Marine and Hydrokinetic Energy Advancement for Naval Facilities

Request for Information

March 17, 2016

Table of Contents

1 Introduction

Reliable and cost-effective energy conversion technologies have great potential to harness marine and hydrokinetic (MHK) resources to supply significant power and long-term advantage to the US Navy. MHK energy (wave and currents from tides, rivers, and the ocean) has potential to provide a strategic advantage to the US Navy by mitigating the risk of exposure to increasing fuel cost, and reducing dependence on foreign energy sources. This request for information (RFI) aims to identify potential sources of technology to be evaluated and demonstrated as part of an integrated research effort to advance MHK energy systems for future use at naval facilities.

We envision large-scale tidal/current and wave energy converter installations powering naval facilities in the near future. Existing naval facilities, however, are not necessarily located at the premier sites for wave and current resources. Specific needs call for increased power capture from devices and arrays, relative to first-generation commercial projects, as well as improvements in reliability, serviceability, and security.

One of the Navy's strategic goals is to minimize its dependence on fuels that are in short supply or foreign-sourced and substantially reduce contributions to air pollution and greenhouse gas emissions. For the Navy to fully realize the benefits of the MHK technology, research, verification, system integration, and technology development are being performed by the University of Washington Applied Physics Laboratory (APL-UW) and the Northwest National Marine Renewable Energy Center (NNMREC).

The objective of this research is to advance all aspects of MHK technology and deployment readiness to enable simple, cost-effective adoption of MHK generation capabilities at naval facilities. The approach is to focus on the development of systems and strategies that maximize MHK resource benefits. In addition to advancing device and array capabilities, demonstration that technologies are environmentally benign, and rapid identification and characterization of potential deployment sites are fundamental elements of our approach to supporting the adoption of marine renewable energy assets for the Navy.

2 Purpose of the RFI

This RFI pertains to a potential collaboration between your company and APL-UW/NNMREC as part of the Navy MHK initiative. We intend to provide funding to technology developers in an effort to evaluate and demonstrate the value of a variety of component technologies. Responses to this RFI will be used to determine your interest and eligibility in responding to a request for proposal (RFP) or request for quote (RFQ).

Responses will be evaluated for a subsequent RFP or RFQ. From the RFP or RFQ we anticipate 3-4 awards up to $150,000. No cost-sharing is required from industry partners. Projects will run from Summer of 2016 to Summer of 2017.

APL-UW and NNMREC are focusing specifically on **current devices** (both axial- and cross-flow) and **wave energy conversion** (via heave plate point absorbers). We are soliciting responses from entities that have an energy converter design, component, system, or strategy, or other relevant technology for harnessing marine hydrokinetic energy that is compatible with our research objectives and has potential for adoption at naval facilities. The breadth of potential interest spans core MHK technologies and critical supporting technologies, examples of which include, but are not limited to:

- PTO Components: Generators, Gearboxes, Bearings & Seals
- Control Strategies: Preview Control, Blade Pitch or Yaw Control (axial flow turbines)
- Hydrodynamic Optimization: Blade Design (axial and cross-flow turbines), Hub and Nacelle Design (axial flow turbine), Heave Plate Design (wave converters), Hull Design (wave converters),
- Supporting Electrical Systems: Battery Storage and Charge Control, Load Diverters
- Supporting Software Systems: Condition Health Monitoring, Microgrid Integration/Control

Collaborative projects will provide opportunities for system integration (with laboratory and field testbeds), optimization, and demonstration. For collaborative projects, funding may cover labor, equipment, supplies, fabrication, delivery, and travel costs. Access to test infrastructure will be provided at no cost.

Of note is the opportunity for real-world validation and demonstration through field tests in Puget Sound, WA. These tests will be conducted from onboard the R/V Henderson which can accommodate current turbines up to 1-m in characteristic diameter. Specific requirements for integration with test platforms will be addressed during the RFP stage. Appropriate permits will be obtained by the University of Washington. Full-scale MHK systems requiring dedicated mooring systems, contact with the seabed, or power output greater than 10 kW are outside the scope of this program.

3 Background

3.1 NNMREC and MHK Advancement for Naval Facilities

NNMREC is a partnership between the University of Washington, Oregon State University, and University of Alaska Fairbanks. The Center's mission is to facilitate commercialization of marine energy technology, inform regulatory and policy decisions, and close key gaps in scientific understanding with a focus on student growth and development. Researchers work closely with a variety of stakeholders, including marine energy device developers, community members, ocean users, federal and state regulators, and government officials to conduct research on wave, tidal, in-river energy, and off-shore wind technologies.

This project is developing prototypes and supporting testbeds to deploy and optimize current and wave energy converters in the laboratory and in the field. The primary laboratory facilities include a current flume (with PIV system), a small-scale heave plate oscillator, and a PTO dynamometer (these allow for testing geometries at small scale and respective emulation of their performance when coupled with the PTO at field scale). The R/V Henderson (a 70-foot catamaran barge) is the primary facility for field testing and can serve as either a driven or moored test platform for current turbines. Small field prototypes (up to 1-m in characteristic diameter) can be tested from onboard this platform. Small WECs (also 1-m characteristic diameter) can be tested autonomously. Other technologies or components can be tested via integration with generic test devices (1-m characteristic diameter cross flow turbine, axial flow turbine, and heave plate point absorber) that are under development.

