Ah-64 Apache Multi-Mission Combat Helicopter
General informations

The Boeing (McDonnell Douglas) (formerly Hughes) AH-64A Apache is the Army's primary attack helicopter. It is a quick-reacting, airborne weapon system that can fight close and deep to destroy, disrupt, or delay enemy forces. The Apache is designed to fight and survive during the day, night, and in adverse weather throughout the world. The principal mission of the Apache is the destruction of high-value targets with the HELLFIRE missile. It is also capable of employing a 30MM M230 chain gun and Hydra 70 (2.75 inch) rockets that are lethal against a wide variety of targets. The Apache has a full range of aircraft survivability equipment and has the ability to withstand hits from rounds up to 23MM in critical areas.

The AH-64 Apache is a twin-engine, four bladed, multi-mission attack helicopter designed as a highly stable aerial weapons-delivery platform. It is designed to fight and survive during the day, night, and in adverse weather throughout the world. With a tandem-seated crew consisting of the pilot, located in the rear cockpit position and the co-pilot gunner (CPG), located in the front position, the Apache is self-deployable, highly survivable and delivers a lethal array of battlefield armaments. The Apache features a Target Acquisition Designation Sight (TADS) and a Pilot Night Vision Sensor (PNVS) which enables the crew to navigate and conduct precision attacks in day, night and adverse weather conditions.

The Apache can carry up to 16 Hellfire laser designated missiles. With a range of over 8000 meters, the Hellfire is used primarily for the destruction of tanks, armored vehicles and other hard material targets. The Apache can also deliver 76, 2.75" folding fin aerial rockets for use against enemy personnel, light armor vehicles and other soft-skinned targets. Rounding out the Apache's deadly punch are 1,200 rounds of ammunition for its Area Weapons System (AWS), 30MM Automatic Gun.

Powered by two General Electric gas turbine engines rated at 1890 shaft horsepower each, the Apache's maximum gross weight is 17,650 pounds which allows for a cruise airspeed of 145 miles per hour and a flight endurance of over three hours. The AH-64 can be configured with an external 230-gallon fuel tank to extend its range on attack missions, or it can be configured with up to four 230-gallon fuel tanks for ferrying /self-deployment missions. The combat radius of the AH-64 is approximately 150 kilometers. The combat radius with one external 230-gallon fuel tank installed is approximately 300 kilometers [radii are temperature, PA, fuel burn rate and airspeed dependent]. The AH-64 is air transportable in the C-5, C-141 and C-17.

An on-board video recorder has the capability of recording up to 72 minutes of either the pilot or CPG selected video. It is an invaluable tool for damage assessment and reconnaissance. The Apache's navigation equipment consists of a doppler navigation system, and most aircraft are equipped with a GPS receiver.

The Apache has state of the art optics that provide the capability to select from three different target acquisition sensors. These sensors are:

- Day TV. Views images during day and low light levels, black and white.
- TADS FLIR. Views thermal images, real world and magnified, during day, night and adverse weather.
- DVO. Views real world, full color, and magnified images during daylight and dusk conditions.

The Apache has four articulating weapons pylons, two on either side of the aircraft, on which weapons or external fuel tanks can be mounted. The aircraft has a LRF/D. This is used to designate for the Hellfire missile system as well as provide range to target information for the fire control computer's calculations of ballistic solutions.

Threat identification through the FLIR system is extremely difficult. Although the AH-64 crew can easily find the heat signature of a vehicle, it may not be able to determine friend or foe. Forward looking infrared detects the difference in the emission of heat in objects. On a hot day, the ground may reflect or emit more heat than the suspected target. In this case, the environment will be "hot" and the target will be "cool". As the air cools at night, the target may lose or emit heat at a lower rate than the surrounding environment. At some point the emission of heat from both the target and the surrounding environment may be equal. This is IR crossover and makes target acquisition/detection difficult to impossible. IR crossover occurs most often when the environment is wet. This is because the water in the air creates a buffer in the emissivity of objects. This limitation is present in all systems that use FLIR for target acquisition.

