Topic: N151-034

ARiA

Doppler-Clutter-Mitigation Processing

Performance of detection and classification of targets in active sonar systems may be degraded in the presence of stationary clutter, ownship motion-induced clutter, and active interference. Applied Research in Acoustics' (ARiA) sparse estimation algorithms estimate and separate targets, reverberation, and mutual interference signals from a cluttered signal and enable novel classification features to be computed from sparse representations. Integration of ARiA's advanced signal and information processing enables automated and semi-automated sonar signal detection and classification, thus reducing operator workload. ARiA's signal and information processing enhancements are targeted for the AN/SQQ89A(V)15 Integrated Undersea Warfare (USW) Combat System Suite's pulsed active sonar (PAS) function segment (PASFS) echo tracker classifier (ETC). However, the developed algorithms are suitable for integration into most active sonar or radar platforms.

Technology Category Alignment:

Acoustic, Seismic and Magnetic
Synthesis/Analytics/Decision Tools
Machine Perception, Reasoning and Intelligence
Undersea Weapons
Test, Evaluation, Validation, and Verification

Contact:
Jason Summers
jason.e.summers@ariacoustics.com
(202) 629-9716
http://www.ariacoustics.com/
SYSCOM: NAVSEA
Contract: N00024-17-C-4003

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00024-17-C-4003

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.
NAVSEA #2018-0527

Topic # N151-034
Doppler-Clutter-Mitigation Processing
ARiA

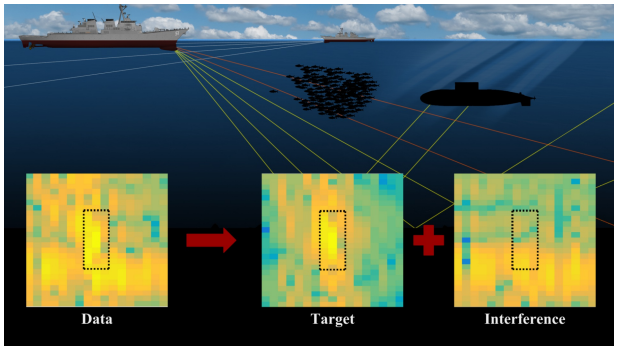
WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS 5.0 Undersea Systems

Transition Target: AN/SQQ89A(V)15 Integrated Undersea Warfare (USW) Combat System Suite's pulsed active sonar (PAS) function segment (PASFS) echo tracker classifier (ETC)

TPOC:
(860)694-3857



Other transition opportunities: Sonar signal processing for: Arleigh Burke (DDG) class destroyers, Ticonderoga (CG) class cruisers, fitted with the AN/SQS-53C mid-frequency active (MFA) hull array and the AN/SQQ-89A(V)15; Littoral Combat Ship (LCS)/Fast Frigate (FF) ASW Mission Package (MP); and Coherent Multistatic Acoustic Processor (CMAP) on the P-8A Poseidon.

Notes: Performance of detection and classification of targets in active sonar systems may be degraded in the presence of stationary clutter, ownship motion-induced clutter, and active interference. Applied Research in Acoustics' (ARiA) sparse estimation algorithms estimate and separate targets, reverberation, and mutual interference signals from a cluttered signal and enables novel classification features to be computed from sparse representations. Integration of ARIA's advanced signal and information processing enables automated and semi-automated sonar signal detection and classification, thus reducing operator workload. The developed algorithms are suitable for integration into most active sonar or radar platforms.

WHAT

Operational Need and Improvement: Navy mid-frequency active sonars, such as the AN/SQS-53C, are adversely affected by spatially spreading Doppler induced clutter. Spreading due to beamformer side-lobes, beam width, motion-induced Doppler spread of reverberation, multi-path Doppler spread, and side-lobes from normalization processing can mask slow-moving low signal-to-noise ratio (SNR) targets. The technology gap addressed by this work is the need for enhanced processing before classify-and-track to mitigate the effects of Doppler clutter.

Specifications Required: Signal processing algorithms for mitigating the effects of Doppler clutter should provide a significant improvement in the performance and detection capability of active sonar by unmasking targets hidden by the zero-Doppler ridge and mutual interference. Better-preserved signals provide more information to the classifier to enable better discrimination of targets from clutter, thus reducing the workload of the operator and automation.

