceiling: 14,000 ft.

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

Accommodation: Two pilots, flight engineer, gunner; **Load:** Up to three PJs and four non-ambulatory patients.



Senior Airman Hayden Legg

HELICOPTERS



Master Sgt. Kelly Goonan

HH-60 PAVE HAWK

Personnel recovery/medium lift

Brief: The HH-60G Pave Hawk is an armed, all-weather day/night CSAR helicopter derived from the UH-60 Blackhawk. Additional missions include casualty/medical evacuation, disaster and humanitarian response, firefighting, and combat/utility support. The HH-60G is equipped with advanced INS/GPS/Doppler navigation systems, SATCOM, and secure/anti-jam communications, and personnel locating system (PLS) that aids location of a survivor's radio. It includes automatic flight control, NVG lighting, FLIR, an 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). Major upgrades include Block 162 which encompasses Avionics Communications Suite Upgrade and replaces obsolete systems with color weather radar, improved TACAN, new RWR, auto direction finding, and digital intercoms. USAF aimed to complete Block 162 upgrades in 2020, and standardize HH-60Us to the same configurations by 2024. Degraded Visual Environment (DVE)/Terrain Awareness and Warning System (TAWS) is planned for fleetwide integration starting in FY22. Additional efforts include safety/survivability, data-linking offboard ISR, and mission avionics. Delivery of the last of 21 Army-surplus HH-60U combat-loss replacements was expected in 2020, with two added airframes increasing the fleet to 116. Both types will be replaced by the HH-60W Jolly Green II currently undergoing testing.

HH-60 JOLLY GREEN II

Personnel recovery/medium lift

Brief: The HH-60W is an armed, all-weather day/night CSAR helicopter fielded to replace the HH-60G. The type is derived from the UH-60M Blackhawk and dubbed "Jolly Green II" in honor of the Vietnam-era HH-3 and HH-53. Additional missions include casualty/medical evacuation, disaster and humanitarian response, firefighting, and combat/utility support. The HH-60W features a fully digital glass cockpit, improved hot weather/high-altitude performance, onboard self-defenses capable of defeating higher-end threats, an enlarged cabin, and double the internal fuel capacity of the HH-60G. Features include digital RWR, laser/missile/hostile fire warning, integrated chaff/ flares, cabin and cockpit armor, externally mounted 7.62 mm and .50 cal weapons, LINK 16, SADL, integrated cockpit/cabin displays, advanced comms, ADSB, tactical moving map displays, upturned IR-masking exhausts, and efficient wide-chord rotor blades. USAF awarded Sikorsky Aircraft the \$1.28 billion Combat Rescue Helicopter contract to replace the HH-60G on June 26, 2014. USAF accelerated procurement plans and now aims to procure a total of 113 HH-60Ws over six lots. A total of 61 LRIP helicopters will be procured in four lots from FY19-FY22, with the final two lots procured through 2024—two years earlier than originally planned. FY21 funds procure 19 aircraft, with a full-rate production decision now expected in 2023. Nine HH-60Ws support developmental testing at Eglin/Duke, and a tenth airframe was added for upgrade testing. Planned improvements include adding Distributed Aperture Infrared Counter Measure (DAIRCM), jam-resistant GPS, Degraded Visual Environment (DVE) system, Video Data Link (VDL), improved Blue Force Tracker, integrated system diagnostics, and wideband-UHF comms. Operational testing is slated to begin in July 2021, and the first production aircraft are planned for delivery in FY21. Moody received its first two aircraft Nov. 5, 2020, followed by Kirtland Dec. 17, 2020. Both bases will receive four initial aircraft for maintenance training and initial operational employment.

Contractor: Lockheed Martin Sikorsky.

First Flight: May 17, 2019.

Delivered: 2019-present.

IOC: 2022 (planned).
Production: 113 (planned).
Inventory: 16.

Operator: AFMC. Planned: ACC, AETC, PACAF, USAFE, ANG, AFRC.
Aircraft Location: Duke Field, Fla.; Kirtland AFB, N.M.; Moody AFB, Ga.
Planned: Aviano AB, Italy; Davis-Monthan AFB, Ariz.; Francis S. Gabreski Arpt., N.Y.; JB Elmendorf-Richardson, Alaska; Kadena AB, Japan; Moffett Field, Calif.; Nellis AFB, Nev.; Patrick AFB, Fla.

Active Variants:
•HH-60W. Developmental next-generation Combat Rescue Helicopter based on the UH-60M.
Dimensions: Rotor diameter 53.6 ft, overall length 64.7 ft, height 16.7 ft.
Weight: Max T-O 22,500 lb.
Power Plant: Two GE Aviation T700-GE-701D turboshafts, each 1,857 shp.
Performance: Speed 176 mph; range 690 miles (air refuelable).
Ceiling: 20,000 ft.
Armament: Two 7.62 mm miniguns or two .50-caliber machine guns.
Accommodation: Crew: two pilots, flight engineer, gunner.
Load: Mission dependent.



Samuel King Jr./USAF

MH-139 GREY WOLF

Missile field security/ light lift

Brief: The MH-139 is based on the Leonardo AW139 and is modified with mission-specific equipment, systems, and armament by prime contractor Boeing. Features include an open-architecture glass cockpit, weather radar, enhanced ground proximity warning, radar altimeter, engine IR signature reduction, and military UHF/satcoms. Modifications will include defensive systems such as chaff/flares and missile warning, cockpit and cabin ballistic protection, and crashworthy, self-sealing fuel tanks. AFGSC aircraft will be optionally armed with cabin-mounted 7.62 mm M240 machine guns. USAF awarded Boeing the \$2.4 billion UH-1N replacement contract on Sept 24, 2018, following cancellation of the earlier Common Vertical Lift Support Program (CVLSP). Requirements were driven by the MH-139's primary ICBM-field security and support role, but it will eventually replace UH-1Ns in the DV lift and aircrew survival training roles as well. The service plans to procure up to 84 MH-139s through FY27, basing 30 at Andrews, 11 each at F. E. Warren, Kirtland (schoolhouse), Malmstrom, Minot, and four each at Fairchild and Yokota, retaining two for integration work at Eglin. Since the commercial AW139 is a mature system, developmental testing will be streamlined and tests will focus largely on ability to meet mission requirements. Two of the initial four airframes arrived at Duke Field in late 2019, and the first developmental test flight took to the air Feb. 11, 2020. Operational testing begins in FY21 and live-fire and aircraft survivability/self-defensive tests are ongoing. USAF plans to procure eight aircraft per year starting in FY21, with full-rate production ramping up to 15 aircraft per year starting in 2023. The service announced Maxwell is its preferred MH-139 formal training location, and Malmstrom will be the first operational location.

Contractors: Boeing (prime contractor); Leonardo (formerly Agusta-Westland) (airframe); Honeywell (avionics).

First Flight: 2019.

Delivered: Dec. 19, 2019-present.

IOC: 2023 (planned).

Production: 84 (planned).

Inventory: N/A.

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

Aircraft Location: Duke Field, Fla. Planned: Fairchild AFB, Wash.; F. E.

Warren AFB, Wyo.; JB Andrews, Md.; Kirtland AFB, N.M.; Malmstrom AFB, Mont.; Maxwell AFB, Ala.; Minot AFB, N.D.; Yokota AB, Japan.

Active Variants:

•MH-139A. Military version of the Agusta-Westland AW139 for utility support and light lift.

Dimensions: Rotor diameter 45.2 ft, length 54.7 ft, height 16.3 ft.

Weight: Max gross 14,110 lb.

Power Plant: Two Pratt & Whitney PT6C-67C turboshaft, each 1,100 shp.

Performance: Speed 167 mph, range 890 miles.

Ceiling: 20,000 ft.

Armament: Two M240 7.62 mm machine guns (mission dependent).

Accommodation: Two pilots, flight engineer; Load: 15 passengers (depending on fuel, equipment, and atmospheric conditions) or up to four litters and five medical personnel.



Airman 1st Class Davis Donaldson

UH-1 HUEY/IROQUOIS

Light lift/training

Brief: The UH-1N aircraft initially provided search and rescue capabilities before replacing earlier Huey variants in the ICBM field security and support role. UH-1Ns also provide administrative/DV lift to U.S. National Capital Region at JB Andrews and U.S. Forces-Japan at Yokota, as well as supporting 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. USAF awarded Boeing the \$2.4 billion UH-1N replacement contract for up to 84 MH-139s in 2018, but contract delays pushed initial fielding to 2023 or beyond. The fleet recently received NVG-compatible cockpits, upgraded sensors, and safety and sustainment improvements. The ongoing SLEP of up to 63 airframes aims to bridge the gap until the MH-139A is fielded and USAF plans to begin retiring the fleet in 2022 with full retirement by 2032. UH-1N is the only DoD aircraft fleet to consistently achieve its target mission capable rate over the past decade.

Contractors: Bell Helicopter; Lockheed Martin (TH-1H prime).

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

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

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

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

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

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

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

Active Variants:

•TH-1H. Modified twin-engine version of UH-1H used for flight training.

•UH-1N. Military version of the Bell 212 used for utility support and light lift.

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

Weight: Max gross 10,500 lb.

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

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

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

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

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

TRAINER AIRCRAFT



Master Sgt. JT May III

T-1 JAYHAWK

Advanced trainer

Brief: The T-1A is a military version of the Beechcraft 400A business jet used in the advanced phase of JSUPT for tanker/transport pilot and CSO training pipelines. The cockpit seats an instructor and two students. Mods include UHF/VHF radios, INS, TACAN, airborne direction finder, increased bird-strike resistance, and an additional fuselage fuel tank. CSO training aircraft also incorporate GPS-driven SAR and simulated RWR, as well as a second student and instructor station. Upgrade efforts are focused on avionics modernization and include new MFD and terrain collision avoidance systems. USAF awarded a \$156 million Avionics Modernization Program (AMP) contract to replace the type's obsolescent flight deck with a commercial glass cockpit in 2018, and the first modified aircraft flew in March 2019. A total of 55 aircraft (including all CSO-training aircraft) will be upgraded using pre-purchased kits. USAF announced plans to divest the majority of the fleet starting in FY23 citing cost-prohibitive obsolescence issues. The service plans to retain only the 21 CSO-configured trainers at Pensacola. The last of 39 aircraft severely damaged in a hailstorm was rebuilt and redelivered to Laughlin on Dec. 17, 2020.

Contractors: Beechcraft (airframe); Field Aerospace/Rockwell Collins (AMP).

Operator: AETC.

First Flight: July 5, 1991 (T-1A).

Delivered: Jan. 17, 1992-July 1997.

IOC: January 1993.

Production: 180.

Inventory: 178.

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

Active Variant:

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

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

Weight: Max T-O 16,100 lb.

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

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

Ceiling: 41,000 ft.

Accommodation: Three pilots (two students side by side, instructor in jump-seat); one pilot, one CSO trainee side-by-side, instructor in jump-seat, one radar/system student and one instructor at aft-consoles (CSO-training configured aircraft).



Senior Airman Keith Holcomb

T-6 TEXAN II

Primary trainer

Brief: The T-6 is a joint Air Force/Navy undergraduate pilot trainer developed under the Joint Primary Aircraft Training System program. The aircraft is based on the Swiss Pilatus PC-9 and the Navy version is designated T-6B. 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 was completed in 2010, with an expected service life of 21 years. Ongoing mods include airspace compliant avionics, improved canopy fracture system, and updated training aids. Development includes controlled flight into terrain avoidance, a crash-survivable flight data recorder, and Next-Generation Onboard Oxygen Generation System (OBOGS) to combat the hypoxia-like incidents expected starting in FY22. Improved maintenance and inspections will mitigate hypoxia risks until fleetwide retrofit is complete.

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

First Flight: July 15, 1998.

Delivered: May 2000-May 2010.

IOC: May 2000.

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

Inventory: 442 (USAF).

Operator: AETC, USN.

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

Active Variants:

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

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

Weight: Max T-O 8,300 lb (T-6).

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

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

Ceiling: 31,000 ft.

Accommodation: Two pilots on Martin Baker MK16LA zero/zero ejection seats.



