Supergen

Offshore Renewable Energy

Early Career Researcher Posters and Abstracts Booklet

2026 Annual Assembly

Surnames C-G

Engineering and Physical Sciences Research Council

Supergen Offshore Renewable Energy

Early Career Researcher Posters 2026

Xiaosheng Chen, University of Oxford Computational Modelling on Device Hyrdodynamics: Work Stream 1
Danny Coles, University of Oxford What is global electricity production potential from tidal stream energy?
William Coombs, University of Oxford Offshore Cable Burial: How Deep is Deep Enough?
Yusril Fatahilmi, University of Edinburgh Optimsing Thermal Management of Modular Electrical Machines for Renewable Energy Systems
Piotr Fojcik, University of Strathclyde Wake Detection and CHaracterisation Utilising Blade Loads and SCADA: a Generalised Approach
Olga Ganilova, University of Strathclyde Evaluation of erosion resistance of thermoplastic polyurethane coating for support structures in offshore renewable energy infrastructure
Jessica Guichard, University of Plymouth Experimental investigation of flexible riser for hydrogen transport from FOWT platform to seabed

CoTide

Engineering and Physical Sciences Research Council

Computational Modelling on Device Hydrodynamics: Work Stream 1

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[1]University of Oxford

Key Science Questions

1. How the hostile **current, turbulence, shear and wave** environment drive **unsteady loading**?
2. How can **blockage and multi-rotor systems and proven positive interference effects** be used to deliver **step change performance increases** in future tidal stream systems?
3. How **fixed-bottom and novel floating systems** can be used and designed to support **dynamically loaded turbines**?

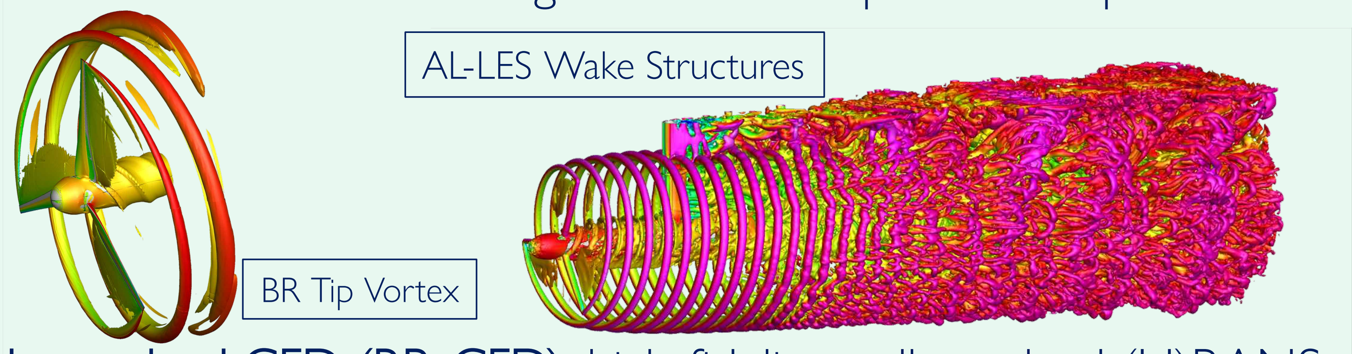
Methodology

We use a hierarchy of rotor simulation methodologies to address the 3 key science questions and inform engineering model development in WS5.

COST / ACCURACY: LOW → MEDIUM → HIGH		
BEM	**ACTUATOR LINE CFD**	**BLADE RESOLVED CFD**
Quasi-steady design tool Broad operational space	Unsteady; virtual blades 2D foil characteristics, empirical corrections	Unsteady; complex mesh, Specific case-studies only
Models for turbulence, waves, hydroelastics No blockage modelling	Wakes: with URANS/LES Rotor interaction effects	3D & complex blade flows Impact of waves, motion, coherent turbulence

I. **Blade Element Momentum (BEM)**: low-order method integrated in the multi-fidelity & multi-objective blade geometry optimisation tool for optimum blade hydrodynamic design, and in the integrated co-design tools for whole tidal systemsWS5.

