Wave Energy

Harnessing Ireland's Largest Renewable Energy Resource
Ocean Energy Experience with Large Scale WEC

Prof Tony Lewis

Emeritus Beaufort Professor
MaREI – SFI Centre for Energy, Climate and Marine
Sustainability Institute, University College Cork

Chief Technology Officer
Ocean Energy
Cobh, County Cork

COER Annual Workshop 2026
Maynooth – 23rd January

MaREI
Energy · Climate · Marine

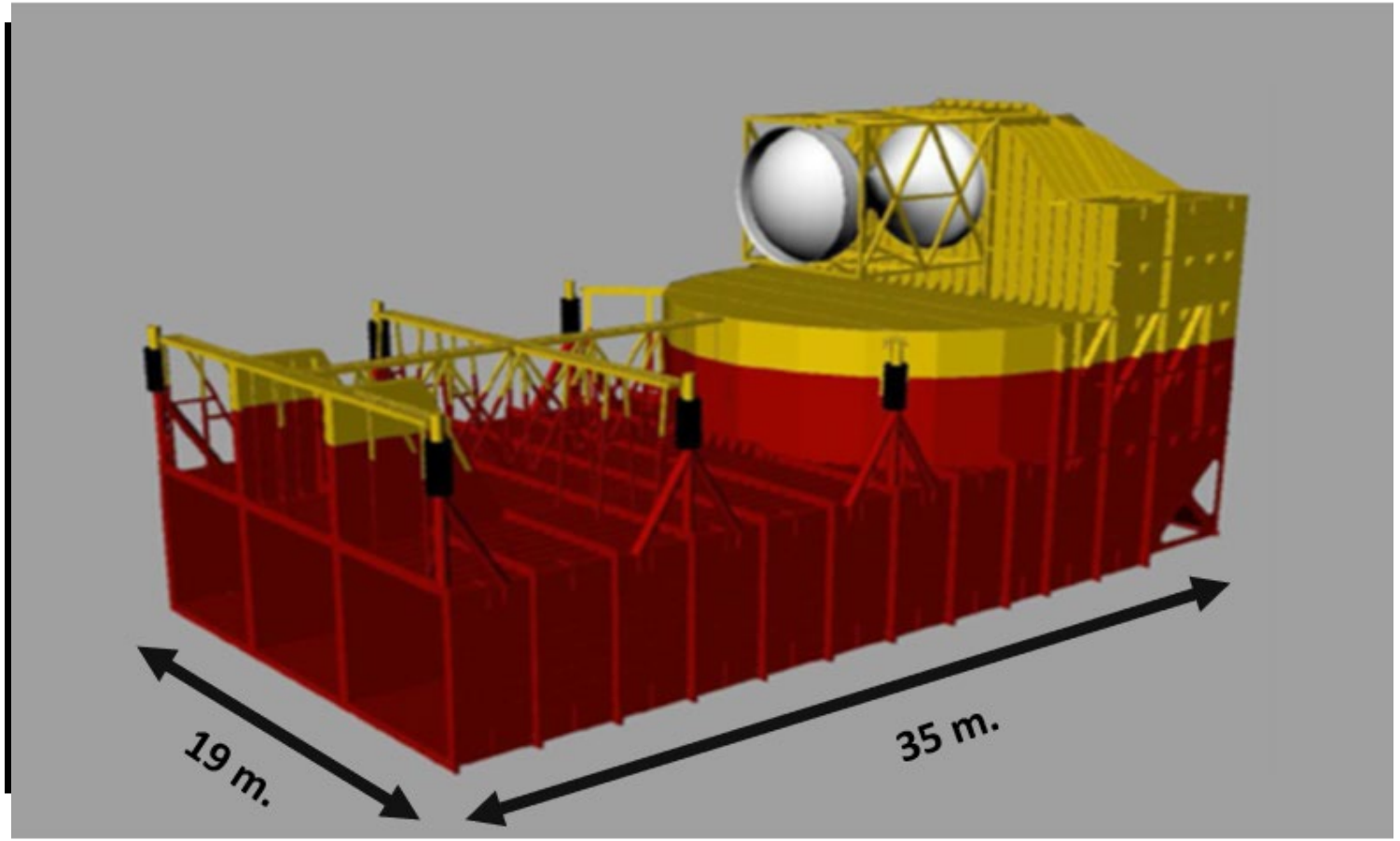
UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

OCEAN ENERGY
A WORLD OF POWER

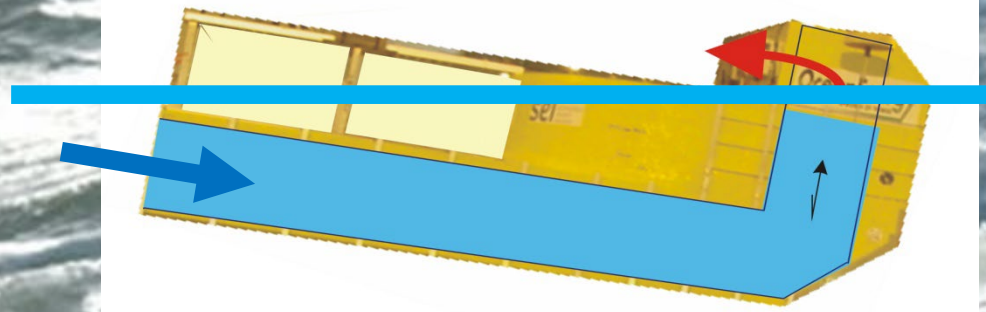
The OE Buoy Construction

Technology Highlights

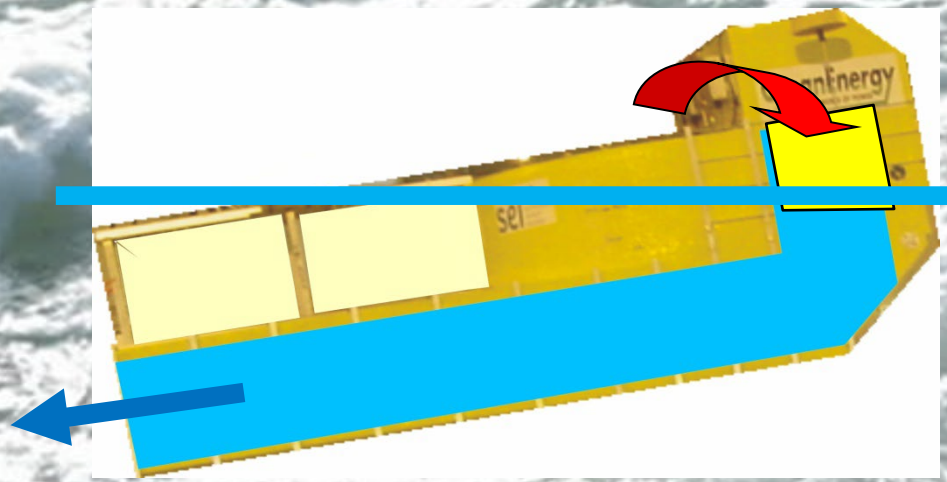
1. No Moving Parts in the Water
2. Unparalleled Survivability at Sea
3. Exceptional Power Performance
4. Simple Construction
5. Low Maintenance
6. Environmentally Benign



OCEAN ENERGY
A WORLD OF POWER



JET
EFFECT



PITCH
ENHANCEMENT

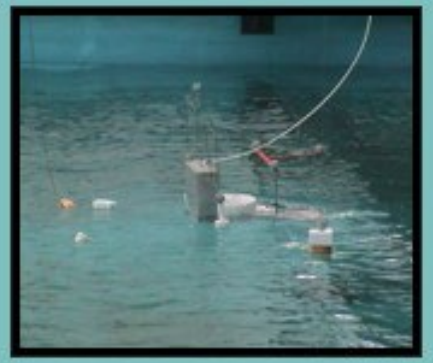
OCEAN ENERGY
A WORLD OF POWER

How does it Work?

OCEANENERGY
A WORLD OF POWER

STAGE 1: 1:50

Improvements: OWC



Improvements: OE Buoy

STAGE 2: 1:15

OE Buoy

OE Buoy Sea Keeping

STAGE 3: 1:3

Sim. PTO: Orifice Plate

PTO #1: Well's Air Turbine

PTO #2: Impulse Air Turbine

STAGE 4: 1:1

OE35 Buoy - Build

OE-35 Hawaii

OCEANENERGY
A WORLD OF POWER

OCEAN ENERGY
A WORLD OF POWER

Galway Bay Results: 2006-2011 Stage 3

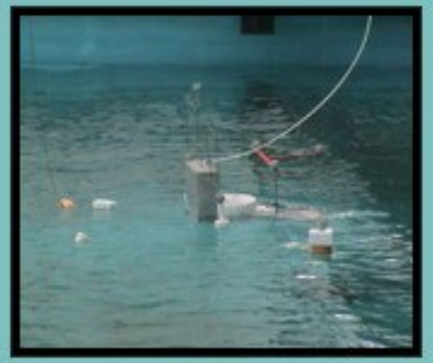
After 24,000 hours of testing, OceanEnergy's technology proved its:

- **Survivability**, functioning in wave heights scalable to over 100 feet (32 meters)
- **Full-scale energy output** enough to power 1,500 homes for a year
- Mooring design & Operating characteristics which resulted in **low mooring tensions** that kept device safely in place