USAF

T-7A RED HAWK

Advanced trainer

Brief: The T-7A Red Hawk is the Air Force's developmental next-generation, supersonic advanced jet trainer. The service selected the joint-venture Boeing-SAAB aircraft as the winner of the \$9.2 billion "T-X" competition to replace the T-38 on Sept. 20, 2018. The Air Force dubbed the type "Red Hawk" in honor of the WWII Tuskegee Airmen. The T-7A was rapidly developed in less than three years using digital design techniques earning USAF's initial "e" prefix designating it part of the "Digital Century Series" to quickly field new, low-cost designs. eT-7A was designed from the outset to replicate the systems and performance of advanced 4th and 5th-generation aircraft including high-G/high angle of attack performance and a blend of synthetic and onboard systems including simulated radar, defensive systems, data links, and smart weapons. It incorporates fly-by-wire controls, a fully digital glass cockpit, "stadium seating" to improve backseat visibility, next-gen ACES 5 ejection seats, modular systems architecture, and maintainer-friendly design to cut downtime and lifecycle cost. T-7A is being developed in tandem with the Ground-Based Training System simulator and courseware to provide AETC with a seamless, comprehensive flight training program. The first of two "production ready" airframes first flew from Boeing's facility at Saint Louis on Dec. 21, 2016. The first two aircraft launched initial flight testing and five additional airframes will support Engineering and Manufacturing Development testing at Edwards beginning flight-envelope expansion. The first production T-7A is planned for delivery to Randolph in 2023, and FY21 funds construction of the initial Ground-Based Training System simulator at JBSA Lackland.

Contractors: Boeing-SAAB, General Electric (engine), Collins Aerospace (cockpit/ejection seats).
First Flight: Dec. 20, 2016 (T-X).
Delivered: 2023 onward (planned).
IOC: 2024 (planned).
Production: 351 (planned).
Inventory: Three (contractor-owned test airframes).
Operator: Boeing, AFMC; Planned: AETC.
Aircraft Location: Edwards AFB, Calif. Planned: Columbus AFB, Miss.; Laughlin AFB, JBSA-Randolph, and Sheppard AFB, Texas; Vance AFB, Okla.
Active Variants:
 -eT-7A. Developmental next-generation advanced trainer.
Dimensions: Span 30.6 ft, length 46.9 ft, height 13.5 ft.
Weight: Max T-O 12,125 lb.
Power Plant: General Electric F404-GE-103 afterburning turbofan, 17,200 lb thrust with afterburning.
Performance: Speed Mach 1+, range approx. 1,140 miles.
Ceiling: 50,000 ft+.
Accommodation: Two pilots on ACES 5 zero/zero ejection seats.



Courtesy

T-38 TALON

Advanced trainer

Brief: The T-38 was the first supersonic trainer aircraft and primarily serves AETC's advanced JSUPT fighter/bomber tracks and Introduction to Fighter Fundamentals. The aircraft is used to teach supersonic techniques, aerobatics, formation, night and instrument flying, and cross-country/low-level navigation. The T-38 is also used by the USAF Test Pilot School to train test pilots and flight-test engineers and by ACC and AFGSC as a companion trainer to maintain pilot proficiency. ACC uses regenerated T-38s as dedicated Aggressor aircraft for F-22 training and companion trainers for the U-2 program. T-38Bs are equipped with a gunsight and centerline station 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 engine inlets. T-38s were designed for 7,000 flying hours but many have surpassed 20,000 hours, requiring life-extension to bridge the gap to replacement by the T-7A. Pacer Classic III is the type's third structural renewal effort and the most intensive in its history. It replaces major longerons, bulkheads/formers, intakes, internal skins, and structural floors on 180 high-risk T-38Cs. The first airframe was redelivered in 2015 and a total of 19 aircraft will complete upgrades in FY21. Additional efforts include wing replacement through 2033, a new forward canopy to improve bird-strike survivability, and low-cost safety mods. Development encompasses digital avionics, replacement HUD, VHF nav/comms, and airspace compliance. AETC plans to begin replacing its T-38s with the T-7A starting at Laughlin in 2033.

Contractors: Northrop Grumman; Boeing (sustainment); CPI Aerostructures (Pacer Classic III kits); Israel Aerospace Industries (re-wing).
First Flight: April 1959 (T-38A); July 8, 1998 (T-38C).
Delivered: 1961-72 (T-38A); 2002-07 (T-38C).
IOC: March 1961.
Production: 1,187.
Inventory: 53 (T-38A); six (AT-38B); 443 (T-38C).
Operator: ACC, AETC, AFGSC, AFMC.
Aircraft Location: Beale AFB and Edwards AFB, Calif.; Columbus AFB, Miss.; Holloman AFB, N.M.; JB Langley-Eustis, Va.; JBSA-Randolph and Sheppard AFB, Texas; JB Langley-Eustis, Va.; Eglin AFB and Tyndall AFB,

Fla., Vance AFB, Okla.; Whiteman AFB, Mo.

Active Variants:

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

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

Weight: Max T-O 12,093 lb.

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

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

Ceiling: 55,000 ft+.

Accommodation: Two pilots on Martin Baker MK16T zero/zero ejection seats.

UNMANNED AIRCRAFT SYSTEMS



Bruce Hoffmann/USAF

BMQ-167 SUBSCALE AERIAL TARGET

Full-scale aerial target

Brief: BMQ-167A is a subscale, unmanned aerial target and threat simulator serving missile/weapons development, testing, validation, and training over the Eglin Test and Training Range. The 82nd Aerial Targets Squadron employs the cheaper subscale targets to complement its QF-16 full scale aerial target fleet operating from Tyndall. The BMQ-167 is boosted to flying speed from a launch rail via a solid-fuel Rocket-Assisted Take Off (RATO) motor which is then jettisoned. BMQ-167 is capable of representing air targets maneuvering at up to nine Gs at speeds up to Mach 0.91 and altitudes between 50 and 50,000 feet. The drone is constructed of durable, lightweight composites, equipped with a recovery parachute, and depending on its condition capable of being refurbished and reused. BMQ-167s incorporate a scoring system and a range of threat-simulating systems/stores including IFF, EA pods, IR/radar countermeasures as well as IR/radar signature augmentation to simulate a variety of threats. The Air Force competitively awarded the first BMQ-167 production contract in 2002, and most recently awarded a \$31.8 million Lot 15 sole-source contract to Kratos for 35 targets in June 2019. FY21 funds support Lot 17 production of 25 subscale targets.

Contractors: Kratos Unmanned Aerial Systems.

First Flight: Dec. 8 2004.

Delivered: 2004-present.

IOC: 2008.

Production: 800+ (planned).

Inventory: Unk.

Operator: ACC.

Aircraft Location: Tyndall AFB, Fla.

Active Variants:

- BMQ-167A. Subscale aerial target.

Dimensions: Span 10.5 ft, length 20 ft, height 4 ft.

Weight: Max T-O 2,050 lb.

Power Plant: MicroTurbo (Safran) Tri 60-5 turbofan, 1,000 lb thrust.

Performance: Speed Mach 0.91, range unk.

Ceiling: 50,000 ft.

Defensive Systems: Chaff/flares, EA pods, IR/RF wing pods (augmentation).

Accommodation: Preprogrammed, unmanned.



Staff Sgt. Omari Bernard



Tech Sgt. Perry Aston

MQ-9 REAPER

Attack/armed reconnaissance

Brief: The MQ-9B is a medium-to high-altitude, long-endurance hunter-killer RPA, primarily tasked with eliminating time-critical and high-value targets in permissive environments. Additional roles include CAS, CSAR, precision strike, armed overwatch, target development/designation, and terminal weapon guidance. The MQ-9 fulfills a secondary tactical ISR role utilizing its Multispectral Targeting System-B (MTS-B), Lynx SAR, and/or Gorgon Stare wide-area surveillance. MTS-B 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. The MQ-9 employs SAR for JDAM targeting and dismounted target tracking. MQ-9B debuted in combat in Afghanistan in 2007. A Reaper system comprises three aircraft, GCS, LOS/BLOS satellite and terrestrial data links, support equipment/personnel, and crews for deployed 24-hour operations. MQ-9 is retrofitted under a flexible acquisition structure, which can rapidly change to meet demand. USAF plans to upgrade the entire fleet (including 144 Block 1, and 136 Block 5 aircraft) to Extended-Range standards. 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. FY21 funds GCS Block 30, ER conversions, data link, GPS, and Gorgon Stare improvements, reliability and maintainability mods, capability upgrades and production line shut down. FY22 will launch DAS-4 high-definition EO/IR sensor retrofits to improve targeting accuracy. USAF is ending MQ-9 procurement and seeks to replace Reaper with a more survivable, flexible, and advanced platform as early as 2031.

Contractors: General Atomics Aeronautical Systems; L3Harris; Raytheon (sensors).

First Flight: February 2001.

Delivered: November 2003-present.

IOC: October 2007; 2015 (ER).

Production: 337 (planned).

Inventory: 289.

Operator: ACC, AFMC, AFRC (associate), AFSOC, ANG.

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

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

Active Variants:

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

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

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

Dimensions: Span 66 ft (79 ft, ER), length 36 ft, height 12.5 ft.

Weight: Max T-O 10,500 lb.

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

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

Ceiling: 50,000 ft.

Armament: Combination of AGM-114 Hellfire (up to eight), GBU-12/49 Paveway II, and GBU-38 JDAMs.

Accommodation: Pilot, sensor operator (operating from GCS).

QF-16 FULL-SCALE AERIAL TARGET

Full-scale aerial target

Brief: QF-16 is a manned/unmanned aerial target and threat simulator serving missile/weapons development, testing, validation, and training. QF-16s began replacing the dwindling and obsolescent QF-4 Full-Scale Aerial Target (FSAT) starting in 2015, through the type's retirement in December 2017. QF-16s are capable of manned or "not under live local operator" (NULLO) control operations. The first of 13 LRIP QF-16s was delivered to Tyndall in early 2015. Boeing is under contract to deliver 121 converted airframes in five production lots through April 2021. FY21 funds procure 13 conversions, and a follow-on sixth lot contract for 13 airframes is expected in mid-FY21. ACC declared IOC with 15 operational aircraft in 2016. Ongoing efforts include developing EA pods/pod improvements and software to more accurately replicate adversary capabilities and tactics, ground-control modernization, and threat realism/countermeasure improvements. Boeing and USAF opened a second QF-16 conversion line at Davis Monthan to augment production at Cecil Field in Jacksonville, Fla., which delivered its first airframe in mid-2020.

Contractors: Lockheed Martin; Boeing (drone conversion).

First Flight: May 4, 2012.

Delivered: February 2015-present.

IOC: Sept. 23, 2016.

Production: 126 (planned).

Inventory: 7 (QF-16A); 36 (QF-16C).

Operator: ACC.

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

Active Variants:

•QF-16A. Converted from retired F-16A Block 15.

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

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

Weight: Max T-O 37,500 lb.

Power Plant: Pratt & Whitney F100-PW-200 turbofan, 23,830 lb thrust (Block 15); Pratt & Whitney F100-PW-220 turbofan, 23,830 lb thrust (Block 25); GE Aviation F110-GE-100 turbofan, 29,000 lb thrust (Block 30).

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

Ceiling: 50,000 ft.

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

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

RQ-4 GLOBAL HAWK

High-altitude reconnaissance

Brief: The Global Hawk is a strategic long-endurance, high-altitude, "deep look" ISR platform complementing satellite and manned ISR. It is capable of imagery, SIGINT, and ground moving target indication (GMTI), depending on variant. The system consists of the aircraft and sensors, launch and recovery element (LRE), mission control element (MCE), and comms/mission planning cell. The pre-production Block 10 debuted in combat in 2001 and retired in 2011. Block 20 was initially equipped with the Enhanced Integrated Sensor Suite (EISS) for imagery intelligence (IMINT). Five were converted as EQ-4B Battlefield Airborne Communications Node (BACN) relays, and four are active following a loss replacement in 2018. Block 30 is a multi-intelligence platform equipped with EO/IR, SAR, and SIGINT sensors. It is also equipped with a universal payload adapter that enables (previously) U-2-unique payloads including the MS-117 and SYERS II EO sensors, and a wet-film Optical Bar Camera to be carried. The Airborne Signals Intelligence Payload (ASIP) was only installed on three of the 11 planned airframes. Block 40 is a ground-moving target surveillance platform equipped with the Multiplatform Radar Technology Insertion



Senior Airman Elora McCutcheon

Program (MP-RTIP). Its AESA and SAR simultaneously conduct moving target and cruise missile tracking, as well as stationary imagery collection. USAF announced plans to retire the EQ-4B and RQ-4B Block 30, retaining only the Block 40. FY21 funds shift to supporting and modernizing Block 40, including a design study aimed at integrating a modular ISR payload adapter. USAF conducted the first RQ-4 flight using the new, modernized ground control station in 2020.

