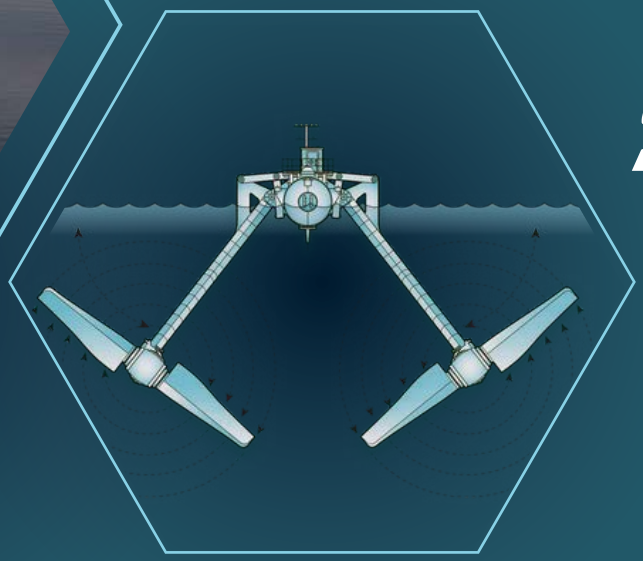


MAXBLADE

MAXIMISING TIDAL ENERGY GENERATION THROUGH BLADE SCALING & ADVANCED DIGITAL ENGINEERING

The Horizon Europe MAXBLADE project aims to reduce the generating cost of Orbital Marine Power's leading tidal stream technology by 20% though a range of blade focussed cost reduction innovations. This is part of a wider research programme incorporating the FORWARD2030 and EUROTIDES projects aimed at unlocking an initial 2,000 MW of tidal stream capacity in European waters.

OPTIMISING TIDAL TECHNOLOGY

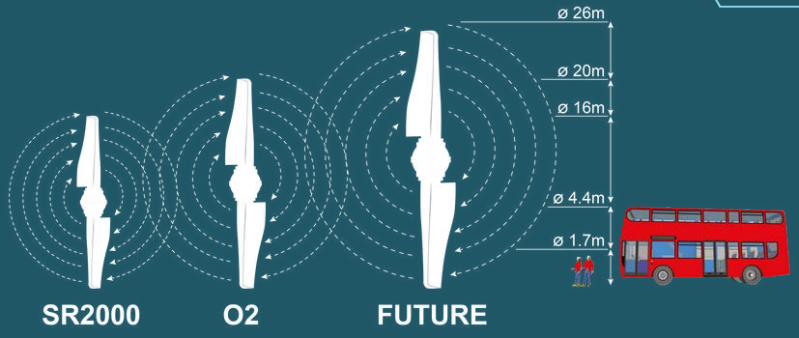
A key focus of the project is research and testing activities towards delivering a cost effective, reliable 13m tidal turbine blade. This scaling of the current blade swept area by 70% will increase project yield by a site average of 22%, significantly improving project economics.

MAXBLADE is also progressing innovations around tidal blade condition monitoring, array level power quality, tools for modelling tidal array wake interactions and array maintenance management. It will introduce circular economy principles into the tidal blade lifecycle and advance European leadership towards capturing the economic benefits associated with the emerging market for tidal blade products and services.

These innovations will be initially validated at University of Edinburgh's FastBlade test facility and Tecnalia's Harshlab before full system testing on 2 x Orbital O2-X tidal turbines to be installed at the European Marine Energy Centre (EMEC) in Scotland for a long term demonstration programme.

The project commenced in January 2023 and will run until June 2028.

The following presents a summary of key activities in the project, their relevance to the wider sector and opportunities for collaboration.



WWW.MAXBLADE.TECH

Co-funded by the European Union

UK Research and Innovation

Funded by the European Union and UKRI.
Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or UKRI. Neither the European Union nor the granting authority can be held responsible for them.

TIDAL BLADE TESTING AND DESIGN

The aim of the blade design and test programme is to develop a blade family for Orbital's tidal technology with a rotor diameter of up to 26m (the maximum diameter that would be typically deployed on a tidal site).

To achieve this, it was decided to implement a full hierarchical test programme by scale of component from material coupon (Level 2) to sandwich panel (Level 3) to spar beam (Level 4) to full blade (Level 5). Level 1 pure material testing has previously been completed by Orbital.

