NASA SBIR 2021 Phase I Solicitation

H9.05 Transformational Communications Technology

Lead Center: GRC

Participating Center(s): GSFC

Scope Title:

Revolutionary Concepts

Scope Description:

NASA seeks revolutionary transformational communications technologies, for lunar exploration and beyond, that emphasize not only dramatic reduction in system size, mass, and power but also dramatic implementation and operational cost savings while improving overall communications architecture performance. The proposer is expected to identify new ideas, create novel solutions, and execute feasibility demonstrations. Emphasis for this subtopic is on the far-term (â‰ˆ10 yr) insofar as mission insertion and commercialization but it is expected that the proposer proves fundamental feasibility via prototyping within the normal scope of the SBIR program. The transformational communications technology development will focus research in the following areas:

- Systems optimized for energy efficiency (information bits per unit energy).
- Hybridization of communications and sensing systems to maximize performance and minimize size, weight, and power (SWaP), especially for harsh environments.
- Advanced materials; smart materials; electronics embedded in structures; functional materials; graphene-based electronics/detectors.
- Techniques to overcome traditional analog-to-digital converter speed and power consumption limitations.
- Technologies that address flexible, scalable digital/optical core processing topologies to support both radio-frequency (RF) and optical communications in a single terminal.
- Nanoelectronics and nanomagnetics; quantum logic gates; single electron computing; superconducting devices; technologies to leapfrog Mooreâ€™s law.
- Energy harvesting technologies to enhance space communication system efficiency.
- Human/machine and brain-machine interfacing to enable new communications paradigms; the convergence of electronic engineering and bioengineering; neural signal interfacing.
- Quantum communications, methods for probing quantum phenomenon, methods for exploiting exotic aspects of quantum theory.

The research should be conducted to demonstrate theoretical and technical feasibility during the Phase I and Phase II development cycles and be able to demonstrate an evolutionary path to insertion within approximately 10 years. Delivery of a prototype of the most critically enabling element of the technology for NASA testing at the completion of the Phase II contract is expected.

Expected TRL or TRL Range at completion of the Project: 2 to 4
Primary Technology Taxonomy:
Level 1: TX 05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
Level 2: TX 05.5 Revolutionary Communications Technologies
Desired Deliverables of Phase I and Phase II:

- Research
- Analysis
- Prototype

Desired Deliverables Description:

Phase I deliverables shall include a final report describing theoretical analysis and prototyping concepts. The technology should have eventual commercialization potential.

For Phase II consideration, the final report should include a detailed path towards Phase II prototype hardware.

State of the Art and Critical Gaps:

While according to the Business R&D and Innovation Survey of the $323 billion of research and development performed by companies in the United States in 2013, Information and Computing Technology industries accounted for 41%. But it must be understood that the majority of these investments seek short-term returns and that most of the investment is in computer technology, cloud computing and networking, semiconductor manufacturing, etc.â€”not new and futuristic "over-the-horizon" technologies with uncertain returns on investment. As a concrete example, deep-space mission modeling indicates a need for a 10Ã— improvement in data rate per decade out to 2040. How will that be achieved? To some extent that goal will be achieved by moving to Ka-band and optical communications and perhaps antenna arraying on a massive scale. But given the ambitiousness of the goal, disruptive technologies like what is being sought here, will be required.

Relevance / Science Traceability:

NASA seeks revolutionary, transformational communications technologies that emphasize not only dramatic reduction in system size, mass, and power but also dramatic implementation and operational cost savings while improving overall communications architecture performance. This is a broad subtopic expected to identify new ideas, create novel solutions, and execute feasibility demonstrations. Emphasis for this subtopic is on the far-term (â‰ˆ10 yr) insofar as mission insertion and commercialization but it is expected that the proposer proves fundamental feasibility via prototyping within the normal scope of the SBIR program.

References:

NASA Space Communication and Navigation (SCaN) Network Architecture Definition Document Executive Summary

https://www.nasa.gov/sites/default/files/files/SCaN_ADD_Vol1Rev4.pdf

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