NASA SBIR/STTR Technologies

T4.01-9919 - Multi-functional Optical Subsystem Enabling Laser Communication on Small Satellites

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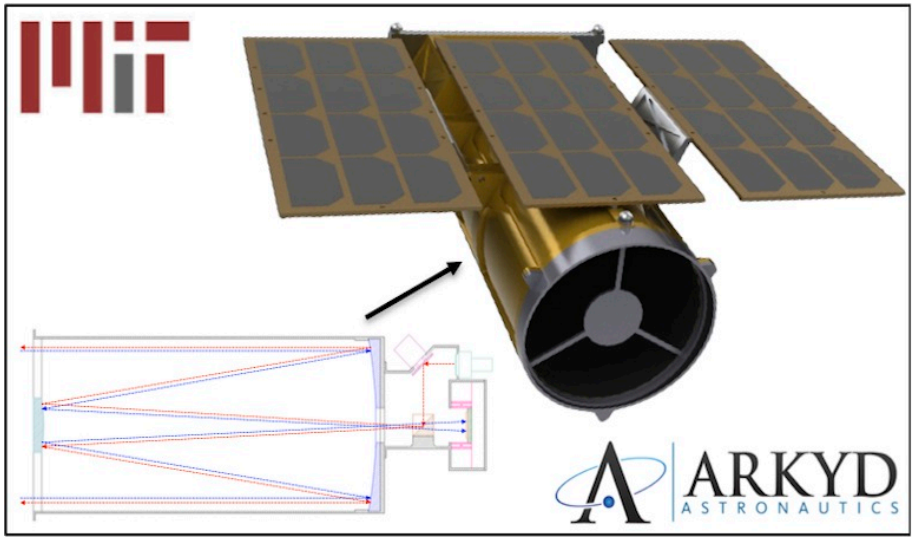

Identification and Significance of Innovation

This multi-functional small satellite optical subsystem is innovative in several ways:

* It is a multi-functional system, providing attitude determination, stability control, scientific observation and laser communication capabilities in one package, which has never been achieved before;

* It is capable of high-precision optical stability down to the sub-arcsecond level, an increase in capability of almost 2 orders of magnitude over current small satellite stability performance, enabling optical communication at high data rates or over long (interplanetary) distances; and,

* It functions within the constraints of a small satellite of less than 20 kg mass and 10,000 cm3 total volume, which adds several limiting constraints to the system.

Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)

Technical Objectives and Work Plan

1. Extend prior ExoplanetSat simulation work to pathfind fine control performance characteristics necessary to improve the current performance of 10 arcsec (3-sigma) by two orders of magnitude to 0.1 arcsec (3-sigma); Arkyd:Contributing MIT:Lead

2. Establish a preliminary design of the multi-functional optical subsystem necessary for optical communication, fine-pointing correction, while maintaining capability to use the prime optic for science observations and fine-attitude knowledge.; Arkyd:Lead MIT:Contributing

3. Evaluate coupled performance of receive/transmit optical stability, and identify feasibility of performance improvements for Phase II implementation; Arkyd:Co-Lead MIT:Co-Lead

4. Perform application-specific performance analyses of the identified preliminary design, including its ability to be used as a shared prime-optic; Arkyd:Lead

5. Prepare Phase I final report and document preliminary subsystem design; Arkyd:Lead

NASA Applications

This proposal enables progress toward several NASA Strategic Goals, Grand Challenges, and Technology Roadmaps:
* NASA 2010 Strategic Goals: 1,2,3
* Grand Challenges: Economical space access, NEO detection and mitigation, telepresence in space, new tools of discovery
* Technology Roadmaps: Science instruments, observatories and sensor systems, Communication and navigation systems, Human exploration destination systems

Non-NASA Applications

* High bandwidth applications for small satellites in LEO
* Low bandwidth applications for small spacecraft in deep-space
* Scientific and commercial observations requiring high optical stability
* Terrestrial high-bandwidth optical data communication

Firm Contacts

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