

AH-1J SeaCobra



The Bell AH-1 SuperCobra is a twin-engine attack helicopter based on the United States Army's AH-1 Cobra. The twin Cobra family includes the AH-1J SeaCobra, the AH-1T Improved SeaCobra, and the AH-1W SuperCobra. The AH-1W is the backbone of the United States Marine Corps's attack helicopter fleet, but it will be replaced in service by the Bell AH-1Z Viper upgrade.

The AH-1 Cobra was developed in the mid-1960s as an interim gunship for the U.S. Army for use during the Vietnam War. The Cobra shared the proven transmission, rotor system, and the T53 turboshaft engine of the UH-1 "Huey". By June 1967, the first AH-1G HueyCobras had been delivered. Bell built 1,116 AH-1Gs for the U.S. Army between 1967 and 1973, and the Cobras chalked up over a million operational hours in Vietnam.

The U.S. Marine Corps was very interested in the AH-1G Cobra, but it preferred a *twin-engine* version for improved safety in over-water operations, and also wanted a more potent turret-mounted weapon. At first, the Department of Defense had balked at providing the Marines with a twin-engine version of the Cobra, in the belief that commonality with Army AH-1Gs outweighed the advantages of a different engine fit. However, the Marines won out and awarded Bell a contract for 49 twin-engine AH-1J SeaCobras in May 1968. As an interim measure, the U.S.

Army passed on 38 AH-1Gs to the Marines in 1969. The AH-1J also received a more powerful gun turret. It featured a three barrel 20 mm XM197 cannon that was based on the six barrel M61 Vulcan cannon.

The Marine Corps requested greater load carrying capability in high temperatures for the Cobra in the 1970s. Bell used systems from its Model 309 to develop the AH-1T. This version had a lengthened tailboom and fuselage with an upgraded transmission and engines from the 309. Bell designed the AH-1T to be more reliable and easier to maintain in the field. The version was given full TOW missile capability with targeting system and other sensors. An advanced version, known as the AH-1T+ with more powerful T700-GE-700 engines and advanced avionics was proposed to Iran in the late 1970s, but the overthrow of the Shah of Iran resulted in the sale being canceled.

In the early 1980s, the U.S. Marine Corps sought a new navalized helicopter, but it was denied funding to buy the AH-64 Apache by Congress in 1981. The Marines in turn pursued a more powerful version of the AH-1T. Other changes included modified fire control systems to carry and fire AIM-9 Sidewinder and AGM-114 Hellfire missiles. The new version was funded by Congress and received the AH-1W designation. Deliveries of AH-1W SuperCobras totaled 179 new-built helicopters plus 43 upgrades of AH-1Ts.

The AH-1T+ demonstrator and AH-1W prototype was later tested with a new experimental composite four blade main rotor system. The new system offered better performance, reduced noise and improved battle damage tolerance. Lacking a USMC contract, Bell developed this new design into the AH-1Z with its own funds. By 1996, the Marines were again not allowed to order the AH-64. Developing a marine version of the Apache would have been expensive and it was likely that the Marine Corps would be its only customer. They instead signed a contract for upgrading 180 AH-1Ws into AH-1Zs.

The AH-1Z Viper features several design changes. The AH-1Z's two redesigned wing stubs are longer with each adding a wing-tip station for a missile such as the [AIM-9 Sidewinder](#). Each wing has two other stations for 70 mm (2.75 in) Hydra rocket pods, or [AGM-114 Hellfire](#) quad missile launcher. The Longbow radar can be mounted on a wing tip station

General characteristics

- **Crew:** 2: pilot, co-pilot/gunner (CPG)
- **Length:** 53 ft 5 in (16.3 m) (with both rotors turning)
- **Rotor diameter:** 43 ft 11 in (13.4 m)
- **Height:** 13 ft 5 in (4.1 m)
- **Empty weight:** 6,610 lb (2,998 kg)
- **Max. takeoff weight:** 10,000 lb (4,540 kg)
- **Powerplant:** 1 × Pratt & Whitney Canada T400-CP-400 (PT6T-3 Twin-Pac) turboshaft, 1,800 shp (1,342 kW)
- **Total engine output:** 1,530 shp (1,125 kW) limited by helicopter drivetrain
- **Rotor systems:** 2 blades on main rotor, 2 blades on tail rotor
- **Fuselage length:** 45 ft 9 in (13.5 m)

- **Stub wing span:** 10 ft 9 in (3.28 m)

Performance

- **Never exceed speed:** 190 knots (219 mph, 352 km/h)
- **Maximum speed:** 152 knots (175 mph, 282 km/h)
- **Range:** 311 nmi (358 mi, 576 km)
- **Service ceiling:** 10,500 ft (3,215 m)
- **Rate of climb:** 1,090 ft/min (5.54 m/s)

Armament

- 20 mm (0.787 in) M197 3-barreled gatling cannon in the M97 turret (750 rounds ammo capacity)
- 2.75 in (70 mm) Mk 40 or Hydra 70 rockets - 14 rockets mounted in a variety of launchers
- 5 in (127 mm) Zuni rockets - 8 rockets in two 4-round LAU-10D/A launchers
- AIM-9 Sidewinder anti-aircraft missiles - 1 mounted on each hardpoint

AH-1Z Viper



The **Bell AH-1Z Viper** is a twin-engine attack helicopter based on the AH-1W SuperCobra, that was developed for the United States Marine Corps. The AH-1Z features a four-blade, bearingless, composite main rotor system, uprated transmission, and a new target sighting system. The AH-1Z is part of the H-1 upgrade program. It is also called "Zulu Cobra" in reference to its variant letter.

Aspects of the AH-1Z date back to the Bell 249 in 1979, which was basically an AH-1S equipped with the four-blade main rotor system from the Bell 412. This helicopter demonstrated Bell's *Cobra II* design at the Farnborough Airshow in 1980. The Cobra II was to be equipped with Hellfire missiles, a new targeting system and improved engines. Later came the Cobra 2000 proposal which included General Electric T700 engines and a four-blade rotor. This design drew interest from the US Marine Corps, but funding was not available. In 1993, Bell proposed an AH-1W-based version for the UK's new attack helicopter program. The derivative design, named *CobraVenom*, featured a modern digital cockpit and could carry TOWs, Hellfire or Brimstone missiles. The CobraVenom design was altered in 1995 by changing to a four-blade rotor system. The design lost to the AH-64D later that year however.

The AH-1Z incorporates new rotor technology with upgraded military avionics, weapons systems, and electro-optical sensors in an integrated weapons platform. It has improved survivability and can find targets at longer ranges and attack them with precision weapons.

The AH-1Z's new bearingless, hingeless rotor system has 75% fewer parts than that of four-bladed articulated systems. The blades are made of composites, which have an increased ballistic survivability, and there is a semiautomatic folding system for storage aboard amphibious assault ships. Its two redesigned wing stubs are longer, with each adding a wing-tip station for a missile such as the AIM-9 Sidewinder. Each wing has two other stations for 2.75-inch (70 mm) Hydra 70 rocket pods, or AGM-114 Hellfire quad missile launchers. The Longbow radar can also be mounted on a wing tip station.

The Z-model's integrated avionics system (IAS) has been developed by Northrop Grumman. The system includes two mission computers and an automatic flight control system. Each crew station has two 8x6-inch multifunction liquid crystal displays (LCD) and one 4.2x4.2-inch dual function LCD display. The communications suite combines a US Navy RT-1824 integrated radio, UHF/VHF, COMSEC and modem in a single unit. The navigation suite includes an embedded GPS inertial navigation system (EGI), a digital map system and Meggitt's low-airspeed air data subsystem, which allows weapons delivery when hovering.

The crew are equipped with the Thales "Top Owl" helmet-mounted sight and display system. The Top Owl has a 24-hour day/night capability and a binocular display with a 40° field of view. Its visor projection provides forward looking infrared (FLIR) or video imagery. The AH-1Z has survivability equipment including the Hover Infrared Suppression System (HIRSS) to cover engine exhausts, countermeasure dispensers, radar warning, incoming/on-way missile warning and on-fuselage laser spot warning systems.

The Lockheed Martin target sight system (TSS) incorporates a third-generation FLIR sensor. The TSS provides target sighting in day, night or adverse weather conditions. The system has various view modes and can track with FLIR or by TV. The same system is also used on the UH-1Y Venom and the KC-130J Harvest HAWK.

