

Ocean Testing at WETS – Ramping Up

Hydrovision 2018
Charlotte, NC
28 June 2018

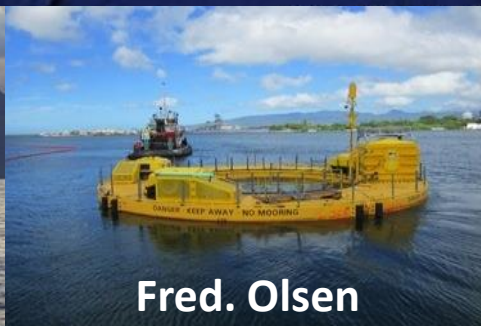
Patrick Cross, Hawaii Natural Energy Institute
University of Hawaii



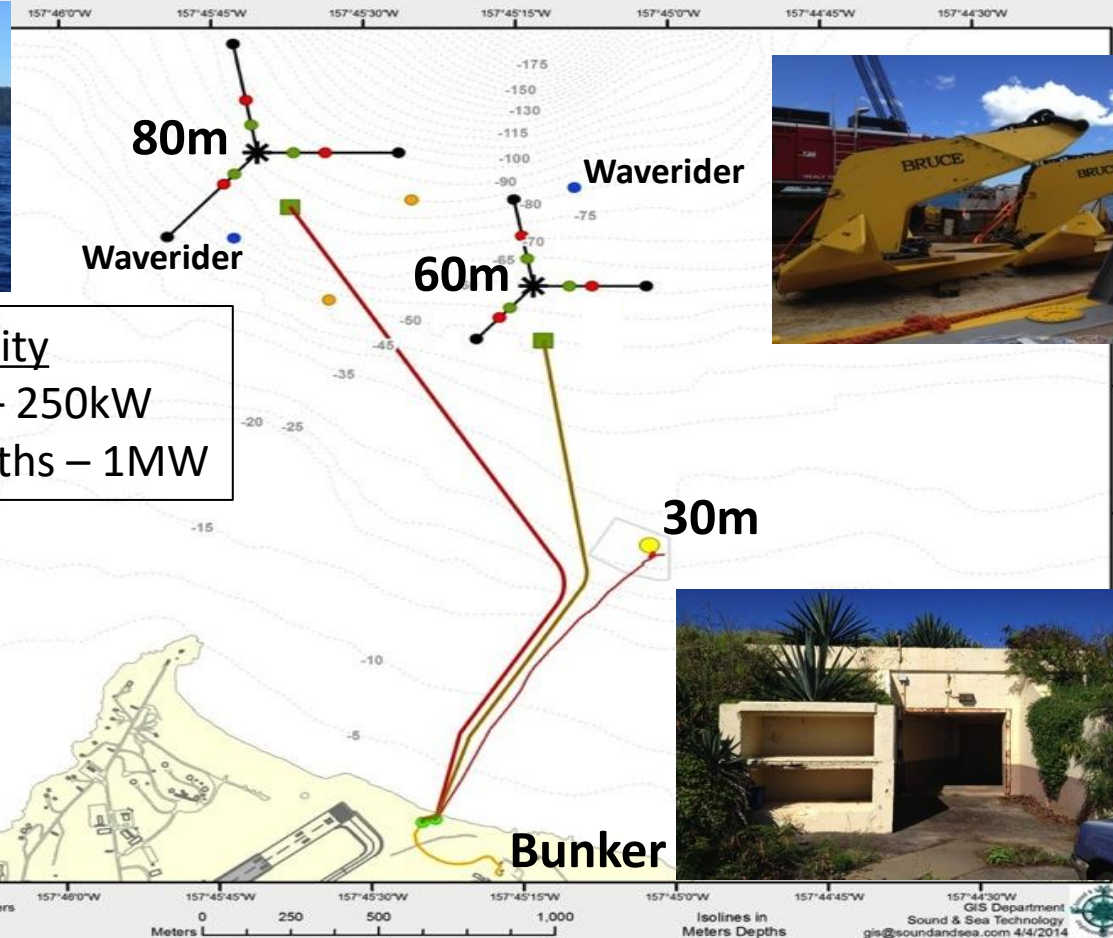


APPLIED RESEARCH LABORATORY

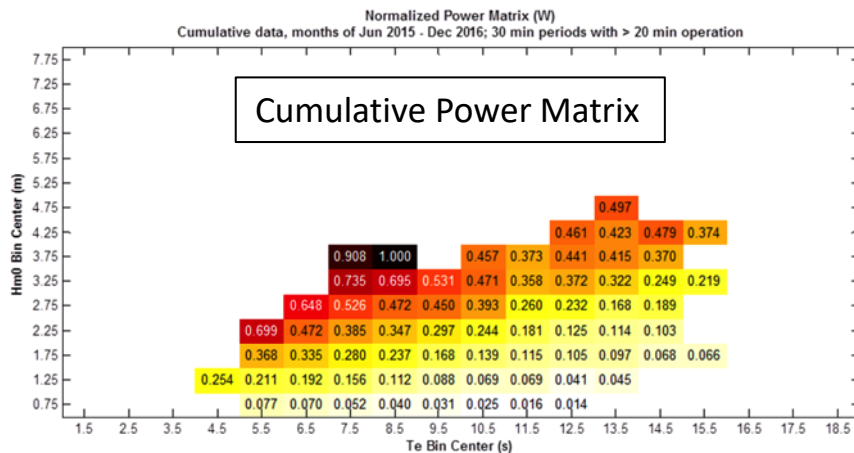
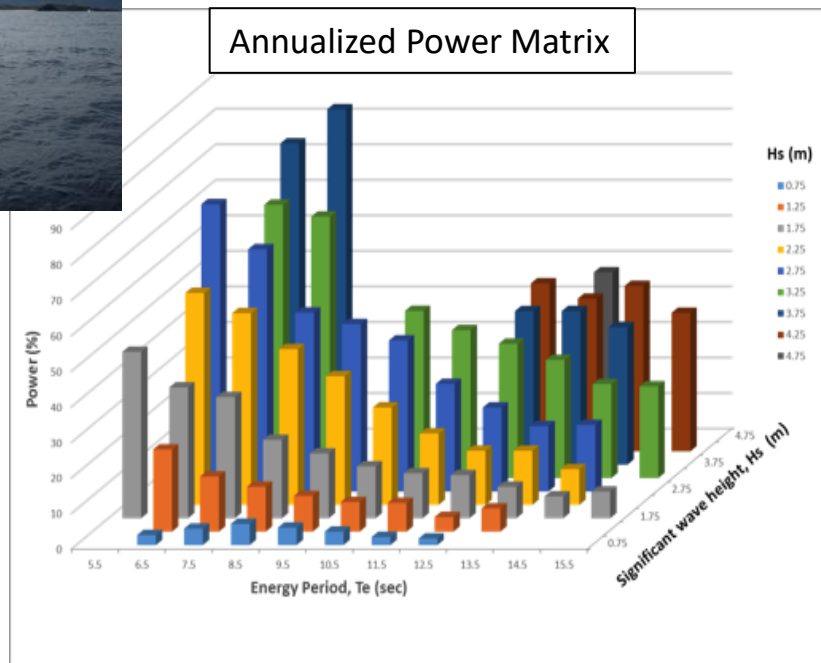
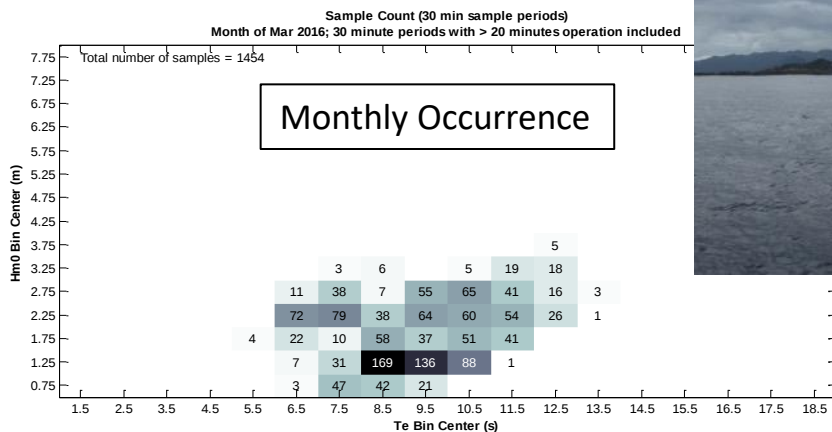
UNIVERSITY OF HAWAII