OCEAN ENERGY
A WORLD OF POWER

STAGE 1: 1:50

Improvements: OWC



Improvements: OE Buoy

STAGE 2: 1:15

OE Buoy

OE Buoy Sea Keeping

STAGE 3: 1:3

Sim. PTO: Orifice Plate

PTO #1: Well's Air Turbine

PTO #2: Impulse Air Turbine

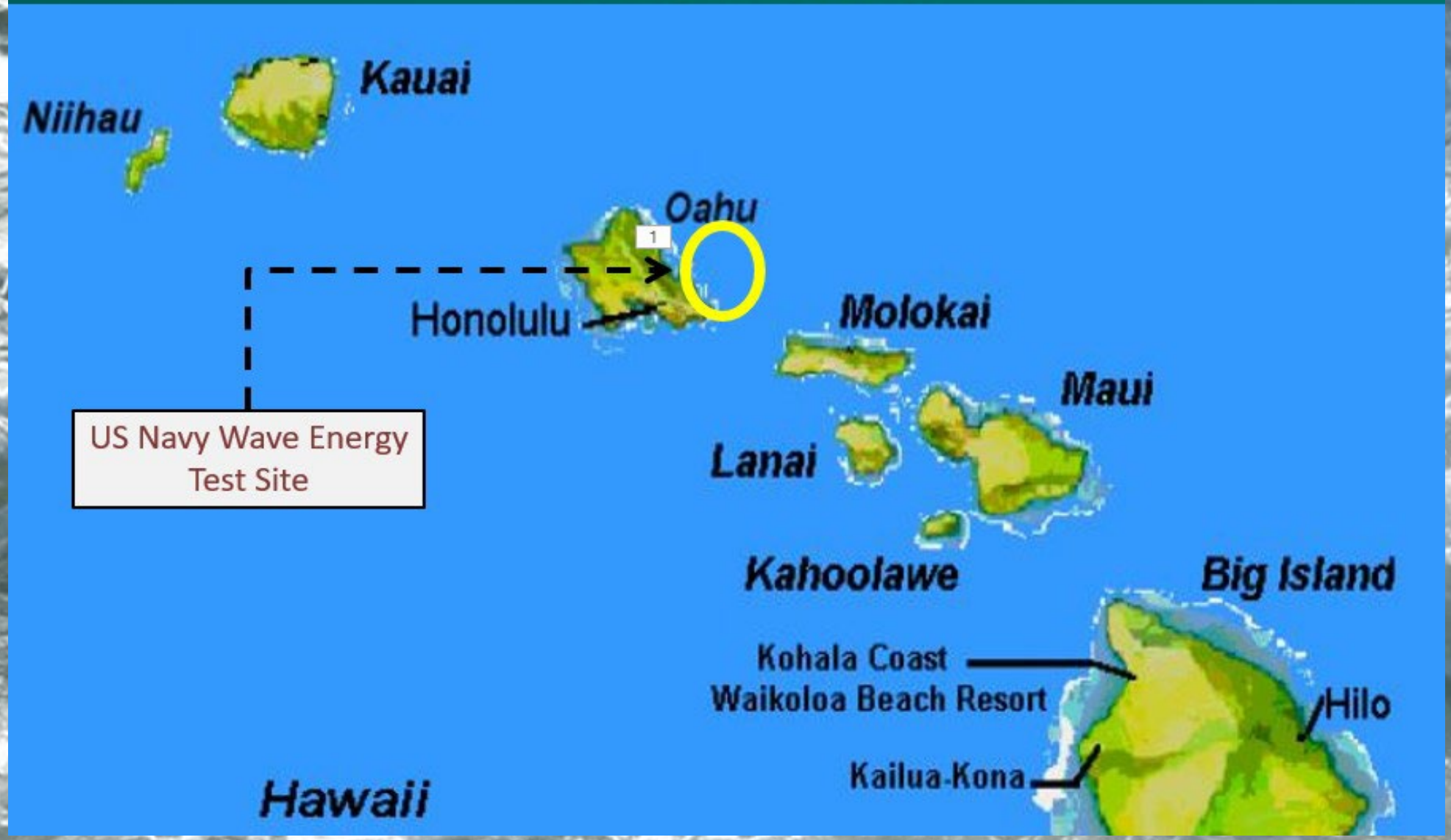
STAGE 4: 1:1

OE35 Buoy - Build

OE-35 Hawaii

OCEANENERGY
A WORLD OF POWER

Hawaii Test Site

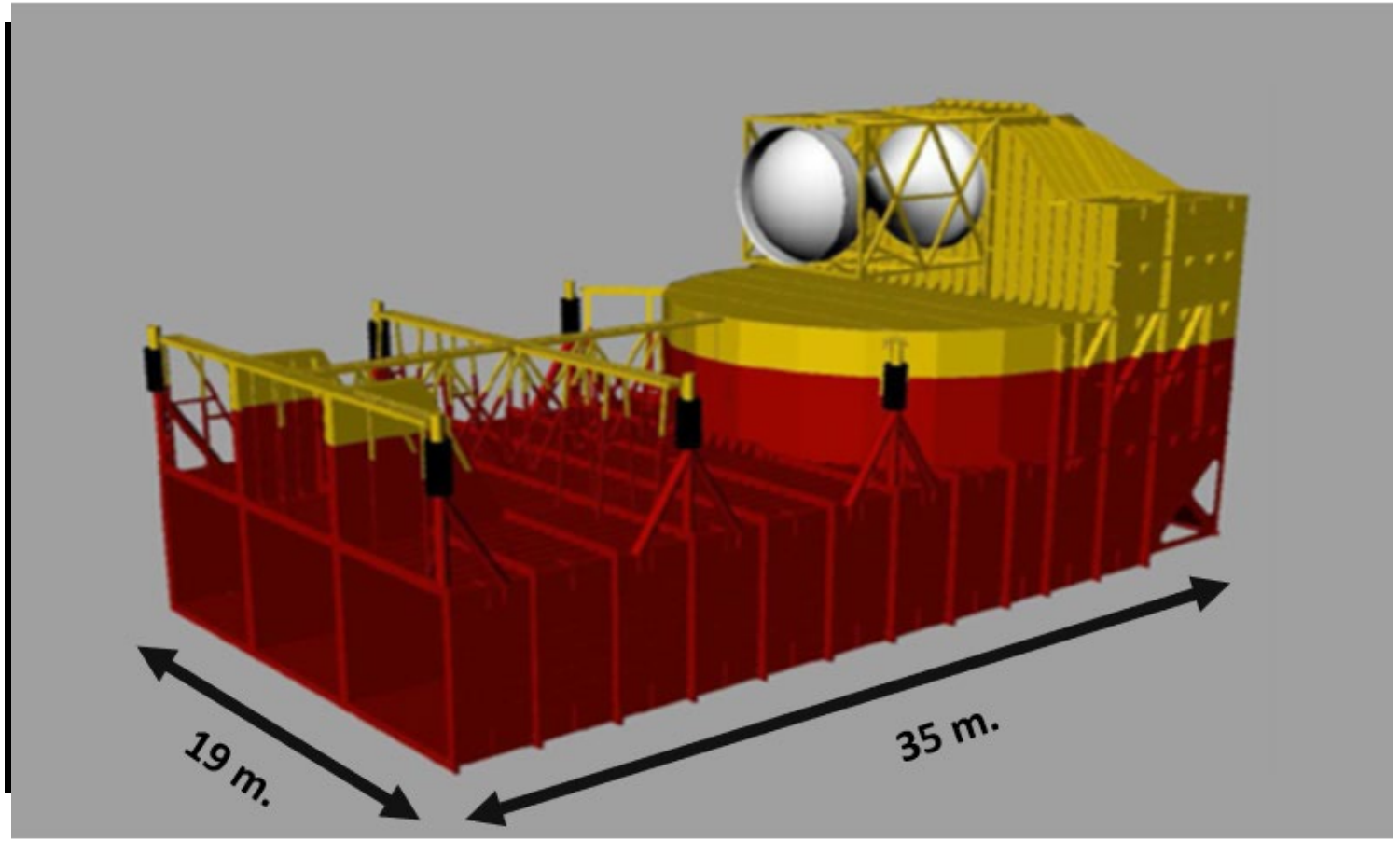


OCEAN ENERGY
A WORLD OF POWER

The OE Buoy Construction

Technology Highlights

1. No Moving Parts in the Water
2. Unparalleled Survivability at Sea
3. Exceptional Power Performance
4. Simple Construction
5. Low Maintenance
6. Environmentally Benign



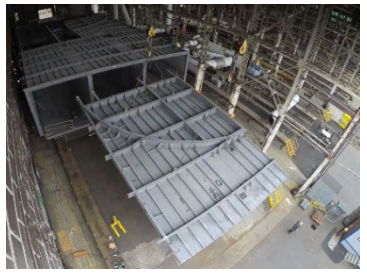
OCEAN ENERGY
A WORLD OF POWER

The OE Buoy Fabrication

Techno
Highlig

1. No Moving Parts in the Water
2. Unparalleled Survivability at Sea
3. Exceptional Power Performance
4. Simple Construction
5. Low Main
6. Environmentally Benign




OCEAN ENERGY
A WORLD OF POWER

The OE Buoy Load Out

OCEAN ENERGY
A WORLD OF POWER

Portland to Hawaii

OCEAN ENERGY
A WORLD OF POWER

OCEAN ENERGY
A WORLD OF POWER

Deployment Plan – Key Dates

- **Depart Portland to Hawaii - Oct 2019**
- **Arrive Hawaii - Dec. 2019**
- **Planned Deployment at test site - Jan/Feb 2020**

COVID 19

OCEAN ENERGY
A WORLD OF POWER

Hawaii Pearl Harbour - Honolulu

OCEAN ENERGY
A WORLD OF POWER

Deployment Plan – Key Dates

- **Depart Portland to Hawaii -** **Oct 2019**
- **Arrive Hawaii -** **Dec. 2019**
- **Planned Deployment at test site -** **Jan/Feb 2020**

  COVID 19
- **Investigation Visit** **Summer 2022**

» Generator short cct. issue

OCEAN ENERGY
A WORLD OF POWER

OCEAN ENERGY
A WORLD OF POWER

OCEAN ENERGY
A WORLD OF POWER

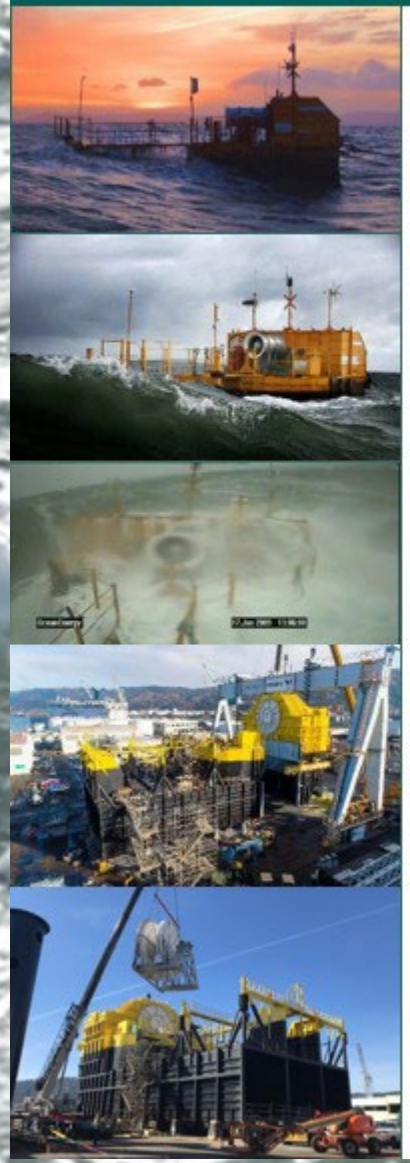
Deployment Plan – Key Dates

- **Depart Portland to Hawaii -** **Oct 2019**
- **Arrive Hawaii -** **Dec. 2019**
- **Planned Deployment at test site -** **Jan/Feb 2020**

  COVID 19
- **Investigation Visit** **Summer 2022**
  - » Generator short cct. issue
- **WETS Test Site Cable Damage in Storm** **February 2022**
- **New Generator Arrives** **October 2023**

