Oregon State University Hinsdale Wave Research Lab

Dr. Pedro Lomonaco

NHERI Natural Hazards Engineering Research Infrastructure

Natural Hazards Engineering Research Infrastructure (NHERI)

Hinsdale Wave Research Laboratory

NHERI-HWRL

May 2, 2018

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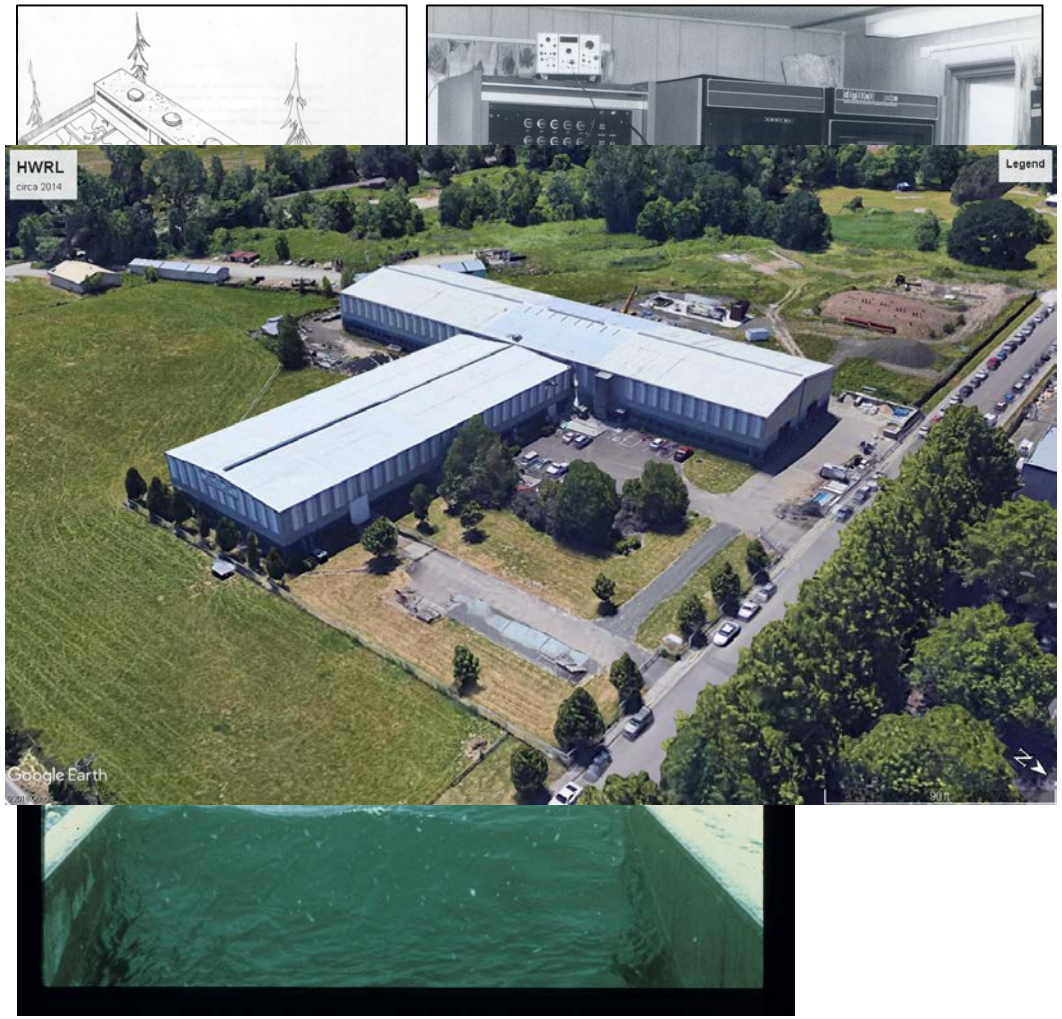
Oregon State University NHERI Natural Hazards Engineering Research Infrastructure

NHERI-HWRL, Oregon State University

- Established in 1972 with the construction of the Large Wave Flume.
- 45 years of uninterrupted research and physical model testing at the largest nearshore experimental facility in the US.
- The building houses the Large Wave Flume (LWF), Directional Wave Basin (DWB), and office space for staff, graduate students, visiting researchers, and clients.
- Through our work we perform research to improve the resilience and sustainability of coastal areas, and to develop innovative solutions to the design of coastal infrastructure.