WETS Layout



Power Performance Assessment



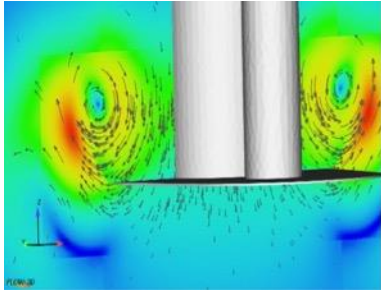
Performance assessed in accordance with
IEC Technical Specification 62600-100

Numerical Modeling Efforts

- Develop numerical models to enhance independent assessment of WEC performance
- Model comparison with ocean test data

Hydrodynamic Motion Analysis

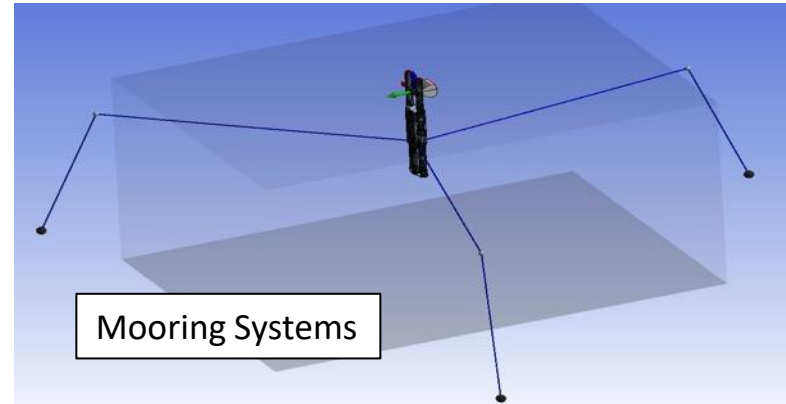
- WEC-Sim (Primary) & In-house code (Selected cases)
- Solution of equations of motion in time domain
- BEM: Estimation of hydrodynamic coefficients (Added mass, Wave damping)
- CFD : Estimation of viscous drag
- Predicted electric power, body motions
- Numerical model tuned with prototype trial data
- (Tuned) Num. model applied for comparative evaluation of versions 1 & 2 of Azura



Dr. Kumar Rajagopalan

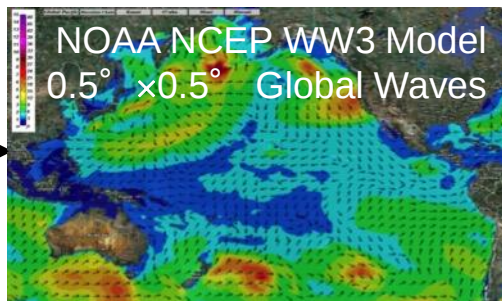
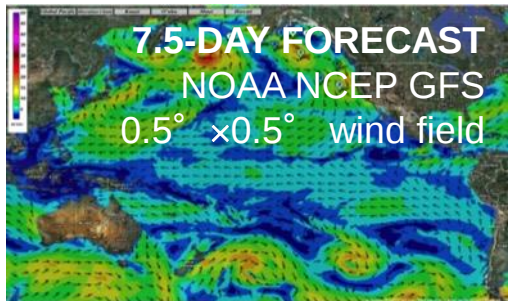
Modeling tools employed

- WEC-Sim
- Flow3D
- OpenFOAM
- ANSYS SUITE
- In-house codes



- Azura moored at 30m berth
- Mooring modeled in ANSYS AQWA

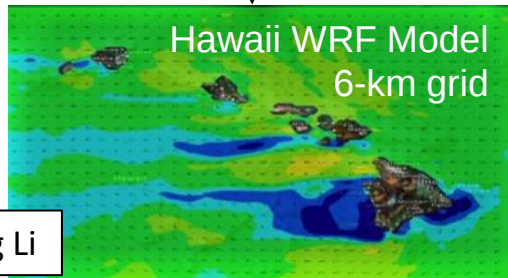
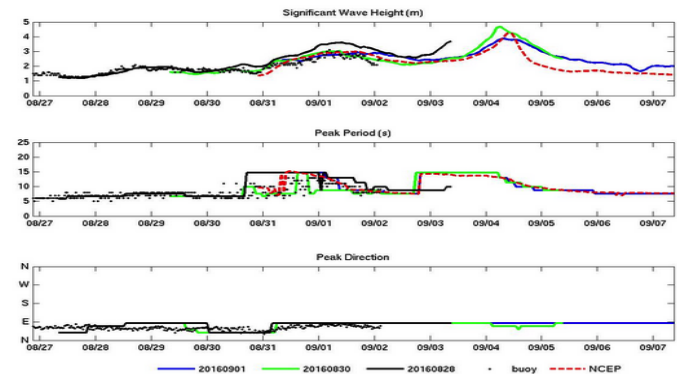
Daily 7.5-day Wave Forecast (oceanforecast.org)