OCEAN ENERGY
A WORLD OF POWER

Deployment Plan – Key Dates

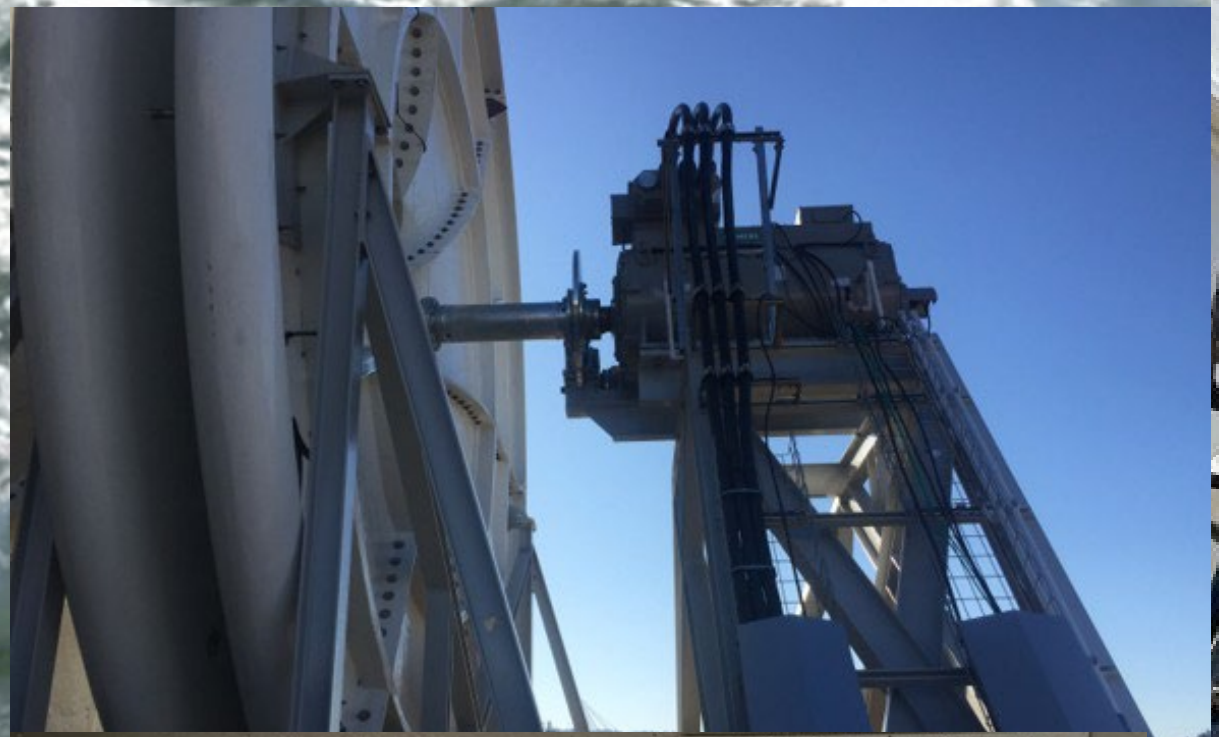


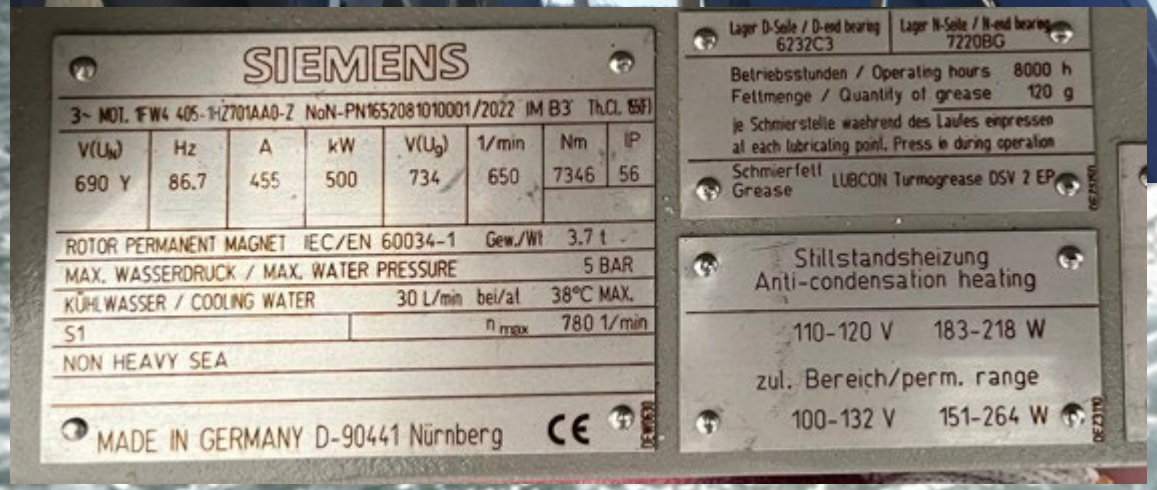
- **Depart Portland to Hawaii -** **Oct 2019**
- **Arrive Hawaii -** **Dec. 2019**
- **Planned Deployment at test site -** **Jan/Feb 2020**

  COVID 19
- **Investigation Visit** **Summer 2022**

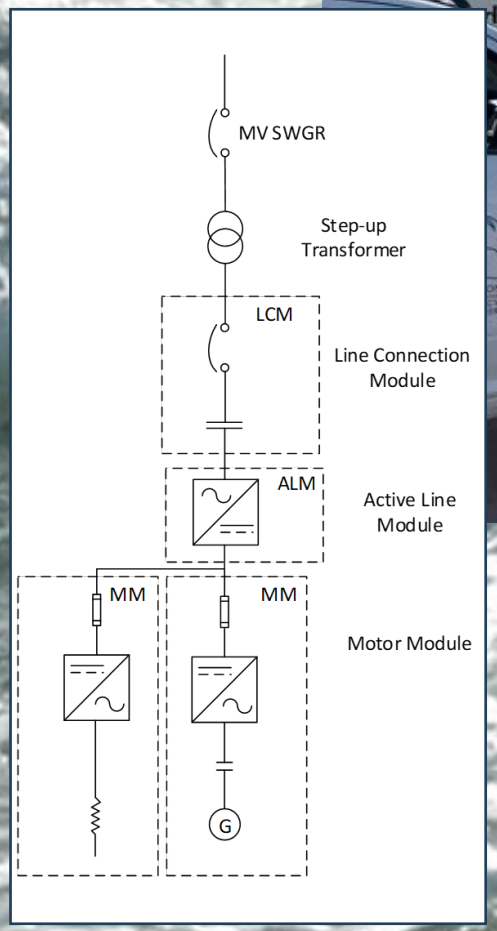
  » Generator short cct. issue
- **WETS Test Site Cable Damage in Storm** **February 2022**
- **Recommissioning – End 2 End Testing** **March 2024**

OCEAN ENERGY
A WORLD OF POWER





OCEAN ENERGY
A WORLD OF POWER



OCEAN ENERGY
A WORLD OF POWER

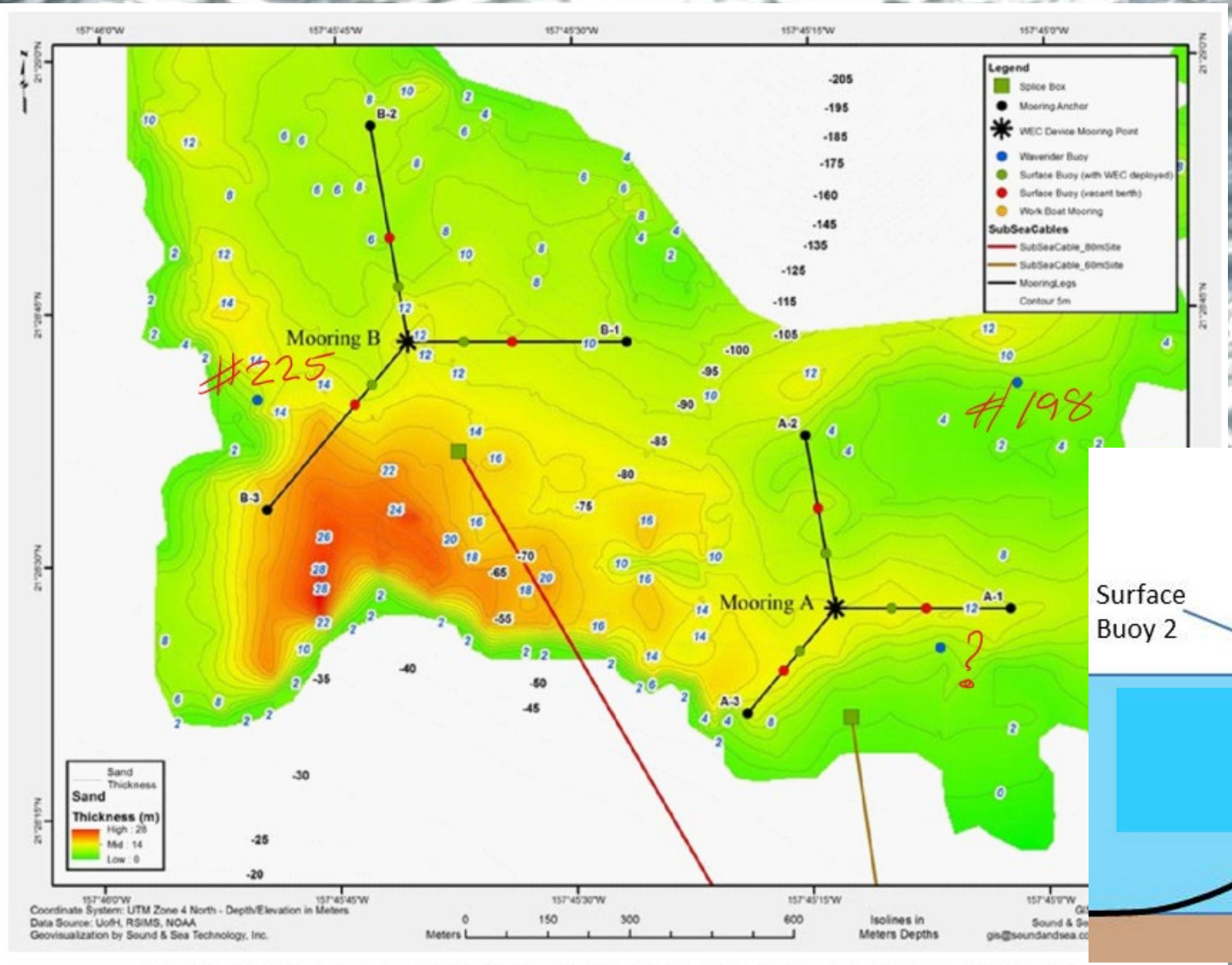
Deployment Plan – Key Dates

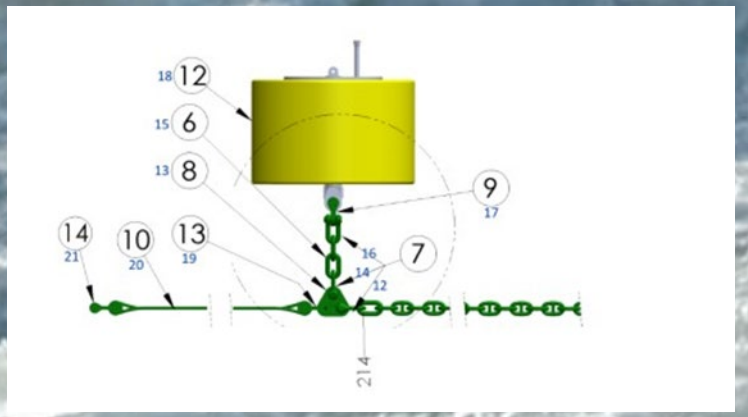
- **Depart Portland to Hawaii -** **Oct 2019**
- **Arrive Hawaii -** **Dec. 2019**
- **Planned Deployment at test site -** **Jan/Feb 2020**