The testing programme commenced in mid-2023. A key focus to date has been qualifying material systems for use in the blade, particularly in ensuring that adhesive systems in key areas of the blade are fully optimised for maximum performance.

This has meant extensive laboratory testing of glass/carbon composite hybrid material systems with sophisticated structures which are differentiated for different segments of the blade. Tests have included tensile, compression, interlaminar shear and fatigue modes to determine all the associated properties and thereby establish fully de-risked design allowables for Orbital's overall blade design.

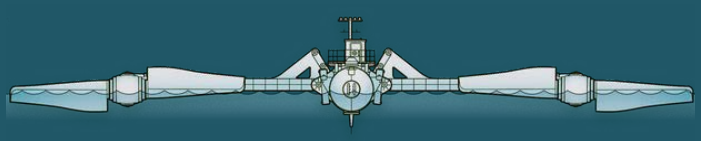
In addition, several larger scale sandwich panels and beams have been tested to determine the scalability of the material properties established in the lab.

In 2025, Level 3 testing will commence.

This will involves taking materials validated in Level 2 and fabricating larger structures to determine any effect of scale and geometry on the measured properties and performance of the laminates.

A large beam of composite, equivalent in scale and lamination to that to be ultimately used in the blade, will then be tested at FastBlade to understand the behaviour of the beam connection to the turbine in application and isolate certain behaviours that would be 'disguised' by other mechanical responses if a full blade were to be tested.

Finally, Level 5 testing towards the latter half of 2025 will involve the testing of a full-scale blade with all the key design features.



WWW.MAXBLADE.TECH

Co-funded by the European Union

UK Research and Innovation

Funded by the European Union and UKRI.
Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or UKRI. Neither the European Union nor the granting authority can be held responsible for them.

TIDAL TURBINE BLADES AND THE CIRCULAR ECONOMY

It is important prior to the wide scale deployment of tidal turbine technology that a strategy is developed for how circular economy principles can be applied to the sector.

Composite material presents recycling challenges. As such, the project is carrying out a thorough review of the current recycling capabilities and options for the composite blade sector, including what innovations with regard to materials, processes and design can be expected in coming years.

At a technical level, a range of tests are being applied to more recyclable thermoplastic materials, to understand their properties better for use in tidal turbine blades in the aspiration that that sector can make a transition to utilising more recyclable materials.

With respect to GHG emissions, a lifecycle carbon analysis of the current tidal turbine blade has been developed. Opportunities for reducing the GHG emissions associated with the manufacturing process of the updated blade design and the wider blade lifecycle will be assessed.

Following these activities, a circular economy roadmap for tidal turbine blades will be developed. This is being led by the University of Edinburgh and the European Composite Industry Association.

Research in applying circular economy principles to composite materials is a very active area of research and very pressing giving the large expansion also envisaged in the offshore wind sector.

We welcome interest in potential collaborations, including around exploring potential synergies in recycling or reuse options and facilities.

CONTACT

James Murray
Project Manager
j.murray@orbitalmarine.com

WWW.MAXBLADE.TECH

Co-funded by the European Union

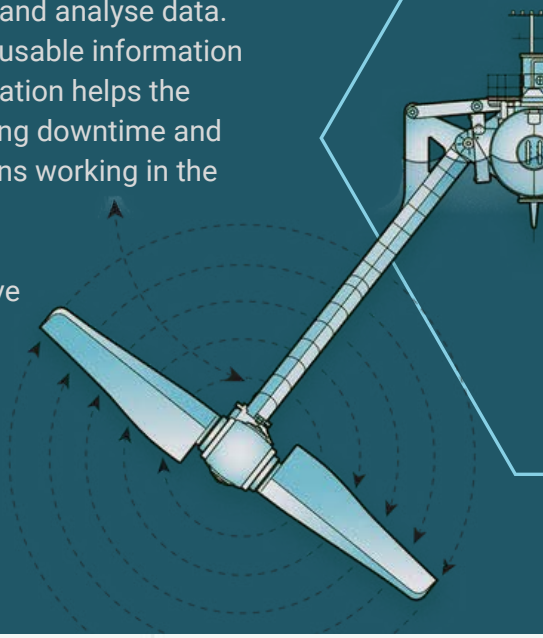
UK Research and Innovation

Funded by the European Union and UKRI.

