LIVING MARINE RESOURCES PROJECT 48

Collection of *in situ* Acoustic Data for Validation of U.S. Navy Propagation Models of Ship Shock Trial Sound Sources

NEED

Each new class (or major upgrade) of surface ships constructed for the Navy undergoes an at-sea shock trial. A shock trial is a series of underwater detonations at various distances from the ship, each of which sends a shock wave through the ship's hull to simulate near misses during combat. The Navy collects data on the acoustic shock waves effects on the ship and equipment and estimates the impact to the environment though acoustic models. However, few *in situ* measurements of the extent of the acoustic propagation within the marine environment have been taken. The Navy needs *in situ* data on acoustic shock wave propagation from the trials through the surrounding marine environment to enhance the Navy's predictive acoustic modeling methods.

SOLUTION

This project will deploy acoustic recording equipment prior to the full ship shock trial of the new Navy aircraft carrier, USS *Gerald R. Ford* (CVN-78), to collect relevant *in situ* data on the acoustic shock wave propagation. The recorders will be retrieved a few weeks after the final detonation. Collected data will be used by the Navy to validate the data used within the Navy Acoustic Effects Model (NAEMO).

METHODOLOGY

Field operations personnel from the project team will deploy moored autonomous underwater recorders that are capable of being deployed for long periods at the near- and far-field locations around the planned ship shock trial zone to capture *in situ* data. During the course of the full ship shock trial, there are three planned detonations. The recorders will be deployed for approximately three months to ensure that retrieval occurs well after the final detonation, but will be programmed to record for longer to ensure that data can be collected if there are unexpected delays in the schedule.

Rockhopper acoustic recording devices ready for a research deployment.
Shyam Madhusudhana

Data on the physical environment—including water column structure, depth, wave height and wind speed, bathymetry, bottom sediment type—as well as anticipated (modeled) received level maps guided the planned locations for the equipment to collect the most useful data. All recorders are largely configured the same way at all sites to ensure that measurements can be easily standardized across devices. The deployed device settings will differ in the hydrophone sensitivities and gain control settings based on proximity to the ship shock trial location (i.e., near-field or far-field).

Following the completion of the ship shock trial, the field operations team will retrieve the devices and deliver the data to the Navy for security screening. Once the data screening is complete, the project team will begin analyses of the acoustic shock wave propagation and estimated received levels at each of

USS *Gerald R. Ford* (CVN 78) completes the first scheduled explosive event of Full Ship Shock Trials.
Seaman Jackson Adkins

the records. If the data supports doing so, the team will also document any observations of acoustical behavior changes by surrounding marine mammals.

SCHEDULE

Devices will be deployed prior to the anticipated ship shock trial, which is expected to occur sometime between June and August 2021. Devices will be retrieved and raw data delivered to the Navy in August/September for security screening. Screened data will be available to the project team to begin analysis a few months later.

NAVY BENEFITS

The *in situ* data will provide measurements of received levels and estimated source levels and spectra to support the Navy's efforts to validate the NAEMO acoustic propagation model with ship shock trial explosive sources. These data will ensure that the Navy's estimates of acoustic impacts from explosive sources are as accurate as possible.

TRANSITION

Data will be provided to the Navy and the LMR program, along with the final reports.

ABOUT THE PRINCIPAL INVESTIGATORS

Kerri Seger is a Senior Scientist at Applied Ocean Sciences. She is also an affiliate research professor with the Center for Acoustics Research and Education at the University of New Hampshire. Her areas of expertise include soundscape parameterization, propagation modeling, bioacoustics and field design. Dr. Seger holds a Ph.D. in oceanography (specialty in bioacoustics) from Scripps Institution of Oceanography.

Shyam Madhusudhana is a postdoctoral research associate at the K. Lisa Yang Center for Conservation Bioacoustics, Cornell Lab of Ornithology, Cornell University, under the supervision of Dr. Holger Klinck. His areas of expertise include passive acoustics, automatic pattern recognition and signal processing. Dr. Madhusudhana earned his Ph.D. in applied physics at Curtin University, Australia.

Holger Klinck is the director of the K. Lisa Yang Center for Conservation Bioacoustics at the Cornell Lab of Ornithology, Cornell University. His current research focuses on the development and application of hardware and software tools for passive acoustic monitoring of marine ecosystems and biodiversity. Dr. Klinck has a Ph.D. in environmental sciences and bioacoustics from the University of Trier, Germany.

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 www.navfac.navy.mil/lmr.