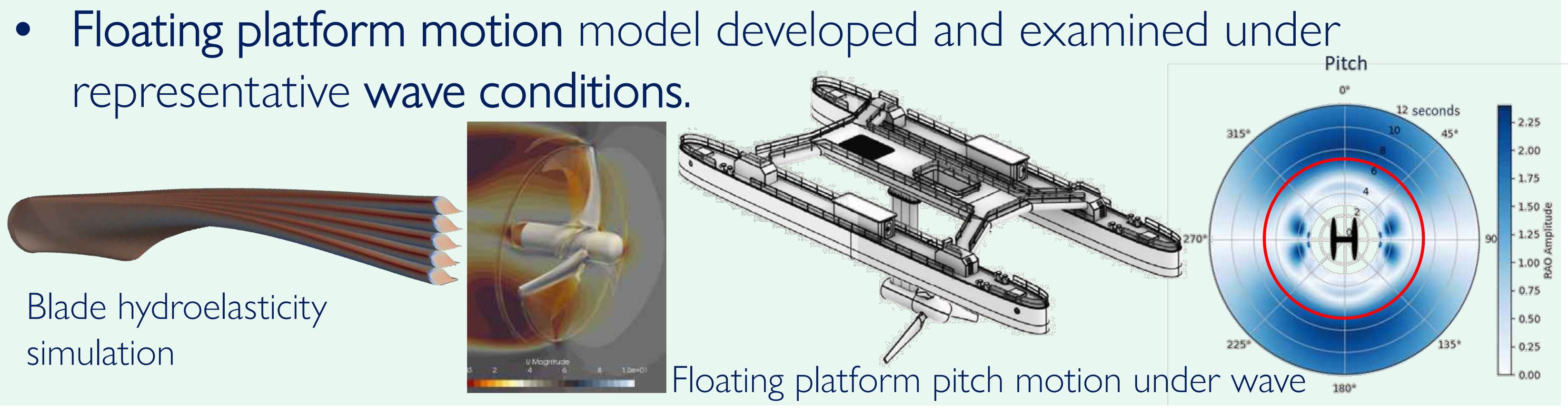
II. **Actuator Line CFD (AL-CFD)**: single and multi-rotor AL-RANS and AL-LES used to investigate performance differences from shear, waves, turbulence, wakes, device-environment and device-device interactions under different control strategies as well as operational spaces.



III. **Blade resolved CFD (BR-CFD)**: high-fidelity wall-resolved (U)RANS and DES used for detailed hydrodynamic investigation of blade tip, root and spanwise flows, cavitation, added mass and damping for rotor motions due to waves and platform motions, blade deformation and load amplification and relaxation through hydroelasticity.

Progress: Blade hydroelasticity and modelling of hydrodynamic structures

- **Blade hydro-elasticity** modelled under experimental and simulated blade loadings.
- **Floating platform motion** model developed and examined under representative **wave conditions.**



