

ARCHIVED REPORT

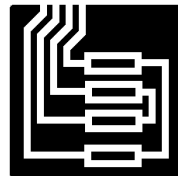
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Bell OH-58 Series

Outlook

- U.S. has again canceled program intended to develop replacement, and cut Kiowa funding post-FY14
- Drones, AH-64 Apache to assume recon mission

Note: Icons indicate area(s) of current and potential retrofit/modernization activity



Orientation

Description. Single-main-rotor, single-turboshaft-powered, light military helicopter.

Current Status. OH-58A/B production ended in 1977. OH-58D production ended in 2000. Conversions of early OH-58s to the D standard continue.

Total Produced. A total of 2,325 OH-58s were produced, plus 56 Model 206B-1s for Australia. Through 1999, 412 OH-58D conversions were performed by Bell for the U.S. Army.

Application. Reconnaissance, observation/scout, surveillance, target acquisition and designation, and special operations forces anti-tank, anti-surface vessel, and troop assault gunship.

Price Range. An OH-58A to OH-58D conversion costs approximately \$10 million in 2011 dollars.

Contractors

Prime

Bell Helicopter Textron Inc

<http://www.bellhelicopter.com>, 3255 Bell Helicopter Blvd, PO Box 482, Fort Worth, TX 76101-0482 United States, Tel: + 1 (817) 280-2011, Fax: + 1 (817) 280-2321, Prime

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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

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Technical Data

(OH-58D Kiowa Warrior)

Design Features. The OH-58D has a four-blade main rotor with composite, foldable blades – the vertical fin is also tiltable, allowing stowage and conversion to flight status within 10 minutes of unloading from a C-130. Transmission is rated 510 shp maximum continuous, with armed AHIPs having 575-hp transmission capability. Landing gear is fixed-skid type. Armed AHIPs have squatting skid gear.

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Main rotor diameter	10.67 m	35 ft
Tail rotor diameter	1.65 m	5.413 ft
Fuselage length	10.31 m	33.825 ft
Fuselage width	1.97 m	6.46 ft
Height to rotor head	2.59 m	8.5 ft
Overall height	3.9 m	12.8 ft
Weight		
Empty	1,737 kg	3,829 lb
Maximum gross weight	2,495 kg	5,500 lb
Performance		
Maximum speed	241 km/h	130 kt
Range	555 km	300 nm

Propulsion

OH-58D (1) Rolls-Royce T703-A-700 turboshaft engine rated a maximum 484 kW (650 shp).

Armament

Pylon-mounted weapons include up to four Stinger, four HELLFIRE, or four TOW anti-tank missiles; .50-inch machine guns with 1,000 rounds; 20mm cannon with 360 rounds; 14 rounds of 2.75-inch rockets.

Program Review

In 1960, the U.S. Army initiated a design competition for a Light Observation Helicopter. The LOH was to fulfill a variety of roles, including casualty evacuation, close support, observation, and light transport. Twelve aircraft manufacturers submitted design proposals, and the Hughes HO-6 (later the OH-6) was chosen as the winner. However, the service soon became disenchanted with Hughes when the unit cost of the

helicopter started to climb steeply and the production rate fell. The LOH competition was reopened in 1967, and in 1968 the Bell 206A was declared the winner.

The Bell helicopter was designated the OH-58 Kiowa. Deliveries began in 1969. The Army ordered 2,200 OH-58s, and an additional 74 were delivered to the Canadian government beginning in 1971. The Canadian aircraft were later redesignated CH-136.

Variants/Upgrades

OH-58A. Initial military version of the Model 206 family purchased beginning in 1968; 2,200 produced. Powered by Allison T63-A-700 turboshaft rated 317 shp. The first was delivered to the U.S. Army in May 1969. Canadian versions are designated CH-136.

OH-58B. Improved version of the OH-58A; also designated 206B-1 Kiowa, 12 of which were delivered to the Australian government. A total of 56 were produced.

