

Topic: N15A-T004

White River Technologies

In-Air E-field Sensor for Airborne Applications

White River Technologies' (WRT) advanced electric field (e-field) technology reduces geomagnetic noise and optimizes magnetic anomaly detection (MAD) to improve Navy anti-submarine warfare (ASW) capabilities. WRT, focused on magnetitic (MAG) and electromagnetic (EM) detection, developed a sensor to perform accurate and robust measurement under varying conditions, that can be deployed via multiple airframes. E-field sensors optimize UAV-based MAD by addressing multiple spatial and temporal noise sources. WRT's compact rotating electrostatic field-mill design, suitable for small UAVs, fully meets size, weight, and power (SWAP) requirements. Combined with innovative digital signal processing (DSP), multi-spectral noise mitigation and target detections are optimized. High-sensitivity (< 1 mV/m) enables generator, and power source detection, making WRT's technology a candidate for integration into a wide range of detection and surveillance applications.

Technology Category Alignment:

Sensors, Electronics and Photonics

Acoustic, Seismic and Magnetic

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SYSCOM: NAVAIR

Contract: N68335-16-C-0397

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-16-C-0397

WHO

SYSCOM: NAVAIR

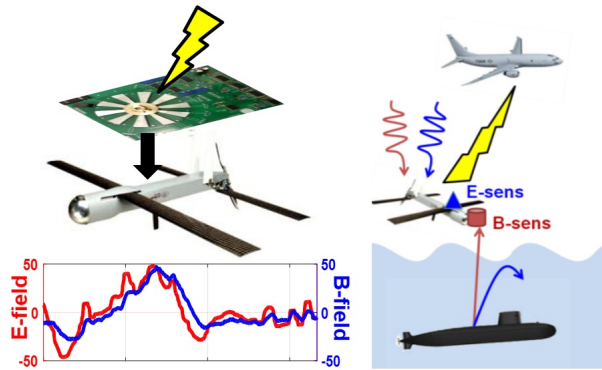
Sponsoring Program: NAVAIR

Transition Target: Unmanned Aerial Vehicle (UAV) Antisubmarine Warfare (ASW)

TPOC:
(301)342-3378

Other transition opportunities: UAV-enabled electric field (e-field) sensors can be used for many uses including power line and power-source detection and characterization.

Notes: E-field sensor technology mitigates geomagnetic noise and enables advanced UAV-based magnetic anomaly detection (MAD) for ASW applications.



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WHAT

Operational Need and Improvement: The Navy uses magnetometers for airborne submarine localization. One significant source limiting performance is geomagnetic noise due to ionosphere currents. A second MAG (magnetometer)/UAV can act as a reference MAG for the first system. The two systems must be separated sufficiently that only one senses a target. Geomagnetic noise is coherent over tens of miles, if signals from two systems are subtracted, the geomagnetic noise is reduced and the target signature is accentuated. Since an electric field originating below water surface will not significantly propagate into the atmosphere, an e-field sensor on the same platform could provide the reference measurement to mitigate geomagnetic noise without loss of target signal. This method requires less equipment and manpower reducing detection operation costs.

Specifications Required: The challenge is designing an e-field sensor with microvolt to millivolt sensitivity with a microvolts per meter (microV/m) ground geomagnetic noise range of operability. The sensor's output must be insensitive to rotation rates of 0.1 – 1.0 degree/second. Additionally, the e-field sensor must also create no magnetic noise greater than 10 picoTesla per root Hertz at one foot. All host platform e-field noise must be mitigated without shielding or modification to the aircraft.

Technology Developed: WRT's rotating electrostatic field-mill design is compact, low-power and suitable for small UAVs. Combined with innovative digital signal processing, noise mitigation and target detection are optimized. Progress on the prototype field mill sensor unit has progressed significantly with a completed overall field sensor concept and modifications and improvements to the prototype system. A low-noise front end had been completed for dual rotor configuration of the field mill. The current field mill is 7.6 cm in diameter with sensitivity as low as 0.5 mV/m.

Warfighter Value: New capabilities include advanced airborne e-field sensing tailored for better MAD noise mitigation. The technology is compatible with the P-8 Unmanned Targeting Air System (UTAS), MQ-8C Firescout, MH60-R, MQ-42 Broad Area Maritime Surveillance (BAMS) and emerging manned and unmanned aircraft. New miniaturized MAD advanced noise mitigation capabilities improve sensing, detection, and tracking and support sensing of low-frequency electric field emissions.

WHEN

Contract Number: N68335-16-C-0397 **Ending on:** August 31, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Concept Design and Alternatives Analysis	High	Determined required E-field sensitivity and UAV-friendly sensor design	2	May 2016
Pre-Prototype Sensor Design and Testing	Med	Develop mini-E-field prototype sensor	3	May 2017
Noise mitigation software	Med	Tailor E>B Coherent Noise Mitigation Software	3	September 2017
Evaluate on existing data	Med	Leverage ONR FNC Tier 1 UTAS Flight Tests	3	October 2017
Benchtest Integration	Med	Quantify capabilities of all system components	4	December 2017

HOW

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

Company Objectives: WRT's objective is to license software and systems designs to DoD Prime contractors and related Subcontractors. These software and system design products are based on our world class, innovative, high barrier to entry, core technologies in the fields of magnetics and electromagnetics. 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: Modular E-field sensors mitigate noise on high-performance MAG payloads on various vehicles/platforms integrated with other sensors. Commercial applications combining miniaturized E- and B-field sensors (MAGS) include underwater mineral and oil and gas exploration, pipeline mapping, and unexploded ordinance detection. These sensors can be integrated into underwater systems (towed arrays) or for silent undersea surveillance. Many other airborne or ground-based applications exist including real-time improvised explosive device (IED) detection. As a defense applications expert, WRT focuses on commercialization of integrated sensor systems on military platforms, while large defense integration partners such as Raytheon are interested in licensing technology for integration in their defense product solutions. WRT anticipates US-allied Foreign Military Sales (FMS) supporting ASW missions and expects sales in this arena.

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