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Reducing costs for subsea cabling installation and handling

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Abstract

Innovation across the supply chain is critical for cost reduction in offshore renewables. The Offshore Renewable Energy Catapult (ORE Catapult) has developed the Renewable Energy Technology Accelerator (RETA) programme to examine a number of research areas relating to offshore power cable installation and cable monitoring technology. Currently the OPEX costs for an offshore windfarm are a significant percentage of the overall costs; therefore, any improvement which can be made to reduce the O&M requirements on subsea power cabling could significantly improve the overall cost performance.

Objectives

The ORE Catapult RETA programme aims to make material progress in the design and installation of subsea cable technology, with the ultimate objective of improving the real-time understanding of the performance of these critical assets and, as a result, reducing the risk of outage by triggering appropriate and timely maintenance interventions. The approach is to undertake a number of collaborative industrial projects to further understanding in this sector and undertake industrial scale demonstration trials to verify the new technology.

Methods

The key innovations funded by the RETA programme include:

- An improved design of a cable trenching vehicle which includes novel concepts for an inter-array cable trencher with a tight turning radius. This is suitable for trenching towards an offshore foundation, with accelerated cable burial capabilities. The aim of this development is to help to reduce offshore wind farm installation and intervention costs, reducing vessel time and improving the efficiency of initial build out. This will also include improved traction of the trenching vehicle to allow greater manoeuvrability of the vehicle in various offshore terrains.

Figure 1. IHC Hi Traq trenching test vehicle

- Smart cable design and operation which includes the development of research around cable design and dynamic modelling of potential failure issues. This is achieved by a test programme of a power cable with condition monitoring technology to develop enhanced preventative maintenance schemes. The work carried out will provide valuable insight into likely in-situ cable performance, as well as helping to establish the key indicators of cable performance, to facilitate further analysis for optimised operations and maintenance interventions.

Figure 2. Physical testing process for Smart Cable: combined tension and bending

Results

The IHC trenching test programme demonstrated excellent manoeuvrability across a range of potential subsea terrain geometries including successful demonstration of 10m turning radii.

