NASA SBIR/STTR Technologies

Solid State Multiwavelength LIDAR for Volcanic Ash Monitoring

Physical Sciences Inc. – Andover, MA

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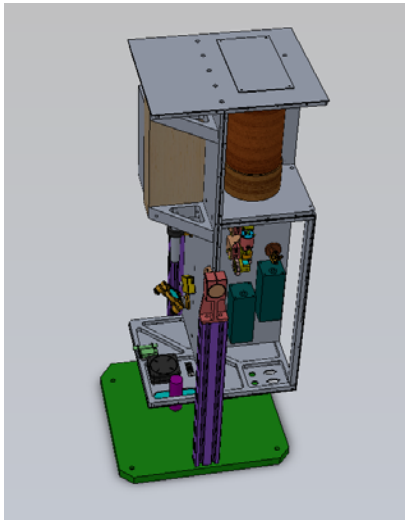

- CAD model of ground-based UV Backscatter LIDAR under development at PSI for DoE.
- LIDAR uses a compact tripled Nd:YAG laser to produce 355 nm
- Chassis size is 11 x 12 x 27 inches

Identification and Significance of Innovation

- Physical Sciences Inc. proposes to develop an Airborne Multiwavelength LIDAR with polarization analysis capability that will be able to identify volcanic ash clouds at distance. The sensor will be developed specifically for airborne deployment, including on Unmanned Aerial Systems.
- The sensor is based on newly available solid-state laser transmitters such as metal doped fiber amplifiers.
- The sensor will be designed with sensitivity to match newly established damage threshold limits for volcanic ash and to have a range of 7-10 km in order to provide sufficient standoff warning.

Estimated TRL at beginning and end of contract: 2-3

Technical Objectives and Work Plan

- The technical objectives are to establish the operating parameters for the LIDAR via modeling and to create a conceptual design for an airborne LIDAR payload capable of monitoring volcanic ash clouds to concentrations below the accepted damage threshold.
- The proposed program consists of the following tasks:
- ***Task 1*** ***Kick-off Meeting.*** Meet with NASA personnel to identify the appropriate measurement and system requirements as well as the concept of operations for an airborne LIDAR for volcanic ash detection.
- ***Task 2*** ***System Modeling.*** Carry out modeling of the backscatter coefficient of volcanic ash clouds as a function of wavelength to determine optimal wavelengths for the LIDAR transmitters. Use measured tropospheric ash size distributions where available.
- ***Task 3*** ***Conceptual Prototype System Design.*** Develop a complete conceptual design for a compact, Airborne Multiwavelength LIDAR. Return power modeling will determine required transmit power and transceiver telescope aperture size. Identify the laser hardware. Develop notional CAD model.
- ***Task 4*** ***System Design Review.*** Meet with NASA personnel to review the system design and determine the scope and goals of the Phase II program.

NASA and Non-NASA Applications

- The Multiwavelength Lidar will be well suited for deployment on small aircraft such as UASs. It is intended to measure profiles of aerosols from a UAS for science missions and for satellite validation, such as for the CALIOP LIDAR, a two-wavelength polarization-sensitive elastic backscatter lidar, aboard the CALIPSO satellite.
- Other applications include serving as a ground based platform to address a variety of air quality aerosol monitoring applications including yellow dust, biomass burning, and coal-fired power generation facility compliance.

Firm Contacts

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NON-PROPRIETARY DATA