

Laser trailblazer: US Navy conducts test of new laser weapon system

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The Layered Laser Defense weapon shoots down a drone during a February demonstration at the U.S. Army's High Energy Laser Systems Test Facility at White Sands Missile Range in New Mexico. The ONR-sponsored demonstration marked the first time the U.S. Navy used an all-electric, high-energy laser weapon to defeat a target representing a subsonic cruise missile in flight. Credit: Lockheed Martin

The ground-based laser system homed in on the red drone flying by,

shooting a high-energy beam invisible to the naked eye. Suddenly, a fiery orange glow flared on the drone, smoke poured from its engine and a parachute opened as the craft tumbled downward, disabled by the laser beam.

The February demonstration marked the first time the U.S. Navy used an all-electric, high-energy laser weapon to defeat a target representing a subsonic cruise missile in flight.

Known as the Layered Laser Defense (LLD), the weapon was designed and built by Lockheed Martin to serve as a multi-domain, multi-platform demonstration system. It can counter unmanned aerial systems and fast-attack boats with a [high-power laser](#)—and also use its high-resolution telescope to track in-bound air threats, support combat identification and conduct battle damage assessment of engaged targets.

The drone shoot-down by the LLD was part of a recent test sponsored by the Office of Naval Research (ONR) at the U.S. Army's High Energy Laser Systems Test Facility at White Sands Missile Range in New Mexico. The demonstration was a partnership between ONR, the Office of the Under Secretary of Defense (Research and Engineering) and Lockheed Martin.

"Innovative laser systems like the LLD have the potential to redefine the future of naval combat operations," said Chief of Naval Research Rear Adm. Lorin C. Selby. "They present transformational capabilities to the fleet, address diverse threats, and provide precision engagements with a deep magazine to complement existing defensive systems and enhance sustained lethality in high-intensity conflict."

The LLD testing supports a broader effort by the naval research and development community, partnered closely with the fleet, to mature technologies and field a family of laser weapons that can address

multiple threats using a range of escalating options. These capabilities range from non-lethal measures, such as optical "dazzling" and disabling of sensors, to destruction of a target.

Laser weapons provide new precision and speed of engagement for naval warfighters. They also offer simplified logistics that are safer for ships and their crews, as lasers are not dependent on the traditional propellants or gunpowder-based ordnance found on ships.

Instead, modern high-power lasers run on electricity, making them inherently safer and able to provide weapon capability as long as a ship has power. This also means the cost per engagement for a laser weapon can be very low, since the only consumable item expended is fuel to run the system.

For years, the Department of Defense (DoD) and all the Services have recognized the promise of directed-energy weapons such as lasers, and continue to prioritize research. Recently, the Under Secretary of Defense for Research and Engineering, the Hon. Heidi Shyu, re-affirmed that directed energy is one of the DoD's critical technology areas.

ONR plays an important role in developing technologies for laser weapons and has fielded demonstration systems for operational experimentation. Notably, in 2014 ONR saw the Laser Weapon System tested successfully aboard the USS Ponce in the Persian Gulf. More recently, ONR fielded the Laser Weapon System Demonstrator aboard the USS Portland in 2021.

Although there's no plan to field the LLD, it offers a glimpse into the future of laser weapons. It is compact and powerful, yet more efficient than previous systems. It has specialized optics to observe a target and focus laser beams to maximum effect, while also incorporating artificial intelligence to improve tracking and targeting.

"LLD is an example of what a very advanced [laser system](#) can do to defeat significant threats to naval forces," said David Kiel, a former Navy captain who is a program officer in ONR's Aviation, Force Projection and Integrated Defense Department, which managed the testing. "And we have ongoing efforts, both at ONR and in other Navy programs, to keep building on these results in the near future."

During the recent test at White Sands, the LLD tracked or shot down an array of targets—including unmanned fixed-wing aerial vehicles, quadcopters and high-speed drones representative of subsonic cruise missiles.

"We're proud to say that the Layered Laser Defense system defeated a surrogate cruise missile threat in partnership with the Navy, White Sands Missile Range and Army High Energy Laser Systems Test Facility teams. Lockheed Martin drew best-in-class laser weapon subsystems from across the corporation, including key industry partner Rolls-Royce, to support the entire threat engagement timeline from target detection to defeat," said Rick Cordaro, vice president, Lockheed Martin Advanced Product Solutions. "We leveraged more than 40 years of directed energy experience to create new capabilities that support the 21st century warfighter."

Dr. Frank Peterkin, ONR's directed energy portfolio manager, said, "The Navy performed similar tests during the 1980s but with chemical-based laser technologies that presented significant logistics barriers for fielding in an operational environment. And, ultimately, those types of lasers did not transition to the fleet or any other Service.

"Today, ONR coordinates closely with the Navy's resourcing and acquisition communities to make sure we develop laser [weapon](#) technologies that make sense for the Navy's requirements to defend the fleet and for operations in the rough maritime environment at sea,"

Peterkin continued. "It's a challenging problem, but Navy leadership at all levels see potential for laser weapons to really make a difference. The next few years are going to be very exciting as we work with the Navy and joint partners to make the capability we just saw demonstrated by the LLD a reality for the naval warfighter."

Provided by Office of Naval Research

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