

DOE FOA 1418 (Topic Area 2): Innovation, Testing and Validation of MHK Environmental Monitoring Instrumentation Performance

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- Uncertainty of environmental impacts of MHK devices leads to long, costly permitting processes and extensive monitoring requirements.
- Existing environmental monitoring technologies not designed for use in the high-energy, and often low-visibility conditions of MHK sites.
- Processing and analysis of the large data streams collected during environmental monitoring is time intensive
- Technical challenges persist and the costs associated with data collection and analysis are still prohibitive.

Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance
- Conduct R&D for Innovative MHK systems & components
- Develop tools to optimize device and array performance and reliability
- Develop and apply quantitative metrics to advance MHK technologies

Deployment Barriers

- Identify potential improvements to regulatory processes and requirements
- Support research focused on retiring or mitigating environmental risks and reducing costs
- Build awareness of MHK technologies
- Ensure MHK interests are considered in coastal and marine planning processes
- Evaluate deployment infrastructure needs and possible approaches to bridge gaps

TA 2

Market Development

- Support project demonstrations to reduce risk and build investor confidence
- Assess and communicate potential MHK market opportunities, including off-grid and non-electric
- Inform incentives and policy measures
- Develop, maintain and communicate our national strategy
- Support development of standards
- Expand MHK technical and research community

Crosscutting Approaches

- Enable access to testing facilities that help accelerate the pace of technology development
- Improve resource characterization to optimize technologies, reduce deployment risks and identify promising markets
- Exchange of data information and expertise

Deployment Barriers

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The Impact

- Improve the technical performance of monitoring instrumentation
- Reduce the overall costs associated with data collection and analysis
- Development of fit-for-purpose, cost-effective tools ready to be used for environmental monitoring by the MHK-community

Topic Area 2 – Innovation, Testing and Validation of MHK Environmental Monitoring Instrumentation and Performance

Goal: Support the final innovative improvements, testing and validation of environmental monitoring technologies and the associated data-processing software in representative MHK field environments. Topic Area 2 is divided into four focus areas to address specific stressors or monitoring targets of high regulatory concern:

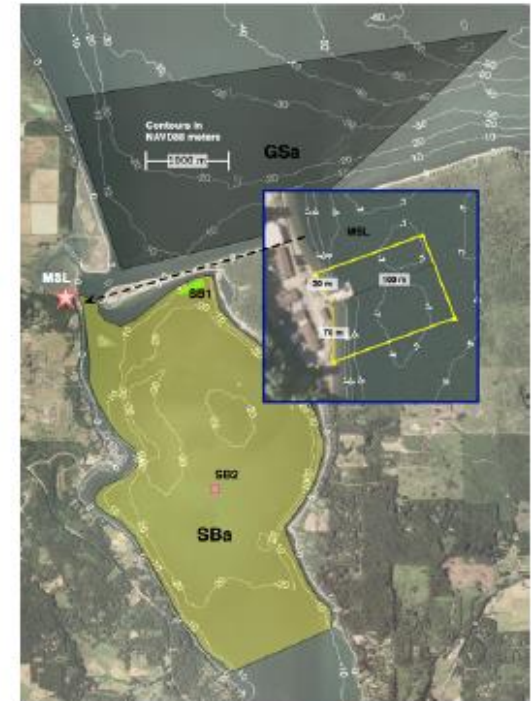
- 1) Acoustic outputs
- 2) Electromagnetic Fields
- 3) Marine Organism Monitoring
- 4) Integrated Sensor Packages

Target Results: Successful projects within this Topic Area will improve the technical performance of monitoring instrumentation, reduce the overall costs associated with data collection and analysis, and will result in fit-for-purpose, cost-effective tools ready to be used for environmental monitoring by the MHK-community.

Project Schedule:

- **Duration:** up to 36 months
- **BP 1:** Conduct in water testing in a semi-sheltered environment to validate baseline technical and cost performance. **Go/No-Go:** based on initial performance, robustness and feasibility of end-goals.
- **BP 2:** Perform hardware and software improvement activities, conduct a brief in-water test to demonstrate technical improvements. **Go/No-Go:** based on the in-water test results and progress towards project end-goals.
- **BP 3:** Test instrument performance and evaluate costs in a more energetic environment, preferably around an MHK device.

