E&P SOUND & MARINE LIFE PROGRAMME

Joint Industry Programme on E&P Sound and Marine Life - Phase III

Request for Proposals Number: JIP III-15-02

Title: Autonomous Aerial and Marine Technology Understanding - Literature review on understanding the current state of autonomous technologies to improve/expand observation and detection of marine species

Release Date: February 24Th, 2015

Introduction

This Request for Proposals (RFP) seeks proposals to provide a literature review that will contribute to understanding the status and potential of aerial and marine autonomous technologies, including but not limited to Unmanned Aerial System (UAS) and Autonomous Underwater Vehicle (AUV) technologies (either surface or underwater) to conduct mitigation monitoring and/or population surveys for marine mammals and other marine species.

The research called for in this RFP is required to meet the information needs of the above JIP, specifically Research Category 5 **Research Tools** (need for new or updated equipment or techniques to improve research data collection or monitoring efficacy) - see www.soundandmarinelife.org website.

The Proposals being requested must address the Objectives, Project Description, Project Components and Project Deliverables detailed below.

Organisations submitting Proposals should also adhere to the Application Procedure and Critical Dates set out below.

Application Procedure

To respond to this RFP, please follow the relevant instructions given on the Funding page of the JIP website. Proposals should refer to the above RFP number and should be submitted electronically to info@soundandmarinelife.org.

Those organisations submitting Proposals should refer to the outline contract on the JIP website. This sets out the terms & conditions (which may from time to time be amended) under which any contract will be carried out under the management of the International Association of Oil & Gas Producers (IOGP) acting as agent for the participants in JIP. In particular, attention is drawn to the specific term relating to management of health, safety, security and environment aspects of a contract. All OGP contracts have such a section, but the specific wording that will appear in this section depends on the type of activity (desk-top study, field work, etc) to be conducted. Please also note the guiding principles on the ***Policy on the use of live animals in experiments*** on the website.

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Critical Dates

Proposals are due by: **April 3rd, 2015**.

We will confirm receipt of proposals. If you have not received confirmation of receipt of your proposal within 1 week of the above deadline, please contact John Campbell at IOGP (Tel +44 (0) 20 3763 9700; e-mail info@soundandmarinelife.org). The review of proposals will conclude within 2 months of the submission deadline, after which applicants will be notified by the JIP.

It is envisaged that the review work be conducted in a time period of around 6 months.

Background and objectives

As global energy demand rises, the oil and gas industry is experiencing an increase in exploration and production (E&P) activities conducted in remote areas historically considered inaccessible. Additionally, in some areas of current operations, regulatory authorities and environmental advocacy groups are increasingly calling for improved knowledge and understanding of marine species distribution and abundance ahead of and following E&P activities being conducted offshore (i.e. the US Gulf of Mexico, Canada, Australia, and the Arctic). Concern has grown about the potential impacts of underwater sound generated from E&P activities on marine resources, particularly marine mammals, sea turtles, and fish. This has created an expectation for E&P and geophysical survey companies to increase monitoring efforts to assess and minimize impacts of their activities on these resources, as well as to contribute to baseline data about the region of interest.

For clarity about the scope of this review we provide information about the marine species of interest and the types of unmanned technology of interest. First, while marine mammals have historically been the marine species of greatest interest, we encourage the inclusion of sensing for other marine species, including sea turtles and fishes. Technologies of interest include Unmanned Aerial Systems (UAS), including but not limited to powered aircraft, gliders, kites and lighter-than-air craft; and Autonomous Underwater Vehicles (AUV), including but not limited to powered underwater or surface craft, wave or wind gliders, and drifting (but not moored) sensor packages for two important and overlapping E&P needs: 1) Real-time or near real-time monitoring for timely decision making during operational environmental risk management and permit compliance; and 2) Collection of survey data to support animal population, density, distribution, movement, and behavioral effects estimation.

Monitoring Applications. Some marine species may respond to the presence of E&P equipment and activities at distances that cannot be monitored from the immediate location of the activity. Observations from autonomous mobile platforms can provide the data to assess the marine species interactions and responses. In these cases, currently accepted monitoring and mitigation methods may not be advisable when operations are too far offshore to safely conduct manned aerial flights, for example. In addition, vessels and aircraft required to monitor marine resources during operations have been known to contribute to the overall soundscape that we are trying to minimize. Thus, novel methods are needed to monitor marine resources in offshore areas to better understand the effects of E&P activities on marine mammal populations.

Survey Data Collection. Methodologies for estimating marine mammal density and population sizes have been successfully developed and demonstrated for some time. Vessel-based or aerial transect surveys, using well-established distance sampling methodologies, are the most common ways of obtaining marine species abundance and distribution information (Buckland et al 2001). These surveys are costly and thus cannot be economically repeated often enough to enable assessment of effects to a marine mammal population from a particular activity that may persist for months or years. Similarly by using existing animal vocalization datasets, recorded on multiple fixed passive acoustic receivers

