



Switching from Gas to Electric

Years of effort bring new power capabilities to laser.

by Joan M. Zimmermann/jzimmermann@nttc.edu

More than 30 years of effort have been devoted to bringing the chemical oxygen iodine laser (COIL) into existence, with the goal of creating a high-energy device that could reliably knock out ballistic missiles during their initial boost phase.

The COIL's operation at infrared wavelengths, and hence its ability to propagate long distances through the atmosphere without distortion, made it a prime candidate for the Airborne Laser (ABL) program—a Missile Defense Agency project to put a giant laser on a modified Boeing 747. However, the high-powered laser has a number of drawbacks when it comes to applications that are less ambitious than those involved in ABL. First, a typical COIL set-up is enormous—in the range of tens of thousands of pounds—and also involves a “witch’s brew” of chemicals such as corrosive chlorine gas and concentrated basic hydrogen peroxide (BHP).

CU Aerospace (Champaign, IL), while making great strides in MDA SBIRs for the development of the COIL, has also investigated other means of creating a similar laser called the ElectricOIL. The ElectricOIL offers a significant size, weight, and safety advantage over the COIL. Instead of massive tanks needed to house BHP and chlorine gas, the ElectricOIL uses a simple electrical discharge sustained in a mixture of oxygen and helium, with a small amount of iodine added downstream to help generate the excited lasing atoms. In research laboratories all over the world, it has taken decades of progress to reach a little more than 5 watts of power for this laser system. However, over the past year, CU has achieved an order of magnitude increase in lasing power, now standing at over 100 watts in a subscale system, through advanced discharge technologies, a more complete understanding of the whole laser system, and a larger volume resonator.


Aside from its high-powered profile designed for advanced air maneuvers, when operating at optimum powers, COIL and ElectricOIL lasers would be far superior to yttrium-aluminum-



▲ An Air Force officer holds a partial missile casing that was shot down by the Airborne Laser, which uses a chemical oxygen iodine laser (COIL). Leveraging knowhow from related MDA COIL work, CU Aerospace has developed a similar but smaller laser that could work well for industrial cutting or drilling operations.

garnet and carbon-dioxide lasers in cutting speed and robotically controlled precision for fiber optic-delivery. If one wanted to adapt its abilities to terrestrial applications, however, the ElectricOIL would be the laser of choice. One ElectricOIL device could replace 10 standard cutting lasers by routing laser energy through 10 different fiber-optic pathways. Such a capability would be valuable in areas of industry where rapid, precision-cutting instruments are needed. Paint-stripping, disaster clean-up, oil-well drilling, and rock-fracturing (via thermal stresses) are other potential applications for these high-powered lasers.

David Carroll, vice president and chief operating officer of CU Aerospace, credits MDA, which granted the company a 2003 SBIR Phase II award to work on closed-cycle ElectricOIL technology, for funding the engineering development and initial demonstrations of the technology. Carroll also gives credit to the Army’s Space and Missile Defense Command for technical monitoring; to the Air Force for funding the early scientific development; to the High Energy Laser Joint Technology Office (HEL-JTO) for funding engineering development of the discharges; and, most recently, to DARPA for its support of the continued evolution of the technology for early moderate-power-scaling efforts.

Carroll said that, although the ElectricOIL is a “hybrid” electric-gas laser technology, the system continues to evolve and proceed at a “realistic” development pace for a new laser technology. He also said he’s expecting that future interest from contractors will result in partnerships that will advance the technology even further. 

CONTACT INFO

David Carroll
CU Aerospace
Tel: (217) 333-8274
E-mail: carroll@cuaerospace.com
Web: www.cuaerospace.com