ORE Catapult Overview

CLIPPER July Meeting

4/7/18 | Andy Macdonald

CATAPULT
Offshore Renewable Energy

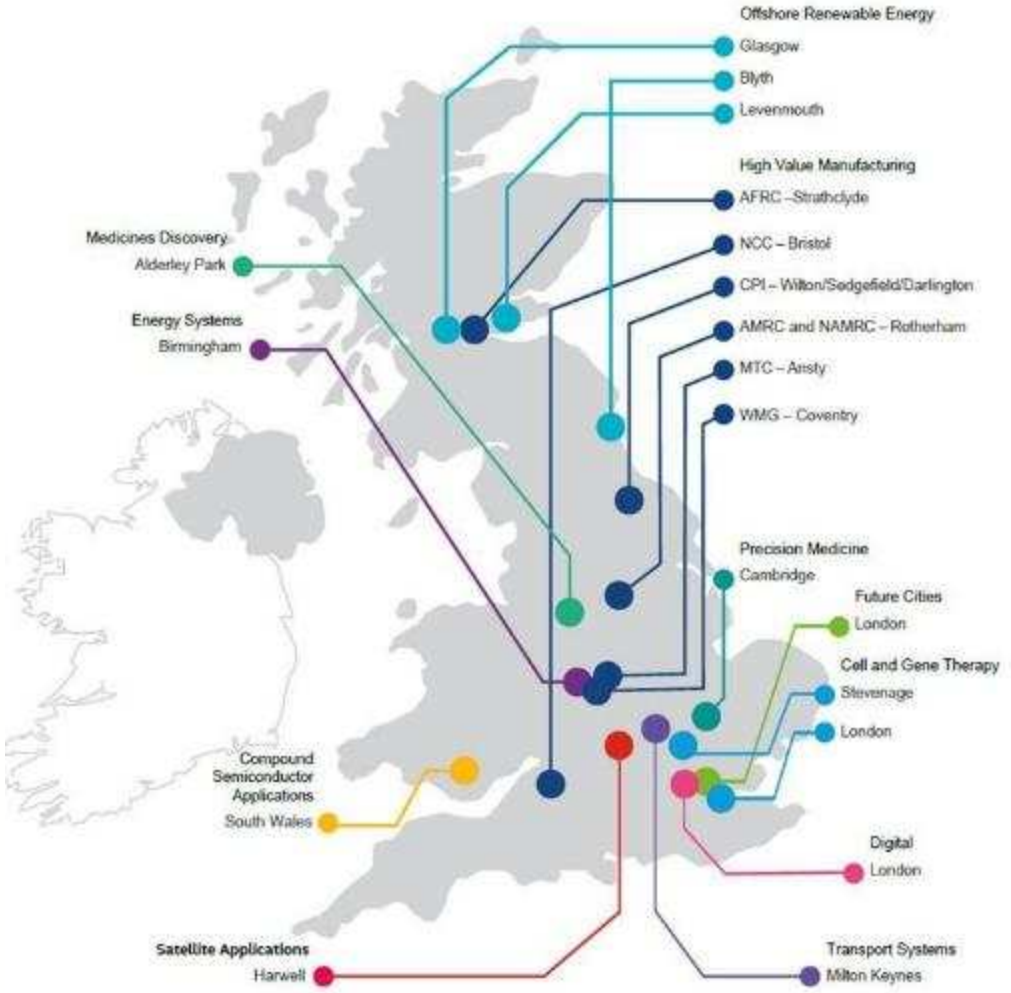
Agenda

- The Catapult network
- Offshore Renewable Energy Catapult
- Offshore Wind in the UK
- Offshore Wind Supply Chain
- Case studies

The catapult network:
A long-term vision for innovation & growth

11 Catapults

- Established by InnovateUK
- Designed to transform the UK's capability for innovation
- Core grant leveraged with industry and other public funding



ORE Catapult

Our Vision:

Abundant, affordable energy from offshore wind, wave and tide

- Reduce the cost of offshore renewable energy
- Deliver UK economic benefit
- Engineering and research experts with deep sector knowledge
- Independent and trusted partner
- Work with industry and academia to commercialise new technologies

