FAU

SOUTHEAST NATIONAL MARINE RENEWABLE ENERGY CENTER

Florida Energy Systems Consortium

Stakeholders Meeting
August 20, 2014

Hosted by FPL

UF UNIVERSITY of FLORIDA

FLORIDA STATE UNIVERSITY 1851

FAU FLORIDA ATLANTIC UNIVERSITY

UCF

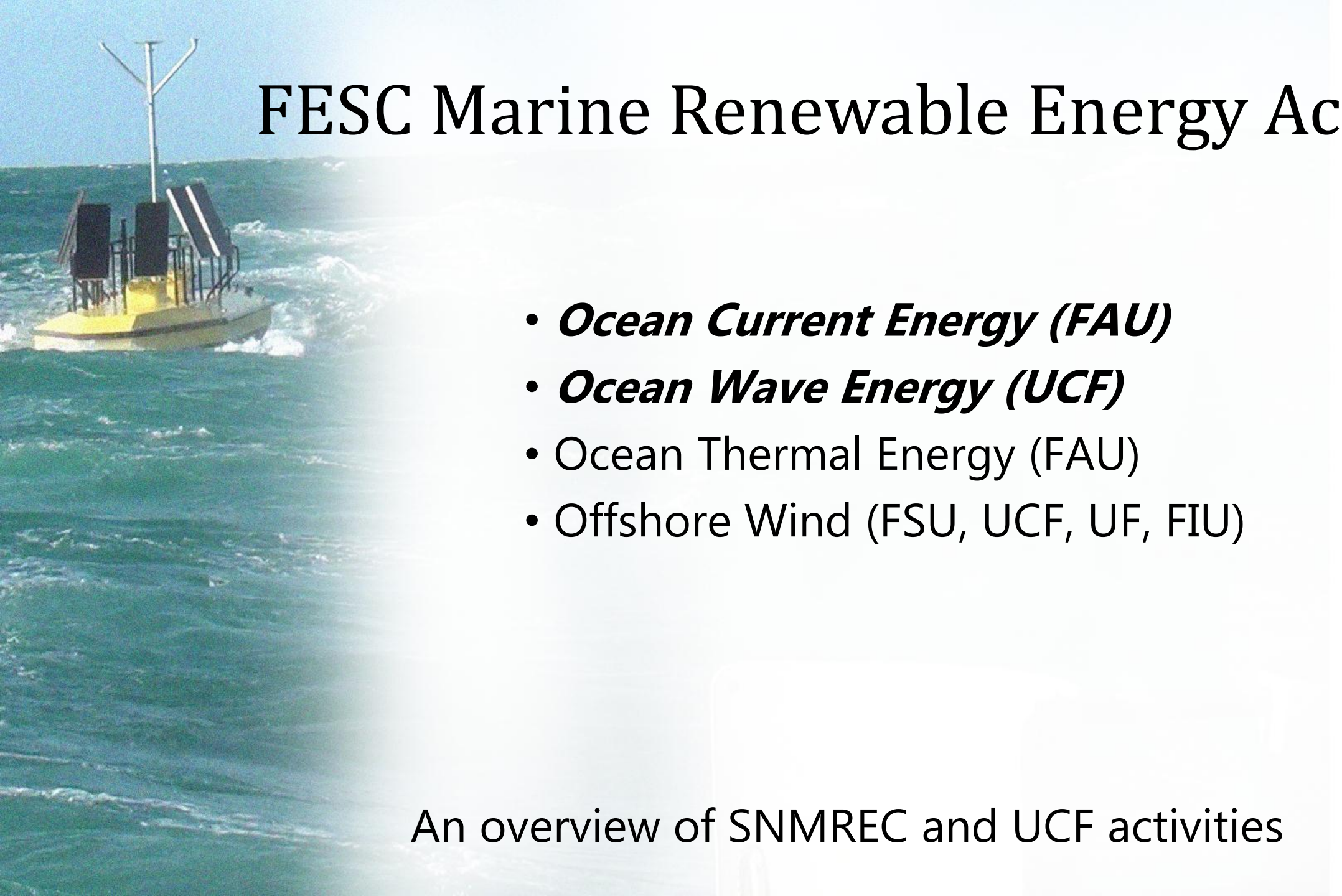
USF UNIVERSITY OF SOUTH FLORIDA

UWF

UNF UNIVERSITY of NORTH FLORIDA.

