

WES PROGRAMME UPDATE

Elva Bannon – Senior Research Engineer

Supergen ORE Hub
Annual Assembly
6 November 2019



WES in brief

WES in brief



Established in
November 2014 as
a subsidiary of Highlands and
Islands Enterprise



5 competitive programmes

- Power Take-Offs
- Wave Devices
- Structural Materials
- Controls Systems
- *Quick connection Systems*



200 Organisations
88 Projects



Developing
cost competitive
wave technology



£39.6M
committed
expenditure



Delivering objectives through
Research, Development
& Innovation Programmes



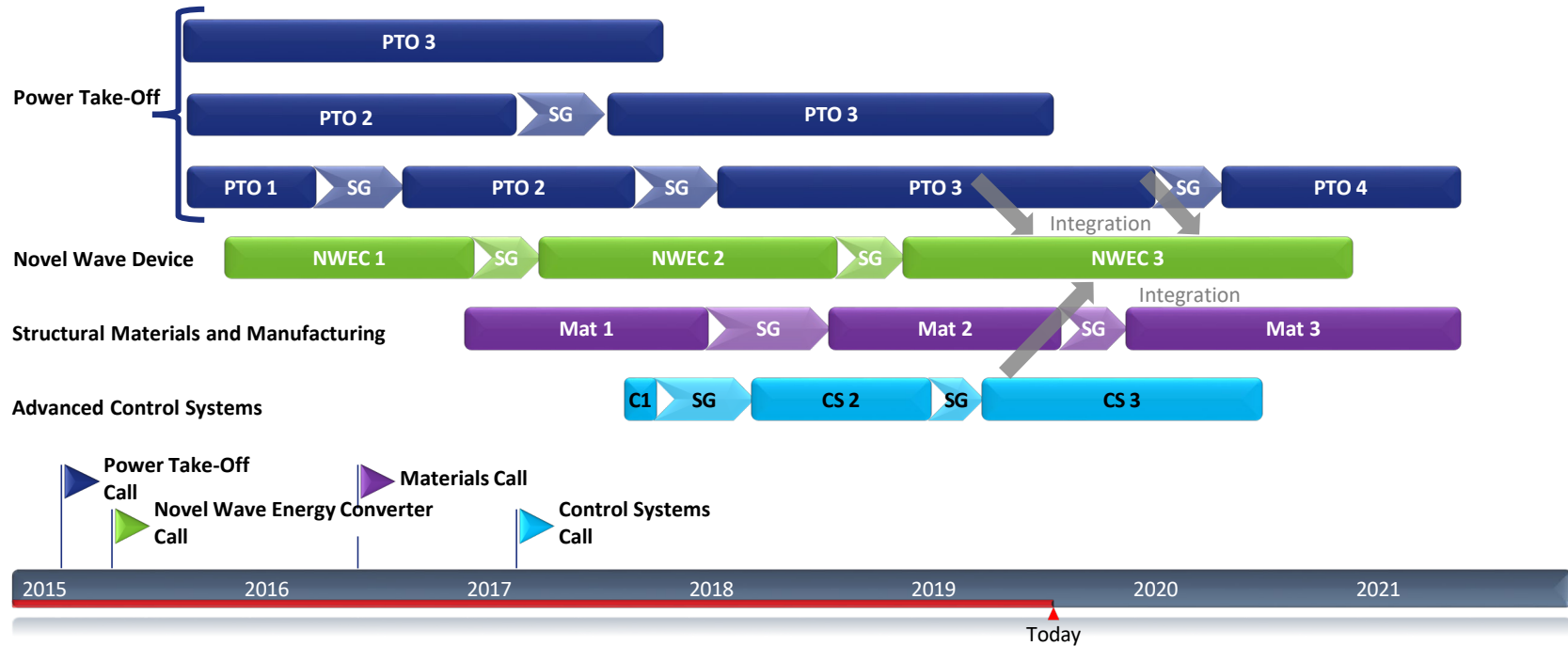
13 Countries



Funded by the
Scottish Government

Technology Development Programmes

WES Technology Programmes



Power Take-Off Programme



Power Take-Off Programme



CorPower Ocean AB

HiDrive

Direct drive PTO for
resonant Wave Energy
Converter

(Cascade gearbox)



Milestones:

- Stage 3 –complete
- Extensive PTO characterisation tests
- Sea trials at EMEC
- Lessons Learned presentation at WES Conference 2018
- Completed: September 2018

Power Take-Off Programme



UmbraGroup

Electro-Mechanical Reciprocating Generator (EMERGE)

