



LIVING MARINE RESOURCES PROJECT 56

Integration and Field Evaluation of the Next Generation High-fidelity Sound and Movement Tags to Investigate Behavioral Response

NEED

Marine mammal tag technology to collect marine mammal movement, diving and acoustic data was previously developed by the Office of Naval Research (ONR) Marine Mammals and Biology program and tags have been used in several LMR projects. However, tag technology is constantly evolving with tag redevelopment or modifications being made to address identified technological issues. Such new and modified configurations of developed tags need to be demonstrated to ensure their robustness for Navy marine species monitoring applications.

SOLUTION

This project will focus on updating and improving high-fidelity sound and movement tags, which are a valuable asset for Navy marine species monitoring. The existing tag leasing pool system, developed under the recently completed LMR project 27, worked well to make these types of tags available to more marine mammal research teams. This expanded use provided extensive and valuable feedback that has identified three gaps in the current tag technology and tag production and use that this project will work to address: updated electronics, dedicated beta-testing and user training before using tags in the field.

METHODOLOGY

Work will fall into three key tasks summarized below.

1. Next Generation Tag Integration

The next generation low-power sensing/electronics (DTAG-4) will be used to enhance the performance of the lease pool tag system. The new, smaller electronics package can provide recording times up to four days, roughly 2.5 times longer



than the current system. The new electronics will affect multiple sub-systems of the tag package: smaller/lighter electronics require less flotation, which can affect how the tag floats at the surface following release. This in turn can affect the VHF radio tracking range. Changes to the overall volume of the tag could also affect the tag body size and shape, changing tag hydrodynamics, which could affect the performance of suction cups used to attach the tag to an animal. This task will begin with engineering design to accommodate the sub-system changes and proceed to fabricating three prototype tags for testing.

2. Lab-based and Dedicated Field Testing

The first three prototype tags will be used for lab-based destructive testing and evaluation to identify conditions that could cause tag failures. The tag subsystems that will be evaluated during the lab tests include: GPS (accuracy), VHF (range), pressure testing (pressure cycling), sensor calibration, battery health, tag attachment (deployment forces) and suction cup performance (leakage rates, peak failure forces).

Dedicated field testing will characterize performance and identify design limitations before the

new systems are introduced into the tag pool. Results will be used to evaluate the performance of the full system (attachment, deployment, recovery and data extraction). Up to 12 units will be fabricated over the course of the project to support the field testing. Units will be field-tested at Stellwagen Bank National Marine Sanctuary, the Hawaiian Islands Humpback Whale National Marine Sanctuary and Kelp Marine Research in the Azores. Humpback whales, the target species at the first two sites, are known to demonstrate different behaviors, offering diverse movement and interactions for performance evaluation. Tags will be deployed on deep diving sperm whales and pilot whales in the Azores to evaluate tag performance on deep diving species. Beaked whales and Risso's dolphins, also present in the study area, will be targeted if available.

Issues identified during the field testing will be documented and cataloged to facilitate necessary design changes to address identified issues. Additionally, data from tags on the animal and system testing in the field will be used to define performance specifications (e.g. localization ranges for the VHF/ARGOS systems), and establish tag performance specifications (e.g. maximum attachment duration) in a setting where outcomes of a scientific effort are not compromised if the tag is lost at sea. This systematic approach will improve tag system design and fabrication to maximize lease pool reliability during high-priority field projects.

