



## NASA SBIR 2011 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 GEOID, SPICA, WFirst (<http://wfirst.gsfc.nasa.gov/>), Space Infrared Interferometric Telescope (SPIRIT), Submillimeter Probe of the Evolution of Cosmic Structure (SPECS), as well as, the Planetary and 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 Joule Thompson, pulse tube and turbo Brayton cycles. Desired cooling capabilities sought are on the order of 40 mW at 4K or 1 W at 50K. 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).
  - Single or Polycrystalline magnetocaloric materials (3).
  - 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 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

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are presently being sought after.

- Heat Switches - Heat switches for operating ranges of
- Highly Efficient Magnetic and Dilution Cooling Technologies - The desired temperature range for a proposed system is
- Low Input Power (