General characteristics

- **Crew:** 2: pilot, co-pilot/gunner (CPG)
- **Capacity:** 6,661 lb (3,021 kg)
- **Length:** 58 ft 3 in (17.8 m)
- **Rotor diameter:** 48 ft (14.6 m)
- **Height:** 14 ft 4 in (4.37 m)
- **Disc area:** 1,808 ft² (168.0 m²)
- **Empty weight:** 12,300 lb (5,580 kg)
- **Useful load:** 5,764 lb (2,620 kg)
- **Max. takeoff weight:** 18,500 lb (8,390 kg)
- **Powerplant:** 2 × General Electric T700-GE-401C turboshaft, 1,800 shp (1,340 kW) each
- **Rotor systems:** 4 blades on main rotor, 4 blades on tail rotor

Performance

- **Never exceed speed:** 222 knots (255 mph, 411 km/h) in a dive
- **Cruise speed:** 160 kn (184 mph, 296 km/h)
- **Range:** 370 nmi (426 mi, 685 km)
- **Combat radius:** 125 nmi (144 mi, 231 km) with 2,500 lb (1,130 kg) payload
- **Service ceiling:** 20,000+ ft (6,100+ m)
- **Rate of climb:** 2,790 ft/min (14.2 m/s)

Armament

- **Guns:** 1 x 20 mm (0.787 in) M197 3-barreled gatling cannon in the A/A49E-7 turret (750 round ammo capacity)
- **Hardpoints:** Up to 6 pylon stations on stub wing
- **Rockets:** 2.75 in (70 mm) Hydra 70 rockets – Mounted in LAU-68C/A (7 shot) or LAU-61D/A (19 shot) launchers
- **Missiles:**
 - AIM-9 Sidewinder air-to-air missiles – 1 mounted on each wing tip station (total of 2)
 - AGM-114 Hellfire air-to-surface missiles – Up to 16 missiles mounted in four 4-round M272 missile launchers, two on each wing

AH-64D Longbow Apache



The **Boeing AH-64 Apache** is a four-blade, twin-engine attack helicopter with a tailwheel-type landing gear arrangement, and a tandem cockpit for a two-man crew. Originally, the Apache started life as the *Model 77* developed by Hughes Helicopters for the United States Army's Advanced Attack Helicopter program to replace the AH-1 Cobra, and was first flown on 30 September 1975. The AH-64 was introduced to U.S. Army service in April 1986.

The AH-64 Apache features a nose-mounted sensor suite for target acquisition and night vision systems. It is armed with a 30-millimeter (1.2 in) M230 Chain Gun carried between the main landing gear, under the aircraft's forward fuselage. It has four hardpoints mounted on stub-wing pylons, typically carrying a mixture of AGM-114 Hellfire missiles and Hydra 70 rocket pods. The AH-64 has a large amount of systems redundancy to improve combat survivability.

The U.S. Army selected the YAH-64, by Hughes Helicopters, over the Bell YAH-63 in 1976, and later approved full production in 1982. McDonnell Douglas continued production and

development after purchasing Hughes Helicopters from Summa Corporation in 1984. The first production AH-64D Apache Longbow, an upgraded version of the original Apache, was delivered to the Army in March 1997. Production has been continued by Boeing Defense, Space & Security; over 1,000 AH-64s have been produced to date.

The U.S. Army is the primary operator of the AH-64; it has also become the primary attack helicopter of multiple nations, including Greece, Japan, Israel, the Netherlands and Singapore; as well as being produced under license in the United Kingdom as the AgustaWestland Apache. U.S. AH-64s have served in conflicts in Panama, the Persian Gulf, Kosovo, Afghanistan, and Iraq. Israel used the Apache in its military conflicts in Lebanon and the Gaza Strip; both British and U.S. Apaches have seen deployments in Afghanistan and Iraq.

The AH-64 Apache has a four-blade main rotor and a four-blade tail rotor. The crew sits in tandem, with the pilot sitting behind and above the copilot/gunner. The AH-64 is powered by two General Electric T700 turboshaft engines with high-mounted exhausts on either side of the fuselage. Various models of engines have been used on the Apache, those in British service use engines from Rolls-Royce instead of General Electric. In 2004, General Electric Aviation began producing more powerful T700-GE-701D engines, rated at 2,000 shp (1,500 kW) for AH-64Ds.

The crew compartment has shielding between the cockpits, such that at least one crew member can survive hits. The compartment and the rotor blades are designed to sustain a hit from 23-millimeter (0.91 in) rounds. The airframe includes some 2,500 pounds (1,100 kg) of protection and has a self-sealing fuel system to protect against ballistic projectiles. The aircraft was designed to meet the crashworthiness requirements of MIL-STD-1290, which specifies minimum requirement for crash impact energy attenuation to minimize crew injuries and fatalities. This was achieved through incorporation of increased structural strength, crashworthy landing gear, seats and fuel system. Up to six AH-64 Apaches can be safely fitted inside the cargo hold of a USAF Lockheed C-5 Galaxy.

Avionics and targeting

One of the revolutionary features at the introduction of the Apache was its helmet mounted display, the Integrated Helmet and Display Sighting System (IHADSS); among other abilities the pilot or gunner can slave the helicopter's 30 mm automatic M230 Chain Gun to his helmet, making the gun track head movements to point at where he looks. The M230E1 can be alternatively fixed to a locked forward firing position, or controlled via the Target Acquisition and Designation System (TADS). The AH-64's standard of performance for aerial gunnery is to achieve at least 1 hit for every 30 shots fired at a wheeled vehicle at a range of 800–1,200 m (870–1,300 yd).

The AH-64 is designed to endure front-line environments and to operate during the day or night and in adverse weather via its avionics and onboard sensor suites. These systems include the Target Acquisition and Designation System, Pilot Night Vision System (TADS/PNVS), passive infrared countermeasures, GPS, and the IHADSS. A newer system that is replacing TADS/PNVS is Arrowhead (MTADS); it is manufactured by Lockheed Martin, a contract was issued in February 2005 to begin equipping all U.S. Apaches.

The AH-64 is adaptable to numerous different roles within its context as Close Combat Attack (CCA), it has a customizable weapons loadout mounted on stub-wings for the role desired. In addition to the 30-mm M230E1 Chain Gun, the Apache carries a range of external stores on its stub-wing pylons, typically a mixture of AGM-114 Hellfire anti-tank missiles, and Hydra 70 general-purpose unguided 70 mm (2.76 in) rockets.

Starting in the late 1980s, the Stinger and AIM-9 Sidewinder air-to-air missiles and the AGM-122 Sidarm anti-radiation missile were evaluated for use upon the AH-64. The Stinger was initially selected over the AIM-9, but the U.S. Army is considering the Starstreak air-to-air missile instead. External fuel tanks can also be carried on the stub wings to increase range and mission time. The stub-wing pylons have mounting points which make maintenance easier; these mountings can be used to secure personnel to the wings for transport for emergencies.

General characteristics

- **Crew:** 2 (pilot, and co-pilot/gunner)
- **Length:** 58.17 ft (17.73 m) (with both rotors turning)
- **Rotor diameter:** 48 ft 0 in (14.63 m)
- **Height:** 12.7 ft (3.87 m)
- **Disc area:** 1,809.5 ft² (168.11 m²)
- **Empty weight:** 11,387 lb (5,165 kg)
- **Loaded weight:** 17,650 lb (8,000 kg)
- **Max. takeoff weight:** 23,000 lb (10,433 kg)
- **Powerplant:** 2 × General Electric T700-GE-701 and later upgraded to T700-GE-701C (1990–present) & T700-GE-701D (AH-64E) turboshafts, -701: 1,690 shp, -701C: 1,890 shp, -701D: 2,000 shp (-701: 1,260 kW, -701C: 1,409 kW, -701D: 1,490 kW) each
- **Fuselage length:** 49 ft 5 in (15.06 m)
- **Rotor systems:** 4 blade main rotor, 4 blade tail rotor in non-orthogonal alignment

Performance

- **Never exceed speed:** 197 knots (227 mph, 365 km/h)
- **Maximum speed:** 158 knots (182 mph, 293 km/h)
- **Cruise speed:** 143 knots (165 mph, 265 km/h)
- **Range:** 257 nmi (295 mi, 476 km) with Longbow radar mast
- **Combat radius:** 260 nmi (300 mi, 480 km)
- **Ferry range:** 1,024 nmi (1,180 mi, 1,900 km)
- **Service ceiling:** 21,000 ft (6,400 m) minimum loaded
- **Rate of climb:** 2,500 ft/min (12.7 m/s)
- **Disc loading:** 9.80 lb/ft² (47.9 kg/m²)
- **Power/mass:** 0.18 hp/lb (0.31 kW/kg)

Armament

- **Guns:** 1× 30 mm (1.18 in) M230 Chain Gun with 1,200 rounds as part of the Area Weapon Subsystem

- **Hardpoints:** Four pylon stations on the stub wings. Longbows also have a station on each wingtip for an AIM-92 ATAS twin missile pack.
- **Rockets:** Hydra 70 70 mm, and CRV7 70 mm air-to-ground rockets
- **Missiles:** Typically AGM-114 Hellfire variants; AIM-92 Stinger may also be carried.

