Free Electron Laser

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At a Glance

What is it?

- The Free Electron Laser (FEL) provides naval platforms with a highly effective and affordable defense capability against surface and air threats, future antiship cruise missiles and swarms of small boats. Utilization of FEL also allows an unlimited magazine with speed-of-light delivery.

How does it work?

- FEL generates high-intensity laser light by utilizing the energy from unbound accelerated high-energy electrons.
- This technology is commonly used in the Department of Energy's particle colliders for basic subatomic research.
- The FEL program is an investment by the Office of Naval Research to transition the accelerator technology from particle colliders to a future ship self-defense weapon system.

What will it accomplish?

- FEL will equip U.S. ships that have high depth-of-fire with speed-of-light delivery, seconds dwell time and a deep magazine for a more powerful means of self-defense. It is a revolutionary weapon that will transform how the Navy fights future battles.

Point of Contact

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The Free Electron Laser (FEL) weapon system will provide U.S. Ships with speed-of-light fire capability for a range of missions and threats, a key element of a future shipboard layered defense.

An Innovative Naval Prototype program for the FEL technology began in 2010. It will demonstrate scalability of the necessary FEL physics and engineering for an eventual megawatt-class device.

This revolutionary technology provides multiple payoffs to the warfighter. The ability to control the frequency of a laser beam allows for operation in the maritime environment. The variability of the beam strength provides graduated lethality with minimum collateral damage and a low cost-per-engagement when compared to the projectile and logistics support costs of conventional explosive munitions. Against low value targets it is an effective alternative to the use of expensive missile systems. The FEL provides speed-of-light and precision engagement of both high speed, sophisticated antiship missiles, as well as swarming, slow speed, unsophisticated small craft.

Research Challenges and Opportunities:

- FEL weapons
- Injectors
- Accelerators
- Amplifier/oscillator designs
- Beam control
- Modeling and simulation
- Scalability