Reciprocating linear
drive recirculating ball
screw technology



<https://marineenergy.biz/2019/10/24/emerge-project-wraps-up-sea-trials/>

Milestones:

- Stage 2 – complete
- Stage 3 – current
- PTO testing complete in Scotland (Doosan)
- Sea trials in Orkney summer 2019
- Expected completion: end 2019

Power Take-Off Programme

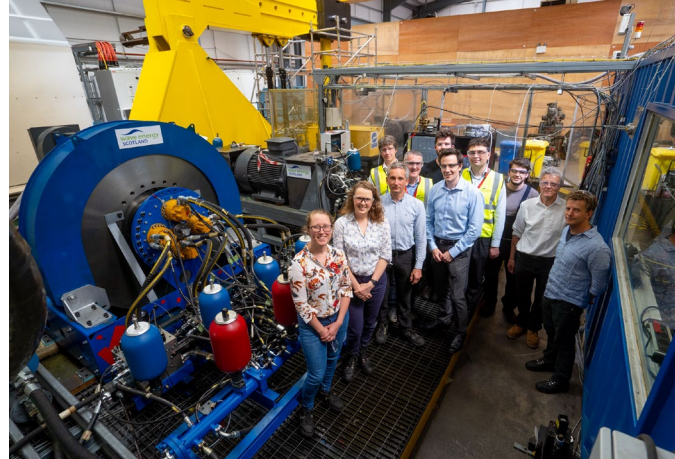
ARTEMIS
INTELLIGENT POWER



Artemis Intelligent
Power Ltd

Quantor

Hybrid Digital
Displacement Hydraulic
PTO



Milestones:

- Stage 2 – complete
- Stage 3 – current
- Bespoke test rig which emulates device inertia
- Extensive testing over 3 months
- Expected completion: end 2019

Power Take-Off Programme



University of Edinburgh

Project Neptune

C-GEN Direct Drive



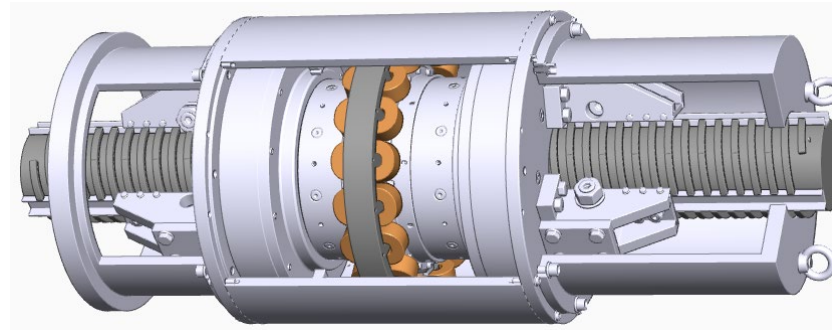
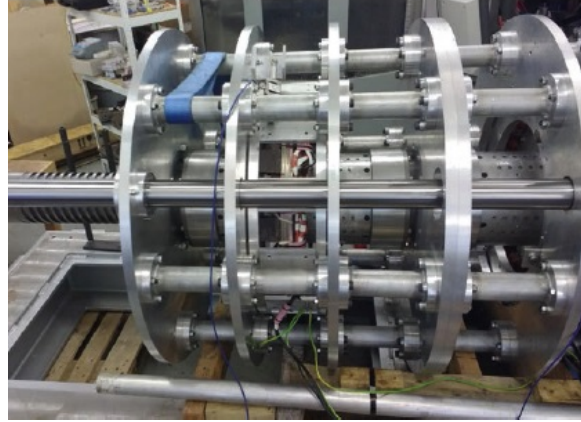
Milestones:

- Stage 2 – complete
- Stage 3 – current
- FAT completed in Rugby (Quartzelec)
- Dry & wet testing in Leith
- Partnering with Mocean for WEC testing
- Expected completion: end 2019

Power Take-Off Programme



Oceaneering
International Services
Ltd



PECMAG

Power Electronic
Controlled Magnet Gear

Milestones:

- Stage 1 – complete
- Stage 2 – complete
- Stage 3 – current
- Dry testing at factory
- Planned sea tests integrated with point absorber WEC
- Expected completion: March 2020

Struct. Materials Programme



Struct. Materials Programme



Tension Technology
International Ltd

NetBuoy II

Inflatable buoy with
load carrying net



Milestones:

- Stage 1 – complete
- Stage 2 – current
- Hydrostatic tests of $\frac{1}{4}$ scale buoy
- Proof of concept testing
- Abrasion tests on material itself
- Expected completion: end 2019

