NASA SBIR 2018 Phase I Solicitation

Z8.03   Low Cost Radiation Hardened Integrated Circuit Technology

Lead Center: LaRC

Participating Center(s): ARC, GRC, GSFC, JPL

Technology Area: TA11 Modeling, Simulation, Information Technology and Processing

As small spacecraft develop in capability, they have the need for more advanced supporting electronics. Low-cost, capable Integrated Circuit (IC) core chipsets are needed that are suitable for use in government and commercial small spacecraft, and other radiation-affected environments. In keeping with the small spacecraft design philosophy and general mission costing profiles, chipsets associated with state-of-the-art IC devices offer a significant potential for improved functionality in space capabilities and cost reduction. However, these devices usually have not been certified for use in the space environment and often have issues with the radiation found in space. As small satellite designers consider mission opportunities beyond low Earth orbit, there is a growing need for IC approaches that provide the functionality found in terrestrial applications and are able to perform their functions over the lifetime of a small satellite mission. Advancing commercial-type functionality to meet these operational needs is desired. Â

There are multiple potential development areas within the suite of spacecraft avionics functions, power systems, and instrument support functions can benefit from taking commercial IC concepts and making them space-ready, specific core chipset capabilities and requirements are not specified in this subtopic. Proposers should consider functions normally found within spacecraft systems (such as avionics, power systems, etc.) and propose solutions to make available for new spacecraft designers. Examples of technology development areas include, but are not limited to: Â

- *Fault tolerant FPGA/ASIC IP Cores* â€“ To enable low cost radiation hardened integrated circuit development, fault tolerant intellectual property cores are sought that can be used to compose fault tolerant System-On-a-Chip (SOC) devices. Â These SOC devices may be used for spaceflight applications including, command and data handling, embedded power system controllers, embedded motor/actuator controllers, and instrument controllers. Â IP cores should be AMBA bus compatible, incorporate built-in test, and employ fault tolerance techniques. Â The IP cores should be sufficiently modular and reusable to allow the implementation of a wide variety of applications.
- *Software Mitigation for Single Event Upset Recovery* â€“ Advanced methods to improve Single Event Upset (SEU) recovery in devices that can be demonstrated to comparable or better performance than hardware techniques across several metrics, such as mass and power, and have minimal impact to system speed performance.
- *ASIC Demonstrator* - Show how a specific rad hard IC for a defined application can be developed and evaluated by using a low-cost ASIC development approach. Â

In response to this topic, Â the proposer should: Â

- Identify the specific function to be advanced and demonstrate how it is not currently available at the full level performance needed.
- Identify the intended application environment(s), e.g., GEO, Cis-lunar space, deep space, etc.
- Explain how the proposed approach exceeds the state of the art in key metrics such as available functionality, power requirements, mass, radiation resistance, temperature range, etc.
- Identify the technology development necessary to get the proposed IC to the performance needed for the proposed environment and application. Â

The technology development plan needs to include test and verification to include full environmental testing so that the end customer can readily incorporate the chipsets into new vehicles without additional testing. Low-cost chipsets that are used both for space applications as well as terrestrial applications such as DoD, commercial aircraft, etc. are the primary emphasis for this call.

General purpose computing processors are explicitly excluded in this call. Â

Proposers are referred to topics S3.08 Command, Data Handling, and Electronics and S4.04 Extreme Environments Technology for related topics of potential interest.