



HIGH BEAMS

WASHINGTON-BASED SMALL BUSINESS HELPS DEVELOP
REVOLUTIONARY LASER SYSTEM

For years, the Department of Defense (DoD) searched for technology breakthroughs that could enable directed energy laser weapons. Eventually, the DoD began to issue Small Business Innovation Research (SBIR) contracts to help develop laser weaponry. Some of the first such contracts were awarded to Bothell, Washington-based Aculight, a company which believed the answer lay with fiber laser technology, specifically a technique called spectral beam combination. Of the lines of development that the company pursued, the one that always stood out as having the most potential was the field of high energy lasers, or HELs.

In the first couple years of its existence, Aculight was awarded more than a dozen SBIR contracts and grants for its work researching and developing laser systems, so the company was familiar with the program.

“It’s hard to develop a business plan for capital funding, so the SBIR

program provides a method for more creative people to generate ideas and get funding to see if those ideas can come to fruition,” said Dr. Robert Afzal, a senior fellow with Lockheed Martin, which later acquired Aculight.



Aculight’s answer to the DoD’s question regarding laser weapons was spectral beam combination.

Imagine the album cover from Pink Floyd’s “Dark Side of the Moon”: a prism on a black background with a luminous rainbow entering one side and exiting the other as a single beam of white light. That, Afzal said, is the idea behind the spectral beam combination: to take the colors of the spectrum and send them through a prism to emerge as a singular, focused, high-energy beam of light.

The beauty of the approach is that it can be extrapolated many times over to increase the energy output, essentially weaving multiple lasers together to create one high-powered end product. One hundred kilowatts is the magic number generally regarded as the power needed for an effective laser weapon capable of shooting down enemy unmanned aerial vehicles (UAVs), rockets, artillery rounds, and mortars from close encounters or greater distances.

“As simple as that sounds, it wasn’t obvious 12 to 15 years ago that that was the right answer,” Afzal said. “In those early days, we had many different approaches to beam combination that we needed to test out to see which worked. The SBIR program provided a number of funding contracts to explore all those avenues.”

The company also secured a notable contract with the U.S. Navy to install a laser weapon system called HELIOS onto an Arleigh Burke-class destroyer ship. The acronym explains the technology’s impact: High Energy Laser (HEL)



is the counter-UAS weapon system, Integrated Optical dazzler (IO) stands for the infrared countermeasures the system can produce, and Surveillance (S) describes the added bonus that long-range weapons systems like HELIOS can also double as very effective surveillance tools.

HELIOS and technologies like it are a huge step forward in the world of military engagement, Afzal said, in terms of both precision and efficiency.

“Being able to direct a very precise beam with low collateral damage is hugely beneficial,” Afzal said. “The system also has a deep magazine since it’s powered by electricity rather than a chemical charge and shells. As long as the platform has power, you can defend yourself. In short, we believe we have a precise weapon with low collateral damage and low cost.”

Afzal said he doesn’t believe lasers will replace traditional kinetic weaponry anytime soon, but that they can provide an additional option for attack and defense.

“We believe they can provide a layer of defense that will be complementary to the capabilities the services already have and need,” he said.

As the company moves toward the 100-kilowatt threshold and beyond, Afzal said it’s easy to get caught up looking ahead. But the past, in particular the stepping stones laid by the “foundational” SBIR program awards, was critical in getting Aculight’s technology to the cutting-edge place it is today.

“The SBIR program was very important in providing the funding and the freedom for creative people to experiment and work through the initial physics to figure out what would be the best path forward in developing this technology,” Afzal said. “It’s hard to imagine Aculight achieving what it did without the SBIR program.”

Aculight, Corp. (Lockheed Martin) • Bothell, WA
Modernization Priority: Directed Energy (DE)
Key Enabling SBIR Awards

Air Force topic AF95-109: “1-3 Micron Tunable Diode Pumped Solid State Laser Sources” (F29601-96-C-0026)

Navy topic N99-191: “Compact Mid-infrared Laser for Countermeasures” (N68335-01-C-0027)

Navy topic N02-139: “High Energy Solid State Laser (SSL) for Ship Self-Defense” (N00178-04-C-3045)

Army topic A06-208: “Fiber Laser Beam Combining for High Efficiency and Light-Weight HEL Systems” (W9113M-07-C-0228) OSD topic OSD05-D04: “High Energy Laser (HEL) Beam Combination” (FA9451-07-C-0005)

MDA topic MDA04-005: “Improved Efficiency Fiber Laser Modules for Beam Combining” (N68936-08-C-0049)