Contractors: Northrop Grumman, Raytheon, L3Harris.
First Flight: Feb. 28, 1998.
Delivered: August 2003-present.
IOC: August 2011 (Block 30); August 2016 (Block 40).
Production: 45 (USAF).
Inventory: 33; four (Block 20); 19 (Block 30); 10 (Block 40).
Operator: ACC, AFMC.
Aircraft Location: Beale AFB, Calif. (Block 30); Edwards AFB, Calif.; Grand Forks AFB, N.D. (Block 20/40); forward operating locations: Ali Al Salem AB, Kuwait (EQ-4B); Andersen AFB, Guam; NAS Sigonella, Italy; Yokota AB, Japan.
Active Variants:
 •EQ-4B Block 20. Battlefield Airborne Communications Node (BACN) comm relay platform.
 •RQ-4B Block 30. Multi-intelligence platform equipped with EO/IR and SAR sensors.
 •RQ-4B Block 40. AESA and SAR equipped ground moving target indication (GMTI) and battlefield ISR platform.
Dimensions: Span 130.9 ft, length 47.6 ft, height 15.3 ft.
Weight: Max T-O 32,250 lb; max payload 3,000 lb.
Power Plant: One Rolls-Royce North American F137-RR-100 turbofan, 7,600 lb thrust.
Performance: Speed 356.5 mph, range 14,150 miles, endurance 32+ hrs (24 hrs on-station loiter at 1,200 miles).
Ceiling: 60,000 ft.
Accommodation: LRE Pilot, MCE pilot, MCE sensor operator (operating from LRE/MCE).



USAF

RQ-170 SENTINEL

Unmanned surveillance and reconnaissance

Brief: RQ-170 is an unmanned, stealthy, penetrating, day/night tactical ISR platform. Although the RQ-170 was still under development and test, USAF employed it in Southwest Asia for Enduring Freedom. The RPA was developed in response to DOD's call for additional RPA support for combatant commanders. USAF publicly acknowledged the aircraft after photos appeared in foreign news media of operations over Afghanistan in 2009. The type is operated by the 432nd Wing at Creech and the 30th

Reconnaissance Squadron at Tonopah Test Range. In 2011, an RQ-170 was captured almost intact by Iranian forces. Iran allegedly reverse-engineered a copy of the aircraft, which the Israeli Air Force reported shooting down during an engagement inside Israeli territory on Feb. 10, 2018. The RQ-170 took part in a joint-exercise at Nellis in August 2020, testing its ability to accompany a B-2 on penetrating operations aided by SEAD F-35s.

Contractor: Lockheed Martin.
Operator: ACC.
GCS Location: Creech AFB, Nev.; Tonopah Test Range, Nev.
Aircraft Location: Tonopah Test Range, Nev.; deployed worldwide.
Known Active Variant:
 •RQ-170. No data available.
Dimensions: Span 65.6 ft, length 14.75 ft.

STRATEGIC WEAPONS



Tinker Air Force Base History Office

AGM-86 AIR-LAUNCHED CRUISE MISSILE (ALCM)

Strategic air-to-surface cruise missile

Brief: The AGM-86 is a low-level, penetrating nuclear strike weapon for use against strategic surface targets. ALCM's small radar signature and low-level flight capability enhance the missile's effectiveness. The nuclear AGM-86B was the first production version with a total of 1,715 delivered through 1986. USAF plans to cut the inventory from its current level to an eventual 528 ALCM. Some ALCMs were modified for conventional use with INS/GPS-guidance and a blast fragmentation warhead and redelivered in 1987 as the AGM-86C ALCM. CALCM was operationally employed for the first time in Desert Storm and widely used in subsequent operations. CALCM was capable of adverse weather, day/night, air-to-surface, accurate, standoff strike capability at ranges greater than 500 miles. The AGM-86D was CALCM's Block II penetrator version with AUP-3(M) warhead used for standoff strikes on hardened, deeply buried targets in Afghanistan. CALCM was retired in early 2019 and the inventory is stored at Barksdale awaiting disposal. ALCM is undergoing SLEP/component remanufacture to stretch its in-service life to 2030, allowing for 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, with Raytheon's design emerging as the focus of USAF's continued development last year. Plans call for fielding the nuclear missile by the late 2020s, possibly followed by a conventional derivative thereafter.

Contractor: Boeing.
First Flight: June 1979 (full-scale development).
Delivered: 1981-1986.
IOC: December 1982 (B); January 1991 (C); November 2001 (D).
Production: 1,715.
Inventory: 536 (B), 186 (C), 34 (D).
Operator: AFGSC.
Unit Location: Barksdale AFB, La.; Minot AFB, N.D.
Active Variants:
 •AGM-86B. Nuclear ALCM variant.
Dimensions: Span 12 ft, length 20.8 ft, body diameter 2 ft.
Weight: 3,150 lb.
Power Plant: Williams/Teledyne CAE F107-WR-10 turbofan, 600 lb thrust.
Performance: Speed 550 mph, range 1,500+ miles (B).
Guidance: Inertial plus Terrain Contour Matching (B).
Warhead: W80-1 nuclear warhead (B).
Estimated Yield: W80-1 warhead: five-150 kilotons (preselectable).
Integration: B-52H.



Giancarlo Casem/USAF

AGM-183 AIR-LAUNCHED RAPID RESPONSE WEAPON (ARRW)

Hypersonic air-to-surface weapon

Brief: The AGM-183A is a developmental boost-glide hypersonic missile to provide future, nonnuclear strike against time-sensitive, heavily defended, high-value targets from standoff range. The missile is designed to accelerate to speeds well in excess of Mach 5 before releasing a non-powered glide vehicle which maneuvers to the intended target. USAF completed a series of seven captive flight-tests utilizing an instrumented test article on a B-52H at Edwards, culminating in an aborted boost-test in December 2020. The service now plans to conduct the first boost-test from a B-52 in early FY21, accelerating a dummy glide vehicle over the Point Mugu Test Range. The service is procuring eight prototype AGM-183s to support testing and a potential early-operational capability. AFGSC plans to operationally deploy the weapon on the B-52 and B-1 as early as 2022, with possible, later integration on the F-15E/EX.

Contractor: Lockheed Martin.

First Flight: N/A.

Delivered: N/A.

IOC: 2022 (planned).

Production: N/A.

Inventory: N/A.

Operator: AFMC, Planned: AFGSC.

Unit Location: Edwards AFB, Calif.

Active Variants:

•AGM-183A. Developmental prototype hypersonic boost-glide weapon.

Dimensions: Unk.

Weight: Unk.

Propulsion: Solid fuel rocket.

Performance: Mach 5+, range approx. 1,000 miles.

Guidance: Unk.

Warhead: Boost-glide vehicle

Integration: Planned: B-1B, B-52H, F-15E.



National Nuclear Security Administration

B61 THERMONUCLEAR BOMB

Air-to-surface thermonuclear bomb

Brief: B61 is an air-dropped battlefield/tactical nuclear weapon. It is the B-2's primary strategic weapon equipping both the F-16 and F-15E in the forward-deployed, allied extended deterrent role, as well as the B-2. The weapon was first delivered in 1966, and the B61 Mod 11 introduced in 1997 adds a ground-penetrating capability, enhancing its effect against 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) begun in 2016 to consolidate the B61-3, -4, -7, and -10 into a single, standardized configuration. The LEP refurbishes the warhead to improve the safety, security, and reliability through 2040. B61-12 also adds a guided tail kit, making it the first precision guided weapon of its type, permitting higher effectiveness at lower yields. USAF and the National Nuclear Security Administration finished

qualification flight-testing on June 9, 2018. The 31 inert test drops greatly exceeded performance requirements, validating nonnuclear components such as arming/fire control, guidance, spin-rocket motors, and software. B61-12 was approved for production and completed operational flight testing on the F-15E and B-2A in 2019. Operational testing included 15 drops, certifying the F-15E as the first aircraft capable of delivering the B61-12 on June 8, 2020. The Department of Energy conducted nine additional drops, culminating in a full-weapon system demo on the B-2A in July 2020. The F-35A dropped an inert B61-12 for the first time on Aug. 25, 2020, employing it in supersonic flight from its internal weapons bay. Delivery of the first production example has been delayed two years to 2022 due to technical issues. Future integration is planned on the F-16, and F-35A.

Contractors: Los Alamos National Laboratory (weapon); Boeing (B61-12 tail kit).

Delivered: 1966.

IOC: 1968.

Production: N/A.

Inventory: Approx. 500.

Operator: AFMC, USAFE.

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

Active Variant:

•B61. Supersonic-droppable free-fall thermonuclear weapon.

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

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

Performance: N/A.

Guidance: None (B61 Mod 1 to 11); unk, likely INS (B61 Mod 12).

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

Estimated Yield: 0.3 kilotons, 1.5 kilotons, 10 kilotons, 50 kilotons (pre-selectable).

Integration: B-2A, F-15E, and F-16C/D; NATO: F-16A/B Mid-Life Upgrade (MLU), and Panavia Tornado IDS. Planned: B-21, F-35A.



Airman 1st Class Braydon Williams

LGM-30 MINUTEMAN III

Strategic surface-to-surface ballistic missile

Brief: Minuteman is a three-stage, solid-propellant nuclear deterrent ICBM housed in a survivable underground silo. Minuteman III became operational in 1970, providing improved range, rapid retargeting, and the capability to place up to three reentry vehicles on three targets with high accuracy. It is the sole remaining US land-based ICBM. Ongoing mods include updated warhead fuses, networking, and cryptography upgrades. FY18 began the Launch Control Center Block Upgrade (LCCBU), which replaces key hardware, software, comms, and environmental control systems in the crew capsule, as well as starting new missile site security and video situational awareness upgrades. Guidance and propulsion upgrades and modernized reentry 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 is also undertaking Launch Control Center AEHF integration to modernize and enhance comms redundancy. The command initially deployed 550 missiles, later reducing that number to 400 based at Malmstrom, Minot, and F.E. Warren. AFGSC reduced 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 to replace Minuteman with a future Ground-Based Strategic Deterrent (GBSD) in 2017. Boeing declined to bid on full development in 2019, leaving Northrop Grumman to develop GBSD. Minuteman III is already more than 40 years beyond its initially planned service life, and USAF expects the system will begin falling below readiness standards as early as 2026 if not replaced. Flight-testing of a

replacement fuze began in February 2019 and will culminate with the last of four test launches in 2024.

Contractors: Boeing; General Electric; Lockheed Martin; Northrop Grumman (formerly Orbital ATK)

First Flight: February 1961.

Delivered: 1962-1978.

IOC: December 1962, Malmstrom AFB, Mont.

Production: 1,800.

Inventory: 397 deployed; 261 non-deployed.

Operator: AFGSC.

Unit Location: F. E. Warren AFB, Wyo.; Malmstrom AFB, Mont.; Minot AFB, N.D.; Vandenberg SFB, Calif. (test location).

Active Variant:

•LGM-30G. Current Minuteman III variant.

Dimensions: Length 59.9 ft, diameter 5.5 ft. Weight: 79,432 lb.

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

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

Guidance: Inertial guidance system.

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

Warhead: One W87 or up to three W78 enriched uranium thermonuclear weapons.



USAF

AGM-154 JOINT STANDOFF WEAPON (JSOW)

Guided air-to-surface glide bomb

Brief: JSOW is a joint USAF-Navy family of medium-range, GPS/INS guided, standoff air-to-ground glide weapons. It is 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. The new AGM-154C-1 variant adds moving, maritime strike capability to the baseline C variant, which reached IOC with the Navy in 2016. The weapon completed operational flight testing on the F-35C in 2019, clearing the way for ongoing internal integration and testing on the F-35A.

Contractor: Raytheon.

First Flight: December 1994.

Delivered: 2000-05 (USAF).

IOC: 2000.

Active Variants:

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

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

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

Dimensions: Length 13.3 ft, diameter 13 in.