deployed over specific areas, marine mammal density estimations have been made from fixed sensor arrays. However, in order to optimize the outcomes of density estimation methods for species of interest, specific data characteristics were needed, such as vocalization characteristics, temporal and spatial variation in habitat usage, etc. This in turn required particular equipment technical design and consideration of both the temporal and spatial deployment configurations of equipment. While fixed platforms will not be considered in this RFP, similar data needs should be considered for mobile platforms reviewed under this task. Progress in Unmanned Aerial System (UAS) technology development has been made over the past years with the purpose of augmenting direct visual surveys from vessels or aircraft, or to operate in areas where aerial survey safety restrictions are in place. Furthermore, Autonomous Underwater Vehicles (AUVs) can be configured to collect not only marine mammal acoustic data, but acoustic data about the sound sources of interest as well as ambient acoustic data. The capabilities of AUV systems for density estimation purposes are currently not well understood. AUV systems may be deployed from either a platform at sea, such as a vessel, or from a shore based facility and can also be equipped with a variety of additional sensors to collect oceanographic data, water quality data and more. Some AUVs may communicate with their operators periodically or continuously through telemetry (satellite signals or underwater acoustic beacons), while others may archive raw or partially processed data for retrieval after the AUV is recovered. Some AUVs must be pre-programmed while others may drift with wind and currents (i.e. Lagrangian drifters). Others can either be directed to change their mission profile via telemetry or to self-navigate based on environmental data received through various sensors while under way.

Acoustic and other sensors on mobile platforms or high-resolution cameras on unmanned aerial systems can produce large data sets. These new unmanned systems have therefore resulted in technical challenges of storing, managing, processing and eventually interpreting the large amount of data that is collected, sometimes on-board the platform, and then transmitting in near-real time raw or partially processed information about the marine animals detected. Consideration of data transmission bandwidth needs and data archival and management needs will therefore also need to be part of the technology review.

The purpose of this RFP is to enhance our understanding of how UAS and AUV systems can be used for environmental monitoring and for estimating population status and trends. While not of primary importance, the collection of oceanographic data, and quantitative measurements of ambient sound as well as characteristics of discrete sound sources of interest such as seismic survey sounds may also be documented. The important consideration is performance of the unmanned systems within the operational conditions of Exploration & Production activities, which implies the inclusion of E&P Industry knowledge in the proposing team and their work products. The UAS and AUV platforms will need to operate for lengths of time that are meaningful and cost effective for our industry, necessitating the comparison of general cost ratio information such as sensor integration cost, platform operation and maintenance costs, battery cost and performance limits, and costs of data telemetry. It is anticipated that sensor performance metrics (e.g. ability to detect, classify and localize marine mammals) will be provided to allow comparison between traditional means of monitoring and survey and the same tasks undertaken by AUV and UAS-based systems.

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Description of Proposals being Requested:

Development of a literature review that will contribute to understanding the status and potential of UAS and AUV technologies to conduct marine mammal monitoring or population surveying.

Desirable Features of Proposals:

- An exhaustive review of available UAS and AUV platforms and sensors technologies that are most pertinent to oil and gas operations for monitoring of marine species. Other than an overview of the available systems and sensors, this review should provide details on cost of systems and sensors, current state of technology maturation, including current commercial availability, sensor performance, system lifespan, limits to operating conditions (weather, depth, currents, etc.), along with relevant references to field tests, sources of cited data and key points of contact for each system.

- Key data types (e.g. digital photographs, digital sound files, oceanographic data, e.g. CTD, currents, bathymetry, GPS data, etc.) and the data's potential uses for assessing the effects of oil and gas industry exploration and production (E&P) as well as geophysical operations (e.g. seismic surveys) on marine species. Proposers should address the technical challenges of managing, storing and analyzing large amount of data produced by the autonomous systems.

- Make recommendations of platform technologies, sensors and data characteristics that would be most relevant for the E&P industry to pursue, either via further advancement of technology development or field trials of existing promising systems, including combinations of sensors/platforms best suited to particular species, geographic, and operational conditions.

- The proposal should include a timeline for completion of major milestones and an expenditures schedule, as well as a detailed budget, curricula vitae or biographies of key team members, and supporting documents as warranted (not to exceed 20 pages).

Project Deliverables:

Project deliverables shall include:

a) Periodic Progress Reports that summarize the work conducted, tasks planned for the coming reporting period, amount spent (vs. budget), and forecasts of spending for the duration of the project. The format and frequency of reports will be determined following contract award.

b) Draft and Final Reports that:
   - document the state of the science for using both UAS and AUV technologies for marine animal monitoring purposes during oil and gas industry activities offshore.
   - Identify specific technologies (platforms and sensors) that might be used in future field trials sponsored by either the JIP or individual companies.

c) Papers or posters at professional conferences and important marine technology conferences at the discretion of the Principal Investigator.

d) A publication with the key findings from the status review. The review team is also encouraged to address the prospects for regulatory concurrence on autonomous technologies as a replacement/complement to current monitoring methods required for operating in low visibility conditions and/or for monitoring long distances from the activity, and finally as a replacement for Marine Mammal Observers (MMOs) / Protected Species Observers (PSOs).

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Terms & Conditions:

By submitting a proposal to JIP, the potential contractor accepts the terms and conditions set out in this RFP. This RFP does not commit the JIP, through IOGP, to contract for any supply or service and the JIP shall not be deemed to have accepted any proposal submitted by any potential contractor unless and until a duly executed written agreement is in place and then only for such scope as specifically identified in the written agreement. The potential contractor acknowledges that IOGP and the JIP participants may accept or reject any proposal for any reason whatsoever. The JIP may decide to fund a study in part or as a whole.

Those responding to this RFP are advised that the JIP will not pay for any costs incurred in preparation of a response to this invitation, including without limitation costs and expenses of attending meetings and worksite visits related to this RFP. All correspondence and documentation associated with this invitation will be in English. Submissions and information will not be shared with other potential contractors.