

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

Request for Proposals Number: JIP III-15-04

Improvements for Towed Passive Acoustic Monitoring (PAM) Technology

Release Date: 26<sup>th</sup> November 2015

### Introduction

This Request for Proposals (RFP) seeks proposals to conduct studies that will investigate and develop improvements for the application of towed Passive Acoustic Monitoring (PAM) for real-time monitoring of marine mammals at sea. Feasibility and assessment of integrating data with other monitoring platforms and methods, such as visual monitoring, is also of interest. Activities for this subject area will build on previous JIP-supported efforts related to acoustic monitoring by enhancing real-time marine mammal monitoring capability during night time and periods of poor visibility conditions.

The research called for in this RFP is required to meet the information needs of the above JIP, specifically Research Category 4 *Mitigation and Monitoring* - see [www.soundandmarinelife.org](http://www.soundandmarinelife.org).

The Proposals being requested must address the Proposal Description, Proposal Features and Project Deliverables detailed below.

Organisations submitting Proposals should also adhere to the Application Procedure and Critical Dates set out below. In addition, the Terms & Conditions referred to at the bottom of this RFP shall apply.

### 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](mailto: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, of a contract with the International Association of Oil & Gas Producers (IOGP) acting as agent for the participants in the JIP. In particular, attention is drawn to the specific term relating to management of health, safety, security and environment aspects of a contract. All IOGP 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.

### Critical Dates

Proposals are due by: **Thursday, 7<sup>th</sup> January 2016.**

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](mailto: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.

## **Background**

Visual monitoring continues to be the primary method of detecting marine mammals at sea during offshore E&P activities. The use of towed Passive Acoustic Monitoring (PAM) has increased significantly in recent years, driven by regulatory demand for monitoring at night or in poor visibility conditions during seismic surveys when visual observation methods are less effective. For poor visibility conditions in particular, PAM is increasingly considered as a 'best available' tool for monitoring; however, it is also one tool in the 'monitoring tool box'.

In recent years, there have been development efforts to integrate PAM capabilities into existing seismic survey hydrophone streamer equipment. However, by far the most common (conventional) configuration of towed PAM used for both industry and research purposes continues to be via separate hydrophone arrays that are deployed, towed and recovered by attachment, either directly from a vessel or via other in-sea equipment.

Whilst the basic elements of a 'conventional' towed PAM system have not changed, a significant amount of time and effort by individual companies has focused on improving deployment/recovery methods and procedures, thereby integrating the use of PAM into overall day-to-day operations of a seismic vessel offshore. Other aspects have improved significantly due to advances in other technology areas; for example, telemetry of PAM data between vessels and from vessels to shore. Such 'remote' user access capability offers the potential to reduce safety exposure of personnel by reducing the numbers of PAM operators required offshore and therefore personnel traveling to/from offshore facilities.

A notable contribution to standardising the use of PAM during oil & gas exploration activities offshore has been the development and open availability of the PAMGuard user interface software. PAMGuard software use has increased and has established a position of being a standard PAM interface being used by industry and increasingly for research purposes as well. The availability of a common user interface simplifies operator training needs. This, in turn encourages a larger pool of trained operators being available as the demand for PAM services from offshore industries increases. As well as the software itself, a basic Support Function currently provides assistance for users and developers of PAMGuard.

As well as a greater understanding of both capabilities and limitations of the technology, the increased use of towed PAM during industry activities has also helped to identify a number of areas that would benefit from further development in order to address some of the fundamental limitations of the towed PAM method. These include improved localisation and ability to detect low-frequency vocalisations.

## **Description of proposals being requested**

The IOGP E&P Sound and Marine Life JIP is requesting proposals which address one or more of the following:

- Integration of sensor types and/or spatial configurations of multiple sensors to resolve port/starboard ambiguity that results from the use of a single hydrophone array PAM system.
  - A critical requirement is to minimise operational complexity of towing multiple sensor arrays from a single monitoring vessel.
- Quantified and enhanced ability to detect low-frequency marine mammal vocalisations; for example, using:
  - Signal processing/filtering improvements
  - PAM hydrophone array deployment depth & control
  - Beam-forming

- Quantified and enhanced ability to localise marine mammal vocalisation detections relative to the monitoring vessel location; for example, using:
  - Beam forming
  - Time of Arrival differences
- Assess the feasibility of integrating data with other monitoring platforms and methods, such as visual and thermographic monitoring.

The methodology and metrics used to quantify enhanced capabilities must be clearly explained and demonstrated relative to existing towed PAM capabilities, for example:

- Frequency range of detection
- Vessel/operating speed
- Metrics for detection, classification and localisation performance, such as anticipated % increase detection rates, reduced false detection rates, true vs false detections, relative distance errors, etc.

