Active Project (2016 - 2016)

High Power, Thermally Optimized Blue Laser for Lidar, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

To enable widespread and rapid airborne bathymetric lidar to adequate depths in many ocean regions a low-cost, rugged, and high energy pulsed laser source must be developed in the ocean water transmittance spectrum of 450 - 490 nm. The ideal laser source will be high performance for lidar (high pulse energy, high rep rate, short pulse duration) with specific targeted emission spectrum to meet ocean water transmittance and filtering requirements. It will also feature low SWaP and a rugged form factor with high reliability for continual use on mobile platforms. No existing laser source can meet these demanding requirements. To address this challenge and meet NASA's lidar source needs, Bridger Photonics, Inc. (Bridger) proposes creating a high power Q-switched, off-line Nd:YAG source at 946 nm, which, when frequency doubled to 473 nm, will provide high transmittance through ocean waters. Bridger's design will leverage three key innovations: efficient, end-pumped, low-quantum-defect architecture; gain crystal design for optimal heat removal; and robust monolithic, alignment-free fabrication. The proposed design would allow for widespread deployment of mobile ocean-penetrating lidar transmitters. Bridger's overall goal for this Phase I effort is construct a breadboard prototype laser emitting 10 WAVG at 473 nm with a viable pathway to a rugged, turn-key system with >10% wall-plug efficiency to be built and delivered in a Phase II effort. Bridger has modeled and constructed similar lasers on Phase I SBIR efforts previously and will apply the innovations developed there towards this new system for NASA.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: NASA's primary application for the proposed transmitter would be ocean bathymetry and underwater object detection. The compact size, rugged design, and efficient electrical-to-optical conversion of

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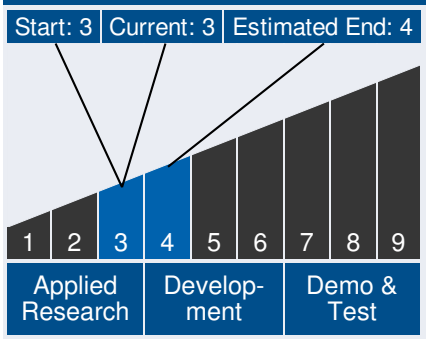
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

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Bridger's proposed laser would make it ideal suited for a mobile ship, airborne, or even satellite platform. Due to larger scattering at shorter wavelengths, the 473 nm source would be favored over the traditional 532 nm source for most cloud and aerosol lidar applications. The 473 nm beam would also work well as a general purpose OPO pump beam especially for generating green to near-IR signal waves or into the SWIR spectral band. The former is an intermediate step towards generating the UV wavelengths used for measuring tropospheric ozone via differential absorption lidar, while the latter is useful for profiling other important greenhouse gases and pollutants such as CH4, CO2, H2O, CO, NO2, and many others. Finally the 946 nm fundamental source would be useful for water vapor lidar.

To the commercial space industry:

Potential Non-NASA Commercial Applications: The proposed laser would be the most compact, high-power, solid-state blue laser source currently available. Within the lidar market there are many organizations that would be potential customers for an ocean penetrating blue lidar transmitter for bathymetry and underwater object detection: the Navy, NOAA, the EPA, the National Geospatial Intelligence Agency, and the Coast Guard for instance. The delivered lidar system would provide the Navy with the capability to conduct rapid and widespread object detection beneath the ocean surface from an airborne platform. This will be an invaluable tool for searching for submarines, mines, and mapping the ocean floor. Bridger envisions a wide variety of additional applications for this laser including gas sensing lidar, hard-target ranging, ablation applications including mass spectrometry, nonlinear spectroscopy and as general purpose OPO pump. The proposed transmitter could easily be adapted to detect a host of gasses, most of which are detected in the short wave infrared and mid-infrared spectral regions which are well suited for a seeded OPO pumped either with the 946 or 473 nm beam.

