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Space Technology

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Agenda

- Disclaimer
- Research Area Objectives
- List of Topics
- Topic Overview
- Questions

Disclaimer

- The published SBIR Solicitation takes precedence over anything written, stated, or implied in this briefing.
- Anything in this briefing which conflicts with the published solicitation is an error and should be ignored.

Follow the directions and respond to what is in the published solicitation!

Space Technology Research Area

Objectives

- Solve Technical Issues/Problems/Limiters of BMDS System Concepts/Designs to Enable Space-Basing
  - Can Enable New System Concepts or Significantly Improve Existing Concept Performance/Cost/Producibility/Life
- Provide Subsystem or Component Suppliers to Our System Prime and Payload Contractors

Scope of Research Area

- All Technologies Developed Must Be Capable of Long Term Operation in Space >>>>> **Radiation!**

Relevance to the BMDS

- Space-Basing Provides Enhanced, Persistent, Pervasive Coverage while Minimizing the Geopolitical and Security Issues of Basing on Foreign Soil/Ports

Transition Is Critical!

List of Topics

- Advanced Sensor Materials for Space
- Advanced Space Power Management & Energy Storage Technologies
- High Performance Radiation Hard Analog to Digital Converter Architectures
- Improved Cryo-cooling Component Technologies
- Legacy Software Conversion Tool
- Low Cost Calibration Targets for MDA Systems
- Passive Cooling of Laser Diodes for Use on Satellites
- Space Component Miniaturization

Topic Overview

Advanced Sensor Materials for Space

Objective

- Develop innovative sensor material solutions to improve strategic space sensors

Technology Areas of Interest*

- Detectors and detector arrays
- Anti-reflection treatments/coatings
- Bandpass filters

Key Performance

- Visible through Very Long Wave IR
- Concepts must meet performance goals post 300Krad (both protons & ionizing radiation) exposure
- Performance > current sensor approaches & sufficient for BMDS strategic sensors

Phase I Goal

- Availability of proof-of-concept/principle demonstration articles for radiation testing by the government

* May propose on more than one but suggest focusing a given proposal on only one area

Advanced Space Power Management & Energy Storage Technologies

Objective

- Develop advanced energy storage and Power Management and Distribution (PMAD) technologies that improve overall EPS system efficiency, environmental survivability, and manufacturability for BMDS satellites

Technology Areas of Interest (A proposal must address only 1 technology.)

- Li Ion Battery: cell precursor materials, low temperature survivability, improved mechanical integrity
- PMAD: Higher efficiency, Higher Voltage operation desired

Key Performance

- Radiation Hardness $\geq$ 300Krad (both protons & ionizing radiation)
- Reduce mass, improve reliability, enable higher voltage operation (75-100V vs. 28V)

Phase I Goals

- Produce an experiment article to demonstrate proof of concept
- Identify feasible, executable path from experimental article to prototype to be developed in Phase II

High Performance Radiation Hard Analog to Digital Converter Architectures

Objective

- Develop useful, high-performance, radiation-hardened analog-to-digital conversion (ADC) components to support of diverse needs of the BMDS

ADCs of Interest (Suggest each proposal address only one!)

- Low-data-rate, high-resolution (for guidance, telemetry, health/status)
- Focal Plane Array (FPA) Read-Out
- Very high rate

Key Performance

- Radiation hardness $\geq$ 300Krad (both protons & ionizing radiation)
- Highly resistant to single event effects
- Low-data-rate, high-resolution: > 50kSAMPS, > 16b, < 1mW/kS
- FPA Read-Out: >150 MSPS, >13b, <3mW/MS with a flexible multi-channel front-end topology having 8-16 channels with aggregate 150MSPS or more
- Very high rate (>10GSPS, >9b, <1W/GS)

Phase I Goal

- Analytical model demonstration of performance of the proposed concept

Improved Cryo-cooling Component Technologies

Objective

- Improve performance of components of the cryo-cooling system for electro-optical (EO) space payloads
  - Includes load flexibility and cross-gimbal transfer of cooling

Areas of Interest

- Application of improved heat conduction materials
- Pumped or wicked cryogenic cooling transfer across a two axis gimbal or flexible join, or to route cooling to multiple locations on a spacecraft
- Thermal control devices for high density microcircuits
- Control electronics associated with any active cooling devices