DIGITAL TOOLS FOR MAINTENANCE MANAGEMENT

As the first tidal stream arrays are deployed, it is important that there is increased focus on how software tools can be applied to support technical management and reduce ongoing O&M costs and risks.

Orbital has been collaborating with Netherlands-based Marasoft in expanding the functionality of its proprietary fleet management software MARAD with a tidal energy module. This module can find the optimal maintenance window, plan tidal maintenance tasks and analyse data. Data is collected from various sources, combined, and transformed into usable information (e.g., algorithms to display tidal curves and other variables). This information helps the technical managers of tidal arrays to optimally plan maintenance, reducing downtime and costs associated with vessel usage, and minimising the risk to technicians working in the harsh offshore environment.



The functionality of the new module has been developed and an extensive testing process is underway. **MAXBlade invites other tidal developers interested in this new functionality to get in touch.**

Orbital will continue to collaborate with Marasoft through the Horizon Europe EUROTIDES project, increasing the functionality of the software to support larger tidal array developments.

WWW.MAXBLADE.TECH

Co-funded by the European Union

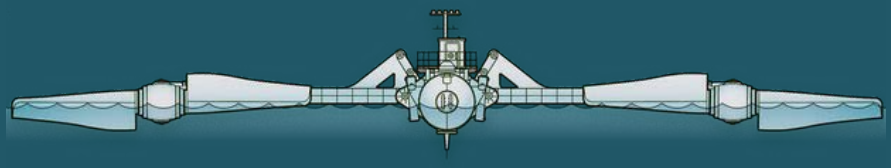
UK Research and Innovation

Funded by the European Union and UKRI.
Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or UKRI. Neither the European Union nor the granting authority can be held responsible for them.

TIDAL TURBINES

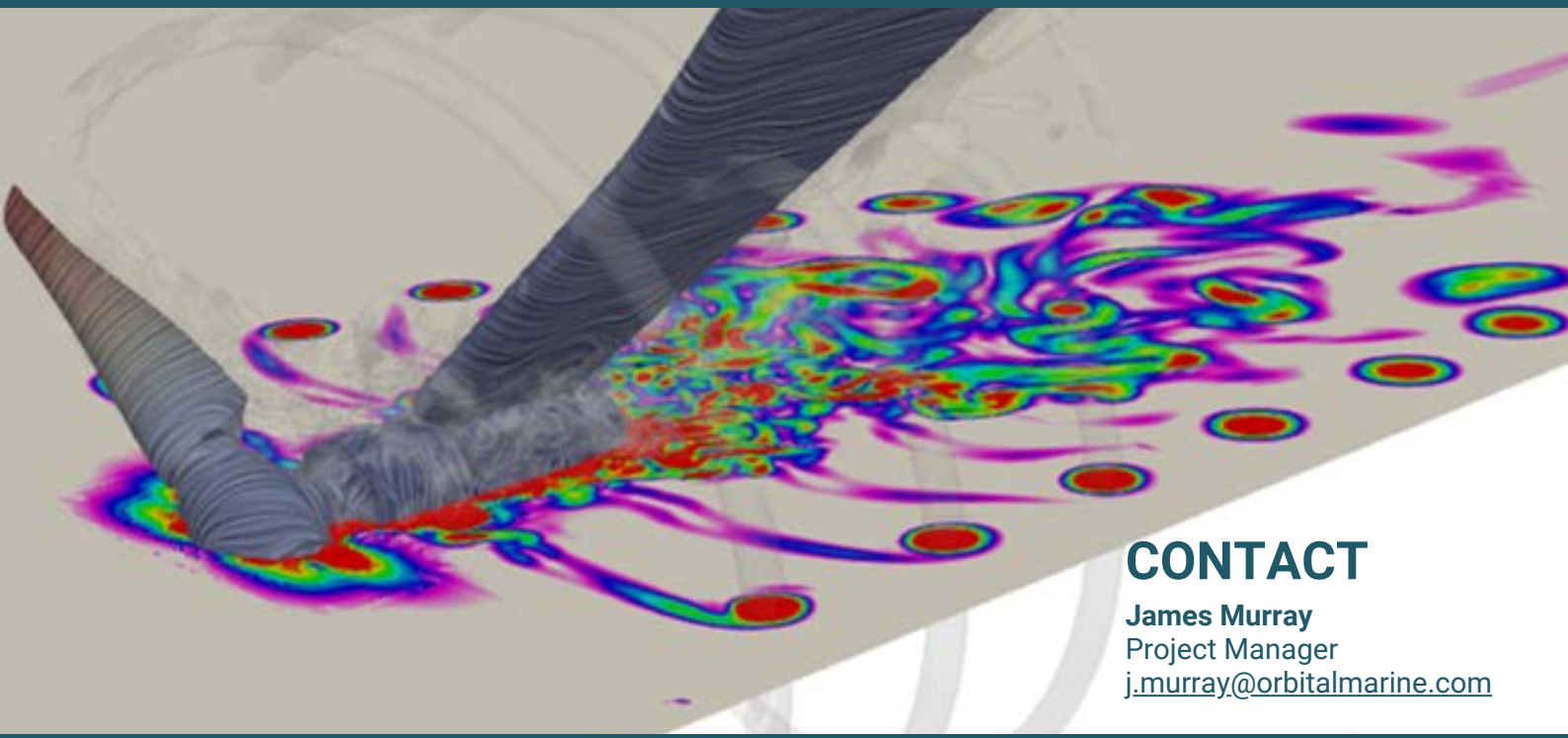
Compared to wind turbines, tidal turbines operate in blocked flow where the tidal current is impacted by the seabed, the tidal channel and the turbine blades themselves. Further research is required to better model these effects to support tidal farm design and energy yield predictions.