80+ technical experts

Our delivery

Wind turbine blade testing facility

ore.catapult.org.uk
@orecatapult

CATAPULT
Offshore Renewable Energy

15MW Wind turbine nacelle testing facility

Electrical and materials laboratories

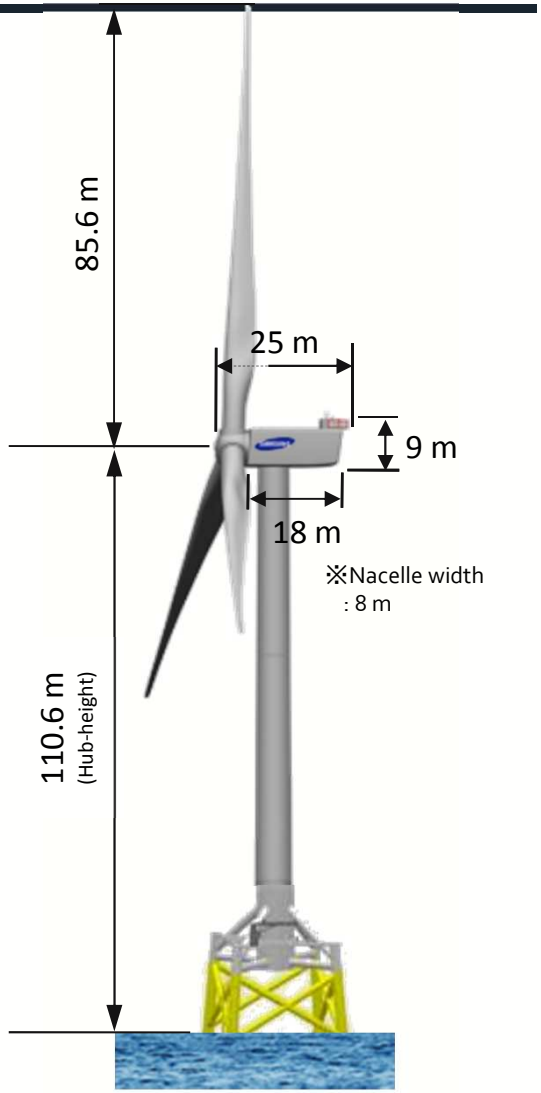
Offshore Anemometry Platform

Marine testing facility

7MW Levenmouth Demonstration Turbine

ORE Catapult's
7MW Offshore Wind Turbine Specification

Wind Class		IEC Class 1a	Rotor dia.		171.2m
Capacity		7MW at grid side	Hub height		110.6m
Generator		Medium (3.3kV), PMG	Converter		Full power conversion
Drive train		Medium speed (400rpm)	Rated frequency		50/60 Hz
Rotor speed		5.9 ~10.6 rpm	Wind speed		3.5 ~ 25 m/s
Temp. range	Survival	-20℃ to +50℃	Humidity	Blade	100%
	Operating	-10℃ to +25℃ -10℃ to +35℃		Nacelle	Inside : < 50 % Outside : 95 %
Lightning protection level		Level 1 (IEC 62305-1)	Corrosion Category (ISO 12944-5)		Inside : C4 Outside : C5-M
Design life		25 years	Certification		DNV



