Department of the Navy SBIR/STTR Transition Program

Topic # N151-076

Modular, Polarization-Preserving, 40-200 GHz, Active, Electronically Steered Array (AESA) Focal-Plane + Reflector Antenna for Next-Generation, Space-borne Radiometer

WHO

SYSCOM: ONR

Sponsoring Program: Office of Naval Research: Code 3.1 Electronics Sensors and Network Research

Transition Target: Navy capital ships and satellite data communications

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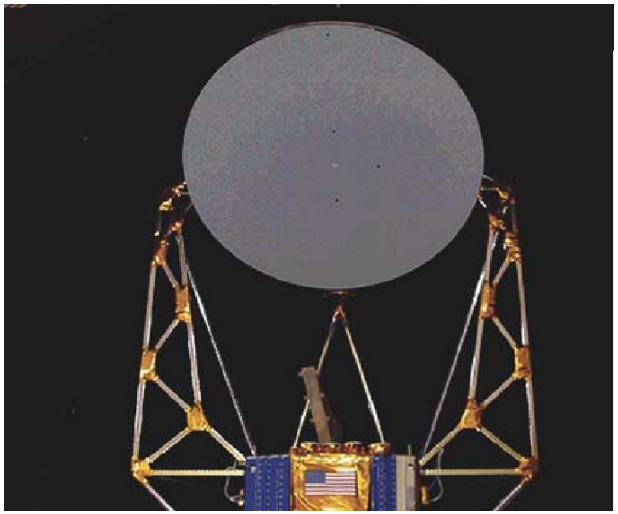
Other transition opportunities: Teqnovations' capabilities are applicable across a wide range of Army, Navy, Marine Corps, and Air Force WindSat satellites, as well as the commercial SatCom and wireless data transmission community.



Courtesy U.S. Navy

WHAT

Operational Need and Improvement: Teqnovations' modular, polarization-preserving 40 - 200 GHz active, electronically steered array (AESA) antenna is targeted for integration into next-generation WindSat satellites. Teqnovations' AESA technology enables WindSat's to customize earth scan location and resolution to precise image wind vectors in critical geographic areas. Application of higher frequencies minimizes interference from lower frequency operations. Modular, AESA configured into planar, timed-array antennas or focal-plane arrays support the design of a wide range of antenna shapes and sizes, including quasi-conformal arrays. Planar, ultra-wideband modular antenna (PUMA) technology supports the acquisition of 40 - 200 GHz polarimetric radiometer data. True-time-delay (TTD), RF liquid-crystal (LC) -based time delayers form beams across the entire frequency band. Multiple antenna beams can be formed entirely in the RF domain, entirely in the digital domain, or hybrid domains via sub-arrays.

Specifications Required: A high gain, low noise figure, rad-hard, dual polarization, electronically steered, multi-beam antenna array for the 40-200 GHz frequency range using a scalable subarray design.

Technology Developed: Teqnovations' ultra-wide-bandwidth, timed-array active, electronically steered array (AESA) antennas enable next-generation intelligence, surveillance, and reconnaissance (ISR), radar, and data communications systems operating between 1 GHz and 200 GHz. True-time-delay beam steering enables transmitting and/or receiving RF signals in a 5:1 frequency range without squint or RF pulse distortion. Low SWaP-C, timed- array antennas enhance the performance of systems on ships, planes, drones, satellites, and the ground.

Warfighter Value: Teqnovation's capability:
- Extends antenna bandwidth and improves radar range resolution
- Enables diverse data communications operation over a wide range of frequencies
- Enables higher frequency, broad-bandwidth persistent ISR
- Enables wider-bandwidth, higher-frequency radiometry, Raises operational range frequency range
- Lower Size, weight, Power, and Costs (SWaP-C)
- Flexible, modular antenna construction – tailorable antenna shape and size

WHEN

Contract Number: N68335-17-C-0058 **Ending on:** March 25, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
PUMA array and antenna architecture	Med	System Specification and Test Criteria Established	TRL-3	2nd QTR FY18
Designed a build-able version of a one beam, dual-polarity PUMA array	Med	Targeted Transmission Rates/Fidelity	TRL-3	1st QTR FY19
Test TDUs for radiation tolerance (total ionizing dose)	Med	200 - 600 krad	TRL-4	3rd QTR FY19
Build and test a one beam, dual-polarity PUMA array	Med	VSWR and polarization isolation goals achieved	TRL-4	4th QTR FY19

HOW

Projected Business Model: Teqnovations proposes to develop a modular, polarization-preserving 40-200 GHz active, electronically steered array (AESA) antenna for the next generation of WindSat satellites. The new WindSat's higher frequencies will minimize interference from operations at lower frequencies. Modular, AESA tiles can be configured into planar, timed-array antennas or into the focal-plane arrays for use with a reflector. The scalable AESA tile design supports a wide range of antenna shapes and sizes, including quasi-conformal arrays. Planar, ultra-wideband modular antenna (PUMA) technology was developed to acquire polarimetric radiometer data in the 40-200 GHz band. Where, true-time-delay (TTD), RF liquid-crystal (LC) -based time delayers form beams across the entire frequency band. Multiple antenna beams are formed entirely in the RF domain, entirely in the digital domain, or in a hybrid of the two domains with sub-arrays. Teqnovations has designed a laboratory version of an AESA with four, dual (V + H) beams. Teqnovations has plans to build hardware to prove its technology. Then develop a complete antenna system or team with a prime for complete antenna development to manufacturer, sell, or license complete antenna systems or antenna modules.

Company Objectives: Teqnovations plans to continue development of its patented, low-SWaP-C, timed-array antenna technology for multiple governmental and commercial applications. Under the Phase II SBIR Teqnovation has prototyped novel, ultra-wide-bandwidth true-time-delay units (TDUs) and conceptually designed a complete, modular Ka-band SATCOM antenna system to include an integrated receiver. Teqnovations is looking for Defense customers with un-met needs to support the development and prime contractors to integrate our technology into advanced systems.

Potential Commercial Applications: Commercial collision avoidance radar applications operating in the 60 GHz range to 94 GHz range is being developed quickly. Short-range communications, such as WiFi hotspots, leverage for portions of the spectrum with large atmospheric attenuation regions with large physical separation. Specific regions within the Commercial SatCom and wireless data transmission community requiring high data rate information and reliable connectivity.

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