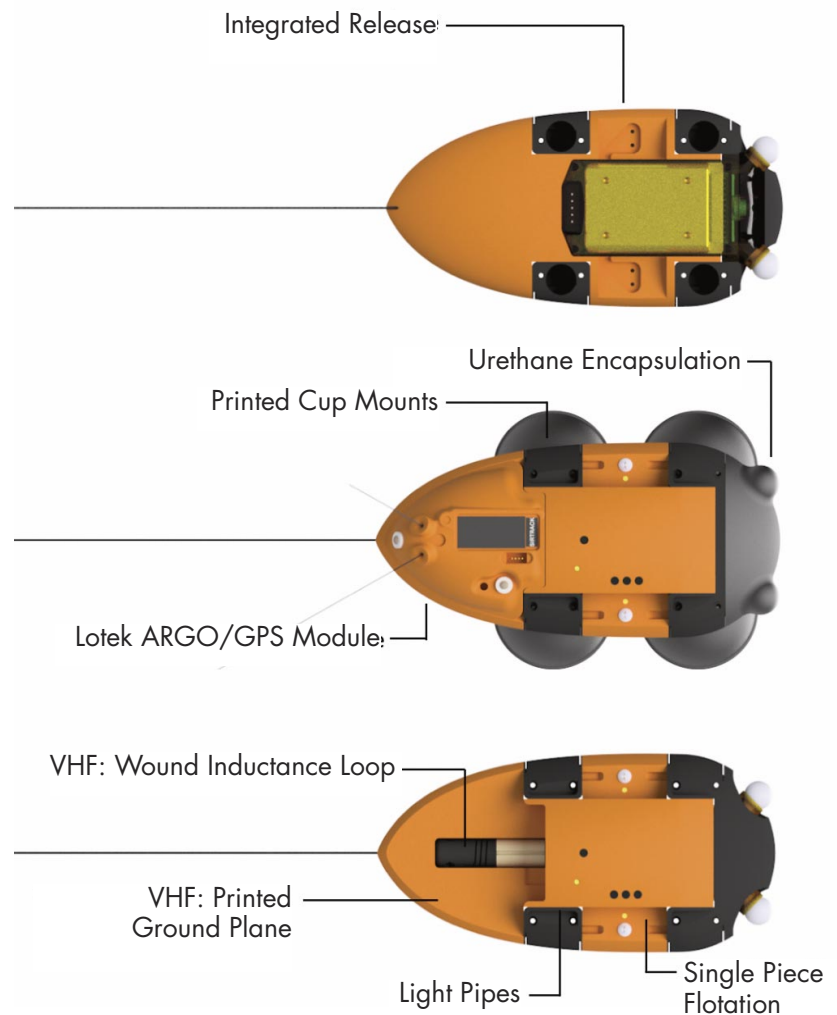
3. Targeted Support and Training

The project team will pilot in-person support to field users, develop operating procedures and guidelines to help users to integrate tags into their field effort (e.g. tag deployment hardware that integrates with hand

poles, VHF/ARGOS tracking gear) and create performance specifications for new tag features (e.g. ARGOS/GPS). This support benefits all users, but particularly new users or users who have not worked with the tags for multiple years. A dedicated pool of funds would support this effort.

SCHEDULE

The project is scheduled to begin in Fall of 2022 and be completed in Spring of 2025. Engineering tasks and prototype design, fabrication and lab testing will be conducted through Summer 2023. Iterative field and lab testing efforts will be performed through the life of the project. User training will be provided as needed during 2023 and 2024.



NAVY BENEFITS

The project will provide rigorously tested, next-generation DTAG technology for the existing tag leasing pool. The updated tags will offer improved performance and data collection for Navy marine species monitoring efforts. The resulting technology will be applicable for both the deep diving beaked whales and the large baleen whales that are priority species for Navy programs.



TRANSITION

The project will integrate next-generation DTAG electronics into the LMR supported lease pool tags. Nine units will be built during the first full year of the project (2023). Three prototype tags will be fabricated for lab-based testing and six will be fabricated for the first round of field work in Massachusetts. An iterative process of testing and refinement will continue through field tests in Hawaii and the Azores during 2024 and 2025. Up to twelve units are expected to be built over the course of the project to support all testing. Data from the field testing will be used to define performance specifications, identify limits of tag performance and improve all elements of the tags and subsystems.

ABOUT THE PRINCIPAL INVESTIGATOR

Alex Shorter is an assistant professor in the University of Michigan's mechanical engineering department. He specializes in biomechanics and persistent monitoring applications for both people and animals. Shorter was one of the original DTAG engineers and has extensive experience with the design and fabrication of marine biologging tags. Dr. Shorter earned his Ph.D. in mechanical engineering from the University of Illinois at Urbana-Champaign.



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@navy.mil or visit exwc.navy.mil/lmr.