Management Team *(cont.)*

Principal Investigator:

- Jason Brasseur

Technology Areas

Primary Technology Area:
Science Instruments, Observatories, and Sensor Systems (TA 8)
└ Remote Sensing Instruments and Sensors (TA 8.1)
└ Lasers (TA 8.1.5)

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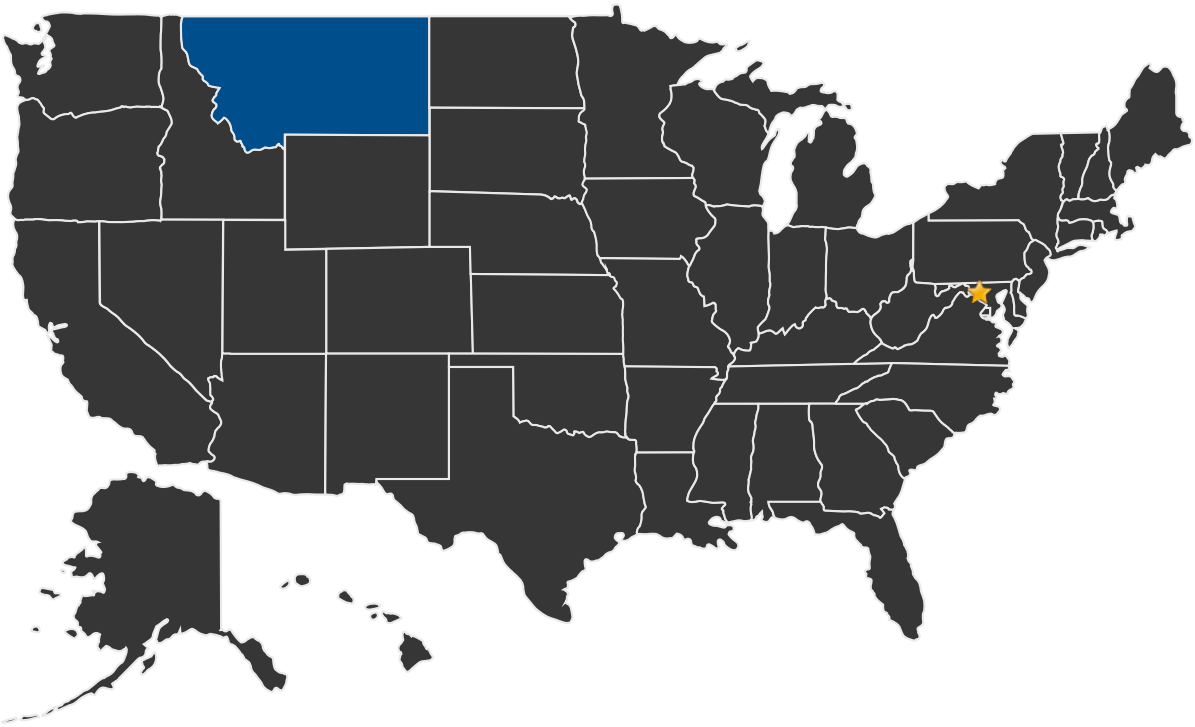
U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Goddard Space Flight Center

Other Organizations Performing Work:

- Bridger Photonics, Inc. (Bozeman, MT)

PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23219)

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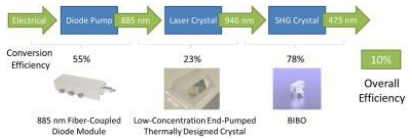
IMAGE GALLERY



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DETAILS FOR TECHNOLOGY 1

Technology Title

High Power, Thermally Optimized Blue Laser for Lidar, Phase I

Potential Applications

NASA's primary application for the proposed transmitter would be ocean bathymetry and underwater object detection. The compact size, rugged design, and efficient electrical-to-optical conversion of Bridger's proposed laser would make it ideal suited for a mobile ship, airborne, or even satellite platform. Due to larger scattering at shorter wavelengths, the 473 nm source would be favored over the traditional 532 nm source for most cloud and aerosol lidar applications. The 473 nm beam would also work well as a general purpose OPO pump beam especially for generating green to near-IR signal waves or into the SWIR spectral band. The former is an intermediate step towards generating the UV wavelengths used for measuring tropospheric ozone via differential absorption lidar, while the latter is useful for profiling other important greenhouse gases and pollutants such as CH4, CO2, H2O, CO, NO2, and many others. Finally the 946 nm fundamental source would be useful for water vapor lidar.