

AH-1Z: A Snake Without Fangs?

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AH-1Z: A Snake Without Fangs?

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The company commander lowered his binoculars as the enemy tank column began to deploy on his front. He watched the Forward Air Controller (FAC) relay the nine-line brief to the quickly approaching AH-1Z attack helicopters. The lead Zulu (AH-1Z) triggered his laser designator, and the rest of the division followed suit. Within seconds, the enemy reacted and a thick cloud of smoke concealed the tank platoon. The tanks, equipped with thermal sights, were unimpeded by the smoke and began to fire on the Marine positions. "Why don't the Zulus fire?" the commander shouted as tank rounds began to impact his lines. "They can't, their lasers cannot penetrate the smoke," shouted the FAC over the noise of exploding rounds. "Then get them the hell out of there, and get me Arty..."

In 2006, the first AH-1Z attack helicopters will begin entering service to replace the current AH-1W Super Cobras. The new aircraft will carry 2.75- and 5-inch rockets, air-to-air missiles, a 20mm gun, but only one type of precision guided missile (PGM). Joint Vision 2020 states that the United States "must be prepared to 'win' across the full range of military

operations in any part of the world..."(5). Yet, armed only with Hellfire missiles, the AH-1Z's lethality and effectiveness on the modern asymmetric battlefield will be degraded without versatile PGMs capable of destroying a multi-faceted enemy.

Hellfire

The AGM-114 Hellfire (an acronym for Heliborne, Laser, Fire and Forget) antitank missile entered into service in 1985. Since that time, it has proven to be an accurate and reliable weapon. It has excellent penetration capabilities against hardened targets and reactive armor, and it can be fired from defilade without exposing the aircraft to enemy fire. However, the AGM-114 is a laser-spot tracker and subject to laser limitations, degrading its performance and usefulness in some situations.

In fact, analysis of AGM-114B failures during Marine Corps field firing exercises revealed that 60-67% were caused by designation errors: personnel, boresight, overspill, underspill and spot jitter (Anderson 1). Personnel and boresight errors are training issues and will not be discussed. However, overspill, underspill and spot jitter errors are inherent to laser-guided munitions and will be examined.

First, laser beam divergence and intervening obstacles cause overspill and underspill. The farther away the designator

is from the target, the greater the laser divergence or "spot" size. For instance, the laser "spot" from an AH-1W is approximately four feet in diameter when designating a target at the Hellfire's maximum range (8km). Overspill occurs when a portion of the laser "spot" spills past the target and onto objects or terrain behind the target. Conversely, underspill occurs when intermediate objects or terrain between the target and the designator are illuminated. In either case, the missile must choose between multiple laser returns. Of course, with proper training, techniques and procedures, these types of errors can be reduced, but not eliminated. For instance, it is nearly impossible for a gunner to cleanly designate a tank partially concealed in a tree line. Spot jitter, on the other hand, occurs when the vibration of the helicopter or operator error causes the laser "spot" to bounce around the target. The result is a miss due to tracking errors or missile oscillations.

Still, the principal limitations on Hellfire operations are those caused by obscurants. These can be dust, mist, smoke, fog or cloud cover, all of which attenuate and distort the laser. For example, in the Gulf War, 2,900 Hellfire missiles were reportedly fired from Apache helicopters. Analysis of Hellfire hit rates found the average to be 65-79%, depending on the unit. Among the problems noted were mechanical launcher failures, weak laser power units, and most notably, "environmental conditions

such as blowing sand, smoke and haze, which at times prevented the Apache's targeting laser from locking on to intended targets" (Cordesman and Wagner 730). Furthermore, Marine AH-1W pilots flying in the gulf indicated "limits to the Hellfire because the laser beam from its designator did not reflect back to the missile adequately in flying sand and rain" (Cordesman and Wagner 726). Since the Gulf War, systems and techniques have improved to resolve these issues, but they remain a problem today.