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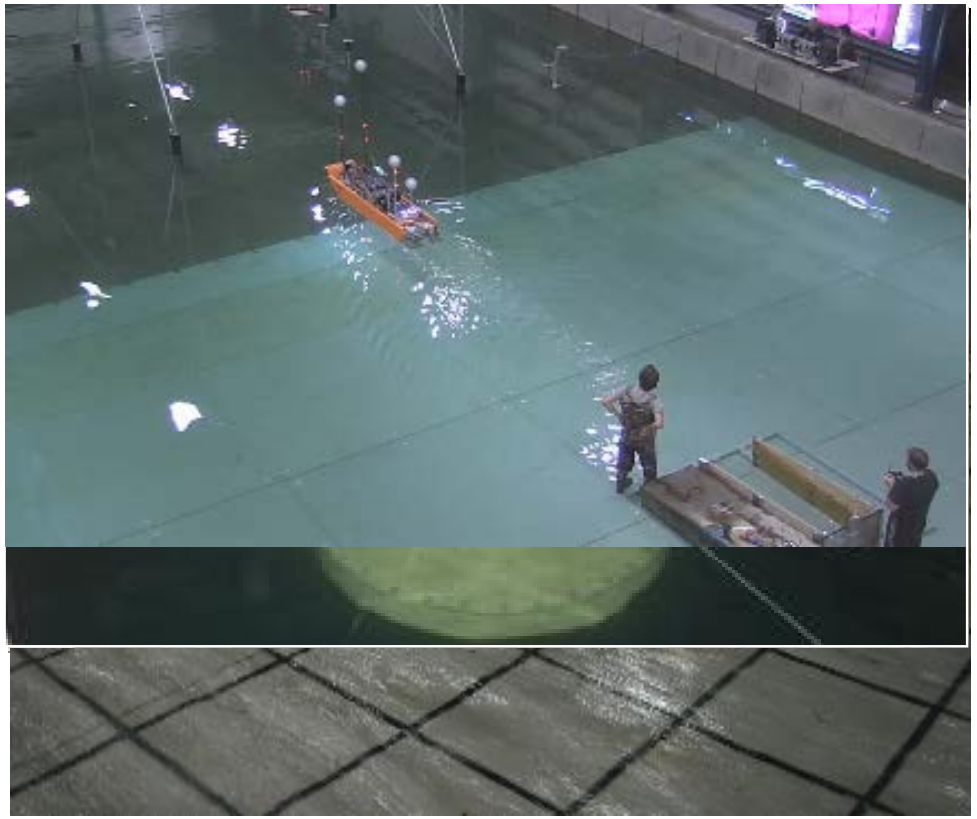
The laboratory conducts research on coastal and nearshore processes involving:

- Nearshore Hydrodynamics
  - Wave transformation *
  - Wave breaking and surf zone turbulence *
  - Swash dynamics
  - Longshore currents and undertow
- Tsunami Research
  - Tsunami runup and overland flow *
  - Tsunami-structure interaction *
  - Landslide generated tsunami
- Coastal Structures
  - Stability *
  - Design optimization *
  - Overtopping *
  - Transmission and reflection



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NHERI-HWRL, Oregon State University

- From 2004 to 2014, the HWRL was an Experimental Facility of the NSF Research Project NEES (Network for Earthquake and Engineering Simulation).

- Since 2016, the HWRL is an Experimental Facility of the NSF Project NHERI (Natural Hazards Engineering Research Infrastructure)
  - PI: Prof. Dan Cox
  - Co-PI: Dr. Pedro Lomonaco and Prof. Christopher Higgins

- HWRL is also an associated test facility of PMEC (Pacific Marine Energy Center)

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Resources at NHERI-HWRL

Large Wave Flume

Specifications:

- Length: 104 m (342ft)
- Width: 3.7 m (12ft)
- Height: 4.6 m (15ft)
- Max water depth: 2 m (6.5 ft) for tsunami, 2.7 m (9 ft) for wind/storm waves
- Movable adjustable bathymetry/beach