Blade hydroelasticity simulation

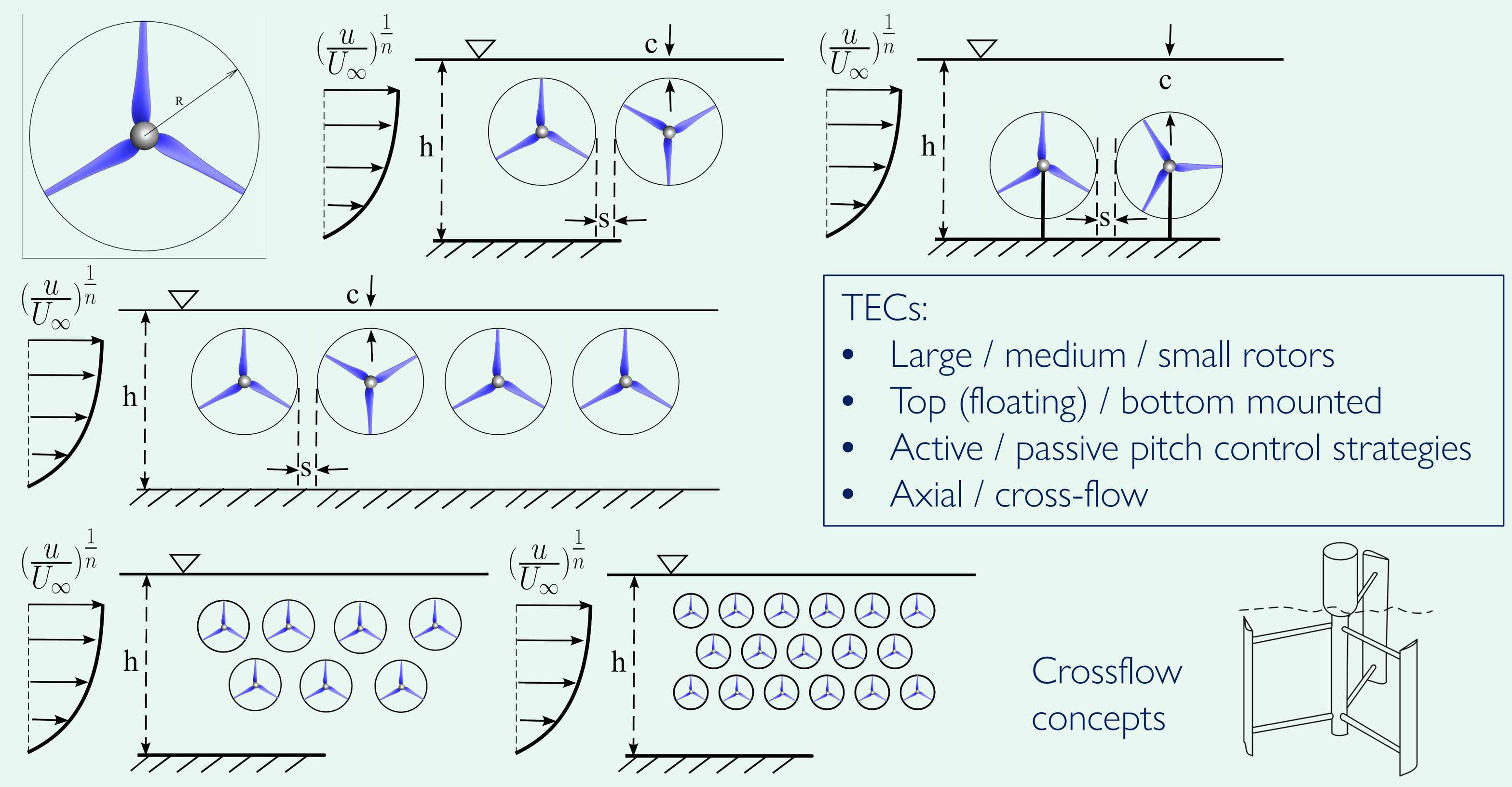
Floating platform pitch motion under wave

Objectives

- Develop knowledge of **steady and unsteady loading** of rotors in **shear, turbulence and wave environments**,
- Development of **engineering models** that build in new understanding,
- Device optimisation and designing in multi-rotor interference effects.

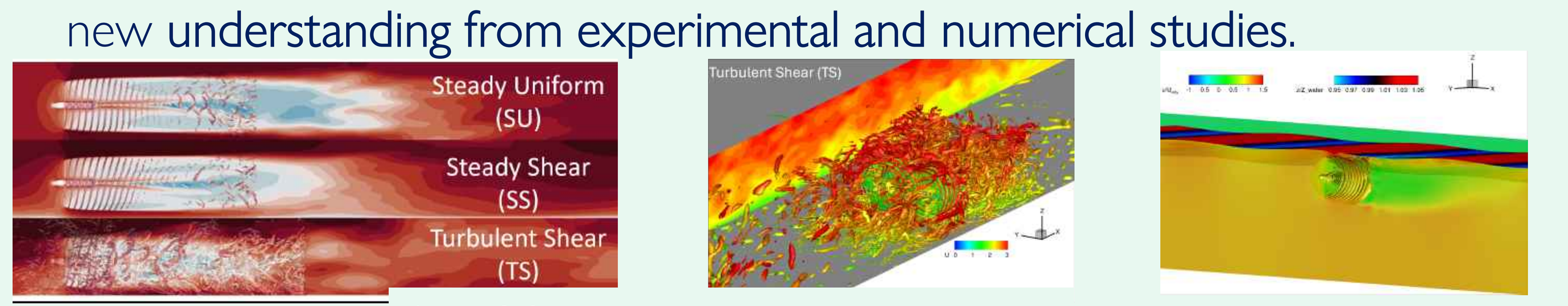
Progress: Tidal Energy Concepts (TECs)

