NASA SBIR 2005 Phase I Solicitation

S3.04 Large-Aperture Lightweight Cryogenic Telescope Components & Systems

Lead Center: MSFC

Participating Center(s): GSFC, JPL

Planned future NASA infrared, far infrared, and submillimeter missions, such as the Single Aperture Far-IR (SAFIR) telescope, Interferometric Terrestrial Planet Finder (TPF-I), Infrared Origin's Probes, Space Infrared Interferometric Telescope (SPIRIT), and Submillimeter Probe of the Evolution of Cosmic Structure (SPECS) require both 10-30 m and 2-4 m class telescopes that are diffraction limited at 5-20 mm and operate at temperatures from 4-10 K. The desired areal density is 3-10 kg/m$^2$. Wavefront control may be either passive (via a high stiffness system) or active control (via mechanisms and deformable mirrors). Potential architecture implementations include 2 m class segments, 4 m class mirrors, or membrane systems. Component and system testing techniques are a particular challenge for low areal density or cryogenic specific architectures. It is anticipated that active cooling will be required. Potential telescope system architectures require transporting 1 W of heat at 15 K with 5 W/K, while others require 100 mW at 4 K with 1 W/K.

This topic solicits proposals to develop enabling component and sub-system technology for cryogenic telescopes, including but not limited to: large-aperture lightweight cryogenic optic manufacture and test; thermal management, distributed cryogenic cooling and multiple heat lift; structure, deployment, and mechanisms; deployable cryogenic coolant lines; active wavefront control; etc. The goal for this effort is to mature technologies that can be used to fabricate 2-4 m and 10-30 m class lightweight cryogenic flight-qualified telescope primary mirror systems at a cost of less than $300,000 per square meter. Proposals to fabricate demonstration components and subsystems with direct scalability to flight will be given preference.