# Ah-64D Longbow

The AH-64D Longbow Apache is a remanufactured and upgraded version of the AH-64A Apache attack helicopter. The primary modifications to the Apache are the addition of a millimeter-wave Fire Control Radar (FCR) target acquisition system, the fire-and-forget Longbow Hellfire air-to-ground missile, updated T700-GE-701C engines, and a fully-integrated cockpit. In addition, the aircraft receives improved survivability, communications, and navigation capabilities. Most existing capabilities of the AH-64A Apache are retained.

Transportability requirements were initially identified in the ORD and further defined in the AH-64D System Specification. Both configurations of the AH-64D, including any removed items and appropriate PGSE, shall be capable of being transported aboard C-141B, C-5A, or C-17 aircraft. The aircraft shall also be capable of being transported and hangar stored below decks in the landing platform helicopter (LPH) type carrier, Fast SeaLift ships, Roll-on/Roll-off, LASH, SEABEE ships, and Military Sealift Command (MSC) dry cargo ships. Additionally, the aircraft shall be transportable by military M-270A1 trailer and commercial "Air-Ride" trailer or equivalent. For aerial recovery, the AH-64D with MMA will be externally transportable by CH-47D aircraft using the Unit Maintenance Aerial Recovery Kit. Two AH-64D plus one FCR aircraft will be transportable by C-141, six AH-64Ds (with a minimum of three FCR mission kits) are transportable by C-5, and three AH-64Ds and three FCR mission kits are transportable by C-17.

The AH-64D is being fielded in two configurations. The full-up AH-64D includes all of the improvements listed above. In addition, a version of the AH-64D without the FCR will be fielded. This version will not receive the new Radar Frequency Interferometer (RFI) or the improved engines, but will retain the other Longbow modifications. The AH-64D without FCR is capable of launching the Longbow Hellfire missile.

All AH-64A Apaches in the fleet are to be upgraded to the AH-64D configuration: 227 will be equipped with the FCR, and the remaining 531 will not. Each attack helicopter company will receive three aircraft with FCRs and five without.

McDonnell Douglas Helicopter Systems is under contract for the first 18 Longbow Apaches and delivered the first remanufactured Longbow Apache in March 1997. The Army and McDonnell Douglas agreed to a five-year, multi-year agreement that will give the Army 232 Longbow Apaches in the first five years of production. The multi-year purchase increases the Longbow Apache production rate in the first year to 24 aircraft and 232 for the five-year period. Under the multi-year contract, the Army will field two additional combat-ready Longbow Apache battalions. The contract also includes funding for McDonnell Douglas to train pilots and maintenance personnel for the first two equipped units, development of interactive electronic technical manuals, development of training devices, first article testing of the production aircraft, initial spares, and a variety of program support tasks for the first production lot. The U.S. Army plans to remanufacture its entire AH-64A Apache fleet of more than 750 aircraft over the next decade.

During Army operational testing in 1995, all six Longbow Apache prototypes competed against standard

AH-64A Apaches. The threat array developed to test the combat capabilities of the two Apache designs was a postulated 2004 lethal and digitized force consisting of heavy armor, air defense and countermeasures. The tests clearly demonstrated that Longbow Apaches:

- Are 400 percent more lethal (hitting more targets) than the AH-64A, already the most capable and advanced armed helicopter in the world to enter service.
- Are 720 percent more survivable than the AH-64A.
- Meet or exceed Army requirements for both target engagement range and for probability of acquiring a seleted target. The specific requirements and results are classified.
- Easily can hit moving and stationary tanks on an obscured, dirty battlefield from a range of more than 7 kilometers, when optical systems are rendered ineffective.
- Can use either its Target Acquisition Designation Sight or fire control radar as a targeting sight, offering increased battlefield flexibility.
- Have the ability to initiate the radar scan, detect and classify more than 128 targets, prioritize the 16 most dangerous targets, transmit the information to other aircraft, and initiate a precision attack -- all in 30 seconds or less.
- Require one third less maintenance man hours (3.4) per flight hour than the requirement.
- Are able to fly 91 percent of the time -- 11 percent more than the requirement.

One issue uncovered during the Initial Operational Test that requires follow-on testing involves the method of employment of the Longbow Hellfire missile. During the force-on-force phase, Longbow flight crews frequently elected to override the system's automatic mode selection logic and fire missiles from a masked position. This powerful technique can significantly increase the helicopter's survivability, but has not been validated with live missile firings during developmental or operational testing. DOT&E is currently working with the Army to develop a test plan that will confirm system performance using this firing technique. This test program will include computer simulation of the missile's target acquisition and fly-out as well as live missile firings at moving armored vehicles.



With the addition of a new and highly sophisticated fire control radar (FCR), more commonly called the Longbow Fire Control Radar, the AH-64D has become the most advanced aerial fighting vehicle in the world. The FCR provides the Apache with the ability to detect, classify and prioritize stationary and moving targets both on the ground and in the air. With state of the art fire control, digital communications, automatic target classification and many other up to date features, the AH-64D Longbow Apache will dominate the battlefield for years to come.