Moreover, low cloud ceilings limit the use of Hellfire due to its high trajectory. In many instances, low ceilings may preclude the use of Hellfire; this certainly is not something a commander wants to hear when enemy tanks roll towards his position.

Additionally, many countries are installing laser detectors and laser countermeasure systems on their infantry fighting vehicles (IFVs) and main battle tanks (MBTs). The Russian T-90 MBT employs a laser detector coupled to an automatic defense system that "detects laser illumination, determines its direction and type (laser range-finder or designator)...and lays in... quick forming aerosol screens within three seconds at a distance of 50-80 meters from the tank" ("Jane's"). Similarly, the Chinese Norinco Type 98 MBT uses a laser detector and a laser dazzler to "neutralize electro-optical sighting systems"

("Jane's"). Jane's Information Group revealed numerous laser-warning systems built for armored fighting vehicles which "were reported as having been procured by customers all over the world." Certainly, aircrew can delay the designation and offset the target initially to counter these systems. However, an 8km Hellfire shot still requires the designator to be on the target for a minimum of eight seconds, giving a T-90 time to fire a smoke screen and displace itself (AH-1W Tactical Manual 112).

TOW

The current AH-1W is armed with Hellfire and the BGM-71 TOW (Tube Launched, Optically tracked, Wire guided) antitank missile. Compared to Hellfire, the TOW is much slower, has less armor penetration capability, half the range of the Hellfire and must be guided all the way to the target. However, the TOW has the flexibility to be used against targets, such as snipers in urban terrain, that are not optimized for laser-guided munitions. In 1999, the Marine Corps built an urban environment training area for attack aircraft in order to test weapons and tactics. One of the lessons learned from these tests was that the TOW was better suited than Hellfire to some situations. For example, the TOW is almost impervious to battlefield obscurants and weather (HMLA-369 LTA Lessons Learned 1). Additionally, the TOW's flat trajectory and wire guidance make it ideal to fire

through open windows or doorways to take out antitank weapons or snipers without causing excessive collateral damage.

However, the TOW was eliminated from the designs of the AH-1Z upgrade. Although not involved in the decision, Lee Standley, one of the Marine Corps leading experts on the TOW missile, agrees for the following reasons:

1. There are over 500 wires interconnecting TOW Weapons Replaceable Assemblies (WRAs), making it **vastly more complex than the Hellfire system**. As the TOW system ages and wiring problems become more prevalent, **reliability will decrease**.
2. The TOW system uses **analog** technology and would need to be completely redesigned in order to be integrated as part of the digital AH-1Z weapon system.
3. TOW launcher bore sighting is time consuming and **reduces the flexibility** to interchange different types of ordnance and fuel tanks.
4. The removal of TOW eliminates **talley rack resolver problems** (drooping rocket pods, auxiliary fuel tanks and Hellfire launchers).
5. The TOW weapon system is **difficult to maintain**, requiring extensive man-hours.

Consequently, the Marine Light Attack Helicopter Operational Advisory Group has identified the requirement for an adequate, inexpensive PGM to replace the TOW (1997-20). Accordingly, the Marine Corps is investigating a number of different options for an additional or replacement missile, including millimeter wave (MMW) radar, and imaging infrared (IIR) seekers.

Millimeter Wave Radar

The U.S. Army is developing the AGM-114L Longbow, a MMW Hellfire, capitalizing on the AH-64 Apache's fire control radar and target acquisition designation sight (TADS). Similarly, Alenia Marconi Systems is developing the Brimstone missile for the British Royal Air Force. The Brimstone is a MMW variation of the Hellfire designed for use on rotary and fixed wing aircraft.

