# Expansion of Existing Facility into **Wave Energy Test Site (WETS)** Marine Corps Base Hawaii (MCBH)

**Briefing to:**

**US Department of Energy (DoE)**

**By:**

**Hawaii National Marine Renewable Energy Center (HINMREC)**
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**February 13, 2011**

# Wave Energy Test Site (WETS)

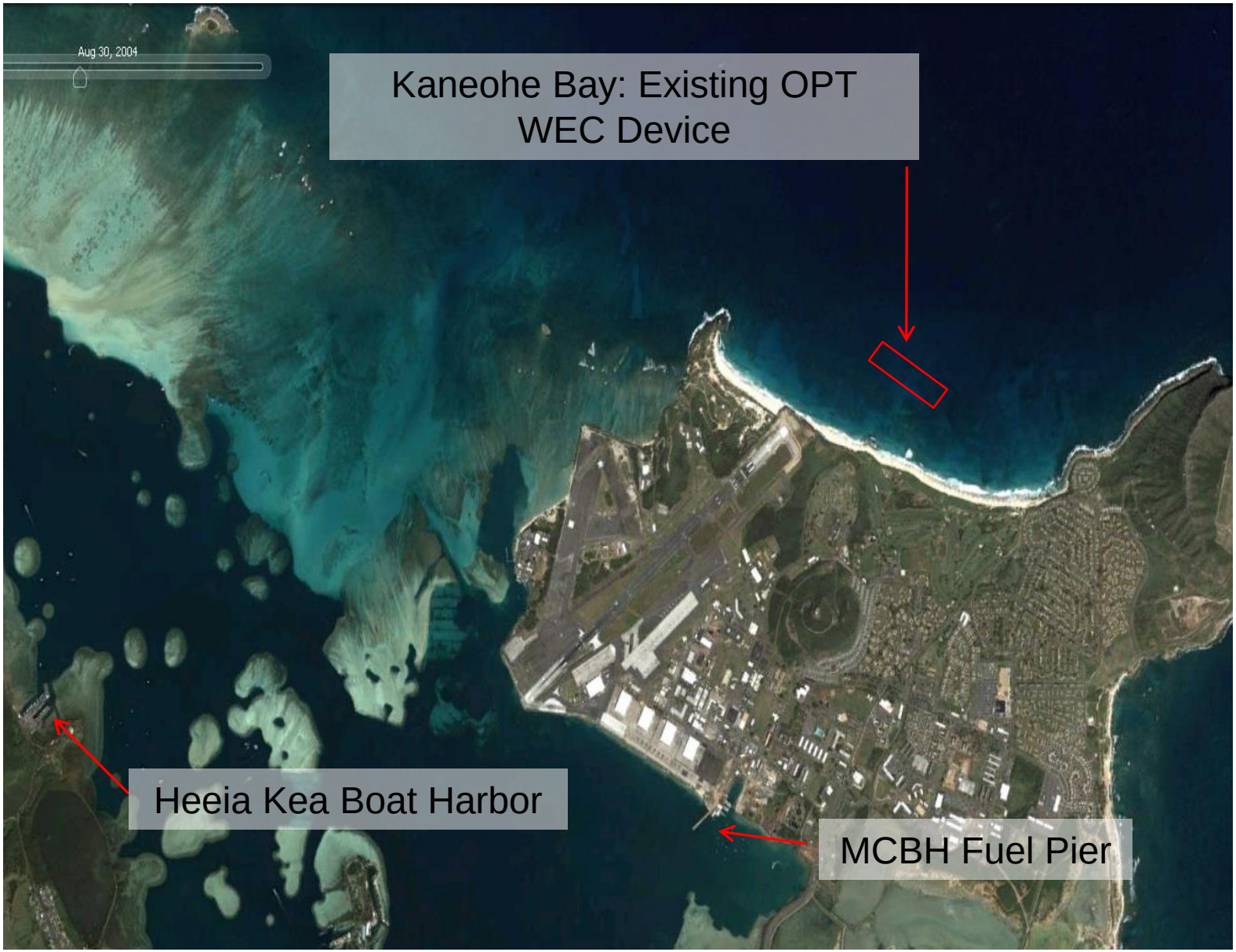
- Objective: Expand infrastructure from *one* → *three*$^{+}$ grid-connected test berths;
- Presently: submarine power cable; data collection system; single "40 kW" OPT buoy 1200 m offshore, 30 m depth; 4$^{th}$ Generation Operational (12/09); Grid(9/10) → Could accommodate one more WEC Device @ 30 m;
- Expansion: Additional submarine power cable → Deeper waters 50 m – 100 m → Two more WECs → Capability to test ≤ 4 WECs at 30m to 100 m depths.