Technology Developed: ARiA is developing Doppler clutter mitigation in mid-frequency active sonar by using sparse estimation to separate targets from clutter, reverberation, and various types of interference. Through our signal processing algorithms, we can separate targets, reverberation, and mutual interference from an apparently noisy signal, resulting in a cleaner tactical display for the sonar operator and improved end-to-end classification performance.

Warfighter Value: ARiA's sparse estimation signal processing algorithms improve detectability of targets, particularly near strong spatially-extended Doppler clutter and interference, thus improving discrimination between targets and clutter. Better discrimination enables a reduction in the number of false contacts and operator workload.

WHEN

Contract Number: N00024-17-C-4003 **Ending on:** October 11, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype Demonstration (ACB21 Step 1)	Low	Demonstrated improved classification performance, few false contacts	4	December 2018
Independent Prototype Evaluation on Recorded Data (ACB21 Step 2)	Low	Demonstrated improved classification performance, fewer false contacts	5	March 2019
Testing & Evaluation of Full Tactical-System Integration in a Laboratory Environment (ACB21 Step 3)	Med	Integrated system, demonstrated reduced FAR, improved classification performance	6	August 2020
At-Sea Testing & Evaluation (ACB21 Step 4)	Med	Successful shipboard tactical integration	7	January 2021

HOW

Projected Business Model: ARiA plans to retain the SBIR data rights for the developed signal processing algorithms, working with Navy and large primes to integrate algorithms into tactical systems for fleet use. ARiA's algorithms are targets for initial transition into the AN/SQQ-89A(V)15 USW Combat System in ACB21 with transition to related tactical systems to follow.

Company Objectives: ARiA's objective is to further investigate and develop Navy and DoD applications of adaptive signal processing algorithms for Doppler clutter mitigation. ARiA intends to integrate these algorithms into the AN/SQQ-89A(V)15 USW Combat System in ACB21 as the initial application of this technology to tactical sonar systems. ARiA is looking for programs and prime partners working with other tactical sensor systems that can benefit from improved detection and Doppler clutter mitigation.

Potential Commercial Applications: The signal processing algorithms that ARiA has developed are applicable to a wide range of sensing modalities including radar and sonar. Algorithms may be adapted most directly to commercial mid-frequency sonars, e.g. for subbottom profiling, single-beam and multiple-beam (swath) bathymetry, and acoustic seafloor characterization.

Contact: Jason Summers, Chief Scientist / Managing Member
jason.e.summers@ariacoustics.com (202) 629-9716

Topic: N151-011

VIP Sensors

Deep Fiber Optic Vector Sensor Array

VIP Sensors' Fiber Optic Vector Sensors (FOVS) system satisfies Navy requirements for a highly sensitive, compact directional acoustic sensing system. An innovative system of fiber optic sensors and compasses coupled with a readout system and a fiber optic interconnecting cable, FOVS is designed to address measurement applications in the challenging undersea environment when deployed in expendable Class A sonobuoys. FOVS sensors have been built and tested, and electronics have been adapted from existing sonobuoy and undersea applications. Specializing in the design and development of systems to address challenging measurement applications, VIP Sensors seeks opportunities to customize and deploy the FOVS technology in various applications to demonstrate their effectiveness and would entertain teaming arrangements with government agencies/prime contractors to incorporate FOVS technology such applications.

Technology Category Alignment:

Acoustic, Seismic and Magnetic
Electro-Optical/Infrared (EO/IR)
RF Components for sensing, transmission and communication
Sensors, Electronics and Photonics
Electronics Integration

Contact:
Alex Karolys
alex@vipsensors.com
(949) 429-3558
http://www.vipsensors.com
SYSCOM: NAVAIR
Contract: N68335-17-C-0128