- Baseline performance testing (year 1) and improvement verification (year 2) will be performed in a semi-sheltered location at PNNL's Marine Sciences Laboratory In Sequim, WA
- Discrete amount of PNNL time, resources, facilities and expertise will be allocated to each project for testing and improvement activities during the project period
 - funded directly by DOE



Research Activities	Project Areas				
	SB1	SB2	SBa	MSL	GSa
Sea bed installations	✓	✓	none	✓	none
Surface platforms and buoys	✓	✓	none	✓	none
MSL dock installations	none	none	none	✓	none
Autonomous underwater vehicle operations	✓	✓	✓	✓	✓
Surveys and sediment sampling	✓	✓	none	✓	none
Vessel use	✓	✓	✓	✓	✓
Acoustic device operation	✓	✓	✓	✓	✓
Electromagnetic field operation	none	none	none	✓	none

FOA funding available

	Maximum DOE funding (per application)	Cost share	Maximum duration
TA 1	\$5.35M	BP 1: 20% BP 2&3: 50%	54 months
TA 2	\$0.75 M – \$1.1 M	20%*	36 months
Total	\$22 M		

Award details

	Awards made	Total DOE support
TA 1	3	\$15.06 M
TA 2	7	\$5.93 M
Total	10	\$20.99 M

Focus Area	Awards
Acoustics	2
Electromagnetic Fields	1
Marine Organism Monitoring	2
Integrated Sensor Package	1
Benthic Habitat Mapping and Monitoring	1

TA 2: Integral Consulting, Inc. (CA)

*Rapidly Deployable Acoustic Monitoring and Localization System
Based on a Low-Cost Wave Buoy Platform*

Project Summary:

- This project will leverage an existing buoy platform to develop a cost-effective compact array of hydrophones and particle velocity sensors that characterizes, classifies, and provides accurate location information for anthropogenic and natural sounds.
- On-board processing will generate a periodic data digest of acoustic metrics which will represent a concise, compressed overview of the acoustic field, and be made available to parties of interest via telemetry.

Impact:

- A low-cost, easily deployable acoustic monitoring system, capable of extended monitoring near MHK devices will reduce the time and cost to measure radiated noise produced by MHK device.

Technology Advanced

Moored acoustic measurement system

DOE Funding

Cost-Share

Total Project
Cost

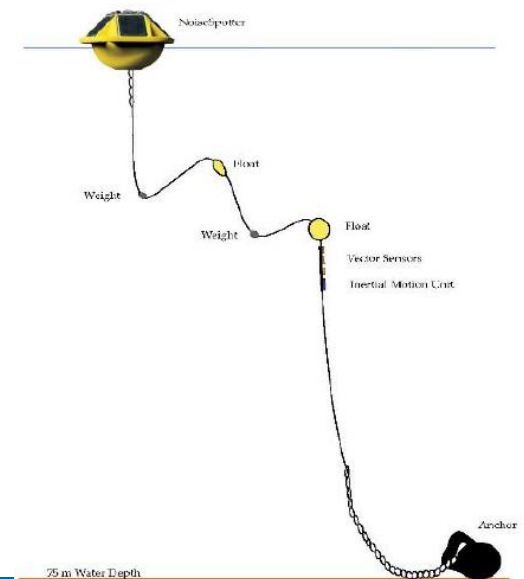
\$745,648

\$199,667

\$945,315

Partners

Spoondrift Technologies Inc., Sandia National Laboratories, Noise Control Engineering LLC, HT Harvey & Associates.



Project Summary:

- This project will systematically optimize the Acoustic Surface Wave Instrumentation Float with Tracking (A-SWIFT) through simulation and field testing to minimize flow-noise and self-noise.
- An integrated sensor suite will simplify deployment and post-processing, and hydrophone synchronization will allow groups of drifting A-SWIFTs to localize marine energy converter sound and objectively discriminate it from other ambient sources.
- Post-processing software will be developed to identify and isolate residual flow-noise and self-noise without operator intervention.

Impact:

- A low-cost, easily deployable acoustic monitoring system, with large spatial coverage capabilities will reduce the time and cost to measure radiated noise produced by MHK device.

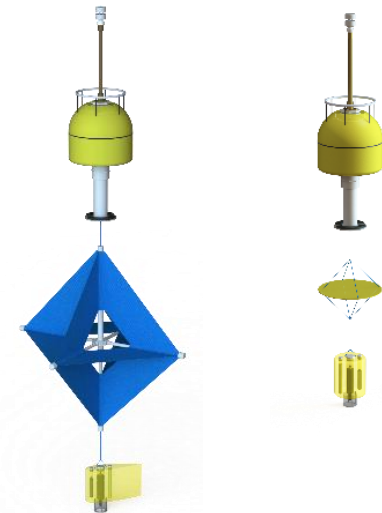
Technology Advanced

Drifting acoustic measurement system

DOE Funding	Cost-Share	Total Project Cost
\$750,000	\$85,197	\$835,197

Partners

MarineSitu, NOAA National Marine Fisheries Service Alaska Fisheries Science Center



Conceptual modifications to A-SWIFTs for currents (left) and waves (right)

TA 2: Woods Hole Oceanographic Institution

A Combined Electric/Magnetic Field Instrument for MHK Environmental Monitoring

Project Summary:

- This project will adapt existing electromagnetic instrumentation design to function in an MHK application by changing out sensors to optimize performance in high energy environments and to detect signals at relevant frequencies.
- The deployment platform will also be altered to provide enhanced stability in energetic waters and allow for tethered operation from a surface ship to provide a rapid aerial survey capability.