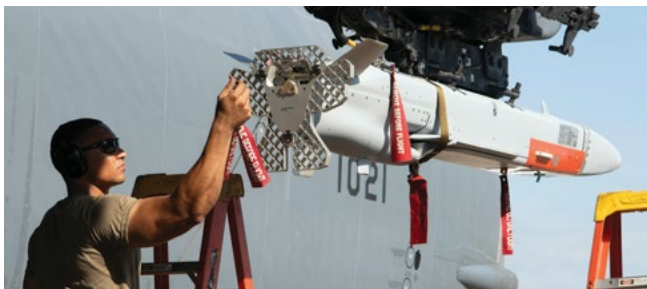
Performance: Range 13.8 miles low altitude, 73 miles high altitude.

Guidance: GPS/INS.

Warhead: See variants above.

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

LONG-RANGE STANDOFF WEAPONS



Airmen 1st Class Celeste Zuniga

ADM-160 MINIATURE AIR LAUNCHED DECOY (MALD)

Aircraft decoy; close-in radar jammer

Brief: MALD is a programmable, low-cost, modular, autonomous flight vehicle that mimics U.S. or allied aircraft to confuse enemy Integrated Air Defense Systems (IADS). MALD-J adds radar jamming capability to the basic decoy platform and can operate alone or in concert with other EW platforms. The jammer version is designed as an expendable, close-in jammer to degrade and deny an early warning or acquisition radar's ability to establish a track on strike aircraft. It also maintains the ability to fulfill the basic decoy mission. F-16 or B-52 are lead employment aircraft for MALD. USAF capped procurement in FY12, converting Lot 4 to the MALD-J variant. Plans call for 3,000, of which 2,400 are the jammer version. USAF demonstrated in-flight retargeting capabilities and is integrating GPS-Aided Inertial Navigation System (GAINS II) to improve navigational accuracy in GPS-denied environments. An upgraded Jammer variant dubbed "MALD-X" successfully demonstrated future, low-level flight capabilities, improved EW payloads, and enhanced data links in 2018. MALD-X aims to establish USAF's future baseline and serves as the basis of the Navy's developmental MALD-N variant. USAF awarded a MALD-J contract option for Lot 10 production in 2016 and a follow-on Lot 11 contract for 250 weapons in 2018.

Contractor: Raytheon.

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

Delivered: Sept. 6, 2012 (MALD-J).

IOC: 2015 (MALD-J).

Active Variants:

•ADM-160B. MALD base decoy variant.

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

Dimensions: Span 5.6 ft (extended), length 9.3 ft. Weight: Less than 300 lb.

Power Plant: Hamilton Sundstrand TJ-150 turbojet, 337 lb thrust.

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

Guidance: GPS/INS.

Integration: B-52H, F-16C. Planned: B-1B.



Tech. Sgt. David Scott-Gaughan

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

Air-to-surface cruise missile

Brief: JASSM is a joint USAF-Navy autonomous, precision cruise missile for use against heavily defended or high-value targets at standoff range. It can attack fixed, relocatable, and moderately hardened/buried targets. The base-variant is a stealthy, low-cost airframe equipped with GPS/INS guidance and imaging IR terminal seeker. The JASSM-Extended Range (JASSM-ER) version uses the same baseline body, but a new engine and fuel system that increases range to more than 500 miles. The ER was cleared for combat use on the B-1B in 2015, reached full operational capability on the F-15E in 2018, and planned for use on all fighter/bomber platforms. Full-rate production began in 2018, and production shifted to ER-only in FY16. Total planned production includes 2,034 JASSMs and 2,866 JASSM-ERs. Further development has resulted in the "extreme range" JASSM-XR, which is slated for future production. Lockheed Martin is also developing the Long-Range Anti-Ship Missile (LRASM) which reached early operational capability on the B-1B in December 2018, and is planned

for additional fielding on the B-52. The service is considering upping total procurement to as many as 10,000 JASSMs and 400 LRSAMs. FY21 funds support procurement of five LRASM and 400 JASSM-ER including initial procurement of 40 extreme-range variants deferred from FY20. USAF conducted a proof of concept employing palletized JASSM deployed from the ramp of a C-17 and MC-130 in September 2020, aimed at using mobility platforms for massed, stand-off attack.

Contractors: Lockheed Martin; Raytheon; Honeywell.
First Flight: April 8, 1999.
Delivered: 2001-present.
IOC: September 2003; December 2014 (ER variant); 2018 (LRASM).
Production: 7,200 JASSM (planned); 50 LRASM (planned).
Active Variants:
 •AGM-158A JASSM. Base-variant.
 •AGM-158B JASSM-ER. Extended-range variant.
 •AGM-158C LRASM. Long-Range Anti-Ship Missile, based on JASSM.
 •AGM-158D JASSM-XR. Future extreme-range variant of JASSM-ER.
Dimensions: Length 14 ft.
Power Plant: Teledyne Technologies J402 turbojet (JASSM); Williams Intl. F107-WR-105 turbofan (JASSM-ER).
Performance: Speed subsonic, range 200+ miles (baseline), 500+ miles (ER), approx. 1000 miles (XR).
Guidance: GPS/INS and imaging IR terminal seeker.
Warhead: 1,000-lb class penetrator (JASSM); 1,000-lb blast fragmentation (LRASM).
Integration: B-1B, B-2, B-52H, F-15E, and F-16 Block 40-52; planned: F-35A (JASSM). B-1B, B-2A, B-52H, F-15E F-16; planned: F-35A (JASSM-ER B1B; planned: B-52 (LRASM).

IOC: Circa 1983 (9M); 2003 (9X).
Production: 1,289 (Block I); 11,635 (Block II/Block II+) (planned).
Active Variants:
 •AIM-9M. Early variant.
 •AIM-9M-9. Expanded anti-countermeasure capability variant.
 •AIM-9X. Newest, highly maneuverable, JHMCS compatible variant.
Dimensions: Span 2.1 ft, length 9.4 ft, diameter 5 in.
Propulsion: Mk 36 Mod 11 (9M); Orbital ATK Mk 139 solid-propellant rocket motor (9X).
Performance: Speed Mach 2+, range 10+ miles.
Guidance: Passive IR homing guidance.
Warhead: HE annular blast fragmentation.
Integration: F-15C/D/E, F-16C/D, F-22A (AIM-9X). Planned: F-35A.



Master Sgt. Michael Jackson

AIR-TO-AIR MISSILES



Airman 1st Class Cedrique Oldaker

AIM-9 SIDEWINDER

Air-to-air missile

Brief: Sidewinder is an IR-guided short-range, supersonic air-to-air missile. It was developed by the Navy for fleet air defense and adapted for USAF fighters. Early versions were used extensively in the Vietnam War. The AIM-9M is a joint Navy-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 for high, off-boresight targeting. The enhanced AIM-9X Block II was cleared for full-rate production in September 2015 and adds improved lock-after-launch and maneuverability, new data link for beyond-visual range engagement, enhanced anti-countermeasures, a new fuse, and safer ground-handling characteristics. AIM-9X production includes 67 converted AIM-9Ms, 1,289 Block I, and planned joint-service procurement of 11,635 Block II/II-plus (nearly double the number originally planned). FY21 funds procure a combined 331 AIM-9X Block II/II+ missiles.

Contractor: Raytheon; Northrop Grumman (propulsion).
First Flight: September 1953; July 1999 (AIM-9X); 2016 (AIM-9X Block II).
Delivered: AIM-9M 1983; AIM-9X from 2002-2011 (Block I); 2011-present (Block II); 2017-present (Block II+).

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

Air-to-air guided missile

Brief: AMRAAM is an active radar-guided, medium-range, supersonic air-to-air missile. It is a joint USAF-Navy follow-on to the AIM-7 Sparrow with launch-and-maneuver capability. The AIM-120B is an upgraded, re-programmable 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 offers improved range, GPS-assisted guidance, updated data links, and jam resistance, in addition to greater lethality. Ongoing upgrades will further enhance weapon performance and electronic protection. The second phase of the AIM-120D System Improvement Program (SIP II) completed operational testing and will be fielded in 2020. Cybersecurity testing was concluded in mid-2019. FY20 funds procure 414 AIM-120D missiles. In 2019, USAF announced it is developing the AIM-260 Joint Air Tactical Missile (JATM) with the Navy to replace AMRAAM with a longer-range, more capable weapon to counter high-end threats.

Contractors: Raytheon; Northrop Grumman; Nammo Group (propulsion).
First Flight: December 1984.
Delivered: 1988-present.
IOC: September 1991; July 2015 (120D).
Active Variants:
 •AIM-120B. Upgraded, reprogrammable variant of AIM-120A.
 •AIM-120C. Production variant optimized for the F-22/F-35.
 •AIM-120D. Latest variant with GPS guidance, improved range, lethality, and jam-resistance.
Dimensions: Span 1.7 ft, length 12 ft, diameter 7 in.
Propulsion: Boost-sustain solid-propellant rocket motor.
Performance: Supersonic, range 20+ miles.
Guidance: Active radar terminal/inertial midcourse.
Warhead: HE blast-fragmentation.
Integration: F-15C/D/E, F-16C/D, F-22A, F-35A.

AIR-TO-GROUND MISSILES/ ROCKETS

ADVANCED PRECISION KILL WEAPON SYSTEM (APKWS)

Air-to-surface guided rocket

Brief: APKWS is a low-cost, semi-active laser-guidance system sized to fit the 2.75-in aerial rocket. It is optimized for precision, low-collateral-damage strike against moving or stationary light vehicle and personal targets. Illuminating and white phosphorous rounds are used for target marking by Forward Air Control aircraft. USAF acquired the system as an urgent operational requirement, and it was employed in combat for



Samuel King/Courtesy illustration

the first time by an F-16 in June 2016. The weapon employs a mid-body guidance package to convert the standard rocket into a guided weapon. APKWS was already in service with the three other services, and initial weapons were procured from Navy stocks. The rockets are launched from multi-round, reusable pods. FY20 funds procure 5,400 APKWS guidance kits. An F-16 successfully destroyed an airborne target using APKWS as part of an anti-cruise missile demo in 2019.

Contractor: BAE Systems.
First Flight: May 2013 (USAF).
Delivered: October 2012-present.
IOC: N/A.

Active Variant:

- AGR-20A. Semi-active, laser-guided 2.75-in rocket, adapted for fixed-wing use.

Dimensions: Span 9.5 in, length 6.25 ft, diameter 2.75 in.
Propulsion: Solid-propellant rocket motor.
Performance: Subsonic, range 1.2 to 6.8 miles.
Guidance: Semi-active laser.
Warhead: HE, white phosphorous, or illuminating round.
Integration: AT-6, A-10, A-29, F-16.



Tech. Sgt. Matthew Doyle

AGM-65 MAVERICK
 Air-to-surface guided missile

Brief: Maverick is a TV, imaging IR, or laser-guided standoff air-to-surface missile employed by fighter/attack aircraft against tanks, vehicles, and air defenses. It was first employed during the Vietnam War and was used extensively in Desert Storm and Iraqi Freedom. AGM-65B is a launch-and-leave, EO/TV guided missile, equipped with "scene magnification" 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. USAF is gradually modifying legacy missiles to Laser Maverick standards, but the FY21 budget does not include additional procurement.

Contractors: Raytheon (missile body); Northrop Grumman (propulsion).
First Flight: August 1969.
Delivered: August 1972.
IOC: February 1973.
Active Variants:

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

Dimensions: Span 2.3 ft, length 8.2 ft, diameter 12 in. Propulsion: Two-stage, solid-propellant rocket motor.
Performance: Supersonic, range 20 miles.
Guidance: EO TV guidance system (B/H/K); Imaging IR seeker (D/G); laser seeker (E).
Warhead: 125-lb cone-shaped (B/D/H); 300-lb delayed-fuse penetrator (E/G/K).
Integration: A-10C, F-15E, F-16C/D.



