AGM-114 Hellfire

The Hellfire Air-to-Ground Missile System (AGMS) provides heavy anti-armor capability for attack helicopters. The first three generations of HELLFIRE missiles use a laser seeker. The fourth generation, Longbow HELLFIRE, uses a radar frequency seeker.

The first generation of Laser HELLFIRE presently is used as the main armament of the U.S. Army's AH-64 Apache and U.S. Marine Corps' AH-1W Super Cobra helicopters. The second generation currently is available for deployment. Laser HELLFIRE homes on a laser spot that can be projected from ground observers, other aircraft, or the launching aircraft itself. This enables the system to be employed in a variety of modes: autonomous, air or ground, direct or indirect, single shot, rapid, or ripple fire.

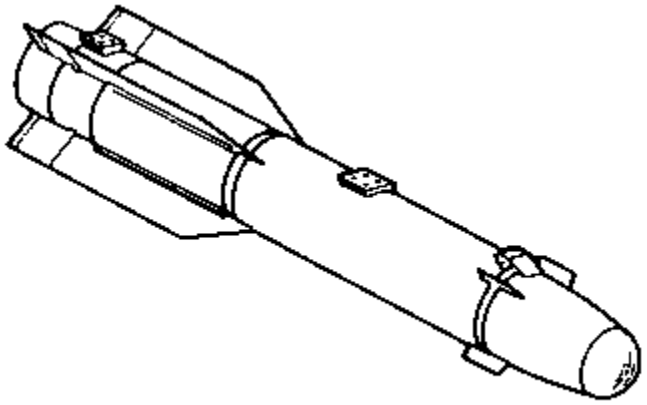
The **AGM-114A Basic HELLFIRE** tactical missile is the originally designed Hellfire missile, which is no longer purchased by the Army. A total of 31,616 were produced by both Martin Marietta and Rockwell International since 1982. AGM-114As in the inventory are released for live-fire training when they are replaced with AGM-114Cs.

The AGM-114B, although primarily designed for Navy use, can be fired from Army aircraft. This missile has an additional electronic arm/safety device required for shipboard use.

The **AGM-114C** missile has an improved semiactive laser seeker with an improved low visibility capability. The AGM-114C has a low smoke motor and a lower trajectory than the 114A. Army missiles should be marked with either the A or C designation just behind the seeker.

The **AGM-114F Interim HELLFIRE** missile features two warheads [adding a precursor warhead to defeat vehicles equipped with reactive armor] a seeker and an autopilot similar to the C-model missile. Final delivery of the Interim HELLFIRE missiles produced by Rockwell was completed in January 1994. Production for foreign military sales continued.
The **AGM-114K HELLFIRE II** missile features dual warheads for defeating reactive armor, electro-optical countermeasures hardening, semiactive laser seeker, and a programmable autopilot for trajectory shaping. The AGM-114K missile is capable of operating with either pulsed radar frequency or A-Code laser codes for those aircraft equipped with dual code capability. Hellfire II incorporates many improvements over the Interim Hellfire missile, including solving the laser obscurant/backscatter problem, the only shortcoming identified during Operation Desert Storm. Other improvements include electro-optical countermeasure hardening, improved target reacquisition capability, an advanced technology warhead system capable of defeating reactive armor configurations projected into the 21st century, reprogrammability to adapt to changing threats and mission requirements, and shipboard compatibility. The Initial Production Facilitation and Production Qualification Test contract was awarded to Martin Marietta in November 1992. The initial production contract was awarded in May 1993, and the second production contract was awarded in February 1994.

Version:	Basic	Interim	HF II	Longbow
Diameter:	7 in	7 in	7 in	7 in
Weight:	100 lb	107 lb	100 lb	108 lb



Length:	64 in	71 in	64 in	69.2 in

Hellfire II is the latest production version of the Laser Hellfire missile. Hellfire II and Longbow Hellfire missiles are complementary. The combination of Hellfire II's precision guidance and Longbow Hellfire's fire-and-forget capability will provide the battlefield commander flexibility across a wide range of mission scenarios, permitting fast battlefield response and high mobility not afforded by other anti-armor weapons.

