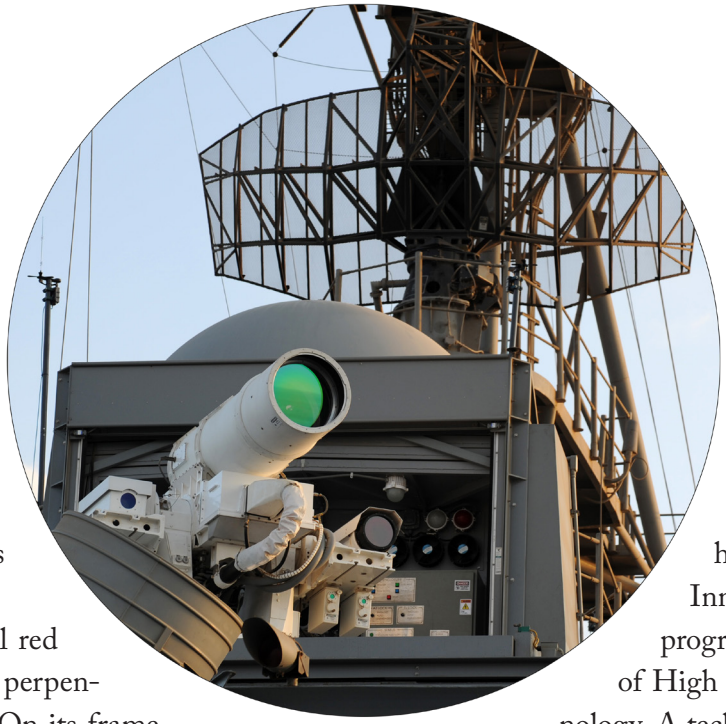
ACTION TRACKED

An SBIR-backed company develops key tracking technology for laser weapon systems



It's November 2014 and the USS Ponce, a 175-meter U.S. Navy amphibious transport dock converted into a testbed, patrols the waters in an undisclosed location.

In the distance, a small red motorboat makes its way perpendicular to the larger ship. On its frame sits a target: a small stack of plastic tubes. Suddenly, the Ponce activates its Laser Weapon System (LaWS), the XN-1 LaWS (AN/SEQ-3), retracting a cover to show a large, white cannon-type device. From the control room, an officer routes the laser, guiding it to lock onto the red motorboat. With a few clicks of a button, the high-powered laser fires its hyper-concentrated beam of light, disintegrating the small stack of tubes and leaving the rest of the vessel completely intact.

While only a demonstration, this display was an example of the raw, state-of-the-art precision and power achieved by the XN-1 LaWS. According to Rear Admiral Matthew Klunder, at that time Chief of Naval Research, "This is the first time in recorded history a directed energy system has ever deployed on anything."

One of the companies behind the laser system, Washington-based Aculight, has been—with the help of the Small Business Innovation Research (SBIR) program—on the leading edge of High Energy Laser (HEL) technology. A technique called spectral beam combination concentrates the power of light into a ray capable of destroying a moving target from a distance of up to five miles.

The cost-effectiveness of such systems, particularly for use against off-the-shelf UAVs, is extraordinary. One "pre-prototype" laser-mounted vehicle can offer a "cost per kill" of about $30, according to an Army document cited in a recent article in *Foreign Policy*. Traditional weapons require expensive stockpiles of ammunition, but '[t]he high energy laser system requires only fuel to complete its mission,' according to the Army document.

But the most powerful weapon in the world is useless without a good sight. So the developers of the HEL system mounted to the USS Ponce looked to a state-of-the-art, image-based track-

ing technology, also built with help from the SBIR program.

The company behind that tracking system, Equinox Corp., was founded in the 1990s. In its early days, the company worked mainly in the areas of optics, developing multispectral low-light-level imaging systems combined with image fusion techniques that could deliver higher quality infrared and night-vision capabilities to soldiers. It was through those technologies that Equinox first made its way into the world of the SBIR program—between 1998 and 2002 it was awarded eight separate contracts.

The company later began branching into directed energy weapons sensors and targeting systems, a rapidly growing field thanks to a newfound emphasis the Department of Defense (DoD) placed on HEL-type weapon systems.

"There was a desire from the Navy, in the form of various requests for proposals, to build these high energy lasers that had the ability to shoot at targets long distances away—farther than for someone shooting a gun," company founder Dr. Lawrence B. Wolff said. "But in order to do that, you need to accurately acquire your target."

Dr. Diego Socolinsky, director of research and development for the company, and his team had already been developing image-based tracking algorithms for other DoD applications, and this requirement from the Navy provided an opportunity to leverage and extend Equinox's existing capabilities.

Following subsequent SBIR contracts, including a 2013 Phase I to develop an aimpoint system for airborne laser systems, the company was able to refine its tracking technology into its current iteration.

"The tracking has two primary aspects; to track a target as an object in the distance in order to select it, and then to maintain precise track on an aim point selected on that target," Socolinsky said. "At that time, the performance that we had was unique, particularly the aim-point maintenance."

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The key to the system is a combination of cameras and a smart algorithm, which together predict a target's movement and allow a weapon system to remain locked on even in adverse weather conditions or with limited visibility. The tracking system functions as an easy-to-use console that works in tandem with the firing interface of a weapon such as the HEL on the USS Ponce, the XN-1 LaWS.

Following the 2013 contract, Equinox was awarded SBIR Phase III contracts from the Joint Directed Energy Transition Office (DE-JTO), AFRL, and ONR, which, according to Socolinsky, were critical in taking the tracking technology from a concept to something applicable in the field.

"That helped from a technology readiness standpoint. With that we went from a technology readiness level of a 4 or 5 [proven to work in a lab setting] to a technology readiness level of at least a 7 [a working prototype in the field]," Socolinsky said.

"The SBIR program provided the high-risk science and tech funding for doing things we wouldn't have been able to do elsewhere, which have resulted in technologies that are now on the verge of deployment out in the field," Wolff said. "I absolutely would recommend the program to other small businesses."

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Modernization Priority: Directed Energy (DE)
Key Enabling SBIR Awards:
Navy Phase II SBIR topic: N04-171 "Panoramically Panned Visible/LWIR Sensor with Target Motion Cueing" (contract: N00024-06-C-4118)
Air Force Phase I SBIR topic AF131-014 "Aimpoint Maintenance of Ground Targets by Airborne Laser Systems" (contract: F131-014-1238)