Staff Sgt. Scott Stewart

AGM-88 HIGH-SPEED ANTI-RADIATION MISSILE (HARM)
 Air-to-surface anti-radiation missile

Brief: HARM is an anti-radiation, air-to-surface missile highly effective against enemy ground radar. AGM-88 is a joint USAF-Navy weapon, carried by SEAD-dedicated F-16CJs. AGM-88B is equipped with erasable and electronically programmable read-only memory, permitting in-field changes to missile memory. The AGM-88C is the current production model with a more lethal warhead. Raytheon began a HARM Control Section Mod (HCSM) in 2013 to convert current models to more precise AGM-88Fs incorporating improved GPS/INS guidance, anti-countermeasure performance, and reduced risk of collateral damage. The Navy is further retrofitting its missiles with advanced networking, digital homing, and terminal millimeter-wave radar seeker resulting in the AGM-88G Advanced Anti-Radiation Guided Missile (AARGM). USAF is pursuing the extended-range AARGM-ER as the basis for its next-generation Stand-in Attack Weapon (SiAW) to equip the F-35A with SEAD capability. The missile will additionally enable it to strike advanced threats including theater ballistic missile and land attack/anti-ship missile sites, GPS jammers, and anti-satellite systems. USAF aims to complete integration and fielding of SiAW on the F-35 by the mid-2020s.

Contractors: Raytheon (HARM); Northrop Grumman (AARGM).
First Flight: April 1979.
Delivered: 1982-98.
IOC: Circa 1984.
Active Variants:

- AGM-88B. Early production variant.
- AGM-88C. Current production variant.

- AGM-88F. Upgraded variant with greater accuracy and precision.
- Stand-In Attack Weapon. Next-generation anti-radiation missile based on the AARGM-ER.

Dimensions: Span 3.7 ft, length 13.7 ft, diameter 10 in.
Propulsion: Thiokol dual-thrust, solid-propellant rocket motor.
Performance: Supersonic, range 30+ miles.
Guidance: Proportional with fixed antenna and seeker head in missile nose.
Warhead: HE fragmentation.
Integration: F-16CJ (Block 50); planned: B-21, F-35A (SiAW).



Robert Brooks

AGM-114 HELLFIRE

Air-to-surface guided missile

Brief: Hellfire is a low-collateral damage, precision air-to-ground missile with semi-active laser guidance for use against light armor and personnel. Missiles are used on the MQ-9 Reaper. AFSOC dropped previous plans to integrate the weapons onto its AC-130W gunships in favor of the Small Glide Munition. Hellfire is procured through the Army, and numerous variants are utilized based on overseas contingency demands. An MQ-1 Predator employed Hellfire in combat for the first time in Afghanistan on Oct. 7, 2001. The latest AGM-114R replaces several types with a single, multitarget weapon, and USAF is also buying variable Height-of-Burst (HOB) kits to enhance lethality. The next-generation Joint Air-to-Ground Missile (JAGM) is also procured via the Army, and adds a new multimode guidance section to the AGM-114R. JAGM is used against high-value moving or stationary targets in all weather. FY21 funds 2,497 Hellfire/JAGM via a common production contract.

Contractors: Lockheed Martin (missile body); Northrop Grumman (propulsion).

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

Delivered: March 2016-present.

IOC: N/A.

Active Variants:

- AGM-114. Numerous subvariants, depending on target and mission requirements.
- AGM-169. JAGM, incorporating a multimode seeker on the advanced AGM-114R.

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

Propulsion: Solid-propellant rocket motor.

Performance: Subsonic, range 5+ miles.

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

Warhead: Shaped charge and blast fragmentation.

Integration: MQ-9.

AGM-176 GRIFFIN

Air-to-surface guided missile

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



Raytheon

a \$105.2 million contract modification to supply additional Griffin missiles in 2018. FY21 SOCOM-wide funds support procurement of 226 AGM-176, including data links.

Contractor: Raytheon.

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

Delivered: September 2001.

IOC: N/A.

Active Variants:

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

Dimensions: Length 43 in, diameter 5.5 in.

Propulsion: Solid-propellant rocket motor. Performance: Subsonic, range 12 + miles.

Guidance: GPS/INS/semi-active laser.

Warhead: Blast fragmentation.

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



Textron Systems

AREA WEAPONS

CBU-105 SENSOR FUZED WEAPON (SFW)

Wide-area munition

Brief: SFW is a tactical area weapon used against massed stationary or moving armor and ground vehicles. The munitions dispenser contains a payload of 10 BLU-108 submunitions, each containing four skeet-shaped copper disks totaling 40 lethal, target-seeking projectiles. The skeet's active laser and passive IR sensors can detect a vehicle's shape and IR signature; if no target is detected, the warhead detonates at a preset time. Primary targets are massed tanks, armored personnel carriers, and other self-propelled targets. SFW can be delivered from high altitude and in adverse weather. It debuted in combat in Iraq in 2003. DOD ceased cluster munition procurement in 2007 and has only employed the weapons in combat once since 2003. CBU-105 was the only standard USAF cluster munition that met the less-than-one-percent failure rate previously mandated by DOD for use beyond 2018. DOD has since reversed course, retaining existing weapons for deterrence on the Korean Peninsula. USAF is now testing the 2,000 lb-class Next Generation Area

Attack Weapons (NGAAW) which replaces explosive submunitions with a high-fragmentation warhead, reducing the risk of unexploded munitions injuring noncombatants.

Contractor: Textron Systems.

First Flight: Circa 1990.

IOC: 1997.

Active Variants:

• CBU-105. CBU-97 casing with Wind-Corrected Munitions Dispenser (WCMD) tail kit.

Dimensions: Length 7.7 ft, diameter 15 in.

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

Guidance: IR targeting in each warhead; INS (via WCMD tail kit pre-dispersal) and GPS-data (via aircraft, prerelease).

Warhead: Shaped charge and blast fragmentation.

Integration: A-10C, B-1B, B-52H, F-15E; F-16C/D, (tested on MQ-9).



Tech Sgt. Marvin Lynchard

CBU-107 PASSIVE ATTACK WEAPON

Wide-area munition

Brief: Passive Attack Weapon is a nonexplosive, kinetic penetrating area weapon for use against sensitive targets. The CBU-107's penetrator rods limit collateral damage and do not scatter potentially contaminating debris when used against enemy WMD stockpiles. The weapon glides toward its target after release. Before impact, its inner chamber begins to rotate, and projectiles are ejected in rapid succession by centrifugal force, penetrating targets within a 200-ft radius. The weapon contains various-size, penetrating projectiles but no explosive. Full production was completed in six months. The weapon was used during Iraqi Freedom.

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

First Flight: 2002.

IOC: December 2002.

Active Variant:

• CBU-107A. Centrifugally dispersed, armor-penetrating weapon with Wind-Corrected Munitions Dispenser (WCMD) tail kit.

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).

Guidance: INS (via WCMD tail kit) and GPS-data (via aircraft) prerelease.

Warhead: Non-explosive projectiles.

Integration: B-52, F-15E, F-16C/D.

NEXT GENERATION AREA ATTACK WEAPON (NGAAW)

Wide-area munition

Brief: Next Generation Area Attack Weapon (NGAAW) is a blast-fragmentation area weapon designed as an alternative to cluster bomb munitions banned by DOD mandate beyond 2018. DOD ceased cluster munition procurement in 2007, and implemented a less-than-one-percent failure rate mandate on area weapons to prevent civilian casualties from unexploded

ordnance. USAF awarded the \$60 million NGAAW procurement contract for a compliant family of weapons in 2019. NGAAW is being developed in two increments, the 500-lb Improved Lethality Warhead (ILW) anti-personnel/materiel weapon based on the BLU-134B, followed by the more potent 2,000-lb high-fragmentation warhead. An F-16 conducted initial live developmental test drops of the 2,000-lb class BLU-136 at the Nellis range in July 2020. The 10-weapon series proved the effectiveness of the weapon against light vehicles, structures, and personnel in excess of a 225 ft radius. The 2,000-lb weapon is externally similar to the standard JDAM when fitted with the precision-guided tail kit requiring little adaptation to existing platforms for operational use. The NGAAW family of weapons will primarily be aimed at replacing the remaining CBU-105/107 stockpile, with potential to replace additional area weapons.

Contractors: Major Tool & Machine, Faxon Machining.

First Flight: 2020.

IOC: N/A.

Active Variant:

• NGAAW Increment I. Optionally GPS/INS-guided Improved Lethality Warhead area weapon based on the 500-lb class BLU-134/B.

• NGAAW Increment II. Optionally GPS/INS-guided 2,000-lb area weapon, based on the BLU-136/B.

Dimensions: Length approx. 12 ft (2,000-lb class with tail kit), diameter approx. 14.5 in.; length approx. 7.8 ft, diameter approx. 10.7 in. (500-lb class with tail kit).

Performance: Range up to 15 miles (based on JDAM guidance/ BLU-136 mass and form factor), 225+ ft effective radius (based on initial testing).

Guidance: GPS/INS.

Warhead: 2,000 lb high-fragmentation area-attack warhead with height-of-burst sensor (BLU-136/B); 500-lb fragmentation area-attack warhead (BLU-134/B).

Integration: N/A.



Airman 1st Class Jessi Monte

PRECISION GUIDED MUNITIONS

GBU-10/12/49 PAVEWAY II

Air-to-surface guided munition

Brief: Paveway II is a laser-guided, free-fall bomb for use against surface targets at short to standoff range. The kit is a folding-wing version of the earlier fixed-wing Paveway I with seeker and reliability improvements. The recent Paveway II Plus adds a modernized, more precise guidance package. GBU-10 is the Paveway II seeker and tail kit mounted on a 2,000-lb general-purpose bomb and primarily used against nonhardened targets. It is, however, capable of penetration. The GBU-12 uses a 500-lb bomb

body and is primarily used against stationary armored targets. GBU-49 is also a 500-lb body, but adds GPS guidance for all-weather precision delivery from 2,500 ft up to 40,000 ft. GBU-49 currently provides the F-35A an interim moving target capability until its Block 3F software is fully fielded. An F-35 dropped the weapon for the first time in a test at Eglin on Nov. 7, 2018, and operational testing is being conducted at Nellis.

Contractors: Lockheed Martin; Raytheon.

First Flight: Early 1970s.

IOC: 1976.

Active Variants:

- GBU-10. Laser/GPS guided 2,000-lb bomb.
- GBU-12. Laser guided 500-lb bomb.
- GBU-16. Laser guided 1,000-lb bomb.
- GBU-49. Laser/GPS guided 500-lb bomb.

Dimensions: Span 5.5 ft, length approx. 14.8 ft, diameter 18 in (GBU-10); span 4.4 ft, length 10.8 ft, diameter 11-18 in (GBU-12/49).

Performance: CEP 29.7 ft, range 9.2 miles (GBU-10); CEP 29.7 ft, range about six miles (GBU-12/49).

Guidance: Semi-active laser.

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

Integration: A-10, B-1B, B-52, F-15E, F-16C/D, F-35 (GBU-49), MQ-9.



Airman 1st Class Akeem Campbell

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

Air-to-surface guided bomb

Brief: JDAM is a GPS/INS-guided, autonomous, all-weather surface attack weapon. The joint USAF-Navy program upgrades the existing inventory of general-purpose bombs by adding a GPS/INS guidance kit for accurate all-weather attack from medium/high altitudes. The weapons acquire targeting information from the aircraft's avionics. After release, an inertial guidance kit directs the weapon, aided by periodic GPS updates. JDAM seeker/tail kits can be mounted on general-purpose or penetrating warheads in each weight class. JDAM can also utilize the 500-lb carbon fiber-cased Very Low Collateral Damage Weapon (VLCDW) for sensitive targets. A JDAM kit is under development for the 5,000-lb BLU-113 penetrating weapon, slated for integration and flight-testing on the F-15E. The Advanced 2,000-lb (A2K) BLU-137/B weapon is also being developed for integration onto the F-15E and B-2A. A2K will improve both precision and penetration to strike a wider variety of targets, eventually replacing the BLU-109 bunker buster. JDAM-class weapons are the most frequent air-to-ground munition expended in combat. FY21 procures 10,000 guidance kits to keep pace with current operations, following surge-production to replenish stocks depleted over Iraq and Syria. USAF is procuring an upgraded tail kit with anti-jam receiver for use in GPS degraded conditions under an Urgent Operational Requirement. The service is also seeking to develop a lighter-weight successor class of weapons incorporating IR/GPS guidance, maneuvering wings, stealth, and EW capabilities. Testers are currently working to integrate the GBU-38 for operational use on the F-35.

Contractors: Boeing, Textron, Honeywell.

First Flight: Oct. 22, 1996.

IOC: 1998.

Active Variants:

- GBU-31. GPS/INS guided 2,000-lb GP, or BLU-109 penetrating weapon.
- GBU-32. GPS/INS guided 1,000-lb GP, or BLU-110 penetrating weapon.
- GBU-38. GPS/INS guided 500-lb GP, or BLU-111 penetrating weapon.