Impact:

- Research-grade technologies capable of measuring the electromagnetic fields produced by subsea cable and MHK devices will provide the much needed data to inform the actual risk associated with EMF, which is frequently raised as a regulatory concern.

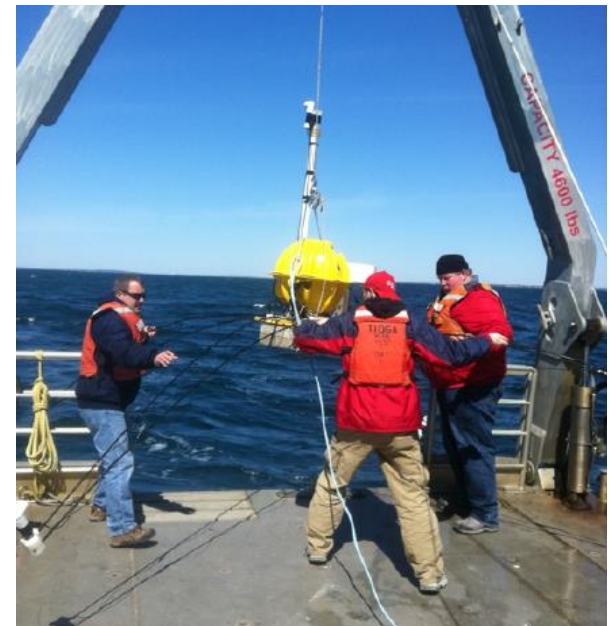
Technology Advanced

Electromagnetic Field Measurements

DOE Funding	Cost-Share	Total Project Cost
\$750,000	\$83,333	\$833,333

Partners

N/A



TA 2: BioSonics Inc. (WA)

A-Long-Range Target Detection and Classification System for Environmental Monitoring at MHK Sites

Project Summary:

- This project will develop an active acoustic monitoring system which includes a Perimeter Detector, to automatically detect and geolocate targets at long ranges (200-300 m), and a Directed Classifier that will be automatically aimed at detected targets to track the target's position in three dimensions.
- Acoustic signatures and behaviors from tracked targets will be analyzed to provide target classification information.
- Low band width, real-time reports will be automatically generated and transmitted to project operators.

Impact:

- The ability to detect, track and classify marine organism near MHK devices addresses a high priority regulatory concern that has previously hindered many MHK deployments.

Technology Advanced

Active acoustics for marine organism monitoring

DOE Funding

Cost-Share

Total Project Cost

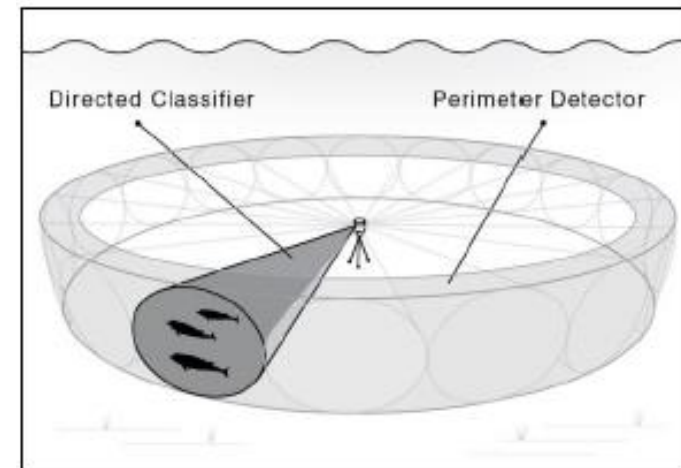
\$750,000

\$187,500

\$937,500

Partners

AIRMAR, Dr. Orest Diachok



TA 2: Florida Atlantic University (FL)

Technical Performance and Cost Optimization of unobtrusive Multi-static Serial LiDAR Imager (UMSLI) for Wide-area Surveillance and Identification of Marine Life at MHK Installations

Project Summary:

- This project will improve upon the existing Unobtrusive Multi-static Serial LiDAR Imager (UMSLI) prototype with extensive testing and validation in operational environments
- Perform capability enhancements related to: (1) detection efficiency, (2) field of view and range of detection, (3) level and diversity of taxonomic classification, (4) deployment duration, (5) reduced production cost, and (6) optimized effectiveness in tidal and wave energy site conditions.