NOVUM COLLEGIUM FLORIDAE MCMLX

FLORIDA GULF COAST UNIVERSITY

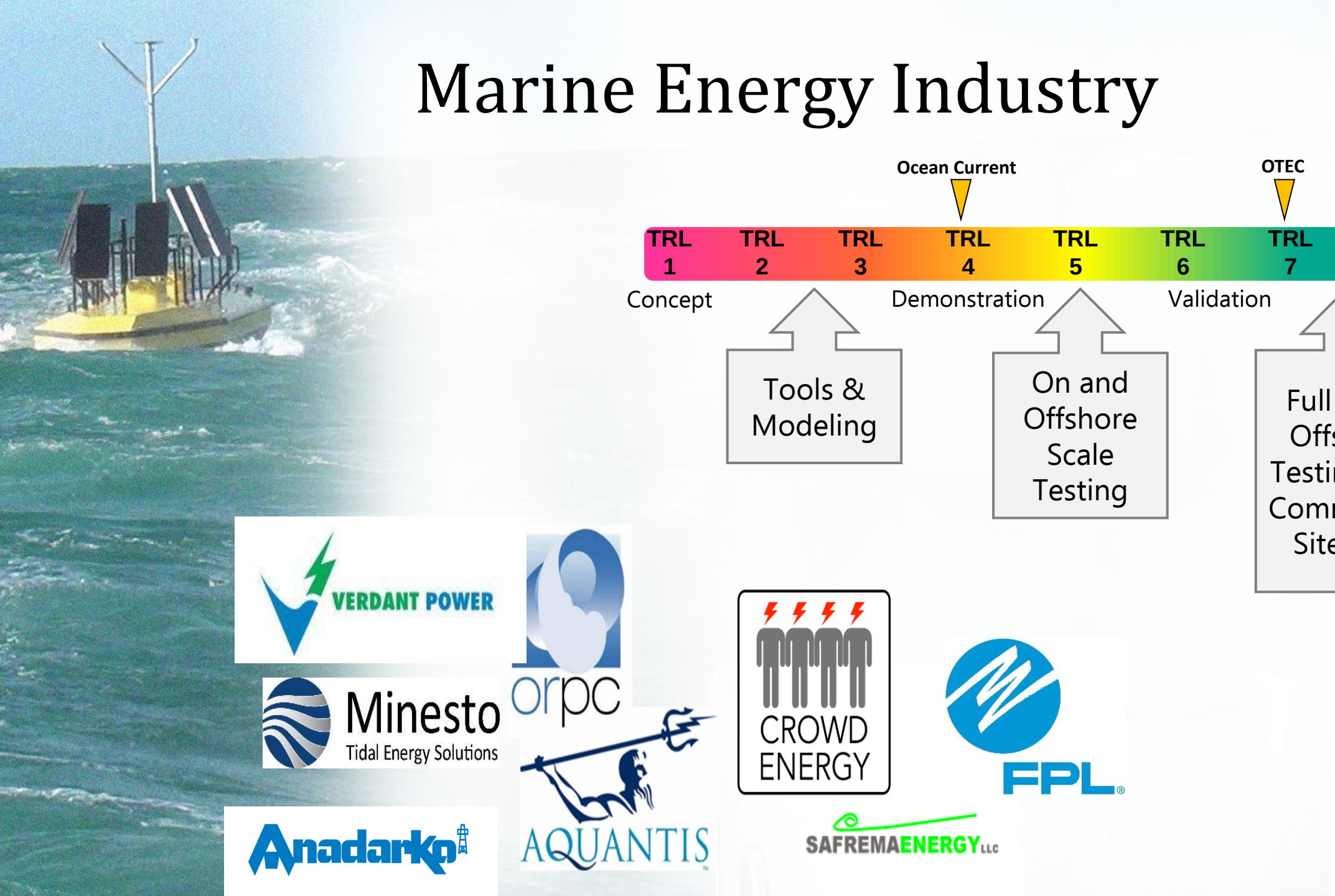


FESC Marine Renewable Energy Activities

- ***Ocean Current Energy (FAU)***
- ***Ocean Wave Energy (UCF)***
- Ocean Thermal Energy (FAU)
- Offshore Wind (FSU, UCF, UF, FIU)

An overview of SNMREC and UCF activities

Marine Energy Industry



VERDANT POWER

orpc

Minesto
Tidal Energy Solutions

CROWD ENERGY

FPL

Anadarko

AQUANTIS

SAFREMAENERGY LLC

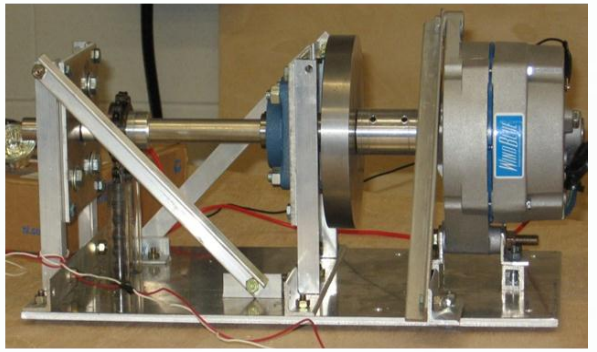
Wave Energy Converter

University of Central Florida

Objective: to develop a new design of wave energy converter consisting of a buoy floating on the ocean's surface connected to the ocean floor via a chain. The heaving motion of ocean waves lifts the buoy, causing the chain to run over a sprocket to rotate a shaft; the shaft rotates within a permanent magnet generator, which in turn produces power.