Low cloud ceilings may not allow the Hellfire seeker enough time to lock onto its target or may cause it to break lock after acquisition. At extended ranges, the pilot may have to consider the ceiling to allow time for the seeker to steer the weapon onto the target. Pilot night vision sensor cannot detect wires or other small obstacles.

Overwater operations severely degrade navigation systems not upgraded with embedded GPS. Although fully capable of operating in marginal weather, attack helicopter capabilities are seriously degraded in conditions below a 500-foot ceiling and visibility less than 3 km. Because of the Hellfire missile's trajectory, ceilings below 500 feet require the attack aircraft to get too close to the intended target to avoid missile loss. Below 3 km visibility, the attack aircraft is vulnerable to enemy ADA systems. Some obscurants can prevent the laser energy from reaching the target; they can also hide the target from the incoming munitions seeker. Dust, haze, rain, snow and other particulate matter may limit visibility and affect sensors. The Hellfire remote designating crew may offset a maximum of 60 degrees from the gun to target line and must not position their aircraft within a +30-degree safety fan from the firing aircraft.

The Apache fully exploits the vertical dimension of the battlefield. Aggressive terrain flight techniques allow the commander to rapidly place the ATKHB at the decisive place at the optimum time. Typically, the area of operations for Apache is the entire corps or divisional sector. Attack helicopters move across the

battlefield at speeds in excess of 3 kilometers per minute. Typical planning airspeeds are 100 to 120 knots during daylight and 80 to 100 knots at night. Speeds during marginal weather are reduced commensurate with prevailing conditions. The Apache can attack targets up to 150 km across the FLOT. If greater depth is required, the addition of ERFS tanks can further extend the AH-64's range with a corresponding reduction in Hellfire missile carrying capacity (four fewer Hellfire missiles for each ERFS tank installed).

Apache production began in 1982 and the first unit was deployed in 1986. As of November 1993, 807 Apaches were delivered to the Army. The last Army Apache delivery is scheduled for December 1995. Thirty-three attack battalions are deployed and ready for combat. The Army is procuring a total of 824 Apaches to support a new force structure of 25 battalions with 24 Apaches for each unit (16 Active; 2 Reserve; 7 National Guard) under the Aviation Restructure Initiative. The Apache has been sold to Israel, Egypt - 24, Greece - 20, UAE - 12, *???*(*Bahrain - 8, Kuvait, South Korea)*) fly three variants of the AH-64 Apache multi-mission combat helicopters – the AH-64A Apache, the next-generation AH-64D Apache, and the AH-64D Apache Longbow, which is equipped with the advanced Longbow fire control radar.

The Russian-developed Mi-24 HIND is the Apache's closest couterpart. The Russians have deployed significant numbers of HINDs in Europe and have exported the HIND to many third world countries. The Russians have also developed the KA-50 HOKUM as their next generation attack helicopter. The Italian A-129 Mangusta is the nearest NATO counterpart to the Apache. The Germans and French are co-developing the PAH-2 Tiger attack helicopter, which has many of the capabilities of the Apache.