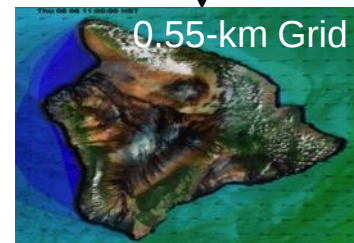
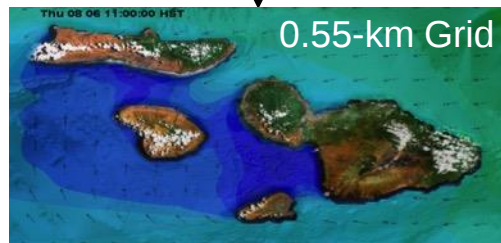
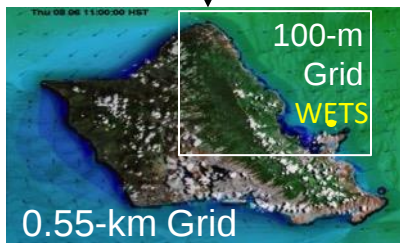
Real-time validation with measurements

- 30 buoys in the Pacific Basin
- Example on-line display for WETS

Hawaii Region, 51207_Kaneohe_Bay UH Forecast Bouy lat = 21.477 N, lon = 157.752 W
Waves are 2.8 meters/ 9.2 feet 8.7 sec. 82° dir. on Thu Sep 01 2016 6 PM HST
[7.5 Day forecast plot](#) [3D spectral animation](#) [7.5 Day forecast table](#) [Performance history](#)
[51207_Kaneohe_Bay Webpage](#)



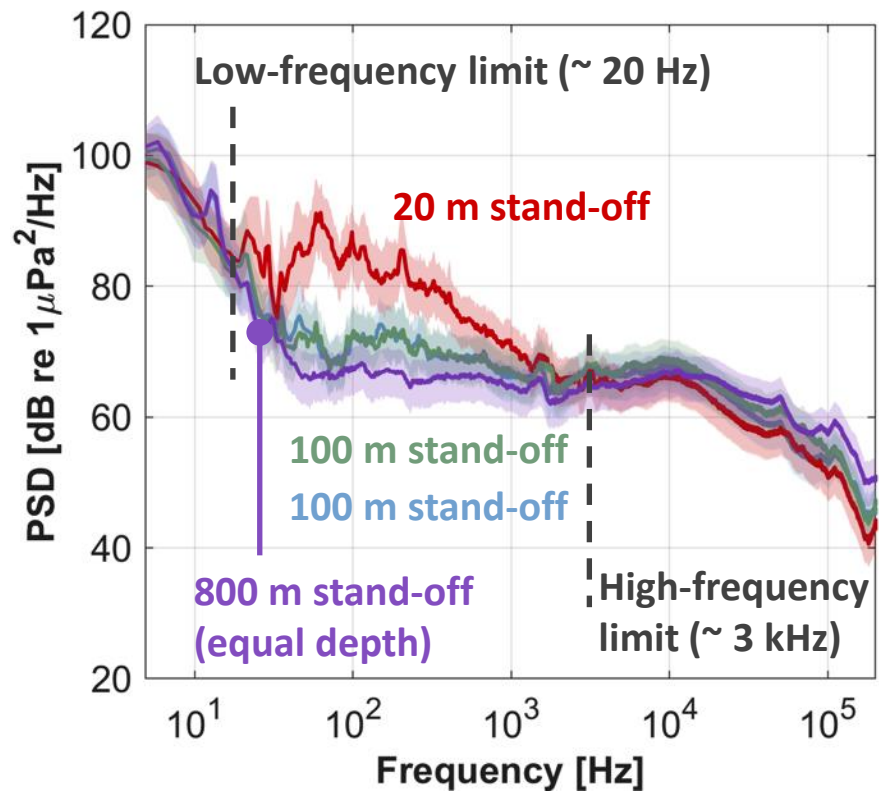
Dr. Ning Li



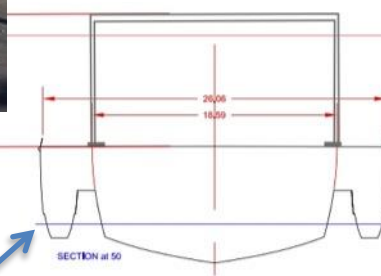
34-year Hindcast paper – N. Li, et al, *Ocean Modelling*, vol. 100, pp. 78-95, Feb. 2016.