Avionics

- Lockheed Martin / Northrop Grumman AN/APG-78 *Longbow* fire-control radar (Note: can only be mounted on the AH-64D)

CH-46 Sea Knight



The **Boeing Vertol CH-46 Sea Knight** is a medium-lift tandem rotor transport helicopter. It is used by the United States Marine Corps (USMC) to provide all-weather, day-or-night assault transport of combat troops, supplies and equipment. Additional tasks include combat support, search and rescue (SAR), support for forward refueling and rearming points, CASEVAC and Tactical Recovery of Aircraft and Personnel (TRAP). The Sea Knight was also the U.S. Navy's standard medium-lift utility helicopter until it was phased out in favor of the MH-60S Knighthawk in the early 2000s.

Canada also operated the Sea Knight, designated as CH-113, and operated them in the SAR role until 2004. Other export customers include Japan, Sweden, and Saudi Arabia. The commercial version is the **BV 107-II**, commonly referred to simply as the "Vertol".

The CH-46 has tandem contrarotating rotors powered by two GE T58 turboshaft engines. The engines are mounted on each side of the rear rotor pedestal with a driveshaft to the forward rotor. The engines are coupled so either could power both rotors in an emergency. The rotors feature three blades and can be folded for on-ship operations. The CH-46 has fixed tricycle landing gear, with twin wheels on all three units. The gear configuration causes a nose-up stance to

facilitate cargo loading and unloading. The main gear are fitted in rear sponsons that also contain fuel tanks with a total capacity of 350 US gallons (1,438 L).

The CH-46 has a cargo bay with a rear loading ramp that could be removed or left open in flight for extended cargo or for parachute drops. An internal winch is mounted in the forward cabin and can be used to pull external cargo on pallets into the aircraft via the ramp and rollers. A belly sling hook (cargo hook) which is usually rated at 10,000 lb (4,500 kg). could be attached for carrying external cargo. Although the hook is rated at 10,000 lb (4,500 kg)., the limited power produced by the engines preclude the lifting of such weight. It usually has a crew of three, but can accommodate a larger crew depending on mission specifics. For example, a Search and Rescue variant will usually carry a crew of five (Pilot, Co-Pilot, Crew Chief, Swimmer, and Medic) to facilitate all aspects of such a mission. A pintle-mounted 0.50 in (12.7 mm) Browning machine gun is mounted on each side of the helicopter for self-defense. Service in southeast Asia resulted in the addition of armor with the guns.

General characteristics

- **Crew:** 5: 2 pilots, 1 crew chief, 1 aerial gunner/observer, 1 tail gunner
- **Capacity:**
 - 24 troops *or*
 - 15 stretchers and two attendants *or*
 - 2270 kg (5,000 lb)
- **Length:** 44 ft 10 in fuselage (13.66 m)
- **Fuselage width:** 7 ft 3 in (2.2 m)
- **Rotor diameter:** 50 ft (15.24 m)
- **Height:** 16 ft 9 in (5.09 m)
- **Disc area:** 3,927 ft² (364.8 m²)
- **Empty weight:** 11,585 lb (5,255 kg)
- **Loaded weight:** 17,396 lb (7,891 kg)
- **Max. takeoff weight:** 24,300 lb (11,000 kg)
- **Powerplant:** 2 × General Electric T58-GE-16 turboshafts, 1,870 shp (1,400 kW) each

Performance

- **Maximum speed:** 166 mph (144 knots, 267 km/h)
- **Range:** 633 mi (550 nmi, 1,020 km)
- **Ferry range:** 690 mi (600 nmi, 1,110 km)
- **Service ceiling:** 17,000 ft (5,180 m)
- **Rate of climb:** 1,715 ft/min (8.71 m/s)
- **Disc loading:** 4.43 lb/ft² (21.6 kg/m²)
- **Power/mass:** 0.215 hp/lb (354 W/kg)

Armament

- **Guns:** 2× Door mounted GAU-15/A .50 BMG (12.7 x 99 mm) machine guns (optional), 1 Ramp mounted M240D 7.62 x 51 mm machine gun (optional)

CH-47 Chinook



The **Boeing CH-47 Chinook** is an American twin-engine, tandem rotor heavy-lift helicopter. Its primary roles are troop movement, artillery emplacement and battlefield resupply. It has a wide loading ramp at the rear of the fuselage and three external-cargo hooks. With a top speed of 170 knots (196 mph, 315 km/h) the helicopter is faster than contemporary utility and attack helicopters of the 1960s. The CH-47 is among the heaviest lifting Western helicopters. Its name is from the Native American Chinook people.

The Chinook was designed and initially produced by Boeing Vertol in the early 1960s; it is now produced by Boeing Rotorcraft Systems. It is one of the few aircraft of that era – along with the fixed-wing Lockheed C-130 Hercules cargo aircraft – that remain in production and front-line service, with over 1,179 built to date. The helicopter has been sold to 16 nations with the U.S. Army and the Royal Air Force its largest users.

In late 1956, the United States Department of the Army announced plans to replace the Sikorsky CH-37 Mojave, which was powered by piston engines, with a new, turbine-powered helicopter. Turbine engines were also a key design feature of the smaller UH-1 "Huey" utility helicopter.

Following a design competition, in September 1958, a joint Army–Air Force source selection board recommended that the Army procure the Vertol medium transport helicopter. However, funding for full-scale development was not then available, and the Army vacillated on its design requirements. Some in the Army aviation corps thought that the new helicopter should be a light tactical transport aimed at taking over the missions of the old piston-engined H-21 and H-34 helicopters, and consequently capable of carrying about fifteen troops (one squad). Another faction in the Army aviation corps thought that the new helicopter should be much larger to be able to airlift a large artillery piece, and have enough internal space to carry the new MGM-31 "Pershing" Missile System.

Vertol began work on a new tandem-rotor helicopter designated Vertol Model 107 or V-107 in 1957. In June 1958, the U.S. Army awarded a contract to Vertol for the aircraft under the YHC-1A designation. The YHC-1A had a capacity for 20 troops. Three were tested by the Army for deriving engineering and operational data. However, the YHC-1A was considered by most of the Army users to be too heavy for the assault role and too light for the transport role. The decision was made to procure a heavier transport helicopter and at the same time upgrade the UH-1 "Huey" as a tactical troop transport. The YHC-1A would be improved and adopted by the Marines as the CH-46 Sea Knight in 1962. The Army then ordered the larger Model 114 under the designation HC-1B. The pre-production Boeing Vertol YCH-1B made its initial hovering flight on 21 September 1961. In 1962 the HC-1B was redesignated the *CH-47A* under the 1962 United States Tri-Service aircraft designation system.

The CH-47 is powered by two turboshaft engines, mounted on each side of the helicopter's rear pylon and connected to the rotors by driveshafts. Initial models were fitted with Lycoming T-53 jet engines with a combined rating of 2,200 shaft horsepower. Subsequent versions of the Chinook were configured with improved Lycoming engines and later with General Electric turbines. The counter-rotating rotors eliminate the need for an anti-torque vertical rotor, allowing all power to be used for lift and thrust. The ability to adjust lift in either rotor makes it less sensitive to changes in the center of gravity, important for the cargo lifting role. If one engine fails, the other can drive both rotors. The "sizing" of the Chinook was directly related to the growth of the Huey and the Army's tacticians' insistence that initial air assaults be built around the squad. The Army pushed for both the Huey and the Chinook, and this focus was responsible for the acceleration of its air mobility effort.

