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)

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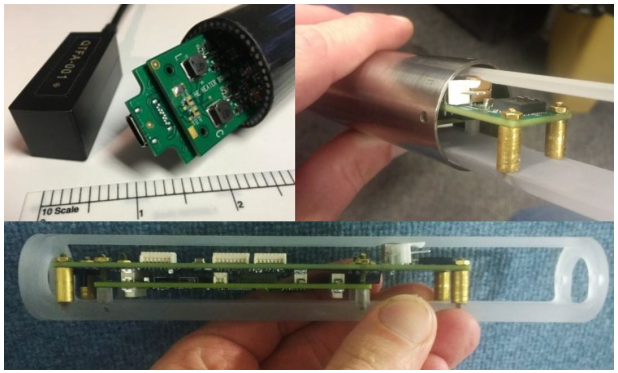

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Other transition opportunities: Low size weight and power (SWaP) magnetic anomaly detection is employed in several other military applications, including sea mines, unexploded ordnance (UXO), and improvised explosive device (IED) detection. Additionally, 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.

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