Both laboratory and field facilities will incorporate instrumentation to enable comprehensive data acquisition to quantify performance and environmental effects. All field-testing will be performed using APL-UW vessels at permitted locations in Puget Sound. Devices will be deployed temporarily and all power generation/condition/consumption and data collection will be self-contained (from onboard the vessel without shore cabling, no device contact with seabed)

The following section provides a basic overview of relevant system design parameters.

3.2 Preliminary MHK System Parameters

There are opportunities to demonstrate and evaluate technologies in the laboratory and/or in the field. The tables in this section provide an overview of design parameters for tidal/current and wave energy conversion systems to be integrated with laboratory or field test bed infrastructure.

3.2.1 Laboratory Scale

3.2.1.1 Current (Tidal/River/Ocean)

Water In-Flow Velocity Range (operating)	0 – 0.7 m/s
Flume Test Section Dimensions	0.75 m wide x 0.5 m deep x 3 m long

3.2.1.2 Wave Heave Plate

Oscillator simulated wave Height/Period range	[0.1 m / 0.5 s] (min) to [0.8 m / 4 s] (max)
Heave plate diameter/weight range	0.2 – 0.6 m diameter, 0 - 36 kg

3.2.2 Field Scale

3.2.2.1 Current (Tidal/River/Ocean)

Water In-Flow Velocity Range (operating)	0-2.5 m/s (approximate)
Water In-Flow Velocity Range (survival)	4 m/s
Cross-Flow Turbine Dimensions	1m diameter x 2m long (approximate)
Axial-Flow Turbine Dimensions	1-2m diameter (approximate)
Water Depth Range	0 – 5 m (systems to be tested near surface)

3.2.2.2 Wave

Wave Height/Period	[0.5m / 3s] (approximate)
Dimensions	1-2m diameter (approximate) surface float and heave plate
Water Depth Range	0 – 40 m

3.3 Context

To identify mature and promising MHK technologies for potential use at naval facilities and also foster collaboration between industry and academia, APL-UW/NNMREC intends to issue subcontracts to US commercial developers of relevant wave and current energy conversion technologies. As previously discussed, these may include devices, components, monitoring systems, optimization strategies, control algorithms/software, or other related components or subsystems. These developers will collaborate with engineers at APL-UW and NNMREC to develop and test advanced research concepts in the laboratory or the field. Collaborations will be structured to reduce the potential for intellectual property conflicts. Industry partners will benefit from access to UW researchers and test facilities, as well as the potential to incorporate advanced research concepts into their own, proprietary technologies at a later date. In addition, these collaborations will provide an opportunity to demonstrate the value of MHK technologies to the US Navy and for NAVFAC to educate industry on the specific needs for deployment and operation of MHK generation assets at naval facilities.

3.4 Statement of Need

APL-UW/NNMREC are seeking partners interested in producing wave or current energy converters and associated component technologies that could be tested in laboratory or field facilities. While responses from government or academic institutions will be accepted, the primary intent is to identify commercial partners with technologies of interest. The overarching goal is to identify and advance MHK technologies that are viable for use at naval facilities. These technologies should be available (or have the ability to become readily available) as commercial products or services. Systems and components will be integrated, as necessary and possible, with existing prototype converters and test facilities to maximize the value from evaluation. Performance of the technology will be evaluated during experimental trials and the utility of component technologies will be demonstrated to the US Navy.

4 How to Respond

To respond to this RFI, please provide a 2-3 page summary of your proposed collaborative project, service, or product. Responses should answer the following:

- What is the collaborative project proposed?
- What is the estimated cost and timeline?
- How does this benefit your company?
- How does this benefit the NAVFAC research initiative?
- Are there any particular IP restrictions and can test data be summarized in journal articles, at conferences, and via technical reports delivered to the US Navy?
- Have you participated in any similar or relevant university collaborations, competitive awards from other entities (e.g. organization, amount of funding, period of performance)?

Responses must include a cover page containing the following information:

- Proposing Institution (name, address, web page)
- Proposer's main products/services
- Proposer's market/customers
- Number of years on the market
- # Employees
- Contact person responsible for RFI

The contact person listed below is available for assistance if needed. The answers to this RFI will be evaluated by a review panel consisting of APL-UW/NNMREC and Navy staff. There is no limit to the number of responses per proposing entity.

Technical Contact: Andrew Stewart, Principal Investigator, (andy@apl.uw.edu)
<u>Responses are due April 29, 2016.</u>
To respond, please submit requested info in MS Word format by email
Submission Contact: Larry Joireman, Project Manager, (larryj@apl.washington.edu)

4.1 Timeline for Decisions and Projects

April 29, 2016	– RFI submissions due
May 31, 2016	– RFP or RFQ sent to selected RFI responders.
Spring, 2016	– Final partners chosen for collaborative projects and awards issued.
Summer, 2016	– Start of collaborative projects
Summer, 2017	– Conclusion of collaborative projects