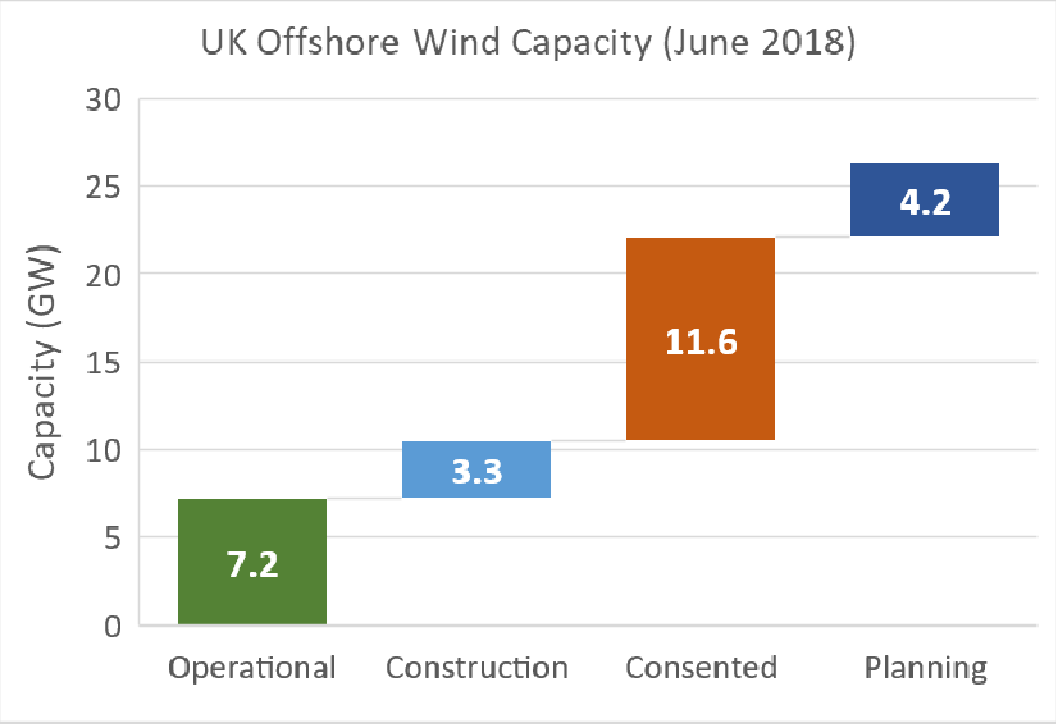
ore.catapult.org.uk
@orecatapult

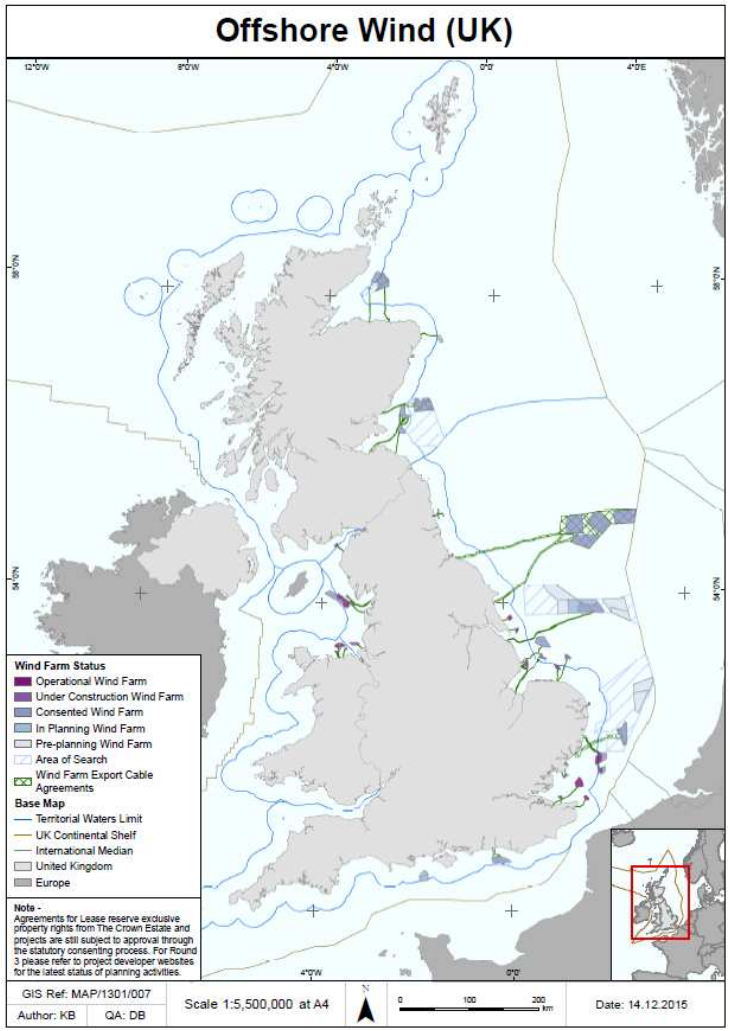
CATAPULT
Offshore Renewable Energy

Offshore wind in the UK

The opportunity

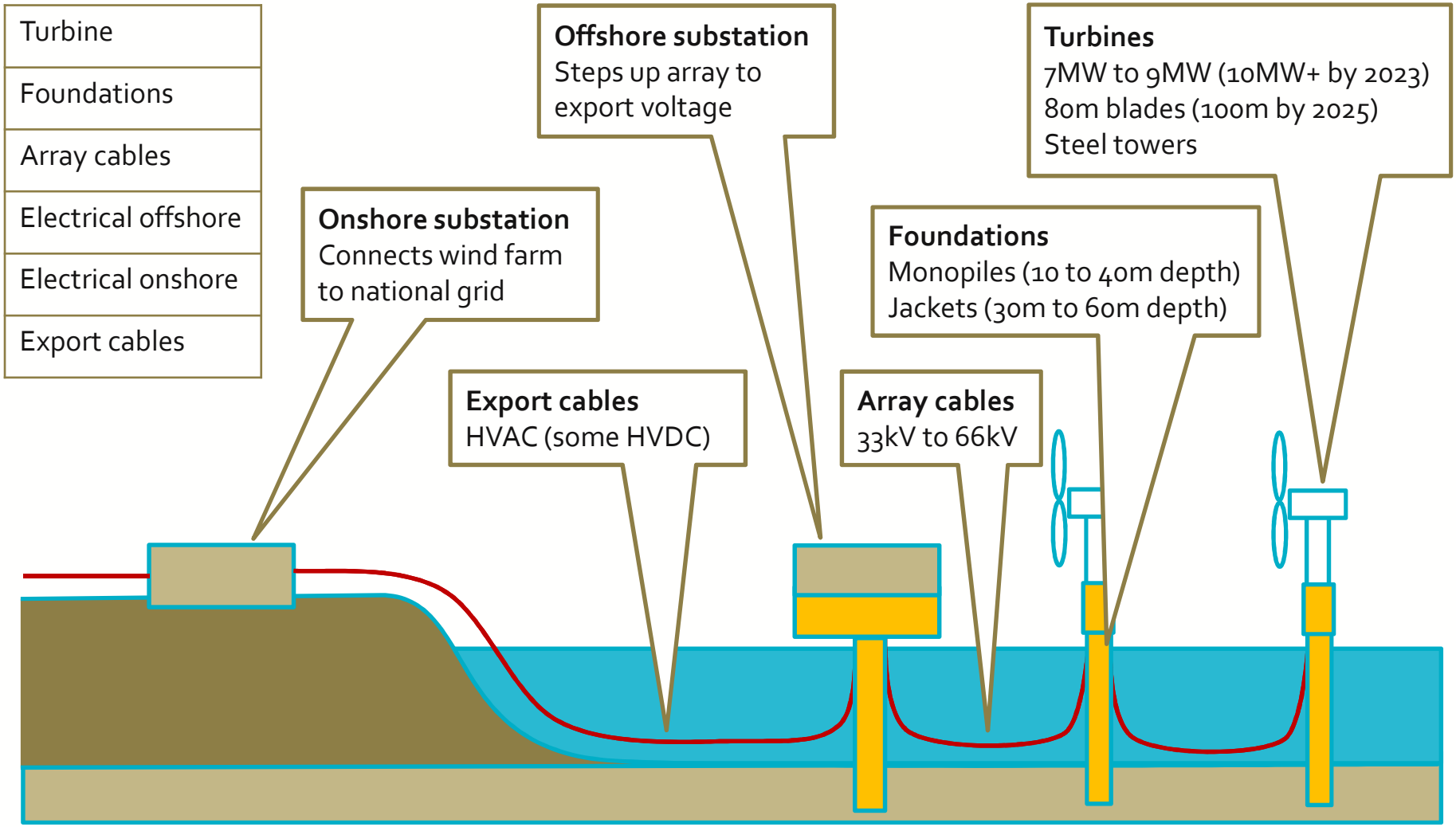
- 1,837 offshore turbines
- 7.2GW operational
- 10GW installed by 2020