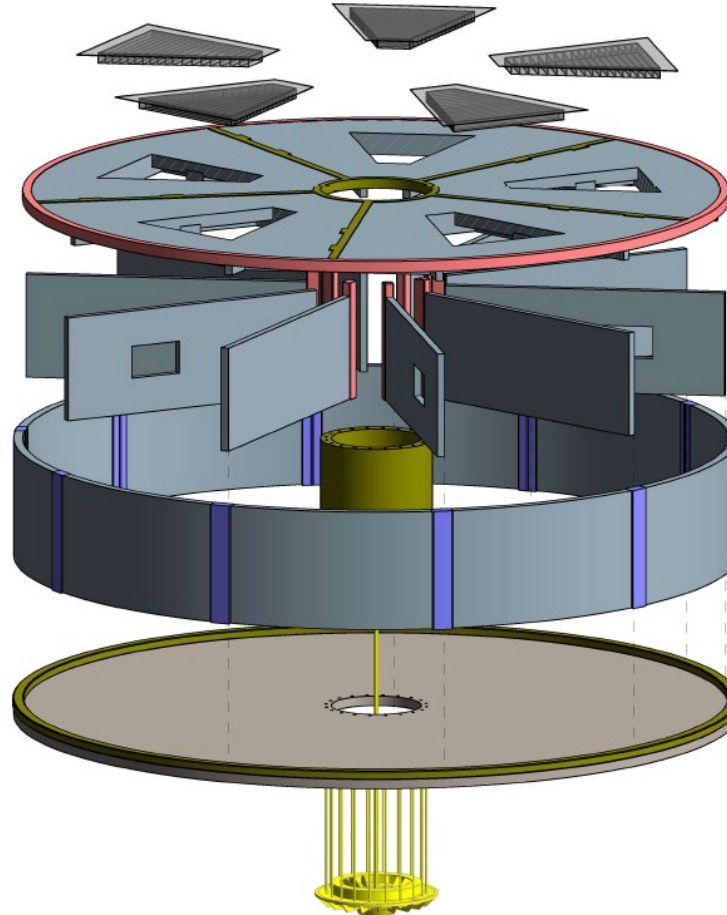
Struct. Materials Programme

ARUP

Ove Arup & Partners Ltd

CREATE

Concrete as a
Technology Enabler



Milestones:

- Stage 1 – complete
- Stage 2 – current
- Pre-fabricated panel design developed
- Lab tests on full-scale panel joint
- Carnegie CETO as test case
- Expected completion: end 2019

