U.S. Navy Living Marine Resources Program
FY18 Need Topic

The U.S. Navy Living Marine Resources (LMR) program issued a call for pre-proposals pertaining to one FY18 need topic.

SOLICITATION OPEN PERIOD: 24 August – 17 October 2017.

SOLICITATION ADVERTISEMENT:

- BAA Solicitation N39430-17-R-7207 posted at www.neco.navy.mil and www.fbo.gov on 24 August 2017.
- Announcement posted on LMR Program website at https://www.greenfleet.dodlive.mil/lmr on 24 August 2017.
- Announcement posted to the bioacoustics-l listserv on 24 August 2017.

NEED TOPIC N-0159-18: IN-SITU EXPLOSIVE SOUND CHARACTERIZATION AND PROPAGATION DATA COLLECTION AND ANALYSIS

RESEARCH NEED

The Navy models the effects of explosive detonations to determine the potential impacts to marine species (mammals, sea turtles, fish, and birds). However, there is a concern that current modeling results may not accurately predict the distance at which sound propagation, and thus effects to marine species, will occur. The current models were validated using explosive sound source characterization and propagation data primarily collected from small net explosive weight (NEW) charges of less than 20 lbs., occurring in shallow water, with sandy bottom conditions, and from near field recording locations. As a result, these data may not be representative of the sound source characterization and propagation conditions that may occur in different training and testing environments and with charges of varying sizes. There is a research need to collect additional underwater in-situ data from real explosive events in a variety of conditions and with a variety of charge sizes ranging from 20 to 250 lbs. NEW, to validate the model. The model validation will be done by the Navy, this current research need is focused on the collection and analysis of underwater in-situ data only.

BACKGROUND: NAVY ACOUSTIC EFFECTS MODEL

The Navy Acoustic Effects Model (NAEMO) is the standard navy software tool used to evaluate the effects of anthropogenic sound on marine species. NAEMO Analysis inputs include training and testing activity definitions, marine species abundance and distributions, and sound propagation data computed for each impulsive source. Activity definitions include operational characteristics of each platform (ship, submarine, aircraft, or unmanned vehicle) and source. These inputs are then used to build a virtual three dimensional environment that is used to run a series of computer simulations. Output from each

computer simulation produces time dependent sound exposures for each animat (virtual animal) defined in the simulation. Animat sound exposures are then evaluated and compared to criteria thresholds to determine the number and level of animat effects that result from each simulation. Effects from all simulations are then combined to determine the overall effects.

The Comprehensive Acoustic Simulation System (CASS) Gaussian Ray Bundle (GRAB) software is used to compute the sound propagation for impulsive sources. Modeling of the impulsive signal is time-dependent. The time dependence is incorporated by using outputs from CASS/GRAB to build a transfer function, and convolving this with a similitude source signature. CASS/GRAB is a navy standard software product that is part of the Oceanographic and Atmospheric Master Library (OAML).

CASS/GRAB supports multiple inputs of environmental properties which can change depending on the distance from the source. Environmental inputs include parameters such as bathymetry, bottom types, water temperature and salinity, and wind speed along with source characteristics.

EXPLOSIVE MEASUREMENT REQUIREMENTS AND ASSUMPTIONS

For the pre-proposal, develop your technical approach and cost estimate to empirically measure underwater in-situ explosive sound propagation based on the following requirements and assumptions:

1. Field tests and data collection should be assumed to occur in the Navy's Point Mugu W-289S Sea Range off the coast of southern California. The Living Marine Resources program will coordinate with Navy personnel at the Point Mugu Sea Range in regards to logistics and testing schedules for explosive events. In addition, the LMR program will coordinate with the NAEMO modeling team to define metrics and requirements. Assume several planning calls and at least one in-person meeting in the first full year of effort.
2. Explosive sources of interest include the use of air launched missiles and rockets or air dropped bombs from fixed and rotary wing aircraft. Explosive detonations can occur at or near the surface of the water, or in-air (within 100'of the surface), and is dependent on the type of munitions. Explosive weights of interest range in size from 20 to 250 lbs. net explosive weight (NEW). Assume at least two types of explosive sources will be measured.
3. Plan to deploy the underwater recording sensors at least one day prior to the explosive event and recover them at least one day after the event in coordination with Range operations.
4. Data collection should include various measurements to calculate the sound velocity profile (temperature, salinity, and water depth), and other environmental measurements such as bottom type, wind speed and wave height.
5. A minimum of three measurement sites between the explosive charge location and the maximum measurement distance (~10 km). Ranges would depend on the size of explosives used.
6. A minimum of two underwater measurement depths between the explosive charge depth and the maximum measurement depth (~1000m).
7. Sampling design should include multiple radials to assess bathymetry effects including up/down/cross slope affects
8. The units for pressure and time can be any of the standard units (such as PSI, MPa, etc.) as long as it is identified which units are used for the measurements and reporting of the data and agreed upon ahead of time. Distance measurements should be in units that are consistent with the pressure units.
9. Include at least one experimental design test and two field measurements, with sufficient time for analysis and verification of the data to make adjustments or improvements between tests.

10. Consider ports of departure and mobilization along the California coast, such as Oxnard and Ventura, as there is no port on San Nicolas Island capable of supporting this effort.
11. List in your proposal any other assumptions you may need to make.

Accurately measuring the pressure time histories requires sufficient experience and instrumentation capable of capturing the rapid rise times that are typically associated with explosive or shock wave time series. This would be particularly important for any proposed near-field measurement sites where the highest rapid rise times occur. Available modeling methods should be used to predict best approach to sampling and experimental design and equipment specifications.

The proposal should focus solely on explosive sound propagation measurements in the field. While the effort will be used to inform and validate the NAEMO model results, we are not requesting any updates or tools to specifically support the NAEMO process.

The goal of the project is to collect, analyze, and report on data in an unclassified manner. However it may be beneficial to have a secret clearance to initially handle and analyze the data.

DATA REPORTING

Data reporting requirements include a detailed description of the experimental design and analysis of results. In addition, measured pressure time history information should be provided both electronically and graphically in the report. The electronic data format should be clearly identified in the report.