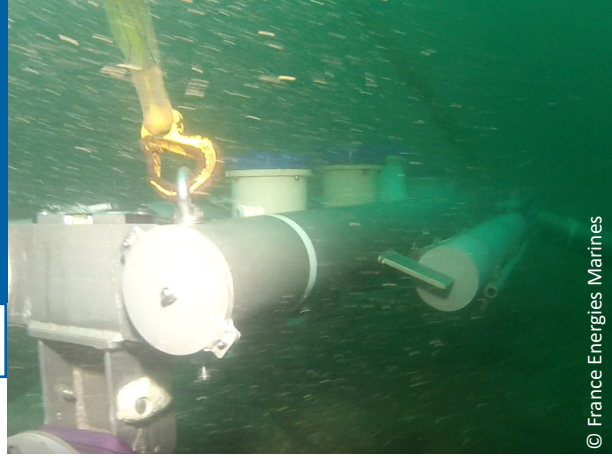
MUSCATTS

Multi-scale approaches at one tidal site

DURATION: 18 months (2018-2020) | **BUDGET:** €76 k



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CONTEXT

The lack of knowledge regarding the characteristics of fluid loadings at different tidal sites leads to certain limitations in the methodology used for fatigue estimation of mobile components such as blades and rotors. **Accurate prediction of component life is necessary to optimise their design and to complete the planning of maintenance operations. The structural definition of each component can be revised accordingly and new materials can be incorporated if the predicted durability is insufficient. Accurate fatigue prediction is therefore crucial to support the development of tidal turbines.**

OBJECTIVE

To improve the identification of complex fluid loads in an open tidal environment (waves and current) in order to improve performance prediction and fatigue design of mobile.

MAIN ACHIEVEMENTS

- Description of flow dynamics at the Alderney Race high-potential tidal energy site
- Proposal of formulations to take into account fluctuating hydrodynamic loads used in fatigue calculations
- Improvement of numerical models to accurately simulate complex flows
- Proposal of recommendations in relation to the specifications for tank tests

CONCLUSION

Current velocity measurements collected by 2 acoustic profilers coupled to 4 beams have allowed to characterise the turbulence in 3D over the entire water column in the Alderney Race. Assuming a tidal turbine aligned with the direction of the prevailing current, MUSCATTS showed that the main parameters likely to affect the structure are: turbulence intensity in the longitudinal direction, shear stress, normal stress and the vertical integral length scale. The turbulence intensity associated with the longitudinal direction was found to be higher than that estimated at other tidal sites around the world. The size of the most energetic vortices associated with the vertical direction is of the order of 10 m.

TECHNOLOGIES

STAGES OF THE VALUE CHAIN

Design

O&M

GENERATED RESOURCES

- **3D vertical profiles** of current velocity and turbulent parameters (turbulence intensity, integral scale, Reynolds tensor components)
- **3 publications** in open access :

  Sentchev *et al.* (2020) **New insights on tidal dynamics and tidal energy harvesting in the Alderney Race.** *Philosophical Transactions of the Royal Society A*, Vol. 378, 20190490

  Thiébaut *et al.* (2020) **Characterization of the vertical evolution of the three-dimensional turbulence for fatigue design of tidal turbines.** *Philosophical Transactions of the Royal Society A*, Vol. 378, 20190495

  Thiébaut *et al.* (2020) **Assessing the turbulent kinetic energy budget in an energetic tidal flow from measurements of coupled ADCPs.** *Philosophical Transactions of the Royal Society A*, Vol. 378, 20190496

PARTNERS

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Région Bretagne