- TECs generated by WS1 to cover a range of **different concepts** across plausible **tidal energy systems**, capture a range of **different design considerations**,
- Co-design process with WS2 and WS3 for **blade and support structures**,
- Generated TECs are being used by **WS4 for resource analysis** and **WS5 for co-design and optimisation**.
- TECs established for **different rotor types, sizes & arrangements** and **deployment strategies**.



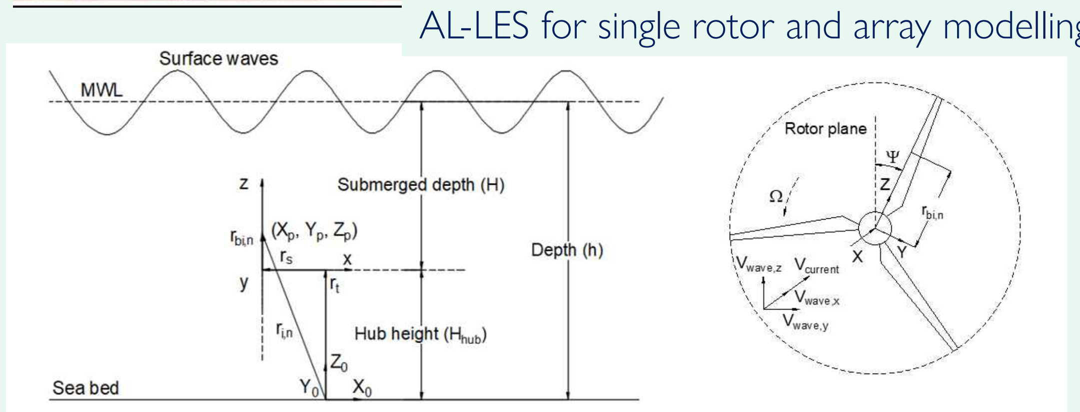
Progress: Rotor and Array Modelling

- Utilising **AL-CFD methods** with different sub models to investigate **rotor performance and unsteady loading under shear, turbulence and waves.**
- Validated **BEM model integrated into the** CoTide design tool bringing in new **understanding from experimental and numerical studies.**