General characteristics

- **Crew:** 3 (pilot, copilot, flight engineer)
- **Capacity:**
 - 33–55 troops *or*
 - 24 litters and 3 attendants *or*
 - 28,000 lb (12,700 kg) cargo
- **Length:** 98 ft 10 in (30.1 m)
- **Rotor diameter:** 60 ft 0 in (18.3 m)
- **Height:** 18 ft 11 in (5.7 m)
- **Disc area:** 5,600 ft² (2,800 ft² per rotor disc) (260 m²)
- **Empty weight:** 23,400 lb (10,185 kg)
- **Loaded weight:** 26,680 lb (12,100 kg)

- **Max. takeoff weight:** 50,000 lb (22,680 kg)
- **Powerplant:** 2 × Lycoming T55-GA-714A turboshaft, 4,733 hp (3,631 kW) each

Performance

- **Maximum speed:** 170 knots (196 mph, 315 km/h)
- **Cruise speed:** 130 kt (149 mph, 240 km/h)
- **Range:** 400 nmi (450 mi, 741 km)
- **Combat radius:** 200 nmi (370.4 km)
- **Ferry range:** 1,216 nmi (1,400 mi, 2,252 km)
- **Service ceiling:** 18,500 ft (5,640 m)
- **Rate of climb:** 1,522 ft/min (7.73 m/s)
- **Disc loading:** 9.5 lb/ft² (47 kg/m²)
- **Power/mass:** 0.28 hp/lb (460 W/kg)

Armament

- up to 3 pintle mounted medium machine guns (1 on loading ramp and 2 at shoulder windows), generally 7.62 mm (0.308 in) M240/FN MAG machine guns

Avionics

- Rockwell Collins Common Avionics Architecture System (CAAS) (MH-47G/CH-47F)

CH-53E Super Stallion



The **Sikorsky CH-53E Super Stallion** is the largest and heaviest helicopter in the United States military. As the Sikorsky S-80 it was developed from the CH-53 Sea Stallion, mainly by adding a third engine, a seventh blade to the main rotor and canting the tail rotor 20 degrees. It was built by Sikorsky Aircraft for the United States Marine Corps. The less common **MH-53E Sea Dragon** fills the United States Navy's need for long range mine sweeping or Airborne Mine Countermeasures (AMCM) missions, and perform heavy-lift duties for the Navy. Under development is the CH-53K, which will be equipped with new engines, new composite rotor blades, and a wider cabin.

The CH-53 was the product of the U.S. Marines' "Heavy Helicopter Experimental" (HH(X)) competition begun in 1962. Sikorsky's S-65 was selected over Boeing Vertol's modified CH-47 Chinook version. The prototype YCH-53A first flew on 14 October 1964. The helicopter was designated "CH-53A Sea Stallion" and delivery of production helicopters began in 1966. The first CH-53As were powered by two General Electric T64-GE-6 turboshaft engines with 2,850 shp (2,125 kW) and had a maximum gross weight of 46,000 lb (20,865 kg) including 20,000 lb (9,072 kg) in payload.

Variants of the original CH-53A Sea Stallion include the RH-53A/D, HH-53B/C, CH-53D, CH-53G, and MH-53H/J/M. The RH-53A and RH-53D were used by the US Navy for mine sweeping. The CH-53D included a more powerful version of the General Electric T64 engine, used in all H-53 variants, and external fuel tanks. The CH-53G was a version of the CH-53D produced in West Germany for the German Army.

The US Air Force's HH-53B/C "Super Jolly Green Giant" were for special operations and combat rescue and were first deployed during the Vietnam War. The Air Force's MH-53H/J/M Pave Low helicopters were the last of the twin engined H-53s and were equipped with extensive avionics upgrades for all weather operation.

Although dimensionally similar, the three engine CH-53E Super Stallion or Sikorsky S-80 is a much more powerful aircraft than the original Sikorsky S-65 twin engined CH-53A Sea Stallion. The CH-53E also added a larger main rotor system with a seventh blade.

The CH-53E can transport up to 55 troops or 30,000 lb (13,610 kg) of cargo and can carry external slung loads up to 36,000 lb (16,330 kg). The Super Stallion has a cruise speed of 173 mph (278 km/h) and a range of 621 miles (1,000 km). The helicopter is fitted with a forward extendable in-flight refueling probe and it can also hoist hose refuel from a surface ship while in hover mode. It can carry three machine guns: one at the starboard side crew door, one at the port window, just behind the copilot, and one at the tail ramp. The CH-53E also has chaff-flare dispensers.

The MH-53E features enlarged side mounted fuel sponsons and is rigged for towing its mine sweeping "sled" from high above the dangerous naval mines. The Sea Dragon is equipped with mine countermeasures systems, including twin machine guns. Its digital flight-control system includes features specifically designed to help towing mine sweeping gear.

Upgrades to the CH-53E have included the Helicopter Night Vision System (HNVS), improved .50 BMG (12.7 mm) GAU-21/A and M3P machine guns, and AAQ-29A forward looking infrared (FLIR) imager.

The CH-53E and the MH-53E are the largest helicopters in the Western world, while the CH-53K now being developed will be even larger. They are fourth in the world to the Russian Mil Mi-26 and Mil V-12, which can lift more than 22 tons (20 tonnes) and 44 tons (40 tonnes), respectively and the Mi-26's predecessor Mil Mi-6, which has less payload (12 tonnes) but is bigger and has a higher MTOW at 42 tonnes.

General characteristics

- **Crew:** 5: 2 pilots, 1 crew chief/right gunner, 1 left gunner, 1 tail gunner (combat crew)
- **Capacity:** 37 troops (55 with centerline seats installed)
- **Payload:** internal: 30,000 lb or 13,600 kg (external: 32,000 lb or 14,500 kg)
- **Length:** 99 ft 1/2 in (30.2 m)
- **Rotor diameter:** 79 ft (24 m)
- **Height:** 27 ft 9 in (8.46 m)

- **Disc area:** 4,900 ft² (460 m²)
- **Empty weight:** 33,226 lb (15,071 kg)
- **Max. takeoff weight:** 73,500 lb (33,300 kg)
- **Powerplant:** 3 × General Electric T64-GE-416/416A turboshaft, 4,380 shp (3,270 kW) each
- **Rotor systems:** 7 blades on main rotor, 4 blades on anti-torque tail rotor

Performance

- **Maximum speed:** 170 knots (196 mph, 315 km/h)
- **Cruise speed:** 150 kt (173 mph, 278 km/h)
- **Range:** 540 nmi (621 mi, 1,000 km)
- **Ferry range:** 990 nmi (1,139 mi, 1,833 km)
- **Service ceiling:** 18,500 ft (5,640 m)
- **Rate of climb:** 2,500 ft/min (13 m/s)

Armament

- **Guns:**
 - 2× .50 BMG (12.7 x 99 mm) window-mounted GAU-15/A machine guns
 - 1× .50 BMG (12.7 x 99 mm) ramp mounted weapons system, GAU-21 (M3M mounted machine gun)
- **Other:** Chaff and flare dispensers

MH-6 Little Bird



The **MH-6 Little Bird** (nicknamed the *Killer Egg*), and its attack variant **AH-6**, are light helicopters used for special operations in the United States Army. Originally based on a modified OH-6A, it was later based on the MD 500E, with a single five-bladed main rotor. The newest version, the **MH-6M**, is based on the MD 530F and has a single, six-bladed main rotor and four-bladed tail rotor.

The A/MH-6 was started in 1960, when the U.S. Army issued Technical Specification 153 for a Light Observation Helicopter (LOH) that could perform personnel transport, escort and attack missions, casualty evacuation, and observation. Twelve companies took part in the competition and Hughes Tool Company's Aircraft Division submitted the **Model 369**. Two designs, those submitted by Fairchild-Hiller and Bell, were selected as finalists by the Army-Navy design competition board, but the Army later included the helicopter from Hughes as well.

The first Model 369 prototype flew on 27 February 1963. Originally designated the **YHO-6A** under the Army's designation system, the aircraft was redesignated the **YOH-6A** under the Department of Defense's new joint system in 1962. Five prototypes were built, fitted with a 252 shp (188 kW) Allison T63-A-5A, and delivered to the U.S. Army at Fort Rucker, Alabama to compete against the other 10 prototype aircraft submitted by Bell and Fairchild-Hiller. In the end, Hughes won the competition and the Army awarded a contract for production in May 1965. The initial order was for 714 aircraft, but that was later increased to 1,300 with an option to buy another 114. Seventy helicopters were built in the first month.

This agile, unarmed helicopter is outfitted with outboard "benches" designed to ferry up to three commandos on each side. There is also a gunship variant, the AH-6. Painted black for nighttime operations, this small aircraft can conduct rapid insertions and extractions of special operations forces into areas its larger brother, the MH-60 Black Hawk, cannot.