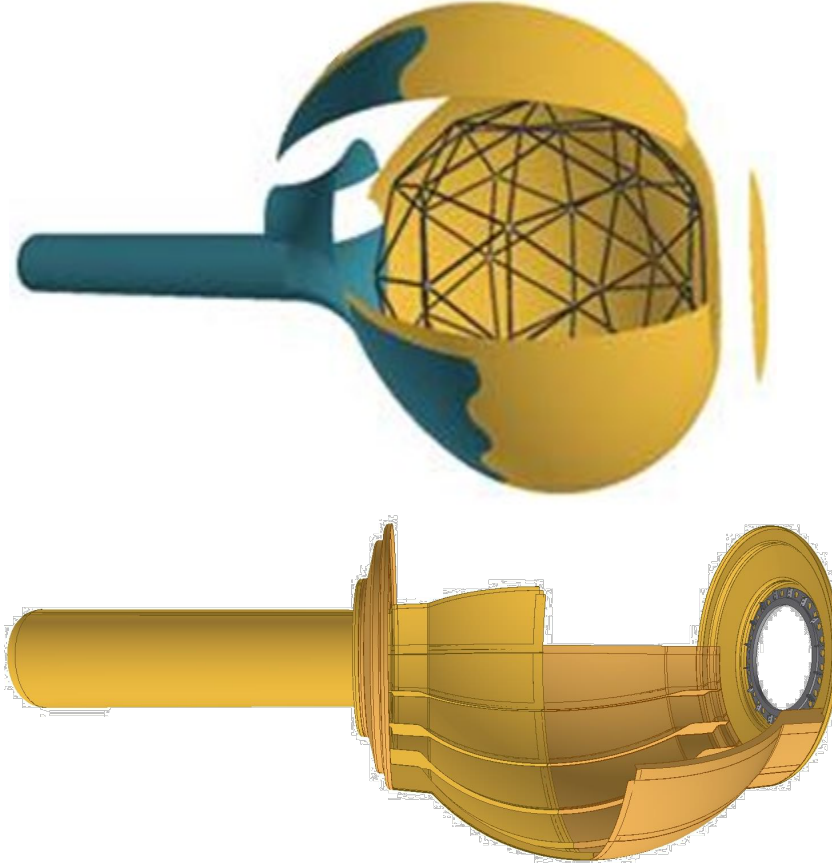
Struct. Materials Programme



CorPower Ocean AB

HydroComp

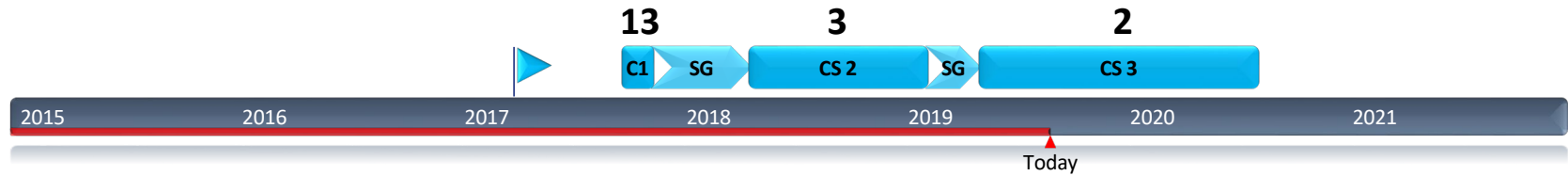
Fibre Reinforced
Polymer



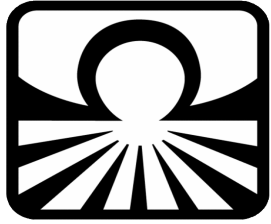
Milestones:

- Stage 1 – complete
- Stage 2 – current
- Composite structure using E-glass fibres
- Panelised design for ease of mass manufacture
- Thorough material tests including fatigue, bending, environmental aging
- Expected completion: end 2019

Control Systems Programme



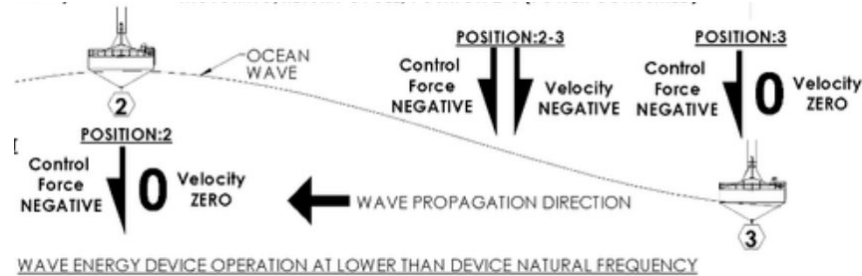
Control Systems Programme



MaxSim Ltd

CEORL

Cost of Energy
Optimised
Reinforcement Learning



Milestones:

- Stage 1 – complete
- Stage 2 – complete
- Stage 3 – current
- HIL and tank testing of reinforcement learning in scale WEC
- Expected completion: end 2020

