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PRECISION IN-SPACE MANUFACTURING FOR STRUCTURALLY CONNECTED INTERFEROMETRY

Abstract

In-Space Robotic Manufacturing and Assembly (IRMA) enables versatile, new space mission architectures. As planned observatories such as the James Webb Space Telescope (JWST) and Wide Field Infrared Survey Telescope (WFIRST) push the technical and programmatic limits of space-based observatories, innovative mission architectures rooted in IRMA technologies are required to meet the demands nestled at the forefront of high-spatial resolution astrophysics. Space-based interferometry navigates this bleeding edge and enables cost-effective observation of faint objects at high angular resolution.

This paper details the use of Made In Space (MIS) Optimast technology to produce a two-aperture system at Sun-Earth L2 (SEL2) utilizing the principle of Structurally Connected Interferometry (SCI). Matured via extensive ground testing in a relevant, space-like Thermal Vacuum (TVAC) environment, Optimast enables the manufacturing and deployment of arbitrarily long booms unconstrained by launch loads or volumetric constraints of standard vehicle fairings. Using Optimast's proven in-space Additive Manufacturing (AM) capabilities, the Optimast-SCI concept enables the efficient packaging of a long-baseline interferometer for launch while retaining the ability to place, coherently and at a large separation, two apertures in order to achieve a greater effective angular resolution in the milliarcsecond regime. The AM process foundational to Optimast-SCI uniquely bypasses limitations of traditional deployable structures by enabling boom designs that eliminate parasitic mass while maintaining required positional control authority at a lower cost and complexity than their deployable predecessors.

This paper will also highlight the scientific potential of Optimast-SCI. Compared to expensive ground-based observatories, the space environment liberates Optimast-SCI from the hindrance of atmospheric turbulence, and achieves milliarcsecond precision in a cost-effective manner. Precision of this magnitude achieves the science requirements for applications such as characterization of exoplanets near bright stars and measurement of individual objects within dense star clusters.