Air Force SBIR/STTR

Innovation

Air Force SBIR/STTR Innovation Story

SBIR Topic Number:
AF06-011

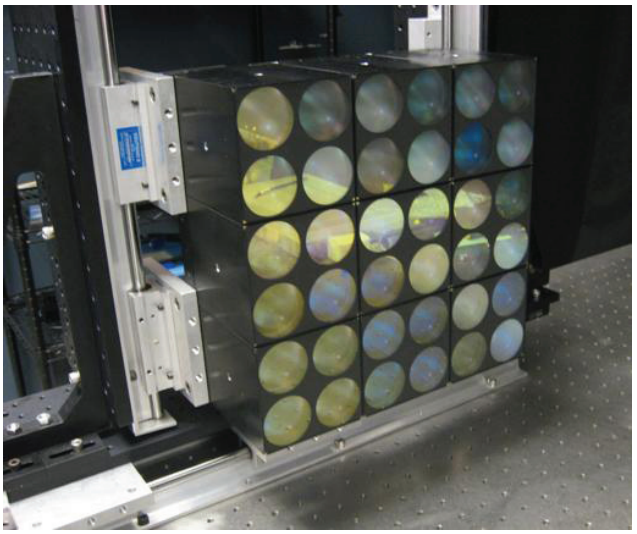
SBIR Title:
Synthetic/Sparse Aperture Imaging Techniques

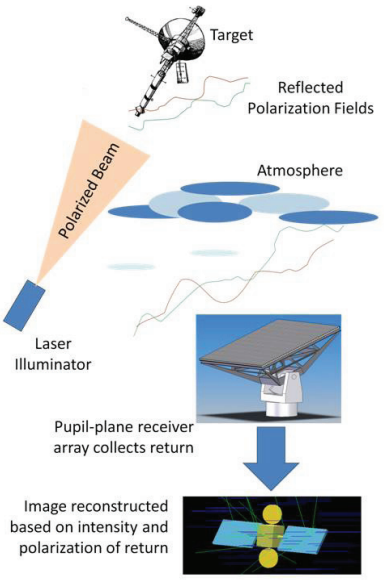
Contract Number:
FA9451-07-C-0034

SBIR Company Name:
Polaris Sensor Technologies, Inc., Huntsville, AL

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.





Synthetic Aperture Imaging Polarimeter

- There is a strong need for the ability to terrestrially image satellites, resident space objects (RSOs), and other low earth orbit (LEO) objects for Space Situational Awareness (SSA) applications
- The Synthetic Aperture Imaging Polarimeter (SAIP) investigates an alternative means to large aperture telescopes with adaptive optics systems for imaging an object in LEO illuminated by laser radiation, providing a flexible platform for imaging of objects in LEO that is not limited by atmospheric turbulence and stray light
- A prototype tiled array was built and tested; the tile concept allows for the system to be scalable and facilitates ease-of-maintenance issues in the field
- The robustness and flexibility of Polaris Sensor Technologies' SAIP concept allows for direct monitoring of the sky in non-ideal locations, such as in low altitude and urban environments

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Air Force Requirement

There is a strong need for the ability to terrestrially image satellites, resident space objects (RSOs), and other low earth orbit (LEO) objects for Space Situational Awareness (SSA) applications.

The Synthetic Aperture Imaging Polarimeter (SAIP) investigates an alternative means to large aperture telescopes with adaptive optics systems for imaging an object in LEO illuminated by laser radiation. The SAIP technology provides a flexible platform for imaging of objects in LEO that is not limited by atmospheric turbulence and stray light.

SBIR Technology

A prototype array consisting of 36 divisions of amplitude polarimeters was built and tested. The prototype was built in a 3x3 tiled array, with each tile containing a 2x2 array of polarimeters. The tile concept allows for the system to be scalable and facilitates ease-of-maintenance issues in the field. Custom, high gain electronics were created with ultra low noise characteristics to detect the returning laser radiation. The completed prototype was a compact, robust assembly measuring approximately 10"x10"x4".

Potential Application

The ability to form high resolution images of RSOs through conventional telescope optics is limited mainly by atmospheric turbulence and stray light. Conventional large aperture telescopes are typically placed at high elevations far away from urban environments to minimize the atmospheric turbulence and eliminate stray light radiation, thereby improving "seeing" conditions.

The SAIP concept provides an alternative means of imaging objects of interest in LEO for SSA applications that is insensitive to atmospheric turbulence and stray light. The robustness and flexibility of the SAIP concept allows for direct monitoring of the sky in non-ideal locations, such as in low altitude and urban environments.

Company Impact

The development of the SAIP represents a potential alternative for replacing expensive adaptive optics systems. While further development to a full scale SAIP system is awaiting resources, the technology developed has already been presented to the SSA community to a good response and has prompted further discussions in that community. In addition, Polaris has benefited from the exposure to the Air Force SSA community and is pursuing applications of some other polarization based concepts as a result.

Polaris' president, Dr. David Chenault, said, "The SAIP demonstrator is an important step forward and will drive company growth and further technology development either with a full scale version of the SAIP or through additional sensor suites based on similar technology."

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