For antiarmor roles, the AGM-114 missile has a conical shaped charge warhead with a copper liner cone that forms the jet that provides armor penetration. This high explosive, antitank warhead is effective against various types of armor including appliqué and reactive. Actual penetration performance is classified. It can also be employed against concrete bunkers and similar fortifications.

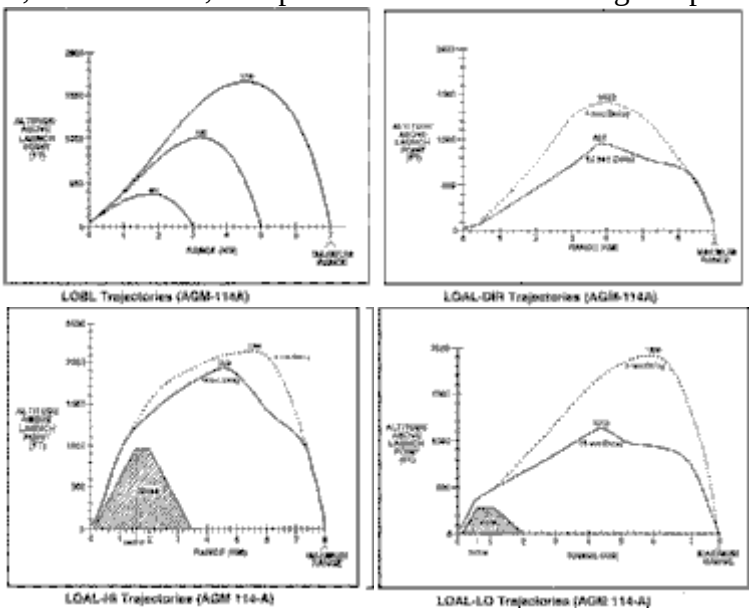
The tactical missiles are propelled by a single stage, single thrust, solid propellant motor. When thrust exceeds 500 to 600 pounds, the missile leaves the rail. Based on a 10g acceleration parameter, arming occurs between 150 to 300 meters after launch. Maximum velocity of the missile is 950 miles per hour. Maximum standoff range is a function of missile performance, launch platform altitude versus target altitude, visibility and cloud cover. Remote designation allows the launch aircraft to stand off at greater distances from the target. This standoff range can be out to the maximum missile effective engagement range.

There are different techniques for tactical employment of the Hellfire missile on the battlefield. These techniques are ultimately driven by the two engagement methods by which the missile can be controlled to the target: autonomous and remote. An autonomous engagement requires the aircraft launching the missile to guide it all the way to the target after the missile is away. In this method, a single aircraft and its crew will locate, identify, fire, and guide the missile until destruction of the target in the same way an M2/M3 Bradley crew employs its TOW missiles. In contrast, a remote engagement requires an aircraft to serve as a launch platform, providing a missile for another aircraft or a ground observer, designating with a laser, to guide the missile to its intended target. A ground designation station such as an FO or Combat Observation Lasing Team (COLT) accomplishes this with lasing devices like the G/VLLD or MULE.

With a remote engagement, the air crew is responsible only for delivering the missile toward the general location of the target, but is no longer responsible for its guidance once it leaves the external launch rails. This allows remote engagements to provide one distinct advantage over autonomous engagements. Using this technique, the launch aircraft is often able to remain masked behind terrain, greatly reducing its visible launch signature while delivering missiles toward the target array, thereby increasing aircraft survivability - a force protection consideration. Remote engagements, however, require a great deal more coordination and planning between the “shooter” and the “observer.”

In addition to the two methods of engagement, there are four modes of delivery that aircrews can utilize when firing the Hellfire missile. These delivery modes are driven by three factors: distance to the target, the weather (primarily visibility and cloud ceiling height), and terrain conditions under which the missile will be fired. When a Hellfire missile flies through obscuration (fog, clouds, smoke) or if the designator fails to lase the target properly until impact,

the missile loses laser lock and will be lost for good. Only one model of Hellfire missile, the AGM-114K, has a built-in system to assist in the reacquisition of the target after laser lock-on is lost. The AGM-114L, when fielded, will provide a true fire-and-forget capability.



