LIVING MARINE RESOURCES PROJECT 68

Thermal Imaging for Vessel Strike Mitigation on Autonomous Vessels

NEED

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 surface detection of marine mammals. The Navy seeks to demonstrate an existing thermal imaging system developed for the purpose of whale detection on a Navy unmanned surface vessel platform.

WhaleDetect system.
Daniel P. Zitterbart

SOLUTION

The project will focus on adapting and testing two existing and proven thermal imaging-based whale detection systems to reduce the potential for vessel strike during navigation of unmanned Navy surface vessels. The project team will build from two systems they have previously developed—WhaleDetect and WhaleID—to address specific Navy needs.

METHODOLOGY

Following a four-phase approach, the project team will address key components of a detection system: mission specific performance requirements, image stabilization, detection and classification algorithms, false alert rate and ultimate system effectiveness.

Phase one will focus on the initial plan and design. The team will identify the list of relevant vessels, their maximum travel speeds and maneuvering capabilities as well as the species of interest. This information will be used to evaluate applicability of the existing vessel strike probability model to required performance parameters and reveal necessary adaptions. The team will evaluate existing thermal imaging components on Navy vessels to determine if existing equipment can be adapted.

Phase two will focus on development and initial field tests. The tests will quantify performance by comparing detection of visual observers to thermal imaging autodetection to the same cue. Experiments will include this dual platform approach to assess integrated system performance. The team will also assess whether the system outputs meet the interface requirements for the Navy vessel.

NAVFAC Naval Facilities Engineering Systems Command
EXWC Engineering and Expeditionary Warfare Center

Phase three will include semi-autonomous system testing and performance evaluation in full integration configuration. This phase will still involve a human operator to assist with decision making. The team will integrate hardware and software into the vessel's command and control system followed by a multi-day test. Field tests will be designed to assess the performance of both the detection and autonomous evasive navigation capabilities. At the end of this phase a close to final version of the product would be installed on the Navy unmanned surface vehicle testing platform.

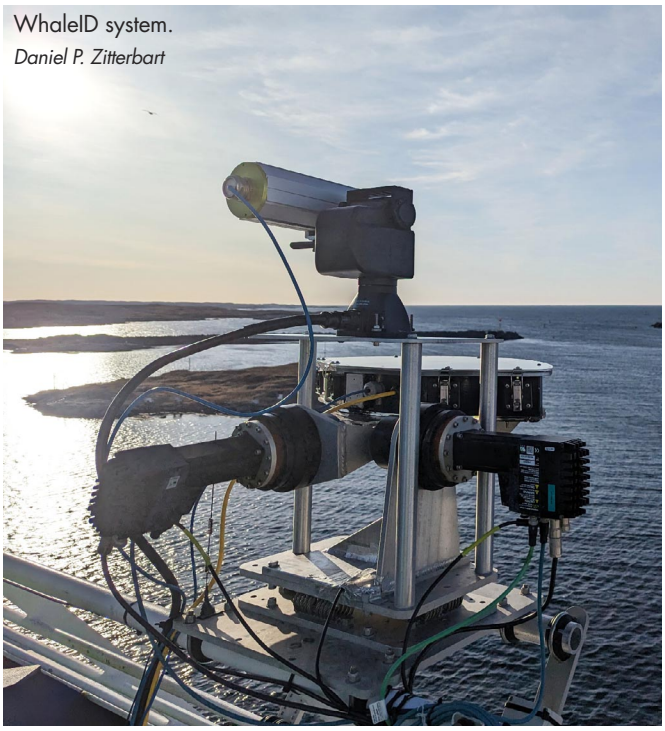
In phase four, system testing would be designed to meet full integration requirements on operational Navy unmanned surface vessels. During testing, the whale detection system would be continuously operated whenever the unmanned surface vehicle is in operation. Operational impact would be continuously monitored, and the physical condition of the system would be checked to assess its long-term usability and maintenance requirements.

SCHEDULE

Phase one is planned for 2024 and 2025. The schedule for subsequent phases will be determined as work progresses.

NAVY BENEFITS

For phase one, the benefits will include a plan and design for the project to proceed through the remaining outlined phases. Ultimately, if successful, this technology would address an important requirement to reduce the potential for whale strikes to occur during use of unmanned Navy surface vessels.



WhaleID system.
Daniel P. Zitterbart

TRANSITION

Project progress and findings for phase one will be presented in a final report, accompanied by analytical results for prospective system users to evaluate. The project will move on to subsequent phases if results of the preceding phase support continuation.

ABOUT THE PRINCIPAL INVESTIGATOR

Daniel P. Zitterbart is an associate scientist in the Applied Ocean Physics and Engineering Department at the Woods Hole Oceanographic Institution. Dr. Zitterbart earned his degree at the University of Erlangen-Nuremberg in Germany. His research interests include marine remote sensing and bioacoustics.

About the LMR Program

The Living Marine Resources (LMR) program seeks to develop, demonstrate, and assess data and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. For more information, contact the LMR program manager at exwc_lmr_program@us.navy.mil or visit exwc.navfac.navy.mil/lmr.