



# Marine Operations and Logistics for Wave Energy Conversion Devices

Marine Corps Base, Oahu, Hawaii

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# Sea Engineering, Inc.



- Founded in Hawaii in 1973, Sea Engineering, Inc. provides marine engineering, construction and diving services.
- Currently have four offices in Hawaii and California and serve professional, business and industrial firms; marine contractors; government agencies and research institutions globally.

# Sea Engineering, Inc.

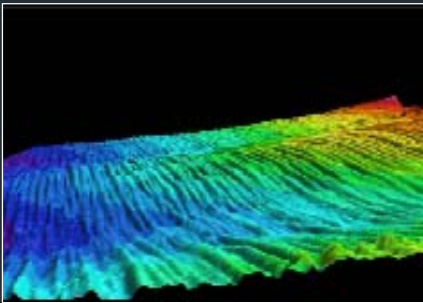
## Core Competencies



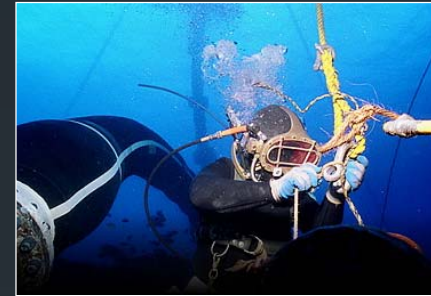
Coastal  
Engineering



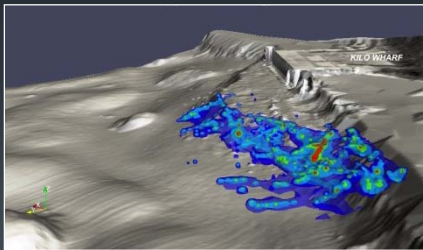
Marine  
Construction



Oceanographic  
Studies



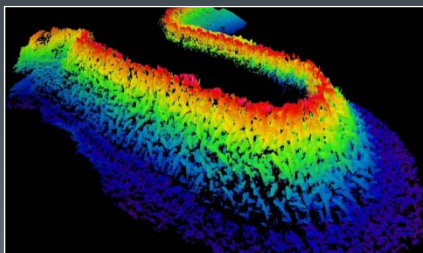
Commercial  
Diving



Marine  
Environmental  
Studies



Boat Services



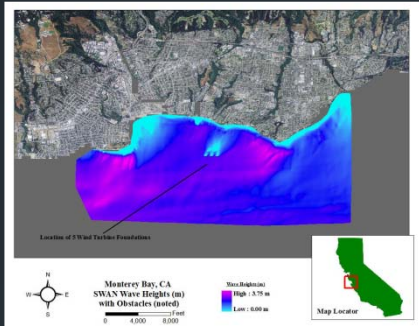
Hydrographic  
& Geophysical  
Surveys



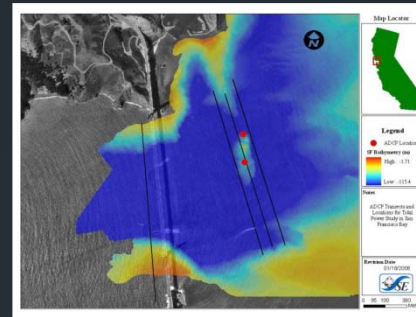
Renewable  
Energy

# Sea Engineering, Inc.

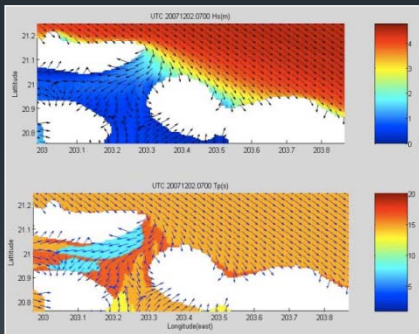
Core Competencies – Renewable Energy



Sediment Transport  
Modeling for Offshore  
Wind and WEC  
Device Farms



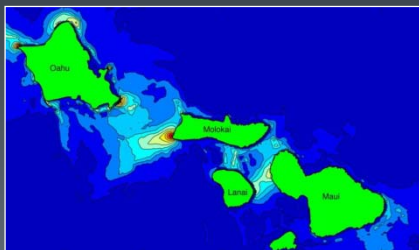
Tidal Power  
Generation  
Studies (Golden  
Gate Bridge)



Wave Energy  
Modeling &  
Assessments  
(Peahi, Maui)



WEC Engineering  
Services and Marine  
Operations Support  
(MCBH)



Ocean Current  
Energy Resource  
Assessment  
(Hawaiian Islands)

# MCBH Wave Energy Test Site

Kaneohe Marine Corps Base, Oahu, Hawaii



- Energetic wave climate, without hurricane force waves.
  - Positive test environment for prototypes
- Year-round consistent wave climate
- Near year-round weather windows for inspection & maintenance
- Access to Heeia Kea Small Boat Harbor & MCBH.
- Larger vessel deployments are a 4 to 6 hour transit