Dimensions: Span 25 in (GBU-31), 19.6 in (GBU-32), 14 in (GBU-38); length (with JDAM and warhead) approx 12 ft (GBU-31), 10 ft (GBU-32), 7.8 ft (GBU-38).

Performance: Range up to 15 miles, CEP with GPS 16.4 ft, CEP with INS only 98 ft.

Guidance: GPS/INS.

Warhead: 2,000-lb Mk 84/BLU-109 (GBU-31); 1,000-lb Mk 83/BLU-110 (GBU-32); 500-lb Mk 82/BLU-111 (GBU-38).

Integration: A-10C, B-52H, B-2A, B-1B, F-15E, F-16, F-22A, F-35A (GBU-31/32), and MQ-9.

GBU-39 SMALL DIAMETER BOMB I

Guided air-to-surface glide bomb

Brief: SDB I 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 fighter or bomber internal weapons bays or to increase overall loadout for more independent strikes per sortie. SDB I employs advanced anti-jam GPS/INS, and target coordinates



86th Fighter Weapons Squadron

GBU-24/28 PAVEWAY III

Air-to-surface penetrating glide bomb

Brief: Paveway III is a laser guided free-fall bomb for use against surface targets from medium standoff range. The third-generation laser guided seeker/tail kit package enables greater precision over Paveway II, and its high-lift airframe enables longer glide slopes for greater standoff employment. It can be dropped from low, medium, or high altitude and is effective against a broad range of high-value targets. GBU-24 is fitted to a 2,000-lb bomb body, with a BLU-109 penetrating warhead. GBU-28 variants are large 5,000-lb class air-to-ground penetrators initially developed for use against Iraq's deeply buried, hardened C2 facilities. The GBU-28B adds GPS/INS guidance to the existing laser seeker for all-weather targeting. It entered production in 1999. The GBU-28C adds a more powerful penetrating BLU-122 warhead in addition to the enhanced guidance package. It entered production in 2005, and quantities are purchased as needed to replenish and maintain stockpiles.

Contractor: Raytheon.

First Flight: Early-1980s (GBU-24); Feb. 24, 1991 (GBU-28).

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

Active Variants:

- GBU-24. Laser guided 2,000-lb penetrating bomb.
- GBU-28B/B. Laser/GPS/INS guided 5,000-lb penetrating bomb.
- GBU-28C/B. Laser/GPS/INS guided 5,000-lb improved penetrating bomb.

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

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

Guidance: Semi-active laser.

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

Integration: B-52, F-15E, F-16C/D (GBU-24); B-2A, B-52, F-15E (GBU-28).



Alejandro Peña/USAF

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. USAF is continuing to replenish precision weapon stockpiles expended in combat, but at a lower level than production-maximized rate funded in FY20. FY21 funds procure a total of 2,462 weapons.

Contractor: Boeing.
First Flight: May 23, 2003.
IOC: Oct. 2, 2006.
Production: 24,000 (planned).
Active Variant:
 •GBU-39/B SDB I. GPS/INS guided 250-lb low-yield bomb.
Dimensions: Length 6 ft, width 7.5 in; BRU-61/A carriage (four bombs) length 12 ft, width 16 in, height 16 in.
Performance: Near-precision capability at standoff range up to 46 miles.
Guidance: GPS/INS.
Warhead: 250-lb class penetrating blast fragmentation munition.
Integration: AC-130W, F-15E, F-16, F-22; planned: A-10, AC-130J, B-1, B-52, F-35A, MQ-9.



William Lewis/USAF

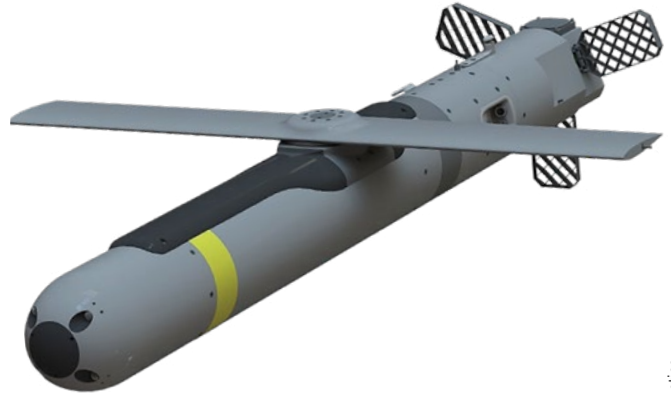
GBU-53 STORMBREAKER (SMALL DIAMETER BOMB II)

Guided air-to-surface glide bomb

Brief: StormBreaker (formerly SDB II) is a joint USAF-Navy program to develop as a low-yield, precision guided munition capable of striking moving targets in all-weather from up to 46 miles away. Its size allows it to be carried in fighter or bomber internal weapons bays or to increase overall loadout to enable more independent strikes per sortie. Several StormBreakers can be simultaneously released against multiple targets. SDB II adds a millimeter-wave radar, imaging IR, and semi-active laser packaged into a tri-mode seeker. The bomb is retargetable after release. Improvements include reduced susceptibility to countermeasures and network-enablement through Link 16/UHF data links. LRIP production began in 2015 and USAF awarded the current LRIP Lot 6 in October 2020. SDB II began operational testing in June 2018 and achieved initial fielding on the F-15E Sept. 23, 2020. The fielding decision paves the way for IOC a year later than anticipated, and testing is underway for follow-on field-

ing on the F-35 and Navy F-18E/F Super Hornet. FY21 funding supports production of up to 1,133 SDB IIs.

Contractor: Raytheon.
First Flight: 2012.
IOC: 2019 (planned).
Production: 12,000 (planned).
Active Variant:
 •GBU-53/B SDB II. Tri-mode guided 250-lb low-yield bomb.
Dimensions: Bomb: length 5.75 ft, wingspan 5.6 ft, diameter 7 in.
Performance: Near-precision capability at standoff range up to 46 miles.
Guidance: Tri-mode seeker millimeter-wave radar, uncooled IIR, and digital semi-active laser.
Warhead: 250-lb class penetrating blast fragmentation munition.
Integration: F-15E; Planned: A-10, AC-130W/J, B-1, B-2, B-52, F-16, F-22, F-35, MQ-9.



Dynetics

GBU-69 SMALL GLIDE MUNITION

Guided air-to-surface glide bomb

Brief: Small Glide Munition is a standoff, precision guided munition specifically tailored to SOF mission requirements. Internally carried GBU-69/B were integrated onto the next-generation AC-103J gunship as part of Block 20+ upgrades, following initial operational testing. USSOCOM is currently working to integrate the weapon onto RPA platforms including the MQ-9. The weapon is deployable from the AC-130J's ramp-mounted Common Launch Tubes or dropped conventionally. It is capable of quietly reaching targets from standoff range using its deployable wings to minimize risk to delivery platforms. The weapon utilizes semi-active laser and lattice-type control fins (similar to the GBU-57) for guidance and terminal stability, and is capable of receiving in-flight targeting updates via two-way data link. The weapon was jointly developed between Dynetics and USSOCOM. The company was awarded two contracts in FY18 totaling \$104 million for delivery of approximately 1,000 weapons through 2022. FY21 SOF funds procure 478 SGMs.

Contractors: Dynetics.
First Flight: Feb. 16, 2000 (USAF).
Delivered: 2020-present.
IOC: N/A.
Active Variants:
 •GBU-69. Semi-active laser guided 36-lb low-yield bomb.
Dimensions: Span 28 in, length 3.5 ft, diameter 4.5 in.
Propulsion: None.
Performance: Near-precision capability at standoff range of 20+ miles.
Guidance: Semi-active laser.
Warhead: 36-lb blast fragmentation.
Integration: AC-130J; planned: MQ-9.

GBU-43 MASSIVE ORDNANCE AIR BLAST (MOAB) BOMB

Massive guided bomb

Brief: MOAB is the largest satellite-guided, air-delivered weapon ever employed. It is designed for use against large area targets, deeply buried targets, or targets in tunnels or caves. The conventional HE bomb is GPS guided, with fins and inertial gyro for pitch and roll. It was developed by the Air Force Research Laboratory Munitions Directorate at Eglin in only



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nine weeks to be available for the 2003 Iraq campaign. The weapon was designated Massive Ordnance Air Blast (MOAB) but is unofficially known as "Mother of All Bombs." The weapon is designed for deployment from the ramp of an MC-130 without a parachute. A total of 18,700 lb of the weapon's 21,000-lb weight is attributed to BLU-120/B warhead. It was used operationally for the first time in April 2017 against an ISIS-occupied cave complex in Afghanistan.

- Contractors:** AFRL; Dynetics.
- First Flight:** March 11, 2003.
- IOC:** April 2003.
- Active Variant:**
 - GBU-43/B. GPS guided 21,000-lb bomb.
- Guidance:** GPS/INS.
- Warhead:** BLU-120/B 18,700-lb HE.
- Dimensions:** Length 30 ft, diameter 3.3 ft.
- Integration:** MC-130H.



Sgt. Chris Thornbury

GBU-54 LASER JOINT DIRECT ATTACK MUNITION (LJDAM)

Air-to-surface guided bomb

Brief: LJDAM is a GPS/INS guided, autonomous, all-weather attack weapon for use against fixed and moving targets. It is a joint USAF-Navy development that combines a laser guidance kit with the GPS/INS-based navigation of the existing GBU-38 JDAM. The current LJDAM is a dual-mode 500-lb guided weapon capable of attacking moving targets with precision. It was developed as an urgent operational need, and testing was completed in less than 17 months. It was first delivered in May 2008 and deployed in combat in Iraq three months later. Boeing is also developing GBU-31 (2,000-lb) and GBU-32 (1,000-lb) variants. The F-35 is currently undergoing tri-service testing to integrate the GBU-38/54 for operational use.

- Contractor:** Boeing.
- First Flight:** 2005.

- IOC:** 2008.
- Active Variant:**
 - GBU-54 Laser JDAM. Laser/GPS/INS guided 500-lb GP, or BLU-111 penetrating weapon.
 - GBU-56 Laser JDAM. Laser/GPS/INS guided 2,000-lb GP, or BLU-109 penetrating weapon.
- Dimensions:** Length (with JDAM and warhead) approx 8 ft.
- Performance:** Range up to 15 miles.
- Guidance:** GPS/INS with laser.
- Warhead:** Mk 82 500-lb munition.
- Integration:** F-15E, F-16. Planned: F-35, B-1B (GBU-56).

GBU-57 MASSIVE ORDNANCE PENETRATOR

Massive PGM



509th Bomb Wing

Brief: MOP is a GPS-guided, earth-penetrating strike weapon for use against hard and deeply buried targets. It was developed and tested through a USAF and Defense Threat Reduction Agency partnership in 2004, and is now managed by AFGSC. Flight

testing was conducted from 2008 to 2010, when the program transitioned to USAF. A B-2 successfully test-dropped the GBU-57 in 2014, 2015, and 2016. Several B-2s completed a total of four test drops at White Sands Missile Range, N.M., in 2017 validating the effectiveness of mods made under the Enhanced Threat Response IV upgrade. MOP proved effective, clearing the way for potential early fielding, though the Air Force's recommendation is classified. The service is currently validating requirements to expand the weapon's capabilities further. USAF issued a \$20.9 million contract in FY18 to procure an undisclosed number of additional GBU-57 for delivery through July 2020. No funds were requested in FY20-FY21.

- Contractor:** Boeing.
- First Flight:** Classified.
- IOC:** 2011.
- Operator:** AFGSC.
- Active Variant:**
 - GBU-57B. GPS-guided 30,000-lb penetrating weapon.
- Guidance:** GPS.
- Warhead:** 5,740-lb HE.
- Dimensions:** Length 20.5 ft, diameter 31.5 in.
- Integration:** B-2A (tests also conducted on the B-52).

