



Laser Weapons: the New Frontier of Missile Defense

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In recent years, the use of high-energy laser weapons has transitioned from an experimental concept to a concrete and potentially operational capability. Keith Krapels, director of the Technical Center of the *US Army Space and Missile Defense Command*, emphasized that these technologies are now "*mature enough*" to directly contribute to next-generation missile defense.

This evolution represents a paradigm shift. Until recently, laser systems were considered laboratory prototypes, limited by power, range, and operational reliability constraints. **Today, however, the integration of high-efficiency laser sources, precision targeting systems, and advanced tracking algorithms makes their use possible in real scenarios, even on mobile platforms.**

One of the strategic objectives is to integrate them into multi-layered air and missile defense systems, alongside interceptor missiles and electronic countermeasures. The ability to neutralize threats such as drones, rockets, artillery, and short-range missiles with a coherent light beam opens scenarios for reducing operational costs, as the laser "shot" has a marginal

cost close to zero compared to traditional missiles.

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Raytheon and Kord: Field Tests and Demonstrated Capabilities

An important step towards operational adoption was made thanks to the collaboration between Raytheon Intelligence & Space and Kord, which in May 2022 successfully tested a 50 kW high-energy laser mounted on a Stryker armored vehicle.

The test, conducted at the White Sands Missile Range in New Mexico, demonstrated the **ability to intercept and destroy a variety of targets, including drones, mortar rounds, and other short-range threats**. The most significant aspect was the repeatability of performance: multiple consecutive engagements with precision and without ammunition reloads, as the energy was supplied by the vehicle's electrical system.

This approach is part of the *Directed Energy Maneuver-Short Range Air Defense* (DE M-SHORAD) program of the US Army, designed to provide **rapid and low-cost protection against saturating attacks**. The operational advantage is twofold: neutralizing emerging threats such as drone swarms and reducing the consumption of traditional interceptors, preserving them for more challenging threats.

From a logistical standpoint, the laser systems mounted on Stryker are modular: they can be integrated with radar, optical sensors, and command and control systems already present in the units, making adoption faster and less expensive.

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Integration into Air Defense and Future Prospects

Raytheon, through its *Integrated Air and Missile Defense* programs, is developing a range of laser solutions for different scenarios: from fixed installations for the defense of strategic infrastructures to mobile naval and land platforms.

High Energy Laser Weapon Systems (HELWS) **use concentrated photons to detect, track, and destroy aerial threats in fractions of a second.** The use of integrated electro-optical sensors and radar allows operation even in complex weather conditions, reducing vulnerability to enemy countermeasures.

The integration of lasers into a multi-layered defense network means being able to combine different capabilities:

- long-range interception with guided missiles;
- medium-short range neutralization with directed energy weapons;
- close defense with automatic cannon systems or electronic countermeasures.

This architecture would allow addressing complex and multi-vector threats, including hypersonic ones in their terminal phase, exploiting the rapid reaction times of the laser.

Future prospects include increasing the available power up to 100 kW and beyond, optimizing adaptive optics to minimize beam dispersion, and developing “plug-and-play” systems compatible with different platforms. In parallel, the reduction of production and maintenance costs will make lasers competitive compared to conventional weapon systems.

The race for operational adoption is not limited to the United States: Israel, Germany, the United Kingdom, and China are developing their own solutions, often focused on missile and drone defense. In this context, the speed with which a country manages to effectively integrate lasers into its operational doctrine could determine a decisive strategic advantage.

Laser weapons are no longer a futuristic vision. Technological developments, operational tests, and demonstrated capabilities indicate that they could soon enter service as an integral part of air and missile defense. The future of protection against aerial threats will be increasingly bright... literally.