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OCEAN POWER TECHNOLOGIES

Wave Energy for Powering Science

VIMS Industry Partnership Meeting

February 17, 2012

Company Overview

Commenced Operations:	1994
Incorporation:	Delaware, USA
Operating Locations:	Pennington, NJ, USA and Warwick, UK
Total Employees:	50
Intellectual Property:	61 US patents issued or pending
Cash and Investments:	$43.1 million (as of July 31, 2011)
Public Listing:	Nasdaq (OPTT)

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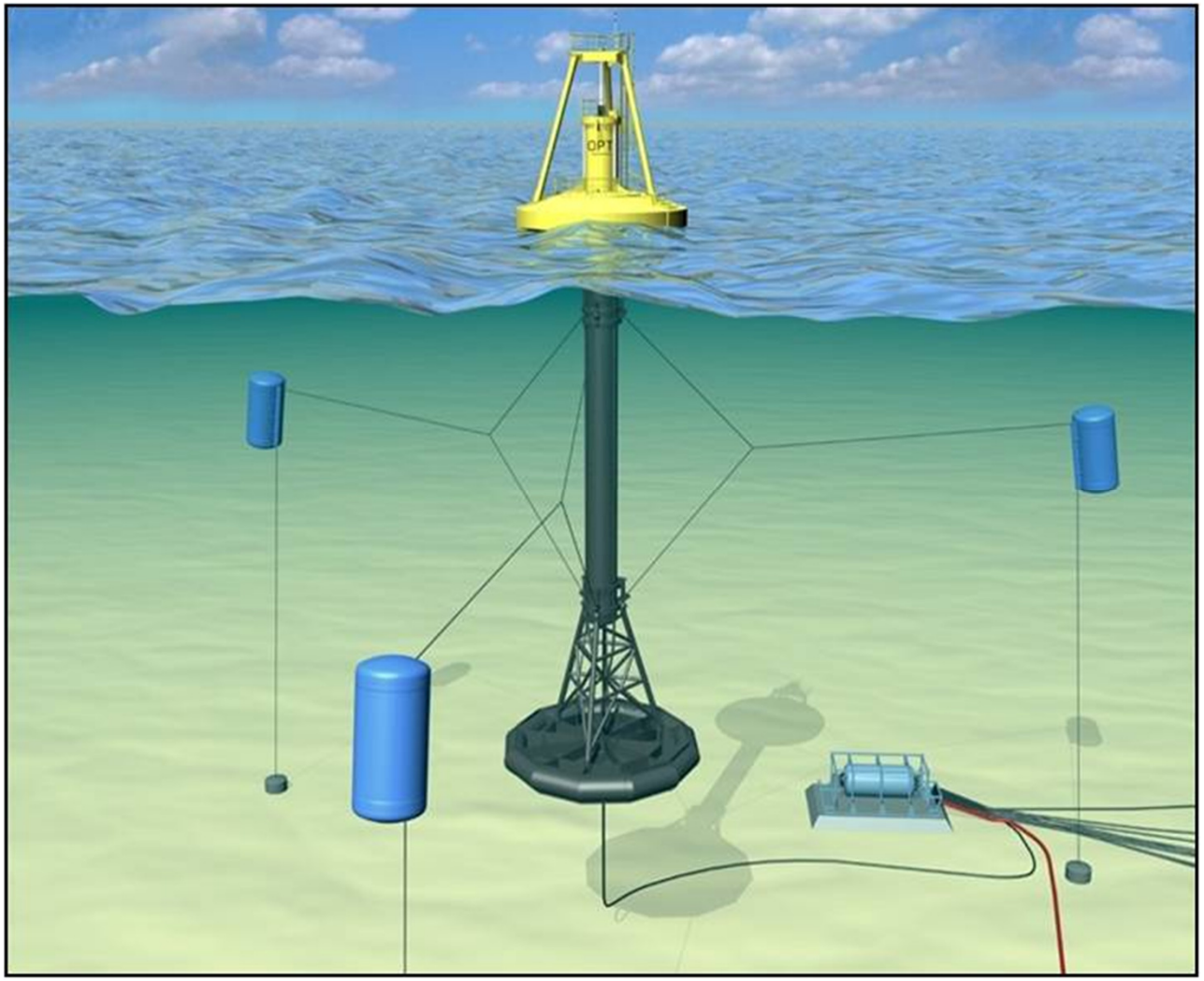
Utility PowerBuoy and Undersea Substation



