Optical Shield for the Starshade Inner Disc Subsystem

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The objectives of this proposed TDEM are to:

(1) Develop the requirements for and design of an Optical Shield (OS) for the Starshade Inner Disc Subsystem (IDS) of the Starshade Development Testbed (SDT).

(2) Fabricate, integrate and test a high fidelity 10 m diameter OS prototype that is compatible with the SDT. The Critical Milestone will demonstrate reliable deployment and validate that deployed petal position tolerances are achieved in a repeatable fashion.

The primary function of the OS is to make the IDS opaque. The OS is the least mature part of the IDS. It must stow in a compact volume, deploy reliably with the IDS perimeter truss and not significantly degrade the deployed accuracy and thermal stability of the truss structure.

This proposal responds to the #1 priority for Medium Scale space activities recommended by the 2010 Astrophysics Decadal Report: to develop technology to directly image rocky exoplanets in the habitable zone through starlight suppression. As stated in the report: “For the direct-detection mission itself, candidate starlight suppression techniques (for example, interferometry, coronagraphy, or starshades) should be developed to a level such that mission definition for a space-based planet imaging and spectroscopy mission could start late in the decade in preparation for a mission start early in the 2020 decade.” The proposed TDEM activity also contributes to the closure of Starshade technology gap #5 from the ExEP Technology Plan and directly addresses starshade technology development needs (a) through (c) on page D.8-7 of the current SAT call: “For starshade technologies there is interest in (a) deployment activities such as petal unfurling mechanisms and latches, (b) shielding (aka blanketing) concepts and demonstrations such as opacity testing and resistance to micrometeoroids, (c) stray light investigation and analyses, including petal surfaces and edges.”

Starshade technology risk will be diminished to a level considered necessary to advance to the system prototype stage and then potentially to launch readiness in the first half of the 2020’s. This enables the capture of spectra from Earth-twins far in advance of other technologies and at far lower cost. The insight provided into biologic activity on other worlds is of profound significance.