SATELLITE SYSTEMS



USAF

ADVANCED EXTREMELY HIGH FREQUENCY (AEHF) SATELLITE SYSTEM

Communications

Brief: AEHF provides global, secure, protected, and jam-resistant military communications. It enhances the previous Milstar satellites and operates at a much higher capacity and data rate. It offers secure, anti-jam tactical and strategic communications around the world. AEHF uses cross-linked satellites, eliminating the need for ground relay stations. The program is a collaboration with Canada, the Netherlands, and the United Kingdom. Launch of SV-4 was originally slated for Oct. 17, 2017, but an issue with the system's power regulator prompted USAF to delay launch a year to

enable a hardware fix. SV-4 launched on Oct. 17, 2018, paved the way for full operational capability declared when the vehicle joined the constellation operationally on May 3, 2019. SV-5 launched Aug. 8, 2019, after a several-month delay due to its launch vehicle, and SV-6 launched from Cape Canaveral on March 26, 2020, marking the newly formed USSF's first launch. SV-6 became operational after completing on-orbit checks on Aug. 22, 2020, completing the constellation. USSF plans to begin replacing AEHF with the next-generation Evolved Strategic SATCOM (ESS) starting in the early 2030s.

Contractors: Lockheed Martin; Northrop Grumman.
Operator/Location: USSF SpOC; Schriever AFB, Colo.
First Launch: August 2010.
IOC: 2015.
Design Life: 14 yrs.
Launch Vehicle: Atlas V.
Constellation: Six.
Active Satellites:

- AEHF SV-1. Launched in 2010, on orbit and operational.
- AEHF SV-2. Launched in 2012, on orbit and operational.
- AEHF SV-3. Launched in 2013, on orbit and operational.
- AEHF SV-4. Launched in 2018, on orbit and operational.
- AEHF SV-5. Launched in 2019, on orbit and operational.
- AEHF SV-6. Launched in 2020, on orbit and operational.

Dimensions: Length 31 ft, width 98 ft (with full solar array extension).
Weight: 13,400 lb.
Performance: 24-hr low, medium, and extended data rate connectivity from 65 north to 65 south latitude worldwide.
Orbit Altitude: Geosynchronous at 22,000+ miles.
Power: Solar arrays generating 20,000 watts.



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DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)

Space and Earth environmental data collection

Brief: DMSP is tasked with environmental data collection for worldwide, military weather forecasting. It provides timely and high-quality weather information to strategic and tactical combat units worldwide. DMSP uses an operational line scan sensor to image cloud cover in visible and thermal IR and analyze cloud patterns. It is equipped with microwave imagers and sounders and a suite of space environment sensors that provide critical land, sea, and space environment data. Block 5D-3 improved spacecraft bus and sensors for longer and more capable missions. Six operational DMSP satellites now survey the entire Earth four times a day. The oldest operational satellite, DMSP-13, suffered an apparent electrical short and exploded, creating a cloud of debris in space in 2015. DMSP-19 most recently launched in 2014. The vehicle subsequently suffered a power failure in early 2016, rendering it uncontrollable. Data from the craft remains usable until its orbit decays. Congress canceled the DMSP program before the final spacecraft (DMSP-20) could be launched. DMSP-20 was stored, awaiting a launch decision to replace DMSP-19. DMSP-17 ultimately assumed the failed satellite's coverage, and DMSP-20 went on permanent display at Los Angeles AFB, Calif. USAF is considering requirements for a follow-on system. The service awarded Ball Aerospace a \$255.4 million development contract for the Weather System Follow-On-Microwave (WSF-M) in November 2018, and the system is planned to replace DMSP starting in FY24. DMSP-14, the last operational Block 5D-2 satellite, was decommissioned Feb. 11, 2020, after 22 years of service.

Contractors: Lockheed Martin; Northrop Grumman.
Operator/Location: National Oceanic and Atmospheric Administration; NOAA Operations Facility, Suitland, Md.
First Launch: May 23, 1962.
IOC: 1965.
Design Life: Five yrs (Block 5D-3).
Launch Vehicle: Delta IV; Atlas V.

Constellation: Four low Earth orbit (LEO).

Active Satellites:

•Block 5D-3. Improved spacecraft bus and sensors for longer, more capable missions.

Dimensions: Length 25 ft (with array deployed), width 4 ft.

Weight: 2,545 lb, incl 772-lb sensor; 2,270 lb with 592-lb sensor payload.

Performance: Polar orbits; covers Earth in about 6 hr; primary sensor scans 1,800-mile-wide area.

Orbit Altitude: Approx 527 miles.

Power: Solar arrays generating 1,200-1,300 watts.



USAF

DEFENSE SATELLITE COMMUNICATIONS SYSTEM (DSCS)

Communications

Brief: DSCS provides high-priority wartime and strategic SHF communications between high-level leadership and deployed forces and ships worldwide. Satellites enable high-data rate, secure, nuclear-hardened, jam-resistant military comms. In addition to joint service command and control, interagency users include the National Command Authority, White House Communications Agency, and Diplomatic Telecommunications Service. The last of 14 DSCS IIIs launched in 2003. AFSPC inactivated its two oldest DSCS satellites, B-12 in July 2014 and DSCS-10 in June 2015, B-12 having exceeded its designed life span by 12 years. The final four DSCS satellites received SLEP before launch, providing higher-power amplifiers, more sensitive receivers, and increased antenna connection options. The satellites also carry a single channel transponder to disseminate emergency action and force direction messages to nuclear-capable forces. WGS began augmenting DSCS in 2007 and will gradually replace the constellation.

Contractor: Lockheed Martin.

Operator/Location: USSF SpOC; Schriever AFB, Colo.

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

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

Design Life: 10 yr (III).

Launch Vehicle: Atlas II, NSSL, Space Shuttle Atlantis (two satellites, 1985).

Constellation: Six (III); 14 deployed/six operational.

Active Satellites:

•DSCS III. Current base on-orbit variant.

•DSCS III. SLEP. Upgrade configuration of last four satellites launched.

Dimensions: Rectangular body 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.

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

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

DEFENSE SUPPORT PROGRAM (DSP)

Strategic and tactical launch detection

Brief: DSP provides ballistic missile early warning and is a key part of North American and theater early warning systems. It is capable of detecting missile launches and nuclear detonations and was initially meant to watch the Soviet military. It was used extensively in the 1991 Gulf War to detect Iraqi theater missile launches against coalition forces and allies in the region. The 23rd and final DSP satellite launched in December 2007



DOD

but malfunctioned and began drifting outside its intended orbit in 2008. 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. The constellations jointly enabled early detection of ballistic missiles launched by Iran against U.S. forces at Al Asad AB, Iraq, on Jan. 7, 2020, minimizing casualties.

Contractors: Northrop Grumman (formerly TRW); Aerojet.

Operator/Location: USSF SpOC; Buckley SFB, Colo.

First Launch: November 1970.

IOC: Circa 1972.

Design Life: Three-year requirement and five-year goal.

Launch Vehicle: Titan IV with inertial upper stage; Delta IV Heavy NSSL.

Constellation: 23 deployed/five operational.

Active Satellites:

- DSP-18. Launched in 1997, on orbit and operational.
- DSP-19. Launched in 1999, on orbit and operational.
- DSP-20. Launched in 2000, on orbit and operational.
- DSP-21. Launched in 2001, on orbit and operational.
- DSP-22. Launched in 2004, on orbit and operational.
- DSP-23. Launched in 2007, on orbit and non-operational.

Dimensions: Diameter 22 ft, height 32.8 ft, with paddles deployed.

Weight: Approx 5,200 lb.

Performance: Uses IR sensors to sense heat from missile and booster plumes against Earth's background.

Orbit Altitude: Geosynchronous at 22,000+ miles.

Power: Solar arrays generating 1,485 watts.



USAF

GEOSYNCHRONOUS SPACE SITUATIONAL AWARENESS PROGRAM (GSSAP)

Situational awareness/orbital tracking

Brief: GSSAP supplies space-based tracking and characterization of manmade objects in geosynchronous orbit, aiding safety and enabling avoidance. They are the "neighborhood watch" satellites augmenting the legacy Space Based Space Surveillance (SBSS) system. SBSS tracks and classifies manmade objects in low Earth orbit, and GSSAP extends this coverage to geosynchronous orbit. The satellites themselves operate

in near-geosynchronous orbit to effectively monitor objects and aid in preventing collisions in space. GSSAP carries EO/IR sensors and are able to maneuver to observe objects at close range. They can track objects without the weather and atmospheric disruptions that affect ground-based systems. Two GSSAP satellites were launched in 2014 and attained IOC in 2015. Two more replenishment satellites launched Aug. 19, 2016, and became operational Sept. 12, 2017. USSF completed a significant overhaul and upgrade of the GSSAP ground system software to enhance the reliability, speed, and security of the system in February 2020. The upgrades also pave the way for future expansion of the constellation. The fifth and sixth sensors are slated for launch aboard the USSF-8 mission planned for launch from Cape Canaveral in mid-to late 2021.

Contractor: Northrop Grumman Space Systems (formerly Orbital ATK).

Operator/Location: USSF SpOC; Schriever AFB, Colo.

First Launch: July 28, 2014.

IOC: Sept. 29, 2015.

Launch Vehicle: Delta IV.

Constellation: Four spacecraft.

Active Satellites:

- GSSAP 1. Launched in 2014; on orbit, active.
- GSSAP 2. Launched in 2014, on orbit, active.
- GSSAP 3. Launched in 2016, on orbit, active.
- GSSAP 4. Launched in 2016, on orbit, active.

Orbit Altitude: 22,300 miles, above geosynchronous.

Power: Solar panels.



Courtesy

GLOBAL POSITIONING SYSTEM (GPS)

Worldwide navigation, timing, and velocity data

Brief: GPS supplies space-based military and civil radio-positioning for geolocation, navigation, and timing. It is a fundamental enabler of precision bombing, CSAR, mapping, and rendezvous. It provides accurate and uninterrupted 3D (latitude, longitude, and altitude) position, velocity, and time data. The last of the GPS Block IIA satellites, launched between 1990 and 1997 was decommissioned in 2020. 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, a new military signal, and a second and third dedicated civil signal. The GPS Block IIIA, first launched on Dec. 23, 2018, has improved accuracy, availability, integrity, and incorporates a steerable, high-power, anti-jam capability. Lockheed Martin is under contract to build the final Block IIIA vehicles (nine and 10) for launch in 2022 and was awarded a follow-on \$7.2 billion contract for 22 Block IIF in 2018. Block IIIF adds a hosted search and rescue payload, as well as geographically targetable high-power military signal and FY21 funds procurement of the second and third vehicles. The third GPS III launch on June 30, 2020, marked the first GPS mission boosted by a SpaceX Falcon 9, and a fourth satellite successfully launched Nov. 5, 2020. Two GPS IIIA launches are slated for 2021 and the first IIIF is slated to be launch-ready by 2026.

Contractors: Boeing (IIF); Lockheed Martin (IIR, IIR-M, III/IIIF).

Operator/Location: USSF SpOC; Schriever AFB, Colo.

First Launch: Feb. 22, 1978.

IOC: Dec. 9, 1993.

Design Life: 7.5 yr (IIR/IIR-M); 12 yr (IIF); 15 yr (IIIA).

Launch Vehicle: Delta II, Delta IV, Falcon 9.

Constellation: 33 spacecraft (not including decommissioned or on-orbit spares).

Active Satellites:

- GPS Block IIR. Launched 1997 to 2004; eight active.
- GPS Block IIR-M. Launched in 2005 to 2009; seven active.
- GPS Block IIF. Launched in 2010 to 2016; 12 active.
- GPS Block IIIA/IIIF. New generation launched in 2018; three active.

Dimensions: (IIR/IIR-M) 5 x 6.3 x 6.25 ft, span incl solar panels 38 ft; (IIF) 9.6 x 6.5 x 12.9 ft, span incl solar panels 43.1 ft.

Weight: On orbit, 2,370 lb (IIR/IIR-M); 3,439 lb (IIF).

Performance: Orbits the Earth every 12 hr, emitting continuous signals, providing time to within one-millionth of a second, velocity within a fraction of a mile per hour, and location to within a few feet.

Orbit Altitude: 10,988 miles.

Power: Solar panels generating 1,136 watts (IIR/IIR-M); up to 2,900 watts (IIF).