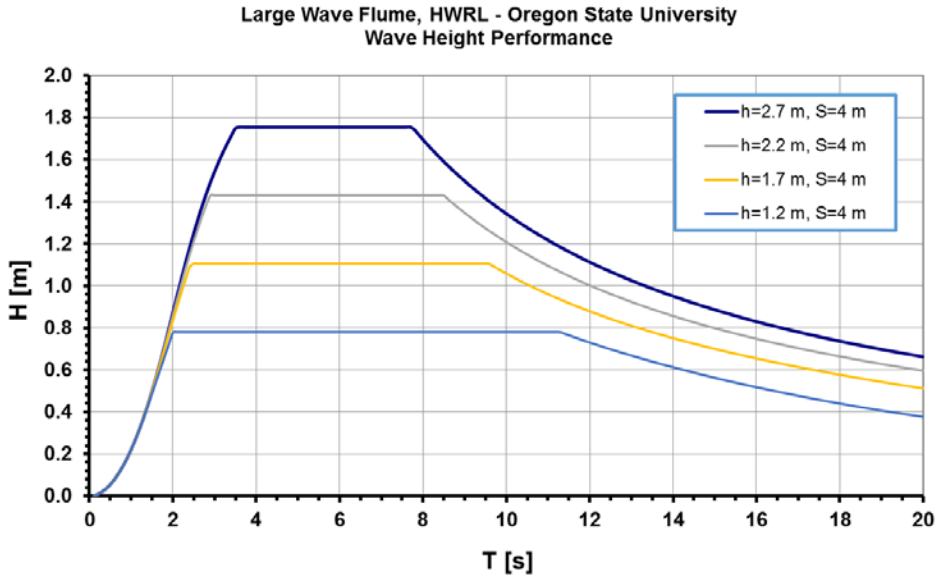
Directional Wave Basin

Specifications

- Lenght: 48.8 m (160 ft)
- Width: 26.5 m (87 ft)
- Height: 2.1 m (7 ft)
- Max water depth: 1 m (3.1 ft) for tsunami, 1.36 m (4.46 ft) for wind/storm waves
- Beach: 1:10 removable steel beach

Resources at NHERI-HWRL

Large Wave Flume



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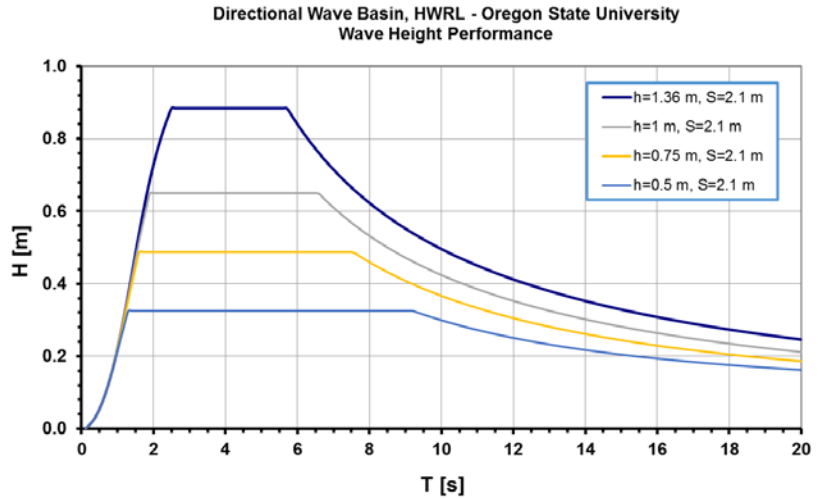
Resources at NHERI-HWRL