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-17-C-0128

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

NAVAIR 2018-668

Topic # N151-011

Deep Fiber Optic Vector Sensor Array

VIP Sensors

WHO

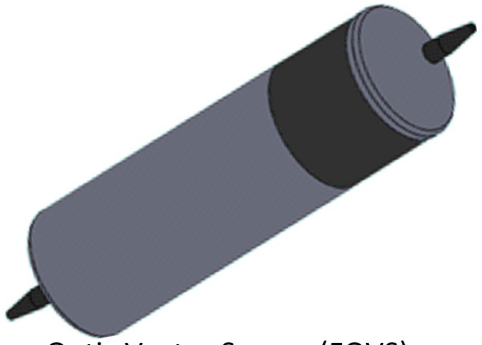
SYSCOM: NAVAIR

Sponsoring Program: PMA 264

Transition Target: Deep Long Life Passive Sonobuoy Sensor System (DLLPSSS) program

TPOC:
(301)757-3694

Other transition opportunities: Air Anti-Submarine Warfare Systems Program Office-Next Generation Airborne Passive System (NGAPS) Future Naval Capabilities (FNC) Program, Naval Research - Advanced Undersea Weapons System (PMS 495 Mine Warfare Program Office), Shallow Water Surveillance System program (PMS 485 Maritime Surveillance Systems Program Office), SURTASS Surveillance Towed Array Sensor System (PMS 485), LDUUV Large Displacement Unmanned Undersea Vehicle (PMS 406 Unmanned Maritime Vehicles Program Office).



Fiber Optic Vector Sensor (FOVS)
1.3”OD x 5.1”L

WHAT

Operational Need and Improvement: Arrays of vector velocity sensors provide major system gains over legacy arrays of omnidirectional hydrophones in bottom moored configurations. For example, gains against ambient noise can be realized, the left-right ambiguity can be eliminated, and sensitivity nulls can be steered towards an interfering source.

Specifications Required: A cost effective sensor array with a low electronic noise floor suitable for deployment in Class A sonobuoys. The array package must be less than 10 inches in height, no greater than 4.5 inches in diameter, and weigh less than 15 pounds (excluding power source).

Technology Developed: VIP Sensors has developed an innovative array with multiple Fiber Optic Vector Sensors (hydrophone, single axis, biaxial or triaxial accelerometer) and Compasses, a Readout system, and Fiber Optic Interconnecting Cable suitable for deployment in expendable Class A sonobuoys.

Warfighter Value: VIP Sensors’ innovative Fiber Optic Vector Sensors (FOVS) technology is a system of proven, reliable fiber optic sensors designed to provide major system gains over legacy arrays of omnidirectional hydrophones in bottom moored configurations in the challenging undersea environment.

WHEN

Contract Number: N68335-17-C-0128 **Ending on:** November 30, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Optical accelerometer Development and Lab Test	Low	Test results that meet sensitivity frequency response and noise requirements	TRL 4	September 2018
Optical Hydrophone Development and Lab Test	Med	Test results that meet sensitivity frequency response and noise requirements	TRL 4	September 2018
Fiber Optic Vector Sensor Prototype Lab Test	High	Test results that meet requirements	TRL 5	October 2018
Electronic Readout Development and Lab Test	Med	Demonstrate to read sensor data	TRL 5	March 2019
FOVS Array Integration and Laboratory Test	High	Over-the-side functional test	TRL 5	October 2019
Underwater System Demonstration	High	Demonstrate that the system meets requirements	TRL 6	November 2019

HOW

Projected Business Model: The business strategy combines the complementary strengths of VIP Sensors and BAE Systems to take the Phase II prototype Deep Fiber Optic Vector Sensor Array System through final development and into acquisition. VIP Sensors is providing the small, very low noise, highly sensitive low power, extrinsic fiber-optic sensors to BAE Systems who will integrate and package these sensors for in-water deployment with the remainder of the sensing subsystem. This includes processing hardware and signal processing software that will conform to open standards and will meet government specified requirements. VIP Sensors and BAE Systems have agreed in principle that the manufacturing, marketing and sales of these underwater acoustic products will be under the auspices of BAE Systems.

Company Objectives: VIP Sensors seeks opportunities to customize and deploy the FOVS technology and derivatives in various military and commercial applications to demonstrate their effectiveness.

