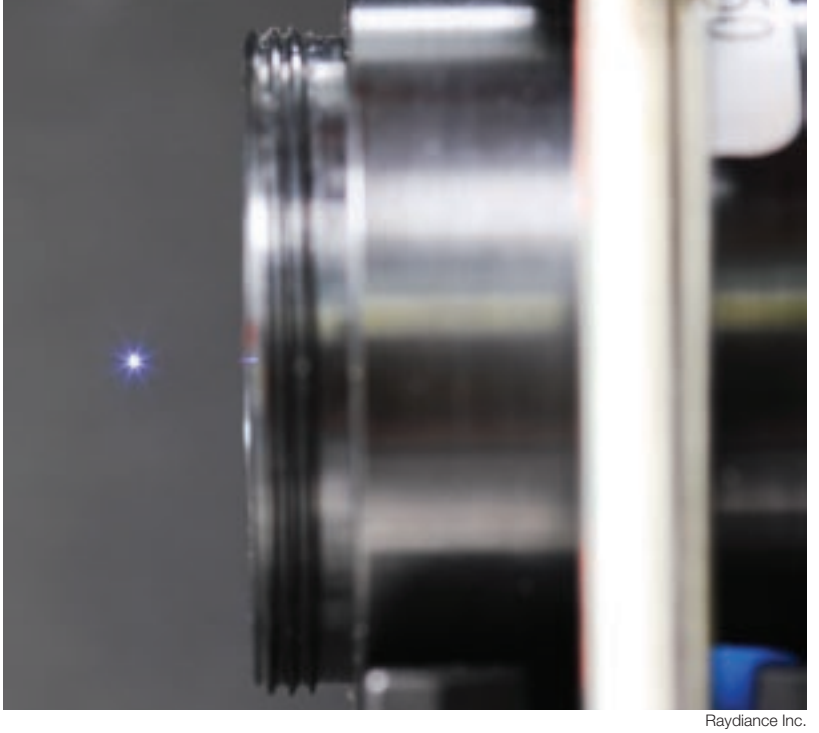
Raydiance Inc.: Thinking Big About SHORT PULSES

Adam Tanous

The Petaluma, Calif., start-up is taking the ultrashort pulse laser industry toward small, smart technology and big markets.



Raydiance Inc.

When Barry Schuler, former CEO and chairman of AOL, first set eyes on an ultrashort pulse (USP) laser, the challenge before him was daunting: How does one take a giant laser and 10-foot optical table and turn it into a viable commercial product?

The answer was not at all obvious to the owners of the laser: the Defense Advanced Research Projects Agency (DARPA). That's why in 2003 they invited Schuler to their offices.

Conceptually, the answer was apparent to Schuler—the technology before him had to be made small and smart. He made that the mission of Raydiance, the company he formed in 2004.

Just two and a half years later, Schuler introduced the Raydiance Discovery System, a broadly enabling ultrashort pulse laser platform. It was small—the size of a microwave oven—and smart—the entire system from pulse generation and amplification to user interface was controlled by software.

Schuler's motivation was simple. Ultrashort pulse laser light has unique capabilities. Particularly, it can ablate virtually any material without generating heat. First discovered in the 1970s, USP has also shown great potential for imaging and the interrogation and modification of materials, both biological and inorganic. If this versatile form of light could be harnessed, a revolution of innovation would follow.

Company name: Raydiance Inc.
URL: www.raydiance-inc.com
Founder: Barry Schuler
Founded: 2004
Location: Petaluma, California and Orlando, Florida
Product line: Ultrashort pulse lasers
CEO: Mel Engle

"Consider what we have managed to do with the electron over the last century or so," Schuler, now executive chairman of Raydiance, says. "And the bulk of the value came in the last 30 years with the advent of the microprocessor." As Schuler explains, not only did computing technology achieve a small form factor; it became accessible in terms of ease and affordability. He believes that industry is at a similar inflection point with the photon. "As we get this platform technology into the hands of engineers, doctors and entrepreneurs, a whole generation of products based on USP will transform industries," he says.

