

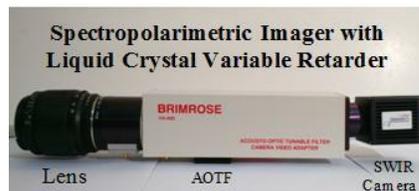
# Acousto-Optic Tunable Filter-Based Polarimetric Spectral Sensor With Progressive Algorithm For Material Analysis and Mapping, Phase II Project

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



## ABSTRACT

One of the strategic goals of NASA's Planetary Science Mission is to advance scientific knowledge of the origin and history of the solar system, the potential for life elsewhere. The current STTR addresses this strategic goal. The proto-type AOTF-based SWIR spectropolarimetric imaging system developed in Phase I (which will be further optimized and integrated with optimal algorithm/software in Phase II), will be a useful tool in determination of chemical composition and physical characteristics of planets of interest, short period comets, primitive meteorites and asteroid bodies, and in identifying the sources of simple chemicals important to prebiotic evolution and the emergence of life. The concept and proto-type instrument developed in this program operates as a hyper-spectral imager as well as a spectropolarimeter. It is capable of obtaining hyperspectral images and the polarization state at the pixel level. It is compact, rugged in nature, fully electronically controlled and has no moving parts. The images can be taken at any desired wavelength/s within the operational range, in any sequence. Hyperspectral data cubes will be collected using aforementioned systems. Before processing the spectral information in the data, system non-uniformity correction, spectral response correction, and atmospheric correction will be applied to the data.

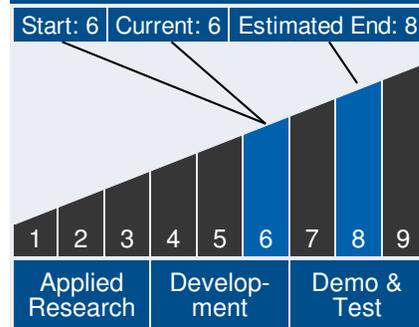


Acousto-Optic Tunable Filter-Based Polarimetric Spectral Sensor With Progressive Algorithm For Material Analysis and Mapping

## Table of Contents

Abstract . . . . .	1
Anticipated Benefits . . . . .	1
Technology Maturity . . . . .	1
Management Team . . . . .	1
Technology Areas . . . . .	2
U.S. Work Locations and Key Partners . . . . .	3
Details for Technology 1 . . . . .	4

## Technology Maturity



## Management Team

### Program Executives:

- Joseph Grant
- Laguduva Kubendran

*Continued on following page.*

## ANTICIPATED BENEFITS

### To NASA funded missions:

Potential NASA Commercial Applications: There are a number of potential NASA applications for the AOTF-based spectropolarimetric imaging. These include material data basing, structural validation, combustion spectroscopy, non-destructive testing of space compliant parts, and qualification of time-sensitive materials in space. As more and more missions are undertaken involving landers, diverse and accurate databases of

# Acousto-Optic Tunable Filter-Based Polarimetric Spectral Sensor With Progressive Algorithm For Material Analysis and Mapping, Phase II Project

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



the spectral and polarimetric characteristics of various materials will be needed to quickly and accurately identify surface solid, liquid and gaseous materials. The spectral and polarimetric data obtained via 2-dimensional spectropolarimetric imaging can be used to view warping, small fractures and other deficiencies/issues that may occur in the structure of space based mission equipment. The 2-dimensional nature of AOTF based hyperspectral imaging allows for area spectral data collection during combustion events such as in ramjet and scramjet studies. Spectropolarimetric imaging allows for the non-contact, non-destructive analysis of the surface of components. And data models will allow the qualification of time sensitive consumable items in space. For instance, the potency of pharmaceuticals. The proposed device can also be used in various missions for in situ, non-destructive analysis of dust and icy surfaces, identification of organics, atmospheric radiometry, and rheology.