USAF

MILSTAR SATELLITE COMMUNICATIONS SYSTEM (MILSTAR)

Communications

Brief: Milstar is the joint-service backbone of strategic/tactical DOD communications. It provides encrypted, secure, anti-jam communications around the world and uses cross-linked satellites, eliminating the need for ground relay stations. Block I satellites incorporate a low data rate payload capable of transmitting 75-2,400 bps over 192 EHF channels. Block II satellites carry both the low data rate payload and a medium data rate payload capable of transmitting 4,800 bps to 1.5 Mbps over 32 channels, allowing larger data to be passed more quickly. Interoperable terminals allow third-party land/sea-based units to upload data in real time to cruise missiles or other compatible weapons. Milstar provides continuous coverage between 65 degrees north and 65 degrees south latitude. The systems utilize multiple-redundant command and control for high survivability. The last of six satellites launched in 2003 and was augmented by the sixth and final AEHF satellite in 2020. AEHF now supplants Milstar as DOD's primary system in the combined, fully back-compatible AEHF-Milstar constellation.

Contractors: Lockheed Martin; Boeing; Northrop Grumman (formerly TRW).

Operator/Location: USSF SpOC; Schriever AFB, Colo.

First Launch: Feb. 7, 1994. IOC: July 1997 (Milstar I).

Design Life: 10 yr.

Launch Vehicle: Titan IV/Centaur.

Constellation: Five: two Milstar I; three Milstar II.

Active Satellites:

- Block I. Milstar I satellites launched 1994-95.
- Block II. Milstar II satellites launched 1999-2003.

Dimensions: Length 51 ft, width 116 ft with full solar array extension.

Weight: 10,000 lb.

Performance: Milstar I low data rate (LDR) payload transmitting 75 to 2,500 bps of data over 192 channels of EHF; Milstar II LDR and medium data rate (MDR) payloads, transmitting 4,800 bps to 1.5 Mbps over 32 channels.

Orbit Altitude: Geosynchronous at 22,000+ miles.

Power: Solar arrays generating 8,000 watts.

SPACE BASED INFRARED SYSTEM (SBIRS)

Space-based surveillance/missile warning

Brief: SBIRS provides advanced space surveillance and missile warning, battlespace characterization, and technical intelligence gathering. It is the follow-on to the Defense Support Program satellite. The system includes IR sensor payloads on host satellites in highly elliptical orbit (HEO), two IR sensors each on dedicated satellites in geosynchronous Earth orbit (GEO), and ground assets. The HEO sensor detects launch of submarine-launched ballistic missiles (SLBMs) from the North Pole region and can be tasked for other IR detection missions. GEO scanning IR sensor performs the strategic missile warning mission, global technical intelligence, and



Lockheed Martin

initial phase for the strategic missile defense mission, providing two times the revisit rate and three times the sensitivity of DSP. USAF announced plans to allow civil use of SBIRS data to aid weather prediction, Arctic ice monitoring, and wildfire tracking. GEO-3 launched into orbit Jan. 20, 2017, after delays to validate the performance of its liquid apogee engine. GEO-4 launched on Jan. 19, 2018. GEO-5 and GEO-6 will be based on a modernized spacecraft and will be launched earlier than planned, in 2021 and 2022 respectively. These satellites will replace the oldest two on orbit and begin migrating ground control to the next generation Enterprise Ground Service (EGS) aimed at consolidating control of multiple satellite systems. USSF also awarded Raytheon a \$197 million contract in 2020 to modernize ground data processing. USAF canceled the final two GEO satellites and is shifting funds to develop the Next-Generation Overhead Persistent Infrared (OPIR) system. OPIR is the most ambitious satellite program, totaling \$2.3 billion for FY21. The constellation will comprise three GEO satellites and two polar HEO sensors. Delivery of the first satellite is expected by 2027, with IOC planned for 2029. Lockheed Martin delivered the fifth GEO satellite (GEO-5) in late 2020 for launch on May 17.

Contractors: Lockheed Martin (prime contractor); Northrop Grumman (payload); Raytheon (data processing modernization).

Operator/Location: USSF SpOC; Buckley SFB, Colo.

First Launch: GEO 1, May 2011.

IOC: HEO 1, Dec. 5, 2008. (Increment 1, Dec. 8, 2001).

Launch Vehicle: Atlas V (GEO). Planned: Delta, Falcon 9.

Constellation: Four GEO sats, two HEO sensors and two HEO on-orbit reserve (hosted).

Active Satellites/Payloads:

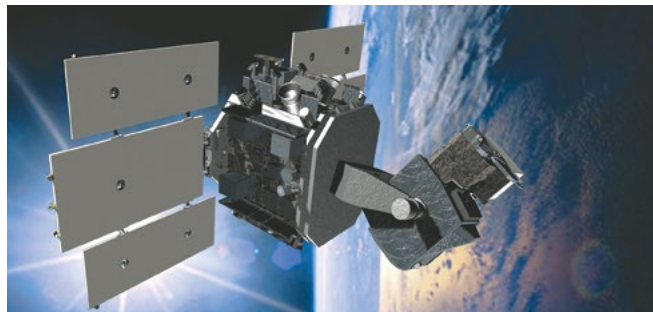
- SBIRS HEO-1. Payload operational in 2008; on-orbit reserve.
- SBIRS HEO-2. Payload operational in 2009; on-orbit reserve.
- SBIRS HEO-3. Payload operational in 2015; active.
- SBIRS HEO-4. Payload operational in 2017; active.
- SBIRS GEO-1. Launched in 2011; active.
- SBIRS GEO-2. Launched in 2013; active.
- SBIRS GEO-3. Launched in 2017; active.
- SBIRS GEO-4. Launched in 2018; active.

Dimensions: 49 x 22 x 20 ft (GEO on orbit); 7 x 4 x 3 ft (HEO sensor).

Weight: 5,525 lb (GEO on orbit).

Orbit Altitude: Geosynchronous and high elliptical.

Power: Solar array, 2,435 watts (GEO), batteries.



Boeing

SPACE BASED SPACE SURVEILLANCE (SBSS)

Orbital surveillance and object identification

Brief: SBSS is designed to track, characterize, measure, and collect optical signatures of Earth-orbiting objects, including space vehicles

and debris. The Missile Defense Agency originally launched SBSS as a technology demonstrator to classify and track ballistic missiles in mid-course flight, before handing it over to AFSPC in 2011. SBSS primarily uses a trainable, ground-controlled Space-Based Visible Sensor to track targets without repositioning. Potential high-end and even kinetic space threats from China and Russia have pushed orbital domain awareness to the top of AFSPC's priority list. AFSPC worked to extend SBSS service life and tasked one of its experimental Operationally Responsive Space satellites to cover a four-year gap in coverage until the newly established Space Force can launch a follow-on spacecraft now targeted for 2022. ORS-5 launched Aug. 26, 2017, and is equipped with an optical sensor to provide rapid, continuous scanning to detect movement in geosynchronous orbit. The Space Force is seeking funds for a follow-on satellite to ORS-5 to enhance surveillance. SBSS works in concert with an array of networked, ground-based sensors including the Space Fence wide-area search and surveillance system recently commissioned on Kwajalein Atoll in the Marshall Islands. SBSS collision-warning data was made openly available to the public starting in 2020 with the aim of improving domain awareness and orbital safety.

Contractors: Boeing (system integration, ground segment, operations, and sustainment); Ball Aerospace (satellite); Orbital ATK (ORS-5).

Operator/Location: USSF SpOC; Schriever AFB, Colo.

First Launch: Sept. 25, 2010.

IOC: Aug. 17, 2012 (SBSS); May 31, 2018 (ORS-5).

Design Life: Seven yr.

Launch Vehicle: Minotaur IV.

Constellation: One LEO satellite; one LEO augmentation satellite.

Active Satellites:

•SBSS Block 10. Launched in 2010; active.

•ORS-5. Experimental satellite launched in 2017 to augment SBSS; active.

Dimensions: Height approx 49 ft; 22ft x 20 ft (SBSS on-orbit); 5 ft x 2.5 ft (ORS-5).

Weight: Approx 5,525 lb (SBSS on orbit); approx 250 lbs (ORS-5).

Orbit Altitude: 390 miles, sun-synchronous orbit (SBSS); 372 miles, geo-synchronous orbit (ORS-5).

Power: Solar arrays and batteries generating 750 watts (SBSS); solar array and batteries (ORS-5).

WIDEBAND GLOBAL SATCOM (WGS) SATELLITE

Communications



Courtesy

Brief: WGS provides worldwide, high-capacity communications for deployed air, land, and sea forces. The system is designed to augment and then replace DSCS X-band frequency service. It also augments the one-way Global Broadcast Service Joint Program Ka-band frequency capabilities and provides a new high-capacity, two-way Ka-band frequency service. Block I includes: SV-1 (Pacific region), SV-2 (Middle East), and SV-3 (Europe and Africa). Block II satellites are modified to better support the airborne ISR mission and include: SV-4 (Indian Ocean) and SV-5 and SV-6, purchased by Australia in 2013. The U.S. is partnering with Canada, Denmark, Luxembourg, the Netherlands, and New Zealand on Block II follow-on satellites SV-7 to SV-10. USAF recently contracted industry to develop anti-jamming capability for tactical users and approved Boeing's preliminary WGS-11+ design. Congress added funds beyond USAF's FY18 request to procure the 11th and 12th satellites. Due to cost, USSF instead opted for the single WGS-11+ platform which offers roughly twice the capability in addition to stronger, more reliable coverage. USSF is seeking to develop and field a WGS follow-on system and potentially lease commercial SATCOM in the interim.

Contractor: Boeing.

Operator/Location: USSF SpOC; Schriever AFB, Colo.

First Launch: October 2007.

IOC: April 16, 2008.

Design Life: 14 yr.

Launch Vehicle: Atlas V, Delta IV.

Constellation: 10 satellites.

Active Satellites:

•SV-1. Block I, launched in 2007; active.

•SV-2. Block I, launched in 2009; active.

•SV-3. Block I, launched in 2009; active.

•SV-4. Block II, launched in 2009; active.

•SV-5. Block II, launched in 2013; active.

•SV-6. Block II, launched in 2013; active.

•SV-7. Block II follow-on, launched in 2015; active.

•SV-8. Block II follow-on, launched in 2016; active.

•SV-9. Block II follow-on, launched in 2017; active.

•SV-10. Block II follow-on, launched in 2019; active.

Dimensions: Based on Boeing 702 Bus.

Weight: 13,000 lb at launch.

Performance: Approx 10 times the capability of a DSCS satellite.

Orbit Altitude: Geosynchronous at 22,000+ miles.

Power: Solar arrays generating 9,934 watts.



45th Space Wing

X-37B ORBITAL TEST VEHICLE

Orbital test

Brief: X-37B is an unmanned experimental Orbital Test Vehicle (OTV) aimed at developing and maturing a reusable space-launch capability and conducting classified, extended, on-orbit missions/experiments and/or launching small satellites. 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 or SpaceX Falcon 9 launch vehicle for long-endurance space missions. The vehicle autonomously re-enters the atmosphere upon command from a ground control station, and it recovers conventionally to the runway. X-37 launches from Cape Canaveral and lands at either Cape Canaveral or Vandenberg. Development includes advanced guidance, navigation and controls, avionics, thermal-resistant materials, propulsion, and autonomous control systems. The program's two test vehicles have successfully completed five orbital missions. The first mission (OTV-1) launched in 2010 and remained on orbit 224 days. The OTV-2 and OTV-3 missions launched in 2011 and 2012, and remained on orbit 468 days and 674 days, respectively. The OTV-4 mission remained aloft for 718 days and landed at Cape Canaveral for the first time on March 25, 2017. The OTV-5 mission marked the type's first launch atop a SpaceX Falcon 9 on Sept. 7, 2017, setting a new record of 780 days on orbit when it touched down at Cape Canaveral on Oct. 27, 2019. USSF launched its inaugural X-37B mission, OTV-6 (USF-7), on May 17, 2020.

Contractor: Boeing.

Operator: USSF.

First Launch: April 22, 2010.

IOC: N/A.

Launch Vehicle: Atlas V, Falcon 9.

Production: Two.

Inventory: Two.

Operational Location: Cape Canaveral SFS, Fla. (launch/landing); Vandenberg SFB, Calif. (landing).

Active Variant:

•X-37B. DARPA/USAF-developed Orbital Test Vehicles.

Dimensions: Span 14 ft, length 29.25 ft, height 9.5 ft.

Weight: 11,000 lb at launch.

Propulsion: Single liquid-propellant rocket motor.

Endurance: 780+ days on orbit.

Orbit Altitude: Low Earth orbit (LEO) at 110-500 miles.

Power: Gallium arsenide solar cells with lithium-ion batteries.

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