Key Performance

- Cooling to temperatures as low as 35K
- Operational life 10 years
- Ability to vary loads (temperature and power) during operation
- Improved mass, input power, efficiency, reliability &/or integration capability

Phase I Goals

- Analytical **&** experimental demonstration of proof-of-principle of the proposed technologies/concepts

Legacy Software Conversion Tool

Objective

- Reduce the manhours/cost required to translate legacy software into modern languages

Capabilities of Interest

- METHODOLOGY to address all four steps of software conversion
  - NOT wrapper technology
- Approach should extend or plug into existing open source development platform for construction of software tools

Desired Capabilities

- Reverse engineer legacy code into abstract syntax trees compatible with existing development tools
- Allow non-Ada programmer to select a portion of Ada code and see the equivalent code in a familiar programming language (e.g., C, C++, or Java).
- Repository of reusable functions in the code (including meta-information) to facilitate construction of new software
- Allow annotation of original software by developers that analyze/modernize the code
- Provide capability to enumerate dependencies and describe mappings to a new platform

Phase I Goals

- Develop an innovative methodology (not a wrapper technology) and conceptual design of a tool
- Demonstrate the technical feasibility and economic merit of the methodology/tool

Topic Overview

Low Cost Calibration Targets for MDA Systems

Objective

- Develop low cost electro-optical calibration targets compatible with sounding rockets or micro satellites

Capabilities Desired

- Low cost optical calibration and test objects for either the STSS or ABL systems
  - Emphasis on electro-optical signature
- Interested in concepts for both small sounding rockets and mircosatellites

Key Performance

- Test objects must have well characterized optical cross sections (OCS) and irradiance
  - OCS ~ 1 m^2 in the visible and near IR spectrums
  - Ability to provide truth measurements and well understood radar properties (to support range operations) are a plus
- Target cost goal $\leq$ $250K
- Ability to alter electro-optical signature also a plus
  - In which case, ability to provide truth data is mandatory!
- Rocket: < 100 kg; size scalable (14” to 22” diameter; 12” to 36” length)
- Microsat: < 50-kg; 40W on-orbit average power

Phase I Goals

- Conceptual designs of the hardware based on preliminary analysis with sufficient hardware development and testing to verify requirements can be met

Passive Cooling of Laser Diodes for Use on Satellites

Objective

- Develop innovative concepts and thermal control architectures for cooling laser diodes and other high power components for satellites

Key Performance

- Must be capable of operation in space
  - Microgravity, vacuum, radiation and other space system impacts must be considered
- Maintain "diode" within $\pm$ 1 °C given a steady state heat flux of up to 700 W/cm^2 and a rejection temperature of 30 °C
- Since operation of the heat source is unlikely to last a full orbit, thermal storage may be used
- Concept must address full thermal system from heat acquisition to radiation/rejection
- Passive concepts are highly desired, but active elements can be included (in which case waste heat from the active element must also be managed)
  - Minimizing mass and power requirement highly desirable

Phase I Goals

- Conceptual designs of the hardware based on preliminary analysis with sufficient hardware development and testing to verify requirements can be met

Space Component Miniaturization/Lightweighting

Objective

- Develop innovative components which enhance system performance & increase payload margins for BMDS missions

Technology Areas of Interest

- Space Qualified MEMS gyros
- LW, Hi-Efficiency Gimbal Motors for optical applications
- Others technologies that meet overall objective will also be considered

Key Performance

- Proposed solutions must demonstrate they meet government near-term goals for performance
- Must demonstrate path to space qualification
- Operational life $\geq$ 10 years
- Reduce mass, volume, & cost, &/or increase precision (compared to current state of the art)

Phase I Goals

- Analytical **&** experimental demonstration of proof-of-principle of the proposed technologies/concepts

Helpful Hints

- Respond to solicitation!
  - Address all evaluation criteria!
- Transition is as important as innovation!
  - Do your homework on the BMDS problem/system you are proposing against
  - To solve a BMDS problem, you have to get your product into a BMDS system
- Watch out for ITAR problems!
  - Do your homework on ITAR!
  - Foreign nationals will, in almost all cases, be prohibited from working on critical BMDS space technologies
    - When in doubt, don't use foreign nationals
    - Establish citizenship status of key personnel in proposal
- Where a topic is broader/multiple concepts/technologies are of interest, focus a proposal on one concept
  - > 1 award/contractor in A topic RARE
- Target your audience (the evaluators)!
  - Proposal is not a scientific paper or journal article

Questions?