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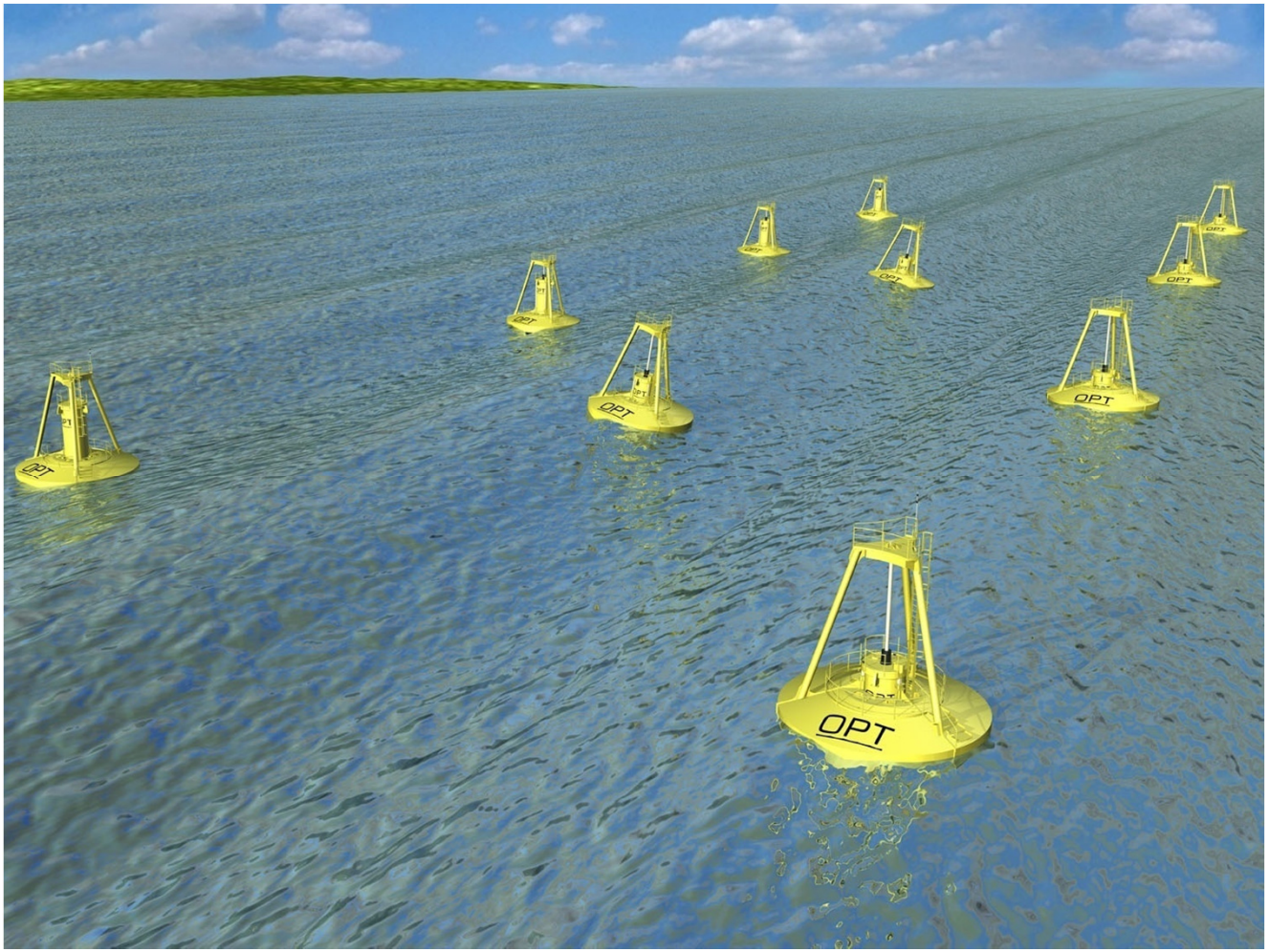
Wave Power Station



