



Impact

SBIR Topic

Number:

MDA02-20

Title:

High Structural Efficiency, Low Cost Silicon Lightweight Mirror Systems (SLMS)

Contract

Number:

F29601-02-C-0147

Company Name:

Schafer Corporation,
Chelmsford, MA

Technical Project

Office:

AFRL Space Vehicles Directorate

An example of Air Force supported SBIR technology that met topic requirements and is being commercialized by the small business partner.



Silicon Lightweight Mirrors (SLMS™) For High Energy Laser and Aerospace Systems

- Extremely lightweight mirrors capable of being rapidly fabricated at low cost are essential for development of high-energy laser and space based applications.
- SBIR contracts supported development of Silicon Lightweight Mirror (SLMS') technology offering significant advantages to the Air Force and commercial aerospace and industrial applications.

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Air Force Requirements

The Air Force wants to develop extremely lightweight mirrors for high-energy laser and space-based applications. Requirements call for these mirrors to be structurally efficient and rapidly fabricated while being produced at low cost.

SBIR Technology

SBIR I and II contracts enabled Schafer Corporation to develop Silicon Lightweight Mirror (SLMS') technology for aerospace and industrial applications. SLMS' mirrors are extremely lightweight, less than 10 kilograms per square meter, and still very stiff, with a first mode frequency much greater than 500 Hertz. These characteristics will serve to lower the weight of high-energy laser systems because both the mirrors and the support structure will be lighter than current systems.

A second significant impact of SLMS' technology is the athermal characteristic of these mirrors. The silicon surface of the mirror can be easily polished to a surface figure of 0.02 waves rms at 633 nm at room temperature and will hold that surface figure while operating at temperatures down to 27 degrees Kelvin. This means that these lightweight mirrors are easier to manufacture for low temperature applications and do not have to be actively cooled to prevent distortion, further reducing the weight of the aerospace system transporting the mirror.

Company Benefit

Schafer Corporation has successfully manufactured SLMS' mirrors up to 13 centimeters in diameter, and is now working on manufacturing mirrors up to 56 centimeters in diameter. Since larger mirrors have a much broader range of applications, Schafer Corporation plans to scale SLMS' mirrors from 0.5 meters to 1.5 meters over the next two years.

Dr. William A. Goodman, Director of Schafer Corporation's Lightweight Optical Systems Business Area said, "The development of new high performance silicon and silicon carbide foam core lightweight mirrors will improve the performance of high energy laser systems and while providing improved lightweight, athermal mirrors for space and airborne optical systems. Our partnership with the Air Force has enabled us to build and demonstrate mirrors tailored for DoD applications. Potential applications include beam control and fast steering mirrors suitable for the Airborne Laser System, Space Based Telescopes (LASIT™) for Transformational Communications, Airborne Communications Hybrid Optical RF Dish (CHORD™) technology for Airborne Lasercom/RF, and Athermal Telescopes for High Altitude Relay Mirror Systems."



U.S. AIR FORCE

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