Offshore wind supply chain

Offshore wind capex



Turbines

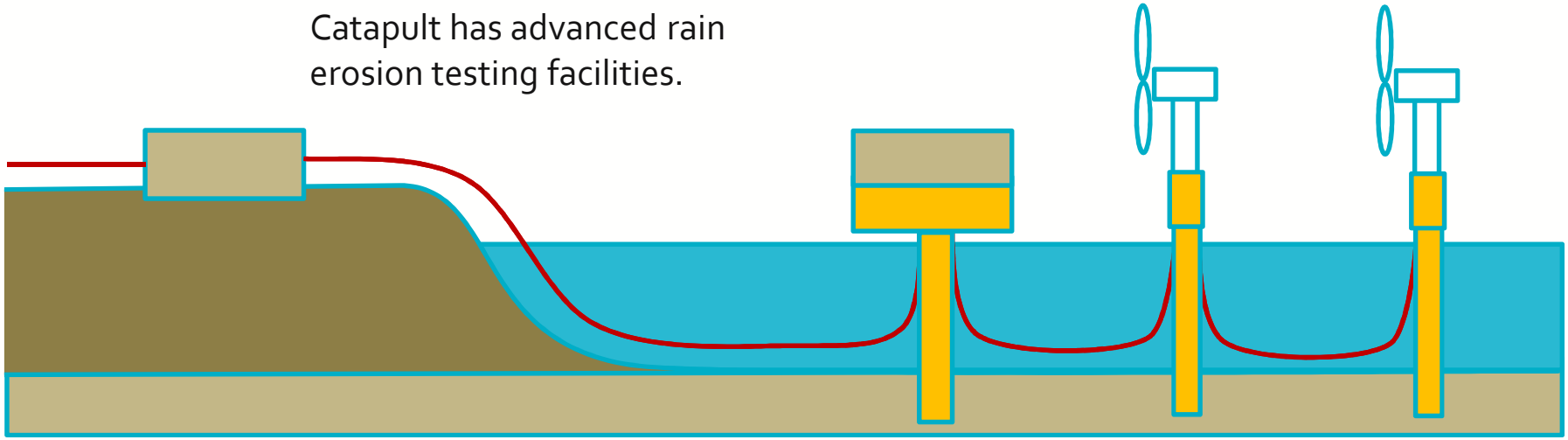
Turbine
Foundations
Array cables
Electrical offshore
Electrical onshore
Export cables

Nacelles	Design expertise but no manufacture in UK
Blades	Siemens, Hull Vestas, Isle of Wight
Towers	CS Wind, Machrihanish

Longer blades and new materials

Catapult has developed dual axis blade testing to improve testing and reduce time to market. Catapult has advanced rain erosion testing facilities.

Siemens Gamesa blade factory in Hull



Foundations

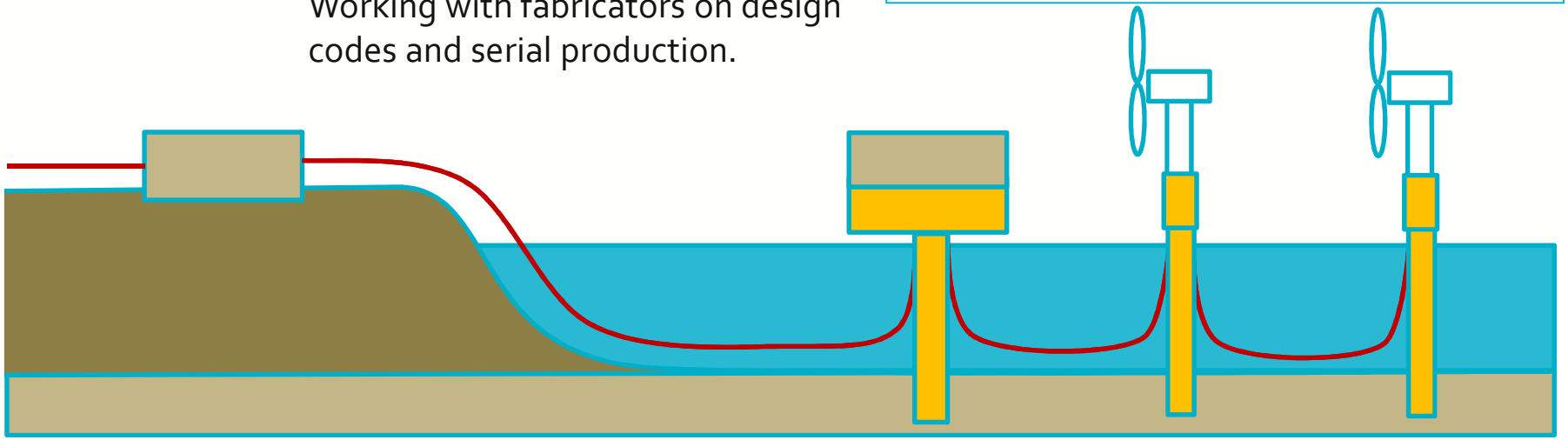
Turbine
Foundations
Array cables
Electrical offshore
Electrical onshore
Export cables

Monopiles	Strong continental suppliers
Jackets	Bifab, Global Energy Harland & Wolff
Gravity base	BAM Nuttall

Deeper water and varied seabed

Catapult is gathering data from gravity base foundations.
Working with fabricators on design codes and serial production.

