



DIRECTED ENERGY LASERS A NEW BREED OF WEAPONRY

If the reports coming from the scientific community are any indication, it can be said with a great deal of certainty that a new breed of weaponry—directed-energy weapons—is about to burst out into the warfighting arena, heralding perhaps the most important revolution in military hardware since the advent of the atomic bomb.

Currently, directed-energy weapons are confined to three areas, ie. lasers, high-powered microwaves (HPM) and particle beams. All of them use the electromagnetic spectrum, with lasers operating in the light or near-light frequencies and the microwave devices utilising the radio-frequency realm. The particle beam weapon generates its destructive power by accelerating sufficient quantities of subatomic particles or atoms to velocities near the speed of light and focusing these particles into a very high-energy beam. This paper does not explore particle beam weapons further.

The basic functional concept behind all three is the same: delivering a concentrated high energy beam to a target instead of kinetic impact or explosive blast. The principle difference between lasers and HPM is that lasers are capable of producing a more focused point of impact, making it more effective as well as affording better discrimination, while HPM affect the internal electronics of the target system. Consequently HPM are completely ineffective against targets devoid of electronics. However, both have the potential to generate regulated effects and create on a target what is increasingly being referred to as 'D5' effects—disrupt, degrade, disable, damage or destroy—as deemed necessary.

Lasers are 'speed-of-light' weapons that eliminate the time currently needed to engage a target after it has been identified. From a purely theoretical point of view this translates to real-time strike capability, overcoming all the constraints that airborne weapon systems currently face. The other advantage is the almost foolproof elimination of collateral damage that is becoming increasingly unacceptable even during all-out war.

One major development program is the Airborne Laser (ABL), which uses a chemical laser mounted in a Boeing 747-400 cargo aircraft. This uses chemical fuels to create a gaseous lasing medium and an optical turret in the nose of the aircraft focuses the beam, aiming more than a megawatt of power against the target. The ABL is expected to be able to destroy a tactical ballistic missile in its boost phase at a distance of up to 600km. The program has, however, been delayed and is now envisaged to reach final demonstration stage only towards the end of 2008.



Airborne Laser Aircraft

From a warfighting point of view the implications are very clear to discern. Operational fielding of the ABL would provide commanders with the ability to neutralise a target in real-time and thereby ensure battlefield dominance. In attaining such dominance the ABL will function both in the offensive and defensive deterrent role. It will be able to degrade or destroy, as the case may be, any incoming threat and thereby create an almost inviolable bubble around a large surface battlefield within which friendly forces will be able to operate with absolute freedom from outside interference.

Another program that is nearing operational trials is the Tactical High Energy Laser (THEL) and its mobile derivative MTHEL. The THEL uses already proven laser beam generation and pointing technologies in combination with existing sensor networks to provide active defence capability against counter-air missions. By providing close-in engagement capability against short- and medium-range threats, THEL enhances the protection of theatre-level assets. The MTHEL is

purposefully designed for battlefield protection of combat forces from rockets, artillery and mortar shells. The system has already been successfully demonstrated and its mobility is currently based on transportation by one C-130 aircraft. It is reported that the final fielded version will be small enough to be mounted on a Humvee. While the development costs of the MTHEL have been fairly high, when operationally fielded in 2009, it will be an extremely cost effective way to protect troops in the field.

Although Directed Energy Lasers seem to be the answer to a number of issues that have plagued the application of force, they are not without their own developmental and birth pangs. There are still some key technological challenges to be addressed. These include the demonstration of sufficient power and beam focus to destroy a missile at a distance that will be tactically viable, development of a system to control the effect of atmospheric interference, the assurance of laser performance at extreme high altitude and the assurance of beam quality.



Beam director of THEL fire unit

There is also an unresolved legal and moral issue of the use of lasers in warfare. Currently the only way to destroy ground targets is by using kinetic or blast effects associated with conventional rockets or bombs. These are less precise than lasers that could hit a very small target without any collateral damage. The problem arises after hitting the target, as the laser energy could be deflected at random in any direction, potentially hitting the operating personnel. The intense heat produced by the laser beam is enough to burn through the human skin. A further complication is that the

human eye is far more vulnerable to laser damage than almost all military targets, because the cornea of the eye focuses laser light onto a tiny spot on the retina, rapidly burning it and causing instant blindness.

Article 1 of the Geneva Convention's protocol on Blinding Laser Weapons states, 'It is prohibited to employ laser weapons specifically designed, as their sole combat function or as one of their combat functions, to cause permanent blindness to unenhanced vision.' However, Article 3 states, 'Blinding as an incidental or collateral effect of the legitimate military employment of laser systems, including laser systems used against optical equipment, is not covered by the prohibition of this protocol', effectively nullifying Article 1.

In effect, from a purely warfighting point of view, ABL and MTHEL provide the commanders with weapon systems that can provide enhanced and almost complete protection at both the tactical and theatre level. There is no doubt that laser weapons will be operationally fielded in the near future as a counter-measure to the proliferation of ballistic missiles. However, the legal and moral aspects of the almost certain side-effects may be prohibitive enough to warrant a second look at their employment in the tactical battle area.

- *DE weapons can disrupt, degrade, disable, damage or destroy*
- *Laser weapons can have up to 600km range and will be able to neutralise very small targets with no collateral damage*
- *Legal and moral issues on their use is yet to be resolved*

In all practicality, the only difference between the laser pointer and the Airborne Laser is just [that] the Airborne Lasers are a billion times more powerful.

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