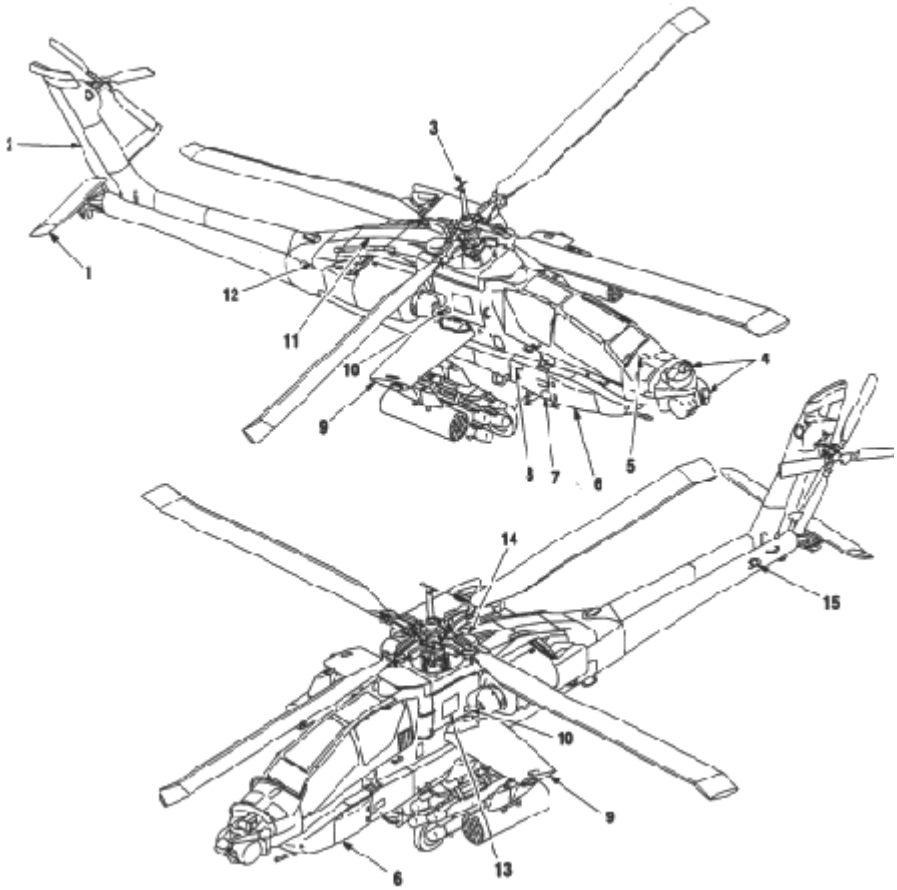
Ah-64 general technical datas

(For specific info see detailed type specification)
Nation: USA
Manufacturer: Hughes Aircraft, McDonnell Douglas, Boeing
Type: Multi - Mission Attack Helicopter
Year: 1984
Engine: 2 General Electric T700-701C turboshaft, 1,857 shp
Rotor Diameter: 48 ft
Tail Rotor Diameter: 9' 2"
Fuselage Length: 49 ft 1 in
Overall Length: 58 ft 3 in
Height: 16 ft 9.5 in
Empty Weight: 10,760 lb
Max Takeoff Weight: 21,000 lb
Max Speed: 186 mph (level), 227 mph (never exceeded powerdive)
Ceiling: 10,200 ft (hover)
Range: 428 miles
Crew: 2
Armament: Hughes M230 30mm chain gun and four hardpoints capable of carrying four Hellfire anti-tank misseles, 19 unguided folding-fin aircraft rockets or one 230 gallon fuel tank each.

AH-64A
AH-64B: 254 AH-64A with minimal updates taken from duty in operation Desert Storm
AH-64C: AH-64A without Longbow radar and Dash