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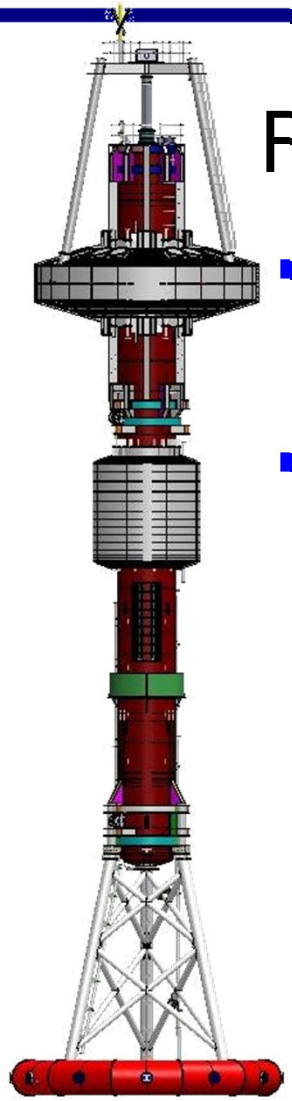
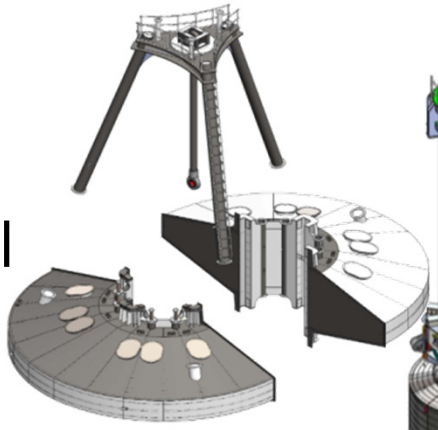
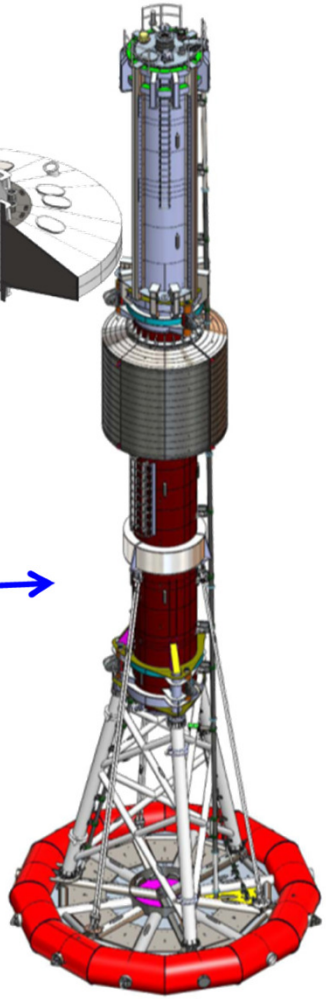
Type of Technology



Floating Point Absorber

- Wave capture element is small in comparison to the wave
- Two hull approach
  - Smaller, much more dynamic, fast responding hull
  - Large, floating, slow responding hull
  - Differential motion = wave capture mechanism





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PB150, 150kW PowerBuoy Installation - Scotland

Tow out – April 2011

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PB150, 150kW PowerBuoy Installation - Scotland

