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Innovative sea trials campaign for offshore cable shape sensing

The monitoring of dynamic subsea power cables is a highly critical topic for the development of the floating offshore wind farm. Whether for developers, transmission system operators or insurance companies, reliability is the key to success. Several monitoring technologies are available on the market, but few have been tested on a real cable in representative conditions offshore. To fill this gap, a unique sea trials campaign was successfully carried out from the 1st to 6th of July, 2024 in the Bay of Douarnenez, France. This experience has enabled the industry to break new ground in more ways than one: data acquisition at sea, using five different technologies simultaneously. The results will be published early 2025 after data post-processing.



The offshore wind sector needs to offer more competitive solutions and develop its industrial facilities to produce locally and in series. Furthermore, extending the offshore interconnection grid is vital if the energy generated by floating wind turbines is to be fully exploited. Dynamic subsea power cables are highly critical components. A proper monitoring of the cable network in the floating windfarm is crucial to enable trust, for bankability and insurability as well as for reducing the costs of maintenance operations.

Sea trials led in the framework of an ADEME supported project

In this context, the HT-20MW project, led by Eolink and financially supported by ADEME, Corimer, BPI France and France 2030, aims to design, test and certify a high-voltage rotating mechanical and electrical connection for a 20 MW floating wind turbine. As part of this project, France Energies Marines is in charge of the work on the monitoring solutions applicable to dynamic cables, including a sea trials campaign. This was a great opportunity to test, and challenge existing in-service solutions applicable to dynamic cable monitoring to improve them. The campaign consisted in deploying a cable, designed for a floating offshore wind turbine, in a lazy-wave configuration from an anchored ship. The objectives were to record the deformed shape in time and space and measuring local curvature radius and stress peaks.

A 1-week innovative campaign in the Bay of Douarnenez, France

The sea trials campaign was successfully carried out from 1st to 6th of July 2024, in the Bay of Douarnenez. The meteorological conditions allowed to successfully test the monitoring solutions under different conditions of swell, wind, water height and horizontal offsets. The innovation lies in the measurements carried out using simultaneously different technologies on a real dynamic cable at sea, and the valuable results obtained for data comparison.

The technologies deployed during the campaign were:

- Ultra-Short Baseline (USBL) beacons located on the cable and an Acoustic Doppler Current Profiler (ADCP) near the ship,
- Multi-Beam Echo Sounder (MBES),
- Distributed Acoustic Sensing (DAS) and Distributed Strain Sensing (DSS) through the communication fibres embedded in the cable,
- added Fibre Bragg Grating (FBG) sensors,
- Strain-Sensing Time-Domain Reflectometry (SSTDTR) using the cable conductive components.

Providing support to SMEs to raise the TRL of their solutions

Five companies have agreed to come on board the TSM Penzer to take advantage of this unique opportunity to test their sensor solutions in real-life conditions: CADDEN (Nantes, France) in partnership with Sonardyne (Yateley, United-Kingdom), FEBUS Optics (Pau, France), NKT (Lyckeby, Sweden), and Viper Innovations (Bristol, United-Kingdom). This was carried out as part of a call for expressions of interest launched with the support of the Pôle Mer Bretagne Atlantique. A sixth company, Exail (Paris, France) was contracted to monitor the cable shape with a multibeam echosounder as a reference for the trials. In the meantime, France Energies Marines recorded the position and movements of the boat and of the cable hang-off, as well as cable tension. This is a good illustration of the support that France Energies Marines can provide to SMEs in the sector to raise the TRL of their solutions. An exciting period of data post-processing will now begin. The results will be communicated early 2025, stay tuned!



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