AL-LES for single rotor and array modelling

AL-RANS wave-rotor modelling



BEM model include effects:
- Current
- Shear
- Wave
- Blockage
- Turbine motion

Acknowledgements

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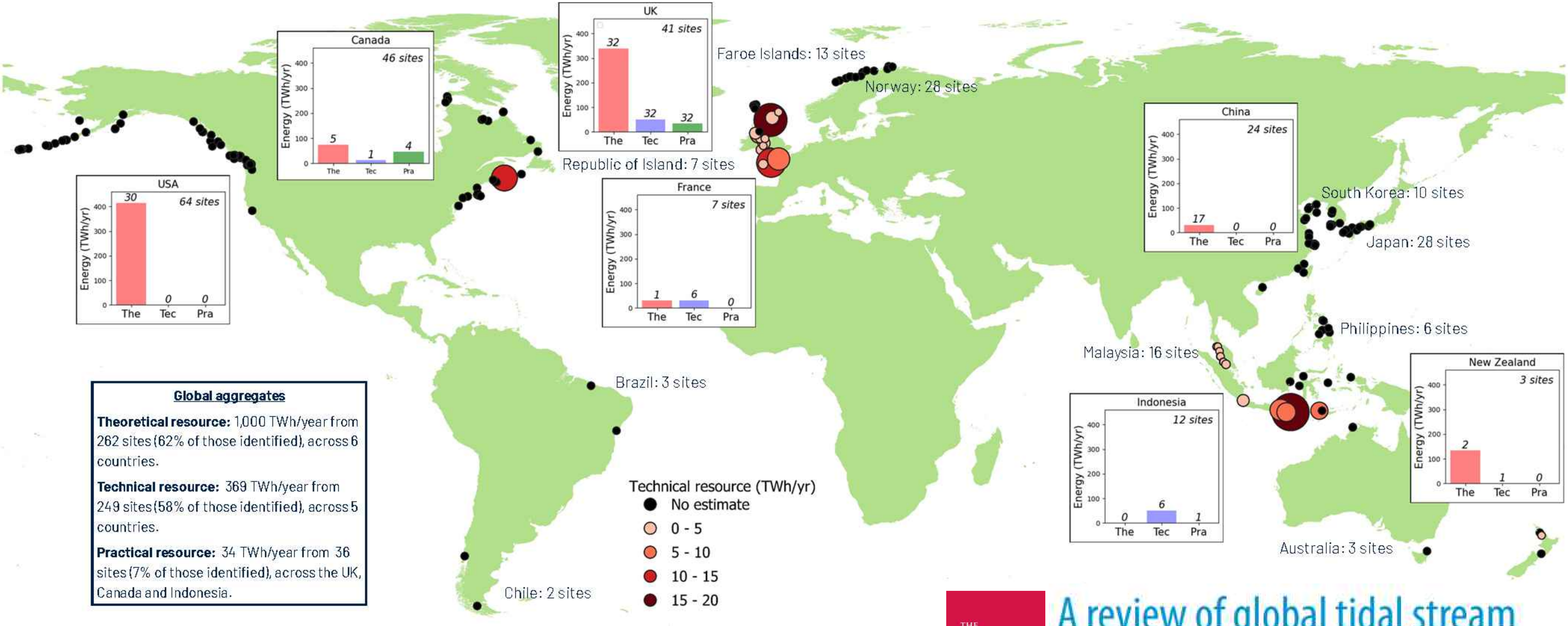
What is global electricity production potential from tidal stream energy?

DEPARTMENT OF ENGINEERING SCIENCE

UNIVERSITY OF OXFORD



Global aggregates

Theoretical resource: 1,000 TWh/year from 262 sites (62% of those identified), across 6 countries.

Technical resource: 369 TWh/year from 249 sites (58% of those identified), across 5 countries.

Practical resource: 34 TWh/year from 36 sites (7% of those identified), across the UK, Canada and Indonesia.

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THE ROYAL SOCIETY

A review of global tidal stream energy resources

Offshore Cable Burial
How Deep is Deep Enough?

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ABSTRACT

Context

Subsea power cables are essential to connect offshore renewable energy installations to electricity networks, to transfer power within networks and interconnect national networks. These cables are at risk of accidental damage; 2024 analysis showed that 70% of subsea cable damage is caused by anchors/fishing gear.

Cable Protection

The primary way to protect a subsea cable from anchor strike is to bury it below the seabed. The burial depth is a compromise between providing sufficient protection and the increasing cost of burial as depth increases. The standard approach to specify the burial depth is the Carbon Trust's Cable Burial Risk Assessment (CBRA) framework, which estimates the penetration potential of an anchor through seabed factors. These are broad classifiers that do not consider the variability within the groups or the potential for layers of different sediment types.

"industry as a whole would benefit from further research into anchor penetration in a range of seabed types"

Methodology

Seabed characterisation combined with centrifuge physical testing and advanced numerical modelling to provide enhanced guidance on likely anchor penetration depths in different seabed conditions.