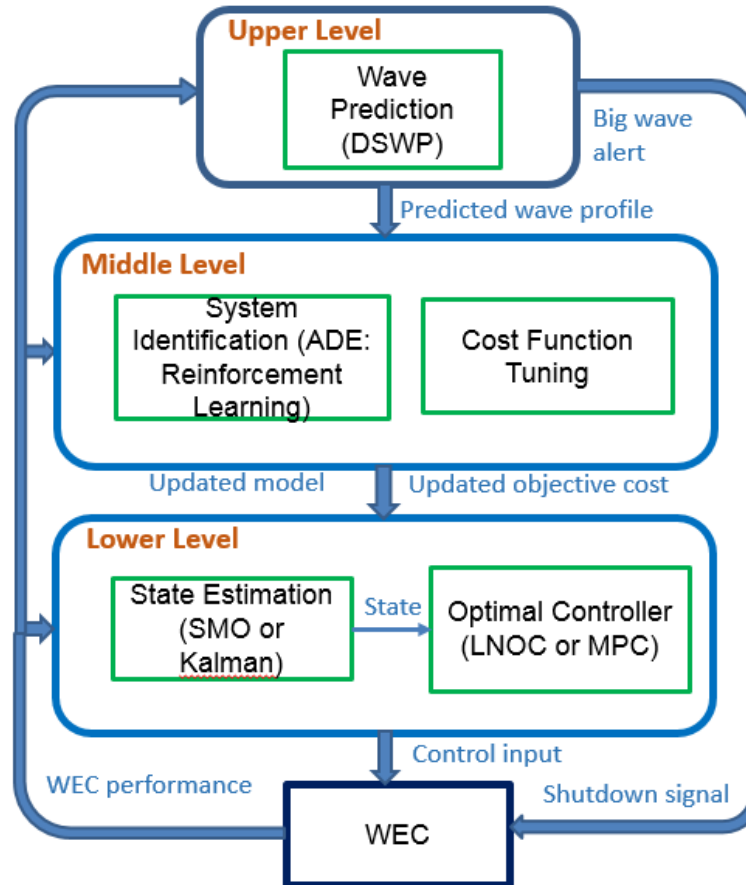
Control Systems Programme



Queen Mary
University of London

Queen Mary University

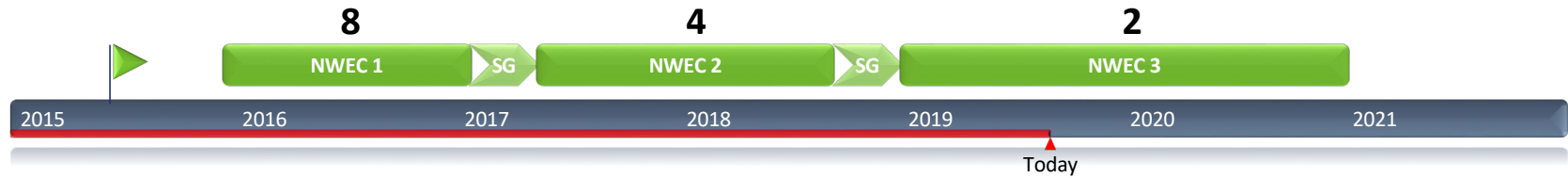
Adaptive hierarchical
model predictive control
of wave energy
converters



Milestones:

- Stage 1 – complete
- Stage 2 – complete
- Stage 3 – current
- Testing Mocean device in FloWave
- Testing wave prediction technique along with controller
- Expected completion: end 2020

Wave Device Programme (NWECS)



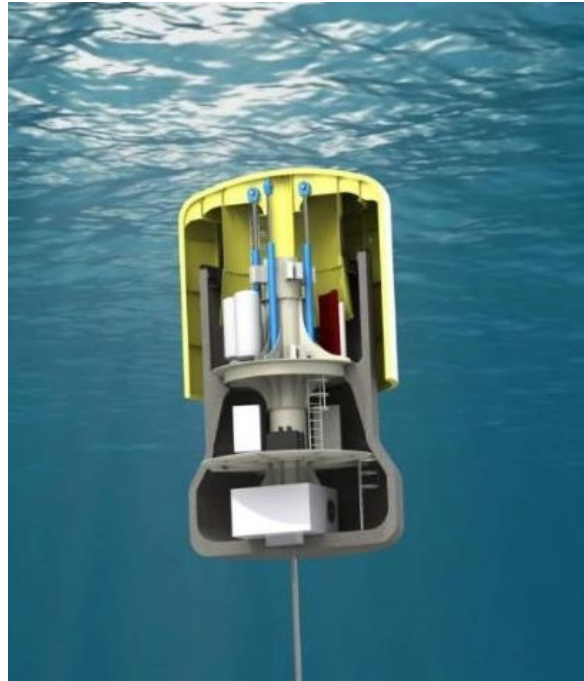
Wave Device Programme (NWECC)