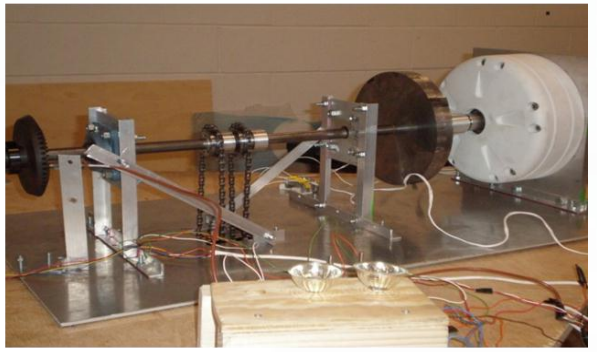
First-Generation Prototype

- Consists of a single ratcheting sprocket and a small flywheel mounted on the shaft.
- First design produced a low power output due to low rpm of the shaft and high frictional losses from generator



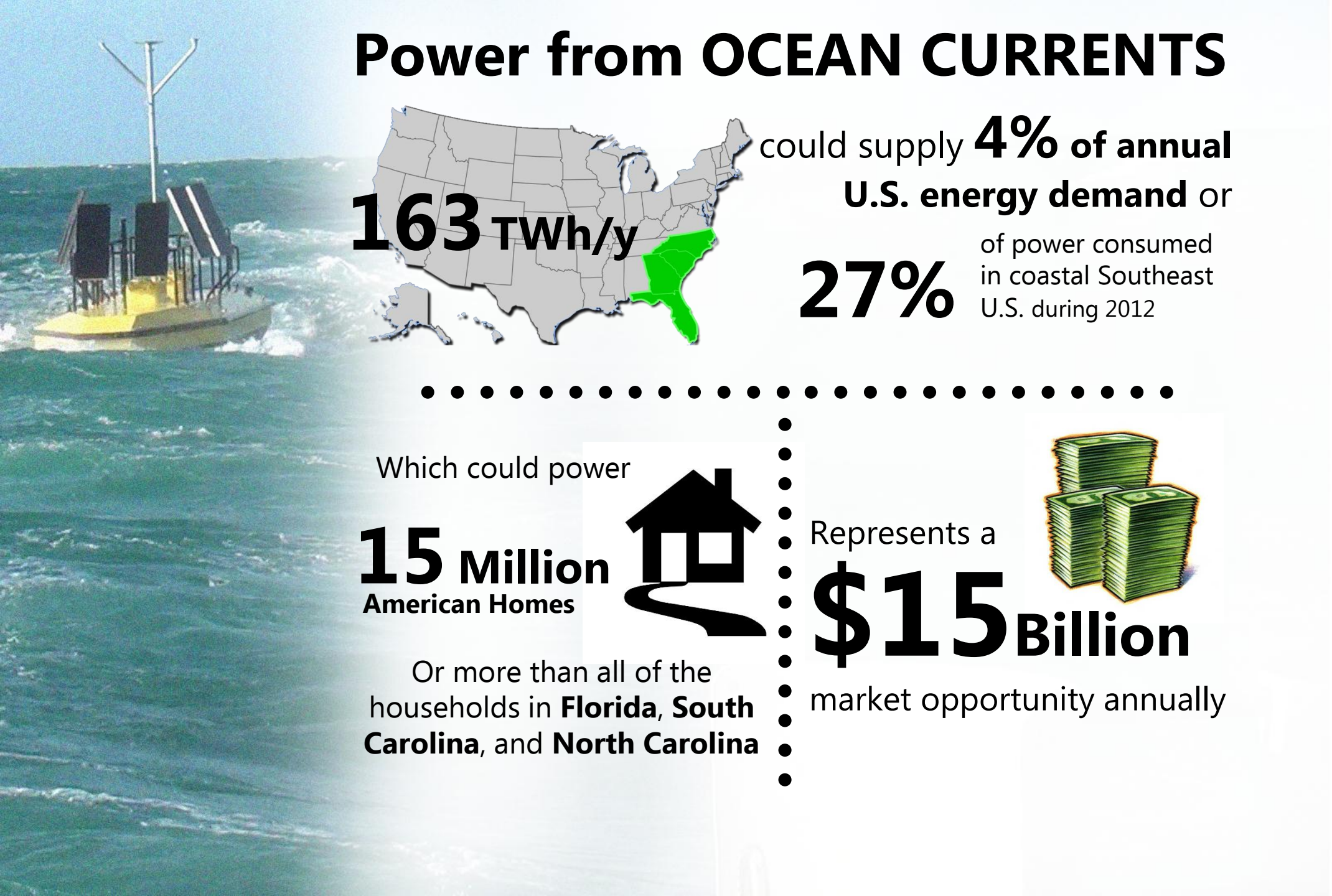
Second-Generation Prototype

- Utilizes two sprockets to rotate the shaft faster and to also drive the shaft on the downward stroke.
- A larger flywheel and a more efficient generator reduced frictional losses imposed on the shaft.