OH-58C. A total of 275 OH-58As were converted to OH-58C configuration beginning March 1978. Changes included a new instrument panel, vulnerability improvements, CONUS navigation equipment, daytime optics, improved avionics and maintainability items, and a 420-shp Allison T63-A-720 engine.

OH-58D. Further improved variant, a conversion of OH-58A/C helicopters, called AHIP. The Model 406 forms the basis for this derivative, having been selected

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in 1981 as winner of the Army Helicopter Improvement Program. The Army's current requirement is estimated at 507 aircraft. The administration of George H.W. Bush halved this number, but Congress subsequently provided unrequested funding, resulting in the authorization of 351 conversions through FY93 inclusive. The first of five prototypes flew in October 1983 and deliveries began in 1985.

OH/AH-58D Kiowa Warrior. OH-58Ds armed with Stinger, HELLFIRE, and TOW missiles, and various ordnance, were developed under the program Prime Chance. Work was begun in September 1987 in order that they could be deployed to the Persian Gulf for participation in the Kuwaiti tanker reflagging exercise. The U.S. Navy conducted operations from floating barges and destroyers against Iranian gunboats. Eighty-one armed AHIPs were planned, with the entire fleet of 280 expected to be so configured. This helicopter, sometimes designated AH-58D, incorporates a modified Allison Model 250-C30X engine with improved power output and a 550-hp transmission, and has a gross weight of 5,500 pounds. The weapon systems fit includes an overhead reflector sight for the pilot, a steering indicator for the pilot flight display, a

multitarget acquisition system, a video tape recorder, a helmet-mounted display slaved to the night vision goggles, a SINCGARS radio, NBC masks, electro-magnetic pulse protection, and a windowless rear door. In addition, central computer memory capacity has been expanded to accommodate infrared (IR) and laser jammers.

OH-58X/UH-58E. Bell proposed this, and its UH-1H and 212, for the U.S. Army's UH-1 replacement program. The UH-58E is essentially an OH-58D with an extended nose section, five seats including three in the rear of the cabin where OH-58D avionics systems are located, six external passenger positions, and a 1-ton cargo hook. The UH-58E has no mast-mounted sight or associated avionics black boxes.

In April 1992, Bell converted an OH-58D to the Light Utility Variant standard and announced details of the design, now designated OH-58X. This model would carry a unit flyaway cost of \$6.7 million and would feature an inertial nav system with an imbedded GPS receiver, a ring laser gyro, a Collins ARC-217 HF radio, and a pilot night vision system to complement the pilot's ANVIS night vision goggles.

Funding

U.S. FUNDING

	FY12 <u>QTY</u>	FY12 <u>AMT</u>	FY13 <u>QTY</u>	FY13 <u>AMT</u>	FY14 <u>QTY</u>	FY14 <u>AMT</u>	FY15 (Req) <u>QTY</u>	FY15 (Req) <u>AMT</u>
U.S. Army Procurement								
Kiowa Warrior	-	92.6	-	113.1	-	108.3	-	-
U.S. Army RDT&E								
PE#0604220A								
Armed, Deployable Helos								
Kiowa Warrior	-	66.6	-	76.1	-	66.3	-	-
Total	-	159.2	-	189.2	-	174.6	-	0.0

All \$ are in millions.

Milestones

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Mar	1968	Initial contract awarded to Bell
May	1969	First OH-58A delivered to U.S. Army
Dec	1971	Initial delivery of OH-58As to Canada
	1973	U.S. Army production completed
Mar	1977	OH-58A/B production completed
Sep	1981	OH-58D engineering development contract awarded
Oct	1983	OH-58D first flight
Dec	1985	Initial OH-58D production deliveries
Late	1999	Final OH-58D conversion deliveries to U.S. Army

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Worldwide Distribution/Inventories