Jacket fabrication at BiFab in Fife



Array cables

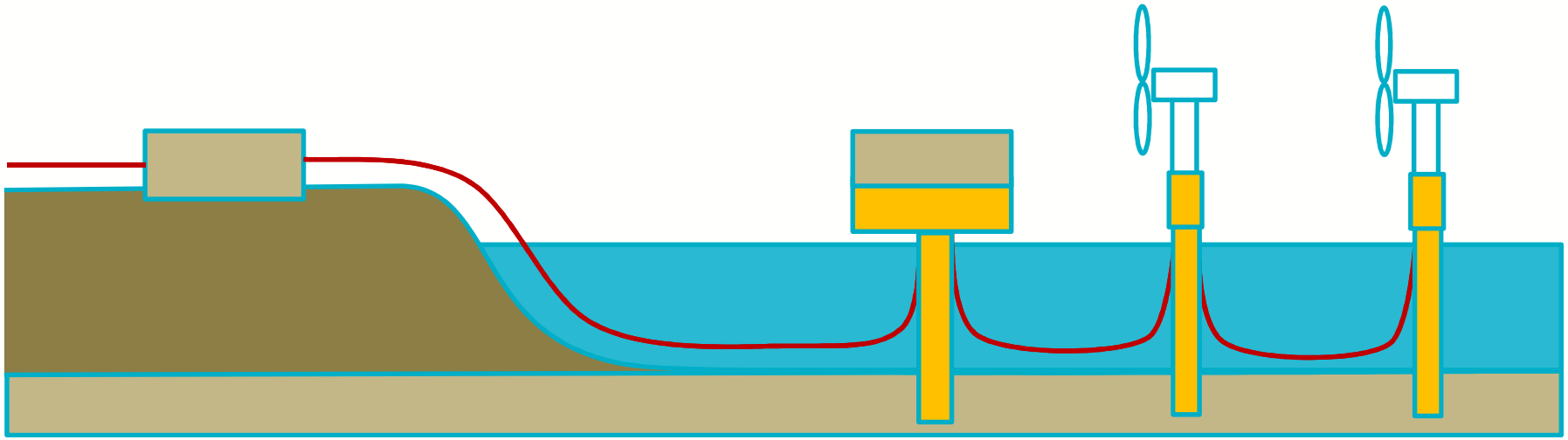
Turbine
Foundations
Array cables
Electrical offshore
Electrical onshore
Export cables

33kV/66kV	JDR Cables

Increase voltage from 33kV to 66kV

Catapult has developed methodology and carried out accelerated testing of new 66kV cables

JDR Cables, Hartlepool



Electrical offshore

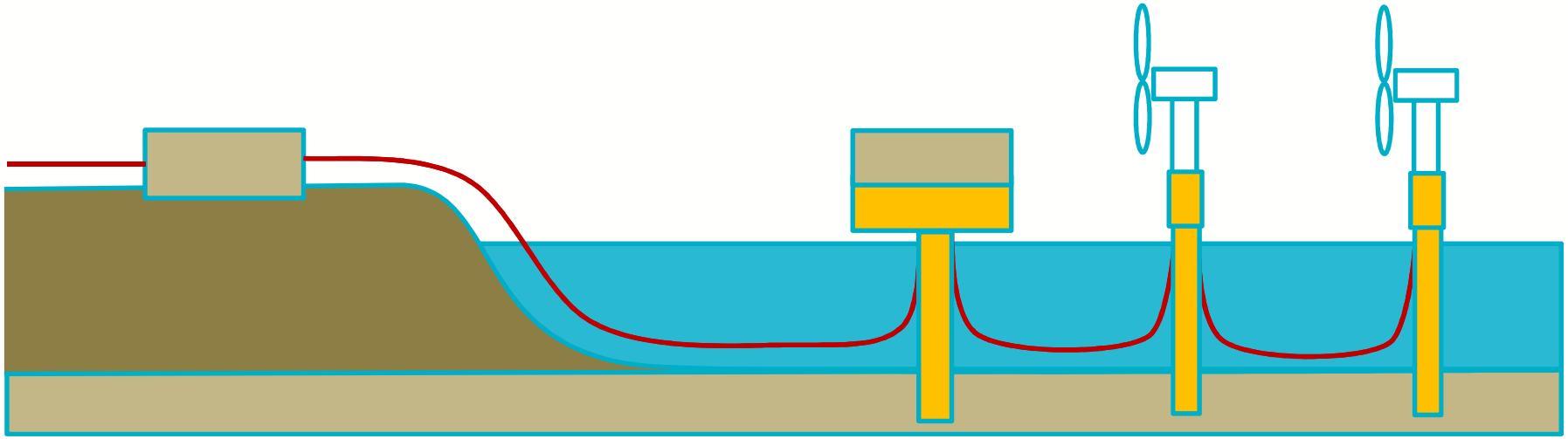
Turbine
Foundations
Array cables
Electrical offshore
Electrical onshore
Export cables