General characteristics

- **Crew:** 2
- **Capacity:** up to 6 passengers for MH-6s
- **Length:** 32.6 ft (9.80 m)
- **Rotor diameter:** 27.4 ft (8.30 m)
- **Height:** 9.8 ft (3.0 m)
- **Empty weight:** 1,591 lb (722 kg)
- **Useful load:** 1,509 lb (684 kg)
- **Max. takeoff weight:** 3,100 lb (1,406 kg)
- **Powerplant:** 1 × One T63-A-5A or T63-A-700 turboshaft, 425 shp (317 kW) takeoff power (derated); 375 shp (280 kW) continuous power
- **Fuselage Length:** 24.6 ft (7.50 m)
- **Fuselage Width:** 4.6 ft (1.4 m)
- **Rotor systems:** 6 blades on main rotor, 4 blades on tail rotor
- **Useful fuel capacity:** 62 US gal (242 L) or 403 lb (183 kg)

Performance

- **Maximum speed:** 152 knots (175 mph, 282 km/h)
- **Cruise speed:** 135 knots (155 mph, 250 km/h)
- **Range:** 232 nmi (430 km, 267 mi) at 5,000 ft
- **Service ceiling:** 18,700 ft (5,700 m)
- **Rate of climb:** 2,061 ft/min (10.5 m/s)

Armament

- **Guns:**
 - 1× 30 mm (1.18 in) M230 Chain Gun; *or*
 - 2× 12.7 mm (.50 cal) GAU-19; *or*
 - 2× 7.62 mm (0.30 in) M134 Minigun
- **Rockets:**
 - 2× LAU-68D/A 7-tubes rocket pods firing 2.75 in (70 mm) Hydra 70 rocket projectiles

- **Missiles:**
 - Anti-tank guided missile: 2× AGM-114 Hellfire
 - Anti-air missile: 2× FIM-92 Stinger for self-defense

The armed variant is equipped with a lightweight universal mounting platform which can accommodate two M134 miniguns, two M260 7-shot Hydra 70 rocket pods. Alternately, the AH-6 can be armed with Hellfire anti-tank missiles, air-to-air Stingers, Mk-19 40 mm automatic grenade launchers, or .50 caliber machine guns

MH-60G/HH-60G Pave Hawk



The **Sikorsky MH-60G/HH-60G Pave Hawk** is a twin turboshaft engine helicopter in service with the United States Air Force. It is a derivative of the UH-60 Black Hawk and incorporates the US Air Force PAVE electronic systems program. The HH-60/MH-60 is a member of the Sikorsky S-70 family.

The MH-60G Pave Hawk's primary mission is insertion and recovery of special operations personnel, while the HH-60G Pave Hawk's core mission is recovery of personnel under stressful conditions, including search and rescue. Both versions conduct day or night operations into hostile environments. Because of its versatility, the HH-60G may also perform peace-time operations. Such tasks include civil search and rescue, emergency aeromedical evacuation (MEDEVAC), disaster relief, international aid, counter-drug activities and NASA space shuttle support.

In 1981, the U.S. Air Force chose the UH-60A Black Hawk to replace its HH-3E Jolly Green Giant helicopters. After acquiring some UH-60s, the Air Force began upgrading each with an air refueling probe and additional fuel tanks in the cabin. The machine guns were changed from

0.308 in (7.62 mm) M60s to 0.50 in (12.7 mm) XM218s. These helicopters were referred to as "Credible Hawks" and entered service in 1987.

Afterward, the Credible Hawks and new UH-60As were upgraded and designated MH-60G Pave Hawk. These upgrades were to be done in a two step process. But funding only allowed 16 Credible Hawks to receive the second step equipment. These helicopters were allocated to special operations use. The remaining 82 Credible Hawks received the first step upgrade equipment and were used for combat search and rescue. In 1991, these search and rescue Pave Hawks were redesignated HH-60G.

The Pave Hawk is a highly-modified version of the Sikorsky UH-60 Black Hawk. It features an upgraded communications and navigation suite that includes an integrated inertial navigation/global positioning/Doppler navigation systems, satellite communications, secure voice, and Have Quick communications. The term PAVE stands for Precision Avionics Vectoring Equipment.

All HH-60Gs have an automatic flight control system, night vision goggles lighting and forward looking infrared system that greatly enhances night low-level operations. Additionally, some Pave Hawks have color weather radar and an engine/rotor blade anti-ice system that gives the HH-60G an all-weather capability. Pave Hawk mission equipment includes a retractable in-flight refueling probe, internal auxiliary fuel tanks, two crew-served (or pilot-controlled) 7.62 mm miniguns or .50-caliber machine guns and an 8,000 pound (3,600 kg) capacity cargo hook. To improve air transportability and shipboard operations, all HH-60Gs have folding rotor blades.

Pave Hawk combat enhancements include a radar warning receiver, infrared jammer and a flare/chaff countermeasure dispensing system. HH-60G rescue equipment includes a hoist capable of lifting a 600 pound (270 kg) load from a hover height of 200 feet (60 m), and a personnel locating system. A number of Pave Hawks are equipped with an over-the-horizon tactical data receiver that is capable of receiving near real-time mission update information.

General characteristics

- **Crew:** 4 (2 pilots, flight engineer, gunner)
- **Capacity:** max. crew 6, 8–12 troops, plus litters and/or other cargo
- **Length:** 64 ft 10 in (17.1 m)
- **Rotor diameter:** 53 ft 8 in (14.1 m)
- **Height:** 16 ft 8 in (5.1 m)
- **Empty weight:** 16,000 lb (7,260 kg)
- **Max. takeoff weight:** 22,000 lb (9,900 kg)
- **Powerplant:** 2 × two General Electric T700-GE-700/701C free-turbine turboshafts, 1,630 shp (1,220 kW) each

Performance

- **Maximum speed:** 195 knots (224 mph, 360 km/h)
- **Cruise speed:** 159 kt (184 mph, 294 km/h)

- **Range:** 373 mi (internal fuel), or 508 mi (with external tanks) (600 km, or 818 km)
- **Service ceiling:** 14,000 ft (4,267 m)

Armament

- 2x 7.62 mm (0.308 in) miniguns *or*
- 2x 0.50 in (12.7 mm) GAU-18/As

Onboard Systems

- INS/GPS/Doppler navigation
- SATCOM satellite communications
- Secure/anti-jam communications
- LARS (Lightweight Airborne Recovery System) range/steering radio to compatible survivor radios
- Automatic flight control
- NVG night vision goggle lighting
- FLIR forward looking infra-red radar
- Color weather radar
- Engine/rotor blade anti-ice system
- Retractable In-flight refueling probe
- Integral rescue hoist
- RWR combat enhancement
- IR infra-red jamming unit
- flare/chaff countermeasure dispensing system

OH-58D Kiowa



The **Bell OH-58 Kiowa** is a family of single-engine, single-rotor, military helicopters used for observation, utility, and direct fire support. Bell Helicopter manufactured the OH-58 for the United States Army based on its Model 206A JetRanger helicopter. The OH-58 has been in continuous use by the U.S. Army since 1969.

The latest model, the *OH-58D Kiowa Warrior*, is primarily operated in an armed reconnaissance role in support of ground troops. The OH-58 has been exported to Austria, Canada, the Dominican Republic, Taiwan, and Saudi Arabia. It has also been produced under license in Australia.

On 14 October 1960, the United States Navy asked 25 helicopter manufacturers on behalf of the Army for proposals for a Light Observation Helicopter (LOH). Bell Helicopter entered the competition along with 12 other manufacturers, including Hiller Aircraft and Hughes Tool Co.,

Aircraft Division. Bell submitted the *D-250* design, which would be designated as the *YHO-4*. On 19 May 1961, Bell and Hiller were announced as winners of the design competition.

Light Observation Helicopter (LOH)

Bell developed the *D-250* design into the *Model 206* aircraft, redesignated as *YOH-4A* in 1962, and produced five prototype aircraft for the Army's test and evaluation phase. The first prototype flew on 8 December 1962. The *YOH-4A* also became known as the *Ugly Duckling* in comparison to the other contending aircraft. Following a flyoff of the Bell, Hughes and Fairchild-Hiller prototypes, the Hughes OH-6 Cayuse was selected in May 1965.

