NASA SBIR 2011 Phase I Solicitation

S3.01   Command, Data Handling, and Electronics

Lead Center: GSFC

Participating Center(s): ARC, JPL, LaRC

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 subtopic goals are to:

- Develop high-performance processors, memory architectures, and reliable electronic systems.

- Develop tools technologies that can enable rapid deployment of high-reliability, high-performance onboard processing applications and interface to external sensors on flight hardware. The subtopic objective is to elicit novel architectural concepts and component technologies that are realistic and operate effectively and credibly in environments consistent with the future NASA science missions.

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 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:

Novel, Ruggedized Packaging/Interconnect

- High-density packaging (enclosures, printed wiring boards) enabling miniaturization.

- Novel high density and low resistance cabling, including carbon nanotube (CNT) based wiring.

Discrete Components for C&DH Subsystems

- Processors - General purpose (processor chips and radiation-hardened by design synthesizable IP cores) and special purpose single-chip components (DSPs), with sustainable processing performance and power efficiency (>40,000 MIPS at >1,000 MIPS/W for general purpose processing platforms, >20 GMACs at >5 GMACS/W for computationally-intensive processing platforms), and tolerance to total dose and single-event radiation effects. Concepts must include tools required to support an integrated hardware/software development flow.

Tunable, Scalable, Reconfigurable, Adaptive Fault-Tolerant Onboard Processing Architectures

- Development system design tools that:

  - Take full advantage of rapid prototyping hardware-in-the-loop (HIL) environments for hybrid processing platforms.

  - Automate/accelerate the deployment of data processing and sensor interface design on flight hardware.

Technologies Enabling Custom Radiation-Hardened Component Development

- Radiation-Hardened-By-Design (RHBD) cell libraries.

- Radiation-hardened Programmable Logic Devices (PLDs) and structured ASIC devices (digital and/or mixed-signal).

- Intellectual Property (IP) cores allowing the implementation of highly reliable System-On-a-Chip (SOC) devices for spacecraft subsystems or instrument electronics. Functions of interest include processors, memory interfaces, and data bus interfaces.

Power Conversion and Distribution relevant to Command, Data Handling, and Electronics, will be covered in sub-topic S3.05 Power Management and Storage.