Offshore substation	Babcock

Lightweight distributed substations

Catapult carried out assessment of novel substation cost model

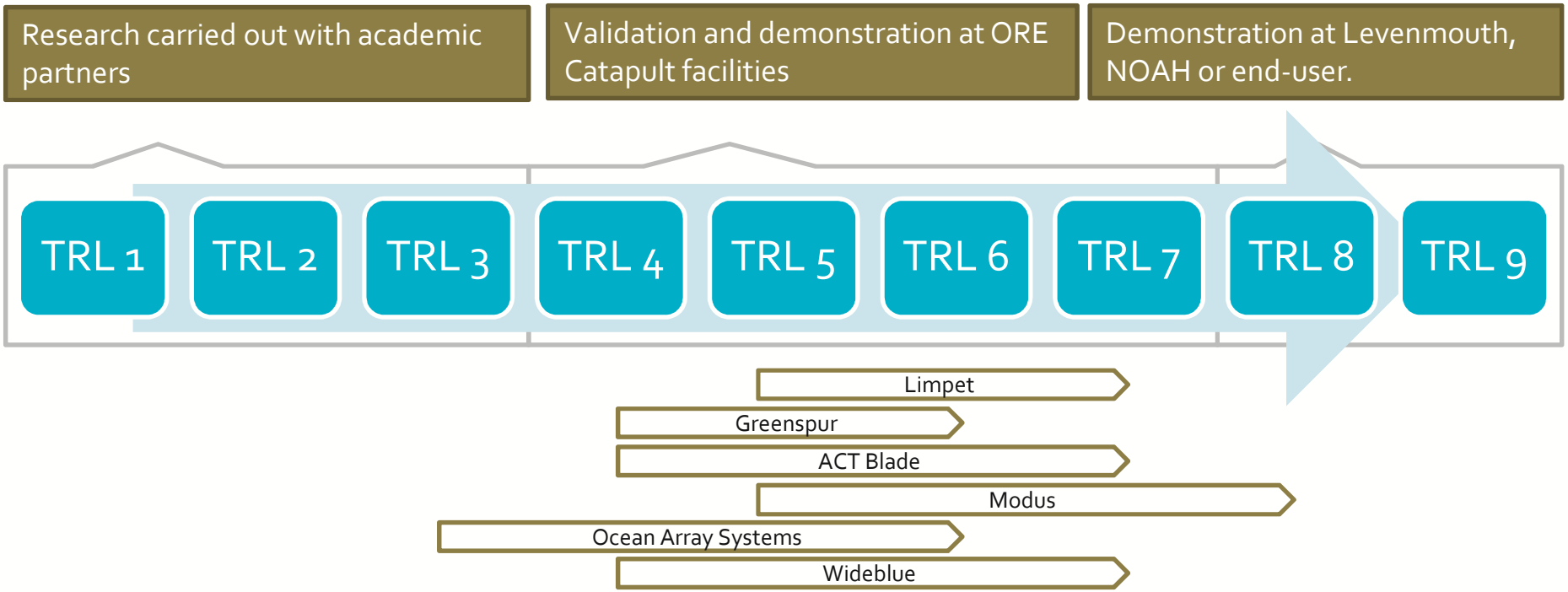
Babcock, Rosyth



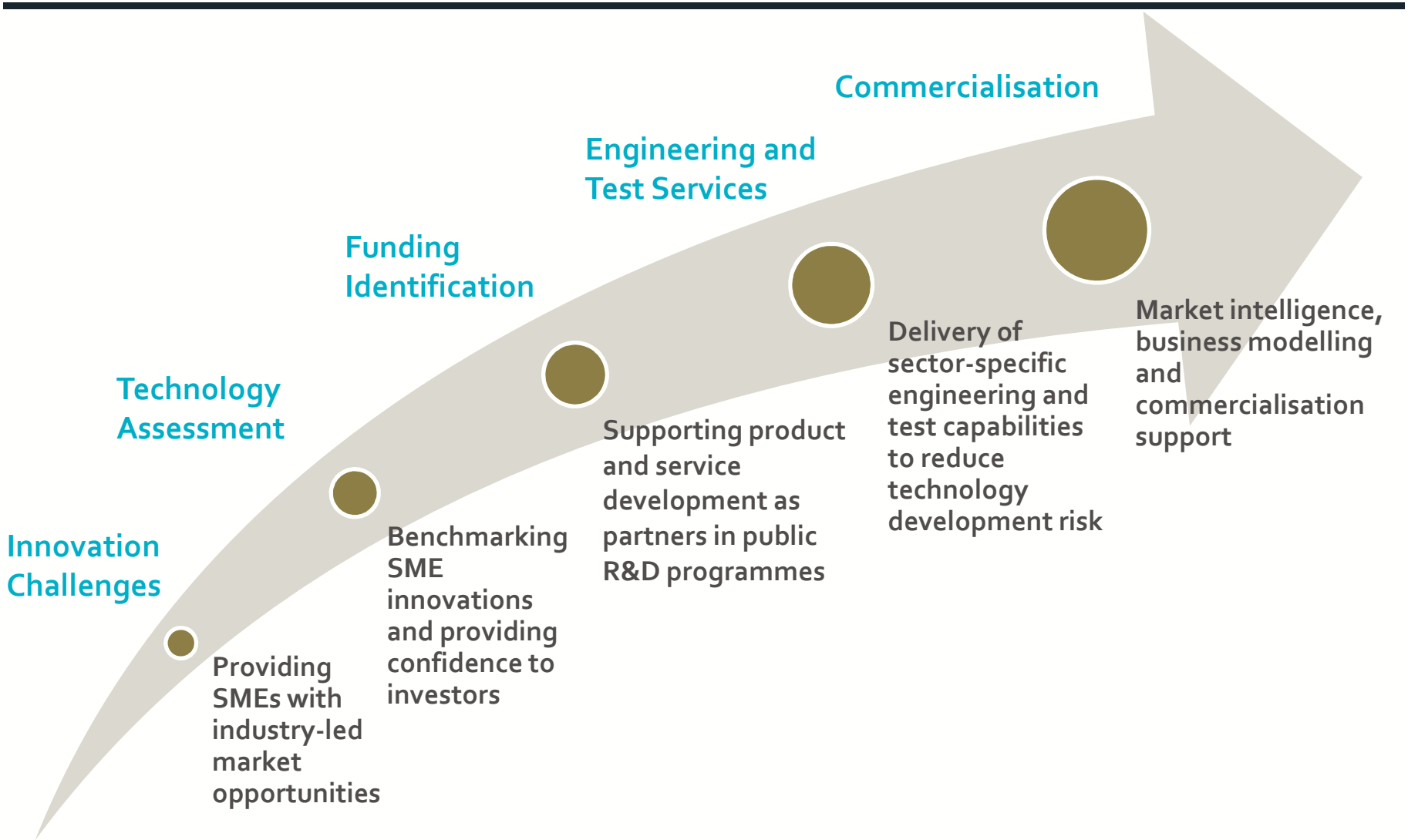
How can Catapult help?