Deployment Process– April 2011

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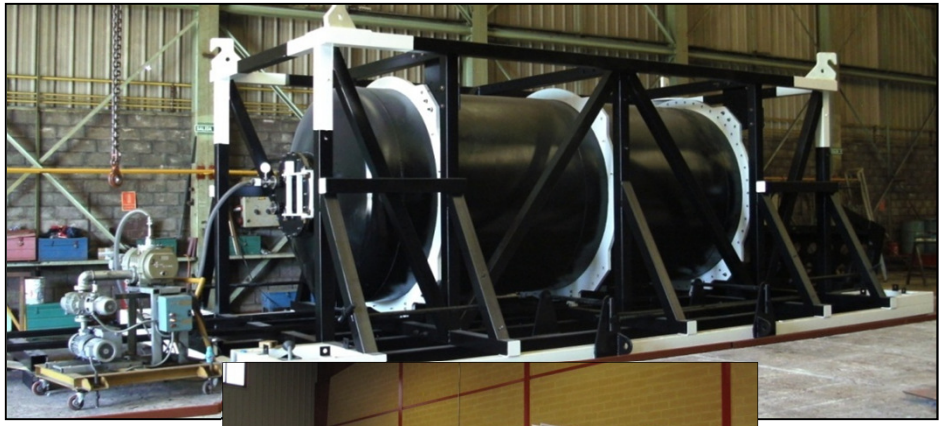
Undersea Substation Pod

- Unique features – open platform
- An enabler for field development of marine energy devices
- Lowers cost per MW installed



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Autonomous PowerBuoys

Technology Readiness

- First autonomous PowerBuoy tested in 2004 off State of Washington under Lockheed contract
- PB40-rated system operated off New Jersey during 2005-2007
  - Withstood Hurricane Wilma
- LEAP PowerBuoy "mission proven" in 2011 in successful integration with US Navy's radar-based, operational maritime security system
  - Persistent power in all wave conditions, using proprietary power management system
  - Withstood Hurricane Irene
- DWADS PowerBuoy prototype tested in 2010 demonstrating station keeping for US Navy
  - Power generation in autonomous mode to maintain station and provide power to sonar-based maritime security system

Key Customers and Partners to Date

- US Navy
- Lockheed Martin

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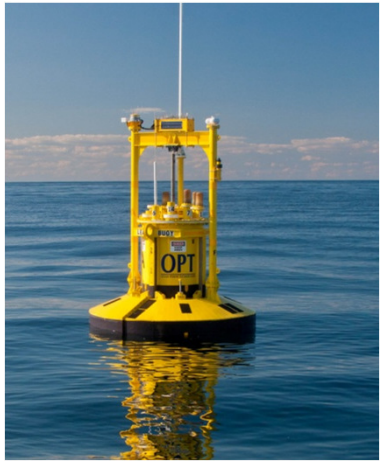
Autonomous PowerBuoys

September 2004 Ocean Test deployed off Washington State

PowerBuoy deployed off Tuckerton, New Jersey, 2005-2006; 2007-2008

DWADS near shore trials off Elizabeth NJ
Nov 2010



LEAP PowerBuoy, deployed August 2011 to present

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Market Opportunities

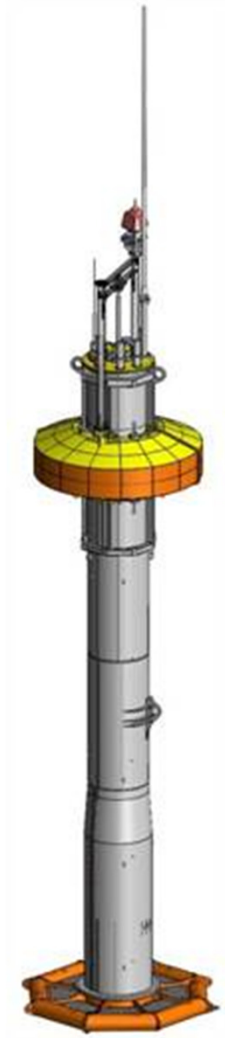
Applications for Autonomous PowerBuoys

- Homeland security
- Off-shore Oil & Gas platforms
- Ocean-based communications – cell tower platforms
- AUV Charging Stations
- Off-shore “Open Ocean” aquaculture
- Oceanographic data collection
- Desalination
- Warning system for tsunamis, cyclones, typhoons

LEAP PowerBuoy

Littoral Expeditionary Autonomous PowerBuoy

- LEAP program designed to provide persistent wave energy for radar-based, enhanced homeland security and maritime surveillance
- Deployed off New Jersey in August 2011
  - Performed well during Hurricane Irene
- Enabling technology
  - Unique power take-off with on-board storage capability
  - Proprietary power management system
  - Provides constant power in all wave conditions for sea-based vessel detection system
- Technology can be used for other deep-sea applications



