Air Force SBIR/STTR

Innovation

Air Force SBIR/STTR Innovation Story

SBIR Topic Number:
AF04-008

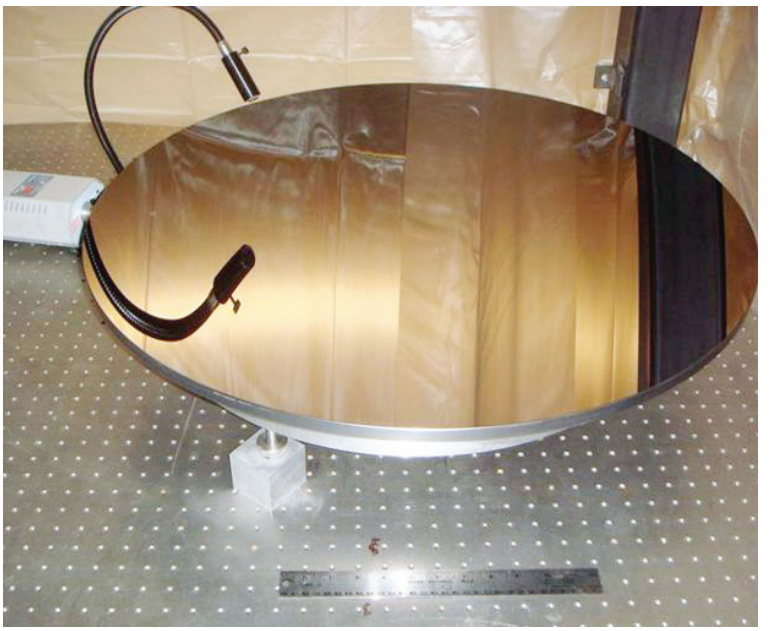
SBIR Title:
Lightweight Optics for High Energy Applications

Contract Number:
FA9451-05-C-0019

SBIR Company Name:
Trex Enterprises Corporation, San Diego, CA

Technical Project Office:
AFRL Directed Energy Directorate, Kirtland AFB, NM

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.



Large Aperture Chemical Vapor Composite Silicon Carbide Mirrors for High Energy Laser

- There is a need to develop a high stiffness, lightweight, low cost mirror fabrication technology for tactical airborne and relay mirror beam control of high energy lasers
- Trex Enterprises Corporation has developed a new Chemical Vapor Composite Silicon Carbide (CVC SiC™) material
- The characteristics of specific stiffness, thermal stability, and optical polish ability make this material an ideal candidate for large-aperture, high energy laser mirrors
- The CVC SiC technology is directly applicable to several prospective Air Force uses, such as beam expanders for tactical airborne applications, telescopes which have an athermal requirement for geosynchronous earth observations, space-based imaging and surveillance instruments, and beam walk mirrors and fast steering mirrors
- Trex has successfully transitioned the technology to other government organizations and government contractors

377ABW-2010-1260

Air Force Requirement

Lightweight optics capable of handling High Energy Laser (HEL) irradiation can potentially benefit airborne and relay mirror systems in tactical missions. While significant progress has been made in lightweight mirror technology under the Advanced Mirror System Demonstrator and other programs, developmental challenges exist in many areas necessary to material procurement, fabrication, testing and scaling. There is a need to develop a high stiffness, lightweight, low cost mirror fabrication technology for tactical airborne and relay mirror beam control of high energy lasers.

SBIR Technology

Trex Advanced Materials Group has developed a new Chemical Vapor Composite Silicon Carbide (CVC SiC™) material. The characteristics of specific stiffness, thermal stability, and optical polish ability make this material an ideal candidate for large-aperture, high energy laser mirrors.

This SBIR Phase II program demonstrated several objectives for CVC SiC for use in HEL systems:
- Produce, polish, and coat laser mirror coupons for damage threshold testing
- Perform laser testing of the lightweight mirrors that were produced during the Phase I project with the intent of qualifying the technology for use in HEL systems
- Demonstrate water-jet machining to a lightweight, full-depth subscale mirror demonstrator substrate
- Design, analyze, produce and polish a prototype primary mirror with a clear aperture of 75 cm diameter

Potential Application

The CVC SiC technology is directly applicable to many current needs of the Air Force, including:
- Beam expanders for tactical airborne applications
- Telescopes which have an athermal requirement for geosynchronous earth observations (GEO) as well as an athermal requirement at cryogenic temperatures
- Space-based imaging and surveillance instruments such as telescopes and spectrometers
- Beam walk mirrors and fast steering mirrors of space-based and high-altitude relay mirror systems and terrestrial HEL systems
- Light detection and ranging (LIDAR) and laser detection and ranging (LADAR) telescopes for remote sensing applications

Company Impact

"The goal of this program was to demonstrate a solid capability and methodology for the design and fabrication of high performance CVC SiC optical mirrors for high energy laser applications," states Dr. Bill Goodman, Director, Optical Programs, Trex Enterprises Corporation. "This Phase II program had several objectives, all of which were achieved in spite of serious challenges in the areas of process equipment, prime power and process scale-up. During the tenure of this project, Trex has successfully transitioned the technology to other government organizations and government contractors."

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