## To the commercial space industry:

Potential Non-NASA Commercial Applications: The commercial product that will result from this work, an AOTF-based spectropolarimeter, has numerous non-NASA commercial applications. The spectropolarimetric system can be used in anomaly detection, countermeasure research, camouflage concealment and detection, and identification and discrimination of materials. Moreover, such a fast system will have varied applications in atmospheric monitoring and other commercial applications. The proposed electro- and acousto-optic will provide fast and real time information about the status of the atmosphere, thus the impact of human activities on the environment can be evaluated more quickly and more accurately. This device can help to facilitate the objectives of the Earth Science Enterprise (ESE) and the Earth Observing System (EOS). Thus the design and development of an imaging system as an outcome of the proposed research will have a multitude of applications in all sectors of life. Moreover, the instrumentation

### Management Team (cont.)

#### Program Manager:

- Carlos Torrez

#### Principal Investigator:

- Sudhir Trivedi

### Technology Areas

#### Secondary Technology Area:

Science Instruments, Observatories, and Sensor Systems (TA 8)  
└ In-Situ Instruments and Sensors (TA 8.3)

# Acousto-Optic Tunable Filter-Based Polarimetric Spectral Sensor With Progressive Algorithm For Material Analysis and Mapping, Phase II Project

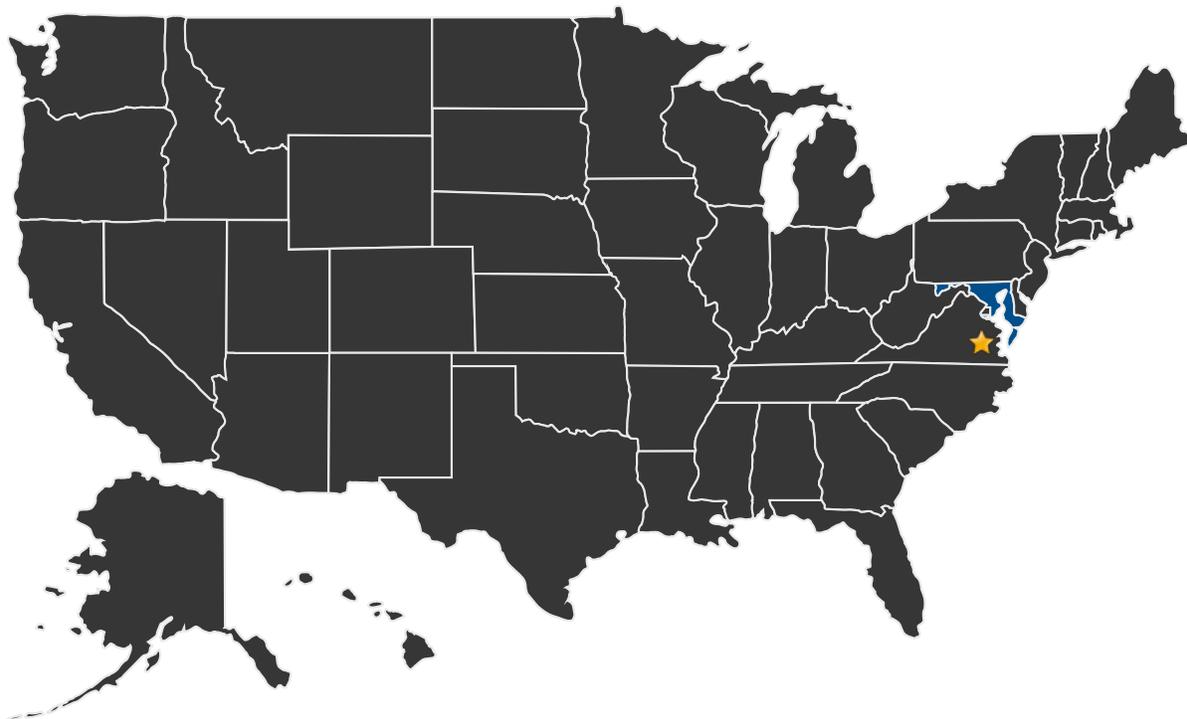
SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



that will result from the proposed program will be immensely valuable for on-line process and feedback control and R&D in a wide variety of industries such as pharmaceuticals, chemicals, pulp and paper, biotechnology, just a name a few.

## U.S. WORK LOCATIONS AND KEY PARTNERS

---



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

### Other Organizations Performing Work:

- Brimrose Technology Corporation (Sparks, MD)
- UNIVERSITY OF MARYLAND BALTIMORE COUNTY

# Acousto-Optic Tunable Filter-Based Polarimetric Spectral Sensor With Progressive Algorithm For Material Analysis and Mapping, Phase II Project

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



## PROJECT LIBRARY

---

### **Presentations**

- Briefing Chart
  - (<http://techport.nasa.gov:80/file/18064>)

## DETAILS FOR TECHNOLOGY 1

---

### **Technology Title**

Acousto-Optic Tunable Filter-Based Polarimetric Spectral Sensor With Progressive Algorithm For Material Analysis and Mapping