# Wave Energy Test Site (WETS)

## Marine Corps Base Hawaii

## Kaneohe Bay

# MCBH at Kaneohe Bay



# Project Location Accessibility & Workability

- Heeia Kea Boat Harbor: medium sized work-boats;
- Kaneohe Bay: calm berthing for larger work-boats;
- MCBH Fuel Pier: staging (*vessel berthing, dive & welding equipment*) and mobilization of OPT equipment (*WEC Buoy, transformer pod, subsurface float*);
- Proposed WETS: work-boat moored in K-Bay with WEC devices assembled and deployed from Fuel Pier;
- WETS Accessibility: Year round Install & Maintenance ops up to 3' Swells and light Trades; and, Inspection & some Maintenance up to 6' Swells.

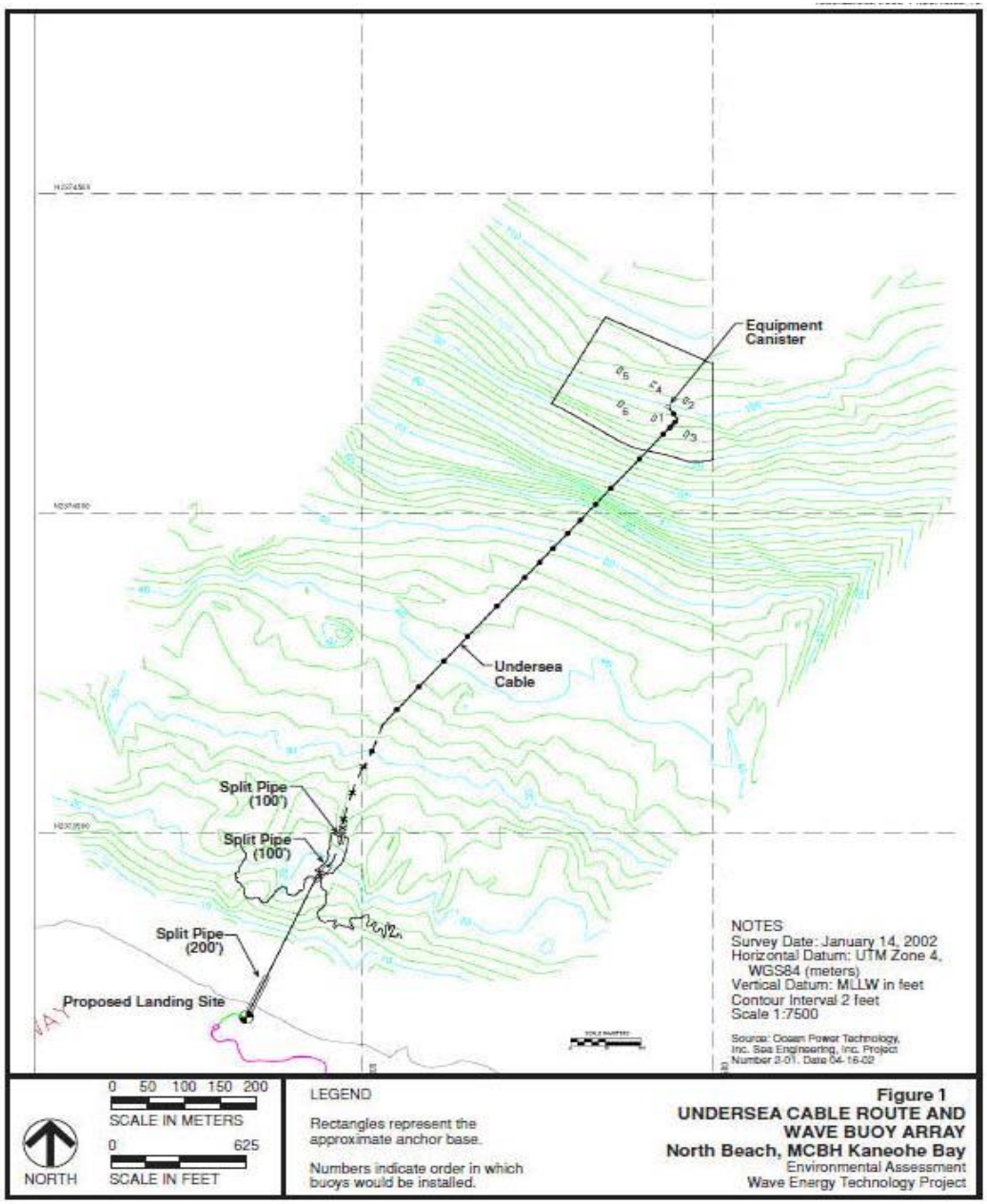
# Deployment Images

"40 kW" Point Absorber Buoy

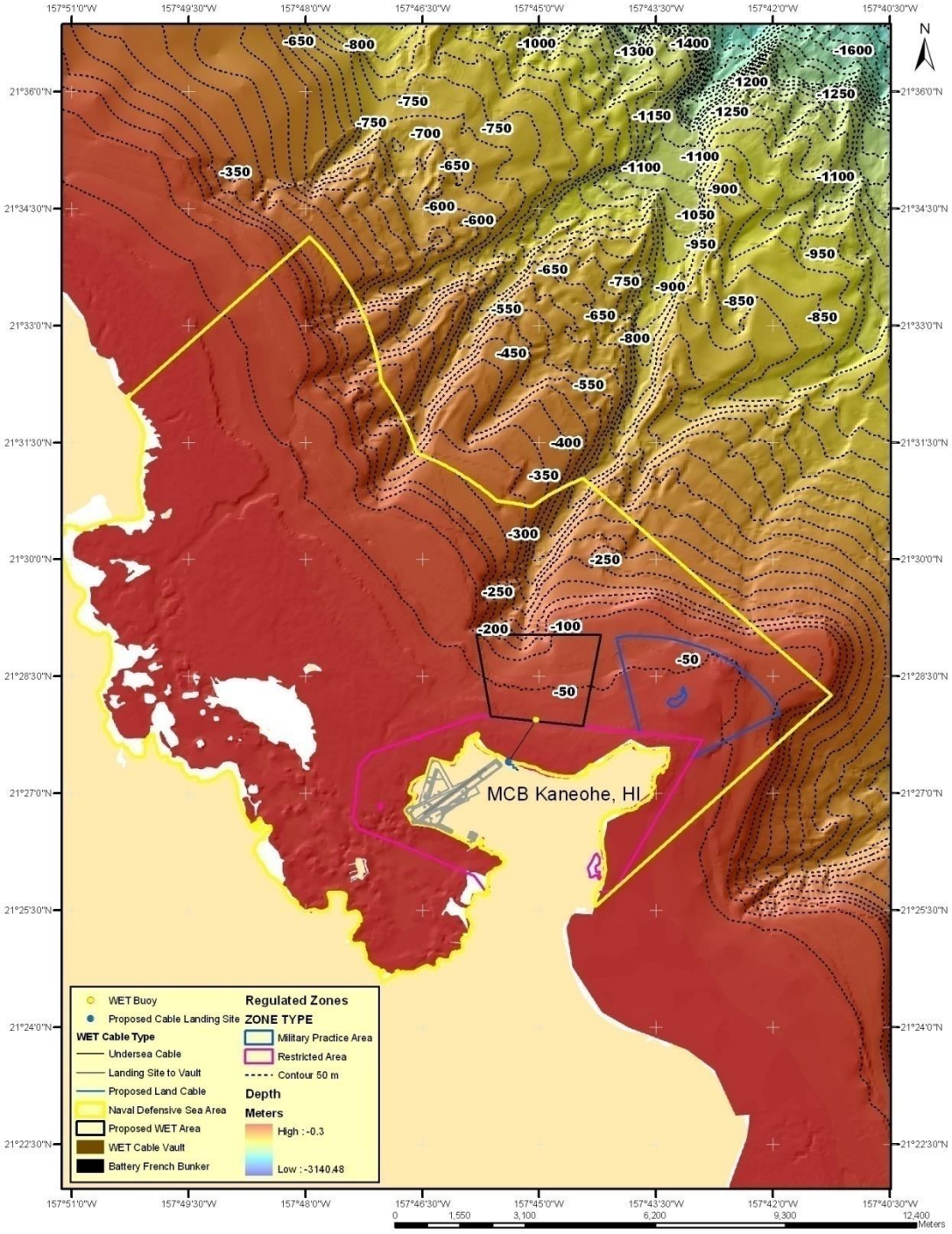
- 3rd Generation Operational since December 2009
- Grid-Connected September 2010