Directional Wave Basin



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NHERI-HWRL, Projects

Research Projects 2016-2018

- Non-linear Long Wave Amplification in the Shadow Zone of Offshore Islands (TAM, USC)
- Fundamental Mechanics and Conditional Probabilities for Prediction of Hurricane Surge and Wave Loads on Elevated Coastal Structures (OSU)
- Probabilistic Assessment of Tsunami Forces on Coastal Structures (UW)
- Numerical and Probabilistic Modeling of Aboveground Storage Tanks Subjected to Multi-Hazard Storm Events (RU)
- Physical modeling of submarine volcanic eruption generated tsunamis (GT)
- Telescopic Structural Flood Walls (Smart Walls LLC)
- Runups of Unusual Size: Predicting Unexpectedly Large Swash Events (OSU)
- Advancing multi-hazard assessment and risk-based design to promote offshore wind energy technology (NU)
- Wave, Surge, and Tsunami Overland Hazard, Loading and Structural Response for Developed Shorelines (ND, USC)
- Transient Rip Current Dynamics: Laboratory Measurements and Modeling of Surfzone Vorticity (UW)

Upcoming

- Vertical Evacuation Structures Subjected to Sequential Earthquake and Tsunami Loadings (UW)
- Physics of Dune Erosion during Extreme Surge and Wave Events (OSU, UD)

NHERI-HWRL, Selected Projects

CMMI-1301016. Fundamental Mechanics and Conditional Probabilities for Prediction of Hurricane Surge and Wave Loads on Elevated Coastal Structures

Prof. Dan Cox. Oregon State University.

CMMI-1536198. Probabilistic Assessment of Tsunami Forces on Coastal Structures.

Dr. Michael Motley, Randall LeVeque, Frank Gonzalez. University of Washington

NHERI-HWRL, Selected Projects

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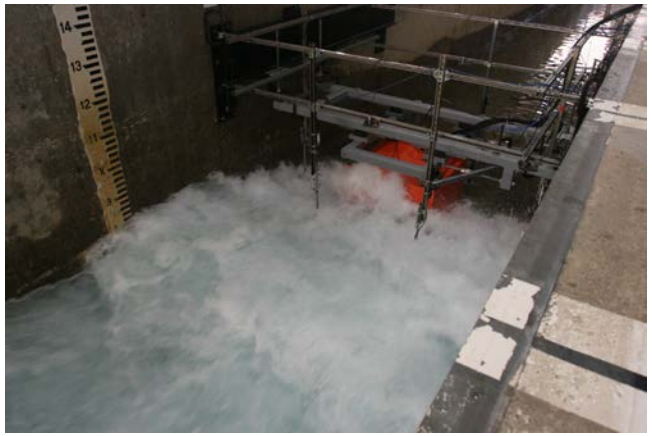
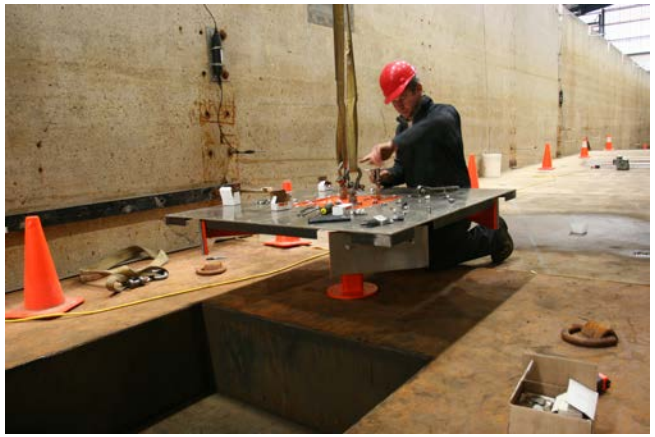
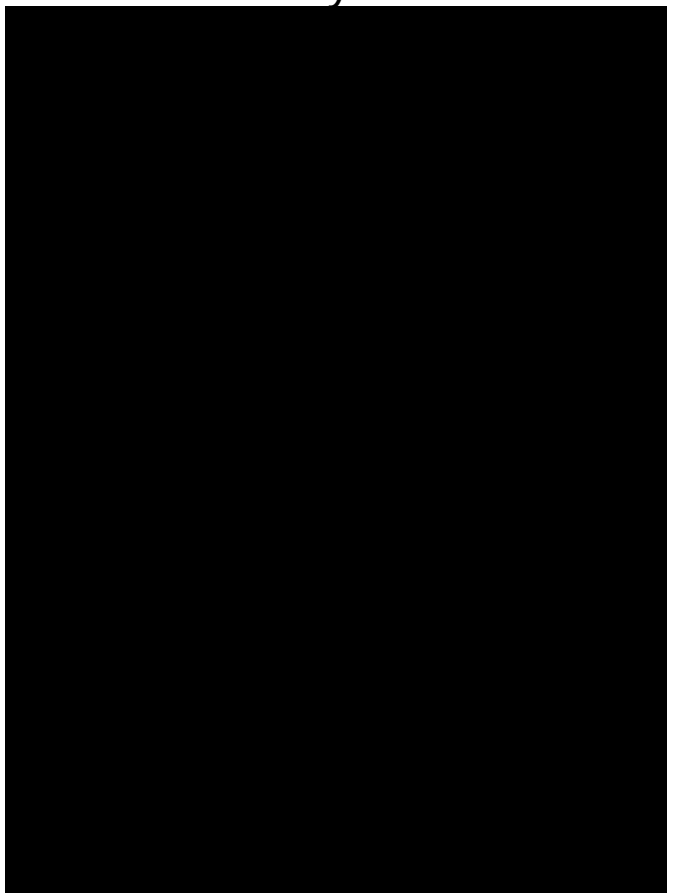


