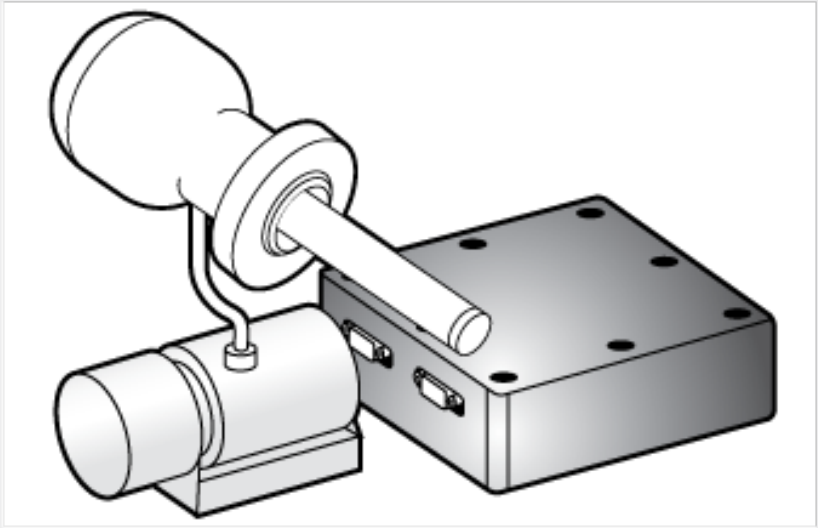
NASA SBIR/STTR Technologies

S1.09-7978 - Deep Space Cryocooler System (DSCS)

PI: Mitul Jambusaria
Iris Technology Corporation - Irvine, CA

Identification and Significance of Innovation

As NASA missions continue to extend the horizon beyond near-Earth missions, higher performance systems must evolve to address the challenges of reduced power resources, longer mission durations, higher radiation exposure, and more broadly, harsher space environments. The vision of the low-temperature and input power Deep Space Cryocooler System (DSCS) is to advance the state of the art in Cryocooler systems by developing a low-cost single stage cryocooler, designed to target low heat rejection temperatures (150K) and low cold-tip temperatures (35K), and integrate it with a set of high reliability, micro-sized Low Cost Cryocooler Electronics (mLCCE) customized to operate efficiently at very low power levels (10W). A key objective of this effort is to develop and demonstrate cryogenic cooling technologies for science measurement capabilities with smaller, more affordable spacecraft and concurrently reducing system risk, cost, size, and development time, consistent with NASA SBIR Science Subtopic S1.09.



Estimated TRL at beginning and end of contract: (Begin: 1 End: 3)

Technical Objectives and Work Plan

The key technical objectives of Phase I include: (1) In consultation with JPL, and Lockheed Martin, draft a design specification to identify the requirements for the uLCCE, (2) work with Lockheed Martin to mature the microcryocooler design to achieve the target cooling performance, and (3) identify and implement electronic design solutions for the uLCCE design. These objectives will be met through the following Work Plan:
Task 1: Program Management *This is the function by which day-to-day technical and programmatic guidance is provided to the program to ensure on-time, on-budget, technically compliant performance.*
Task 2: Requirements Initialization *The basic requirements will flow from a discussion with the NASA customer and the SBIR solicitation. A draft Design Specification will document these requirements.*
Task 3: Thermo-Mechanical Unit Design & Performance Estimates *A subcontract will be issued to Lockheed Martin to complete the Themodynamic modeling and performance estimates of the modified Microcryocooler operating at the low input-power and low temperature environment described in the SBIR solicitation*
Task 4: Cryocooler Electronics Design & Analysis *Detailed simulation and analyses will be used to inform the design of the uLCCE board for integration with the DSCS.*

NASA Applications

NASA's Interplanetary, Solar System, and Astrophysics missions are examples of the type of deep-space mission we are targeting with this proposed effort. The Europa missions could immediately benefit from this product, and as technology advancements are pushing boundaries deeper into Space, the DSCS can also serve as a foundation for additional planetary exploration. The future destinations being explored for the New Frontiers initiative or the Mars missions, would also require similar performance targets the DSCS would support.

Non-NASA Applications

Companies such as Lockheed Martin, Harris Corporation, Honeywell Hymatic, and Raytheon, have all expressed interest in our mLCCE to our larger sized HP-LCCE products, and we expect this interest to grow with an expanded portfolio. The addition of the uLCCE increases commercial application to both low-power applications with small SWaP requirements, and those applications extending to deeper space.

Firm Contacts

Mitul Jambusaria
Iris Technology Corporation
P.O. Box 5838
Irvine, CA, 92616-5838
PHONE: (949) 975-8410
FAX: (949) 975-8498

NON-PROPRIETARY DATA