OPT
OCEAN POWER TECHNOLOGIES




**- Existing WEC Device Test Site at MCBH (Kaneohe Bay);**
**-Subsea Cabling Installed 2003;**
**- 3rd Generation 40 kW Point Absorber Operational.**




# WETS

**Ocean Test Area**: 4.92 km$^2$

- Black trapezoidal area set aside by Navy/USMC;
- To be surveyed by HINMREC/HNEI
- "Yellow dot" Existing OPT Buoy
- Depths in meters

**Beyond WETS**

- Could Enclose: ~ 70 MW Wave Farm-Array

# Why WETS?

- **USN**:

  - President's Executive Order 13123 $\rightarrow$ development of renewable power resources at federal installations;

  - U.S. Federal Energy Policy $\rightarrow$ reduce the nations dependence on foreign oil.

- **DoE**:

  - Implement Test Sites for Wave Energy Conversion (WEC) Devices in the USA.

# Why WETS at MCBH?

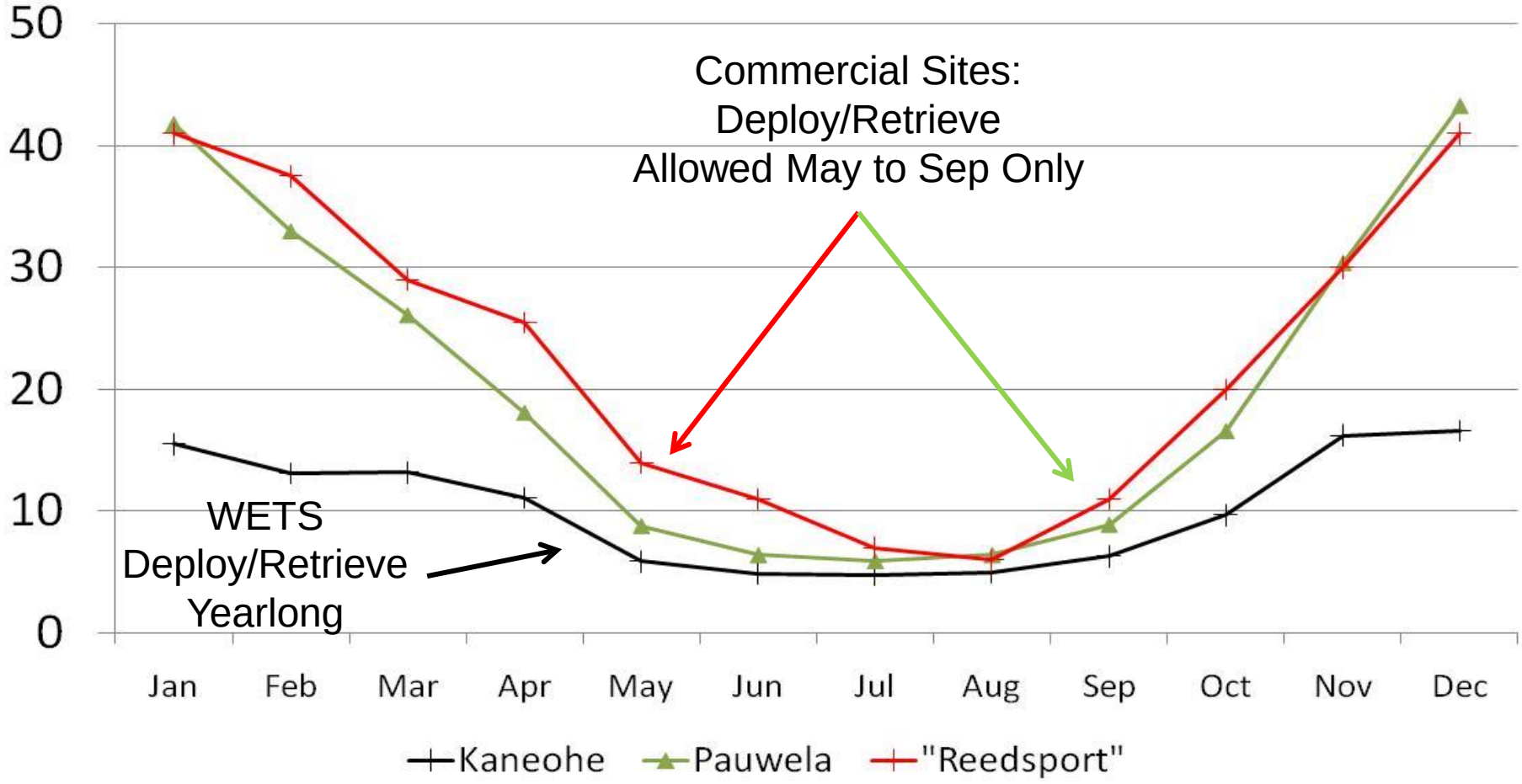
- Technical:
  - Expanding *Existing Navy/USMC Site vis-a-vis* Implementing a *New Site* elsewhere;
  - Hawai'i Pertinent Ocean Eng. Facilities & Site Specific Deployment & Maintenance Experience (since 2003);
  - HNEI in position to manage site.
- Licensing & Permitting:
  - *New-Site* > 24-months and challenging;
  - *Expansion* < 12-months: (i) NEPA Process similar to 2003 Navy EA/FONSI; (ii) Federal & State Agencies defer to USN FONSI; (iii) FERC License not required because power delivered to DoD Installation.

# Why WETS at MCBH?

- Funding:
  - Leverage DoE/USN Funds;
  - Navy processing environmental permitting for expansion;
  - DoE funding of detailed bathymetric and bottom survey to be funded through HINMREC.

# Wave Power Flux (kW/m) Monthly Average:

- Commercial Sites (Reedsport, OR; Pa'uwela, HI)
- Test Site (Kaneohe, MCBH, Oahu)



# MCBH Installation & Maintenance Infrastructure Available

{*WEC Device Specific Since 2001; 4th Generation OPT Buoy*}

Installation (workboats, divers & experienced crew)

- Submarine power and data cables;
- Cables landing & Grid interconnections;
- Mooring systems;
- WEC Devices Deployment, Commissioning and Retrieval.

