



## NASA SBIR 2009 Phase I Solicitation

### S1.07 Cryogenic Systems for Sensors and Detectors

Lead Center: GSFC

Participating Center(s): ARC, JPL, MSFC

Cryogenic cooling systems often serve as enabling technologies for detectors and sensors flown on scientific instruments as well as advanced telescopes and observatories. As such, technological improvements to cryogenic systems (as well as components) further advance the mission goals of NASA through enabling performance (and ultimately science gathering) capabilities of flight detectors and sensors. Presently, there are six potential investment areas that NASA is seeking to expand state of the art capabilities in for possible use on future programs such as IXO (<http://ixo.gsfc.nasa.gov/>), Safir (<http://safir.jpl.nasa.gov/>), Spirit, Specs (<http://geons.gsfc.nasa.gov/live/Home/SPECS.html>) and the Europa Science missions (<http://www.nasa.gov/multimedia/podcasting/jpl-europa20090218.html>). The topic areas are as follows:

#### Extremely Low Vibration Cooling Systems

Examples of such systems include pulse tube coolers and turbo brayton cycles. Desired cooling capabilities sought are on the order of 20 mW at 4K or 1W at 50 K. Present state of the art capabilities display

#### Advanced Magnetic Cooler Components

An example of an advanced magnetic cooler might be Adiabatic Demagnetization Refrigeration systems. Specific components sought include:

- Low current superconducting magnets;
- Active/Passive magnetic shielding ( 3-4 Tesla magnets);
- Superconducting leads (10K - 90K) capable of 10 amp operation with 1 mW conduction;
- 10 mK scale thermometry.

#### Continuous Flow Distributed Cooling Systems

Distributed cooling provides increased lifetime of cryogen fluids for applications on both the ground and

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spaceborne platforms. This has impacts on payload mass and volume for flight systems which translate into costs (either on the ground, during launch or in flight). Cooling systems that provide continuous distributed flow are a cost effective alternative to present techniques/methodologies. Cooling systems that can be used with large loads and/or deployable structures are presently being sought after.

### **Heat Switches**

Current heat switches require detailed procedures for operational repeatability. More robust (performance wise) heat switches are currently needed for ease of operation when used with space flight applications.

### **Highly Efficient Magnetic and Dilution Cooling Technologies**

The desired temperature range for proposed systems is

### **Low Temperature/Power Cooling Systems**

Cooling systems providing cooling capacities approximately 0.3W at 35 K with heat rejection capability to temperature sinks upwards of 150 K are of interest. Presently there are no cooling systems operating at this heat rejection temperature. Input powers should be limited to no greater than 10W. Study of passive cooler in tandem with low power, low mass cryocooler satisfying the above mentioned requirements is also of interest.

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.