NASA SBIR 2019 Phase I Solicitation

H9.05 Transformational Communications Technology

Lead Center: GRC

Technology Area: TA5 Communication and Navigation

Revolutionary Concepts

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, including security. The proposer is expected to identify new ideas, create novel solutions and execute feasibility demonstrations. For example, there is interest in exploiting the demarcation between quantum and classical communications, specifically quantum coherent transport devices as opposed to ballistic transport devices. 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)
- Advanced materials; smart materials; electronics embedded in structures; functional materials; graphene-based electronics/detectors
- Technologies that address flexible, scalable digital/optical core processing topologies to support both RF and optical communications in a single terminal
- Nanoelectronics and nanomagnetics; quantum logic gates; single electron computing; superconducting devices; technologies to leapfrog Moore’s law.
- Quantum communications, methods for probing quantum phenomenon, methods for exploiting exotic aspects of quantum theory.
- Human/machine and brain-machine interfacing; the convergence of electronic engineering and bio-engineering; neural signal interfacing.
- Integrated photonic circuit quantum memory.

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.

The expected TRL for this project is 2 to 4.

NASA is seeking cutting-edge technology to keep the U.S. at the forefront of information and communications technology. For example, NASA Space Technology Roadmap TA 05 identifies quantum communications as a critical area. China launched the world's first quantum satellite in 2016 (the Quantum Experiments at Space Scale (QUESS) satellite). A fleet of quantum-enabled craft is likely to follow. Groups from Canada, Japan, Italy and Singapore also have plans for quantum space experiments and this competition represents a new space race.

References:

- NASA Space Technology Roadmaps (2015) : https://www.nasa.gov/offices/oct/home/roadmaps/index.html
- "The Quantum Communications Space Race: A Review of Quantum Key Distribution Initiatives from Around the World," E. Katz, NASA TM 219760 (2018).
- https://sbir.nasa.gov/sites/default/files/Presentation15_CharlesNiederhaus.pdf
- https://www.nasa.gov/pdf/675092main_SCaN_ADD_Executive_Summary.pdf