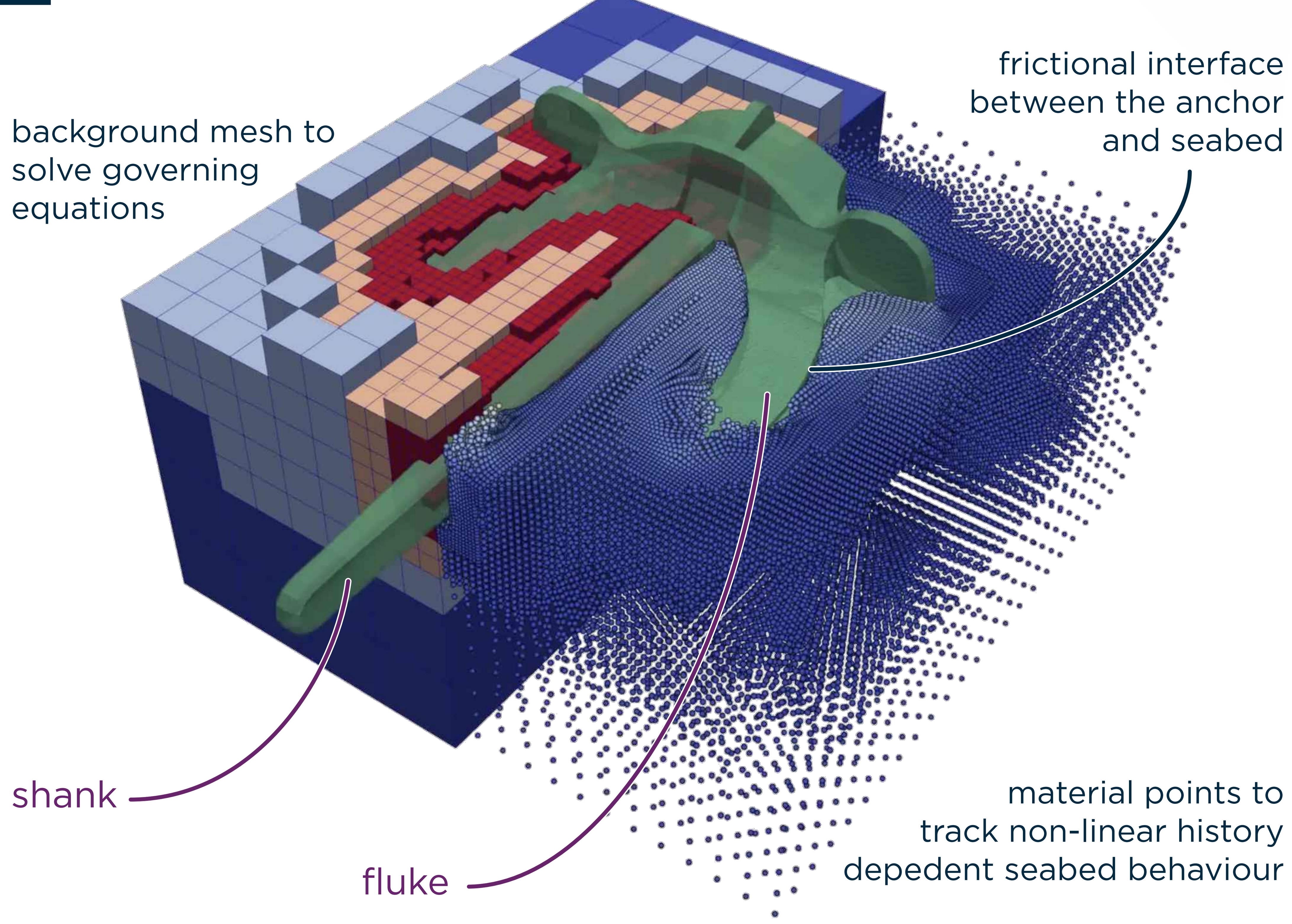
Results

Anchor penetration depths are highly dependent on seabed conditions and anchor geometry. Penetration depth scales linearly with anchor fluke length. Behaviour in layered seabeds is complex, anchor geometry dependent and site specific.