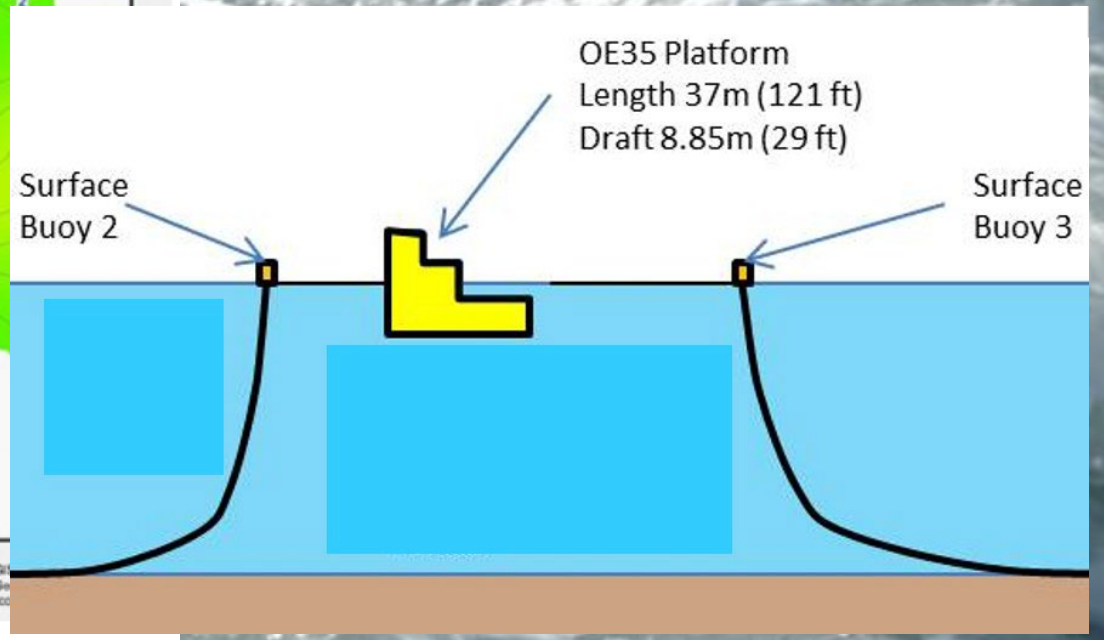
  COVID 19
- **Investigation Visit** **Summer 2022**

  » Generator short cct. issue
- **WETS Test Site Cable Damage in Storm** **February 2022**
- **Recommissioning – End 2 End Testing** **March 2024**
- **Cable Repair / Mooring Repair** **April 2024**