Commercialisation of UK innovation

- SMEs frequently struggle in the range from TRL 4 through to TRL 9
- The ORE Catapult test facilities are designed to address this need.

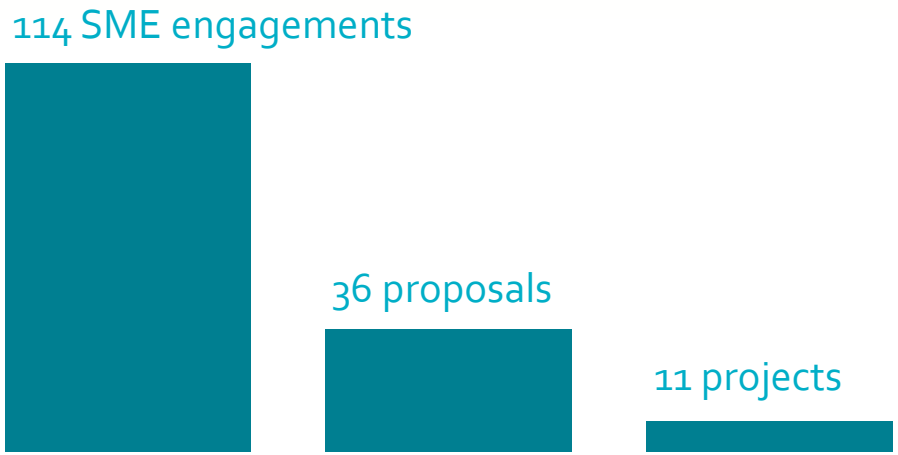


Commercialising technology with SMEs



SME Support Process (16/17)

Industry priorities	Innovation challenges	SME engagements	SME support	Collaborative projects
Priorities identified by industry via: • advisory groups • research projects • workshops	Specific challenges and market context. Promoted via website, media, events and conferences.	Follow up engagement with SMEs on specific activity.	Collaborative development of new projects proposals.	Successful in new public funding (IUK/EC)



In 16/17 SME innovation challenges delivered 11 new projects worth £10m to SMEs and £2m to ORE Catapult

Case studies

Collaborative Public Funding: FS FOUND

Scope

To demonstrate the feasibility of the float-and-submerged gravity base foundation solution at all critical stages: design, manufacture and quayside construction, preparation and loadout, seabed preparation, towing, installation, commissioning and operations.

Outputs

To verify the manufacturing and installation methodology and benefit from the lessons learnt in order to optimise plans for the future transnational exploitation of GBFs

To design, install, commission a condition monitoring system on two GBFs to monitor their behaviour.

To assess the structural response to extreme and fatigue loads on the GBF and compare theoretical loads with real ones

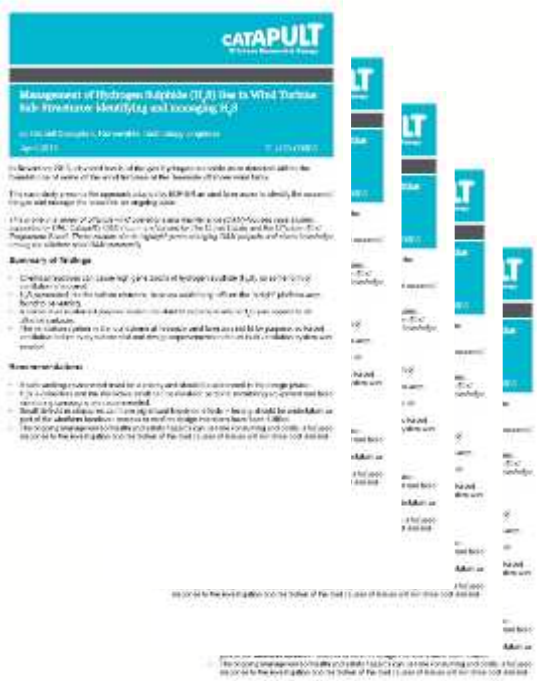
- **World first** of a float-and-submerged gravity base foundation for offshore wind turbines.
- Joint funded Demowind project with **UK and Dutch partners** include BODL, EDF Energy R&D UK Centre, Bam Nuttall and Catapult

ore.catapult.org.uk
@orecatapult

CATAPULT
Offshore Renewable Energy

Knowledge Sharing Case Study

Case Study Name	Lead
Self Perform O&M at Robin Rigg	E.ON
An Evidence Based Appraisal of Crew Transfer Vessel Thresholds	RWE
Early Fault Detection Using SCADA Data	E.ON
End of Warranty O&M Contracting Strategy	Centrica
Assuring O&M Data Quality	Centrica
Management of H_2S Gas in Wind Turbine Sub-Structures	EDF
Early O&M Experience of Jacket Foundations	Vattenfall
Responding to an HSE Emergency	Centrica
The Integration of Operational Data Using CORE	SPR
A Novel Offshore Wind Transfer Technique	Repsol
Helicopter Strategy Appraisal at Westermost Rough	DONG



