



Keeping Focused

Company positioning itself to be supplier of durable deformable mirrors.

by Dale McGeehon/techapps@nttc.edu

a Missile Defense Agency-funded company developing the next generation of deformable mirror systems hopes to become known as *the* supplier of the products because its are more precise, more versatile, stronger, and faster than those currently available.

One reason why officials at Optical Physics Company (OPC; Calabasas, CA) believe they will succeed is because their mirror's design significantly minimizes the unwanted surface distortion caused by the intense heat generated when exposed to high-energy laser radiation. Therefore, the mirror can direct high-energy lasers more precisely on target and for longer periods of time than other mirrors used now.

The ability to avoid distortion caused by thermal ripple attracted the attention of MDA, which awarded the company a \$1 million SBIR Phase II contract in 2007. The agency believes the mirror could be used in military high-energy laser programs.

The Phase II funding helped OPC produce and test a 10-centimeter-diameter mirror. The company is expecting to receive add-on funding to build a 30-centimeter device, and is partnering with Lockheed Martin on a high-energy laser program.

OPC's adaptive optics system employs a Shack-Hartmann wavefront sensor and algorithms that account for and counteract the atmosphere's scintillating effect by providing instructions to actuators that then make

adjustments to the mirror's shape—so that the laser is directed accurately.

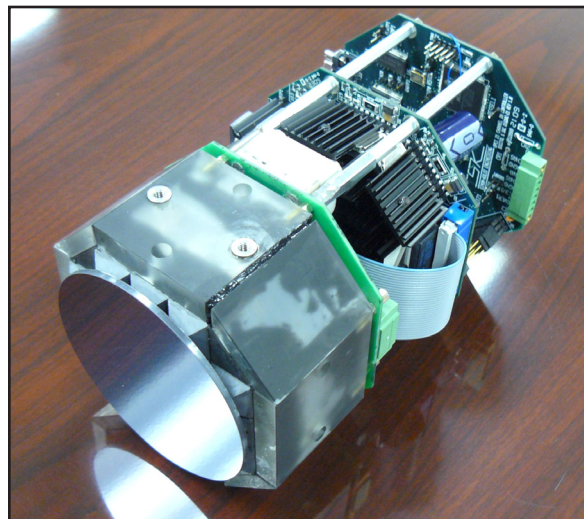
Those actuators move more quickly and have a greater range of motion than those used on competing deformable mirrors, said Marc Jacoby, OPC's vice president of manufacturing. OPC's actuators can move over a range of up to 15 microns, as opposed to 6 or 8 microns for competing actuators. In addition, OPC's actuators operate at 20 kilohertz, while competitors operate at 4 to 5 kilohertz, he said.

In testing, company officials have put the actuators

through a billion cycles—when an actuator moves up and down to its full length—and detected no degradation in performance.

The mirror's proprietary components and assembly also create a thermal sink that OPC's competitors don't have, Jacoby said. The ability to whisk away the heat from the laser's radiation is the reason why OPC's thermal ripple is so small. Its distortion is measured in nanometers, as opposed to competitors' micrometers, a three-orders-of-magnitude difference, Jacoby said.

The smaller the thermal ripple, the longer the laser beam that can be employed. "You can continue to send out your laser beam for minutes, instead of seconds," said Gail Erten, OPC's director of marketing, "If you can hold it on target for a couple of minutes, you can punch a hole in even pretty thick metal. If all you had were seconds, then you'd just heat it up a little bit."



▲ Optical Physics' deformable mirror offers a solution to the distortion-and-accuracy problem that can nag high-energy lasers.

continued on page 2

A common concern with deformable mirrors is that they can break when adjacent actuators move in opposite directions, putting the mirror under stress.

"We have no concern about that whatsoever," Jacoby said. The company has asked attendees at conferences and demonstrations to key in configurations that challenge OPC's mirror, and they have been "surprised and actually delighted that they can't break it," he said.

Traditionally, electronics are placed on a rack several feet away from the mirror, connected by lengthy wiring. OPC's configuration places the electronics on the back of the mirror itself. The configuration significantly reduces latency, Jacoby said.

High-energy lasers may not be the only application of the mirror, according to OPC. Astronomers who want to eliminate distortion caused by the atmosphere's light-refracting movement use deformable mirrors to counteract the effect, Erten said. With better adaptive optics systems, land-based telescopes could view the stars almost as well as the Hubble Telescope, which floats above the atmosphere so that the air will not interfere with visible, ultraviolet, and infrared light signals, Jacoby said.

OPC's immediate focus is on ensuring that its deformable mirror can pass a tough regimen of tests. "That will put us on the map," Erten said. "I think that will say, 'OK, OPC is ready for prime time, and they can deliver the systems that are needed for functional HEL (high-energy laser) weapons.'"

With such success, the company would be in a good position to supply new military acquisition programs that need deformable mirrors, Erten said.

Meanwhile, the company is expecting to receive an AS9100C certification—which is like an International Organization for Standardization certification for the aerospace industry—by mid-2011. Also, OPC is working on the Navy's Free Electron Laser, which would protect ships from such surface and air threats as anti-ship cruise missiles or attacks from a swarm of small boats. For such applications, OPC's deformable mirror could maintain high beam quality.

Another potential customer for OPC's mirror is the Defense Department's High Energy Liquid Laser Area Defense System program, whose aim is to develop a high-energy laser weapon system that is lighter than existing laser systems so that it can be integrated onto tactical aircraft, significantly increasing engagement ranges compared with ground-based systems.

CONTACT INFO

Gail Erten
Optical Physics Company
Tel: (818) 880-2907 x 202
E-mail: gerten@OPCI.com
Web: www.opci.com

Find Back Issues and Special Reports Online



Visit www.mdatechnology.net to find past issues of the *MDA TechUpdate* newsletter. The online archive extends back to 1994.

The Web site also features nearly 20 special reports on missile defense technology applications.