Operator	Designation	Quantity	Average Age
Austria Air Force	OH-58B	11	38.00
Colombia Air Force	OH-58A	4	42.00
Dominican Republic Air Force	OH-58A	8	42.00
Dominican Republic Army	OH-58A	9	42.00
Iraq Army	OH-58C	8	44.00
Israel Air Force	OH-58B	18	41.00
Spain Army	OH-58	2	45.00
Taiwan Army	OH-58D	38	20.67
United States Army	OH-58A	107	42.00
United States Army	OH-58C	209	41.50
United States Army	OH-58D	363	42.80

Identified Retrofit & Modernization Contractors

Airframe

Bell Helicopter Textron Inc	http://www.bellhelicopter.com , PO Box 482, Fort Worth, TX 76101-0482 United States, Tel: + 1 (817) 280-2011, Fax: + 1 (817) 280-2321 (OH-58A to OH-58D Conversion)
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Propulsion

Bell Helicopter Textron Inc	http://www.bellhelicopter.com , PO Box 482, Fort Worth, TX 76101-0482 United States, Tel: + 1 (817) 280-2011, Fax: + 1 (817) 280-2321 (Upgrade Run Dry-Capable Main Transmission)
Rolls-Royce Defence Aerospace	http://www.rolls-royce.com/defence/ , PO Box 3, Filton, BS12 7QE Bristol, United Kingdom, Tel: + 44 117 97 91234, Fax: + 44 117 97 98005 (Engine Upgrade)

Electronics

AAI Unmanned Aircraft Systems, A Textron Systems Company	http://www.aaicorp.com , 124 Industry Ln, PO Box 126, Hunt Valley, MD 21030-0126 United States, Tel: + 1 (410) 666-1400, Email: AAIReg@aaicorp.com (One System Remote Video Terminal (OSRVT))
BAE Systems Inc, Electronic Systems	http://www.baesystems.com , 65 Spit Brook Rd, Nashua, NH 03060 United States, Tel: + 1 (603) 885-4321, Fax: + 1 (603) 885-2772 (AAR-57 Common Missile Warning System)
Honeywell Aerospace, Defense & Space Electronics Systems	http://aerospace.honeywell.com/defense , 9201 San Mateo Blvd NE, Albuquerque, NM 87113-2227 United States, Tel: + 1 (505) 828-5000, Fax: + 1 (505) 828-5105 (Improved Master Controller Processor Unit (IMCPU) Upgrade; Control Display System Modification)
L-3 Communications - Communication Systems - West	http://www.l-3com.com/csw/ , 640 N 220 W, PO Box 16850, Salt Lake City, UT 84116-0850 United States, Tel: + 1 (801) 594-2000, Fax: + 1 (801) 594-3572 (Datalink Systems)

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Raytheon Space and Airborne Systems, Integrated Communications Systems	http://www.raytheon.com/businesses/ncs/ics/ , 1801 Hughes Dr, Fullerton, CA 92834 United States, Tel: + 1 (714) 446-4305, Fax: + 1 (714) 446-4314 (ARC-231 Communication System)
Raytheon Space and Airborne Systems	http://www.raytheon.com , 7408-7412 Brent Way, McKinney, TX 75070 United States, Email: SAS_Comms_PA@raytheon.com (AAS-53 Common Sensor)

Opportunities

In July 2005, the U.S. Army selected a version of the Bell 407 as its new Armed Reconnaissance Helicopter (ARH) to replace the OH-58D Kiowa Warrior. Delivery was originally planned for FY06-FY13, but the program encountered setbacks, including a prototype that sustained damage during a hard landing. Its cost had also ballooned, to an estimated \$6.3 billion – more than 25 percent above the 2005 estimate, and as such the ARH faced a Nunn-McCurdy breach. The Army looked for ways to keep the program afloat through reductions and other cost-cutting measures, but, ultimately, it could not be salvaged and was canceled.

Though the Pentagon attempted to re-compete the contract under the Armed Aerial Scout program, that too was scrapped in 2013. Then, in late 2013, the U.S. Army announced a plan to scrap the entire Kiowa fleet even though no replacement had yet been found. Instead, reconnaissance missions would be carried out by AH-64 Apache helicopters – already present for ground support and attack missions – and unmanned drones. The FY15 presidential budget request zeroes all spending on the OH-58 fleet after FY14.