When the *YOH-4A* was rejected by the Army, Bell went about solving the problem of marketing the aircraft. In addition to the image problem, the helicopter lacked cargo space and only provided cramped quarters for the planned three passengers in the back. The solution was a fuselage redesigned to be more sleek and aesthetic, adding 16 cubic feet (0.45 m³) of cargo space in the process. The redesigned aircraft was designated as the *Model 206A*, and Bell President Edwin J. Ducaet named it the *JetRanger* denoting an evolution from the popular *Model 47J Ranger*.

In 1967, the Army reopened the LOH competition for bids because Hughes Tool Co. Aircraft Division could not meet the contractual production demands. Bell resubmitted for the program using the Bell 206A. Fairchild-Hiller failed to resubmit their bid with the *YOH-5A*, which they had successfully marketed as the *FH-1100*. In the end, Bell underbid Hughes to win the contract and the Bell 206A was designated as the *OH-58A*. Following the U.S. Army's naming convention for helicopters, the *OH-58A* was named Kiowa in honor of the Native American tribe.

Advanced Scout Helicopter

In the 1970s, the U.S. Army began evaluating the need to improve the capabilities of their scout aircraft. The *OH-58A* lacked the power for operations in areas that exposed the aircraft to high altitude and hot temperatures, areas where the ability to acquire targets was a critical deficiency in the tactical warfare capabilities of Army aviation.

The power shortcoming caused other issues as the Army anticipated the *AH-64A*'s replacement of the venerable *AH-1* in the Attack battalions of the Army. The Army began shopping the idea of an Aerial Scout Program to industry as a prototype exercise to stimulate the development of advanced technological capabilities for night vision and precision navigation equipment. The stated goals of the program included prototypes that would:

...possess an extended target acquisition range capability by means of a long-range stabilized optical subsystem for the observer, improved position location through use of a computerized navigation system, improved survivability by reducing aural, visual, radar, and infrared signatures, and an improved flight performance capability derived from a larger engine to provide compatibility with attack helicopters.

In early March 1974, the Army created a special task force at Fort Knox to develop the system requirements for the Aerial Scout Helicopter program, and in 1975 the task force had formulated the requirements for the Advanced Scout Helicopter (ASH) program. The requirements were formulated around an aircraft capable of performing in day, night, and adverse weather and compatible with all the advanced weapons systems planned for development and fielding into the 1980s. The program was approved by the System Acquisition Review Council and the Army prepared for competitive development to begin the next year. However, as the Army tried to get the program off the ground, Congress declined to provide funding for it in the fiscal year 1977 budget and the ASH Project Manager's Office (PM-ASH) was closed on 30 September 1976.

While no development occurred during the next few years, the program survived as a requirement without funding. On 30 November 1979, the decision was made to defer development of an advanced scout helicopter in favor of pursuing modification of existing airframes in the inventory as a near term scout helicopter (NTSH) option. The development of a mast-mounted sight would be the primary focus to improve the aircraft's ability to perform reconnaissance, surveillance, and target acquisition missions while remaining hidden behind trees and terrain. Both the UH-1 and the OH-58 were evaluated as NTSH candidates, but the UH-1 was dropped from consideration due to its larger size and ease of detection. The OH-58, on the other hand demonstrated a dramatic reduction in detectability with an MMS.

On 10 July 1980, the Army decided that the NTSH would be a competitive modification program based on developments in the commercial helicopter industry, particularly Hughes Helicopters development of the Hughes 500D which provided significant improvements over the OH-6.

Army Helicopter Improvement Program (AHIP)

The Army's decision to acquire the NTSH resulted in the "Army Helicopter Improvement Program (AHIP)". Both Bell Helicopter and Hughes Helicopters redesigned their scout aircraft to compete for the contract. Bell offered a more robust version of the OH-58 in their model 406 aircraft, and Hughes offered an upgraded version of the OH-6. On 21 September 1981, Bell Helicopter Textron was awarded a development contract. The first prototype flew on 6 October 1983, and the aircraft entered service in 1985 as the OH-58D.

Initially intended to be used in attack, cavalry and artillery roles, the Army only approved a low initial production level and confined the role of the OH-58D to field artillery observation. The Army also directed that a follow-on test be conducted to further evaluate the aircraft due to perceived deficiencies. On 1 April 1986, the Army formed a task force at Fort Rucker, Alabama, to remedy deficiencies in the AHIP. As a result of those deliberations, the Army had planned to discontinue the OH-58D in 1988 and focus on the LHX, but Congress approved \$138 million for expanding the program, calling for the AHIP to operate with the Apache as a hunter/killer team; the AHIP would locate the targets, and the Apache would destroy them in a throwback to the traditional OH-58/AH-1 relationship.

The Secretary of the Army directed instead that the aircraft's armament systems be upgraded, based on experience with Task Force 118's performance operating armed OH-58D helicopters in the Persian Gulf in support of Operation Prime Chance, and that the aircraft be used primarily for

scouting and armed reconnaissance. The armed aircraft would be known as the OH-58D Kiowa Warrior, denoting its new armed configuration. Beginning with the production of the 202nd aircraft (s/n 89-0112) in May 1991, all remaining OH-58D aircraft were produced in the Kiowa Warrior configuration. In January 1992, Bell Helicopter received its first retrofit contract to convert all remaining OH-58D Kiowa helicopters to the Kiowa Warrior configuration.

General characteristics

- **Crew:** 2 pilots
- **Length:** 42 ft 2 in (12.85 m)
- **Main rotor diameter:** 35 ft 0 in (10.67 m)
- **Height:** 12 ft 10⁵/₈ in (3.93 m)
- **Main rotor area:** 14.83 ft² (1.38 m²)
- **Empty weight:** 3,829 lb (1,737 kg)
- **Gross weight:** 5,500 lb (2,495 kg)
- **Powerplant:** 1 × Rolls-Royce T703-AD-700A or 250-C30R/3 turboshaft, 650 hp (485 kW) each

Performance

- **Maximum speed:** 149 mph (241 km/h)
- **Cruise speed:** 127 mph (204 km/h)
- **Range:** 345 miles (555 km)
- **Service ceiling:** 15,000 ft (4,575 m)

Armament

- AGM-114 Hellfire anti-tank missiles
- Hydra 70 rockets
- M296 or M3P .50 cal (12.7 mm) machine gun.
- AIM-92 Stinger air-to-air missiles (no longer used)

UH-1N Twin Huey



The **Bell UH-1N Twin Huey** is a medium military helicopter that first flew in April, 1969. The UH-1N has a fifteen seat configuration, with one pilot and fourteen passengers. In cargo configuration the UH-1N has an internal capacity of 220 ft³ (6.23 m³). An external load of 5,000 lb (2,268 kg) can be carried by the UH-1N. The **CUH-1N** (later **CH-135**) Twin Huey was the original version, first ordered by the Canadian Forces.

Based on the stretched fuselage Bell 205, the Bell 212 was originally developed for the Canadian Forces (CF) under the designation **CUH-1N Twin Huey**. Later the CF adopted a new designation system and the aircraft was re-designated as the **CH-135 Twin Huey**. The CF approved the development of the aircraft on 1 May 1968 and purchased 50 aircraft, with deliveries commencing in May 1971.

The UH-1N's main rotor is powered by a PT6T-3/T400 Turbo Twin Pac made up of two Pratt & Whitney Canada PT6 turboshaft power turbines driving a single output shaft. They are capable of producing up to 1,342 kW (1,800 shp). Should one engine fail the remaining engine can

deliver 671 kW (900 shp) for 30 minutes or 571 kW (765 shp) enabling the UH-1N to maintain cruise performance at maximum weight.

The United States Marine Corps (USMC) modified a large number of their UH-1Ns with a Stability Control Augmentation System (SCAS) which provides servo inputs to the rotor head to help stabilize the aircraft during flight. This modification removed the gyroscopic "Stabilization Bar" on top of the main rotor head, instead relying on the computer system for stability.

