

3-color DPAS Aerosol Absorption Monitor, Phase II Project

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



ABSTRACT

We propose to develop a highly sensitive and compact RGB DPAS aerosol absorption monitor for NASA's Airborne Measurement Program. It will measure aerosol light absorption simultaneous at three spectral regions: blue, green and red. The proposed measurement technique takes advantage of the current rapid development on high-power semiconductor lasers MEMS microphones. It will eventually weigh less than 25 pounds and consume approximately 300W electrical power. It will also be capable of being remotely controlled and being operated at a variety of sampling pressure conditions for the airborne measurements. Since majority of the electronic and optical components of the proposed system are commercially available except the home-designed acoustic cells, its total manufacturing cost could be less than \$20,000 per unit.

ANTICIPATED BENEFITS

To NASA funded missions:

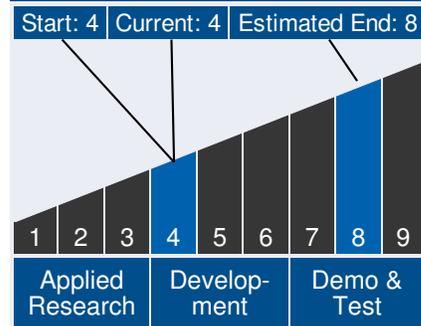
Potential NASA Commercial Applications: The primary NASA need for this technology is to measure spectrally resolved light absorption by atmospheric aerosols for its Airborne Measurement program. At present, aerosol light absorption is measured by collecting sample on a filter subtract and measuring light extinction and scattering of the collected samples during the airborne measurements. This method suffers from a number of intrinsic errors. The proposed RGB DPAS technique will be far more sensitive than the filter-based techniques, and is capable of providing 1s data acquisition measurement. Additionally, past NASA programs such as EXCAVATE, APEX, UNA-UNA, and AAFEX have had as a major focus, on the measurement of black carbon emissions from civilian aircraft engines. Since mass absorption coefficient of black carbon is known at several visible wavelengths, the proposed DPAS aerosol absorption monitor can be used as a black carbon emission monitor.



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Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

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To the commercial space industry:

Potential Non-NASA Commercial Applications: We expect that the 3-color RGB DPAS aerosol absorption monitor developed under this program will significantly benefit the atmospheric science community in characterizing the radiative properties of ambient aerosols. The ability of the proposed instrument to simultaneously measure particle absorption with good time resolution and high precision in three colors will enable continuous measurements of the particle optical absorption that can be directly used by regional and global climate forcing models. In combination with the Cavity Attenuated Phase-Shift (CAPS) extinction monitor, which represents a dramatic improvement on current particle extinction measurement technology, single particle albedo of ambient aerosols could be directly determined. Since aerosol scattering of solar radiation causes atmospheric cooling, whereas absorption can cause atmospheric warming, direct measurements on single particle albedo of ambient aerosols are critical in understanding aerosol effect on the Earth radiative balance.

Management Team *(cont.)*

Principal Investigator:

- Zhenhong Yu

Technology Areas

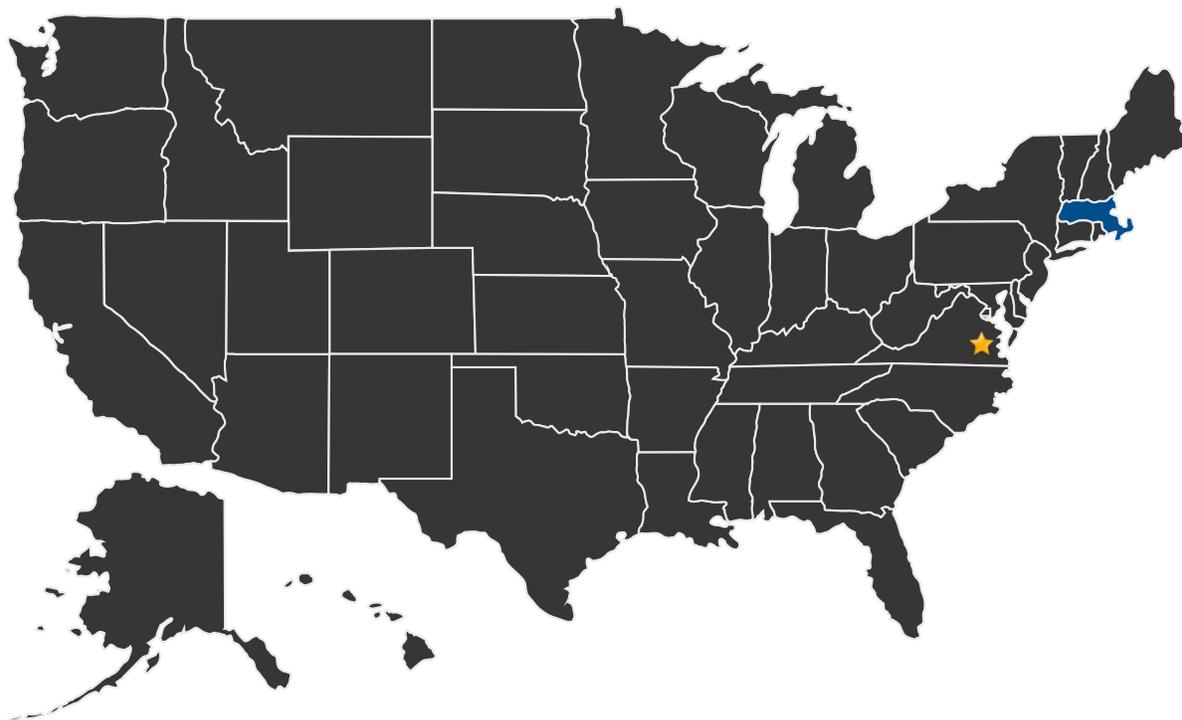
Primary Technology Area:

Science Instruments, Observatories, and Sensor Systems (TA 8)

- └ Remote Sensing Instruments and Sensors (TA 8.1)
 - └ Detectors and Focal Planes (TA 8.1.1)



U.S. WORK LOCATIONS AND KEY PARTNERS



- U.S. States With Work
- ★ **Lead Center:**
Langley Research Center

Other Organizations Performing Work:

- Aerodyne Research, Inc. (Billerica, MA)

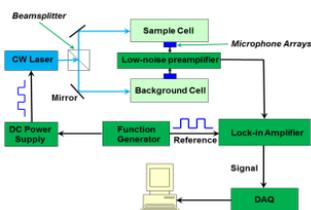
PROJECT LIBRARY

Presentations

- Briefing Chart
 - (<http://techport.nasa.gov:80/file/23119>)



IMAGE GALLERY



3-color DPAS Aerosol Absorption Monitor, Phase II

DETAILS FOR TECHNOLOGY 1

Technology Title

3-color DPAS Aerosol Absorption Monitor, Phase II

Potential Applications

The primary NASA need for this technology is to measure spectrally resolved light absorption by atmospheric aerosols for its Airborne Measurement program. At present, aerosol light absorption is measured by collecting sample on a filter subtract and measuring light extinction and scattering of the collected samples during the airborne measurements. This method suffers from a number of intrinsic errors. The proposed RGB DPAS technique will be far more sensitive than the filter-based techniques, and is capable of providing 1s data acquisition measurement. Additionally, past NASA programs such as EXCAVATE, APEX, UNA-UNA, and AAFEX have had as a major focus, on the measurement of black carbon emissions from civilian aircraft engines. Since mass absorption coefficient of black carbon is known at several visible wavelengths, the proposed DPAS aerosol absorption monitor can be used as a black carbon emission monitor.