OCEAN ENERGY
A WORLD OF POWER

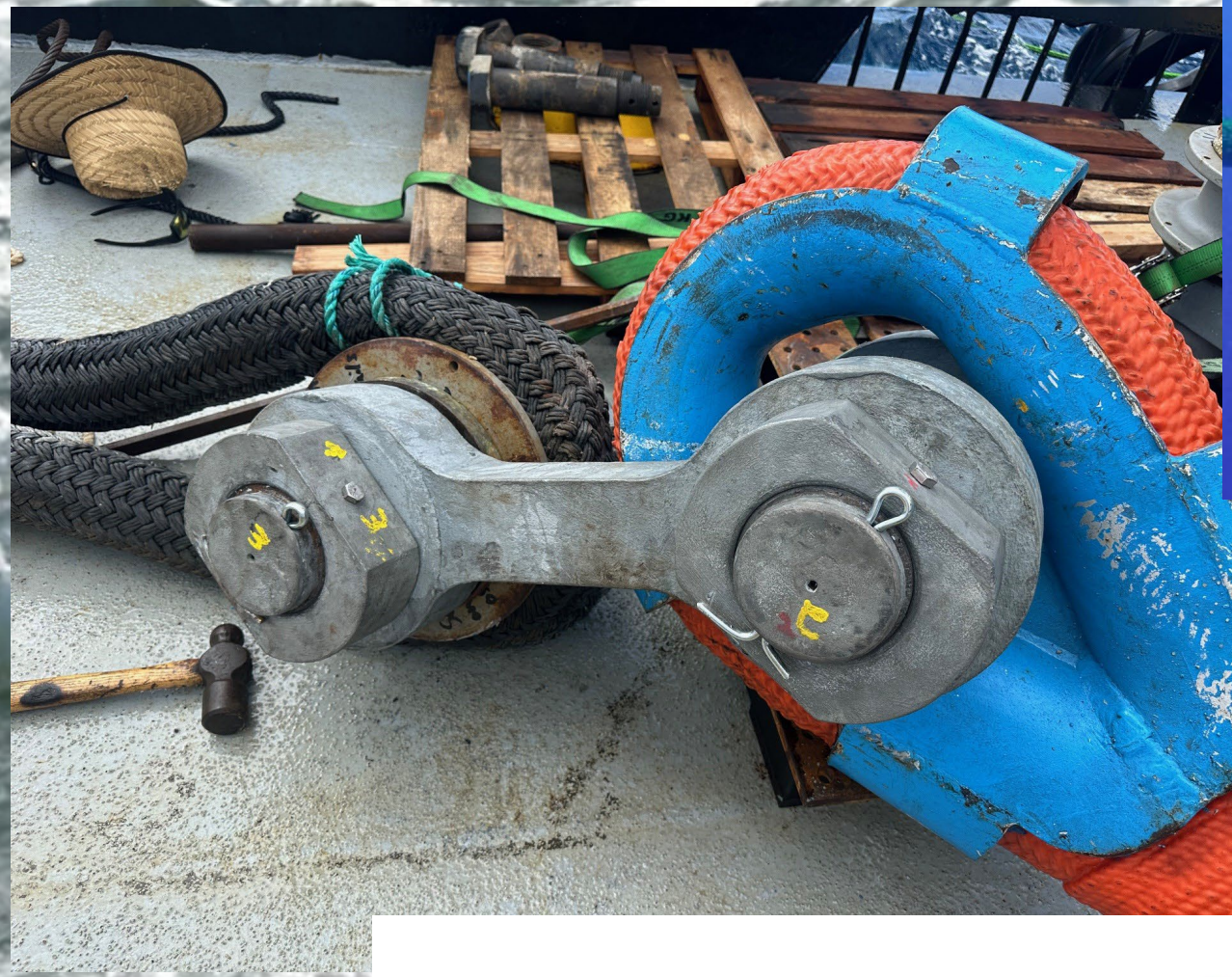


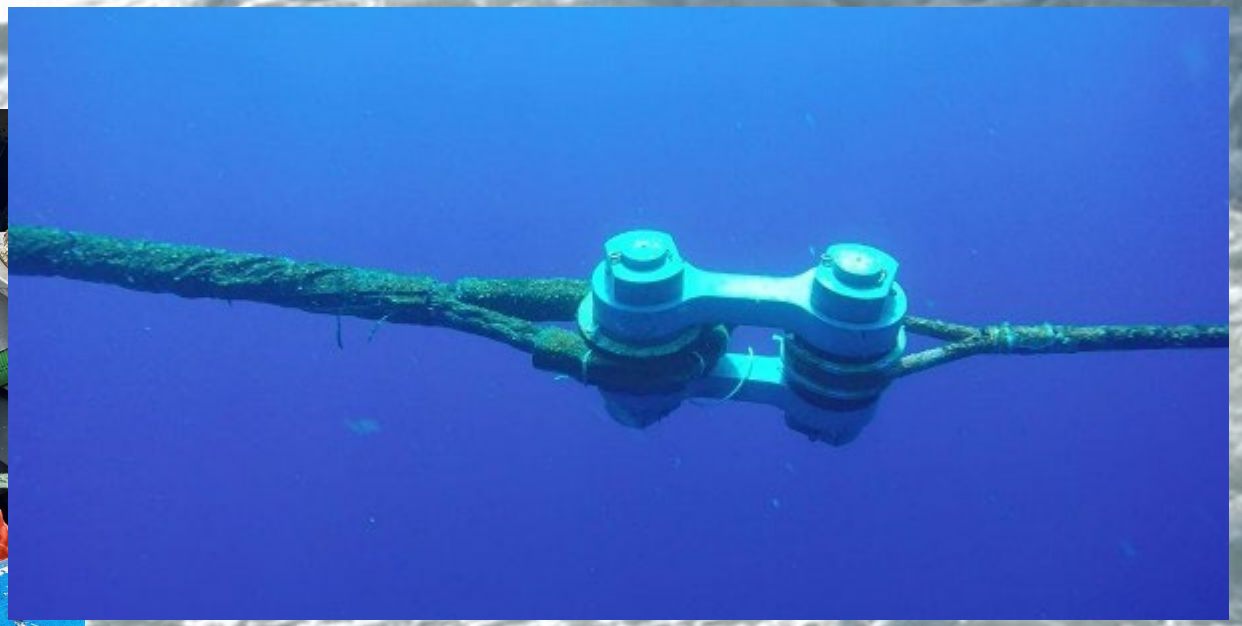


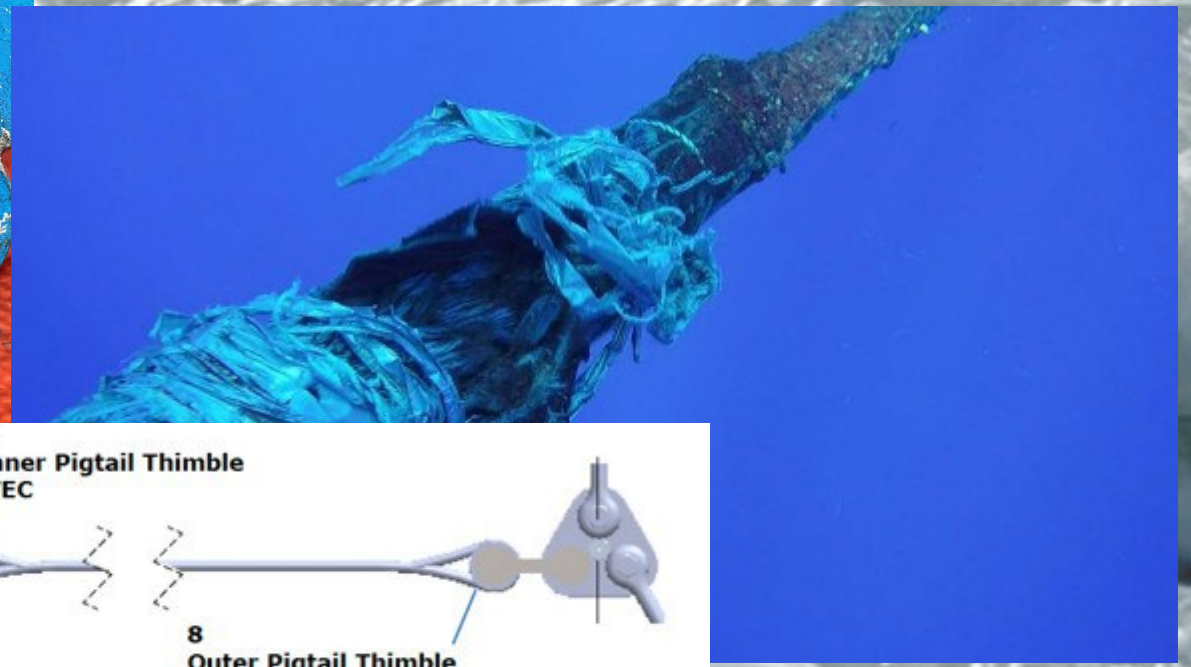


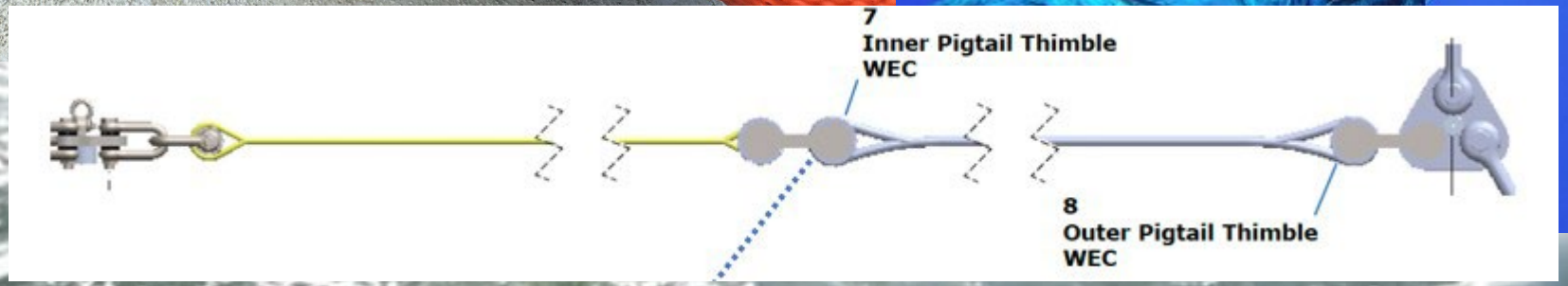
PRE-INSTALL SURVEY SHOWING MOORINGS PLAN (TO SCALE)

OCEAN ENERGY
A WORLD OF POWER









OCEAN ENERGY
A WORLD OF POWER

Deployment Plan – Key Dates

- **Depart Portland to Hawaii -** **Oct 2019**
- **Arrive Hawaii -** **Dec. 2019**
- **Planned Deployment at test site -** **Jan/Feb 2020**

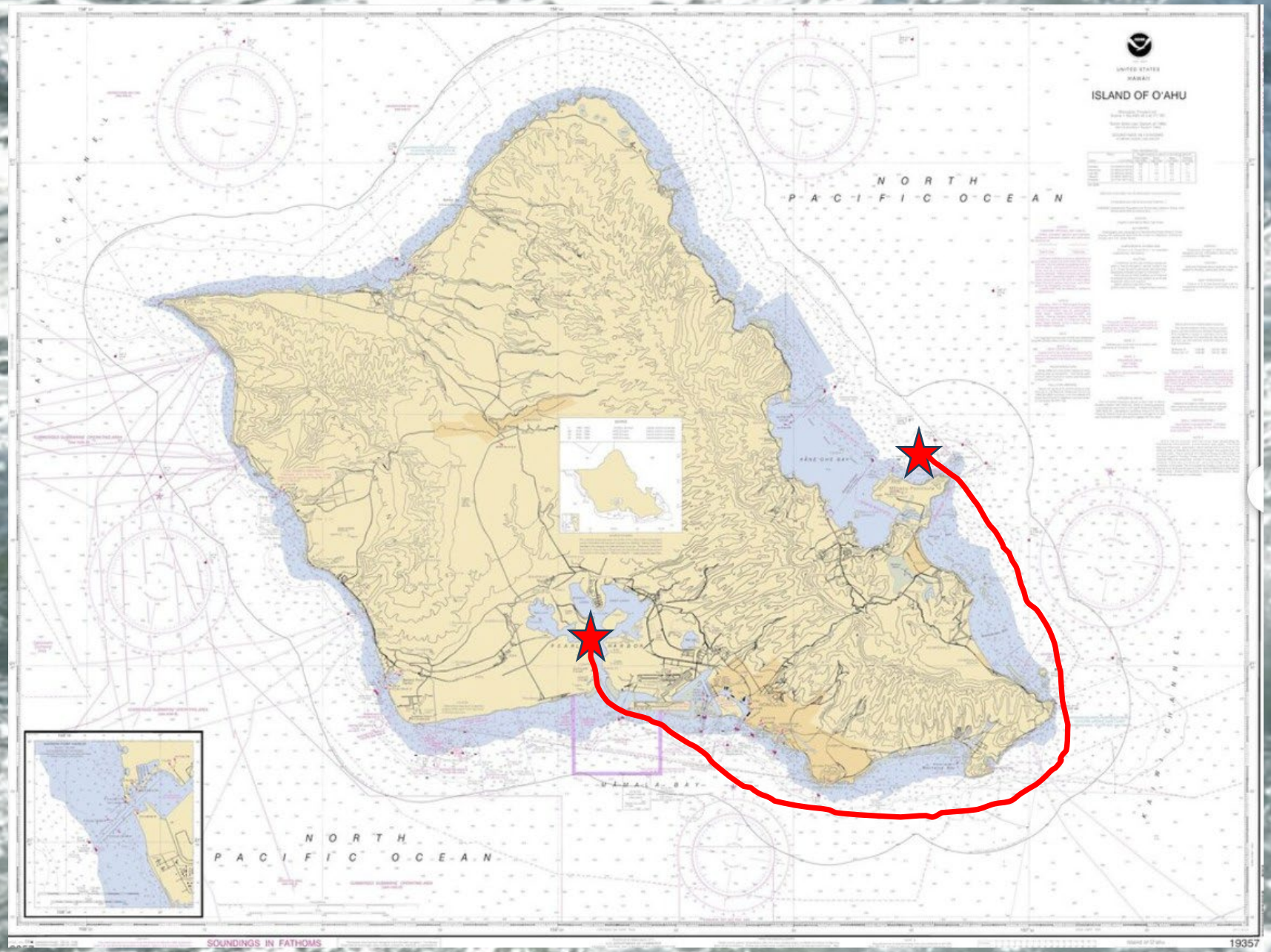
  COVID 19
- **Investigation Visit** **Summer 2022**

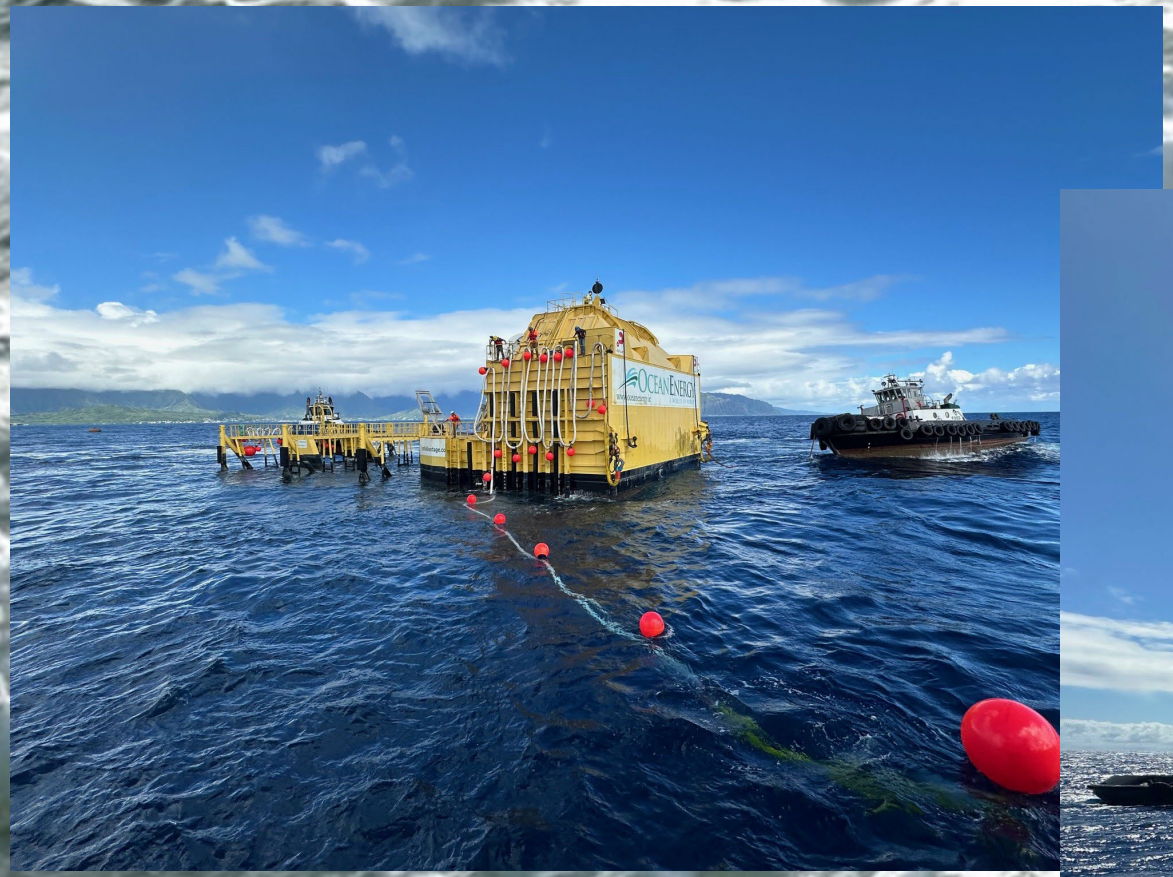
  » Generator short cct. issue
- **WETS Test Site Cable Damage in Storm** **February 2022**
- **Recommissioning – End 2 End Testing** **March 2024**
- **Cable Repair / Mooring Repair** **April 2024**
- **Deploy at Test Site -** **July 2024**