PI: Dr. Zhihua Qu
Faculty: Dr. Kurt Lin
Graduate Students: Mr. Shiyuan Jin and Mr. Steven Helkin, Mr. Carlos Velez

Power from OCEAN CURRENTS



163 TWh/y

could supply **4% of annual U.S. energy demand** or

27% of power consumed in coastal Southeast U.S. during 2012

Which could power

15 Million
American Homes

Or more than all of the households in **Florida**, **South Carolina**, and **North Carolina**

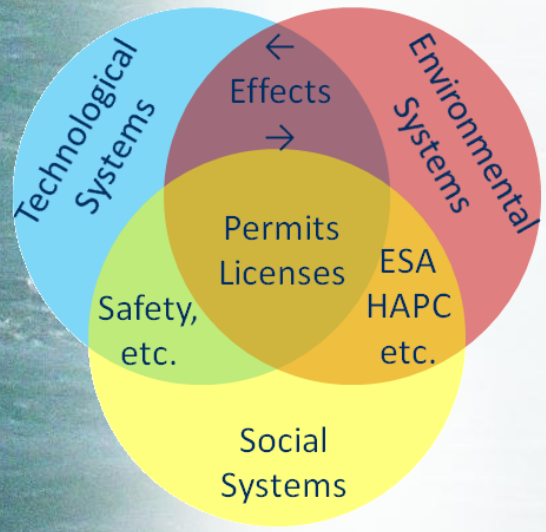
Represents a

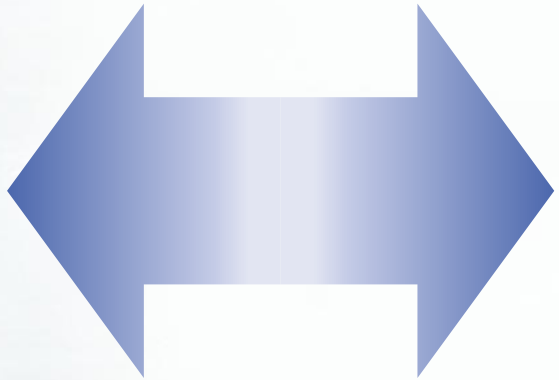
$15 Billion

market opportunity annually

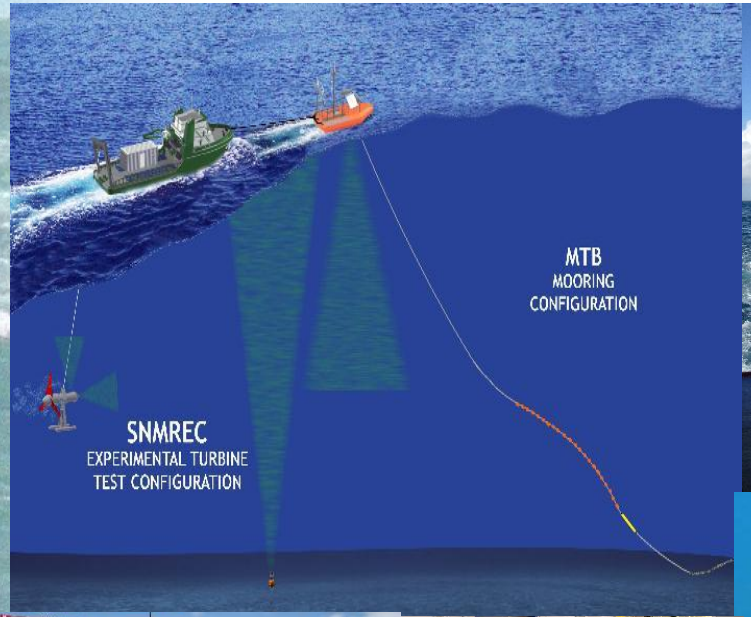
Ocean Current Energy - SNMREC Approach

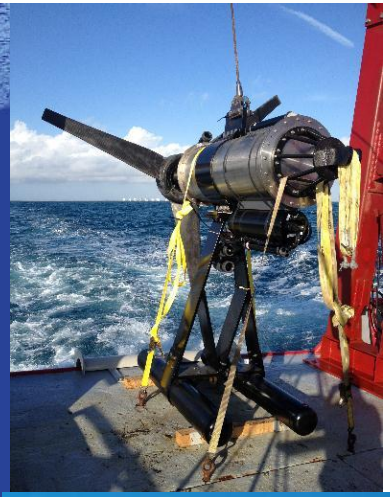
Enable commercialization of marine renewables





