High Energy Fiber Laser System

ONR Program Code 35 | September 2012

At a Glance

What is it?

- The High Energy Spectral Beam Combined Fiber Laser System (HEFL) will deliver a prototype high energy laser weapon system with 25 kW of laser power and the attendant beam director, control, prime power and thermal management subsystems.

How does it work?

- Driven by the telecom industry, rapid advances in the strength and efficiency of electrically powered fiber lasers have occurred.
- Spectral Beam Combining (SBC) brings together the output of many fiber lasers using an optical grating.
- While the SBC laser operates in a narrow band of the short wave infrared, conceptually the process is like a rainbow being combined into a single beam of white light by a grating or prism.
- The SBC high power laser beam then passes through the beam director/control subsystem which modifies the beam to point and hold it on the target aimpoint.
- The target is damaged when the laser light is absorbed by the target, creating rapid heating and ablation of material.
- The damage done to the target depends on the power of the laser, the aperture of the beam director, the quality of the laser beam, the range of the target and the dwell time of the laser beam on the target.

What will it accomplish?

- The HEFL prototype will be demonstrated in a graduation exercise from a helicopter against representative maritime targets.
- The goal is to provide the warfighter with a state-of-the-art, cost effective directed energy capability that complements existing kinetic weapons.

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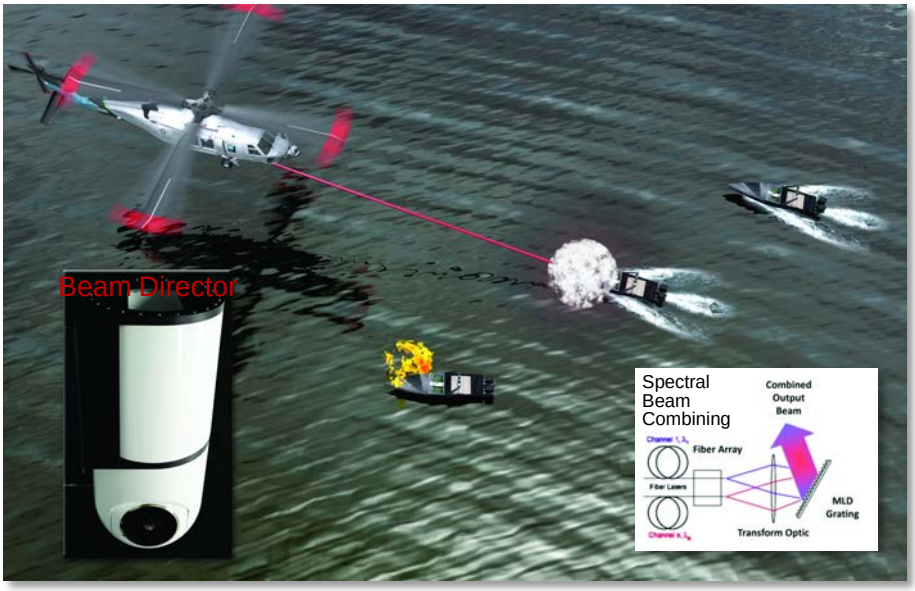

The High Energy Fiber Laser (HEFL) System Future Naval Capability (FNC) Product is working now to provide a directed energy weapon that will complement existing kinetic weapons. The Office of Naval Research, in concert with Resource, Requirements and Acquisition sponsors, are working together to establish the baseline for new program of record, which will deliver an airborne High Energy Laser Weapon System (HELWS) to the Fleet. The Concept of Employment for a HELWS, operating from a rotary wing platform includes an offensive capability in target rich environments (e.g., barrage, swarm, and stream raids) and a self protect capability (e.g., hard-kill of MANPADS and similar threats). Increased mission kills per sortie (at lower cost by using aviation fuel converted to high energy laser power) against low-end asymmetric threats, frees the limited load-out of advanced kinetic weapons to strike advanced high-end threats.

The HEFL scalable, modular approach to an airborne laser weapon demonstration is an outgrowth of the Navy's Small Business Innovative Research (SBIR) projects in lasers, beam control, thermal management, and prime power. The FNC funding is being applied to further develop the SBIR subsystems and conduct a system level demonstration. The laser architecture – Spectral Beam Combining (SBC) – is inherently scalable by varying the number of lower power laser modules combined together to form a single higher power laser beam. The modules are operating at closely spaced wavelengths and combine with little loss, creating a very bright spatially coherent beam. The beam director design is adaptable to multiple platforms and has been evaluated for rotary wing, fixed-wing, and mobile ground operation.

HEFL will demonstrate the deep magazine that enables a single platform to engage large numbers of adversaries, with precision engagement and speed-of-light delivery of damaging effects at relevant ranges and dwell times. Ultimately, the laser's deep magazine could reduce number of platforms/sorties required for mission success (i.e., lower cost) and potentially reduce the cost of procuring and fielding large numbers of kinetic weapons.

Research Challenges and Opportunities:

- Optical components and coatings for high energy optical train
- Light weight, rechargeable, high energy storage devices
- Adaptive optics to reduce power lost from atmospheric induced beam distortions.