



NASA SBIR 2011 Phase I Solicitation

01.02 Reconfigurable/Reprogrammable Communication Systems

Lead Center: GRC

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

NASA seeks novel approaches in reconfigurable, reprogrammable communication systems to enable the vision of space, exploration, science, and aeronautical flight systems. Advancements are required in communication systems to manage the demands of the harsh space environment on space electronics, maintain flexibility and adaptability to changing needs and requirements, and provide flexibility and survivability due to increased mission durations. NASA missions can have vastly different transceiver requirements ranging from 1's to 10's Mbps at UHF & S frequency bands while X & Ka frequency bands require 10's to 1000's of Mbps. Available mission resources also vary greatly depending on the science objective, operating environment, and spacecraft resources. For example, deep space missions are often power constrained; operating over large distances, and subsequently have lower data transmission rates when compared to near-Earth or near planetary satellites. These requirements and resource limitations are known prior to launch, which can be used to maximize transceiver efficiency while minimizing resources consumed. Larger platforms such as vehicles or relay spacecraft may provide more resources but may also be expected to perform more complex functions or support multiple and simultaneous communication links to a diverse set of assets.

This solicitation seeks advancements in reconfigurable transceiver and associated component technology with a goal of providing flexible, reconfigurable communications capability while minimizing on-board resources and cost. Technological domains of interest include the development of software defined radios or radio subsystems which demonstrate reconfigurability, flexibility, reduced power consumption of digital signal processing systems, increased performance and bandwidth, reduced software qualification cost, and error detection and mitigation technologies. Complex reconfigurable systems will provide multiple channel and multiple and simultaneous waveforms. Within these domains of interest, desired proposal focus areas to develop and/or demonstrate technologies are as follows:

- Software/firmware for the management of waveform and/or functional reconfiguration during simultaneous radio operation while adhering to the Space Telecommunications Radio System (STRS) is desired.
- Methods and tools for the development of software/firmware components that are portable across multiple platforms. Standards-based approaches are preferred.
- Dynamic/distributed on-board processing architectures that are scalable and designed to operate in space

environments.

- Component technology advancements in bandwidth capacity and reduced resource consumption.
- Analog-to-digital converters or digital-to-analog converters to increase sampling and resolution capabilities.
- Novel techniques or processes to increase memory densities.
- Novel approaches to mitigate device susceptibility to radiation effects.

STRS Architecture documentation is available at the following link:

(<http://spaceflightsystems.grc.nasa.gov/SpaceOps/CoNNeCT/>).

The above URL also provides an overview of the Communications, Navigation, and Networking reConfigurable Testbed (CoNNeCT) flight program. The reconfigurable radios developed for this system represent the state-of-the-art in technology for space flight communication systems and may be used as a reference for the focus areas above. See also subtopic O1.06 - CoNNeCT Experiments for additional information.

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.

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Phase I Deliverables: Research to identify and evaluate candidate telecommunications technology applications to demonstrate the technical feasibility and show a path towards a hardware/software demonstration. Bench or lab-level demonstrations are desirable.

Phase II Deliverables: Emphasis should be placed on developing and demonstrating the technology under simulated flight conditions. The proposal shall outline a path showing how the technology could be developed into space-worthy systems. The contract should deliver a demonstration unit for functional and environmental testing at the completion of the Phase II contract.