NHERI-HWRL, Selected Projects

CMMI-1552559. Advancing multi-hazard assessment and risk-based design to promote offshore wind energy technology.

Dr. Andrew Myers. Northeastern University





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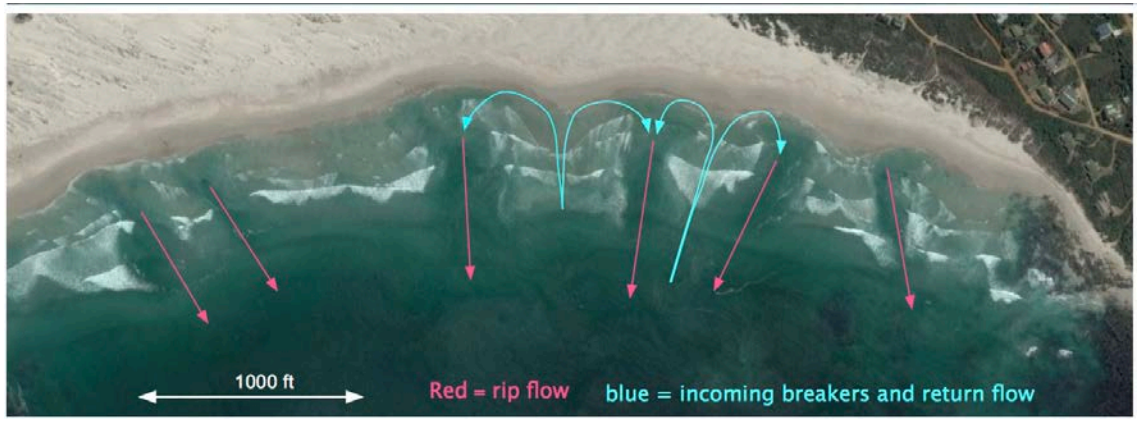
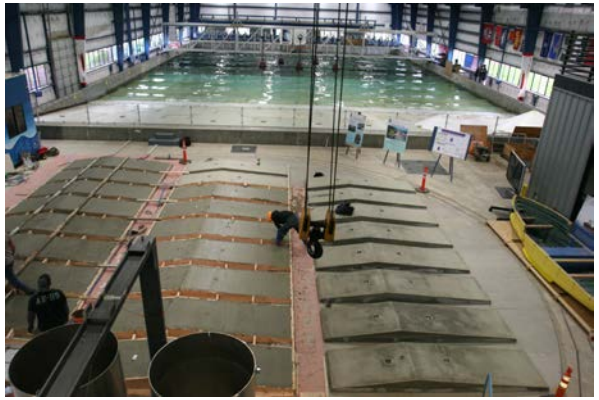
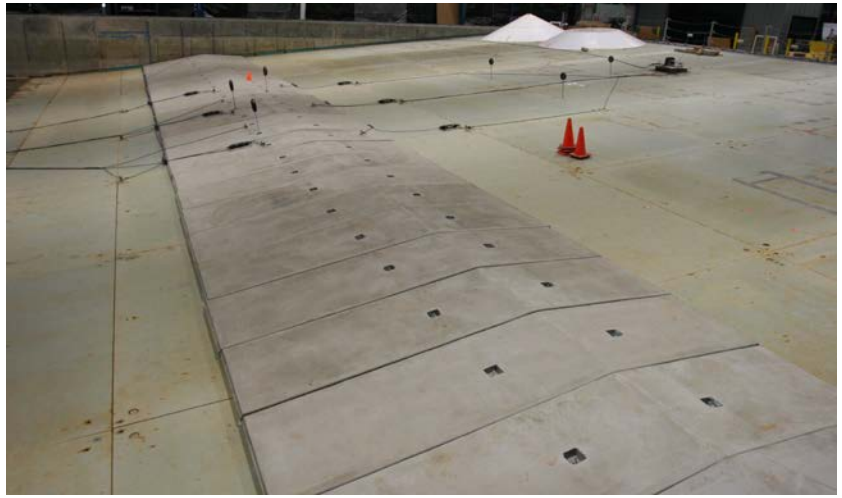
NHERI-HWRL, Selected Projects