In this task, computational fluid dynamics (CFD) modelling is being utilised to better understand how blockage effects wake recovery. The outputs of the CFD modelling are being used to calibrate lower fidelity models which are in turn being incorporated into existing design tools that can more practically be used for array layout optimisation. Good progress has been made with the task due for completion in early 2025.



This area of research is likely to continue to be refined as more tidal farms are installed and additional data becomes available.

MAXBLADE partners welcome enquiries future collaboration.



CONTACT

James Murray
Project Manager
j.murray@orbitalmarine.com

WWW.MAXBLADE.TECH

Co-funded by the European Union

UK Research and Innovation

Funded by the European Union and UKRI.

MAX BLADE

EUROPEAN LEADERSHIP IN TIDAL TURBINE BLADES

The tidal stream industry is in an emerging stage and as such the opportunity to supply blade products and services represents a whole new growth opportunity for composites manufacturers, with the potential for European companies to take first-mover advantage owing to presence of first pilot arrays in European Waters.

There is also an immediate need to scale the supply chain to deliver tidal turbines blades in sufficient numbers for these first commercial projects.

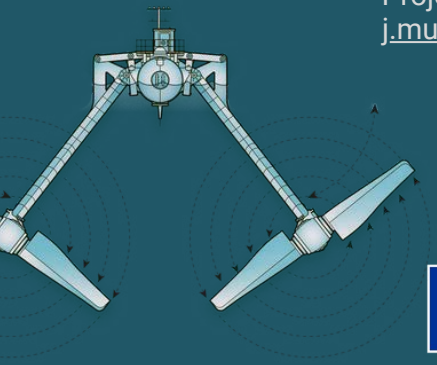
Within MAXBlade, a review is being carried out of the current capability of the composite sector to scale to meet this ambition including consideration of how European capacity matches up with international competitors and what policy and support mechanisms can support industry expansion. The focus is on identifying frameworks consisting of micro-economic factors that provide the level of detail required to shape and influence supply chain competitiveness of the European sustainable energy technology sector at a national level.

The consortium has engaged with a number of prospective European blade suppliers to understand their capabilities, techniques and facilities. This engagement work will form the basis of building relationships and confidence in potential suppliers, who in turn will work towards the supply of the full scale test blade and follow on O2-X tidal turbine blades.

The consortium welcomes enquiries from composites suppliers who many be interested in exploring opportunities for entering the tidal blade market as the industry expands.

CONTACT

James Murray
Project Manager
j.murray@orbitalmarine.com



WWW.MAXBLADE.TECH

Co-funded by the European Union

UK Research and Innovation

Funded by the European Union and UKRI.
Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or UKRI. Neither the European Union nor the granting authority can be held responsible for them.

ORBITAL MARINE POWER · TechnipFMC · tecnalia MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE · EMEC THE EUROPEAN MARINE ENERGY CENTRE LTD

THE UNIVERSITY of EDINBURGH · ENGIE · Laborelec RESEARCH & INNOVATION · marad · EuCIA European Composites Industry Association