The first delivery mode is known as the Lock-on Before Launch (LOBL) technique. In this mode, the missile laser seeker acquires and locks-on to the coded laser energy reflected from the target prior to launch. The advantage to using this particular delivery mode is that the air crew is assured that the missile has already positively locked on to the target prior to launch from the aircraft, thereby reducing the possibility of a lost or uncontrolled missile. The disadvantages of a LOBL delivery revolve around the trajectory of the Hellfire missile. To compensate for a low cloud ceiling, an aircraft may need to expose itself to threat weapons ranges in order to ensure a successful engagement.

One method to reduce the maximum altitude of the Hellfire's flight trajectory is to select the Lock-on After Launch -Direct (LOAL-DIR) delivery mode. This delivery mode results in the lowest of all trajectories during missile flight because it is employed using a laser designation delay. Overall, depending on the length of laser delay time, the maximum altitude reached during the flight trajectory is much lower; a distinct advantage over all other delivery modes. The downside to this method, however, is that air crew is not assured of positive lock-on prior to launch.

The last two delivery modes are unique in that they allow the launch aircraft to remain masked behind terrain to reduce its firing signature and increase aircraft survivability. These delivery modes are known as Lock-on After Launch - High (LOAL-HI) and Lock-on After Launch -Low (LOAL-LO). The first mode, LOAL-HI, allows the missile to clear a 1,000 ft. high terrain feature to front of the aircraft, provided the aircraft remains a minimum of 1500 meters away from that terrain feature. This technique is most effective in a remote engagement. The major disadvantage of employing the LOAL-HI method, however, is that the missile flies the highest trajectory of all delivery modes and is most susceptible to a break in missile lock due to penetration of low-lying clouds. Using the last delivery mode, LOAL-LO, will help to reduce the

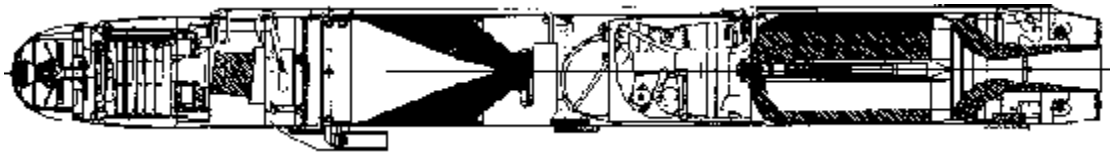
maximum altitude of the Hellfire trajectory somewhat, but will also limit the size of the terrain mask utilized by the aircraft for survivability.