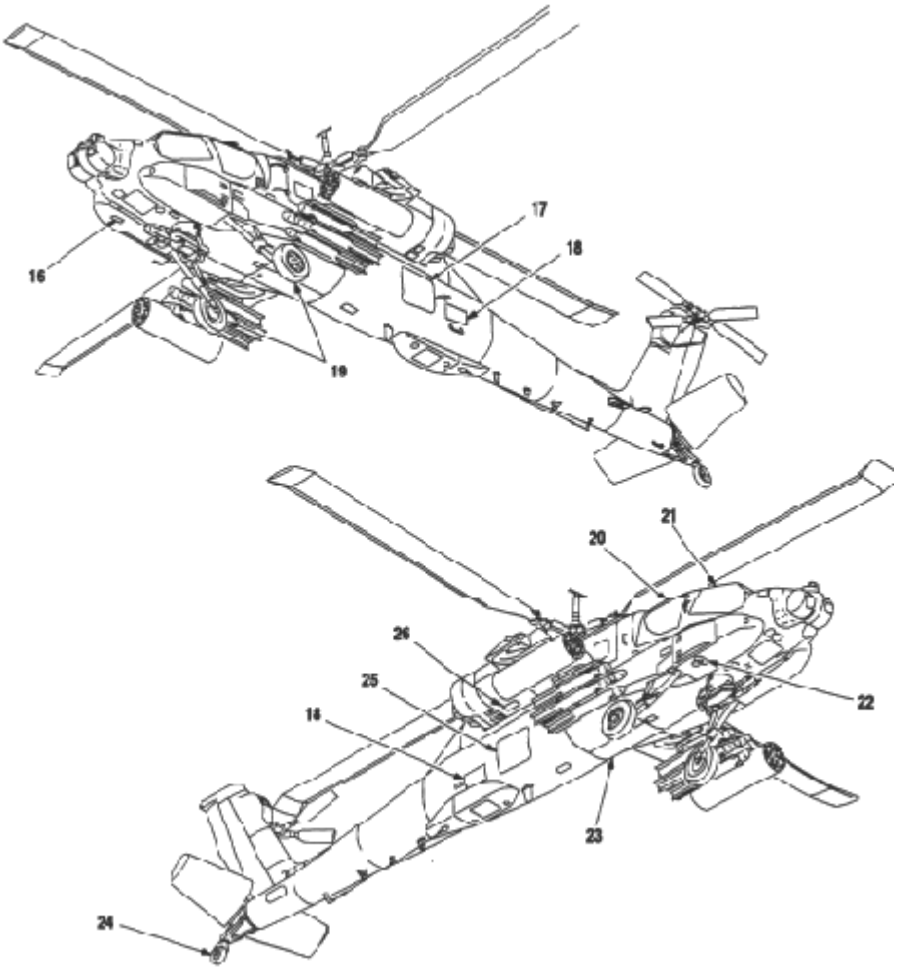
701C engine
AH-64D 1st flown 11th Mar 1991
AH-64D Longbow 1st flown 15th Apr 1992
WAH-64 Apache
International Apache: export version

First model 77 developed by Hughes Helicopter (YAH-64) with YAH-63 produced by Bell, in Dec 1976 approved serial production AH-64 and in 1981 get name Apache. Official "rollout" of PV01 30th Sep 1983 in Mesa. Test flights of first serial models (PV01-PV13) realised in Jan 1984 in Mese (Arizona) (PV02), May 1984 Yuma (Arizona) (PV06), in Jan 1985 taken to Fort Rucker base (Alabama),
1st prototype YAH-64: 30th Mar 1975 (AV02).
AV02 with new tail stabiliser.
AV02 with T tail stabiliser due hellfire missile tests.
AV02 prepared for serial production in Farnborough 1982.
2nd prototype YAH-64: 22nd Nov 1975 (AV03)
AV02, AV03 test flights 700 hours until 29th Dec 1978 1000hrs
(AV04, AV05, AV06) AV04 - Nov 1979, AV05 - Dec 1979, AV06 - Mar 1980
After many problems with horizontal stabiliser. Prototype YAH-64 with smal vertical stabilisation facets on horizontal stabiliser.
First Apache PV14 serving in USAF.
Missions:
1989 Panama operation "Just cause"
1991 Persian Gulf operation "Desert Storm"



1. Stabilator
2. Vertical stabilizer
3. Air data sensor
4. TADS & PNVS turrets
5. Canopy jettison handle
6. Forward avionics bay
7. Mooring lug
8. Fire extinguisher
9. Intercom
10. Main transmission oil level sight gage
11. Aft equipment bay ("catwalk")
12. Hydraulic ground service panel
13. Hydraulic oil level sight gage
14. Infrared countermeasure device
15. Chaff module
16. Utility light / ground power receptacle
17. Aft storage bay
18. Survival equipment storage bay
19. Main landing gear
20. Pilot door
21. Co-pilot door
22. Searchlight
23. Ammunition bay
24. Tail landing gear

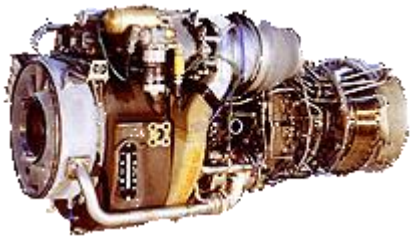
25. Aft avionics bay
26. APU oil level sight gage