OCEAN ENERGY
A WORLD OF POWER

OCEANENERGY
A WORLD OF POWER

OCEAN ENERGY
A WORLD OF POWER

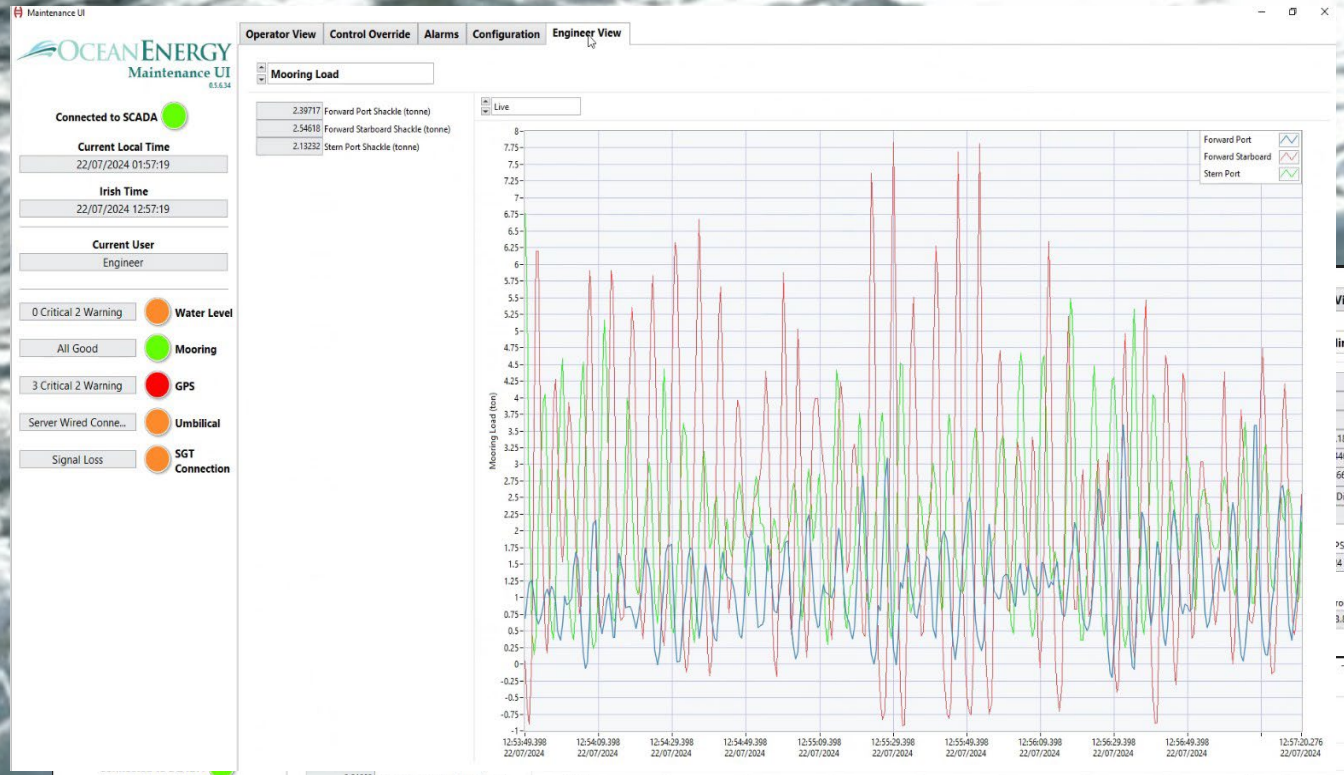

ISLAND OF O'AHU
NORTH
PACIFIC OCEAN
NORTH
PACIFIC OCEAN
SOUNDINGS IN FATHOMS
19357

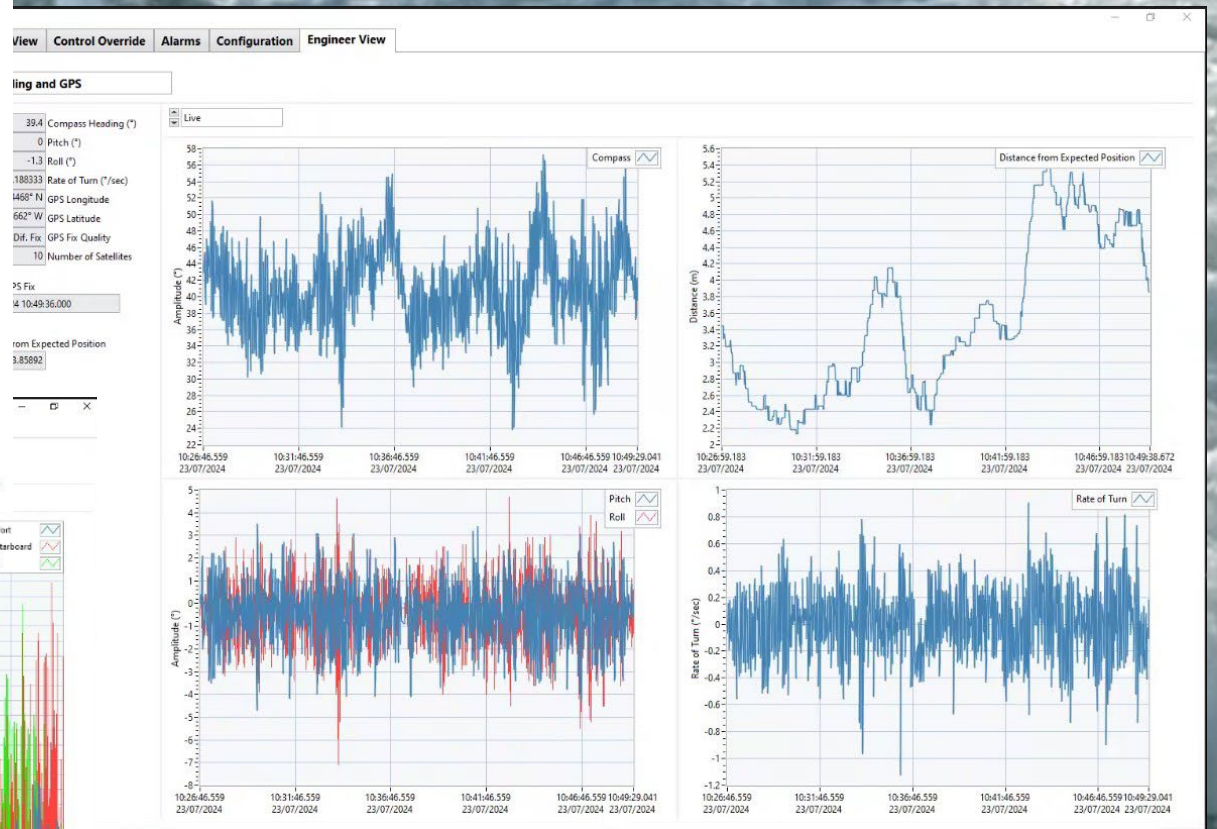


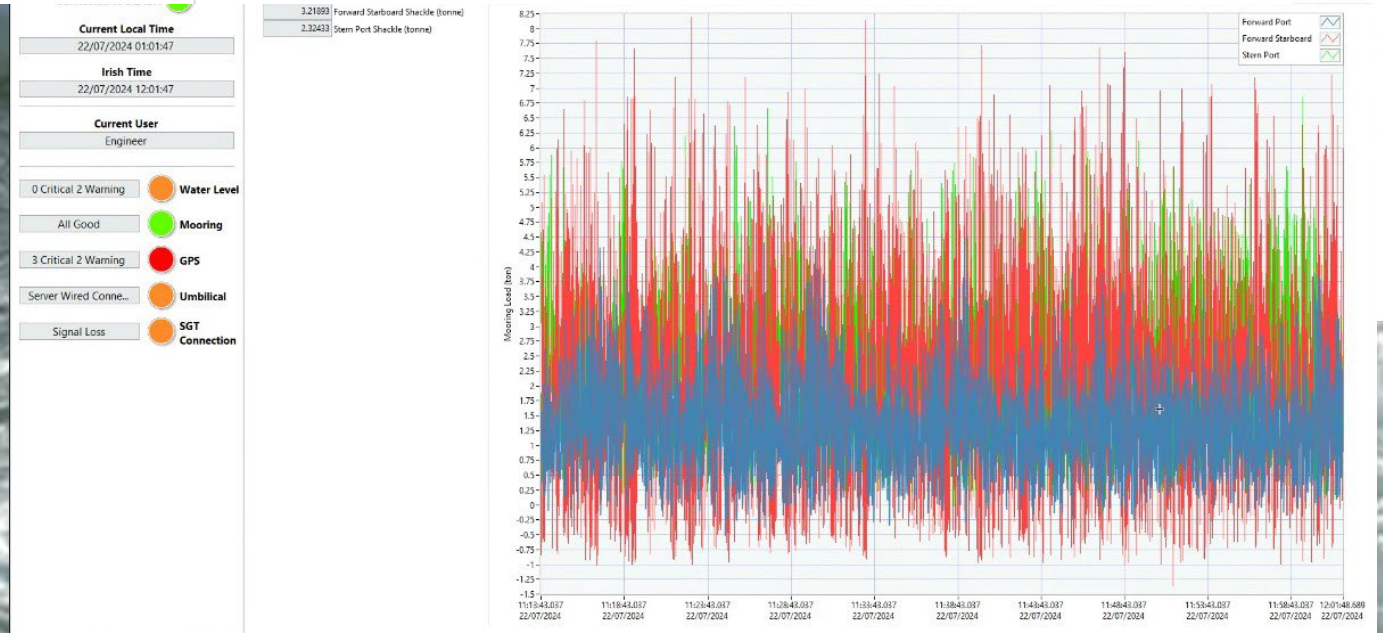
OCEAN ENERGY
A WORLD OF POWER

OCEAN ENERGY
A WORLD OF POWER


10-16-2024 Wed 11:21:20
Exterior Forward
10-16-2024 Wed 11:21:20
Exterior Aft
Exterior Aft
16/10/2024 11:21:16 WED
Control Room Port
Control Room Centre
Control Room Starboard







