

Topic: N161-004

Toyon Research Corporation

Maritime Traffic Model Aided Tracking

Toyon's MTP-Predict solution delivers predictive analytics to enhance the Navy's ability to detect, track, and identify surface vessels in littoral waterways. The data-driven technology automatically learns motion patterns from available surveillance data – such as archived radar tracks or automatic identification system (AIS) reports – and delivers high-fidelity surface vessel motion predictions at long time horizons. The targeted applications include automatic target tracking, sensor resource management, and mission planning for platforms that surveil littoral waterways with dense and diverse surface traffic; including the P-8A (Poseidon) and unmanned helicopters. Feasibility was demonstrated through extensive analysis using simulated surveillance data, while prototype development and validation are currently underway. Toyon Research Corporation is a nationally recognized small business performing both technology development and defense systems analysis.

Technology Category Alignment:

Advanced Computing/Software Development

Human Computer Interfaces (HCI) for Decision Making

Information Collection/Management

Synthesis/Analytics/Decision Tools

Sensors

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SYSCOM: NAVAIR

Contract: N68335-18-C-0091

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-18-C-0091

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2018-737

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WHO

SYSCOM: NAVAIR

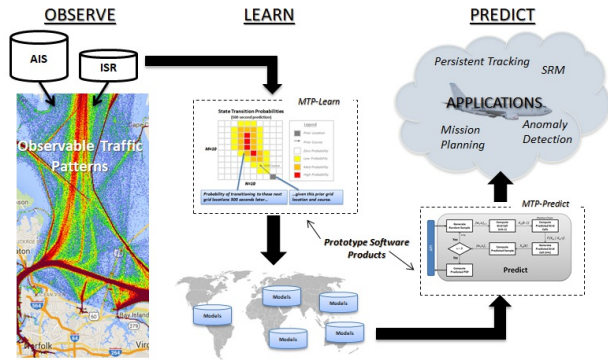
Sponsoring Program: PMA 299 H-60 Helicopter Program Office

Transition Target: The specific transition target for this technology is the Minotaur mission system architecture, which is currently being transitioned to multiple maritime surveillance platforms in the fleet.

TPOC:
(301)904-4742

Other transition opportunities: This technology enhances the Navy's ability to understand and predict vessel motion in congested waterways which is a fundamental capability in maritime surveillance. Therefore, multiple maritime surveillance platforms are near-term transition targets including H-60 Seahawk (PMA-299), P8-A Poseidon (PMA-290), MQ-8 Firescout (PMA-266), and MQ-4C Triton (PMA-262). Near-term integration with Minotaur will streamline the transition to these platforms.

Notes: Toyon Research Corporation and Raytheon Company are partnered on this SBIR program.



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WHAT

Operational Need and Improvement: Naval forces conducting transits through straits and other congested littoral operational areas are presented with a challenging force protection requirement. Surface traffic density is often high, with many ferries, fishing and pleasure boats, and large cargo ships maneuvering in a small area. State-of-the-art surveillance techniques based on high-range resolution (HRR) radar signatures and emitter exploitation can be used to improve long-term tracking of feature-rich vessels such as naval combatants. However, many smaller vessels lack adequate features to provide adequate track re-association. The technology being developed in this program improves maritime tracking performance for such vessels by automatically learning traffic patterns from archived vessel data and exploiting those patterns to better predict region-specific vessel motion, in real-time.

Specifications Required: A significant capability increase in tracker performance should be demonstrated using operationally realistic littoral surveillance data. The maritime traffic patterns should be learned automatically from archived data in the mission region and those patterns should be employed to demonstrate measurable improvement in real-time situational awareness.

Technology Developed: This data-driven software solution will digest archived and real-time surface traffic data - which describes the behavior of vessels in a waterway - and will automatically learn motions patterns from the data. The system will then exploit these learned patterns to produce predictions of vessel motion dynamics on-demand. The customized, high-fidelity motion predictions will improve the quality of information available to the operator and the various Intelligence, Surveillance, and Reconnaissance (ISR) components which require predictions to perform.

Warfighter Value: The enhanced predictions produced by the technology will improve continuity in the track picture, will improve sensor tasking decisions, and will expand the analytics available to system operators executing maritime surveillance missions with legacy radar systems. A continuous track picture provides greater insight to the operator attempting to distinguish hostile actors from benign surface traffic, particularly in congested waterways. With better insight delivered automatically by the system, the warfighter will spend less time on low-level data processing tasks and more time on high-level data analysis tasks. More data analysis leads to more rapid and better-informed decisions and mitigates the risk our Naval forces face in congested waterways.

WHEN

Contract Number: N68335-18-C-0091 **Ending on:** December 24, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Proof-of-Concept Demonstration	N/A	Tracker performance improvement over baseline	3	November 2017
Validation with APY-10 Radar Data	Med	Tracker performance improvement over baseline	4	December 2018
Software Prototype Completion	Med	Robustness to real-world data conditions	5	September 2019
Integration with SEMS / Minotaur	Med	Operational demonstration with targeted software system	6	December 2019
Software Delivery	Med	Delivery of operational software prototypes to NAVAIR	6	June 2020
Live Demonstration with APY-10 Radar System	High	Improved tracking of small surface vessel in littoral region	7	December 2020

HOW

Projected Business Model: At the conclusion of Phase II prototype versions of two software products will be available. The MTP-Learn software application will provide automated tools to learn maritime traffic pattern (MTP) models from data describing the motion of vessels in the littoral waterways; such as archived automatic identification system (AIS) reports and radar tracks. The MTP-Predict software library will then leverage the MTP models and provide prediction-as-a-service (PRaaS) to integrated third-party software systems that require surface vessel motion predictions. During one or more Phase II.5 efforts, Toyon will work with the Navy program offices to integrate the software products with existing maritime surveillance platforms to demonstrate and mature the technology. Once sufficiently matured, Toyon will work with prime contractors to include the solution as part of a planned software update for the platform. Revenue will be derived from software licenses and through long-term software support agreements.

Company Objectives: Toyon Research Corporation is a nationally recognized small business performing both technology development and defense systems analysis. Since 1980, we have supported more than 50 government and commercial customers on over 1000 contracts. Our corporate objective is to continue delivering superior technology to our customers and to be an industry leader in the delivery and deployment of safe and effective autonomous systems.

Potential Commercial Applications: At its core, the technology being developed in this program is novel in its ability to learn patterns-of-life in archived surveillance data and to exploit those patterns to enhance situational awareness. The solution is therefore extendable to other surveillance problems and industries. For example, congested urban environments impose a huge surveillance problem for both the Army and Air Force during overland operations. As the volume of archived surveillance data continues to grow, so too does the potential for learning and exploiting motion patterns in the data.