Impact:

- This novel application of LiDAR could allow for a powerful new tool for the observation of marine animal interactions with MHK devices, particularly in turbid or low light conditions, which is a high priority regulatory concern.

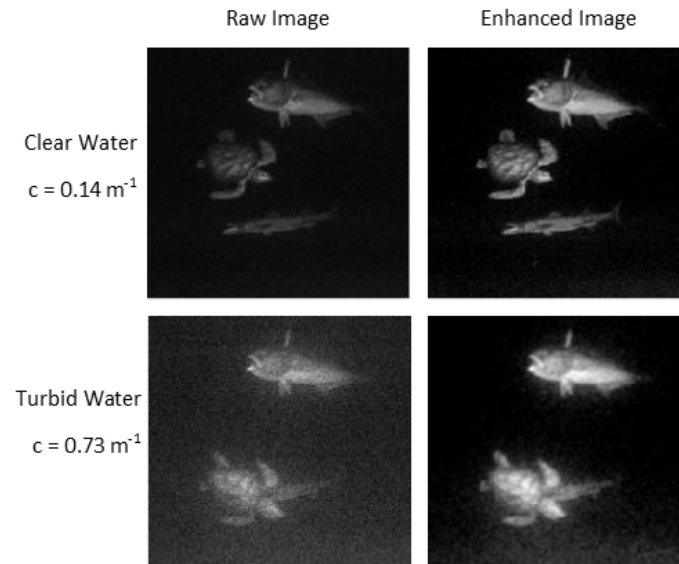
Technology Advanced

Marine Organism Monitoring - LiDAR

DOE Funding	Cost-Share	Total Project Cost
\$850,000	\$94,444	\$944,444

Partners

University of Florida



TA 2: University of Washington (WA)

3rd Generation Integrated Instrumentation: Enhancements to the Adaptable Monitoring Package

Project Summary:

- This project will improve upon the existing intelligent Adaptable Monitoring Package (iAMP) including:
 - (1) Development of a scene classifier based on fusion of information streams;
 - (2) Augmentation of information streams available to the scene classifier;
 - (3) Expansion of iAMP controller capabilities to dynamically regulate data acquisition and minimize the invasiveness of monitoring activities;
 - (4) Increasing the flexibility of backbone hardware and software to minimize non-recurring engineering needed to meet project-specific objectives;
 - (5) Expansion of deployment options to meet the full range of industry needs.

Impact:

- Improvements to integrated sensor packages offer the enhanced ability to monitor marine organism interactions with MHK devices at both long range and close range and potentially record rare interactions, without incurring huge data mortgages.

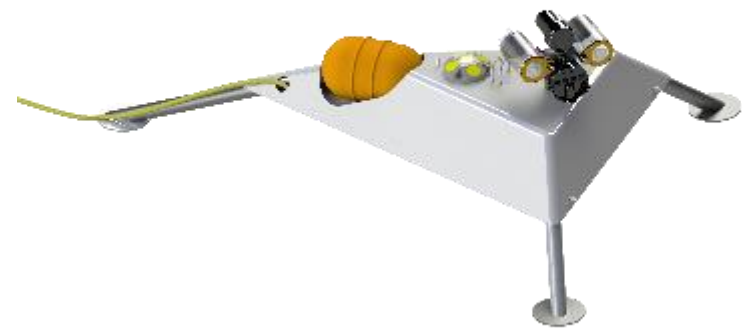
Technology Advanced

Integrated Sensor packages

DOE Funding	Cost-Share	Total Project Cost
\$1,397,008	\$157,910	\$1,554,918

Partners

MarineSitu, NOAA National Marine Fisheries Service Alaska Fisheries Science Center



Enhanced and Simplified System Concept

TA 2: Integral Consulting Inc. (CA)

Standardized and Cost-Effective Benthic Habitat Mapping and Monitoring Tools for MHK Environmental Assessments

Project Summary:

- This project will develop and field test a standardized benthic habitat mapping tool set and protocol for assessing benthic habitat conditions at MHK sites.
- New hardware and software tools will be developed, centered around integrating data from an established, but not widely utilized tool (i.e., the Sediment-Profile Image and Plan View camera system) with well-established geophysical tools (e.g., multibeam echo sounding and backscatter) to efficiently develop detailed and relevant maps of benthic habitat and define baseline conditions across broad areas of the seafloor.

Impact:

- The proposed approach will reduce the cost of benthic habitat mapping required for pre-construction studies.

Technology Advanced

Benthic Habitat Mapping & Monitoring

DOE Funding	Cost-Share	Total Project Cost
\$684,431	\$171,100	\$819,531

Partners

Sandia National Laboratories, H. T. Harvey & Associates