Kaneohe Marine Corps Base, Oahu, Hawaii

# Marine Operations & Logistics

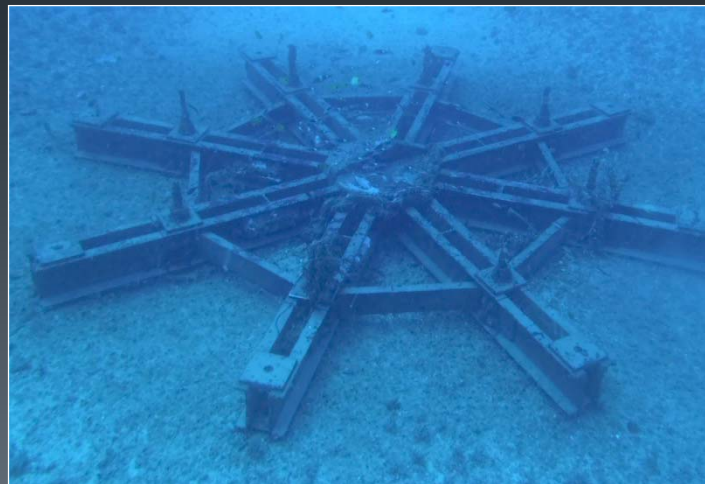
## Ancillary Component Installation



### Power Cable(s)



### Mooring and Anchor Installation

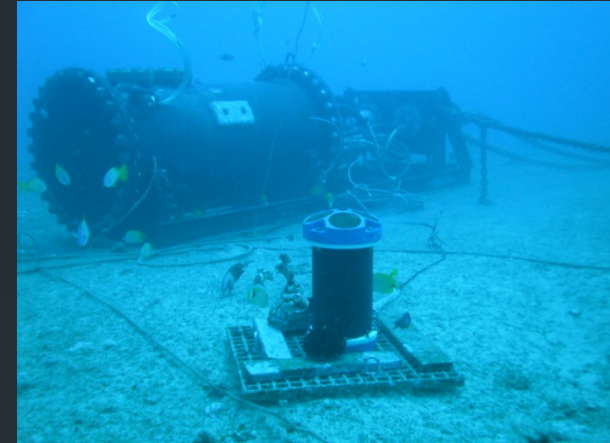
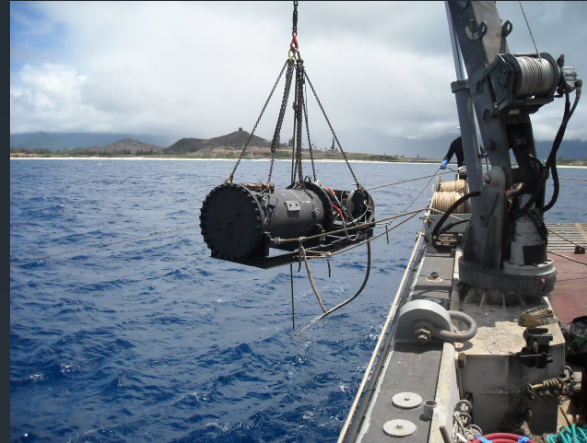


# Marine Operations & Logistics

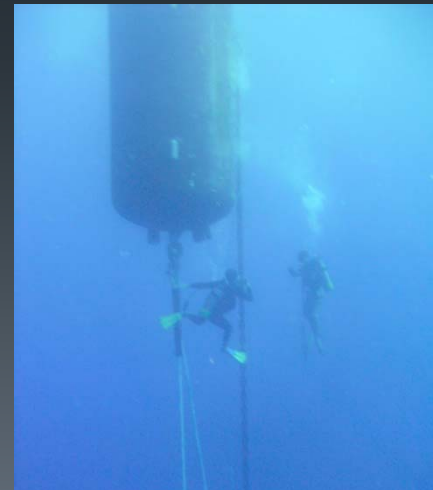
## Ancillary Component Installation



### Transformer Pod



### Sub-Surface Float(s)



# Marine Operations & Logistics

## Wave Energy Conversion Device Installation



WEC Device being Transported to Water



WEC Device Deployed at Shipyard



WEC Device Being Towed Out of Honolulu Harbor



WEC Device Being Towed Out of Shipyard



# Marine Operations & Logistics

## Wave Energy Conversion Device Installation



WEC Device Being Delivered On-Site



WEC Device Final Positioning



WEC Device In-Situ

# Marine Operations & Logistics

## Inspection & Maintenance



- WEC device and all ancillary components
- R&D Phase – Wear patterns and unexpected failures
- In-depth monthly inspection to catalog wear and identify any maintenance requirements



Regular (ex. monthly) inspections are essential for complete understanding of long-term performance of components and materials and to minimize significant maintenance events

# Marine Operations & Logistics

Wave Energy Conversion Device & Component Recovery



# Operational Considerations



- Site Location & Available Infrastructure
  - Design should take into account local infrastructure and capabilities
  - In the U.S, WEC device development is occurring where there is no oil and gas industry.
  - WEC device industry is not mature enough to support their own deep water diving and vessel operations – local marine services a must
- Diving operations
  - Developers should work early in the design phase with marine engineering contractors to identify operational tasks which require diving operations. If possible, redesign that task to be completed on the surface.
  - As developers move into deeper water, designs should incorporate deep water tasks to be completed with ROV's, or strive to keep diving tasks within 100 ft. W.D.
- Partner with marine engineering firms early in the design process. Early planning can help lower deployment and O&M costs.