Opportunity Title: Advanced Antenna Concepts for Aerospace Communications
Opportunity Reference Code: 0031-NPP-MAR24-GRC-TechDev

Organization	National Aeronautics and Space Administration (NASA)
Reference Code	0031-NPP-MAR24-GRC-TechDev
Application Deadline	3/1/2024 6:00:59 PM Eastern Time Zone
Description	The research objective is to develop innovative concepts in the design, modeling, characterization, self-calibration, and/or development and implementation of low SWaP, low cost, electronically steered antennas (ESAs) for aeronautics and space applications. Specific research areas of interest include: dual-use ESAs for communications and sensing/radar applications, 5G phased array technologies employing 3GPP/LTE protocols for both aero and space environments, wideband K/Ka-band (17-31 GHz) ESAs, use of ESAs to generate orbital angular momentum (OAM) in the millimeter wave, novel rapid in-situ characterization techniques for ESAs (e.g., relevant environment testing, rapid state-switching measurements), novel techniques for self-calibration of ESAs (i.e., utilizing mutual coupling or signals of opportunity), adaptive/cognitive algorithms for ESA performance optimization (particularly interference mitigation and power), and multi-beam systems for communications relays. Examples of applications of this technology range from small unmanned aerial systems (UASs) operating in the national air space, urban air mobility, vehicle swarms, space-based user terminals, and small satellite lunar communications relays. Antenna metrology, design, modeling and simulation facilities are available to support this opportunity. A far-field antenna facility is available to support the antenna characterization tests with the current upper bound frequency capability of 40 GHz. This frequency limit could be extended with new instrumentation. A cylindrical near-field antenna facility is also available to support characterization requirements of different types of antennas with the largest aperture dimension of 10 inches or smaller in the frequency range between 2 to 40 GHz (extendable with new instruments). This range is currently in the process of being upgraded for spherical measurement capability. A 22' x 22' vertical scanner near field antenna range is operational to 50 GHz. A robotic scanning system known as PLGRM (Portable Laser Guided Robotic Metrology) is available for testing and novel measurement technique integration. Hardware is also available for over the air modulation and bit-error-rate testing, as well as smaller scale digital array testing. A state-of-the-art testbed called the MATRICS (Multiple Asset Testbed for Research in Innovative Communications Systems) provides an emulation capability for testing hardware in simulated relevant environments. Additionally, a space-based platform for novel phased array experiments is planned to be available for demonstrations starting in Fall of 2021. Standard Radio

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Frequency (RF) design, modeling and simulation tools includes HFSS, CST Studio Suite EM Field Simulation Capabilities, and Zeland-Scalable EM Simulation Solution Capabilities, among others.

General-purpose facilities include a 1,500 square-feet Class 100 Clean Room, computer-controlled rapid prototyping antenna and printed circuit board fabrication systems, ribbon and wire bonding facilities, and electrical characterization capabilities (e.g., Performance Network Analyzer (PNA) and Cascade Probe Station) from DC to 110 GHz.

Location:
Glenn Research Center
Cleveland, Ohio

Field of Science: Technology Development

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Eligibility Requirements

- **Citizenship:** LPR or U.S. Citizen
- **Degree:** Doctoral Degree.