Topic: N142-114

Applied Signals Intelligence

Spectrum Monitoring Payload for ScanEagle Unmanned Aerial Vehicle
Applied Signals Intelligence (ASI) recently developed small form factor HF, VHF and UHF precision direction finding that's enabling Navy's Spectrum Monitoring payload. Early mission systems operate from 1-600MHz and are integrated onto turboprop manned aircraft (Cessna Caravan, Beechcraft King Air) and small boats (RB-S, SURC). Frequency expansion to 10GHz and Size, Weight and Power (SWaP) reduction to ScanEagle are underway. Key product differentiators are: small size (<10% wavelength); lightweight (non-ferrous); wide instantaneous bandwidth; generation of azimuth and elevation angle; and, operation on horizontally and vertically polarized emitters. Awarded U.S. patent 9,279,880. ASI direction finding will be at the M80 Stiletto Capability Demonstration Program 16-3-1/2. ASI seeks relationships with primes for ship, aircraft, vehicular and manpack platforms and private equity investment to accelerate market penetration.

Technology Category Alignment:

RF Components for sensing, transmission and communication
Command, Control, Communications, Computers, & Intelligence (C4I)
Electronic Warfare (EW)
Sensors
Guidance, Navigation & Control (GN&C) and Data Links

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SYSCOM: ONR
Contract: N68335-16-C-0049

Department of the Navy SBIR/STTR Transition Program

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ONR Approval # 43-2203-16

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WHO

SYSCOM: ONR

Sponsoring Program: PMW-120

Transition Target: Turboprop manned aircraft (Cessna Caravan, Beechcraft King Air); Small Umanned Aerial System (UAS) similar to a ScanEagle

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Other transition opportunities: The enabling technology of this SBIR cuts across communication, radar and navigation application areas: (1) the system is ready (Sep'16) for HF, VHF and UHF radio direction finding (DF) missions from manned turboprop aircraft (mission systems deployed). The DF product roadmap extends operating band; (2) operation against foreign Integrated radar systems that use multiple, networked, radars, operating at different frequencies, to search, track, and acquire targets (including OTHR HF radar) can be enabled with processing enhancements to the system; and, (3) extension of the technology to navigation in GPS denied / degraded environments has begun to determine the users position using DF to beacons and signals of opportunity (e.g. AM, FM, TV) with know positions.

WHAT

Operational Need and Improvement: Radars at typical shipboard heights are dramatically affected by the non-homogeneous refractivity index of the air, which can cause radars to miscalculate the height and positions of targets and to be blind in areas they are expected to see. The refractivity-from-radio (RFR) project seeks to improve the ship's crew's knowledge of the operational performance of its radar systems by augmenting propagation environment estimation processes with Electromagnetic (EM) spectrum measurements taken in realtime at specific locations. Obtaining these EM measurements requires airborne platforms and sensors that are accurate regardless or aircraft pose (pitch, roll, yaw) and angle of arrival (AOA) of the wavefront from the transmitter.

Specifications Required: Requirements include: functionally similar to a computer-controlled spectrum analyzer; size, weight and power (SWaP) compatible with ScanEagle UAV; concurrent operation with meteorological payloads; ability to withstand 24 hours immersion in salt water; and, provide accurate measurements regardless of AOA of the EM field relative to the aircraft's pose.

Technology Developed: Electrically small lightweight (non-ferrous) vector sensor technology (U.S. Patent 9,279,880 granted) enabling an airborne RF Spectrum Analyzer and Direction Finding (DF/SpecAn) system. There are two Objective Systems: (1) a variant suitable for manned turboprop aircraft (e.g. Cessna Caravan, Beechcraft King Air); and, (2) a further SWaP reduced variant for ScanEagle Unmanned Aerial Vehicle (UAV). The first deliverable, integrated onto a Cessna Caravan, has been completed (Sep'16). Early mission systems have already been deployed in DF mode for counter push-to-talk radio applications.

Warfighter Value: (1) enables single platform radio and radar signal intercept and DF from HF to VHF/UHF (today); (2) RFR support to improve ship's crew's knowledge of radar performance; and (3) potential for position localization in GPS denied/degraded environments.

WHEN

Contract Number: N68335-16-C-0049 **Ending on:** February 28, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Caravan 2MHz to 600MHz	Low	Precision DF with +/- 1 dB spectrum measurement	TRL 7	September 2016
ScanEagle 2MHz to 600MHz	Med	Precision DF with +/- 1 dB spectrum measurement	TRL 4	September 2016
Caravan 2MHz to 6GHz	Med	Precision DF with +/- 1 dB spectrum measurement	TRL 6	June 2017
ScanEagle 2MHz to 6GHz	High	Precision DF with +/- 1 dB spectrum measurement	TRL 4	June 2017
Both 2MHz to 18GHz	High	Precision DF with +/- 1 dB spectrum measurement	TRL 6	February 2018

HOW

Projected Business Model: Initial sales of the DF system are to intel and special operations customers integrated onto turboprop aircraft. Either the turboprop integrator or ASI are prime depending on the customer. As the technology matures to programs of record, ASI will work with prime contractors to integrate to platforms.

Company Objectives: (1) combatant commands and program executive offices for: HF, VHF and UHF DF products on turboprop and larger air platforms and patrol boats/ships. (2) connection to Kennedy Irregular Warfare Center, Naval Special Warfare (NSW), and Navy Expeditionary Combat Command (NECC); and, (3) labs to further extend and enhance the underlying technology roadmap: higher frequencies and smaller platforms, radar including OTHR, covert communications, and navigation in GPS denied / degraded environments.

Potential Commercial Applications: The key commercialization areas are: RF Direction Finding; SUAV for counter radar (including HF OTHR); navigation in GPS denied/degraded environments; and covert communication assurance.

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