

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0404

Topic # N171-044

Cognitive Software Algorithms Techniques for Electronic Warfare

Helios Remote Sensing Systems, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO IWS 2

Transition Target: AN/SLQ-32 Surface Electronic Warfare Improvement Program (SEWIP) Block 2

TPOC:

(812)854-6217

Other transition opportunities:

AN/BLQ-10 electronic warfare (EW) system for Navy submarines, which includes the Virginia-, Los Angeles-, and Seawolf-class fast-attack submarines, Ohio-class conventional guided-missile submarines, and future Columbia-class ballistic-missile submarines; EA-18G Growler Next Generation Jammer (NGJ).

Notes: Helios implements modular capabilities to insert into open architectures, including technology insertion for several open Program of Record architectures such as: AN/SLQ-32 surface ship; AN/BLQ-10 submarine; AN/TPQ-53 ground based radar; and AN/APY-1, AN/APY-2, and Next Generation Jammer (NGJ) airborne platforms. Helios technology is software based so it is easily integrated as part of a platform software upgrade by either the Prime or the Navy Program Office.



<https://www.navy.mil/Resources/Photo-Gallery/?igphoto=2002358066>
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WHAT

Operational Need and Improvement: Traditionally, electronic warfare (EW) techniques have relied on some prior knowledge of threat emitters. In the most basic form, this can be a catalog of threat emitter characteristics against which received signals are compared, that is, a database of signal characteristics that are used to quickly classify emitters and where ambiguities in signal characteristics remain due to incomplete data. Furthermore, creation and maintenance of threat libraries is costly and time consuming and the continued emergence of agile radar will only exacerbate the problem. Cognitive techniques will reduce the dependence on threat libraries or may, through the use of learning algorithms, eliminate the need for manually created and maintained threat libraries altogether.

Specifications Required: Although this was previously a largely uncharted field, customer reviewed metrics to capture accuracy of classification include "Correct Emitter Tracks" and "False Emitter Tracks." These are analogous to classic Electronic Warfare / Radar requirements for "Probability of Detection" and "Probability of False Alarm," respectively. In addition to accuracy of classification, processing speed is the only quantifiable performance metrics and both are to be optimized accordingly. In order to do so, it is assumed that threat emitter models will also have to be created in order to evaluate cognitive EW algorithm performance.

Technology Developed: Helios is developing machine learning algorithms to detect agile emitters. These algorithms operate with or without emitter libraries, without just focusing on new signals outside those libraries. These algorithms correctly identify agile emitter pulses as originating from a single emitter, without fragmenting them into multiple unknown emitters. Helios machine learning algorithms build a database of new emitters. Helios has verified EW machine learning using state-of-the-art pulse densities and missing pulses.

Warfighter Value: Detecting agile emitters as a single emitter both reduces operator workload and facilitates situational awareness, which also allows operators to more quickly assess threat intent, for a quicker response and more kill chain reaction time. Lower acquisition costs result from coordinating with the prime contractor on algorithm interfaces. Lower life-cycle costs result from collecting new emitter data for potential inclusion in signals intelligence (SIGINT) databases.

WHEN

Contract Number: N68335-19-C-0084 **Ending on:** November 9, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
N00024-13-P-4513 Enhanced De-Interleavers for Submarine EW Support Systems – Final Report	N/A	Successful application of machine learning and artificial intelligence to deinterleaving generic EW emitters	3	April 2013
HR0011-13-C-0033 Adaptive Radar Countermeasures – Final Report	N/A	Classified derivative and extension of N00024-13-P-4513	3	April 2014
N00178-17-C-1139 Cognitive Software Algorithms Techniques for EW – Final Report	N/A	Quantified machine learning / artificial intelligence performance increase over current solutions, with new classes of emitters.	4	March 2018
N68335-19-C-0084 Cognitive Software Algorithms Techniques for EW – 18-month Review	N/A	Quantified machine learning / artificial intelligence performance increase over current solutions, with relevant high pulse densities	5	May 2020
N68335-19-C-0084 Cognitive Software Algorithms Techniques for EW – Final Report	Med	Quantified machine learning / artificial intelligence performance increase over current solutions, with high percent missing pulses	6	December 2021

HOW

Projected Business Model: Helios plans for technology insertion with: modular capabilities to insert into open architectures, including technology insertion for several open Program of Record architectures; software solutions for easy integration in platform software upgrades by either the Prime or the Navy Program Office; and cost-effective solutions through compatibility with Navy provided Interface Design Descriptions (IDDs). Helios seeks a development contract to integrate these algorithms in electronic support measures (ESM) programs of record such as AN/SLQ-32, AN/BLQ-10, and EA-18G Growler Next Generation Jammer (NGJ).

Company Objectives: Helios has successfully transitioned Electronic Warfare (EW) SBIR Phase I contracts for N00024-13-P-4513 and N00178-17-C-1139 into the SBIR Phase II contract for N68335-19-C-0084, and into SBIR Phase III contracts for both Adaptive Radar Countermeasures, and also for Characterization and Detection of Agile and LPI Radar Signals. Helios seeks Government arrangement of: independent Government evaluation; evolution of the above evaluation metrics into program requirements; Government program office to define a transition window; and Government inclusion of Helios in plan years for technology transition. Helios is also looking for Government points-of-contact for EA-18G Growler Next Generation Jammer (NGJ).

Potential Commercial Applications: Potential non-military applications include improving maritime situational awareness for the Coast Guard and for the Department of Homeland Security. Algorithms for cognitive processing and decision making have increasing application in the area of wireless communication so the core technology potentially has wide application.

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