Potential Commercial Applications: The Extrinsic Fabry-Perot Optical Sensors and the Detection System technologies will fuel the development of various multi-million dollar product lines. Besides the Deep Fiber Optic Vector Sensor Array, there are multiple applications in the test and measurement community for derivative products such as optical accelerometers, hydrophones, pressure sensors, and microphones, as well as standalone detection instruments. This basic new technology has the potential to significantly improve measurement systems across many industries that use large numbers of sensors, such as Flight Testing, Wind Tunnel Testing, Structural Testing, Structural Monitoring, and Airplane, Satellite and Ship Monitoring.

Contact: Alex Karolys, President / CEO
alex@vipsensors.com 949-429-3558

Topic: N152-117

White River Technologies, Inc.

Low Size, Weight, Power, and Cost (SWAP-C) Magnetic Anomaly Detection (MAD) System

A new generation of miniaturized atomic magnetometers is being developed and integrated into naval systems such as small unmanned fixed wing and rotorcraft platforms. This project is intended to develop a magnetic anomaly detection (MAD) system that integrates these small and low-power sensor elements, control electronics, auxiliary or reference sensors, and digital signal processing methods into a compact form factor. The objective is to develop a capable and flexible system that has utility for multiple naval air assets and can be readily integrated into larger systems or used in a stand-alone fashion. The combination of miniaturized atomic magnetometers with optimal hardware and processing algorithms will accelerate integrated sensor packages that meet the Navy's requirements for sensitivity and operational performance.

Technology Category Alignment:

Synthesis/Analytics/Decision Tools

Contact:
Jack Foley, Ph.D.
foley@whiterivertech.com
(978) 479-9519
http://www.whiterivertech.com/

SYSCOM: ONR

Contract: N68335-17-C-0173

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-17-C-0173

Department of the Navy SBIR/STTR Transition Program

Topic # N152-117

Low Size, Weight, Power, and Cost (SWAP-C) Magnetic Anomaly Detection (MAD) System

White River Technologies, Inc.

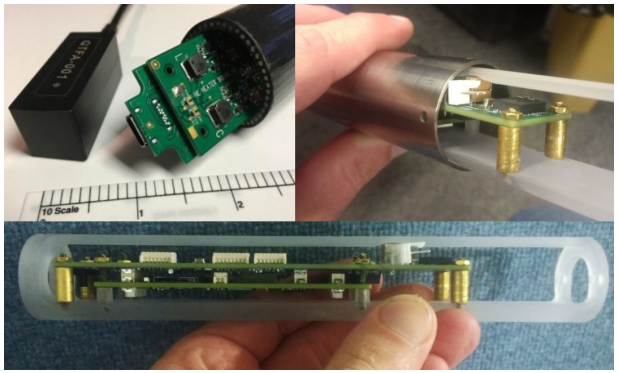
WHO

SYSCOM: ONR

Sponsoring Program: PMA 264 Air Anti-Submarine Warfare Systems, PMA 290 Maritime Patrol and Reconnaissance Aircraft

Transition Target: MQ-8C (Fire Scout), MH60-R Seahawk (also P-8A Inc. 3)

TPOC:
Fletcher Blackmon
fletcher.blackmon@navy.mil



Copyright, 2018, WRT, Inc..

Other transition opportunities: Low size weight and power (SWaP) magnetic anomaly detection is employed in several other military applications, including sea mines, unexploded ordnance (UXO), and improvised explosive device (IED) detection. Additionally, this technology can be used for new and innovative solutions for seabed infrastructure assessment and port and harbor security applications.

Notes: White River Technologies' (WRT) new MAD technology is low size, weight, power, and cost (SWaP-C) and can be configured to enable new anti-submarine warfare (ASW) and target detection applications. WRT provides a "plug-and-play" interface for various state-of-the-art miniaturized optical magnetometer technologies through a universal data interface module.

WHAT

Operational Need and Improvement: The Navy requires new systems to address the evolving needs associated with ASW. Research over the last decade has significantly reduced the SWaP of atomic vapor magnetometers, making these sensors a good match for unmanned Navy vehicles. The Navy needs innovative designs that incorporate such magnetometers into Magnetic Anomaly Detection (MAD) systems, including both the hardware and software to detect, localize, and track a magnetic dipole target from an Unmanned Aerial Vehicle (UAV).