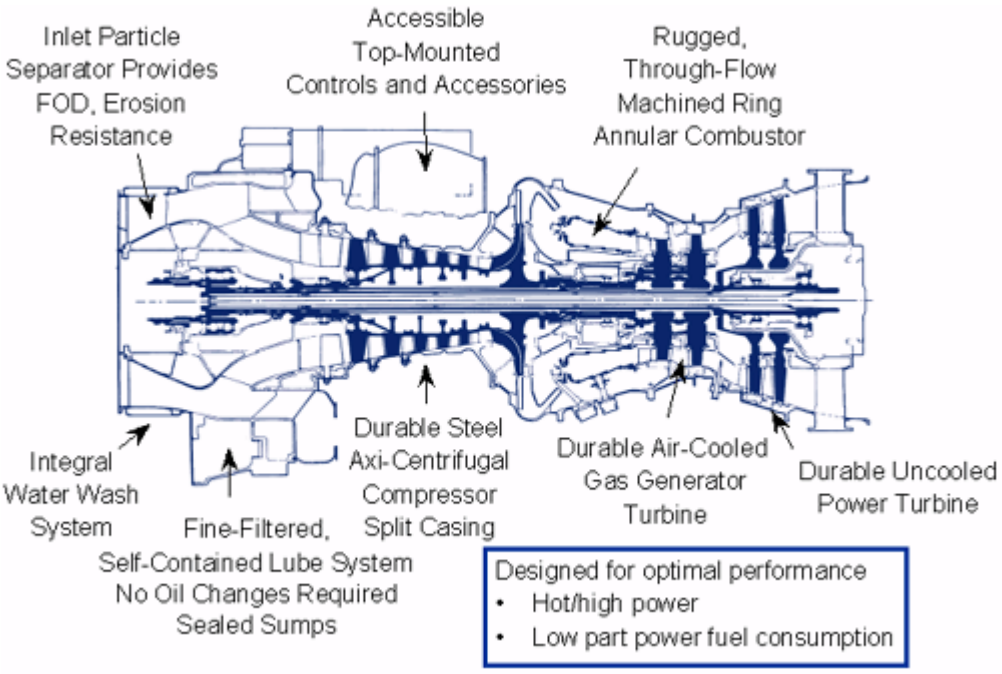


Engine:

Two General Electric T700-GE-701C turboshafts, 1857 hp each

Length:46 in (1,17 m)
Height: 58,4 cm
Width: 63,5 cm
Nominal Diameter:15.6 in (39.6 cm)
Weight: 456 lbs (207 kg)





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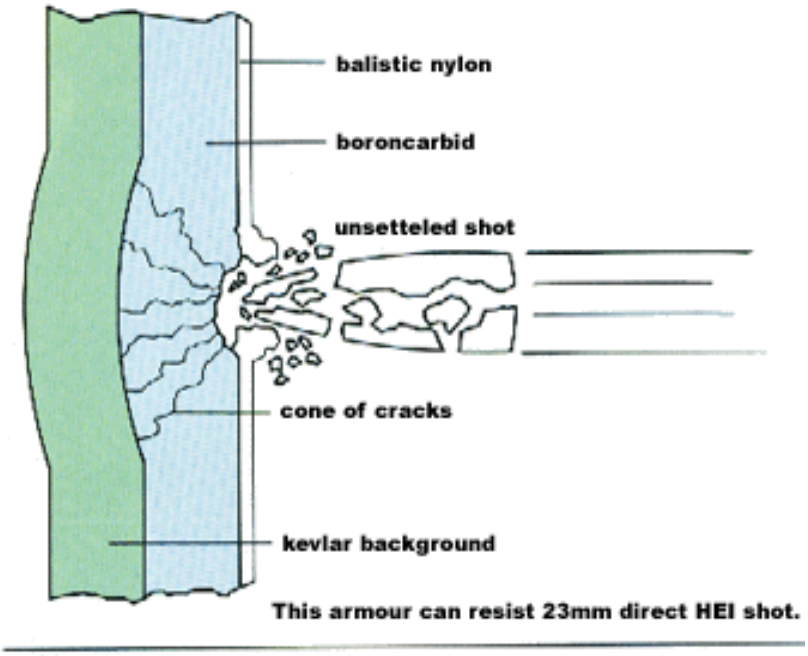
Engine Specifications (Sea Level/Standard Day)		
	SHP (kW)	**SFC**
Contingency (2.5 min. OEI)	1,940 (1,447)	--
Maximum (10 min.)	1,890 (1,409)	0.462 (78.1)
Intermediate (30 min.)	1,800 (1,342)	0.460 (77.7)
Maximum Continuous	1,662 (1,239)	0.459 (77.6)
SHP - Shaft Horsepower SFC - Specific Fuel Consumption in lb/SHP-hr (µg/J) OEI - One Engine Inoperative		