The AH-64D Apache Longbow increases combat effectiveness over the AH-64A by providing a more flexible digital electronics architecture and integrating computer-based on-board Built-In Test Equipment (BITE), Automatic Test Equipment (ATE), and hard copy operator or Interactive Electronic Technical Manual (IETM) troubleshooting/maintenance manuals that will easily accommodate changes resulting from system growth. In addition, upgrades to electrical power and cooling systems and the

expansion of the forward avionics bays to accommodate the installation of the FCR, and provide for future growth. Navigation system accuracy is improved through integration of a miniaturized integrated Embedded Global Positioning System (GPS)/Inertial Navigation Unit (INU) (EGI), and an improved DOPPLER Velocity Rate Sensor (DVRS).

The fully integrated AH-64D without Longbow Mission Kit incorporates greater ordnance capability and flexibility than the AH-64A by utilizing the family of Semi-Active Laser (SAL) missiles (including the HELLFIRE II) and Longbow HELLFIRE RF Missile. The AH-64D without Longbow Mission Kit can operate in harmony with the FCR-equipped AH-64D and can accept a target hand over and fire the Longbow missile with minimum exposure to hostile forces.

The AN/APG-78 FCR is a multi-mode Millimeter Wave (MMW) sensor integrated on the Apache Longbow with the antenna and transmitter located above the aircraft main rotor head. It enhances Longbow system capabilities by providing rapid automatic detection, classification, and prioritization of multiple ground and air targets. The radar provides this capability in adverse weather and under battlefield obscurants. The FCR has four modes:
(1) the Air Targeting Mode (ATM) which detects, classifies, and prioritizes fixed and rotary wing threats
(2) the Ground Targeting Mode (GTM) which detects, classifies, and prioritizes ground and air targets
(3) the Terrain Profiling Mode (TPM) which provides obstacle detection and adverse weather pilotage aids to the Longbow crew
(4) and the Built in Test (BIT) Mode which monitors radar performance in flight and isolates electronic failures before and during maintenance.

The Longbow RF missile and the Longbow HELLFIRE Launcher (LBHL) are referred to as the LBHMMS. The system incorporates a fire-and-forget missile that accepts primary and/or secondary targeting information from the FCR and single targeting information from TADS or another aircraft to acquire and engage targets. Similar to the FCR, the RF missile provides the capability to engage threats in adverse weather and through battlefield obscurants. Two acquisition modes, lock-on-before-launch (LOBL) and lock-on-after-launch (LOAL), allow engagement of ground and rotary wing threats at extended ranges. In the LOBL mode, the missile will acquire and track moving or short range stationary targets prior to leaving the launch platform. In the LOAL mode, the missile will acquire long range stationary targets shortly after leaving the launch platform.

The combination of the integrated FCR, LBHMMS and the Apache aircraft enhances battlefield awareness by providing coverage of the battle area at extended ranges, by reducing operational dependence on weather and battlefield conditions, and by rapid display of detected targets. It further improves the Longbow system's war fighting capability and survivability by providing rapid multi-target detection and engagement ability, navigational aids, and a fire-and-forget weapon delivery system.

The addition of the Longbow FCR provides a second and completely independent target acquisition sensor which may be operated by either crew member or combined to provide a degree of multi-sensor synergy. When operated independently, the pilot could use the FCR to search for air targets in the ATM mode while the copilot/gunner (CPG) searches for ground targets using the Target Acquisition Designation Sight (TADS).

Using both TADS and the FCR together combines the unique advantage of each sight. The rapid search,

detection, classification, and prioritization of targets by the Longbow FCR can then be quickly and positively identified by using the electro-optics of TADS. The center of view can be focused on the location of the highest priority target and the CPG, at the touch of a switch, can view either display. Alternately, the FCR centerline can be cued to the TADS so that a rapid and narrow search could be made of a suspected target area.

The RFI is an integral part of the Longbow FCR. It has sensitivity over an RF spectrum to detect threat emitters when a threat radar is in a search and acquisition mode and also when the threat emitter is "looking" directly at and tracking the Longbow system. The RF band has been extended over that which was developed for the OH-58D Kiowa Warrior at the low end of the RF spectrum to detect newly identified air defense threats. The RFI has a programmable threat emitter library to allow additional threat signatures to be stored and/or updated.

The Materiel Fielding Plan (MFP) is essentially a one-stop reference for all fielding activity requirements. It shows who develops, fields, receives, and stores a piece of equipment and its associated tools, test equipment, repair parts, and training devices. The MFP will outline what the piece of equipment is used for, who uses it, who repairs it, the maintenance and supply structure which will be in place to provide life cycle support, and the training requirements inherent to the system. Several draft version MFPs are published per the documents listed above in order to generate a dialogue between the developer and the end user in order to simplify and expedite the fielding process.

The AH-64D Apache Longbow aircraft, Fire Control Radar (FCR), and Longbow Hellfire Modular Missile System (LBHMMS) were fielded starting with the 1-227 Attack Helicopter Battalion in July 1998. As this is a FORSCOM unit, the first MFP published will be for FORSCOM. Other MFPs, each tailored to the specific Major Command (MACOM) receiving the AH-64D, will be published at the appropriate time. Therefore, FORSCOM, TRADOC, USAREUR, EUSA, USAR, and the ARNG will each receive their own version of the MFP. Distribution varies with each subsequent draft prepared.