While the U.S. Army retirement will gut the worldwide active fleet, some of these aircraft may be transferred or sold to other nations that have a need for a light reconnaissance helicopter. The OH-58D aircraft in particular have recently been through a major refresh that should keep them mission-capable for many years to come.

At some point, the United States will develop and field a new reconnaissance aircraft. The chances that it will be based on the Kiowa are slim, and indeed United States programs accounted for all previously anticipated future retrofit activity. Now that those programs have been eliminated, the OH-58's days are numbered.

AIRFRAME

Army Helicopter Improvement Program. This program has been completed but remains one of the most extensive and significant upgrades of the Kiowa ever undertaken.

AHIP provided for extensive modifications to the OH-58 helicopter, including:

- Mast-Mounted Sight. Northrop Grumman Corp and McDonnell Douglas Corp (now part of The Boeing Company) developed the AHIP Mast-Mounted Sight (MMS). The sight is a ball-shaped structure mounted at the top of the helicopter's rotor. It is composed of a television camera for day observation and a thermal imaging system for use in a variety of conditions: bad weather, the battlefield, smoke, and haze. Also included is a laser rangefinder/designator, which provides precise range and target designation for guided missile firings. McDonnell Douglas attributed the performance of the system to the stabilization technology developed by the company for the U.S. Army. This technology, known as "soft mount," isolates the sight's sensors from vibration, giving the crew a clear view of the target.

The copilot/observer slews the sight, using a thumb switch on the cyclic control stick. It is also possible to designate a target by depressing the thumb switch straight down, after which the sight continues to track automatically.

In 2007, the U.S. Army awarded DRS Technologies a \$51 million contract to support the manufacture of these systems.

- Integrated Cockpit Design. The OH-58D has a fully integrated, multiplexed cockpit design, the first provided for any U.S. Army helicopter. Honeywell is responsible for providing the cockpit control and display subsystem, which simplifies the scout crew workload and provides rapid target handoff to other weapons systems. Northrop Grumman provides the LR-80 attitude heading reference system (AHRS) for improved navigation.
- Four-Blade Rotor. The OH-58A/C's two-blade main rotor is replaced with a four-blade soft-in-plane composite main rotor design derived from Bell's commercial helicopter products. The rotor is composed of glassfiber composite blades with a hollow spar and afterbody skins supported by a Nomex honeycomb core. This main rotor provides the agility required for precise helicopter control in the nap-of-the-earth environment, while

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providing an extremely low-vibration environment for the MMS and the scout crew.

- **Improved Tail Rotor.** AHIP aircraft feature an improved tail rotor that provides accurate heading control in winds up to 35 knots from any direction. The rotor allows for the stabilization of the Mast-Mounted Sight, critical for maintaining the target area, and provides a margin of safety for the scout crew. The two-blade, non-lubricated rotor is located on the port side of the tailboom. The blades are composed of a glassfiber composite with a nickel-coated abrasion strip.
- **Engine and Transmission Upgrade.** An improved, power-matched drivetrain, consisting of the Rolls-Royce 250-C30R turboshaft engine and Bell's "run dry"-capable main transmission, is installed on AHIP aircraft. The engine carries the military designation T703-A-700 and has an intermediate power rating of 484 kW (650 shp) at sea level, ISA.

The U.S. Army's most recent OH-58 upgrades to the D standard are all in the Kiowa Warrior configuration. All previously unarmed OH-58Ds, it should be noted, have been converted to the Kiowa Warrior standard as well (detailed below).

OH-58A to OH-58D Conversion. In order to replace aircraft lost in Iraq and Afghanistan, the U.S. Army funded the conversion of OH-58As to the OH-58D standard. Funding began in 2012 and ended in 2014, along with all Kiowa funding.