Anti penetration protection



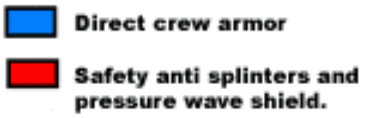
Balistic prevention is about 1130 kg of airframe (from Teledyne Ryan Aeronautical).

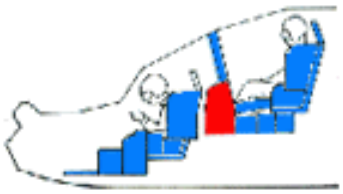
Light boron armour - (Ceradyne), sides, cabin decking, front/back cabin - can resist 23mm HEI shot.

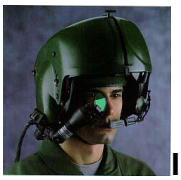
Kevlar pilot seats - (Simula)

Anti presswave acrylat shield - (Sierracin)

Glasses - (PPG Industries)





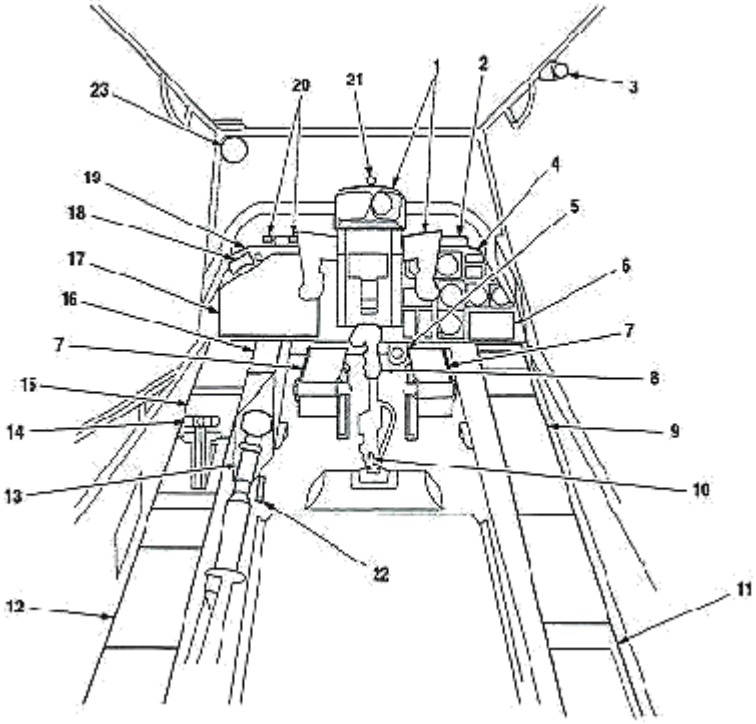
(IHADSS) -  **INTEGRATED HELMET AND DISPLAY SIGHT SYSTEM**

1st pilot seat

2nd pilot / shooter seat

1st PILOT SEAT

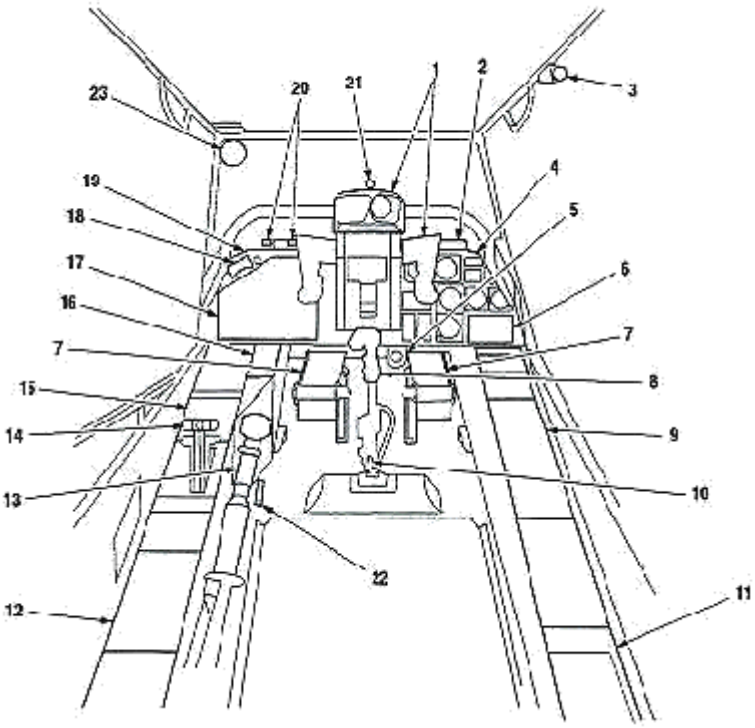
1. Standby compass
2. Master Caution/ Warning panel
3. Canopy door release
4. Instrument panel
5. ASE control panels
6. Cyclic stick
7. Caution/ Warning panel
8. Directional control/ Brake pedals
9. Pedal adjust lever
10. Right console
11. Collective stick
12. Left console
13. Auxiliary air vent
14. Power levers
15. Center console
16. Fire control panel
17. Tail wheel lock panel
18. Canopy jettison handle
19. Parking brake handle
20. Engine fire pull handles
21. Circuit breaker panel
22. Boresight reticle unit
23. Stabilator control panel



24. Stowage box

2nd PILOT/SHOOTER SEAT

1. Optical relay tube and handgrips
2. Master Caution/ Warning panel
3. Canopy door release
4. Right instrument panel
5. Conditioned air outlet
6. Caution/Warning panel
7. Directional control/ Brake pedals
8. Cyclic stick
9. Right console
10. Pedal adjust lever
11. Map storage compartment
12. Circuit breaker panel
13. Collective stick
14. Power levers
15. Left console
16. Data entry keyboard
17. Fire control panel
18. Canopy jettison handle
19. Left instrument panel
20. Engine fire pull handles
21. Boresight reticle unit
22. Stabilator control panel



23. Mirror

Production facilities and Training grounds:
Fort Eustis, Virginia - US Army Aviation Logistics Center
Fort Gordon, Georgia - US Army Signal School
Fort Hood, Texas - US Army Forces Command Apache Training Brigade
Loring AFB, Maine - transit AFB btw. to flight over Europe