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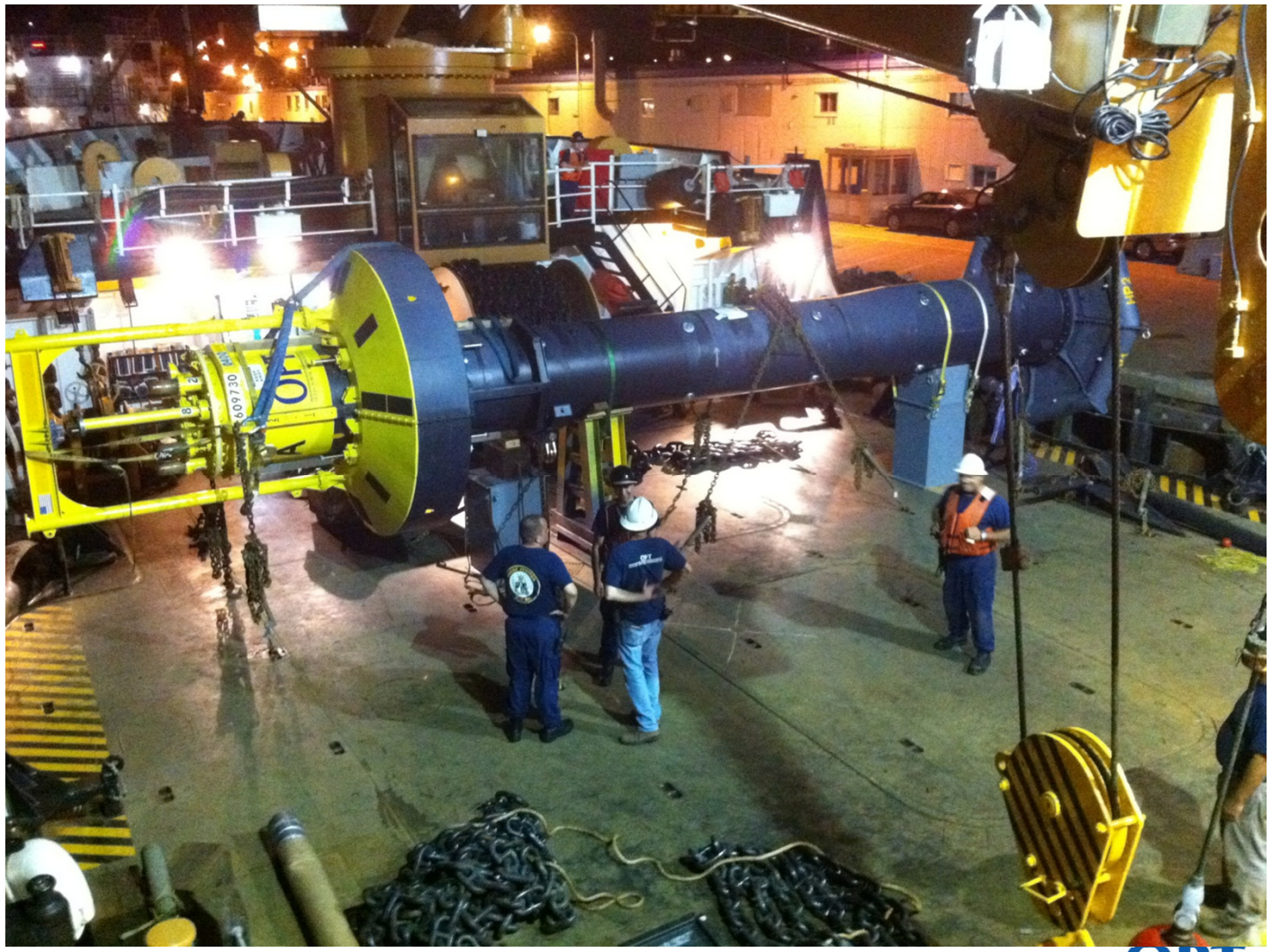
Manufacturing Process