Bell Helicopter modified the aircraft's center sections to the CDS4 configuration standard on the OH-58D. Corpus Christi Army Depot completed the remaining modifications, including all SEP, weight reduction, and Cockpit and Sensor Upgrade Program (CASUP) modifications.

Fielded Fleet Upgrades & Weight Reduction. In FY04, the U.S. Army began a weight reduction effort for the Kiowa Warrior to improve operational and autorotational characteristics as well as increase system reliability and lower support costs. Multiple initiatives have been launched to attain the weight reduction. Efforts include removing obsolete and extraneous hardware, repainting after removing excess layers of paint, replacing the current bomb rack, replacing and upgrading existing armor, updating the multifunction displays (MFDs) with lightweight alternatives, and installing the GAU-19 .50-caliber, three-barrel Gatling gun in place of the helicopter's M2 .50-caliber machine gun.

This program was expanded in the wake of the ARH cancellation; however, now that the Kiowa is being retired, it too will see final funding in FY14.

Previously planned to begin in FY07, the weight reduction program was accelerated due to congressional action. The weight reduction effort was combined with the safety enhancements (see below) in the Fielded Fleet Upgrades and Weight Reduction program.

ELECTRONICS

Fielded Fleet Upgrades. Combined with the weight reduction efforts as a component of the Fielded Fleet Upgrades and Weight Reduction program, the fielded fleet upgrades primarily enhance the OH-58D's safety features.

Under this upgrade, the reliability of the engine's Full Authority Digital Engine Control (FADEC) system is improved, a video data transfer system is installed, BAE Systems' AAR-57 ultraviolet common missile warning system (CMWS) is added, and a new Health Usage Monitoring System (HUMS) is installed.

As this upgrade is part of the Weight Reduction program (see above), the same timeframe and funding descriptions apply.

Cockpit and Sensor Upgrade Program (CASUP). A new program with initial funding in 2010, the CASUP was intended to ensure that the Kiowa Warrior could fly for at least another decade. The program is also referred to as Life Support 2020.

The upgrade includes a Control Display System version 5 (CDS5), Raytheon's ARC-231 satcom radios, color multifunction displays (including a third display), a dual-channel FADEC, a CMWS, Raytheon's AAS-53 common sensor to replace the existing MMS, universal weapons pylons, lightweight digital launchers, and improved .50-caliber machine guns.

After the cancellation of the Armed Reconnaissance Helicopter program, this life extension effort took on new significance – it was to keep the Kiowa fleet flying long enough to field a suitable replacement. At one point, the program would have covered 364 aircraft at an estimated cost of \$1.4 billion. The U.S. Army's reversal on the Kiowa means that all funding for this program has been cut.

Level II Manned/Unmanned (L2MUM) Teaming Upgrade. Comparable to the AH-64 Apache's VUIT-2 system, the L2MUM teaming upgrade would dramatically enhance integration between the Kiowa's

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sensor and avionics systems and those of other assets in the air and on the ground. The system was fielded on the OH-58D, and was planned for integration onto CASUP-modified OH-58Fs.

the Apache, the Raven, the Shadow, the Sky Warrior, the Predator, and others.

Delivery of the 377 A-kits and 180 B-kits concluded in FY11, at a total cost of \$70.4 million.

Like VUIT-2, L2MUM is fully interoperable with an assortment of manned and unmanned aircraft, including

FI's Opportunity Outlook

AIRFRAME													
		High Confidence					Good Confidence			Less Confidence			
Status		Thru 2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Estimated Potential Candidates	221	OH-58A to OH-58D Conversion <> OH-58 A <> United States <> Army											
Planned/In Progress		12	3	0	0	0	0	0	0	0	0	0	3
Speculative			0	0	0	0	0	0	0	0	0	0	0
Estimated Potential Candidates	429	Fielded Fleet Upgrades & Weight Reduction <> OH-58 D <> United States <> Army Note: Figures are estimated.											
Planned/In Progress		250	25	0	0	0	0	0	0	0	0	0	25
Speculative			0	0	0	0	0	0	0	0	0	0	0