OCEAN ENERGY
A WORLD OF POWER

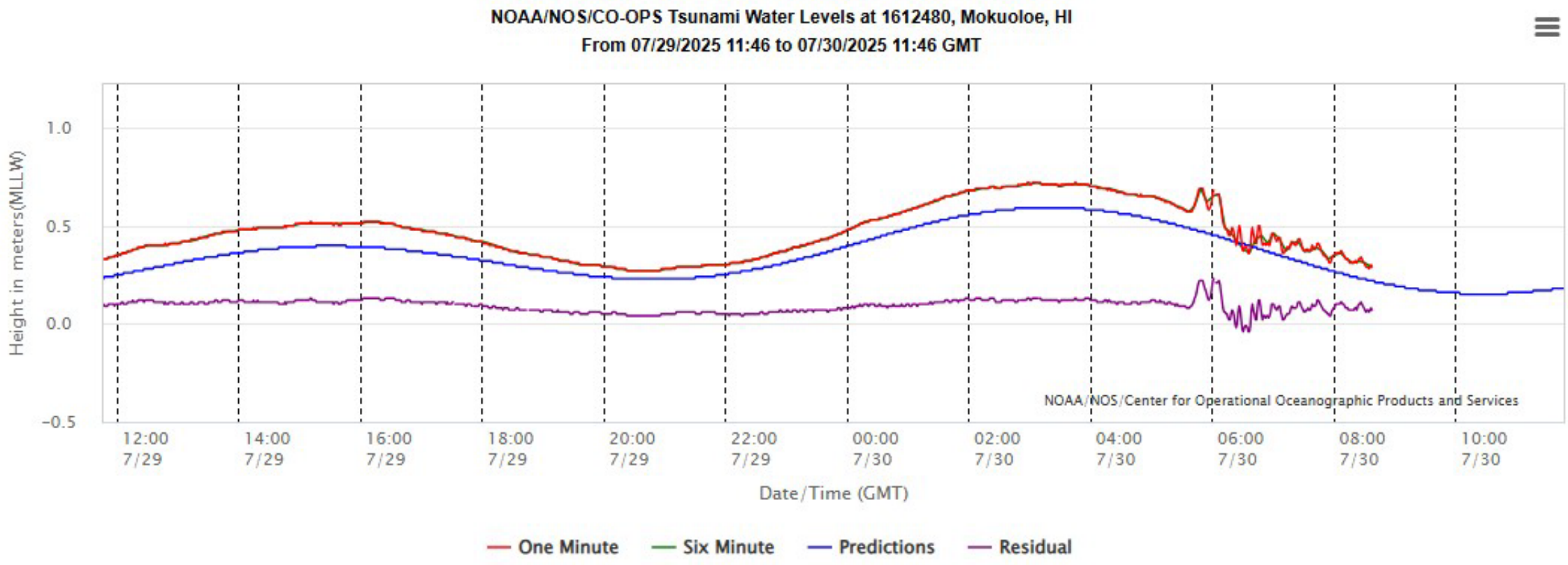
August Storm Data

Largest Wave: 3m (~10ft) Hs
Largest Recorded Force: 29t

OCEAN ENERGY
A WORLD OF POWER

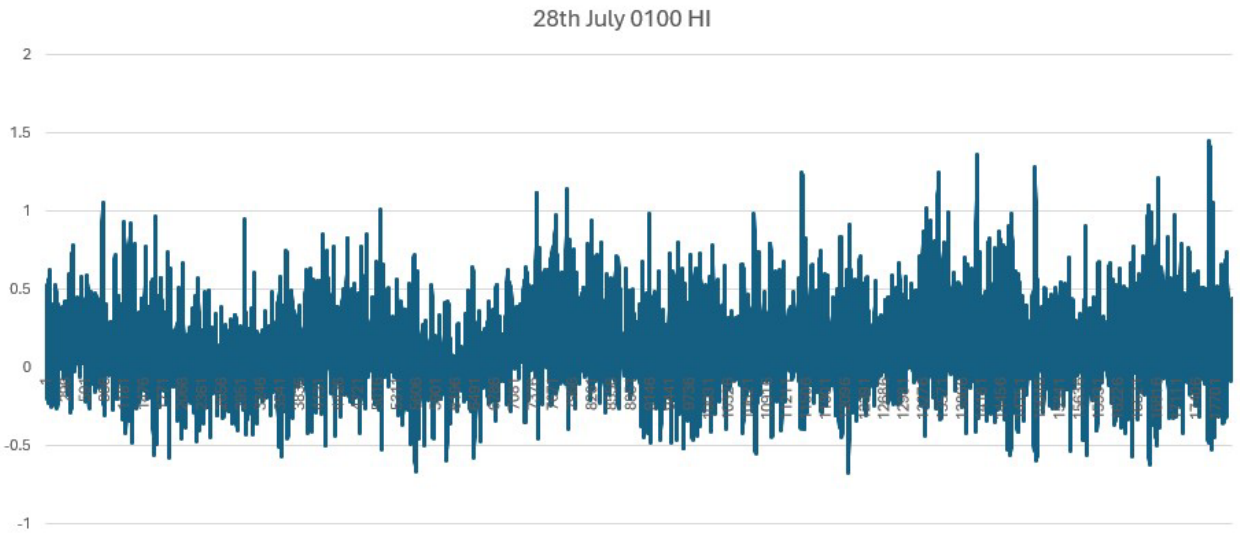
Center for Operational Oceanographic Products and Services (CO-OPS)
Water levels for 1612480 - Mokuoloe, HI
From 07/29/2025 11:46 through 07/30/2025 11:46 GMT
Disseminating sensor: A1 | Datum: MLLW

Auto-Refresh is off

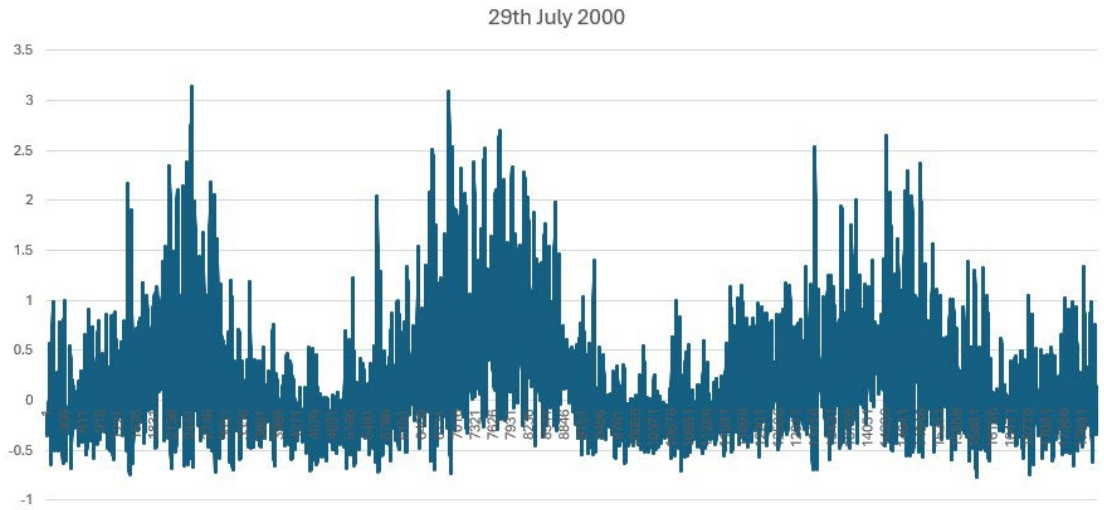


Hint: Click items in legend to enable or disable on plot. Click and drag to zoom to a time period.

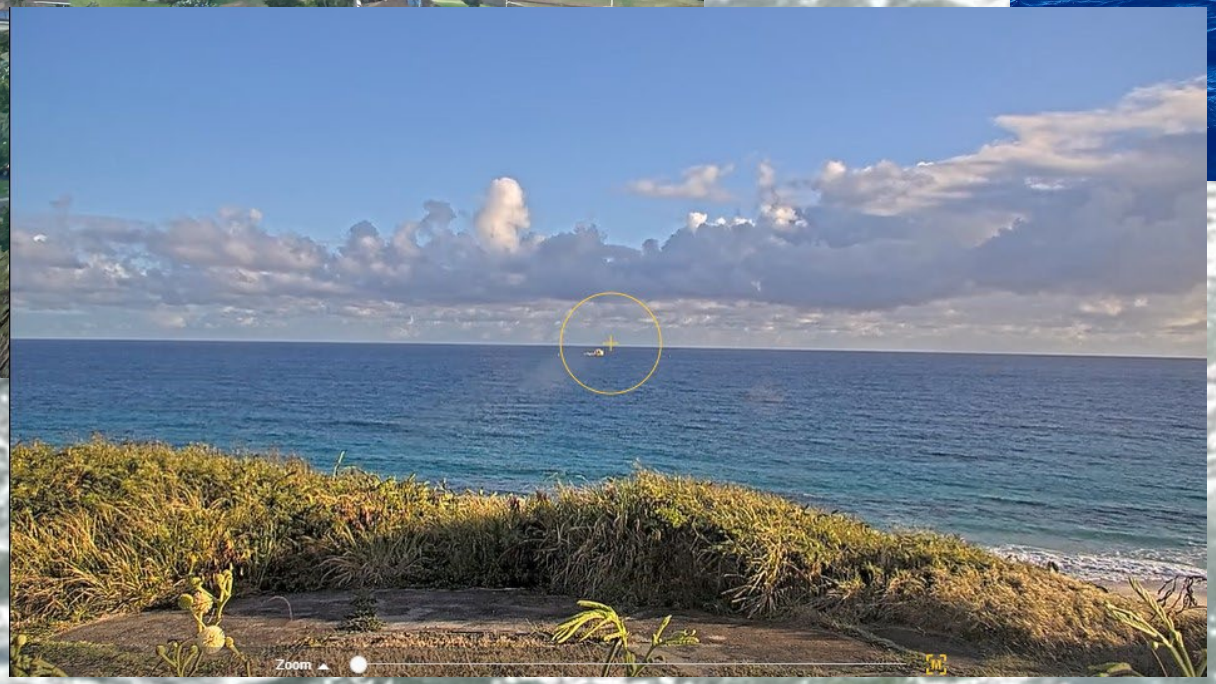
OE35 Mooring Forces during Tsunami



before



during



OCEAN ENERGY
A WORLD OF POWER

STAGE 4 – Single Device Demonstration

Part 1 – 500kW

STAGE 4: 1:1

OE35 Buoy - Build

OE-35 Hawaii

2024-2025

Part 2 – 1MW

STAGE 4: 1:1

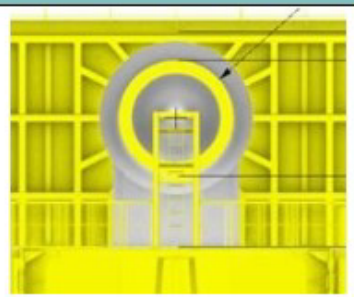
OE35 Buoy

WEDUSEA

A step change for wave energy

OCEAN ENERGY

A WORLD OF POWER



AST Wells Turbine

2024-2026

WEDUSEA

A step change for wave energy

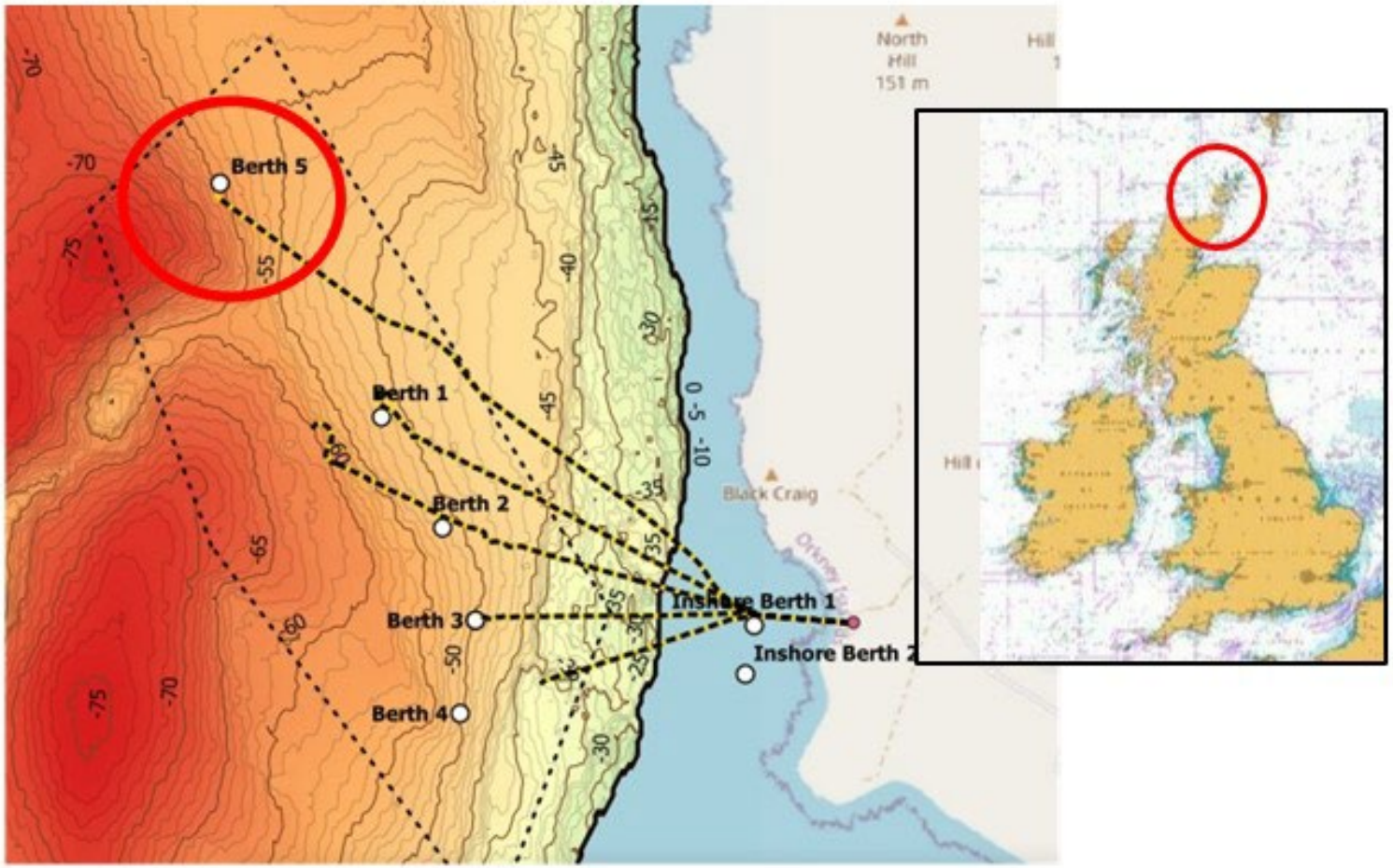
Wave Energy Demonstration at Utility Scale to Enable Arrays