And indeed this appears to be happening. Early adopters are using the Raydiance platform to build applications in ophthalmology, dermatology, gene transfection, high value materials processing, next-generation surgery and homeland security and defense.

According to Raydiance President Scott Davison, one of the keys to the versatility of the platform approach is the embedded software design. "Software command and control is not just tacked on as an afterthought. It is a fundamental part of our architecture. It is baked into the DNA of our system." Indeed, Davison says, "software integrates every aspect of laser operation, the user interface and third party application software. Ultimately, it enables those who are not laser experts to innovate and discover."

Also important in getting to large commercial markets are small product footprint and reliability, both of which are tied to Raydiance's design. Davison says that, by employing a fiber-based design, the company bypassed the large space requirements of "free-space" lasers, which rely on mirrors and free space inside the laser to generate the USP beam. And in building a system to operate at the eye-safe but invisible wavelength of 1,552 nm, Raydiance is able to leverage the proven reliability of components developed for the telecom industry. The RayOS software operating system manages all internal components and hundreds of internal parameters to keep the system functioning reliably.

The Raydiance manufacturing team can attest to the system's reliability. They once watched a Discovery laser system fall four feet from a hydraulic lift. Minutes later, however, the team fired up the laser and it worked flawlessly.

Taking a page from the script of an old Timex commercial, a Raydiance

team this year threw a system in the back of a rental car and drove from Frankfurt to Munich—at Autobahn speeds and over the occasional cobblestone road—to deliver a Discovery system to Nobel laureate Ted Hänsch. Hänsch watched the team plug the system into a wall outlet, run it through its initialization sequence and get to "Beam On" in 10 minutes.

Raydiance Inc.

> "As we get this platform technology into the hands of engineers, doctors and entrepreneurs, a whole generation of products based on USP will transform industries."
>
> — *Barry Schuler*
> *Executive chairman of Raydiance*

To support commercial markets, Davison believes that it is critical to offer a product that can be manufactured in volume. Too often, he says, USP companies have been locked into one-off manufacturing cycles and thus forced to pursue niche market opportunities. Raydiance has invested both intellectual and monetary capital in designing a platform product and a manufacturing process that can support large-scale manufacturing. Currently, the manufacturing team can turn a phone order into laser delivery in 10 days. The industry-standard turnaround time hovers somewhere between six and eight weeks.

From Davison's perspective, large scale commercialization is also about building a nimble network of inventors, commercial partners and venture capital resources. Early on, Davison and Schuler decided that the best way to build a company capable of rapid, proof-of-concept invention was to lower the barriers to innovation, namely by reducing the financial risk involved.

Traditional laser companies offer a traditional sales model—large, up-front capital purchases. In contrast, Raydiance has made its technology available as a monthly subscription service. Rather than make a large capital investment in a fixed technology, customers can subscribe to a rapidly advancing technology stream—Raydiance hardware and software. As the company builds on its technology, subscribers simply get upgraded. This approach lowers the financial risk for discovery work, expanding the opportunities for innovation. It also keeps applications developers on the leading edge of the USP technology envelope.

"To really build a multi-billion-dollar industry, not only Raydiance, but the entire laser industry has to see the value in shooting for large commercial markets," Raydiance CEO Mel Engle says. "For too long, lasers haven't delivered on the revolutionary changes they are capable of." Engle believes that, if the mindset of the industry moves to that of volume commercialization, there will be a dramatic drop in the costs of goods—which will in turn drive down product prices. Once that happens, more markets will open up for more applications. "Venture capital flows in and the cycle repeats itself."

It's no small challenge, as Schuler, Engle and Davison are quick to admit. But it's one they believe in. Four years after visiting the DARPA labs, Schuler is more evangelical than ever in his pursuit. "If we can take this unique technology, make it easy to use and affordable, and then put it in the hands of creative people, the next great technological revolution will be powered by photons." ◭

Adam Tanous (atanous@raydiance-inc.com) is director of marketing for Raydiance Inc.