Conclusion

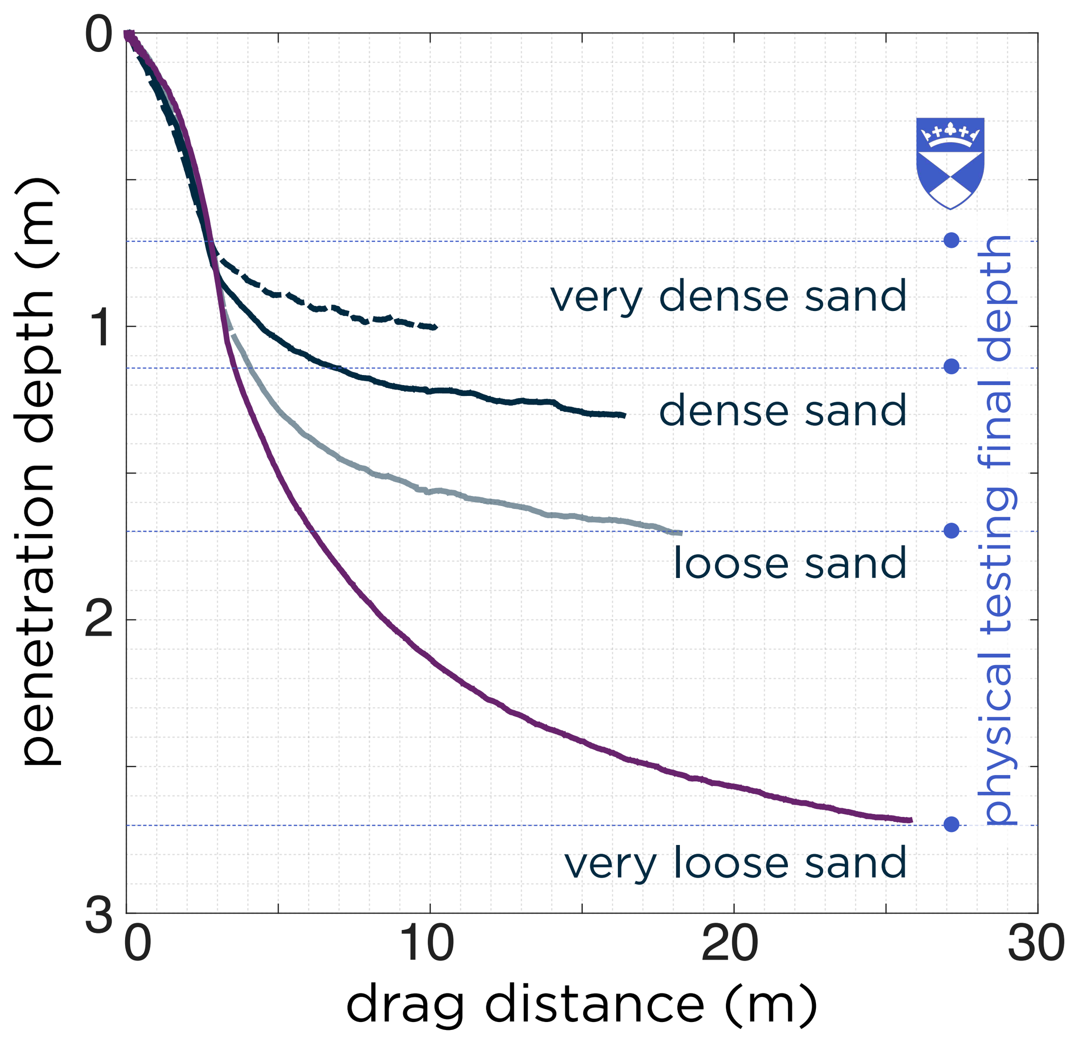
Overall, this project provides key insights and data for the next generation of CBRA approaches to better protect subsea cables.