Specifications Required: This MAD system will provide a common sensor for use on various Tier 1 UAVs and towed from helicopters. Hardware goals are driven by small UAV applications including total field magnetometers: sensor head size <100cc, electronics module <500cc, low-power (<5W total objective), and low-weight (<5 lbs total). MAD systems address sensor noise, platform noise, geomagnetic noise, and movement in gradient fields. The noise floor should match or improve upon current commercially available sensors at 0.35 pT/rtHz between 0.01-100 Hz, with raw heading errors <300 pT, compensated heading errors <10 pT, and removal of dead zones inherent in traditional magnetometer designs. The system should operate in all Earth's field conditions.

Technology Developed: WRT's next-generation MAD technology includes: (1) embedded processors for real-time data analysis and platform integration; (2) a data fusion interface unit controlling multiple heterogeneous sensors and facilitating multiple hardware configurations; and (3) a comprehensive sensor suite including miniaturized total field magnetometers, 3-axis vector magnetometers, embedded GPS and inertial measurement units, and other ancillary sensors. Built for flexibility, this technology has been integrated into several UAS, tow-birds, and other small platforms. MAD software detects, localizes, and tracks dipole targets using GPS coordinates, without rigid requirements for straight and level flight. Embedded software will implement geomagnetic and platform self-signature noise reduction, optimizing real-time detection and tracking capabilities.

Warfighter Value: WRT's MAD technology delivers advanced system capabilities to aid ASW missions. This miniaturized, low-unit-cost, low-SWaP technology provides advanced capability for real-time, non-acoustic submarine detection, tracking, and target confirmation when acoustic and optical imaging are ineffective due to clutter, obscured targets, or complex / shallow-water environments.

WHEN

Contract Number: N68335-17-C-0173 **Ending on:** March 31, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Concept Design and Alternatives Analysis	Med	Determine required MAG sensitivity and UAS noise mitigation	3	3rd QTR FY16
Laboratory and controlled bench-top testing	Med	Develop integrated sensors, controller and interface unit	4	2nd QTR FY17
Field testing in controlled setting	Med	UAS and tow-bird system testing	6	3rd QTR FY18
Noise mitigation software	Med	Tailor MAG / UAS Noise Mitigation Software	6	1st QTR FY19
Realtime embedded data processing and target detection	Med	Evaluation of system prototype at operational government facility	7	2nd QTR FY19

HOW

Projected Business Model: WRT's business model involves license of MAD manufacturing rights. Prior to licensing, WRT will provide specialized services to mitigate risk and deliver confidence to our target customers. The specific manufacturing licensee depends on the program, the market, the primes, and subcontractors involved. WRT's team is capable of manufacturing low-rate initial production (LRIP) and can provide critical support to our target customer. At the same time, WRT's manufacturing license-based business model will serve to clearly signal willingness to partner with a favored manufacturer or vendor at the appropriate time.

Company Objectives: WRT's objective is to license hardware, software, and systems designs to DoD Prime contractors and related subcontractors. These hardware, software and system design products are based on WRT's world-class, innovative, high barrier-to-entry, core technologies in the field of applied magnetics. By successfully executing a licensing model in the DoD market, WRT maximizes its focus on innovation and technology development and while eliminating development of redundant skill sets provided by large established companies.

Potential Commercial Applications: Beyond NAVY ASW missions, MAD technologies have numerous commercial applications. The final MAD technology will consist of configurable, low-noise, high-performance magnetometer payloads on various unmanned platforms integrated with GPS and ancillary sensors. Both in-water and in-air implementations will significantly reduce SWaP requirements and enable new advanced deployment tactics. Commercial applications include airborne and underwater mineral and oil and gas exploration, pipeline/infrastructure mapping, UXO detection, and many other uses for detection, mapping, and surveillance. As a defense applications expert, WRT focuses on commercialization of integrated sensor systems on military platforms, while large integration partners may be interested in licensing technology for integration into other defense product solutions. WRT also anticipates US-allied Foreign Military Sales (FMS) supporting ASW missions and expects sales in this arena.

Contact: Jack Foley, Ph.D., Vice President of Operations
foley@whiterivertech.com (978) 479-9519

Topic: N161-001

SeaLandAire Technologies, Inc.