Small-scale Offshore Testing





SNMREC: 20 kW 3-meter Rotor Research Turbine

Surface-deployed *without* power transmission to shore

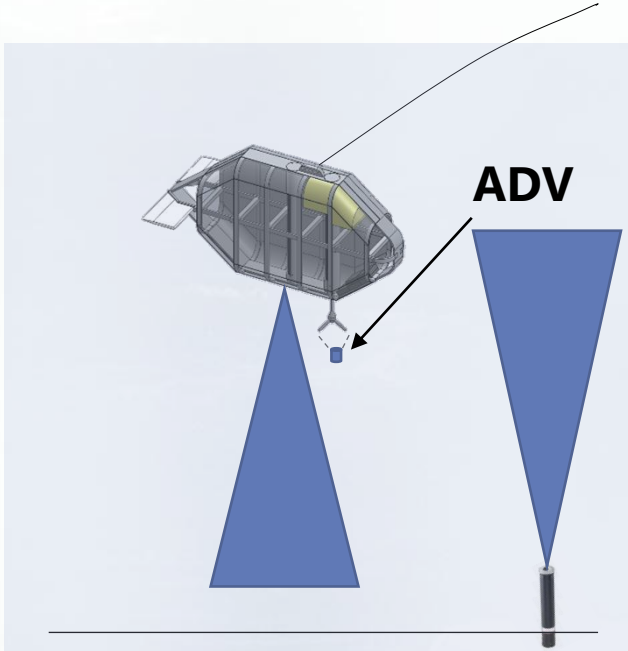
Capable of testing **1/10 – 1/4** scale systems up to **100kW** or **7m** diameter demonstration turbines

Resource Characterization:

Turbulence and Shear Measurements

- **Preliminary testing to quantify measurable frequency range**
- SNMREC Lab Tests (1-60s)
- NNMREC Data (1-50s)

