S2.02-1106 - Precision In-Space Manufacturing for Structurally-Connected Space Interferometry

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NON-PROPRIETARY DATA

IDENTIFICATION AND SIGNIFICANCE OF INNOVATION

Made In Space, Inc. (MIS) proposes the construction of large baseline structures, 15 meters or greater, for infrared space interferometry missions by autonomous in-space manufacturing. This enables the deployment of large trusses unconstrained by launch restrictions that meet science requirements for the high angular resolutions (less than 0.3 arcseconds) necessary to detect planets near bright stars and measure individual objects in star clusters. In this Phase I effort, MIS investigates the mass, performance, and mission planning benefits of in-space manufacturing for structurally-connected interferometers (SCI). Adapting the MIS Optimast technology to produce long baseline structures with low thermal expansion materials enables simultaneous structural fabrication and positioning of the optical subsystems to the required static, thermal deflection, and oscillation tolerances. An Optimast-SCI baseline structure provides superior absolute position control over traditional deployable structures at much lower cost, mass, and integration complexity and eliminates parasitic mass.

TECHNICAL OBJECTIVES AND WORK PLAN

The Optimast-SCI development is guided by three technical objectives.

- Create a Design for a Structurally-Connected Interferometer Baseline Structure Enabled by In-Space Manufacturing
- Develop an Architecture for Multifunctional In-Space Manufactured Structures
- Demonstrate the Scalability of In-Space Manufactured Precision Structures

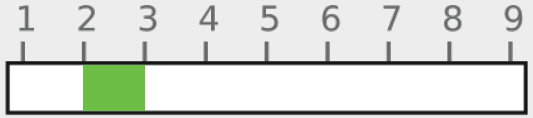
For the proposed effort, MIS will leverage the technical approach successfully demonstrated during execution of the 3D Printing in Zero-G Experiment (3DP), the Additive Manufacturing Facility (AMF), and the entirely commercial MIS Fiber project. The technical objectives will be accomplished with a work plan divided into the following five tasks:

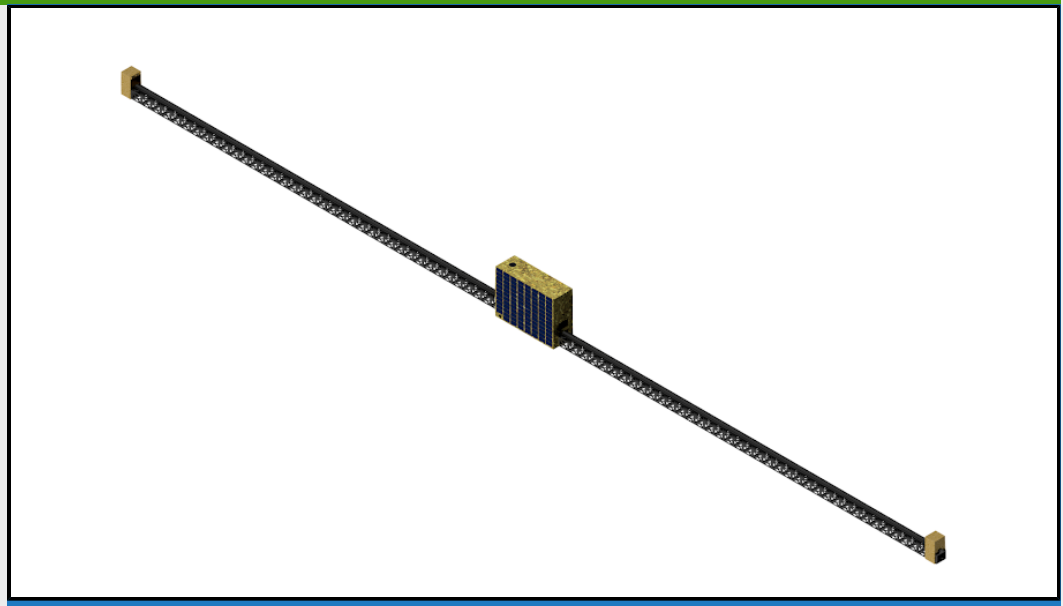
1. Develop Concept of Operations (ConOps) and Supporting Requirements
2. Trade Studies of Passive and Active Thermal Structural Control
3. Trade Studies of Optimast Scalability with Interferometer Performance
4. Preliminary Design of Optimast-SCI
5. Create Integration and Development Roadmap

The deliverables are reports on the CONOPS and functional trade studies, a preliminary design of the Optimast-SCI system, and a System Integration Plan for Phase II and III.

TRL

Estimated





NASA APPLICATIONS

Long baseline interferometry is necessary to provide the sub-arcsecond angular resolution and high spectral resolution for collecting spectral data on protostellar disks, finding protoplanets hidden in dust fields, and resolving questions about how galaxies merge. The Optimast-SCI technology is also applicable to the development of large deployable antennas, manufactured structures for large backplanes and other spacecraft systems, and structurally-connected interferometry in other wavelengths.

NON-NASA APPLICATIONS

MIS has preliminarily identified opportunities for Earth remote sensing and space situational awareness for large optical interferometers in Earth orbit. Depending on the customer requirements for spatial resolution, target resolution, and imaging wavelength, MIS plans to consult with industry partners and further develop concepts for structurally-connected interferometers intended for commercial applications.

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