General characteristics

- **Crew:** 4 (Pilot, copilot, crew chief, gunner)
- **Capacity:** 6-8 combat-equipped troops, or equivalent cargo
- **Length:** 41 ft 8 in (12.69 m)
- **Rotor diameter:** 48 ft 0 in (14.6 m)
- **Height:** 14 ft 5 in (4.4 m)
- **Disc area:** 1,808 ft² (168.0 m²)
- **Empty weight:** 6,000 lb (2,721.5 kg)
- **Loaded weight:** 10,500 lb (4,762.7 kg)
- **Useful load:** 4500 lb (2038.0 kg)
- **Max. takeoff weight:** 10,500 lb (4,762.7 kg)
- **Powerplant:** 2 × Pratt & Whitney Canada T400-CP-400 turboshaft, 900 shp (671 kW), (total 1,250 shp) each

Performance

- **Maximum speed:** 130 knots (135 mph, 220 km/h)
- **Cruise speed:** 110 knots (126 mph, 207.3 km/h)
- **Range:** 248 nmi (286 mi, 460 km)
- **Service ceiling:** 17,300 ft (5,273 m)
- **Rate of climb:** 1,755 ft/min (8.9 m/s)
- **Power/mass:** hp/lb (W/kg)

Armament

- 2.75-inch (70 mm) rocket pods,
- GAU-16 .50 Cal. machine gun,
- GAU-17 7.62mm minigun or M240 7.62mm lightweight machine gun

UH-1Y Venom



The **Bell UH-1Y Venom** (also called **Super Huey**) is a twin-engine medium size utility helicopter, part of the United States Marine Corps' H-1 upgrade program. The helicopter is also called *Yankee* for its variant letter, Y.

The UH-1Y is currently in full-rate production to replace the USMC's aging fleet of UH-1N Twin Huey light utility helicopters first introduced in the early 1970s. The UH-1Y was to have been remanufactured from UH-1Ns, but in 2005 it was approved for the aircraft to be built as new.

In 1996, the United States Marine Corps launched the H-1 upgrade program by signing a contract with Bell Helicopter for upgrading 100 UH-1Ns into UH-1Ys and upgrading 180 AH-1Ws into AH-1Zs. The H-1 program created completely modernized attack and utility helicopters with considerable design commonality to reduce operating costs. The UH-1Y and AH-1Z share a common tail boom, engines, rotor system, drive train, avionics architecture, software, controls and displays for over 84% identical components.

The Y-model updates an airframe that has been central to the Marine Corps aviation in Iraq. The Huey has many mission requirements including command and control (C²), escort, reconnaissance, troop transport, medical evacuation and close air support. Typically detachments of 2–4 Hueys have been deployed with detachments of 4–8 Cobras. The forward mounted weaponry of the Cobra combined with the door guns of the Huey provides a 240° field of fire.

Over the years new avionics and radios, in addition to modern door guns and safety upgrades, have greatly increased the UH-1N's empty weight. With a maximum speed of approximately 100 knots (190 km/h) and an inability to lift much more than its own crew, fuel and ammunition, the UH-1N, while useful, is limited in its utility.

The Y-model upgrades pilot avionics to a glass cockpit, adds further safety modifications and provides the UH-1 with a modern FLIR system. However, the biggest improvement is an increase in engine power. By replacing the engines and the two bladed rotor system with four composite blades the Y-model will return the Huey to the utility role for which it was designed. Originally the UH-1Y was to have been remanufactured from UH-1N airframes, but in April 2005 approval was granted to build them as new helicopters.

Bell delivered two UH-1Ys to the U.S. Marine Corps in February 2008. As of September 2009, the UH-1Y is in full-rate production, with the Marine Corps expected to have 21 by the end of the year. The Marine Corps plans to eventually buy 160 of the Y-models to replace their inventory of N-models, with aircraft deliveries to be completed by 2016.

The UH-1Y variant modernizes the UH-1 design. Its most noticeable upgrade over previous variants is a four-bladed, all-composite rotor system designed to withstand ballistics up to 23 mm. A 21-inch (530 mm) insert just forward of the main door has been installed for more capacity. The UH-1Y features upgraded engines and transmission, a digital cockpit with flat panel multifunctional displays, and an 84% parts commonality with the AH-1Z. Compared to the UH-1N, the Y-model has an almost 125% increased payload, almost 50% greater range, a reduction in vibration, and higher cruise speed. The UH-1Y can keep up with the other helicopters it is escorting. The UH-1Y will have more power to maneuver. Ground forces commanders riding in the Y-model will have radios, firepower and the range to match the transport helicopters carrying their troops.

The Lockheed Martin target sight system (TSS) incorporates a third-generation FLIR sensor. The TSS provides target sighting in day, night or adverse weather conditions. The system has various view modes and can track with FLIR or by TV. It is also used on the AH-1Z Viper and the KC-130J Harvest HAWK.

General characteristics

- **Crew:** One or two pilots, plus crew chief, other crew members as mission requires
- **Capacity:** 6,660 lb (3,020 kg) including up to 10 crashworthy passenger seats, 6 litters or equivalent cargo
- **Length:** 58 ft 4 in (17.78 m)
- **Rotor diameter:** 48 ft 10 in (14.88 m)

- **Height:** 14 ft 7 in (4.5 m)
- **Disc area:** 1,808 ft² (168.0 m²)
- **Empty weight:** 11,840 lb (5,370 kg)
- **Useful load:** 6,660 lb (3,020 kg)
- **Max. takeoff weight:** 18,500 lb (8,390 kg)
- **Powerplant:** 2 × General Electric T700-GE-401C turboshaft, 1,828 shp for 2.5 min; 1,546 shp continuous (1,360 kW for 2.5 min; 1,150 kW continuous) each

Performance

- **Never exceed speed:** 198 kn (227 mph, 366 km/h)
- **Maximum speed:** 164 knots (189 mph, 304 km/h) for 30 minutes
- **Cruise speed:** 158 kt, 182 mph, 293 km/h (long range cruise (LRC): 135 kn, 155 mph, 250 km/h)
- **Combat radius:** 130 nmi (150 mi, 241 km) with 2,182 lb, 990 kg payload
- **Endurance:** 3.3 hr
- **Service ceiling:** 20,000+ ft (6,100+ m)
- **Rate of climb:** 2,520 ft/min (12.8 m/s)

Armament

- 2 external stations for 70 mm (2.75 in) Hydra 70 rockets
- 2 pintle mounts for 7.62 mm M240D machine guns, .50 BMG GAU-16/A machine guns, or 7.62 mm GAU-17/A Gatling guns

UH-60 Black Hawk



The **Sikorsky UH-60 Black Hawk** is a four-bladed, twin-engine, medium-lift utility helicopter manufactured by Sikorsky Aircraft. Sikorsky submitted the S-70 design for the United States Army's Utility Tactical Transport Aircraft System (UTTAS) competition in 1972. The Army designated the prototype as the *YUH-60A* and selected the Black Hawk as the winner of the program in 1976, after a fly-off competition with the Boeing Vertol YUH-61.

The UH-60A entered service with the U.S. Army in 1979, to replace the Bell UH-1 Iroquois as the Army's tactical transport helicopter. This was followed by the fielding of electronic warfare and special operations variants of the Black Hawk. Improved UH-60L and UH-60M utility variants have also been developed. Modified versions have also been developed for the U.S. Navy, Air Force, and Coast Guard. In addition to U.S. Army use, the UH-60 family has been exported to several nations. Black Hawks have served in combat during conflicts in Grenada, Panama, Iraq, Somalia, the Balkans, Afghanistan, and other areas in the Middle East.

In the late 1960s, the United States Army began forming requirements for a helicopter to replace the UH-1 Iroquois, and designated the program as the Utility Tactical Transport Aircraft System (UTTAS). The Army also initiated the development of a new, common turbine engine for its helicopters that would become the General Electric T700. Based on experience in Vietnam, the Army required significant performance, survivability and reliability improvements from both UTTAS and the new powerplant. The Army released its UTTAS request for proposals (RFP) in January 1972. The RFP also included air transport requirements. Transport aboard the C-130 limited the UTTAS cabin height and length.

The UTTAS requirements for improved reliability, survivability and lower life-cycle costs resulted in features such as dual-engines with improved hot and high altitude performance, and a modular design (reduced maintenance footprint); run-dry gearboxes; ballistically tolerant, redundant subsystems (hydraulic, electrical and flight controls); crashworthy crew (armored) and troop seats; dual-stage oleo main landing gear; ballistically tolerant, crashworthy main structure; quieter, more robust main and tail rotor systems; and a ballistically tolerant, crashworthy fuel system.

Four prototypes were constructed, with the first YUH-60A flying on 17 October 1974. Prior to delivery of the prototypes to the US Army, a preliminary evaluation was conducted in November 1975 to ensure the aircraft could be operated safely during all testing. Three of the prototypes were delivered to the Army in March 1976, for evaluation against the rival Boeing-Vertol design, the YUH-61A, and one was kept by Sikorsky for internal research. The Army selected the UH-60 for production in December 1976. Deliveries of the UH-60A to the Army began in October 1978 and the helicopter entered service in June 1979.

