NASA SBIR 2010 Phase I Solicitation

O1.02 Reconfigurable/Reprogrammable Communication Systems

Lead Center: GRC

Participating Center(s): AFRC, GSFC, JPL, JSC

This solicitation seeks advancements in reconfigurable transceiver and associated component technology. The goal of the subtopic is to provide flexible, reconfigurable communications capability while minimizing on-board resources and cost. Areas of interest to develop and/or demonstrate are as follows:

- Software/firmware for the management of waveform or functional reconfiguration. Simultaneous operation while reconfiguration takes place and an adherence to the Space Telecommunications Radio System (STRS) v 1.02.1 document is desired, which will soon be publicly available at https://www.spacecomm.nasa.gov/spacecomm/default.cfm
  - Goal: Simultaneous operation while reconfiguration takes place.
  - Goal: STRS compliance
- Methods and tools for the development of software/firmware components that are portable across multiple platforms. Standards-based approaches are preferred.
  - Goal: Tool chain and/or development processes that result in 80% portability between 2 standards-based SDR platforms.
- Dynamic/distributed on-board processing architectures that are scalable and are designed to operate in various space environments.
  - Goal: 10x processing capability increase for fixed SWaP.
- Component technology advancements in bandwidth capacity and reduced resource consumption.
  - Goal: 5x bandwidth processing increase, 2x decrease in resource consumption.
- Analog-to-digital converters or digital-to-analog converters to increase sampling and resolution capabilities.
  - Goal: 3x increase in sampling resolution capabilities.
- Novel techniques or processes to increase memory densities.
  - Goal: 5x increase in memory per unit volume.
- Novel approaches to mitigate device susceptibility to radiation effects.
  - Goal: Target payload class SEU and latch-up mitigation techniques to achieve requirements for various class payloads in the desired space environment at lowest SWaP cost.

NASA also seeks to populate a repository for STRS compliant waveforms. These waveforms may be field or ported to available STRS-compliant SDRs. The description of STRS-compliance is available in the STRS 1.02.1 document, soon to be publicly available at https://www.spacecomm.nasa.gov/spacecomm/default.cfm.

Note that NASA not only seeks reconfigurable/reprogrammable communication systems for flight applications, but also for the additional capabilities reconfigurable/reprogrammable systems may add to R&D and interoperability test labs. NASA centers have varying roles, capabilities, and R&D interests/priorities. Therefore, this year’s call will
also take into consideration how the products from O1.03 (Phase I, II, and III) will contribute to the current
administration’s vision for NASA and its commercial and international partners, and where these products may be
relevant within our collection of terrestrial labs and/or flight systems.

The advancement of component technology for reconfigurable/reprogrammable communications systems is highly
desirable for the insertion of these systems into space missions. Further adoption of
reconfigurable/reprogrammable communications systems allow NASA science and human space flight missions to
reduce risk and evolve as future requirements mature. These component technologies address either the reduction
of size, weight, and power of these systems, or the costs associated with development.

For all above technologies, research should be conducted to demonstrate technical feasibility during Phase I and
show a path toward Phase II hardware and software demonstration and delivering a demonstration unit or software
package for NASA testing at the completion of the Phase II contract.

Phase I Deliverables: The Phase I deliverable consists of a report detailing the technical feasibility of the innovation
and it’s contribution to the advancement of the state-of-the-art. The Phase I technology is expected to result in the
component technology developed to TRL 2-3.

Phase II Deliverables: The Phase II deliverable consists of a demonstration of hardware and/or software
prototype(s) with the intent of integration or testing in a relevant NASA laboratory, with a corresponding report
detailing operating instructions for the component technology. The Phase II technology is expected to result in the
component technology developed to TRL 5-6.