Environmental Data Collection

- Device acoustic signatures
 - Bottom-mounted and drifting hydrophone systems
- Sediment transport
- Ecological surveys
- Protected marine species monitoring



WETS Site-Dedicated Support Vessel – Sea Engineering, Inc.



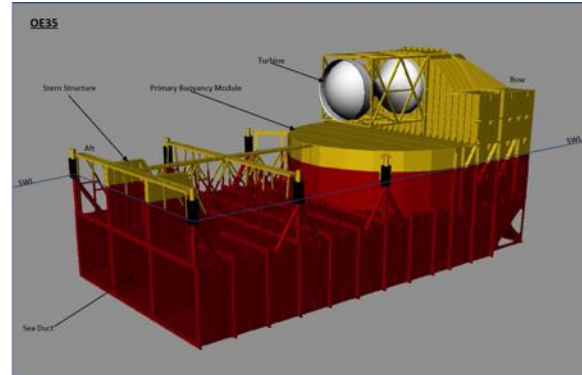
- 85 foot LOA
- 4-point mooring capability
- 10-ton A-frame lift capacity
- Knuckle-boom crane
- Deepwater dive spread
- ROV enclosure
- Reconfigured w/added beam
- To be kept at boat harbor ~ 1hr away



WEC Device Testing at WETS

- Northwest Energy Innovations (NWEI) Azura
- Fred. Olsen BOLT Lifesaver
- NWEI Modified Azura

- BOLT Lifesaver Redeployment
- Ocean Energy USA, LLC OE35
- Columbia Power Technologies StingRay
- NWEI (grid-scale device)
- Oscilla Power
- California Wave Power Technologies
- Aquaharmonics