Funded by the European Union

UKRI Innovate UK

OCEAN ENERGY
A WORLD OF POWER

WEDUSEA Deployment at EMEC



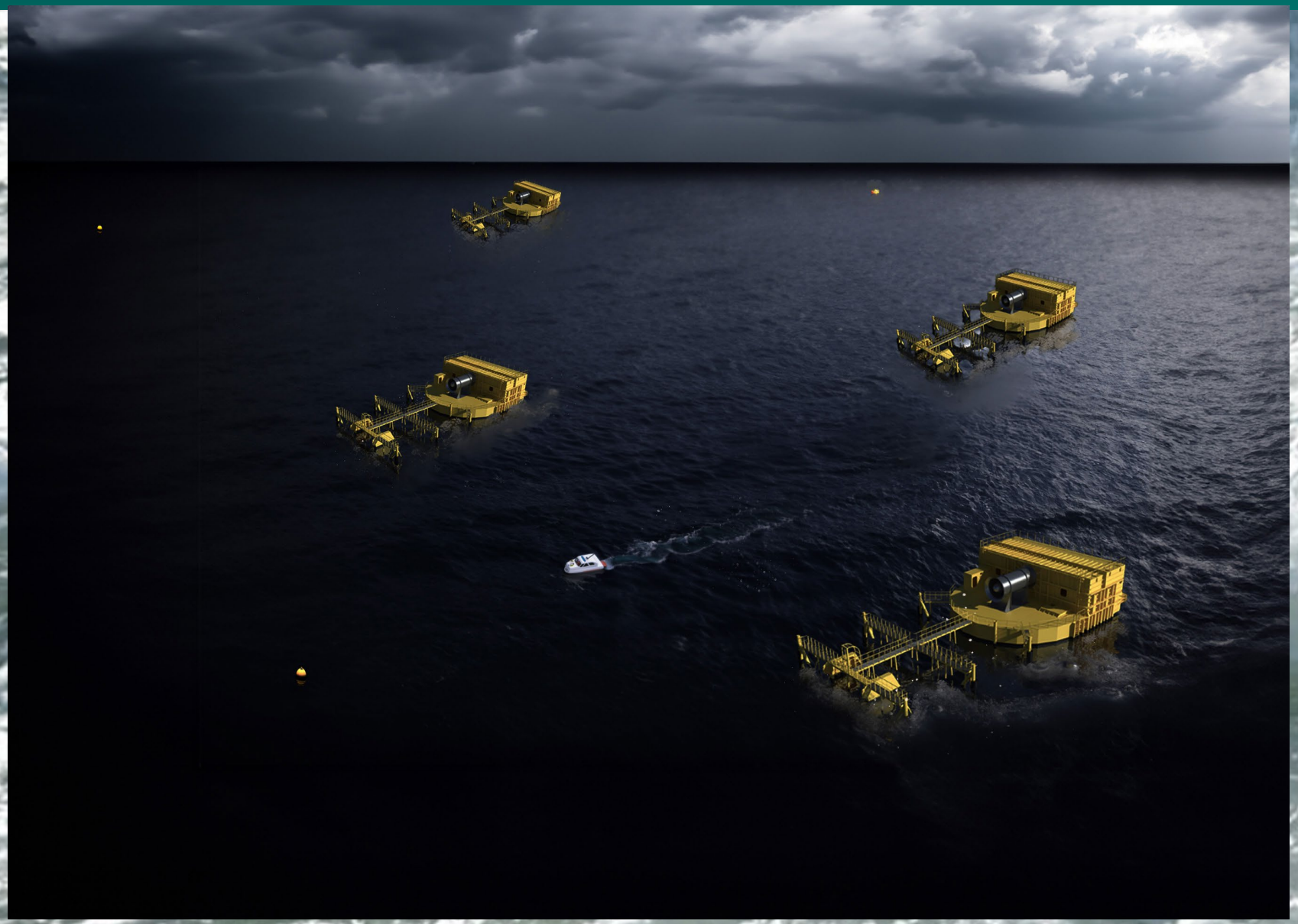
Billia Croo Wave Energy Test Berths at EMEC, Orkney

OCEAN ENERGY
A WORLD OF POWER

Operational Testing Q4 2024 – Autumn 2026

OCEAN ENERGY
A WORLD OF POWER

STAGE 5 – SUSTAINABLE WAVE ENERGY FARM



OCEAN ENERGY
A WORLD OF POWER

FUTURE ARRAYS

OCEAN ENERGY
A WORLD OF POWER

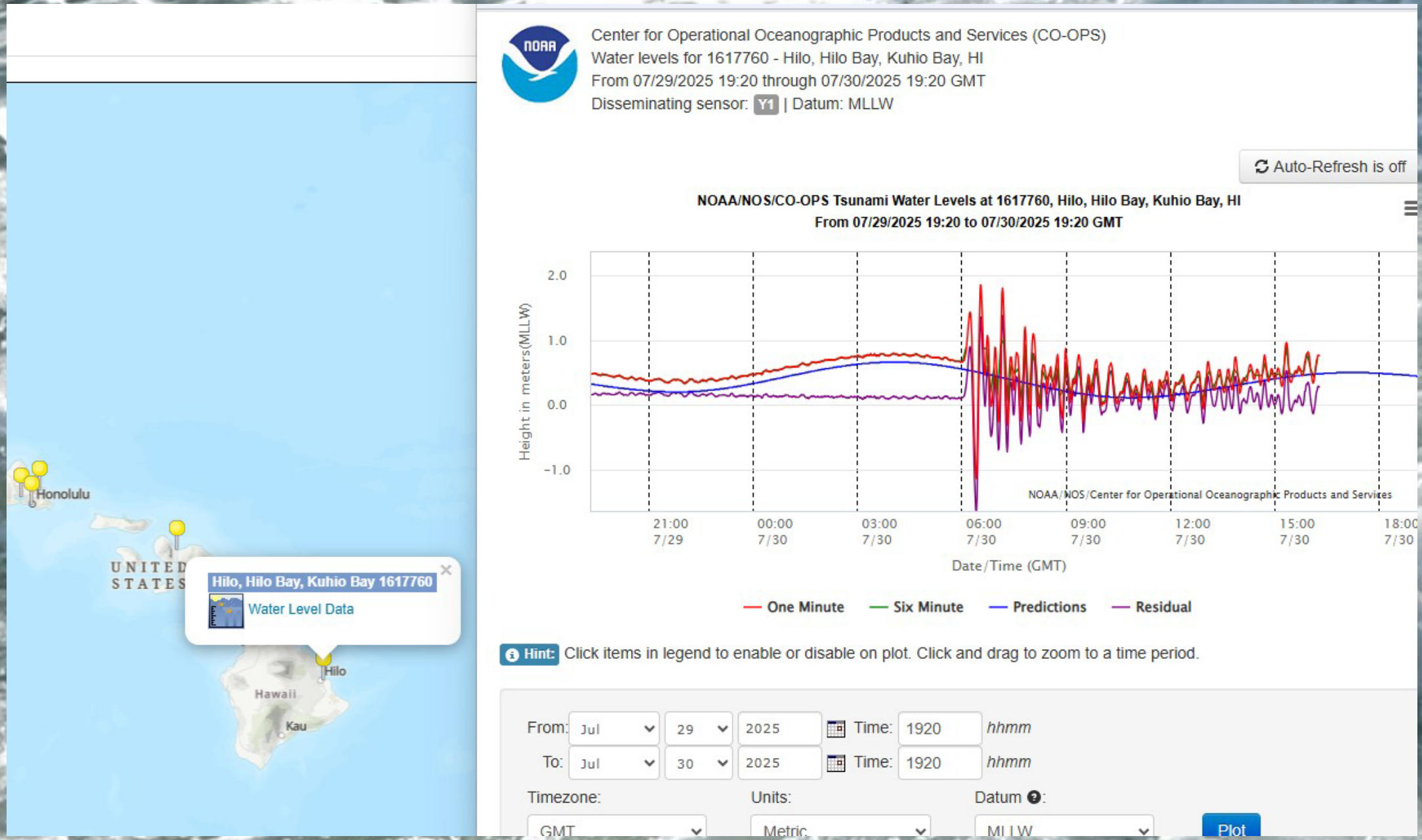
Thank You !

Contact Details : Prof. Tony Lewis

t.lewis@ucc.ie

tl@oceanenergy.ie


OCEAN ENERGY
A WORLD OF POWER


Honolulu
UNITED STATES
Hilo, Hilo Bay, Kuhio Bay 1617760
Water Level Data
Hilo
Hawaii
Kau
Center for Operational Oceanographic Products and Services (CO-OPS)
Water levels for 1617760 - Hilo, Hilo Bay, Kuhio Bay, HI
From 07/29/2025 19:20 through 07/30/2025 19:20 GMT
Disseminating sensor: Y1 | Datum: MLLW
Auto-Refresh is off
NOAA/NOS/CO-OPS Tsunami Water Levels at 1617760, Hilo, Hilo Bay, Kuhio Bay, HI
From 07/29/2025 19:20 to 07/30/2025 19:20 GMT
Height in meters(MLLW)
2.0
1.0
0.0
-1.0
NOAA/NOS/Center for Operational Oceanographic Products and Services
21:00 7/29
00:00 7/30
03:00 7/30
06:00 7/30
09:00 7/30
12:00 7/30
15:00 7/30
18:00 7/30
Date/Time (GMT)
One Minute
Six Minute
Predictions
Residual
Hint: Click items in legend to enable or disable on plot. Click and drag to zoom to a time period.
From: Jul 29 2025 Time: 1920 hhmm
To: Jul 30 2025 Time: 1920 hhmm
Timezone:
GMT
Units:
Metric
Datum:
MLLW
Plot