Fabrication

- Several Steel & Al Shops, Honolulu Harbor side. PTO/Electronics proprietary

Maintenance

- Minor: in-situ at MCBH
- Major: e.g., Pacific Shipyards Int. Dry-docks & Builder of SWATH ships, Tanker Mooring Buoys

# Current Tenant (OPT): Test Site Assessment

- Site ideal for experimental and prototype at-sea tests - wave resource is adequate for testing; and, maintenance ops are feasible year-long;
- Deployment only authorized (US Army Corps) during summer months at commercial sites in Hawai'i (Pa'uwela) and Oregon (Reedsport);
- WEC device can be located in fairly deep water, without long power cabling to shore;
- Hill/Bunker at MCBH allows for visual/camera observation and communications (direct line of site) without a tower;
- MCBH a willing customer; →

# Current Tenant (OPT): Test Site Assessment

- MCBH supportive of renewable energy development;
- Dive operations for inspections enhanced with extensive underwater visibility in Hawaii;
- Mokapu Waverider (wave measurements) buoy supported by UH;
- UH staff experience in ocean eng & oceanography;
- Well developed transportation infrastructure to and between the islands for equipment deliveries. Test Site is relatively close to Honolulu Harbor;
- Private Sector Support: Ocean Engineering firms available with ten year experience supporting OPT in Assembly, Deploy, Install, Maintain, Repair and Retrieve.

# WETS Implementation: Tasks

**Funded Tasks**

- **HINMREC /NFESC** – Environmental Studies → EA/EIS input ;
- **NFESC** - Amended EA/FONSI → multiple test berths 30 m to 100 m depth.