No doubt, MMW-guided missiles provide distinct advantages. First, their fire-and-forget characteristic allows for faster engagements and increased aircrew survivability. Second, they are true all-weather weapons, and not susceptible to battlefield obscurants. Lastly, when integrated with the shooting aircraft's radar system, Longbow and Brimstone could theoretically "track up to 16 targets simultaneously and engage them within one minute" (Cordesman and Wagner 732). However,

this capability is lost on the AH-1Z which is not equipped with radar, but rather with the target sight system (TSS), a 3rd generation forward looking infrared (FLIR). Because both Brimstone and Longbow were designed to be integrated with an aircraft's radar system, acquisition and tracking times are uncertain when launched from a non-radar platform.

Moreover, the MMW missile is susceptible to enemy counter-measures due to its active radar seeker. For instance, The T-80 MBT and the BMP-3 IFV defense systems detect incoming missiles with a multidirectional MMW radar sensor and then fire an explosive projectile into the missile's path before it impacts.

Imaging Infrared

Another option is imaging infrared. IIR guided missiles detect an object's electromagnetic radiation, and are not dependent on ambient light. Further, IIR missiles are passive; this and the IIR's fire-and-forget nature decrease the enemy's chance of detection.

However, atmospheric conditions and temperature variances affect IR detection. Conditions such as high absolute humidity, precipitation, smog and dust are all factors of image quality. Additionally, precipitation, temperature swings and wind can affect the overall thermal scene, thereby degrading infrared imagery (MAWTS-1 ASP 37). In spite of these deficiencies, IIR

missiles are superior to laser guided munitions in bad weather and on "dirty" battlefields.

Indeed, missile technology will continue to evolve. The Army and Marine Corps are looking toward future technology advances and replacing Hellfire and TOW with the Common Modular Missile (CMM). Currently, CMM has not made it past the concept phase. However, designers envision CMM to have a range of 18km and "to be capable of ground-launch or air-launch... to have an imaging IR seeker with automatic target recognition or man-in-the-loop guidance options. The missile may be supersonic, and an in-service date of 2008 has been reported" ("Jane's").

TOW Fire and Forget

In the interim, the Army has contracted Raytheon to produce the Tube-launched, Optically engaged, Wireless Fire and Forget (TOW F&F) missile as a replacement for the current TOW.

Raytheon claims the TOW F&F

"will significantly reduce the gunner's exposure during combat; will eliminate the gunner's aiming error (jitter) during missile fly-out; will increase the system's probability of hit and kill; and will increase the system's rate of fire...In addition to Fire and Forget [mode], it also retains TOW's unmatched man-in-the-loop command guidance mode with a 'stealthy' radio frequency (wireless)

link. Together both modes ensure that the gunner can 'engage any target he can see'..." ("Raytheon").

Accordingly, by having a dual-mode missile, the aircrew will have a weapon capable of operating in virtually all battlefield conditions and settings. In addition, it has a modular design, allowing upgrades and improvements for it to evolve "into the Joint Common Missile as new technologies are developed" ("Raytheon"). Furthermore, it could replace current TOWs within infantry companies, giving them an unprecedented heavy anti-armor capability. Using one missile for ground and air units, coupled with the fact that TOW F&F leverages much of the existing TOW technology, makes it extremely cost effective as well. Current studies estimate initial fielding for 2005, aligning it with the introduction of the AH-1Z the following year.¹

In summary, the AH-1Z must perform across the full spectrum of military operations. Whether destroying Republican Guard tanks in a full-scale war or taking out an enemy sniper during military operations other than war (MOOTW), the AH-1Z must be equipped with versatile PGMs. If history is any indication of the future, it is far more likely that aircrews will face non-conventional threats rather than main battle tank formations. Accordingly, the Marine Corps must be equipped to provide commanders with maximum flexibility. Adding TOW F&F technology

to the aircraft's arsenal provides this flexibility with advanced IIR-guidance for conventional threats and manual wireless guidance for non-conventional targets. The AH-1Z must be equipped and ready to fight with its fangs bared and set to strike.

¹In spite of all its advantages, the Army is considering canceling the TOW F&F program to pay for other acquisitions.

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