The UH-60 features four-blade main and tail rotors, and is powered by two General Electric T700 turboshaft engines. The main rotor is fully articulated and has elastomeric bearings in the rotor head. The tail rotor is canted and features a rigid crossbeam. The helicopter has a long, low profile shape to meet the Army's requirement for transporting aboard a C-130 Hercules, with some disassembly. It can carry 11 troops with equipment, lift 2,600 lb (1,170 kg) of cargo internally or 9,000 lb (4,050 kg) of cargo (for UH-60L/M) externally by sling.

The Black Hawk helicopter series can perform a wide array of missions, including the tactical transport of troops, electronic warfare, and aeromedical evacuation. A VIP version known as the VH-60N is used to transport important government officials (e.g., Congress, Executive departments) with the helicopter's call sign of "Marine One" when transporting the President of the United States. In air assault operations it can move a squad of 11 combat troops or reposition a 105 mm M119 howitzer with 30 rounds ammunition, and a four-man crew in a single lift. The Black Hawk is equipped with advanced avionics and electronics for increased survivability and capability, such as the Global Positioning System.

The UH-60 can be equipped with stub wings at top of fuselage to carry fuel tanks or various armaments. The initial stub wing system is called External Stores Support System (ESSS). It has two pylons on each wing to carry two 230 US gal (870 L) and two 450 US gal (1,700 L) tanks in total. The four fuel tanks and associated lines and valves form the external extended range fuel system (ERFS). U.S. Army UH-60s have had their ESSS modified into the crashworthy external fuel system (CEFS) configuration, replacing the older tanks with up to four total 200 US gal (760 L) crashworthy tanks along with self-sealing fuel lines. The ESSS can also carry 10,000 lb (4,500 kg) of armament such as rockets, missile and gun pods. The ESSS entered service in 1986. However it was found that with four fuel tanks it would obstruct the firing field of the door guns. To alleviate the issue, the external tank system (ETS) with unswept stub wings to carry two fuel tanks was developed.

The unit cost varies with the version due to the varying specifications, equipment and quantities. For example, the unit cost of the Army's UH-60L Black Hawk is \$5.9 million while the unit cost of the Air Force HH-60G Pave Hawk is \$10.2 million.

General characteristics

- **Crew:** 2 pilots (flight crew) with 2 crew chiefs/gunners
- **Capacity:** 2,640 lb (1,200 kg) of cargo internally, including 11 troops or 6 stretchers, or 8,000 lb (3,600 kg) (UH-60A) or 9,000 lb (4,100 kg) (UH-60L) of cargo externally
- **Length:** 64 ft 10 in (19.76 m)
- **Fuselage width:** 7 ft 9 in (2.36 m)
- **Rotor diameter:** 53 ft 8 in (16.36 m)
- **Height:** 16 ft 10 in (5.13 m)
- **Disc area:** 2,260 ft² (210 m²)
- **Empty weight:** 10,624 lb (4,819 kg)
- **Loaded weight:** 22,000 lb (9,980 kg)
- **Max. takeoff weight:** 23,500 lb (10,660 kg)
- **Powerplant:** 2 × General Electric T700-GE-701C turboshaft, 1,890 hp (1,410 kW) each

Performance

- **Never exceed speed:** 193 knots (222 mph, 357 km/h)
- **Maximum speed:** 159 kt (183 mph, 295 km/h)
- **Cruise speed:** 150 kt (173 mph, 278 km/h)
- **Combat radius:** 368 mi (320 nmi, 592 km)
- **Ferry range:** 1,380 mi (1,200 nmi, 2,220 km) with ESSS stub wings and external tanks
- **Service ceiling:** 19,000 ft (5,790 m)
- **Rate of climb:** 1,315 ft/min (4.5 m/s)
- **Disc loading:** 7.19 lb/ft² (35.4 kg/m²)
- **Power/mass:** 0.192 hp/lb (158 W/kg)

Armament

- **Guns:**
 - 2 × 7.62 mm (0.30 in) M240H machine guns or
 - 2 × 7.62 mm (0.30 in) M134 minigun or
 - 2 × .50 in (12.7 mm) GAU-19 gatling guns
- **Hardpoints:** 4, 2 per ESSS stub wings and provisions to carry combinations of:
 - **Rockets:** 70 mm (2.75 in) Hydra 70 rockets
 - **Missiles:** AGM-114 Hellfire laser guided missiles, AIM-92 Stinger air-to-air missiles
 - **Other:** 7.62 mm (0.30 in), 12.7 mm (0.50 in), 20 mm (0.787 in), or 30 mm (1.18 in) M230 gunpods
- **Bombs:** Can be equipped with VOLCANO minefield dispersal system.

UH-72 Lakota



The **Eurocopter UH-72 Lakota** is a twin-engine helicopter with a single, four-bladed main rotor. The UH-72 is a militarized version of the Eurocopter EC145 and is built by American Eurocopter division of EADS North America. Initially marketed as the **UH-145**, the helicopter was selected as the winner of the United States Army's Light Utility Helicopter (LUH) program on 30 June 2006. In October 2006, American Eurocopter was awarded a production contract for 345 aircraft to replace aging UH-1H/V and OH-58A/C helicopters in the Army and Army National Guard fleets.

The US Army's *LHX* program began in the early 1980s, proposing two helicopter designs with a high percentage of commonality of dynamic components. One was a light utility version ("LHX-U") for assault and tactical movement of troops and supplies, the other was a light scout/attack version ("LHX-SCAT") to complement the growing development of the AH-64 Apache. As the program was developed, the light utility version was dropped and focus was placed on the light attack reconnaissance version, which eventually became the RAH-66 Comanche.

In 2004, the Department of Defense and the US Army made the decision to terminate the RAH-66 program. As part of the termination, the Army was allowed to keep the future years' funding programmed for the Comanche. To replace the capability that the Comanche was supposed to offer, the Army planned several programs, including three new aircraft. The Army Staff decided that these three aircraft, the Armed Reconnaissance Helicopter (ARH), the **Light Utility Helicopter (LUH)**, and the Future Cargo Aircraft (FCA) (later renamed Joint Cargo Aircraft, or JCA), were to be existing, in-production commercial aircraft modified for Army service.

The UH-72 is designed to take on a range of missions, from general support and medical evacuation (MEDEVAC) to personnel recovery and counter-narcotics operations. They are planned to replace the UH-1 and OH-58A/C, which are older light utility helicopters, and supplant other types in domestic use, primarily those in Army National Guard service. The UH-72 is being procured as a commercial off-the-shelf (COTS) product, which simplifies logistics support of the fleet. EADS NA has teamed with Sikorsky to provide Contractor Logistics Support (CLS) for the UH-72, through its Helicopter Support, Inc. (HSI)/Sikorsky Aerospace Maintenance. (SAM) subsidiaries.

In 2013, Congress questioned why the UH-72 had not been considered for a possible armed scout role. Army General Ray Odierno responded that the UH-72A was developed for homeland operations rather than for battlefield conditions. The UH-72 is typically employed by the U.S. Army National Guard as a utility helicopter in the U.S., which allowed UH-60 Black Hawks to deploy overseas. As of 2013, the utility version is not considered to be operationally deployable to a warzone; combat-capable versions are being evaluated for the Armed Aerial Scout program.

General characteristics

- **Crew:** 2 pilots
- **Capacity:** 8 troops or 2 stretchers and medical crew
- **Length:** 42 ft 7 in (13.03 m)
- **Rotor diameter:** 36 ft 1 in (11.00 m)
- **Height:** 11 ft 9 in (3.45 m)
- **Disc area:** 1,023 ft² (94.98 m²)
- **Empty weight:** 3,950 lb (1,792 kg)
- **Useful load:** 3,953 lb (1,793 kg)
- **Max. takeoff weight:** 7,903 lb (3,585 kg)
- **Powerplant:** 2 × Turbomeca Arriel 1E2 turboshafts, 738 shp (551 kW) each

Performance

- **Maximum speed:** 145 knots (167 mph, 269 km/h)
- **Cruise speed:** 133 knots (153 mph, 246 km/h)
- **Range:** 370 nmi (426 mi, 685 km)
- **Service ceiling:** 18,000 ft (5,791 m)
- **Rate of climb:** 1,600 ft/min (8.13 m/s)