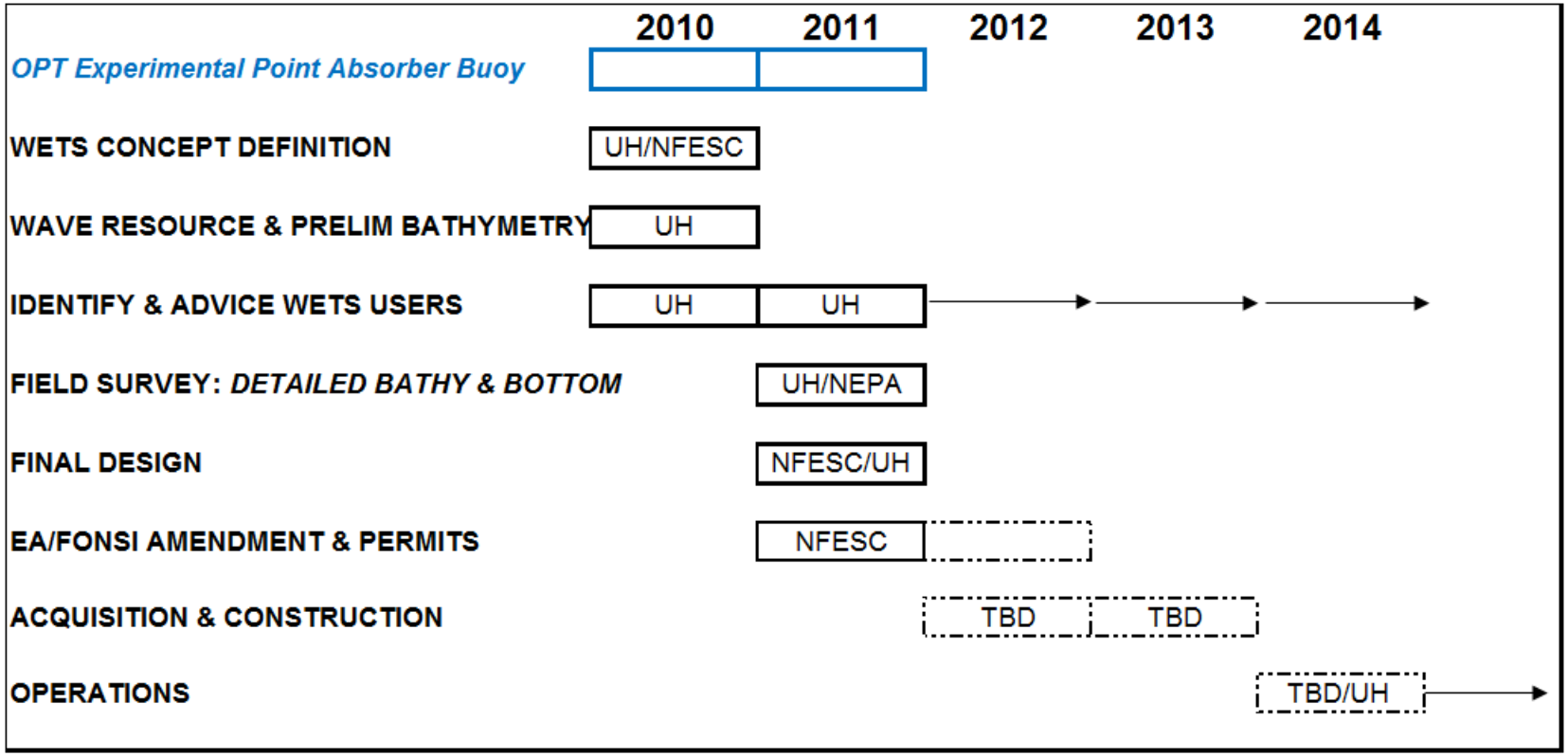
**Ongoing**

- **UH/HNEI** - Coordinate DoD, DoE, State partnership to develop Congressional support & funding for Expansion (~ $9 M Required).

**WETS Modus Operandi**

- **Navy/MCBH** – provide/host test site, use/purchase power;
- **HNEI** - Operate & Manage WETS (~$ 1 M/year Required);
- **Developers** - Responsible for: device, mooring, connection to socket, user fee *(plug & test)*,data acquisition & shore controls.

# WETS at MCBH: Timeline and Partners




**UH** : University of Hawaii National Marine Renewable Energy Center. Tasks funded by DOE
*2010-2012: $215 K for Permitting & Environmental ; $180 K Eng. Support.*
*2013-2014: $125 K Expected for Additional Eng. Support*
**UH/NEPA**: Tasks require NEPA Compliance Authorization
**NFESC**: Naval Facilities Engineering Service Center. Tasks funded by NAVFAC
**TBD**: Funding Source to-be-determined. Budget estimated at $9 M. Currently $0.28 M from DOE; plus $0.17 M expected 2013-2014
**TBD/UH**: UH to Manage Upgraded Test Facility. $1 M Annual Budget Estimated. Funding Source to-be-determined

# WETS Schedule Summary

Task Upgrade Navy infrastructure from 1 into $3^+$ socket berths ready for WECs to *plug & test.*

Team (i) Navy: amend EA/FONSI (ongoing); Final WETS Design (pending); Infrastructure (pending) ;

