NASA SBIR 2008 Phase I Solicitation

S3.02 Thermal Control Systems

Lead Center: GSFC

Participating Center(s): ARC, GRC, JPL, MSFC

Future Spacecraft and instruments for NASA's Science Mission Directorate will require increasingly sophisticated thermal control technology (http://nasascience.nasa.gov/search?SearchableText=missions+under+development, http://www.nap.edu/catalog.php?record_id=10432). Some of these requirements include:

- Optical systems, lasers (ICESAT 2), and detectors which require tight temperature control, often to better than +/- 1Â°C. Some new missions such as CON-X and LISA, and upcoming Earth Science missions require thermal gradients held to even tighter micro-degree levels.
- Exploration science missions to the Moon and Mars present engineering challenges requiring systems which are more self-sufficient and reliable.
- The introduction of low-cost, small, rapidly configured spacecraft as described in Topic S4 requires the development of new thermal technologies to reduce the time and costs typically required for analysis, design, integration, and testing of the spacecraft. The Small Spacecraft Build effort highlighted in Topic S4 (Low-cost Small Spacecraft and Technologies) participates in this subtopic and offerors are encouraged to take this in consideration as a possible flight opportunity when proposing work to this subtopic.

Innovative proposals for the cross-cutting thermal control discipline are sought in the following areas:

- Methods of precise temperature measurement and control to tight temperature levels.
- High conductivity, vacuum-compatible interface materials to minimize losses across make/break interfaces.
- High conductivity materials to minimize temperature gradients and provide high efficiency light-weight radiators, including interfaces to heat pipes and fluid loops that overcomes issues with CTE mismatch.
- Advanced more efficient thermoelectric coolers capable of providing cooling at ambient and cryogenic temperatures.
- Advanced thermal control coatings or process technologies including variable emittance surfaces applicable to small spacecraft.
- Single and two-phase mechanically pumped fluid loop systems which accommodate multiple heat sources and sinks, and long life, lightweight pumps for these systems. Also includes advanced fluid system components such as accumulators, valves, pumps, flow rate sensors, etc. optimized for improved reliability, long life, and low resource needs.
- Efficient, lightweight, oil-less, high lift vapor compression systems for cooling up to 2 KW.
- Advanced thermal modeling techniques that can be easily integrated into existing codes, emphasizing inclusion of two-phase systems and mechanically pumped system models.
- Integration of standardized formats into existing codes for the representation and exchange of Thermal Network Models and Thermal Geometric Models and results.

Research should be conducted to demonstrate technical feasibility during Phase 1 and show a path toward a Phase 2 hardware and software demonstration. Phase 2 should deliver a demonstration unit or software package for NASA testing at the completion of the Phase 2 contract.

Proposals should show an understanding of one or more relevant science needs, and present a feasible plan to fully develop a technology and infuse it into a NASA program.Â