Fort Rucker, Alabama - US Army Aviation Center

US Army gives Boeing a second multi-year AH-64D contract
3 October 2000

The US Army and Boeing have signed an option contract for the remanufacture of 269 additional US Army AH-64A Apaches into next-generation AH-64D Apache Longbow helicopters.
The Army expects to exercise the option once fiscal year 2001 funds become available later this month. Under the contract, a five-year, multi-year contract, worth more than $2.3 billion, Boeing will convert 269 AH-64As into AH-64D Apache Longbows from 2002-2006. By agreeing to a multi-year contract, the Army will save millions of dollars and provide stability for the Boeing assembly line here through 2006.
Boeing is in the fourth year of its first five-year, multi-year contract with the Army to remanufacture 232 AH-64A Apaches into next-generation Apache Longbows. Nearly 150 remanufactured Apache Longbows have been delivered, and two combat-ready Apache Longbow units are in service with the US Army. Together the two contracts mean that Boeing will remanufacture a total of 501 Apache aircraft for the Army.
In addition to the remanufacture of 269 aircraft, the second multi-year contract includes maintenance and operator training devices, spare parts, logistics and support services, and a variety of items designed to further improve maintainability and supportability.
Apaches produced under the second multi-year contract will integrate numerous enhancements. The contract incorporates enhanced capabilities in communications, navigation, data management and safety

equipment that provide a foundation in support of the Army's emerging digitised battlefield requirements. Enhancements to trainers and the Interactive Electronic Technical Manual also are included in the contract.
The latest long-term agreement with the Army will benefit international sales, company officials said, noting that customers will be able to take advantage of numerous configuration enhancements and reduced costs offered by linking their purchases to the Army's multi-year production programme.