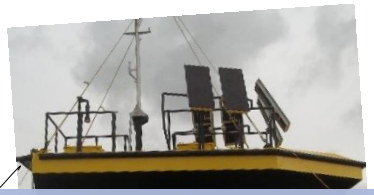
SNMREC Shallow Water Test

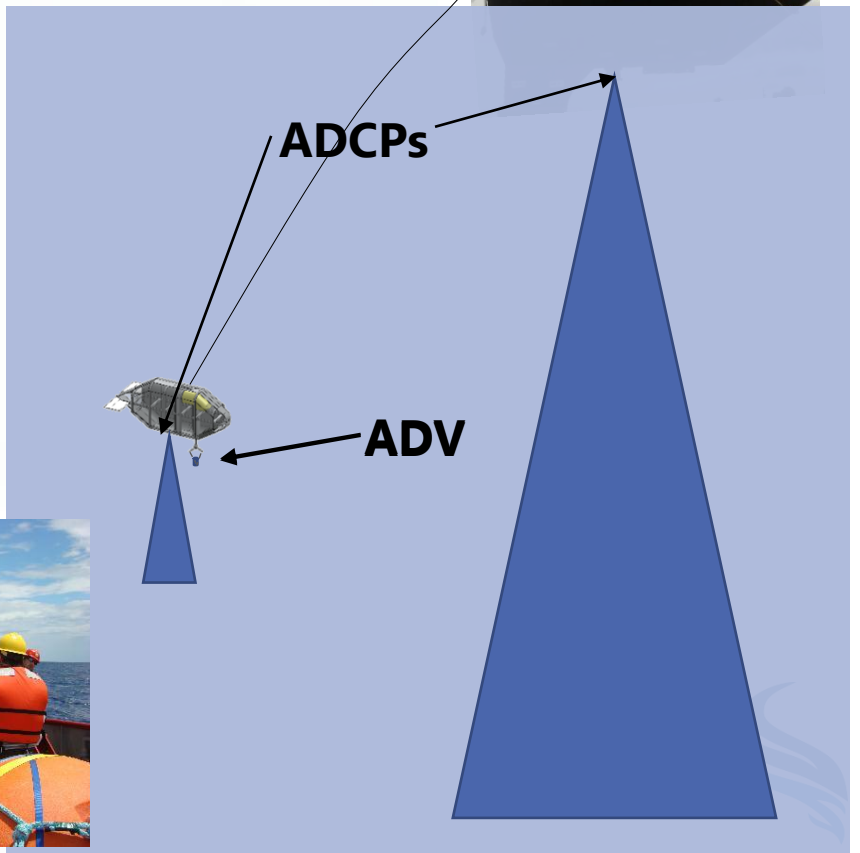


Open Ocean Measurements

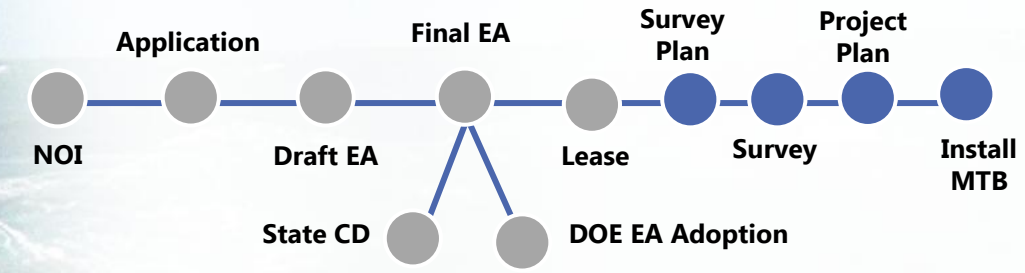
ADCPs: Shear

ADV: Turbulence

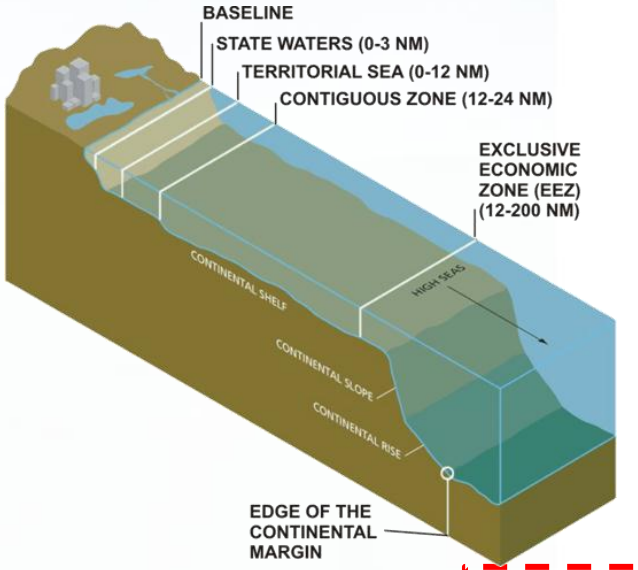




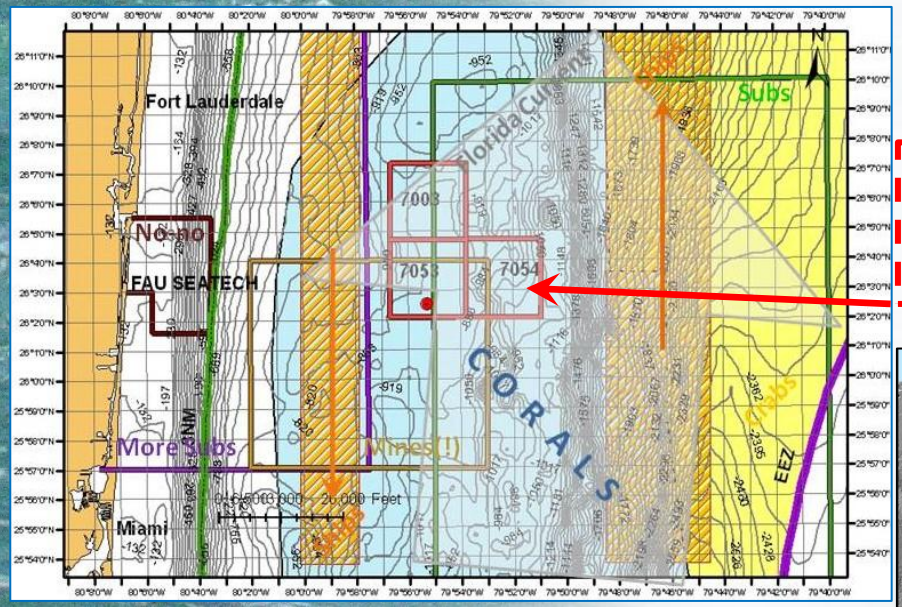
Regulatory Framework



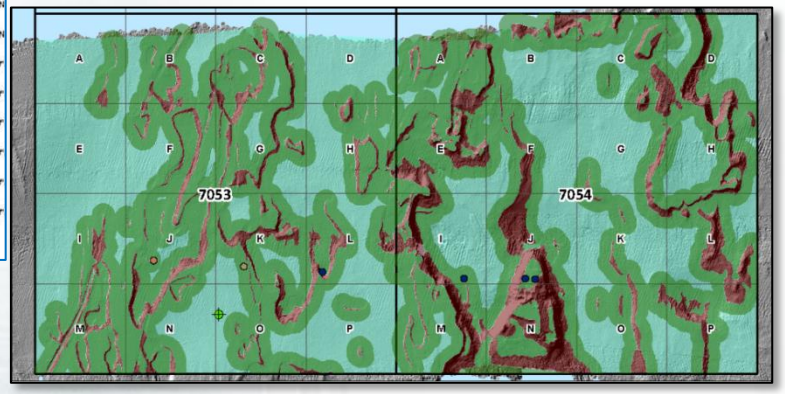
2007	July 2010	April 2012	August 2013	June 2014	Spring 2015