Mid Frequency Active Sonobuoy

The increasing capabilities of adversary submarines, combined with the challenging acoustic characteristics of littoral waters create a significant challenge, particularly for current tactical Anti-Submarine Warfare (ASW) systems, which are primarily platform centric and designed for mono-static operations. SeaLandAire Technologies (SLA) specializes in rapid development of advanced engineering solutions in a broad range of applications. SLA is developing an A-size Mid Frequency Active Sonobuoy (MFAS) capable of significantly improving the ASW effectiveness resulting in better defense for the carrier fleet in all ASW mission areas. The end objective of this Phase II is to have a field-proven buoy design that can then be moved to production and qualification, with the assistance of our transition partner.

Technology Category Alignment:

Modularity
Acoustic, Seismic and Magnetic
Microelectronics and Nanoelectronics
RF Components for sensing, transmission and communication

Contact:
Jenna Jarvis
jjarvis@sealandaire.com
(517) 784-8340156
http://sealandaire.com/
SYSCOM: NAVAIR
Contract: N68335-18-C-0129

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-18-C-0129

Department of the Navy SBIR/STTR Transition Program

DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.
NAVAIR 2018-669

Topic # N161-001
Mid Frequency Active Sonobuoy
SeaLandAire Technologies, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA 264

Transition Target: PMA-264 Air ASW Systems Program Office as a new program of record

TPOC:
(301)757-3694

Other transition opportunities:

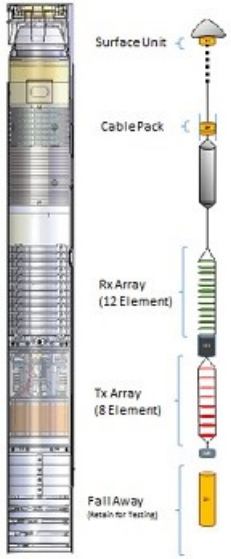


Image courtesy of SeaLandAire Technologies, Inc, Copyright 2018

WHAT

Operational Need and Improvement:
There is a need for a mid-frequency sonobuoy to provide a more integrated coverage area.

Specifications Required:
A-size sonobuoy with wide bandwidth receive and transmit capability.

Technology Developed:
The key technology development is a mid-frequency wideband active/passive A-size sonobuoy. This includes subsystems of sonar amplifier, receive electronics, processing, power, RF link, cable and suspension.

Warfighter Value:
- Provides a coordinated anti-submarine warfare (ASW) system for wide area search capability
- Improved detection range, localization and track capability
- Baseline technology for future development in this field

WHEN

Contract Number: N68335-18-C-0129 **Ending on:** December 1, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Acoustic Receive & Projector Array Test-Seneca Lake	Low	Prove out functionality and data such as beam patterns, frequency response	3	September 2018
Lower Unit / Projector Array Integration Test - Seneca Lake	Low	Lower unit on/off functionality, achieve required SPL	4	January 2019
Full Acoustic System Performance Validation Test	Med	Successful receive and transmit of pings	5	October 2019

HOW

Projected Business Model:
SeaLandAire has the ability to produce sonobuoys at a low rate using in-house manufacturing, however, for larger commercialization efforts we will team with a manufacturer. SeaLandAire has identified a manufacturing partner for transition of this technology to the defense sector and is in the process of further defining the partnership.

Company Objectives:
SeaLandAire's objective for presenting at the Navy Forum for SBIR/STTR Transition (FST) is to showcase our rapid response development capability. We have found the FST to be a great forum to let primes know about our capability. We have had two primes in particular that have observed our work at the FST on other programs and have come to SeaLandAire for significant development work although not directly related to the program that was being presented. Another objective SeaLandAire has for the FST is to highlight some of our other technology that is not directly related to the current project. This helps show SeaLandAire's range of experience in air and sea autonomous vehicles and sensor systems.

Potential Commercial Applications:
The SeaLandAire team anticipates transitioning the Mid Frequency Active Sonobuoy (MFAS) to a future DOD production program as well as to non-DOD opportunities. We will facilitate transition of the MFAS and all technology developed under this SBIR to the fleet for purposes of improving the US Navy's ASW capabilities.

Contact: Jenna Jarvis, Project Manager
jjarvis@sealandaire.com 517-784-8340 x 156