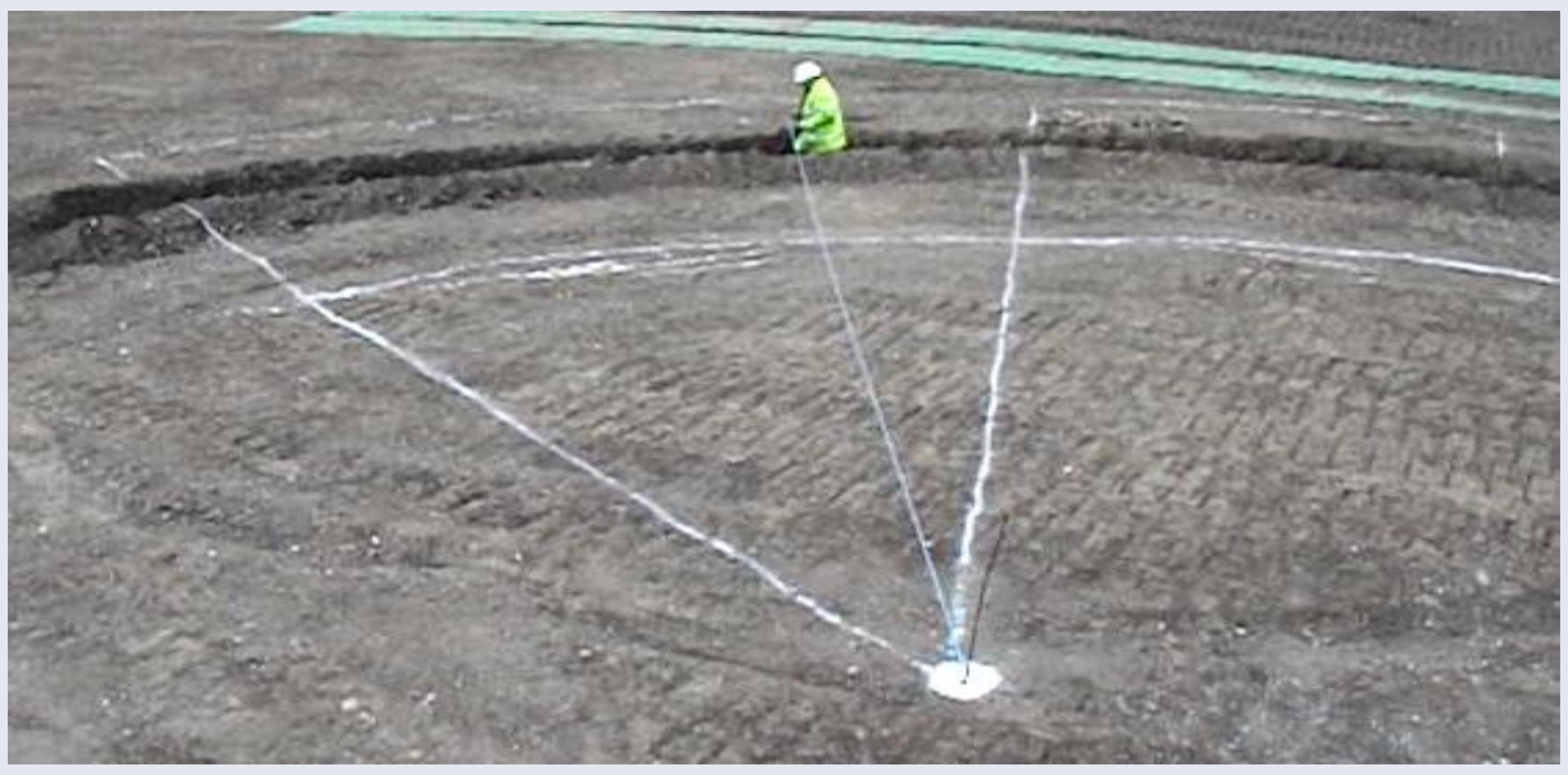

Figure 3. Demonstration of tight turning radius for trenching vehicle

Initial results of the smart cable testing programme, incorporating strain sensing Fibre Optic Cables (FOC) into a power cable, indicated:

- Measurement of longitudinal strain via the central FOC element; some level of measurement of strain due to tension by the outer layer FOC sensors, but limited sensitivity to bending strain;
- Strong correlation between FOC and measured ambient temperature;
- Results point towards a poor strain coupling between the cable structure and the sensors, though this varies under higher load regimes.