- Buoy fabricated by outside vendor
- Power take-off and control system (“smart-part”) built in New Jersey
- Integration and test of completed PowerBuoys completed by OPT

PowerBuoy at Fabrication Site

LEAP on Deck USCGC Juniper



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LEAP Deployment – USCGC Juniper

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LEAP New Jersey Post Hurricane Irene

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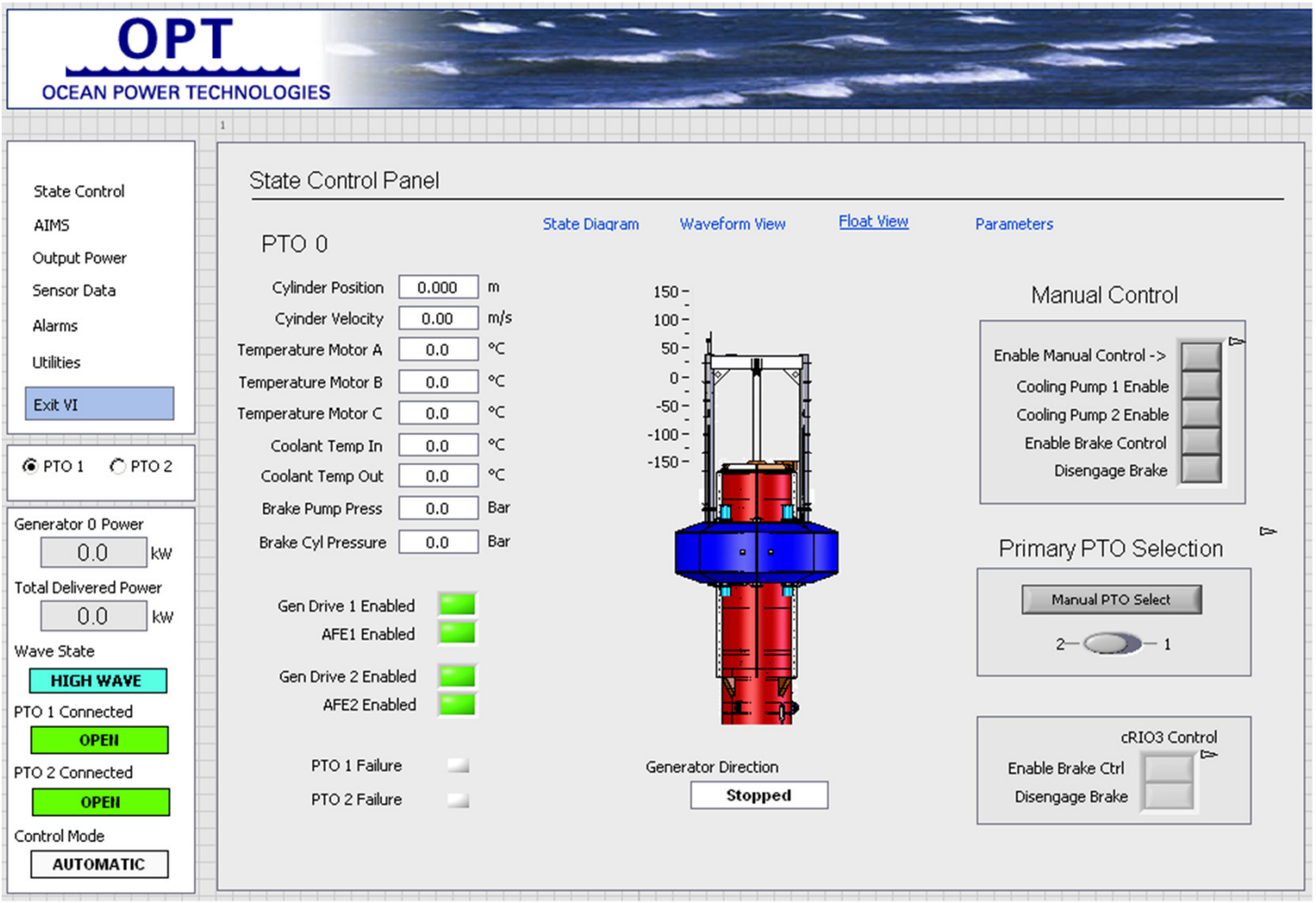
PowerBuoy Monitoring and Control