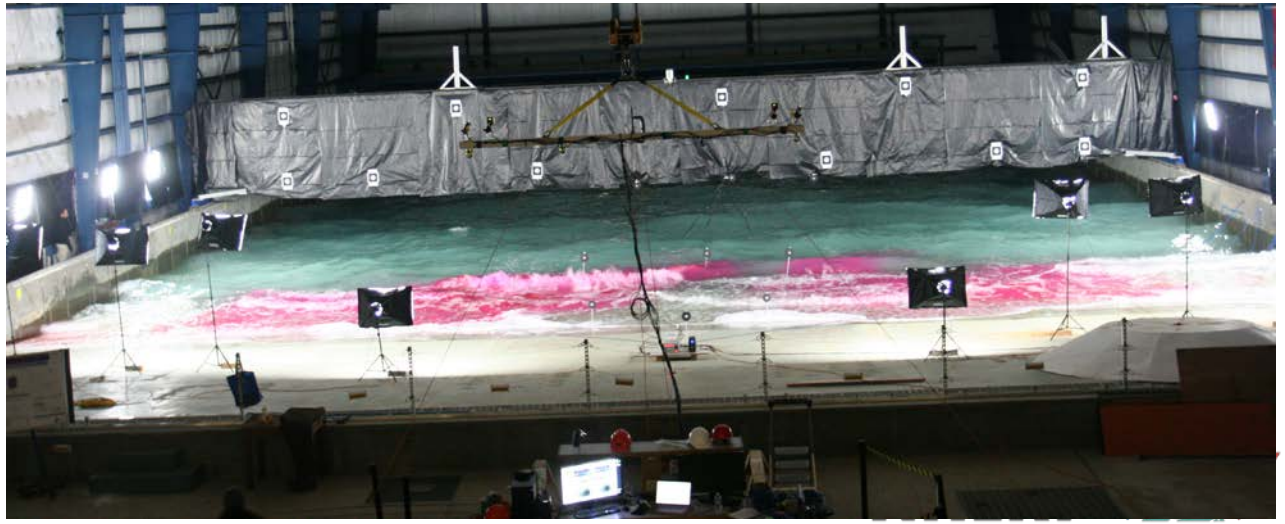
OCE-1735460. Transient Rip Current Dynamics: Laboratory Measurements and Modeling of Surfzone Vorticity.

Dr. Nirnimesh Kumar and Dr. Melissa Moulton. University of Washington









NHERI: lessons learned

- Specimen design and procurement needs to be addressed as soon as the PI knows in details the scope of the testing
- Estimation of costs for specimen costs seems to be always underestimated
- PI's tend to underestimate the time and effort required to install and instrument specimens
- HWRL has a full year-long calendar, while PI's are still bounded to the academic calendar
- Outsourcing works very well, but the involvement with the PI and the EF is necessary and requires time and effort
- The EF needs to constantly remind the PI on dates, efforts, instrumentation, and interaction with other projects
- The EF needs to transmit to the PI the time scale of planning and execution of tests

NHERI: distributed, multi-user, national facility

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Thank you!

Directional Wave Basin

Large Wave Flume

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