

Topic: N181-046

## Vadum

Tracking Algorithm(s) for Determining Highest Probability Predicted Intercept Points(s) in the AEGIS Combat System

Accurate predicted intercept points can improve missile performance/efficiency against advanced threats; reducing requirements for missile upgrades, expanding the battlespace of anti-cruise missile engagements, and reducing the number of missiles needed for a given engagement. Targeting the AEGIS Combat System, the Threat Predictor for Air Defense (TPAD) algorithms are designed to perform long-term prediction of anti-ship cruise missiles; improving fire control solutions, including a framework for incorporation of prediction algorithms rather a single prediction algorithm and attempts to estimate its own performance and degrades gracefully when performance is low. Vadum, a scientific research and technology development organization focused on new solutions to national defense issues seeks high-fidelity testing support, appropriate intelligence data to inform the machine learning components of the solution, and identification of additional transition targets.

## Technology Category Alignment:

Weapons Technologies

Autonomy

Command, Control, Communications, Computers, & Intelligence (C4I)

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**SYSCOM:** NAVSEA

**Contract:** N68335-19-C-0512

 Corporate Brochure: [https://navystp.com/vtm/open\\_file?type=brochure&id=N68335-19-C-0512](https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0512)

 Tech Talk: <https://www.youtube.com/watch?v=U-DEcZN1TKg>

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0439

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WHO

**SYSCOM:** NAVSEA

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

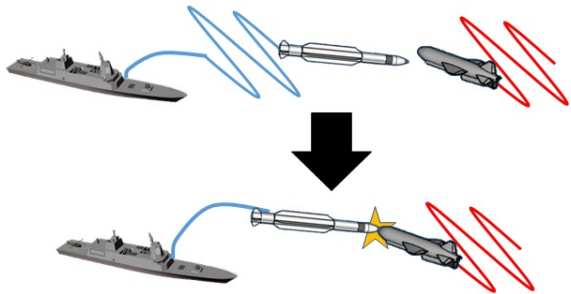
**Transition Target:** Aegis Combat System

**TPOC:**  
(202) 781-3165

**Other transition opportunities:**

Legacy Aegis Combat System, 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).



Eliminate costly missile reactions to target motion

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WHAT

**Operational Need and Improvement:** Anti-ship cruise missile capability is increasing and driving the need for improved cruise missile defense systems. Current commercially developed software algorithms concentrate on single point intersections and do not necessarily account for environmental factors, or engagement clutter and debris associated with military applications. Evolving threats, and the prolific manner in which they are deployed, necessitate the calculation of multiple predicted intercept points (PIPs) to: (1) maintain the highest probability of kill for a single threat and (2) successfully eliminate multiple threats.

**Specifications Required:** A solution will not increase combat system processing time to achieve its primary objective. It will integrate with all elements of the ACS. This includes track managers, weapons, and missile systems. Because of the planned implementation in both operational and testing environments, the software will permit realistic testing of interceptor versus evolving threat types and configurations in a dynamic test environment. Track visualization will be delivered through existing ACS console Graphical User Interfaces (GUIs) to support operator track management and decision-making. It shall also be able to integrate with the AEGIS Test Bed (ATB) to facilitate system evaluation against more advanced and prolific threats. This will enable shortening of testing and certification timelines for new AEGIS baselines as compared to current timelines. This will also help in maintaining or improving product quality through the early detection of deficiencies in the product. The speed and accuracy of the solution must exceed existing ACS performance attributes resonant in the ATB by 10% or better.

**Technology Developed:** Vadum, Inc. has developed a framework for integrating motion models of cruise missile threat systems, the Threat Predictor for Air Defense (TPAD) algorithms, which are designed to perform long-term prediction of anti-ship cruise missiles; improving fire control solutions, including a framework for incorporation of prediction algorithms rather than a single prediction algorithm and attempts to estimate its own performance and degrades gracefully when performance is low.

**Warfighter Value:** By changing the way defensive interceptor missiles are guided to their cruise missile targets, Vadum, Inc.'s predicted intercept point will improve the margin currently held over today's cruise missile systems. This excess margin can be used to expand battlespace or probability of kill. The predicted intercept point algorithms will also improve capability against advanced future threats.

WHEN

Contract Number: N68335-19-C-0512    Ending on: August 21, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Integration of high fidelity threat and weapon system data	Med	Missile miss distance and energy metrics	4	January 2021
Integration and testing of algorithms in LM High-Fidelity Model	Med	Missile miss distance and energy metrics	5	August 2021
Development of transition software (if Option exercised)	Low	Software integration time and effort	5	January 2022
Integration and testing of algorithms in Government-Owned high fidelity model (if Option exercised)	Med	Probability of kill with algorithms on/off	6	August 2022

HOW

**Projected Business Model:** Algorithms will be transitioned to Lockheed Martin Rotary and Mission Systems (LM RMS). Revenue will result from Vadum involvement with 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 TPAD algorithms to existing and future ship defense platforms. Our short-term objective is to meet the needs of our program sponsor and apply the TPAD algorithms to at least one Navy program of record. Future objectives include identifying transition and development partners outside of the Aegis Combat System for TPAD. Vadum is actively participating in DARPA's Adaptive Radar Countermeasures (ARC) program.

**Potential Commercial Applications:** The main purpose of this program is to support PEO IWS 1.0 in transitioning the prototype tracking software applications to allow for further experimentation and refinement. The prototype tracking software application will be incorporated into the AEGIS baseline testing modernization process. This will consist of integration into a baseline definition, incorporation of the baselines existing and new threat capabilities, validation testing, and combat system certification.

Commercial applications include those in which vehicles must be identified based on unique aspects of their motion. A potential application includes the typing of cooperative and uncooperative aircraft in a given sector of civilian airspace; tracking algorithms could provide assistance to air traffic controllers in monitoring potential collisions.

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