- Software suite allows for full autonomous operations of PowerBuoy
- Operator can monitor and control PowerBuoy state, motions, power performance
  - Windows based control software
  - Human/Machine Interface – HMI
  - Everything from reading minor values through complete software upgrade
- Data stored locally and exported via Wi-Fi, fiber or radio to SQL database on shore

PowerBuoy Monitoring and Control



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LEAP Specifications

Length	12.75 m	41.9 ft
Height above waterline	3.42 m	11.3 ft
Spar diameter	1.07 m	3.6 ft
Weight	10,000 kg	22,046 lbs
Mission payload :	150 kg	330 lbs
external	0.25m dia. x 0.60m	0.8ft x 1.9ft
internal, upper	0.25m x 0.35m x 1.60m	0.8ft x 1.1ft x 5.2ft
internal, lower	0.60m x 0.60m x 1.50m	1.9ft x 1.9ft x 4.9ft

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LEAP Electrical Specifications

Power – for one meter wave height avg

Continuous	300 W
Peak (1 hour/day)	7.2 kW

Voltage Ranges

5 – 300	VDC
100-240	VAC

*Power is variable based on site specific conditions. Values shown are representative offshore NJ coast

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LEAP Mooring

- Minimum water depth 25 meters
- Shallow water mooring configuration with side bridle
- Deep water configuration with single point connection on bottom of heave plate
- Connection on buoy for subsea power and communications cable
- Mooring can be provided by OPT or customer