Jun 2015 – Dec 2016

Mar 2016 – Apr 2017

Feb – Jul 2018

Jul 2018 – Jan 2019

Dec 2018 – Dec 2019

Jun 2019 – Jun 2020

2020/2021

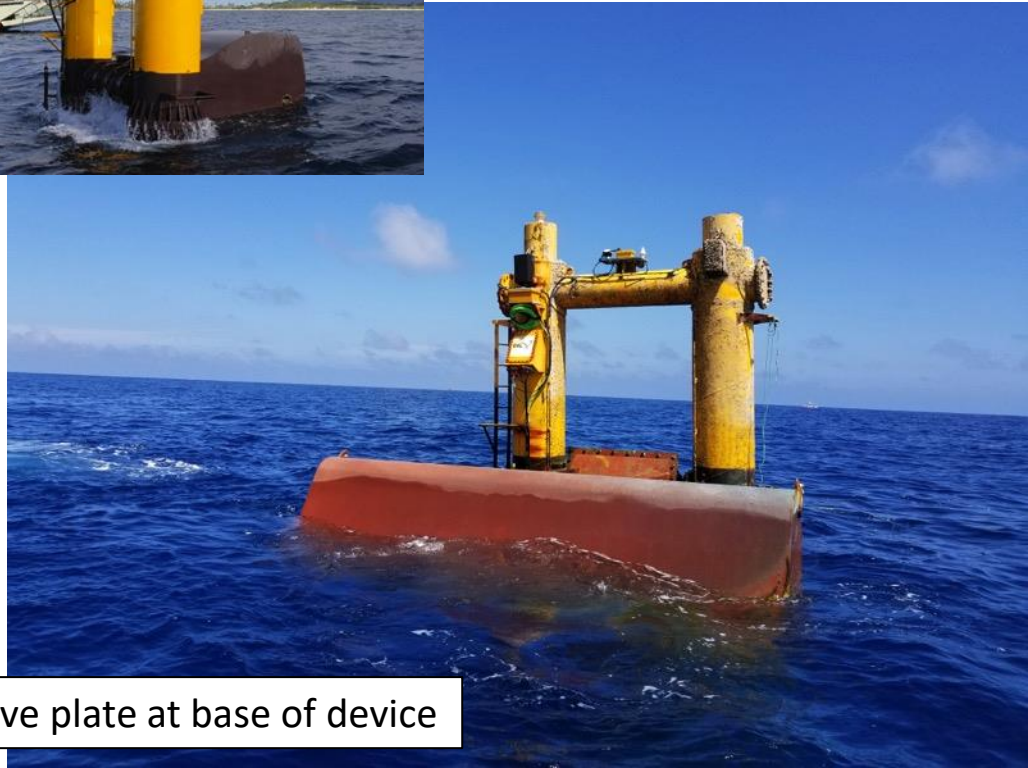
Jul 2019 – Jul 2020

2020/2021

Late 2019 – late 2020

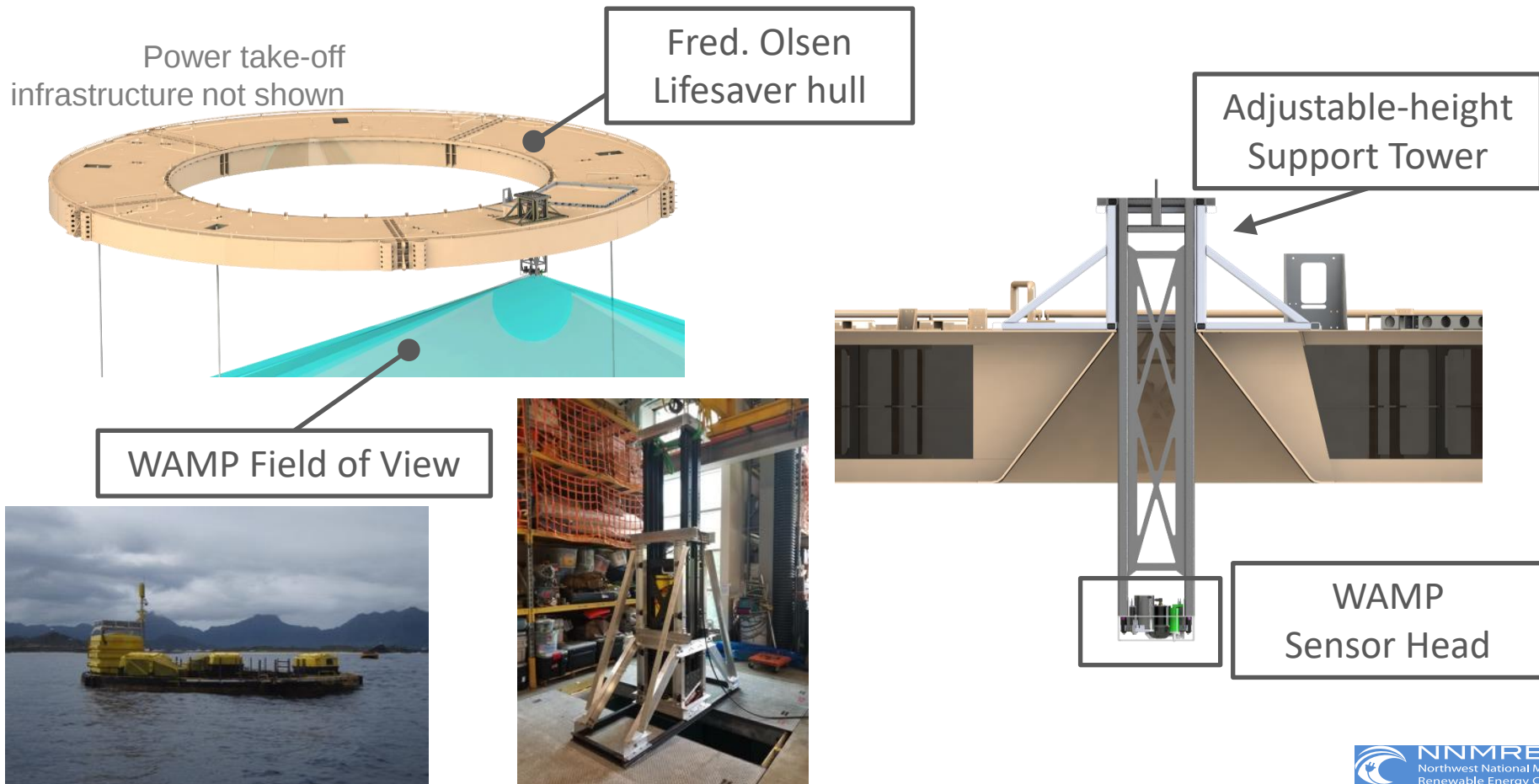
Projects receive support funding from Navy and/or DOE