US Army goes for Apache sensor modernisation
24 October 2000

The US Army has selected Team Apache Systems, led by Lockheed Martin and The Boeing Company, for its Apache sensor helicopter modernisation programme valued at approximately $1 billion long term, beginning with an announcement of the approximately $80 million for the development (EMD) phase. Called Arrowhead, the advanced technology Forward-Looking Infrared (FLIR) thermal system will take the Apache helicopter through the next 20 years and beyond with expected operational and support cost savings to exceed $47 million per year-nearly $1 billion in total savings over the life of the system.

The lower turret mounts an Arrowhead Targeting System (ATS) FLIR capable of a 40-percent increase in targeting range and an improved charge-coupled device (CCD) camera for day TV viewing. Improvements to the laser adapt Comanche technology for Apache. Direct-view optics are eliminated, increasing survivable space in the crew station and enhancing the display resolution with a large flat-panel targeting display.

The upgraded Arrowhead Pilotage System (APS) provides an advanced FLIR capability with image intensification and provisions for image fusion. Coupled with the improved IHADSS, the pilot will have greatly enhanced nap-of-the-earth (NOE) capability.

Team Apache Systems (TAS) consists of Lockheed Martin Millimetre Technologies Inc., and McDonnell Douglas Helicopter Systems (an indirect subsidiary of The Boeing Company). The major subcontractors to TAS are Lockheed Martin Missiles and Fire Control, Orlando, Florida, producers of the current generation TADS/PNVS system, and The Boeing Company rotorcraft unit in Mesa, Arizona, the makers of the AH-64 Apache helicopter.
Stan Arthur, President, Lockheed Martin Missiles and Fire Control-Orlando and board member of TAS said, "Arrowhead is the first significant modernisation upgrade for the Lockheed Martin TADS/PNVS electro-optical system on the Boeing AH-64 Apache helicopter. With the Arrowhead advanced technology electro-optical system for night and adverse weather flight and targeting, performance will increase by nearly 100 percent and reliability will improve over 130 percent above the current, high performing Apache systems."
The Arrowhead Engineering and Manufacturing Development (EMD) phase begins immediately upon contract announcement and production starts in late 2003. The first units will be fielded in early 2004.
"A major characteristic of the Arrowhead upgrade - the advanced technology pilotage system - gives Apache pilots the option of a switchable image intensification (I2) TV for better situational awareness. Provisions for image fusion and wide field of view (30 x 52-degree) helmet-mounted displays are also engineered into the system leaving flexibility for future improvements," explained Michael T. Donovan, Vice President, Fire Control & Sensors for Missiles and Fire Control.
Arrowhead uses digital video to enhance recording capability and facilitate still-frame video imagery transmission to the ground commander or another aircraft during normal operations. In answer to the US

Army's call for horizontal technology insertion (HTI), Arrowhead incorporates components and technologies used for other Army systems and programmes.
The Arrowhead system is designed for "plug-and-play" component replacement that can be done in minutes at the flightline. "The simplicity of design ensures that two-level maintenance is facilitated, easing the workload of the Apache maintainers," said Donovan.

US Army grounds AH-64 helicopter fleet
18 December 2000

The US Army has grounded its entire AH-64 Apache helicopter fleet "...as a precautionary measure following the discovery of a faulty tail rotor swashplate assembly." Failure of a tailrotor swashplate assembly (which effectively produces yaw control) could result in the loss of an aircraft and crew injuries. The Army has ordered a serial number inspection of all 742 AH-64A and D aircraft to determine if specific swashplate assemblies are on an aircraft. Certain serial numbers have been identified as being potentially faulty and will be replaced. An investigation will determine the status of the remaining swashplates.
This is the second time in just over a year that the Apache fleet has been grounded. In November 1999 crash investigators identified suspect rotor bearings and transmission units, and ordered the aircraft out of the skies until the problems were fixed.

Model of Ah-64 for 3D Studio
(2.74 MB *zip file)
Battle Chopper