LEAP Science Uses – Sensor Networks

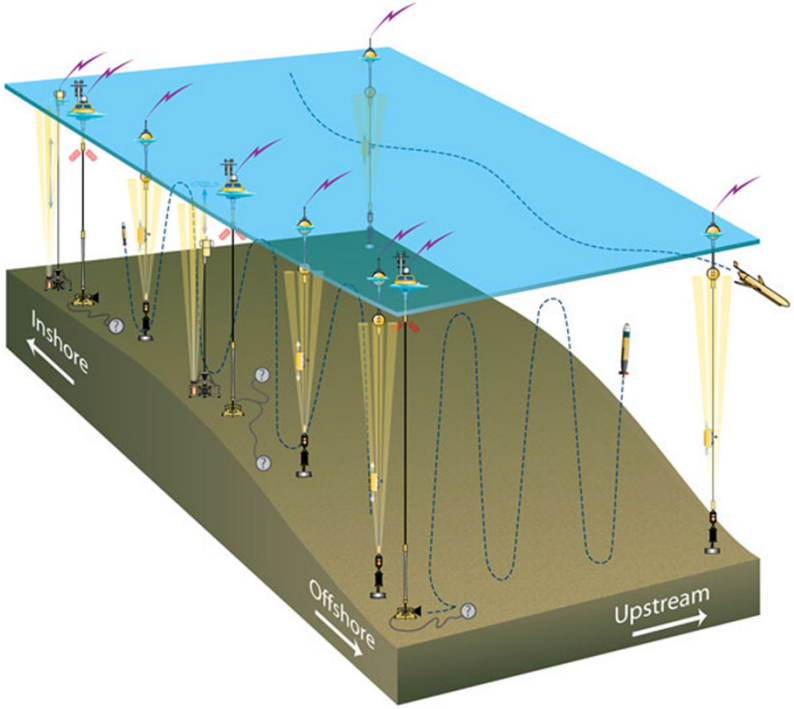

Image from www.whoi.edu

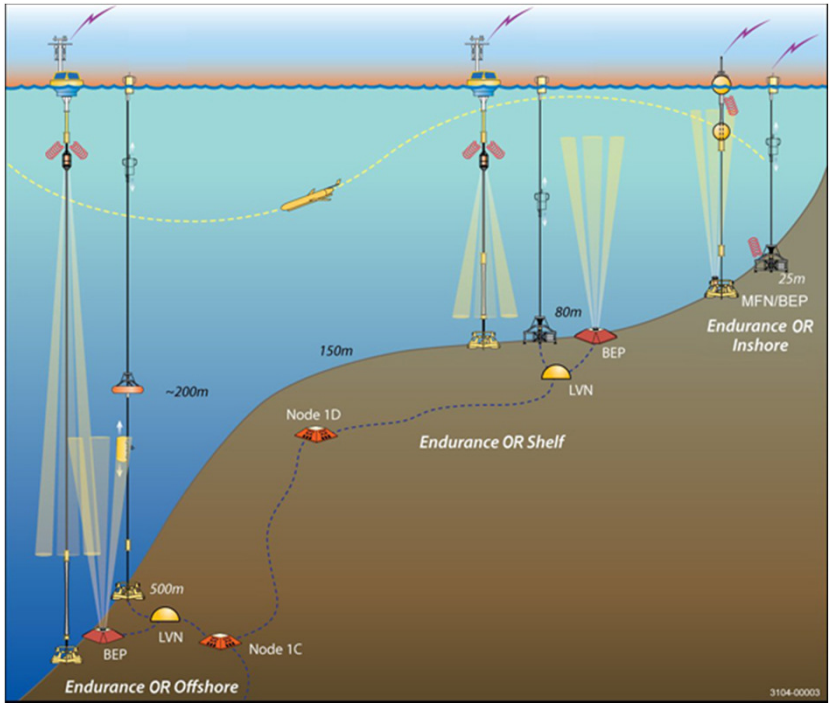

Image from www.whoi.edu

- Provides continuous 300W of power today, larger capacity buoys to follow
- Leverages power to increase spatial coverage of cabled sensor networks
- Reduces maintenance costs by eliminating re-fueling trips

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LEAP Science Uses – AUV Docking Stations

Providing persistent power for rapid charging, **increasing** vehicle **availability** and time for scientific investigation !!

Image from www.offshore-mag.com

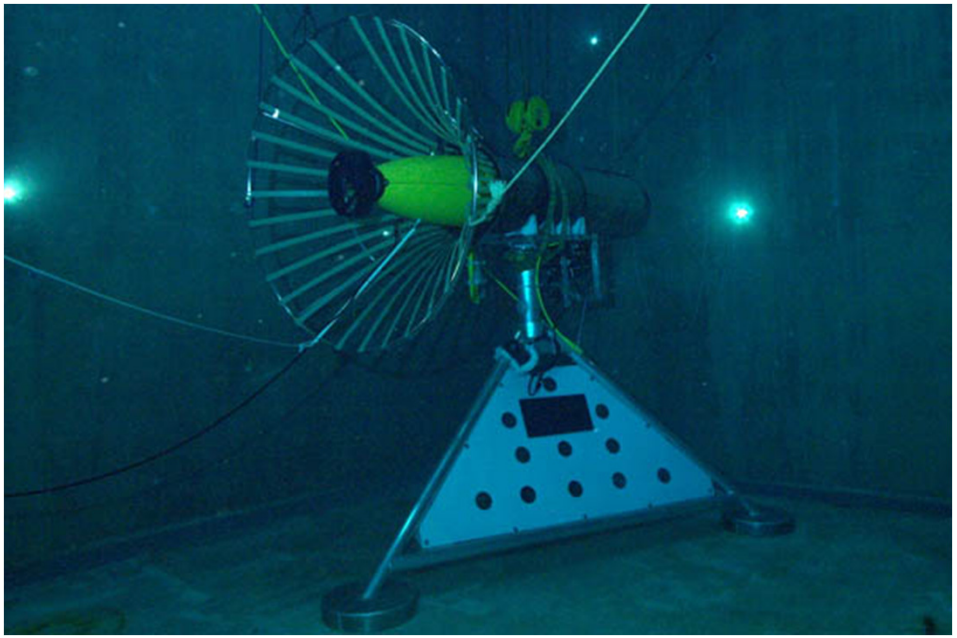

Image from www.mbari.org

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