Missile Defense Agency
SBIR/STTR Industry Day

Radar Research Area

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Agenda

- Research Area Objectives
- Topic List
- Individual Topic Overview
- Questions

Radar Research Area Objectives

Provide innovative subsystem improvements to enhance BMDS Radar performance against emerging threats to support existing and future radar systems through increased sensitivity, wider bandwidth, improved discrimination, countermeasure mitigation, open systems architecture, scalability, packaging, and affordability.

10.3 Radar Topics

SBIR Topics

- Photonic Multi-Beam Receive-Only Arrays
- Photonic Time Delay Units (TDUs) for Radar True Time Delay (TTD)
- Wideband Scalable Digital Receiver/Exciter (DREX)
- Accelerated High Power RF MEMS Switch/Phase Shifter Reliability Test Methodologies

SBIR Topics Overview (Cont)

"Photonic Multi-Beam Receive-Only Arrays"

Objective: Study, design, and develop a photonic multi-beam RF receive-only array architecture that would enable multiple simultaneous receive beams with high bandwidths, would provide an instantaneous dynamic range of a minimum of 60 dB, would provide the necessary accurate time delays to accomplish the beam-forming and provide the necessary beam pointing accuracy, would minimize the losses in the system design, and would use packaging/integration approaches to support the producibilty of the design.

Supplemental Information:

- The architecture of a Transmit/Receive Array has significant design constraints due to the need for isolation between transmit and receive, and for switching between the transmit and receive functions. In addition, there are substantial cooling requirements due to RF power amplifiers and with other losses in the implementation; and the constraints of accomplishing accurate true time delay with the electronics circuitry.
- Removing the transmit function from the phased array (making a receive-only array) greatly simplifies the multi-beam receive array design and would result in a much lower fabrication cost.

Topic POC:

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SBIR Topics Overview

"Photonic Time Delay Units (TDUs) for Radar True Time Delay (TTD)"

Objective: Develop a practical Time Delay Unit (TDU) employing Photonics technology that operates at X-band, has a minimum of 60 dB instantaneous dynamic range and a wide instantaneous bandwidth.

Supplemental Information:

- Photonic techniques for True Time Delay (TTD) beamsteering of active phased array antennae have long been recognized and individual components for these architectures have been developed and improved.
- The goal is to design a practical photonics TDU that employs mature component technologies that meet the requirements of the topic.

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SBIR Topics Overview

"Wideband Scalable Digital Receiver/Exciter (DREX)"

Objective: Study, design, develop, and implement techniques to cohere multiple wideband DREX channels for application to next generation BMD Radar.

Supplemental Information:

- Next Generation BMD Radar Systems are anticipated to utilize highly digitized sub-arrayed digital beam-forming (DBF) architectures and Multiple-Input Multiple-Output (MIMO) Radar processing.
- These architectures will require multiple DREX channels, scalable from tens to hundreds of channels.
- Implementation of DBF and MIMO techniques often assumes perfectly calibrated and cohered DREX channels.

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SBIR Topics Overview (Cont)

"Accelerated High Power RF MEMS Switch/Phase Shifter reliability"

Objective: Identify and develop high-power Radio Frequency Micro Electro-Mechanical Systems (RF-MEMS) accelerated reliability test methodologies to reduce technology acceptance time for switched phase shifters that utilize capacitive or contact RF MEMS switches.

Supplemental Information:

- Currently RF MEMs life testing conducted on these devices at government and contractor facilities requires significant time and cost due to a lack of physics-based test acceleration methodology.
- Identification of acceleration protocols, beyond currently conducted real-time life testing approaches, is required to shorten the test time required and accelerate acceptance of these technologies by government programs.
- The development of an acceptable physics-based model and accelerated test methodology would significantly reduce the cost and time required for system qualification and insertion of high-power RF-MEMS switches and phase shifters for Radar/EW phased array applications.

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The End

Questions

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