The Office of the Deputy Chief of Staff for Operations and Plans (ODCSOPS) makes the decision as to what units receive the AH-64D and in what order. The AAH PMO publishes and distributes MFPs based on ODCSOPS' schedule. The fielding schedules change from time to time, and the schedule in the MFP is, therefore, current as of the publishing date. The First Draft for each MACOM's MFP is published approximately 26 months before the first aircraft and equipment are fielded to a MACOM. A MACOM's Final MFP is published approximately 8 months prior to its first-unit fielding. The fielding schedule as of 1 June 1997, is attached. It does not include the aircraft destined for the TRADOC training fleet at Ft. Rucker. Ft. Rucker begins receiving its AH-64Ds in June 1999; the TRADOC First Draft MFP left the AAH PMO in May.
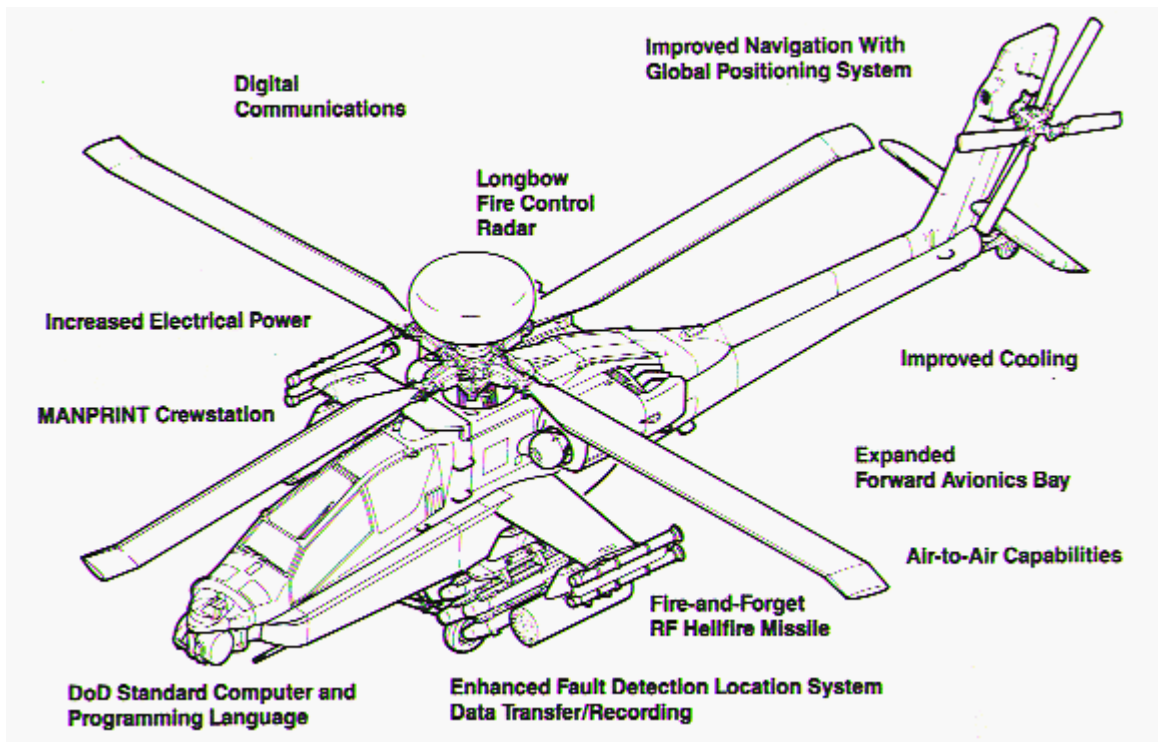
### Longbow Specifications

| | Standard Day | Hot Day ISA + 15C |
|---|---|---|
| **Length:** | 58.17 ft (17.73 m) | |
| **Height:** | 16.25 ft (4.95 m) | |
| **Wing Span:** | 17.15 ft (5.23 m) | |
| **Primary Mission Gross Weight** 16,601 lb (7530 kg) | **Standard Day** | **Hot Day ISA + 15C** |
| **Hover In-Ground Effect (MRP)** | 13,690 ft (4172 m) | 12,290 ft (3745 m) |
| **Hover Out-of-Ground Effect (MRP)** | 9,480 ft (2889 m) | 7,960 ft (2427 m) |
| | **Sea Level Standard Day** | **Hot Day 2070 ft (610 m)** |
| **Vertical Rate of Climb (MRP)** | 1,475 fpm (450 mpm) | 1,255 fpm (383 mpm) |
| **Maximum Rate of Climb (IRP)** | 2,415 fpm (737 mpm) | 2,370 fpm (723 mpm) |
| **Maximum Level Flight Speed** | 141 kt (262 kph) | 143 kt (265 kph) |
| **Cruise Speed (MCP)** | 141 kt (262 kph) | 143 kt (265 kph) |