T5.05-2204 - Solar Sail Tubular Mast

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NON-PROPRIETARY DATA

IDENTIFICATION AND SIGNIFICANCE OF INNOVATION

SSTM enables simple, low risk solar sails at the 10,000 m^2 scale. Complex guywires and spin-tensioning / deployment are not required to achieve a sail and boom mass per area of 5 g/m^2. SSTM increases structural performance from that of a low performance open cross section TRAC Boom to a high-performance truss of tape-springs boom. The proposed innovations represent the next leap forward in HSC and CTM boom technologies. For example, cross-section innovations over prior CTMs booms include an extensively trussed cross-section, increased local curvature, and faceted/skewed sides for increase torsional stiffness. This further enables the truss members to be highly curved, increasing buckling strength over cross-sections that mimic a tube. These features are unlike current competing CTMs that are essentially a constant thickness with lower performance tubular shell cross-sections. An innovative recirculating belt deployer is also proposed. The deployer exhibits very low stowed volume, allowing four sail booms to be wrapped and deployed independently without increasing spacecraft volume.

TECHNICAL OBJECTIVES AND PROPOSED DELIVERABLES

The primary objective of the proposed work is to increase the structural mass efficiency of the solar sail tubular mast to a bending performance index greater than 1,000, more than double the performance (half the mass) of current solar sail boom technologies. Boom mass is typically on the same order as the sail mass such that a factor of two improvement in boom mass results similarly significant performance improvements at the sail level. The low mass of SSTM becomes enabling as sail size is increased and boom structural requirements increase even further. Additional technical objectives include development of system level structural models demonstrating the use of SSTM in practical solar sail architectures and tailoring recirculating belt deployer technologies for solar sail systems. Current recirculating belt deployers are designed for much higher boom loads and a significant mass reduction is anticipated. While the program includes prototype fabrication and testing activities, the program deliverables are restricted to contractually mandated reports.

TRL

Estimated

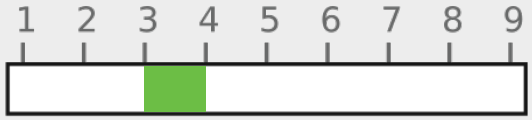
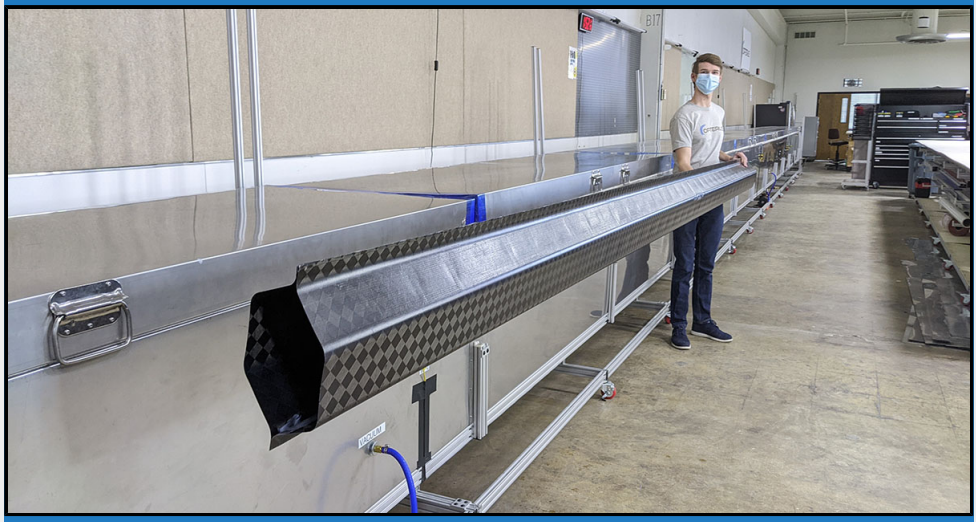


IMAGE TITLE: 5-meter CTM



NASA APPLICATIONS

While optimized for sail sails, SSTMs are also performance enhancing and enabling for a broad range of deployable boom applications. These include satellite and lunar surface solar power systems, large science antennas and instrument booms, telescope sunshades, telescope occulter systems, and lunar towers.

NON-NASA APPLICATIONS

DoD and commercial applications additionally include large communications and sensor platforms. SSTMs are also enabling for large area thermal and RF shield systems.

FIRM CONTACTS

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