For new or enhanced capabilities that require interaction with a PAM operator in the field via a software user interface, the following aspects must be considered:

- The development and integration of an appropriate user interface module that is compatible with the PAMGuard software application.
  - Source code for PAMGuard modules should all be in Java (JRE 7 or later) unless interfacing to pre-existing external libraries in which case C/C++ may be used so long as a PAMGuard compatible JNI (Java Native interface) is provided. Source code must be made available under the terms of the GNU General Public License, Version 3 or later (<http://www.gnu.org/licenses/gpl-3.0-standalone.html>).
    - Proposal authors are encouraged to liaise with the PAMGuard Support team at an early stage in the project to discuss how new developments may integrate with PAMGuard core functionality and to obtain access to the Sourceforge Code repository.
    - Information regarding interfacing with the PAMGUARD software application is available via the PAMGuard website - [www.pamguard.org](http://www.pamguard.org)
- Utilising standard data formats to enable import/export capability of detection, classification, localisation and/or other data streams

The technical specification of equipment and physical configuration of any proposed demonstration deployments of acoustic monitoring systems **must be** appropriately designed to consider the following:

- Areas of E&P activity and anticipated species of interest in these areas.
- Spatial extent of detection capability relative to typical mitigation monitoring zone distances commonly implemented during oil and gas activities, for example 500 metres.
- Ease of equipment deployment methods, for example from a seismic streamer, source or other type of vessel, maintenance and data retrieval and analysis.
- Minimising potential interaction with nominal E&P activities and operational implications should be considered.
- Operational Health, Safety & Environment (HSE) considerations during offshore activities.

### **Desirable features of proposals**

Responses to this RFP should address each of the following (see also **RFP Response Format** page of website):

- Demonstrate a knowledge and understanding of:

- Previous JIP-supported development efforts related to towed PAM hardware and software systems.
- The practicalities of implementing towed Passive Acoustic Monitoring during E&P operations, such as seismic surveys or other activities that may deploy PAM.
- Marine mammal species presence relative to areas of E&P development.
  - Open availability of software and/or source code
- Type of functionality being improved (Detection, Classification or Localisation) and detailed description of method and its limitations.
- Species of marine mammal the improved functionality is applicable to, including description of vocalisation behaviour (e.g. dependence on gender, context, diel cycle, annual cycle).
- Software interface requirements - Full compatibility with PAMGuard software
- Hardware interface - What type of hardware is required?
  - Data acquisition speeds
  - Number of hydrophone elements
  - Auxiliary sensors
- Geometric configuration of towed hardware
- Field verification methodology, addressing the following:
  - Definition of metrics used for verification (e.g. proportion of correct mitigation decisions).
  - reliability of detection robustness of classification and accuracy of localisation techniques and how this varies with distance, azimuth and species in a typical E&P setting including ship and air-gun noise
  - acquisition method for reference (ground truth) data to be used in verification
  - deployment, recovery of in-sea equipment and real-time use of newly developed software functionality
- Timeframe for completion of project and significant milestone events during the project.
- A detailed cost estimate in US dollars, which includes:
  - Support for travel in order to interface with related company representatives or others with expertise in this subject area;
  - Costs associated with prospective publications in peer-reviewed journals
  - Assumptions to support the cost estimate; and
  - Any contingencies to address unknowns.
- A list of personnel to be involved in the project and their qualifications, their proposed role in this project and associated cost/time allocation throughout the project.
- Researcher experience in this area and previous work.
- Operational HSE considerations during offshore activities.
- Where appropriate to the project, a discussion on how you manage animal care and use in your proposed work (see also Application Procedure above)
- An overall proposal summary (one paragraph).

### **Project deliverables**

Project deliverables shall include:

- a) **Monthly Progress Reports** that summarise the work conducted, milestone status, tasks planned for the coming month, amount spent (vs budget), and forecasts a spend plan for the duration of the project. The specific reporting formats will be determined following contract award.
- b) **Draft and Final Project Reports** to include:
  1. Detailed description and technical specification of function capability
    - Types of hardware and software
    - Data acquisition speeds/rates

- Number of hydrophone elements
  - Auxiliary sensors Data collection
2. Maps or other graphics showing modelled detectability and localisation errors (relative to monitoring vessel/platform) for given, equipment geometry, background conditions and animal species characteristics, such as vocalisation source levels and frequency content.
  3. Field verification methodology and results
  4. Setup and user help documentation
  5. Software developer documentation
  6. An overview and critical assessment of capabilities and application of the improved monitoring functionality and methods. This should include:
    - Ability to successfully detect/classify/localise marine mammals at sea
    - Accuracy of detection, classification and localisation techniques and how this varies with distance and species
    - Deployment/recovery
  7. Data transfer, collection and access.
  8. Operational implementation plans for equipment deployment, maintenance and data retrieval. This **must include** operation HSE considerations and interface requirements with any O&G installation.
  9. A quantification of the uncertainty involved in the various fundamental inputs/assumptions and how this uncertainty might impact results
  10. Data analysis and assessment of the accuracy (compared to other towed PAM methods).
  11. Identification of potential areas of further development and suggested ways forward in order to provide or improve effectiveness of towed acoustic monitoring datasets. This should include improved or simplified logistics and financial viability.
  12. Recommendations for a path forward to address the potential areas of further development, which balances factors such as:
    - Feasibility of successful development
    - Likely development costs and timing of availability
    - Perception of need and its urgency.
- c) **One or more Manuscripts submitted for publication** in a peer-reviewed journal, describing and discussing the improvements compared to existing towed PAM capabilities, including the performance for detecting/classifying/localising marine mammals at sea.

### **Terms & conditions**

By submitting a proposal to the 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.