# Opportunity for a Marine Energy Intermediate Scale Test Facility at PNNL's Marine Sciences Laboratory

Pacific Northwest NATIONAL LABORATORY

*Proudly Operated by Battelle Since 1965*

***Background*** - The emerging marine and hydrokinetic (MHK) energy technology market is expected to grow and mature into a sizable industry in the next 10 – 15 years, similar to the pace of technology advancement in the wind energy industry over its first 20 years. Tidal power is a predictable and potentially significant source of energy in parts of the US. Realizing significant benefit from this renewable energy source will require answering questions concerning potential environmental effects as well as long-term durability, efficiency, and operating costs of MHK devices. Obtaining these answers will require testing in marine waters, under known conditions, in an environment similar to where devices will be deployed commercially. Testing environments are needed at intermediate stages of device development that reflect deployment conditions and allow for ease of deployment, maintenance and retrieval with few constraints on the deployment window to keep pace with the speed of technology development and contain costs.

***Testing Needs –***A gap exists in moving the MHK market from laboratory scale testing of designs and components to pilot and full-scale field deployment. Full-scale testbeds for MHK devices are being developed by university consortia at the National Marine Renewable Energy Centers. PNNL will collaborate on full-scale tidal testing with the Northwest National Marine Renewable Energy Center (NNMREC) at the University of Washington (UW) and wave testing with the University of Oregon (OSU). By providing an intermediate scale test facility (ISTF) at PNNL's Marine Science Laboratory (MSL) in Sequim Bay, the intent is to complement testing of commercial scale devices by UW in nearby Admiralty Inlet, and testing of wave devices by OSU in coastal Oregon. Ultimately, it is the goal of this facility to promote responsible development of tidal power systems that will reduce costs and increase acceptance of tidal power as a meaningful technology in our regional energy portfolio.

***Advantages of the ISTF*** - MSL in Sequim Bay, Washington, USA is an ideal location for an ISTF. The Sequim Bay site is well characterized, and renewable energy R&D has been established as a compatible marine use for the area; environmental permitting will be reasonably straightforward. This will be a one-of-a kind facility that fills a gap in the current testing and evaluation process for MHK devices. Such a facility will provide environmental and device assessment capabilities that are not available at the laboratory scale and setting. The ISTF will also allow environmental monitoring protocols and innovative monitoring technologies to be developed and tested for MHK devices. Adjacent laboratories and instrumentation, along with material expertise at PNNL, will also greatly enhance the operation of the facility.

**PNNL's Marine Sciences Laboratory**

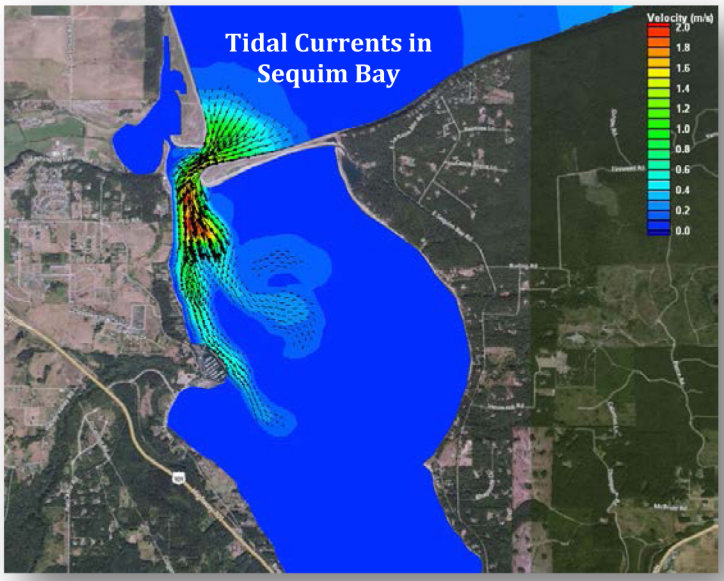
***Components of the Facility:*** The ISTF will be comprised of three primary components applied to environmental and device performance monitoring and evaluation: (1.) a testing platform to determine device performance and near-field (direct) interactions with the surrounding environment; (2.) a sensor array to test sensor/instrument technologies and strategies to better understand far-field (indirect) environmental effects; and (3.) an information center where device manufacturers, regulators and stakeholders can view the operation of devices in real time.

***The Testing Platform***: The facility will be located adjacent to and contiguous with MSL's existing laboratory and pier at the entrance to Sequim Bay. MSL will provide simplified access to tidal water through an existing pier/dock complex without need for vessel support. Locating the facility at this site will allow for rapid deployment of devices and instrumentation, while keeping facility components away from the main navigation channel. Tidal currents at this location are concentrated along the western shore and current magnitudes are sufficient for operation of tidal power generation devices. An ISTF will be capable of testing 1/10 to 1/4 scale MHK devices (TRL level 4-6), components, materials, coatings, foundations/anchoring systems, and new monitoring systems.

***Sensors and Capabilities:*** The testing facility will be capable of deploying a wide range of instruments and sensors to monitor near-field environmental conditions (water quality, organism interactions, biofouling, turbulence, flow, etc.) and characterize device performance (device power output, failure alert sensors, etc.). Data can then be used to populate models to investigate potential far-field (indirect) effects. Sensors will be modular with the ability to swap out sensor packages.

***Information Center*:** Data generated by a tested device will be routed to an MHK Information Center associated with the ISTF. Data will be provided in real time via a secure internet connection for complex analysis and conditioning. This will provide an opportunity for device developers, regulators and other stakeholders to interact with test devices, as well as visualize device operation and environmental interactions in real time.

***Linkages:*** The Pacific Northwest has some of the highest potential in the nation for MHK energy. In addition the proposed ISTF, plans are also underway to establish a Materials and Manufacturing Research Center at MSL that will provide a facility for industry to apply the testing results to refinements in device and component designs.




The full scale testing platforms being developed by the NNMRECs will provide the next scale of device testing to ensure performance. The Olympic Composites Corridor is working to unite critical resources and facilities for composites manufacturing companies in the Pacific Northwest. The ISTF is a critical component to this, providing the opportunity to advance from R&D to production of full scale devices and components. Together we can offer the enabling of an end-to-end R&D, testing, evaluation, and manufacturing capabilities.

---

**About Pacific Northwest National Laboratory**

The Pacific Northwest National Laboratory, located in southeastern Washington State, is a U.S. Department of Energy Office of Science laboratory that solves complex problems in energy, national security and the environment, and advances scientific frontiers in the chemical, biological, materials, environmental and computational sciences. PNNL currently has approximately 4,900 staff members, a business volume of more than $1.1 billion, and has been managed by Ohio-based Battelle since 1965.

For more information about the science you see here, please contact:

**Jennifer States**
Pacific Northwest National Laboratory
Marine Sciences Laboratory
1529 West Sequim Bay Road
Sequim, WA 98382
360-582-2529
Jennifer.States@pnnl.gov



PNNL-SA-86673