Topic: N132-117

Physical Optics Corporation

Adaptive Disturbance Mitigation System
The Adaptive Disturbance Mitigation System (ADiMiS) is a dynamic control solution that stabilizes a moving platform against external motion disturbances. It can mitigate tow-point-induced motion disturbance on a towed body such as AQS-20 minehunting sonar. It can complement the existing towed-body controller to provide low cost of implementation onto AQS-20. Computer simulations of ADiMiS on actual AQS-20 towed data showed that ADiMiS effectively reduces pitch and yaw disturbances by an average of >18 dB in diverse towing conditions. These motion stability improvements can greatly enhance AQS-20 mine detection and classification performance. Physical Optics Corporation (POC) has a quality system currently certified to ISO 9001:2008/AS9100C, as well as ISO 9001:2008/AS9110B. POC will explore other platforms to which ADiMiS can be transitioned.

Technology Category Alignment:
Advanced Electronics
Autonomy
Ground and Sea Platforms
Mobility
Sensors

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SYSCOM: NAVSEA
Contract: N00024-16-C-4003

Department of the Navy SBIR/STTR Transition Program

Statement A: Approved for Release. Distribution is unlimited.

NAVSEA #16-654

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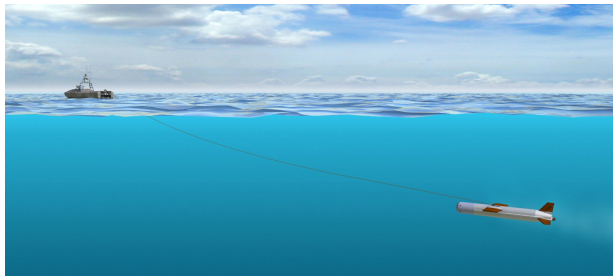Adaptive Disturbance Mitigation System

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WHO

SYSCOM: NAVSEA

Sponsoring Program: PEO LCS

Transition Target: PMS406, Unmanned Maritime Systems Program Office, Unmanned Influence Sweep

TPOC:
(850)235-5766

Other transition opportunities: PEO Team Ships

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WHAT

Operational Need and Improvement: The proliferation of sea mines in littoral waters poses significant threats to the safety of Navy operations ranging from military deployments and maritime security to humanitarian aid. To ensure the safety of these operations in these uncertain waters, the Unmanned Maritime Systems Program Office (PMS 406) intends to add a minehunting capability to the Unmanned Surface Vehicle (USV) in the Unmanned Influence Sweep System (UISS). This will provide the USV Unmanned Increment 2 with minehunting capability in addition to mine sweeping capability. This minehunting system is currently expected to be the AN/AQS-20A sonar – an underwater towed body to be autonomously deployed from the aft deck area of a Fleet Class USV.

Specifications Required: Minehunting sonars housed in the AN/AQS-20A towed body require stability to achieve the required sonar performance. Sea-state-induced tow point motions on the USV negatively affect towed sonar performance, leading to potentially missed detections and difficulty in accurate mine classification. Thus, the Navy needs an innovative solution to mitigate the tow point surge of a Fleet Class USV in sea states ≤3 at towed speeds up to 20 knots to provide a more stable tow for a sonar towed body. The proposed system hardware must be lightweight (<100 lb), compact enough to fit in the aft deck area of a Fleet Class USV, and not require modification to the craft hull forms or towed bodies.

Technology Developed: POC is developing the new Adaptive Disturbance Mitigation System (ADiMiS) based on an advanced process control method for calculating control solutions for the towed body's fins to mitigate tow-point-induced disturbances. It adjusts the fin commands calculated by the towed body controller. The continuous real-time data processing enables ADiMiS to mitigate the tow point disturbances that negatively impact the towed body's motions. ADiMiS is designed to complement the existing AQS-20 controller as a second layer controller.

Warfighter Value: A more stable sonar towed body will provide a wider effective scanning path-width. This will improve the minehunting efficiency by increasing the time on station and the area covered per sortie for a given fuel load. Increased time on station lowers sortie rates, which leads to reduced USV host platform manning requirements by reducing the number of required sortie turnarounds.

WHEN

Contract Number: N00024-16-C-4003   **Ending on:** November 9, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Optimized ADiMiS Controller Design	Low	Reduce towed body motions by >10 dB in sea states 1 to 3 in simulation studies.	5	December 2016
Integrate ADiMiS with Towed Body Legacy Controller	Low	Working with the legacy controller in real-time simulations to stabilize the towed body.	5	August 2016
Compilation of ADiMiS in AQS-20 executable code	Low	An ADiMiS executable software that can be transition to Phase III for control testing.	6	June 2017

HOW

Projected Business Model: POC can develop business for ADiMiS or license ADiMiS to a company that specializes in dynamic and system control.

Company Objectives: Identify other Navy programs that can benefit from ADiMiS methodology or its related technology for controlling the dynamics of different types of moving platforms.

Potential Commercial Applications: Aerial towed body stabilization, imaging instrument and sensor stabilization on aerial or underwater moving platforms.

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