U.S. Navy Living Marine Resources Program
FY23 Need Topic

The U.S. Navy Living Marine Resources (LMR) program issued a call for pre-proposals pertaining to one FY23 need topic.

SOLICITATION OPEN PERIOD: 20 October – 05 December 2022.

SOLICITATION ADVERTISEMENT:

- BAA Solicitation N39430-23-S-2503 posted under Contract Opportunities on Beta.SAM.gov https://beta.sam.gov on 20 October 2022.
- Announcement posted on LMR Program website at https://exwc.navfac.navy.mil/lmr/ on 24 October 2022.
- Announcement posted to MARMAM and bioacoustics-l listservs on 25 October 2022.

NEED TOPIC 0279-23: Automated Detection of Marine Mammals for Unmanned Surface Vessel Strike Avoidance

Background

The U.S. Navy is required under the Marine Mammal Protection Act (MMPA) and Endangered Species Act (ESA), to mitigate any potential strike of large whales from a Navy vessel. The primary means of mitigation is to use lookouts to visually detect marine mammals at the surface to direct the vessel to avoid striking the animal. With Navy's ongoing development of new vessel technology such as medium and large displacement unmanned surface vessels, there is an increasing need for new methods of visual detection of marine mammals.

The Navy has reviewed various technologies to detect marine mammals from a moving vessel and is primarily interested in infrared camera systems for this effort. Infrared camera systems offer the potential to observe marine mammals on the surface across all light conditions (low-light or night-time). Infrared systems usually are comprised of an infrared camera, camera gimballed stabilization for shipboard operations and detection algorithms. Infrared camera technology has been demonstrated on cliff-based observation points and vessels, and the performance of the system to detect whale blows and the body at the surface has been compared to human visual observers (Zitterbart et al 2013, Zitterbart et al 2020, Baille and Zitterbart 2021). Agent-based models have been developed to explore the effectiveness of surface-based whale detection methods for vessel strike mitigation. However, this

type of technology has not been demonstrated on an unmanned vessel to determine how it would be used as the primary means of autonomous marine mammal detection.

Need

LMR is seeking pre-proposals to demonstrate an existing infrared system developed for the purpose of whale detection on a Navy unmanned surface vessel platform. The initial goals of this effort are to establish infrared system performance criteria aboard Navy unmanned surface vessels, and identify integration and application requirements so that the infrared system's output could be used to inform the unmanned surface vessel navigation and avoid striking a whale. After the initial planning and development phase, the primary goals of the project are to: refine the hardware and software components of the infrared system for specific Navy unmanned surface vessel application, test the infrared system performance onboard a Navy unmanned surface vessel platform and demonstrate the infrared system's capability of detecting whales to inform and comply with ship strike mitigation requirements. Current mitigation requirements state that while underway, all Navy vessels shall avoid approaching marine mammals head on and shall maneuver to maintain a mitigation zone of 500 yards around observed whales.

Pre-Proposal Structure

A successful pre-proposal will demonstrate the offeror's experience and capability to leverage existing research on infrared system technology development for marine mammal detection. Prior experience with the proposed infrared system for whale detection must be included in the pre-proposal. Pre-proposals might also include infrared camera specifications, stabilization hardware description, results of detection algorithm performance (i.e. comparison to human visual observers), and prior land-based and/or vessel-based infrared system application performance results (i.e. probability of detection with distance, probability of detection of different cues, how detection is affected by environmental conditions), and any validation effort (i.e. false positives, false negatives).

Phase I – Initial plan and proposed design.

- Outline a strategy to work with LMR program managers and applicable Navy program offices to define infrared system integration requirements, performance goals, and decision-making criteria for ship-strike mitigation on an unmanned surface vessel platform.

- Evaluate acceptable detection performance as a function of vessel speed, sensor height off the water, and maneuvering capability for strike avoidance. With the assistance of the applicable Navy program office, evaluate acceptable false alarm rate to avoid impeding operations.

- Evaluate whether existing infrared system components used for navigation (i.e. camera, stabilization system and detection algorithms) on Navy unmanned surface vessels would be feasible to be used for this application. A list of existing infrared system components will be provided to successful offerors.

- Determine detection software interface and appropriate output requirements as specified by the Unmanned Maritime Autonomy Architecture Interface Definition Language that will be provided to successful offerors.

- Detail proposed infrared system technology design and configuration for application on the Navy unmanned surface vessel platform identified for testing.

- Detail how the technology will be made available to the Navy for use and procurement.

- Propose a Phase II study.

While the statement of prior experience and Phase I plan is the focus of the current pre-proposal, phases II-IV would be funded via separate awards. Please structure the remainder of the pre-proposal to include how you would approach the following phases:

Phase II – Camera system development and initial field tests. Phase II would be implemented if Phase I is successful and meet performance requirements for Navy application.

- Field test prototype infrared system with human-operator configuration (i.e. human operator in the loop) on a Navy unmanned surface vessel platform (without integration) in comparison with marine mammal visual observers onboard to characterize infrared system performance.

- Assess whether infrared prototype performance and outputs meet the interface requirements as specified in the Unmanned Maritime Autonomy Architecture Interface Definition Language.

- Detail system performance results and readiness level for testing on a Navy unmanned surface vessel.

- Propose a Phase III study.

Phase III – Semi-Autonomous infrared system testing and performance evaluation in full integration configuration on Navy unmanned surface vessel platform. Phase III will be implemented if Phase II is successful and meets established performance and integration requirements.

- Integrate infrared system hardware (i.e. camera and camera stabilization) and software (i.e. detection algorithms) into Navy unmanned surface vessel platform and command and control system.

- Field-test the effectiveness of infrared system to detect marine mammals and for the unmanned surface vessel to maneuver to mitigate a strike.

- Evaluate operational impact and remaining system requirements for operational use.

- Propose a Phase IV plan.

Phase IV – System testing to meet full integration requirements on operational Navy unmanned surface vessels.

- Propose a plan to test the infrared system to meet full integration requirements as specified by the Navy program office, for future inclusion in operational unmanned surface vessel platforms running in full autonomous configuration.

Additional Requirements:

1. No foreign developed hardware or software technology.

2. All technology needs to meet Information Assurance specifications as required by the Navy program office.