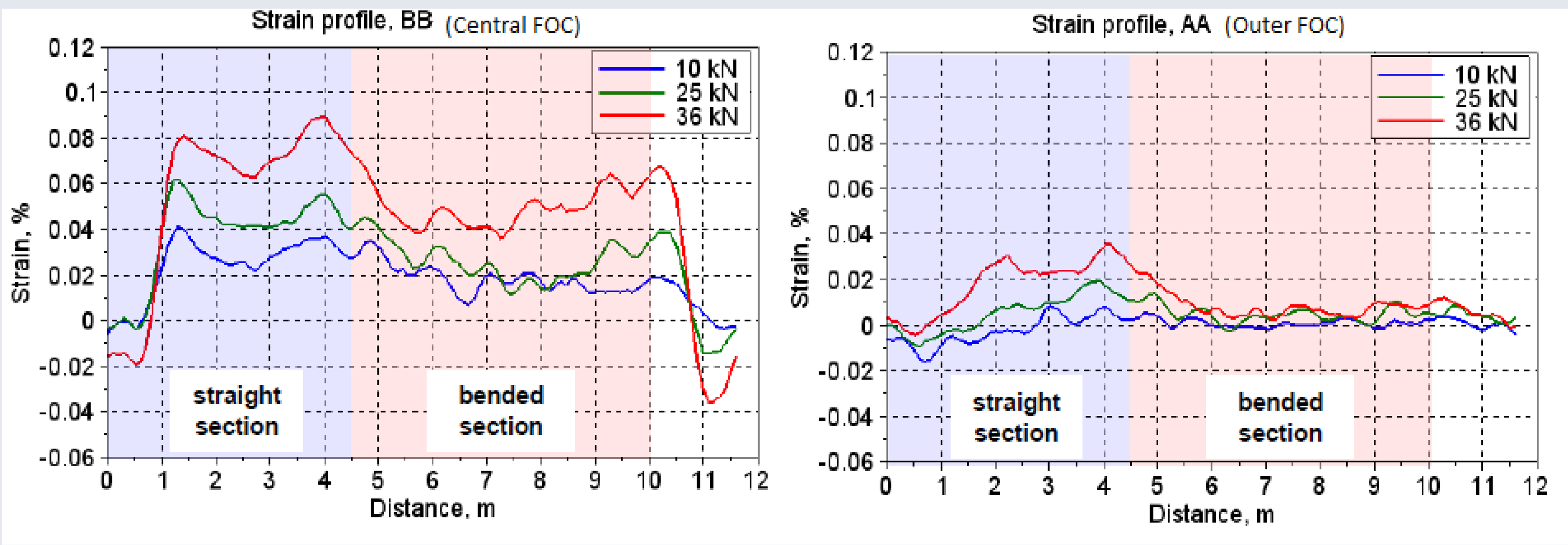

Figure 4. Example strain profiles: combined tensile bending tests indicating variation in strain coupling at different loads and FOC position

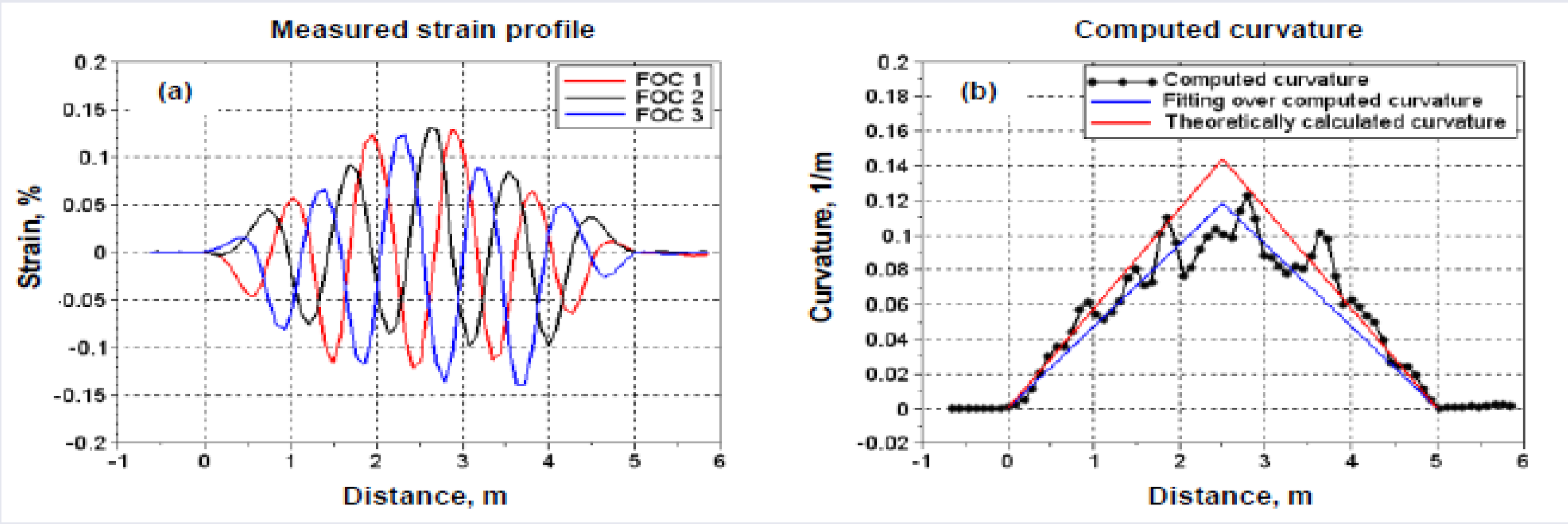

Figure 5. Proof of concept – measurement of bending strain and calculation of radius of curvature using FOC

Conclusions

Overall conclusions that can be drawn from the activity in the RETA innovation programme to date include:

1. The trenching vehicle has demonstrated significantly improved traction across a range of potential offshore subsurface topologies. This includes operating at across 20 degree slopes, undertaking a range of skid steering and trenching.

2. Proof of concept in the usage of the condition monitoring technology within a subsea power cable for temperature, tension and bending strain measurement with the potential to significantly improve understanding of likely in-situ performance and installation practices.

3. Strain results demonstrate variation in strain coupling between FOC and cable components indicative of variation in internal friction in the cable under varying loads; to improve the accuracy of the strain measurement results, enhanced coupling of the FOC to the internal cable cores will be required during manufacturing.

References

1. JDR Research Umbilical RETA: Bending and Tensile Test Data Analysis Report (September 2014)

2. IHC Hi Traq Demo Vehicle Project Summary report (April 2014)