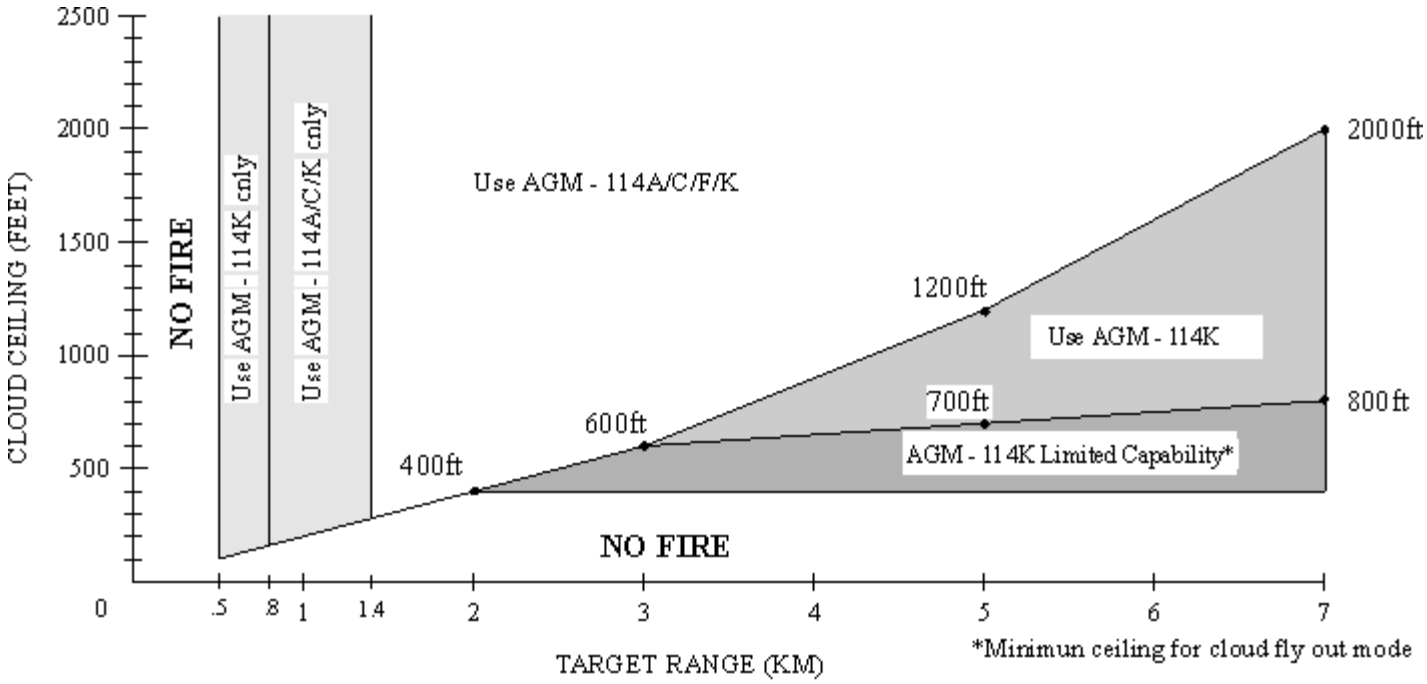
LONGBOW HELLFIRE MISSILE SYSTEM

AH-64D Apache Longbow firing Hellfire Missile

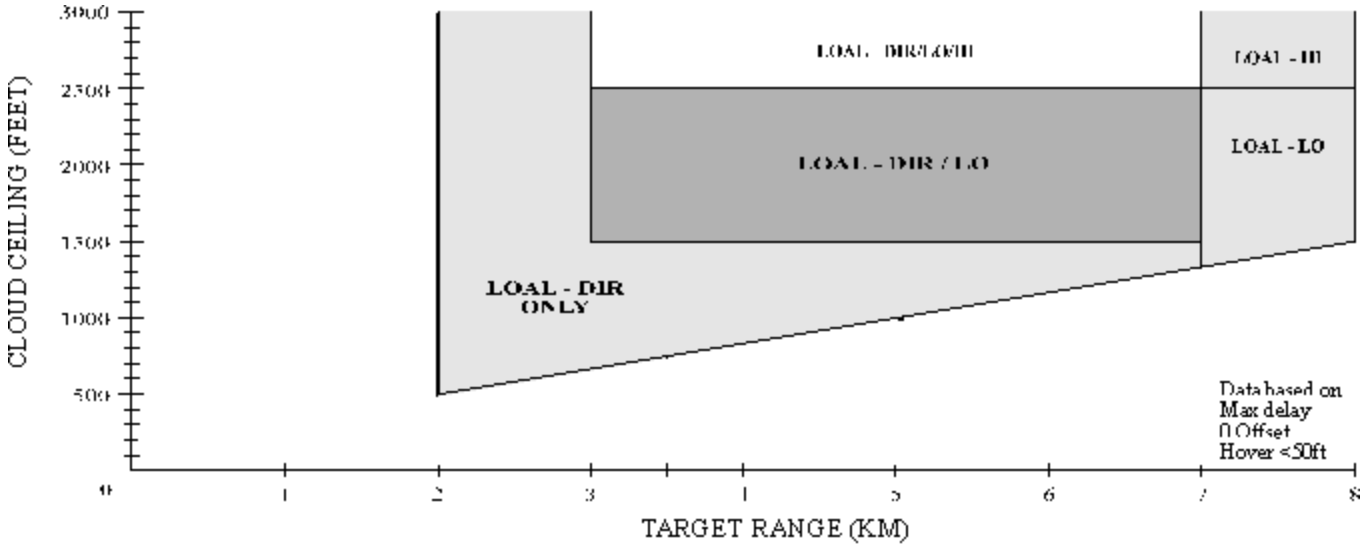
The Longbow Hellfire missile will provide an adverse weather, fire-and-forget, heavy anti-armor capability for attack helicopters.The Longbow Hellfire missile is a millimeter wave radar fire-and-forget version of the Hellfire missile. The Longbow development program also includes development of a fire control radar system and numerous modifications to the helicopter. The Longbow fire control radar system will locate, classify, and prioritize targets for the Longbow Hellfire missile. The Longbow system is being developed for integration into the Apache attack helicopter and the Comanche armed reconnaissance helicopter. Longbow is planned for integration into the entire fleet of Apache aircraft and into one-third of the Comanche fleet.

