USASMDC/ARSTRAT

Technical Center

HEL CT

High Energy Laser Component Technology

Summary

- SSL devices meeting weapon performance levels (>100kW) in the laboratory in FY09
- Field testing of the weapon scale hardware will be conducted beginning in FY11
- Development of compact, all-electric SSL technologies will enable compatibility with FCS platforms
- The SSL weapon will enhance the Future Combat System's survivability

Army HEL component technology develops and demonstrates compact, all-electric, proof-of-principle weapons-level laser devices with potential multi-mission applications.

The HEL Technology program is developing and demonstrating weapons-level laboratory solid state laser (SSL) devices. This technology will be capable of protecting the warfighter against a variety of threats such as, rockets, artillery, mortars and unmanned aerial systems (UAS). Currently, the program is developing two laboratory SSL devices based on diode pumped Nd:YAG slab geometries that could be ruggedized for placement in ground vehicles to perform a variety of missions. A SSL will be tested against dynamic threats at the High Energy Laser Systems Test Facility at White Sands Missile Range, N.M. within two years.

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Overview

The U.S. Army Space and Missile Defense Command/ Army Forces Strategic Command (USASMDC/ARSTRAT) is the lead technical agency within the Army responsible for developing high energy laser technologies and capabilities. It has, throughout the last thirty years along with other Department of Defense (DoD) organizations, demonstrated the capability of HEL technologies to defeat a wide variety of threats. In conjunction with the High Energy Laser Joint Technology Office (HEL JTO) and the other services, the Army is leading the Joint High Power Solid State Laser (J-HPSSL) program to develop and integrate diode-pumped solid state laser technologies and fabricate proof-of-principle compact weapons-level laboratory laser devices. These laboratory devices will demonstrate the technology readiness of the components to support the development of a HEL Technology Demonstrator. In addition, a J-HPSSL device will be moved to the High Energy Laser Systems Test Facility at White Sands Missile Range, N.M., where it will be coupled to an existing beam director to conduct field tests beginning in FY11.

Benefits for Tomorrow's Defense

The Army believes that high energy laser weapons can be effectively employed in a variety of mission areas, providing unique or complementary capabilities to other weapon systems and resolving several existing capability gaps identified by the soldier in the field. High energy laser weapons offer the unique performance capabilities of near real-time engagements of targets, scalable lethality effects, and precision engagements with minimal collateral effects.

Technical Concept

Current HEL Technology development is based on diode pumped, slab-based, solid state lasers. Early flashlamp pumped SSLs were limited in their ability to achieve high average power due to pumping inefficiencies which resulted in generation of large amounts of waste heat. Diode pumping is significantly more efficient, mitigating thermal management issues for SSLs operating at high average power levels. The improved efficiency of diode pumped SSLs also allows more compact packaging that enables compatibility with military platforms. Beam power, electro-optical efficiency and run time are key drivers for determining the size and weight of an SSL system. The smaller the power and the shorter the required run time, the smaller the thermal management system needs to be.

There are several different architectures being developed and tested for slab-based SSLs under the J-HPSSL program, as well as other DoD programs. Each of the architectures offers modularity for scaling to powers greater than the J-HPSSL power goal of 100kW. This goal has already been demonstrated by one laboratory device under the J-HPSSL program for run times in excess of 300 seconds.

As a follow-on to the J-HPSSL program, the Army plans to again partner with the HEL JTO and other services to develop the next generation of SSLs that will be more efficient, rugged, and reliable than current laboratory devices. The Army HEL Component Technology development effort is also addressing beam control subsystem (BCS) components to reduce the weight, lower the cost, and improve the performance of SSL weapon systems. Another area of interest to the Army is developing SSLs that operate at wavelengths that reduce eye hazards from reflected energy.

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