AWS ocean energy

AWS Ocean Energy Ltd

At sea demonstration of
the Archimedes
Waveswing



Milestones

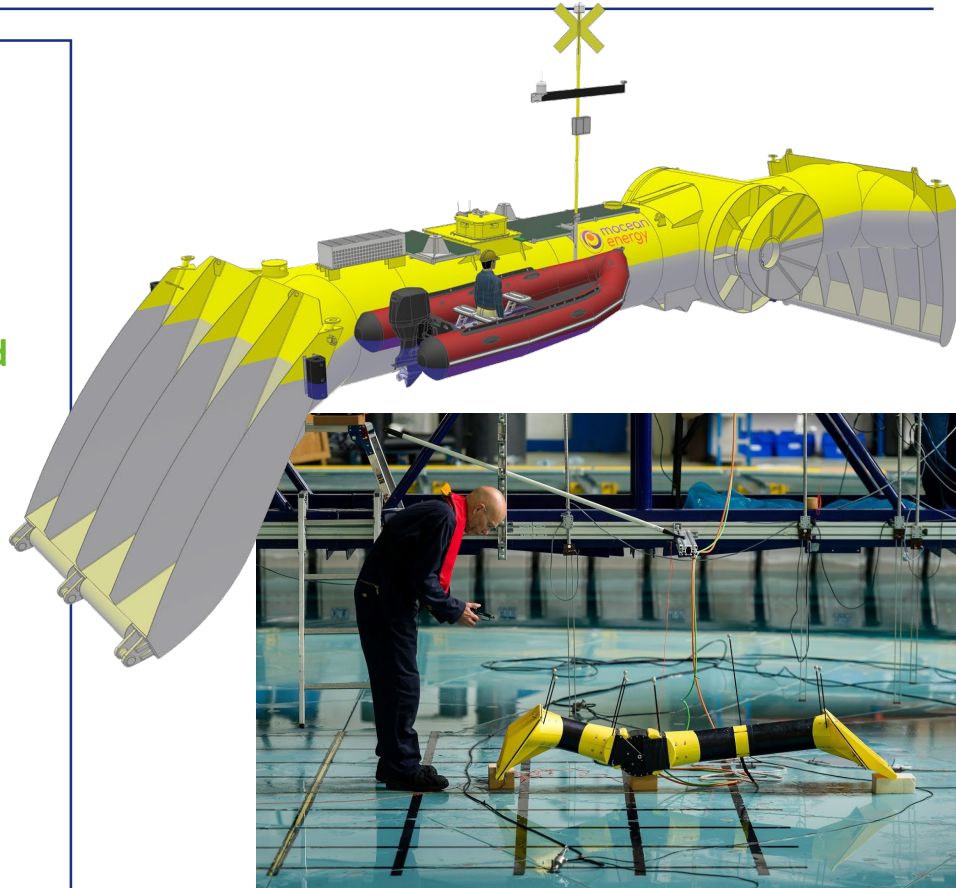
- Stage 1 – complete
- Stage 2 – complete
- Stage 3 – current
- Orkney sea trials in Summer 2020
- ½ Scale device
- Expected completion date: end 2020

Wave Device Programme (NWECC)