Currently working on review of substructure inspection and monitoring best practice

All available here: https://ore.catapult.org.uk/analysis-insight

SPOWTT: improving Safety and Productivity of Offshore Wind Technician Transit

- 2 Year DEMOWIND project - €3.6m
- Optimising the **selection**, **utilisation** and use of Crew Transfer Vessels (CTVs)
- Improving **productivity** & **safety** of technicians
- Combines **vessel motion** with **psychological** and **physiological** technician impacts to produce an **open access decision making model** for informing CTV launch
- **Opportunity** for Owner / Operators through provision of access to CTVs and technicians to increase data set

SIEMENS Ingenuity for life

ECN

University of Hull

MARIN

SMC

BMO OFFSHORE

Project Partners

ACT Blade

ACT Blade Ltd

Novel blade technology from sailing sector to renewables

- Two genuinely groundbreaking ideas:
    - a **textile** blade and a **modular** blade

Benefits

- Cost reduction
- Increased efficiency of energy production,
- More eco-friendly materials

ORE Catapult Support

- SMAR AZURE responded to Blade Innovation Challenge
- Identified funding avenues & co-developed bid
- Secured 3 rounds of Energy Catalyst funding (IUK)
- ACT Blade Ltd set up to exploit technology

Innovate UK

SMAR AZURE design and manufacture sails

Tekmar

ORE Catapult's Support

Replicated a full scale cable pull in trial in our shallow water test facility, to simulate the offshore operation of the Tekmar's cable protection system to key customers

Result

Tekmar secured an order for 92 TekTube systems for the Westermeerwind offshore wind project

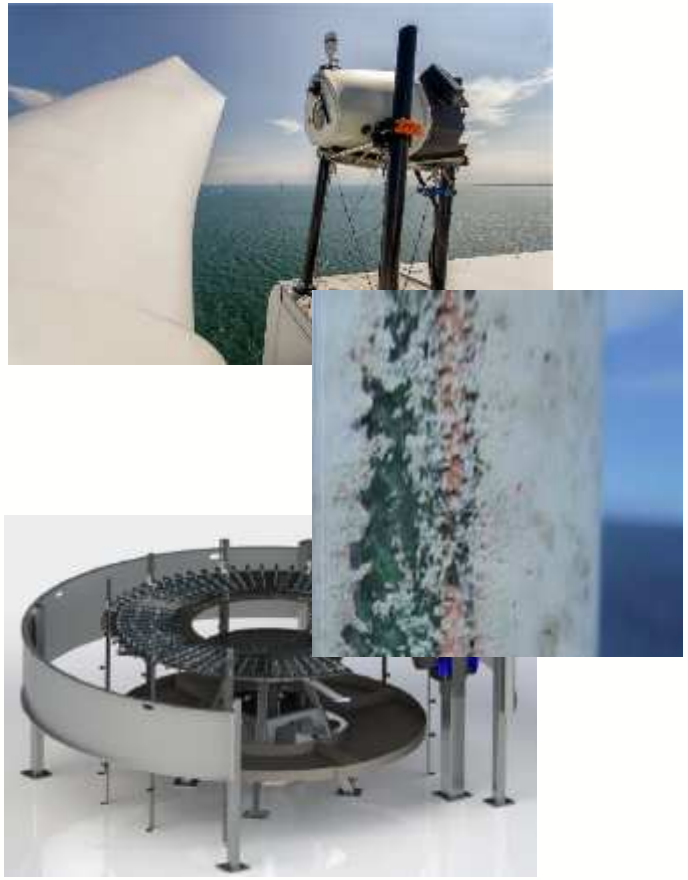
Pull in trial at ORE Catapult

Blade Leading Edge Erosion Programme (BLEEP)

Aim: reduce the cost impact of blade erosion

Ongoing activity:

- **BLEEP JIP**
  - 8 operators and 1 OEM
  - Assessing erosion degradation rates and the impact on power performance (in field)
- **Rain erosion test rig**
  - Recently installed at Blyth
  - Research & testing of new blade coatings & representative test methods
- **Erosion research**
  - ERODE – H2020 bid
  - Understanding the physics of blade erosion
  - Improving the resistance of coatings



Erosion on blade

MaRINET2

Providing subsidised rates for wind, tidal and subsea testing at ORE Catapult

- 39 organisations
- 57 test facilities
- 13 European countries

How to participate

- Competitive process for funding for companies outside of the UK (to use ORE Catapult's facilities)

www.marinet2.eu

Facility 1

50m blade test

1MW powertrain test rig

Facility 2

High voltage electrical laboratory

Materials laboratory

Facility 3

Marine and subsea

Contact us

GLASGOW

ORE Catapult
Inovo
121 George Street
Glasgow
G1 1RD

T +44 (0)333 004 1400
F +44 (0)333 004 1399

BLYTH

ORE Catapult
National Renewable Energy Centre
Offshore House
Albert Street
Blyth, Northumberland
NE24 1LZ

T +44 (0)1670 359 555
F +44 (0)1670 359 666

LEVENMOUTH

ORE Catapult
Fife Renewables Innovation Centre (FRIC)
Ajax Way
Leven
KY8 3RS

T +44 (0)1670 359 555
F +44 (0)1670 359 666

info@ore.catapult.org.uk
ore.catapult.org.uk