Azura Modification



Also added heave plate at base of device

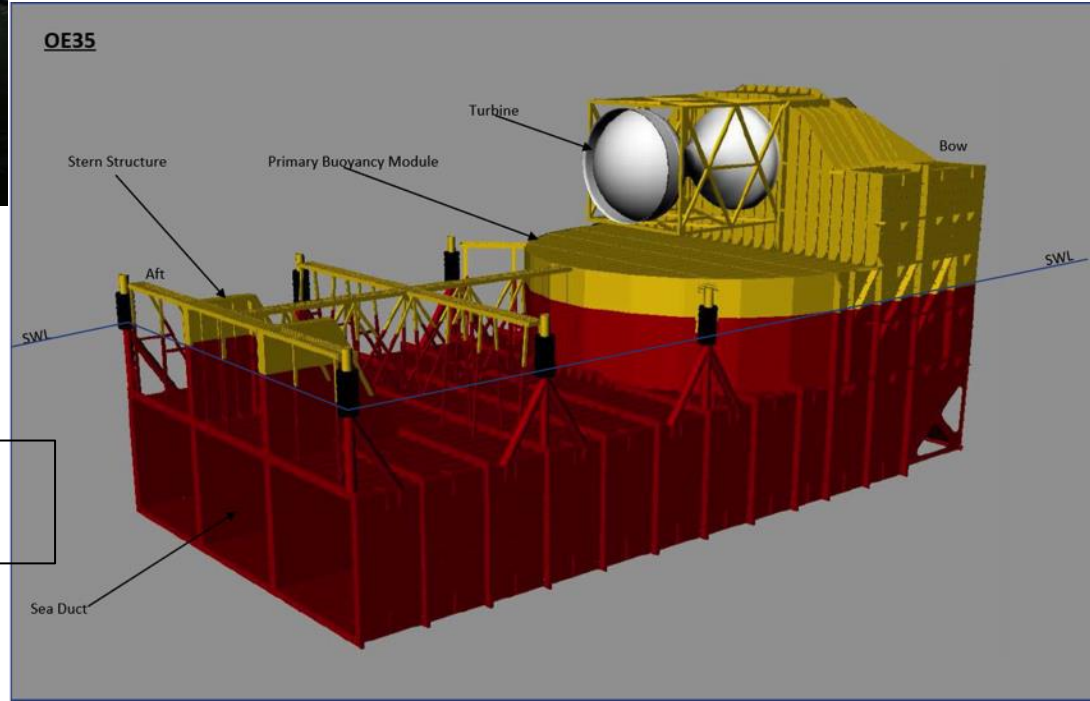
UW AMP Integrated w/Fred. Olsen Lifesaver



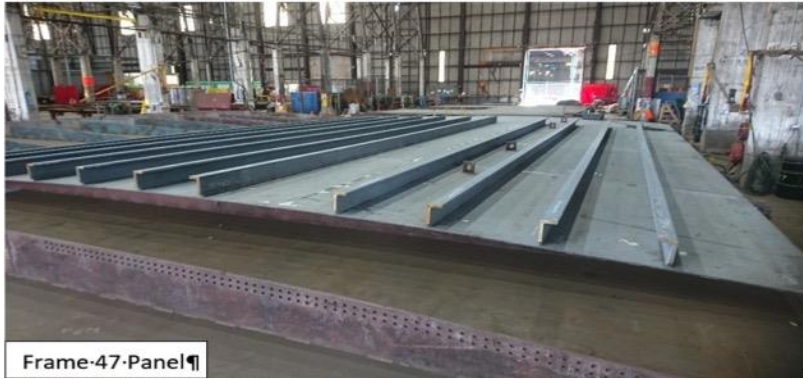
Ocean Energy OE35



Will deploy at WETS 60m berth late 2018 for 1 year



Ocean Energy's OE35



Frame-47-Panel



Forward-Towing-Padeye-Insert-Plates



Forward-Ballast-Tank-Assembly



Longitudinal-Bulkheads-Internal-Stiffening-Sub-Assembly

Vessels Available to Work at WETS



5-ton Lift Capacity



10-ton Lift Capacity

\$ <<



Healy Tibbits Crane Barge for Heavy Lift

Questions?