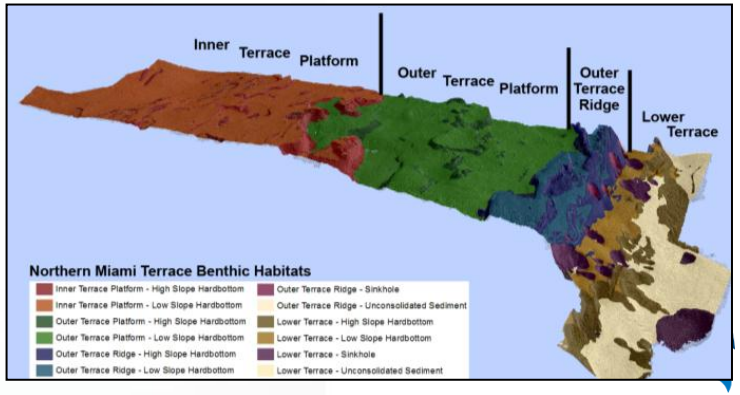


FIRST National Lease on the OCS:
Establishing the framework for future applicants

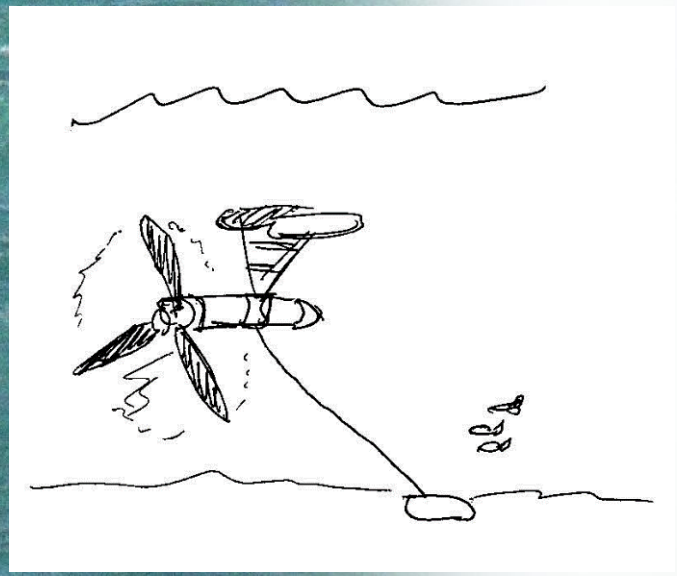


SNMREC Lease Areas = 1,068 Acres:
Block 7053, Aliquot L
Block 7054, Aliquots K & L

