

FREE ELECTRON LASERS:

Directed Energy for Shipboard Defense

The Office of Naval Research has long been interested in the potential of Directed Energy Weapons for shipboard defense. Developing a laser that could operate in a maritime environment and be consistent with the Navy's planned all-electric ship has been a recent focus for ONR. One promising technology, the high average power infrared Free Electron Laser, provides intense beams of laser light that can be tuned to optimum wavelengths and utilized for speed-of-light shipboard defense.



FEL Superconducting Electron Accelerating Structures

High average power FEL development is being funded by ONR at the Department of Energy's (DOE) Thomas Jefferson National Accelerator Facility (Jefferson Lab). The Jefferson Lab FEL delivered 10 kilowatts of infrared laser light in July 2004, making it the most powerful tunable laser in the world. The laser's capabilities offer applications in defense and manufacturing, and support advanced studies of chemistry, physics, biology, and more.

The FEL is based on Jefferson Lab's expertise in superconducting radiofrequency accelerator technology which also enables Jefferson Lab's main accelerator for Nuclear Physics research, funded by DOE.

ONR is funding the operation and optimization of the 10 kW FEL, and has several experiments slated to begin in early fall including laser materials damage studies and atmospheric propagation studies to assess the potential of new laser-based shipboard defense strategies.

The Navy is also interested in the ultraviolet and terahertz light that the FEL can produce at world-record powers. The Navy plans to build on its partnership with Jefferson Lab and its support of the FEL, scaling to the megawatt needed for speed-of-light shipboard defense.

JLab FEL specifications:

Average Power: 10kW

Wavelength Range: 1 –14 microns

Time Structure: 0.5 – 1.0 ps pulses at 75 MHz

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