

**Ocean Acoustics (Code 322OA) Experimental Support Services
for ONR's Ocean Battlespace Sensing Division**

Clayton H. Spikes
4100 N. Fairfax Drive
Suite 730
Arlington, Virginia 22203
phone: (703) 465-8404 fax: (703) 465-8420 email: Clay.Spikes@marineacoustics.com

Cheryl L. Schroeder
4100 N. Fairfax Drive
Suite 730
Arlington, Virginia 22203
phone: (703) 465-8404 fax: (703) 465-8420 email: Cheryl.Schroeder@marineacoustics.com

Award Number: N00014-04-D-0576, Order 0015
[http:// www.marineacoustics.com/Product1.htm](http://www.marineacoustics.com/Product1.htm)

LONG-TERM GOALS

The collection of *in-situ* underwater acoustic and oceanographic data is critical to achieving a more complete understanding of how marine environmental conditions affect underwater acoustic transmissions, especially over vast ocean expanses. At-sea experiments provide the requisite data and performance measurements that are essential to developing and improving underwater sound detection systems, improving sound propagation and other models, and accurately characterizing the ambient underwater acoustic environment over annual cycles and differing spatial scales. Prior to at-sea experiments that involve underwater active acoustic transmissions, a thorough analysis of potential impacts on the marine environment associated with the transmission of anthropogenic sound is required by Federal legislative and regulatory dictates. Marine Acoustics, Inc. (MAI) provides the Ocean Acoustics department with the analytical rigor needed to ascertain potential environmental impacts associated with ONR Code 322OA-sponsored at-sea experiments. This impact analysis supports the comprehensive documentation required to verify compliance with the pertinent Federal and Navy requirements.

OBJECTIVES

The ultimate technical objective of this contract effort is the preparation of environmental compliance documentation that demonstrates that the Ocean Acoustics department follows ONR Ocean Battlespace Sensing Division policies, Navy guidance and policies, and all applicable Federal and State legislative mandates when conducting at-sea experiments; and that further, the experiments are conducted in a manner that will not significantly affect the marine environment.

APPROACH

For each Ocean Acoustics department-sponsored at-sea experiment conducted during 2010, MAI marine biologists, acousticians, and modelers worked closely with the Principal Investigators of the experiment team to acquire the information necessary to completely understand the experiment's objectives, specific design metrics, and characteristics of any underwater active acoustic sources to be deployed during the experiment. After carefully researching and reviewing the scientific literature and available data, our marine biologists established which protected marine species occur in the experimental locale and compiled or derived density estimates of each potentially occurring species for the appropriate season. MAI's acousticians and modelers used the density estimates, sound propagation characteristics of the ambient environment and the active acoustic source(s), and animal movement information to model sound exposure levels for individual marine animals. From this exposure, estimates of the potential for harassment (per the Marine Mammal Protection Act) were computed using the appropriate acoustic threshold criteria.

WORK COMPLETED

By completing a thorough environmental impact analyses and environmental compliance documentation, MAI provided the Ocean Acoustics department and ONR Ocean Battlespace Sensing Division with the requisite foundation needed to authorize and conduct the North Pacific Acoustic Laboratory 's (NPAL's) 2010 Philippine Sea Experiment, which took place over three months during the 2010 fiscal year.

RESULTS

On the basis of MAI's analysis and documentation, the Ocean Acoustics department was able to authorize the NPAL 2010 multi-phased experiment to be conducted by a consortium of researchers. The successfully-deployed instrumentation and resulting data that were collected will enable the team of scientists to characterize a complex and highly dynamic region of the Pacific Ocean acoustically and oceanographically and gain a greater understanding of how ocean variability affects acoustic propagation, as well as signal stability and coherence over great ocean distances.

IMPACT/APPLICATIONS

MAI provided the foundation documentation needed for ONR Ocean Acoustics department to conduct the NPAL 2010 Experiment, during which oceanographic and acoustic data were collected over an annual cycle and which will provide valuable insight into how underwater sound propagates through a vast region of the North Pacific Ocean. Data collection will be ongoing throughout the last quarter of fiscal year 2010 and much of fiscal year 2011.

RELATED PROJECTS

The NPAL program is an ongoing collaborative underwater acoustics and oceanography research effort of 13 scientific universities and organizations sponsored by ONR and the Ocean Acoustics department. MAI has worked with the NPAL research team over the last decade to prepare the environmental documentation needed for their continuing marine research. MAI will continue collaborating directly with NPAL scientists to gather information about the planned activities in 2011

that will conclude the experiment begun in 2010. More information about the NPAL program and their past experiments can be found at: <http://www.npal.ucsd.edu/>.

PUBLICATIONS

- Final Acoustic Impacts Analysis for the North Pacific Acoustic Laboratory (NPAL) Philippine Sea 2010 Experiment. Final Technical Report. March 2010. Ocean Battlespace Sensing Science and Technology (Code 32); Ocean Acoustics Department (Code 322OA). 61 pages. [not published]