Longbow Hellfire incorporates a millimeter wave radar seeker on a Hellfire II aft section data bus. The primary advantages of the Longbow missile include adverse weather capability (rain, snow, fog, smoke, and battlefield obscurants); millimeter wave countermeasures survivability; fire-and-forget guidance, which allows the Apache Longbow to launch and then remask, thus minimizing exposure to enemy fire; an advanced warhead capable of defeating reactive armor configurations projected into the 21st century; and reprogrammability to adapt to changing threats and mission requirements.

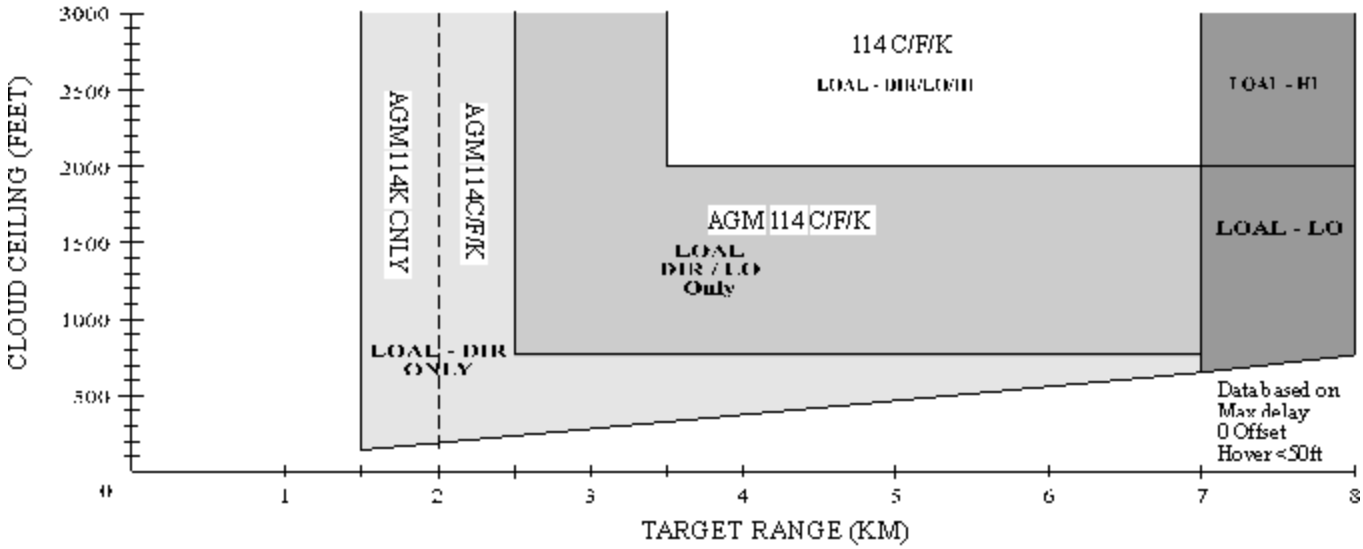




Minimum Cloud Ceiling - LOBL



AGM-114A Minimum Cloud Ceiling, LOAL



AGM-114C/F/K Minimum Cloud Ceiling, LOAL