



NASA SBIR 2020 Phase I Solicitation

H9.05 Transformational Communications Technology

Lead Center: GRC

Participating Center(s): GSFC

Technology Area: TA5 Communication and Navigation

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 (?10yrs.) 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 RF and optical communications in a single terminal
- Nanoelectronics and nanomagnetism; quantum logic gates; single electron computing; superconducting devices; technologies to leapfrog Moore'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 bio-engineering; 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.

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.

References

https://sbir.nasa.gov/sites/default/files/Presentation15_CharlesNiederhaus.pdf

https://www.nasa.gov/pdf/675092main_SCaN_ADD_Executive_Summary.pdf

Expected TRL or TRL range at completion of the project: 2 to 4

Desired Deliverables of Phase II

Prototype, Analysis, Research

Desired Deliverables Description

The proposer is expected to identify new ideas, create novel solutions and execute feasibility demonstrations. Emphasis for this subtopic is on the far-term (?10yrs.) 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.

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. - 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 10X 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 sub-topic expected to identify new ideas, create novel solutions and execute feasibility demonstrations. Emphasis for this subtopic is on the far-term (?10yrs.) 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.