Topic: N131-044

Adaptive Methods

Mission Planning Application for Submarine Operations and Risk Management
Adaptive Methods, teamed with Pennsylvania State University Applied Research Laboratory, is developing the Foresight Autonomy Suite which provides an Autonomy Framework responsible for interfacing to UUV systems and prototype components for Situation Awareness and near term Course of Action (COA) planning. Prior work has provided an architecture and operational foundation that allows us to build on lessons learned from the autonomy COI. Our objectives are to improve UUV robustness, behavior stability and autonomous adjudication, in order to facilitate system-human trust and shared authority. It is being developed in coordination with NUWC Newport in support of the LDUUV and related programs. Program objectives are aligned with autonomous undersea vehicle requirements for 2025 and coordinated with NUWC Newport to align with OSD's vision for autonomy include a common, interoperable capability among all Unmanned Vehicles (UXV) / Robotic and Autonomous Systems (RAS).

Technology Category Alignment:

None
None
None

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SYSCOM: NAVSEA
Contract: N00024-16-C-4032
Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00024-16-C-4032

Department of the Navy SBIR/STTR Transition Program

Statement A: Approved for Release. Distribution is unlimited.
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Topic # N131-044
Mission Planning Application for Submarine Operations and Risk Management
Adaptive Methods, Inc

WHO

SYSCOM: NAVSEA

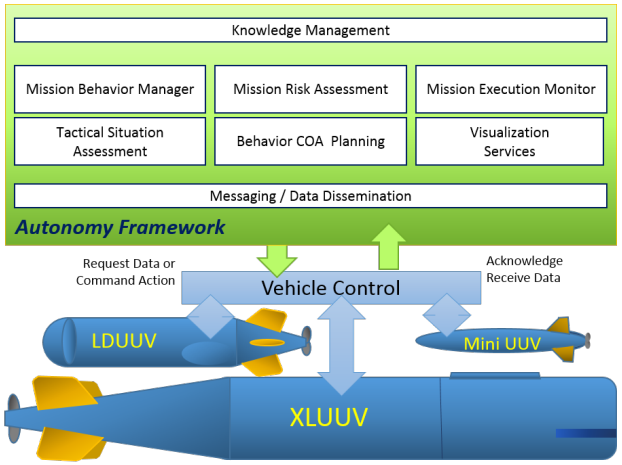
Sponsoring Program: PMS 406

Transition Target: Large Displacement Unmanned Underwater Vehicle (LDUUV) Program

TPOC:
(401)832-3551

Other transition opportunities: The technology being developed is transition-able to any scale UUV and extensible to other UXV platforms.

Notes: The Autonomy Framework provides a Service Oriented System architecture that provides a suite of common interfaces to a variety UUV platforms, thus allowing the functional component configurations to be built which are optimally supporting the current operational environment, payloads and missions.



WHAT

Operational Need and Improvement: UUV's will be required to operate autonomously on complex missions, in large, remote areas, with limited communications. In order to perform these complex missions UUV's must autonomously navigate for long periods of time in the open ocean requiring both accurate perception of the local environment, and assessment of the tactical situation presented by the environment. Adaptive Methods' Autonomy Framework provides a suite of compatible autonomy-centric components which can optimize mission objective achievement and reduce overall platform risk.

Specifications Required: The Autonomy Framework needs to align with the 2025 autonomous undersea vehicle requirements and key attributes to include 1) flexible, adaptable, configurable, and modular behavior; 2) robust, stable behavior with minimal pre-mission planning and 3) cooperation in mission execution supporting autonomy-human trust and shared control authority. To support the framework development, prototype components are also being provided which optimize potential future Courses Of Action (COA) based on mission effectiveness and risk.

Technology Developed: We are developing technology in two areas. First, an Autonomy Framework which is responsible for interfacing to UUV hardware, on-board software systems and for management, communications and coordination among autonomy components, and secondly a suite of framework compatible components for UUV missions. Ultimately, the developed framework and components will be integrated onto a surrogate LDUUV ready for at sea evaluation and eventual transition.

Warfighter Value: The developed software systems are designed to support UnderSea Warfare (USW) forces with effective alternatives for placing sailors in harm's way by demonstrating relevant USW missions with autonomous operation. Ultimately this will include use cases for complex missions, such as oceanographic survey, payload delivery, USW hold at risk and seabed warfare. UUV's will be assigned to these missions with the expectation of stable autonomous operations providing a significant force multiplier.

WHEN

Contract Number: N00024-16-C-4032 **Ending on:** January 13, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Framework Initial Specification and Prototype	Low	Successful Proof of Concept	TRL 3	October 2016
Top Level Design and Revised Prototype	Low	Prototypes of Critical Components	TRL 3	January 2017
In Laboratory demonstration using simulations	Med	Functional Laboratory Demonstration	TRL 5	September 2017
In Water demonstration of surrogate LDUUV	Med	Sucessful In Water Operations	TRL 6	January 2018

HOW

Projected Business Model: The software framework and components being developed will be targeted to be deployed through a prime contractor providing system integration. However, Adaptive Methods is capable of deliverying complete systems, including hardware and software directly to the government.

Company Objectives: Adaptive Methods' short term goal is to successfully demonstrate the Autonomy Framework developed under the Phase II LDUUV SBIR. Once the benefits and feasibility of such a framework has been shown, Adaptive Methods plans to expand the concept to support a wider range of autonomous UUVs with different hardware platforms, autonomy capabilities, payloads, and missions.

Potential Commercial Applications: Advancements in UUV technology provide new opportunities to deploy UUVs to support an ever wider variety of missions and tasks, both within the defense and commercial sectors. Adaptive Methods expects its initial technology transitions will be focused on military applications, to include maritime reconnaissance, undersea search and survey, communications/navigation aids to support submarine operations, and track and trail operations. There is also the potential for employing autonomous UUV technology for very long range torpedoes, sophisticated decoys and training platforms, for example an enhanced replacement for the Mk 39 Expendable Mobile ASW Training Target (EMATT). The need for UUV autonomy will be driven by the need for efficient, reliable UUVs, to support military modernization and continued technical support for new and evolving platforms, missions and payloads.

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