

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-867

Topic # N17B-T035

Cognitive Adaptation and Mission Optimization (CAMO) for Autonomous Teams of UAS Platforms

Opto-Knowledge Systems, Inc. (OKSI)

WHO

SYSCOM: NAVAIR

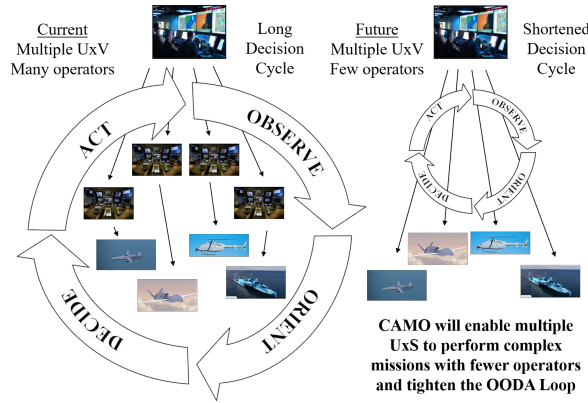
Sponsoring Program: PMA-281

Transition Target: Common Control System (CCS)

TPOC:
(301)757-1884

Other transition opportunities: The Common Control System is envisioned as the single control system for all USN unmanned vehicles (UxVs). Therefore by transitioning into CCS CAMO will eventually be used by all USN UxVs as UxVs are transitioned to CCS. CAMO can also be used by any standalone UxV program and is not dependent on the type or size of UxV. CAMO could also be directly incorporated outside of CCS if required depending on a program's need. Target programs could be the Triton program, any ATD/R Applications, FireScout, and Man-Machine Teaming Applications.

Notes: OptoKnowledge techniques and hardware are being used across the DoD for Automatic Target Recognition and navigation in GPS denied environment. The XM1155 Extended Range Cannon Artillery (ERCA) shell will be able to engage both stationary and moving targets out to 70kms using OptoKnowledge technology.



Opto-Knowledge Systems, Inc.

CAMO will enable multiple UxS to perform complex missions with fewer operators and tighten the OODA Loop

WHAT

Operational Need and Improvement: Missions involving multiple UxS platforms currently require a great deal of human operator burden to optimize search areas that show the most promise while minimizing risk exposure. This task is complicated even with a single platform, but when multiple dissimilar platforms are involved, divvying up a large area search task can become intractable. We propose an AI-based approach that mines Action Based Intelligence (ABI) data to leverage domain knowledge, e.g., probability, uncertainty maps generated from ABI data, target knowledge (known behavioral patterns, dynamic constraints, vehicle dynamics, and sensing capabilities) to optimize the probability of finding targets of interest.

Specifications Required: Enable dissimilar UxS, for this STTR UAV and UGVs teams to mine ABI data, share data in real-time, and make decisions that maximize the effectiveness of searching for targets of interest.

Technology Developed: OptoKnowledge in cooperation with Washington State University is developing enabling capabilities in the areas of i) data ingestion, ii) measurement updates, iii) Action Based Intelligence, and iv) AI-based command and control v) real-time mission planning. We have developed unique tools for the data ingestion and measurement updates, including nonlinear / non-Gaussian Bayesian updates with uncertainty bounds.

Warfighter Value: OptoKnowledge envisions CAMO embedded within CCS, enabling a UAS, such as the Triton MQ-4, to provide cueing for other UxSs (FireScout, LUSV,) or precision strike weapons such as the Joint Strike Missile. Ultimately CAMO will contribute to greater distributed lethality to address threats posed by near-peer competitors. CAMO will allow one operator to control multiple UxS teams allowing the human in the loop to make mission-critical decisions faster than potential adversaries shortening the OODA loop cycle contributing to the mission success.

WHEN

Contract Number: N68335-19-C-0138 **Ending on:** February 19, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
All Core Algorithms Proof of Concept In Simple Domain	N/A	Probability & Uncertainty, Bayesian Updates, routing and coordination, ATD and ATR	3	February 2018
All Algorithms in physics-based simulation	N/A	Machine learning for routing UAVs and UGVs without collision in dynamic environments	5	September 2019
All Capabilities on Relevant Platform	N/A	Successful flight test of UAS with surrogate UxVs	6	July 2020
Transfer of all capabilities into relevant Navy target domain	Med	Take all tooling / software created and adapt it to directly support Navy needs in theatre.	7	June 2021

HOW

Projected Business Model: OptoKnowledge anticipates this program becoming classified to at least the SECRET level during the Phase II.5 and beyond. We seek to provide the cloud-based ABI data mining & fusion capabilities and UAV-UGV autonomy capabilities directly to the Navy CCS program. Additionally, we see opportunities for infusing other UxV capabilities developed by OptoKnowledge into the CCS program, including collision avoidance and routing capabilities.

Company Objectives: OptoKnowledge wants to be the lead for developing Navy autonomous UxS teaming software capabilities. Including databasing, cloud-based computing, real-time data sharing, data fusion, and coordinated decision making. We want to make effective software tools that leverage state-of-the-art ML / AI and Deep Learning to help the Navy maintain dominance on the world stage. OptoKnowledge is willing to team with the CCS prime contractor to incorporate CAMO into CCS. OptoKnowledge is also looking for opportunities within the Department of Defense to include CAMO capabilities in other services UxS platforms.

Potential Commercial Applications: In its current configuration, CAMO will benefit the Department of Interior for its wildlife mapping and monitoring programs. We are already in talks with DOI team members for performing census surveys of wild animal species in Alaska on the Arctic variant of the RQ-23A Tiger Shark. Additional consumer opportunities exist in forest fire monitoring and treatment applications, as well as in precision farming. However, our initial commercial focus will be on DOI animal census applications. CAMO can also be used by the nascent UAS Traffic Management system being developed by the FAA and NASA. UAS delivery systems are being developed by companies such as UPS, ZipLine, and Matternet.

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