Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0430

Topic # N181-055

Scheduling Algorithm for Efficient and Effective Predicted Intercept Points (PIPs) for Multiple Targets

Vadum

WHO

SYSCOM: NAVSEA

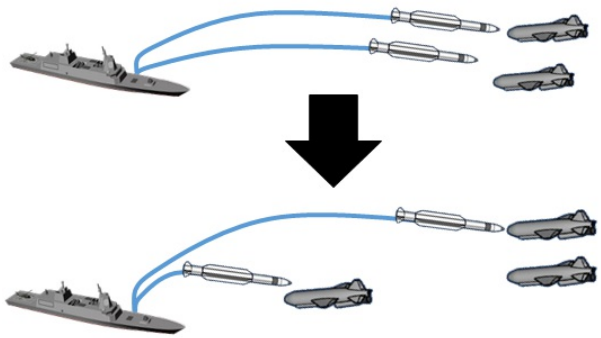
Sponsoring Program: Program Executive Office Integrated Warfare System (PEO IWS) 1.0 – AEGIS Combat Systems

Transition Target: Aegis Combat System

TPOC:
(202) 781-3165

Other transition opportunities: Legacy Aegis, Navy Frigate FFG(X), the Ship Self-Defense System (SSDS), and any system with requirements for cruise missile defense to include those supported by the Missile Defense Agency's (MDA) and the US Army, e.g., MIM-104 Patriot Missile.

Notes: Vadum is a software supplier with Northrop Grumman on multiple advanced development efforts relating to electromagnetic maneuver warfare (EMW).



Shot Spacing to Avoid Interference

WHAT

Operational Need and Improvement: The AEGIS Combat System (ACS) utilizes the predicted intercept points (PIP) of the interceptor to the target to determine weapons engagement sequencing and scheduling of ACS functions; a PIP is the intersection of two moving or one stationary object by an interceptor(s). Evolving threats, and the prolific manner in which they are used, necessitate the calculation of multiple PIPs to: (1) maintain the highest probability of elimination of a single threat and (2) successfully eliminate multiple threats. Hundreds of data sets comprise a single PIP and the calculation of a PIP requires the use of hundreds of thousands of algorithmic calculations. Current engagement planning against multiple closely-spaced threats does not take into account confounding factors such as engagement-to-engagement interference. A scheduling software algorithm is needed that can instantaneously predict numerous simultaneous intercept points to improve scheduling performance of AEGIS Weapons Systems (AWS).

Specifications Required: The scheduling algorithm must reliably provide ACS resourcing recommendations utilizing PIPs that account for variations in the type of threats, the number of threats, operational and test environments, and environmental and engagement debris. A solution must not increase any combat system processing time to achieve its primary objective. It will integrate with all elements of the ACS in order to collect the maximum amount of data sets to include in PIP determination, including track managers, weapons, and missile systems. It will also be able to integrate with the Combat System Test Bed (CSTB) using Real-time JAVA programming language to facilitate system evaluation against more advanced and prolific threats.

Technology Developed: Vadum's Prediction, Optimization and Scheduling of System Engagements (POSSE) algorithms are designed to decrease missile-to-missile interference, jointly maximize the probability of raid annihilation when engaging raids of closely spaced anti-ship cruise missiles, and be integrated into the AEGIS Combat System Baseline 10 architecture.

Warfighter Value: The Vadum engagement planning algorithms will increase the efficiency of raid engagements (i.e., engagements against multiple closely-spaced threats) by reducing the number of defensive Surface-to-Air missiles needed to shoot down the incoming threatening missiles. This improves magazine depth and overall survivability.

WHEN

Contract Number: N68335-19-C-0492 **Ending on:** September 30, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Integration of realistic threat and weapon system data	Med	Probability of Raid Annihilation, Missiles Fired	4	January 2020
Integration and testing of algorithms in LM High-Fidelity Model	Med	Probability of Raid Annihilation, Missiles Fired	5	August 2021
Development of transition software packages (if Option exercised)	Low	Software integration timeline and level of effort	5	December 2021
Integration and testing of algorithms in Government-Owned high fidelity model (if Option exercised)	Med	Probability of Raid Annihilation, Missiles Fired	6	August 2022

HOW

Projected Business Model: Vadum is at the leading edge of many advanced technology development programs to improve the performance of tactical aircraft, ballistic missile radar, and custom RF sensors. Algorithms will be transitioned to Lockheed Martin Rotary and Mission Systems (LM RMS) where Vadum will be involved with the initial algorithm integration, testing, and ongoing support and maintenance as well as development and testing to support new Aegis requirements.

Company Objectives: We anticipate the Navy SBIR/STTR Transition Program (STP) Forum will facilitate connecting with a prime or system integrator that wishes to add POSSE algorithms to existing and future ship defense platforms. Our short-term objective is to meet the needs of our program sponsor and apply the POSSE algorithms to at least one Navy program of record. Future objectives include identifying transition and development partners outside of the Aegis Combat System for POSSE. Vadum is actively participating in DARPA's Adaptive Radar Countermeasures (ARC) program.

Potential Commercial Applications: The chief focus of this effort is to support PEO IWS 1.0 in transitioning the prototype PIP algorithm to AEGIS use in the baseline testing modernization process where the effort will consist of integrating into a baseline definition, incorporation of the baselines existing and new threat capabilities, validation testing, and combat system certification. That said, commercial applications include multi-factor motion planning in addition to aircraft, ship, and UxV collision avoidance systems.

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