1 Methodology: Material Point Method for soil structure interaction



2 Results: Seabed state

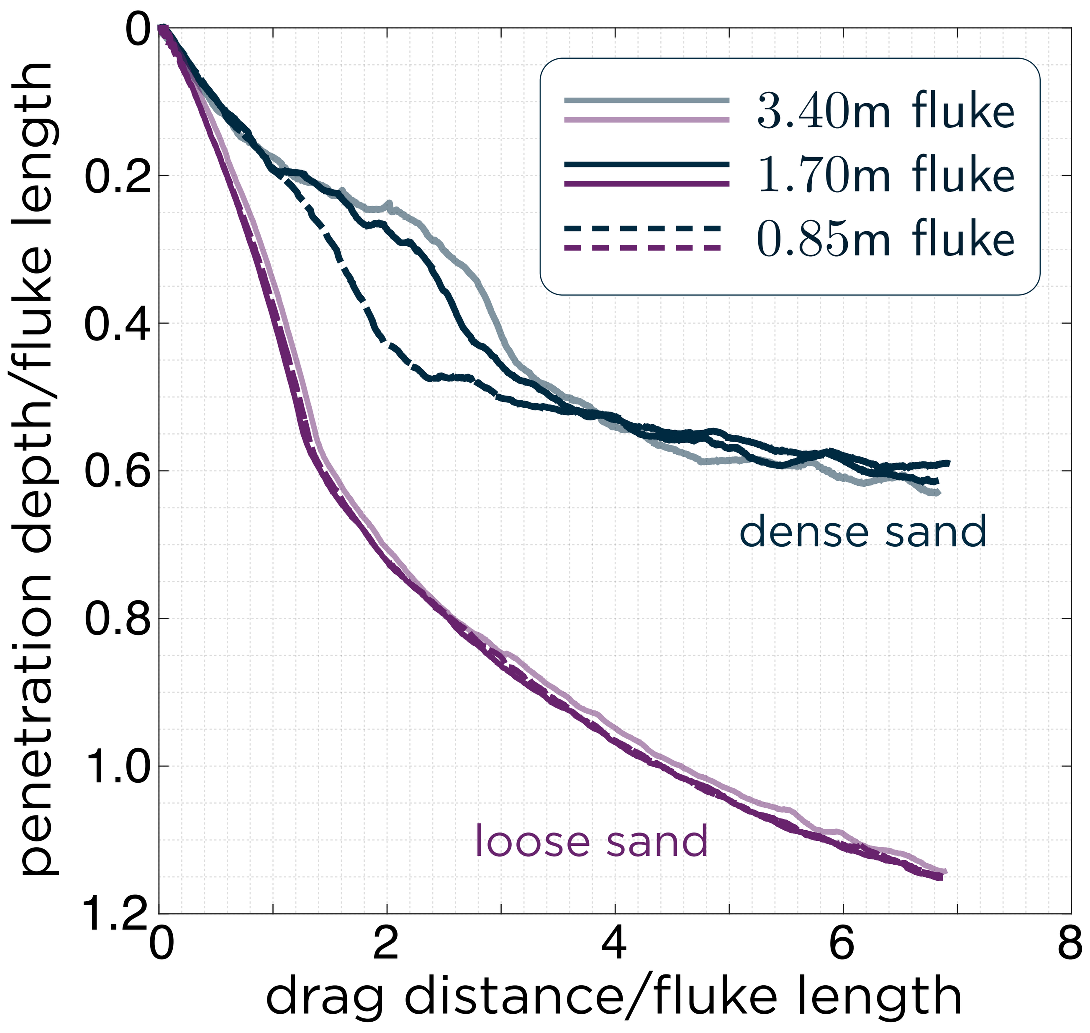
Hall anchor, impact of seabed state, validation with physical testing



- Anchor penetration is highly dependent on sand relative density.
- Numerical predictions validated through physical testing.

3 Results: Anchor size

AC-14 anchor, impact of anchor size in two seabed states



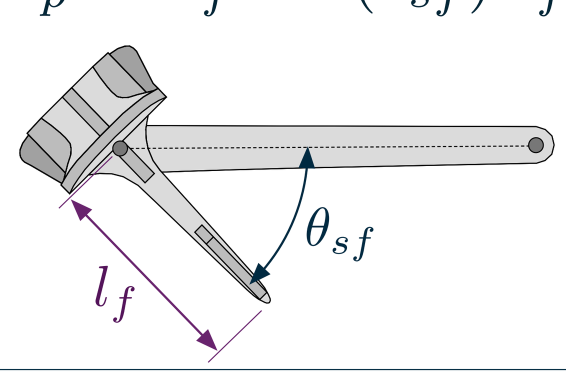
- Anchor penetration scales linearly with fluke length.
- Penetration is dependent on the full anchor geometry, not just fluke length.

4 Practice: Cable burial implications

$$d_p = S_f \ \sin(\theta_{sf}) \ l_f$$

CBRA anchor penetration predictions, d_p, incorrectly assume a common seabed factor, $S_f = 1$, for all sand seabeds.

Numerical modelling and physical testing have determined sand sebed factors between 0.8 and 3.6.



Durham University | University of Dundee | BGS British Geological Survey

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