Mocean Energy Ltd

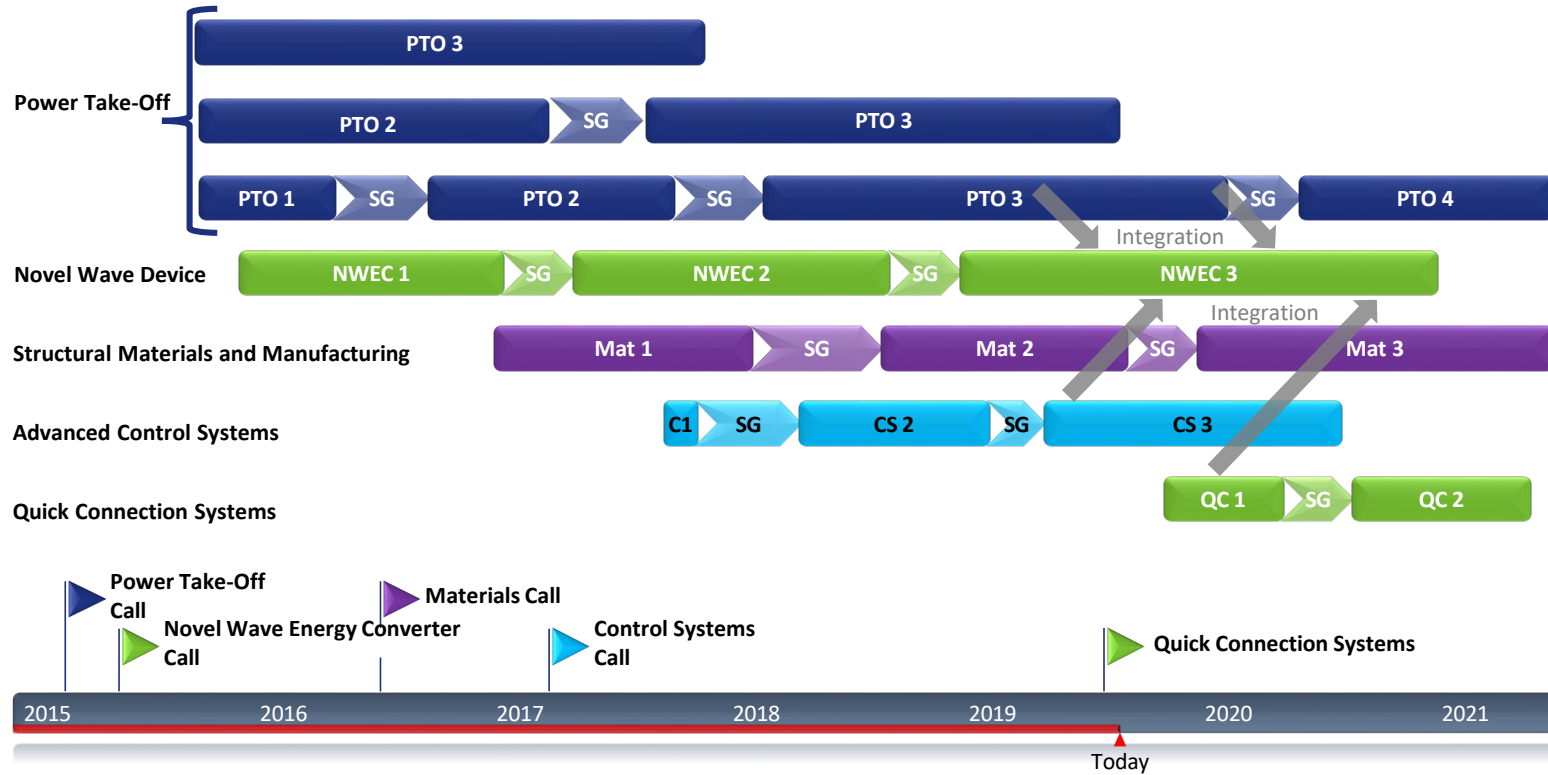
Mocean WEC: Blue
Horizon



Milestones:

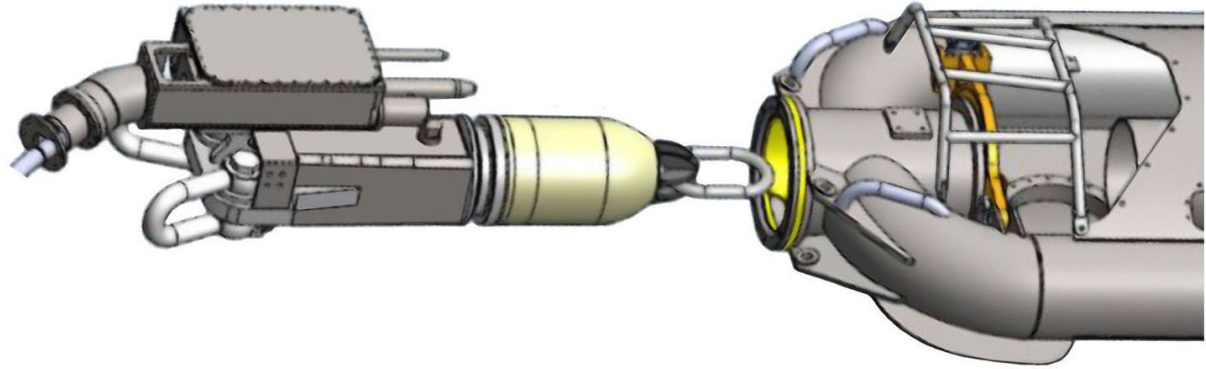
- Stage 1 – complete
- Stage 2 – complete
- Stage 3 – current
- Orkney sea trials in Summer 2020
- ½ Scale device
- C-GEN PTO
- QMU control System
- Expected completion date: end 2020

WES Technology Programmes



Overall Competition Objectives

- Reduce the duration, cost and risk of offshore operations for prototype wave energy converters



by

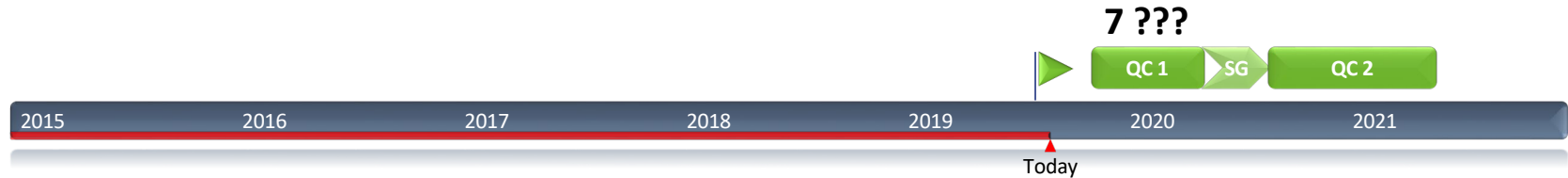
- supporting projects to design and develop a quick connection and disconnection system between a device and its moorings and/or electrical system.

Quick Connection Systems

Quick Connection Systems for a wave energy converter which target the connection and disconnection of either the:

- Mooring system,
- Electrical system,
- Mooring and electrical systems combined.