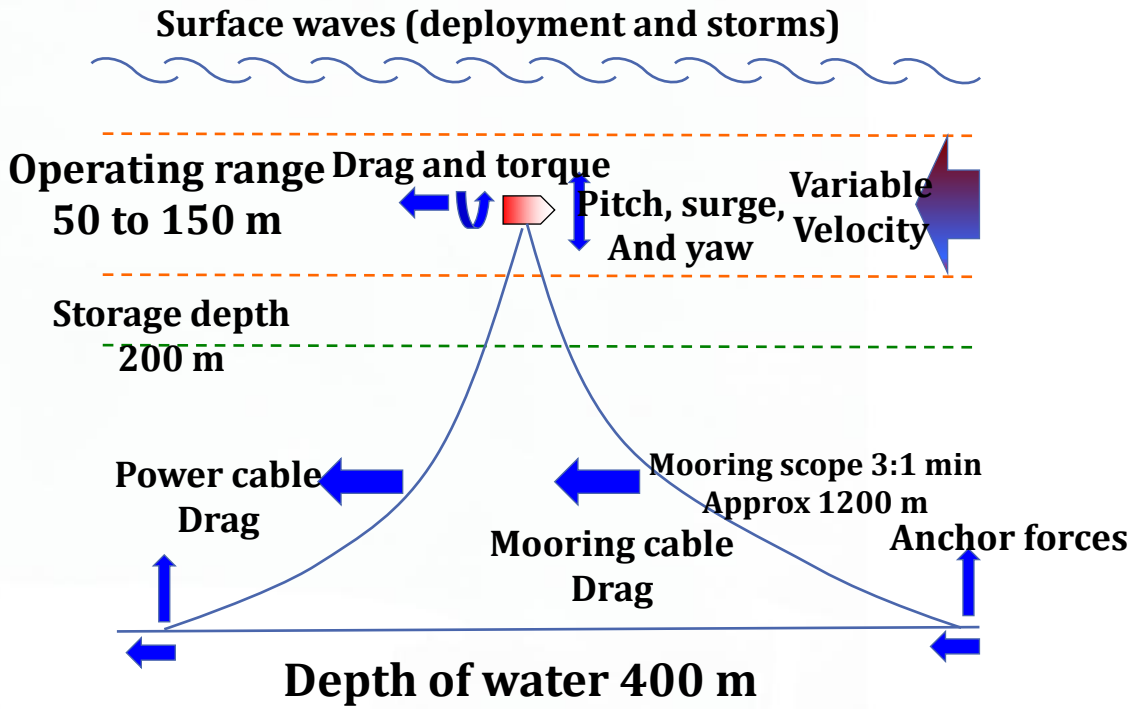




Full-scale Prototype Testing

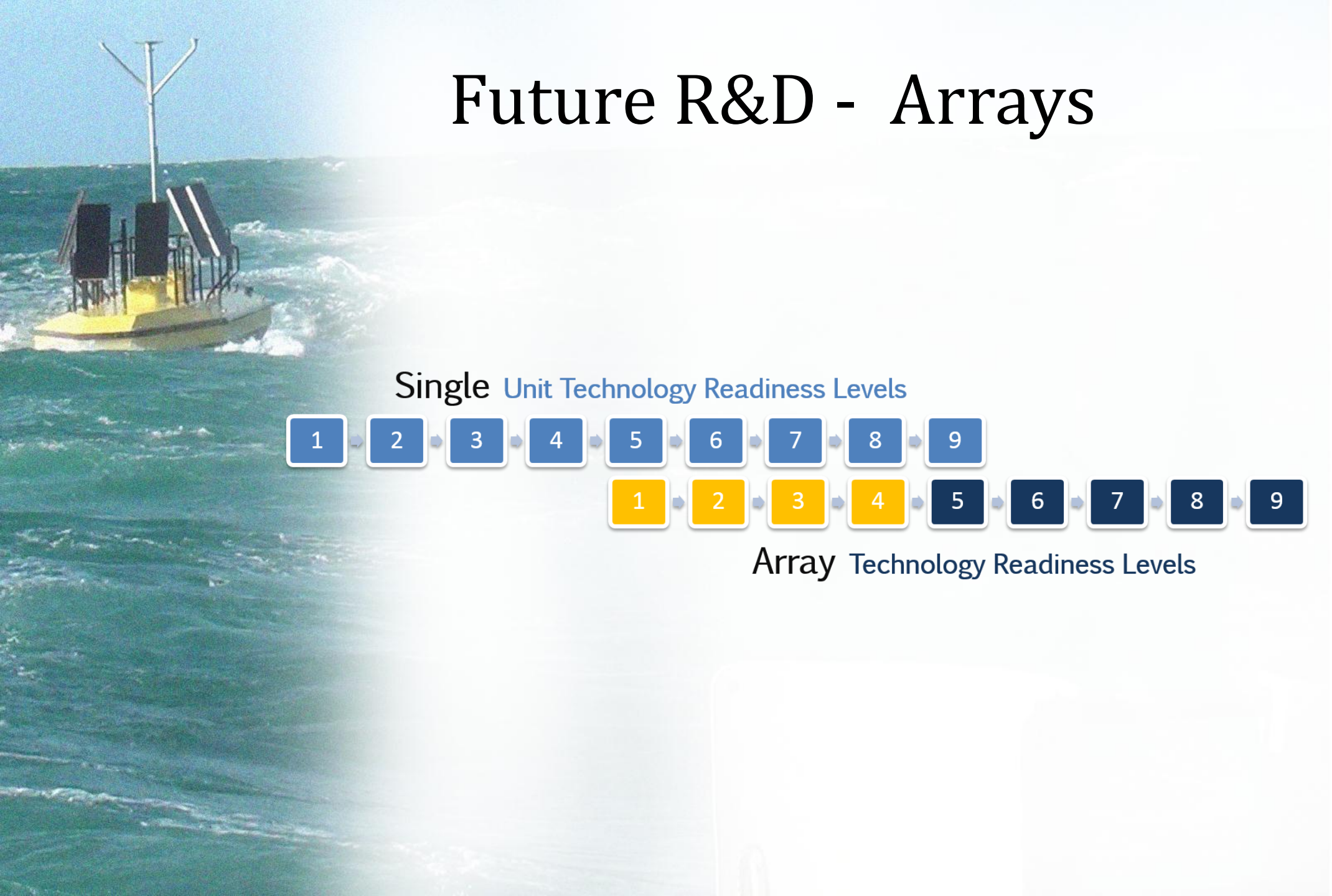


Ready for service!



TRL 8-9

Future R&D - Arrays



Single Unit Technology Readiness Levels

1 → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9

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Array Technology Readiness Levels

Bigger Picture

- FL-BOEM task force
- SE Collaboration
- Global markets
- Industry Forums