NASA SBIR 2018 Phase I Solicitation

S3.08 Command, Data Handling, and Electronics

Lead Center: GSFC

Participating Center(s): JPL, LaRC

Technology Area: TA4 Robotics, Telerobotics and Autonomous Systems

NASA's space based observatories, fly-by spacecraft, orbiters, landers, and robotic and sample return missions, require robust command and control capabilities. Advances in technologies relevant to command and data handling and instrument electronics are sought to support NASA's goals and several missions and projects under development.

The 2018Â subtopic goals are to develop platforms for the implementation of miniaturized highly integrated avionics and instrument electronics that:

- Are consistent with the performance requirements for NASA science missions.
- Minimize required mass/volume/power as well as development cost/schedule resources.
- Can operate reliably in the expected thermal and radiation environments.
- Successful proposal concepts should significantly advance the state-of-the-art. Proposals should clearly:
  - State what the product is.
  - Identify the needs it addresses.
  - Identify the improvements over the current state of the art.
  - Outline the feasibility of the technical and programmatic approach.
  - Present how it could be infused into a NASA program.

Furthermore, proposals developing hardware should indicate an understanding of the intended operating environment, including temperature and radiation. It should be noted that environmental requirements can vary significantly from mission to mission. For example, some low earth orbit missions have a total ionizing dose (TID) radiation requirement of less than 10 krad(Si), while some planetary missions can have requirements well in excess of 1 Mrad(Si). For descriptions of radiation effects in electronics, the proposer may visit (http://radhome.gsfc.nasa.gov/radhome/overview.htm).

If a Phase II proposal is awarded, the combined Phase I and Phase II developments should produce a prototype that can be characterized by NASA.

The technology priorities sought are listed below:Â *â€‹*

- *I/O Expansion Chip for next generation spaceflight processor devices, including the High-Performance Spaceflight Computing (HPSC) Chiplet* - Â This ASIC interfaces to a radiation hardened space

processor,Â via a XAUI port and acts as an I/O expansion and protocol converter. Desired interfaces include TIA/EIA-422, SpaceWire, SpaceFiber, MIL-STD-1553, SPI, CameraLink, PCI-e, and Time Triggered Ethernet (TTE)/Time-Triggered Gigabit Ethernet (TTGbE). Â The offeror should survey the market and develop a list of I/O interconnects that will accelerate adoption of next generation processors into the broader space, and potentially terrestrial, markets, then design the device and implement it in a form suitable for use in spacecraft, and cyber-physical/robotics or autonomous systems in both terrestrial and natural space radiation environments. The I/O Expansion Chip hardware design and associated software will facilitate interfacing the processor to the I/O Expansion Chip in a manner that is transparent to the rest of the processor and will make the Expansion Chip seem an integral part of the processor architecture.

- *Serial RapidIO (SRIO) Hub/Switch* - This module, preferably implemented as an ASIC, provides switching and routing of SRIO Version 4 Harsh Device Class links. The SRIO Hub will provide the necessary routing of SRIO links onboard spacecraft, and other platforms to enable use of SRIO as the system interconnect. The full SRIO Version 4 speed need not be supported. The Offeror should determine what levels of radiation tolerance vs baud rate are achievable, perform a survey of anticipated spacecraft interconnect needs, and propose an implementation that is compatible with spacecraft systems envisioned for the near-mid future.
- *Smart, multi-output high efficiency POL (point of load) converter* - This module, preferably implemented utilizing one or more controller ASICs, will source a minimum of 3 settable output voltages when provided with standard spacecraft power bus input. Output voltages should be independently settable to any voltage between 5 and .5 V with efficiency of at least 95%. Regulation, noise filtering and other operational specifications should be commensurate with industry standards for space-based systems. The module should provide standard spacecraft power supply features, including over voltage protection, fault tolerance, load monitoring, and should allow control and status monitoring by a remote power system controller. There is also interest in a capability to provide data over powerline communication to the converter for control and monitoring functions.Â The offeror should determine radiation tolerance levels achievable utilizing commercially available processes and indicate, in the proposal, the radiation tolerance capability to be achieved.
- *System-In-Package Integrated Assemblies* â€“ Technologies are sought enabling highly integrated System-In-Package (SIP) assemblies integrating multiple die from different processes and foundries, enabling implementation of miniaturized, highly-reliable embedded processing, sensor readout, or motor/actuator control modules.Â The offeror should propose both the SIP technology to be developed, as well as a proof of concept application (relevant to spaceflight subsystems or instruments) that demonstrates the technology.Â The offeror should address key technical issues in the SIP implementation including thermal management, reliability, and signal integrity.
- *COTS Micropower/Ultra-Low Power Computing* - Technologies enabling the use of COTS micropower/ultra-low power computing devices in highly reliable spacecraft avionics systems.

Please see Z8.03 for a related topic of potential interest.