Successful projects announced in mid-December



International Collaboration

IEA-OES Task 12

“International Technology Evaluation Framework for Ocean Energy”



- How to measure
- Clear definitions
- Evaluation methods
- Links to existing standards
- Wide review to gain international consensus



- 3-year project
- €8m budget
- 18 partners in 8 countries
- WES leading Stage Gate design tool work package
- Defining metrics for technology development process (TRL 1-9)

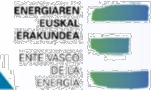




OceanSET is supporting the ocean energy implementation plan of the European Strategic Energy Technology Plan (SET Plan)

3-year project

Partners: WES (UK), University of Edinburgh (UK), SEAI (Ireland), FEM (France), OEE (EU), PLOCAN (Canaries), ENEA (Italy), DGEG (Portugal), EVE (Basque Country)



THE UNIVERSITY of EDINBURGH



This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement N° 840651



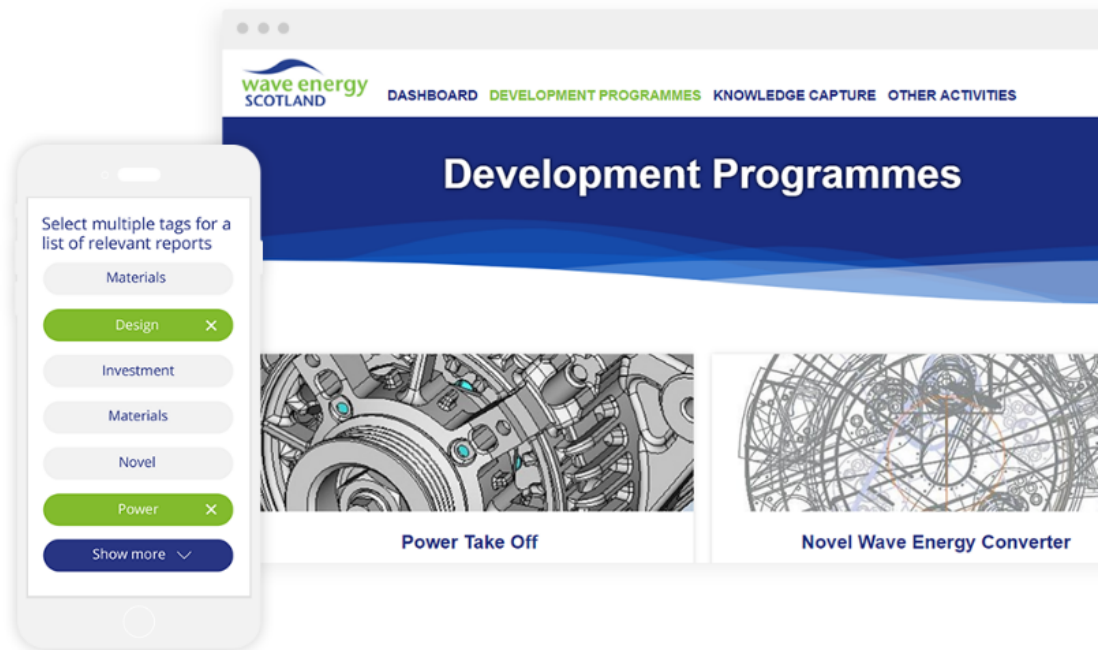
Knowledge Sharing

Knowledge Library

Wave Energy Scotland is managing the most extensive technology programme of its kind in the wave energy sector. The Knowledge Library provides access to key information and documents generated through this world leading commercial and academic research & development.

Access world leading R&D in wave energy technology

- Discover the projects supported through the Wave Energy Scotland Programme
- Find Potential collaborators in your own or other fields
- Search project reports on work completed through Wave Energy Scotland Programme
- Find information on previous wave energy technology development in Scotland



library.waveenergyscotland.co.uk

A banner for the Wave Energy Scotland Annual Conference 2019. The background is a dark blue image of ocean waves. On the left, there are three white rectangular boxes containing text. On the right, the Wave Energy Scotland logo is displayed, featuring a stylized blue wave above the text 'wave energy' in green and 'SCOTLAND' in white.

ANNUAL CONFERENCE

5 DECEMBER 2019

REGISTER NOW

The logo for Wave Energy Scotland. It consists of a stylized blue wave icon above the text 'wave energy' in a green, lowercase, sans-serif font, and 'SCOTLAND' in a white, uppercase, sans-serif font below it.

wave energy
SCOTLAND

Submit project details for chance to display poster on the day

<https://www.surveymonkey.co.uk/r/WESAC19Poster>

Register for conference through B2Match (case sensitive)

www.bit.ly/WESAC19

THANK YOU

Elva Bannon

Twitter
LinkedIn

@WaveEnergyScot
waveenergyscotland