(ii) UH: Resource & Prelim Bathymetry (done); Concept Definition (done); Identify/Advise developers (ongoing); Detailed Bathy. and Bottom Survey (pending).

Budget $9 M Infrastructure & $1 M/year for Ops (not available); only $0.45 M from DoE for Infrastructure.

Timeline EA/FONSI & Final Design by 12/11 on schedule but Infrastructure Funding not expected until 2013 the earliest.

# Summary

- Current DoE funding sufficient for laboratory testing, modeling, baseline environmental studies, and technical support by UH but not adequate to directly support technology development or pre-commercial in-water testing;
- HINMRE/HNEI has been unable to perform any field/survey work pending (~1-year$^{+}$) *NEPA Compliance Authorization* from DoE;
- HNEI is working with Navy, DoE and State of Hawaii to identify WETS funding (~$9M required for infrastructure; and ~$1 M/year for operations) .

# Annex

# WETS at MCBH
# DoE Funded Activities at HINMREC

- **Phase I (Completed)**
  - Concept for multiple testing berths was developed (WETS), working with NFESC/NAVFAC;
  - Potential users identified;
  - Wave resource and preliminary bathymetry were documented.
- **Phase II (Planned)**
  - Detailed Bathymetric Survey & Environmental/Other Studies as input to Amended EA and Permitting Process;
  - Expanded WEC testing with the goal of establishing a WETS Facility *(currently no funding for development).*