

OFFSHORE DEMONSTRATION BLADE (ODB) PROJECT: LEADING EDGE EROSION SOLUTIONS



CASE STUDY



PROTECTING AGAINST BLADE LEADING EDGE EROSION WITH AEROSPACE-INSPIRED TECHNOLOGY

Protecting against the erosion of the leading edge of an offshore wind turbine blade is a major area of research and innovation for the offshore wind industry.

With offshore wind farms designed and built for a 25-year operational life span, ensuring that the wind turbine blades operate at maximum energy generating capacity for the life of an offshore wind turbine, often in harsh environmental conditions, is of paramount importance to keeping costs down and energy production up.

With the market for cutting-edge technological solutions to leading edge protection estimated to be worth around £120m annually over the next 10 years for UK businesses, the Offshore Renewable Energy (ORE) Catapult is now working to support leading offshore wind supply chain companies and equipment manufacturers to further develop and commercialise new products and services in blade leading edge protection.

The Catapult's engineering expertise, as well as our world-leading test facilities, are supporting the development of an innovative metallic alloy leading edge protection

“As part of our strategy to develop new applications for this proven technology, we engaged with ORE Catapult and utilised their specialist market knowledge to identify an opportunity for providing lifetime leading edge erosion protection on wind turbine blades, which could substantially reduce the operational maintenance costs of offshore wind farms.”

Steve Wainwright, R&D Projects Manager, Doncasters Bramah

85
HOURS

The test lasted 85-hours at accelerated tip speeds with no observable material degradation

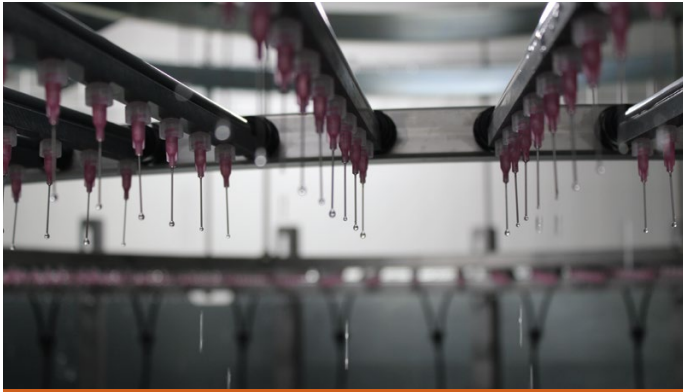


A highly innovative approach to blade leading edge protection, developed in the UK

3.2%

The leading edge solution could reduce the levelised cost of energy by as much as 3.2%

CASE STUDY



ORE Catapult's Rain Erosion Test Rig provides accurate and repeatable testing



Rain erosion solutions will lead to significant reductions in operating costs

system by Sheffield specialist aerospace component manufacturer Doncasters Bramah. The protection system is one of seven novel technologies under development as part of the EU Demowind-funded Offshore Demonstration Blade project, led by the Catapult and focused on the research, development and demonstration of wind turbine blade innovations.

Inspired by aerospace technology used in helicopter rotor blades, the metal alloy has extremely good erosion protection properties and acts as an erosion barrier. The metal is designed as an in-factory solution, applied to the blade through a process called electroforming. A copy of the blade geometry is used, and the alloy is 'grown' around the blade form.

Although initially more expensive than a paint-type leading edge protection solution, a metallic leading-edge solution could provide near lifetime protection for the blade, as well as the ability to withstand higher blade tip speeds. Higher tip speeds would lead to lighter turbine nacelles and reduced forces acting on the drive train. All this contributes to reducing the capital cost of the wind turbine by 6% and the operating cost by 3.5%, with a 3.2% reduction overall in the Levelised Cost of Energy (LCOE).

A sample of the metal alloy underwent an 85-hour test in the Catapult's rain erosion test rig at Blyth at an accelerated tip speed of 173 m/s. Normally, materials are tested to failure, but after 85 hours no degradation of the material was observed, and the test was stopped. Next stages include plans to retrofit the protection system to the 7MW Levenmouth Demonstration Turbine in Fife, to test it in real-world operating conditions.

The success of the initial testing phase has led to follow on projects, such as the Leading Edge for Turbines (LEFT) project, for which Doncasters Bramah has secured £200k funding from InnovateUK to further develop metallic protection solutions. The Catapult is also using its partnership with the University of Bristol in the Wind Blade Research Hub to sponsor a PhD student to study the incorporation of metallic and thermoplastic shield solutions during the blade manufacturing process.



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