

# MONITOR

## Multi-model investigation of tidal energy converter reliability

Fostering renewable energies and energy efficiency



**WP2 – Project Communication**

**Report on Developer Forum 1,**

**ICOE, June 2018**

# Revision

Revision no.	Revision Text	Initials	Date
1.0	Draft	CT	02.07.2018
2.0	Review first draft	LM MT	03.07.2018
3.0	Review second draft	All partners	10.07.2018
4.0	Final	CT	31.07.2018

# Project Information

<b>Project title</b>	Multi-model investigation of tidal energy converter reliability
<b>Project Acronym</b>	MONITOR
<b>Project Number</b>	EAPA_333/2016
<b>Programme priority &amp; Specific objective</b>	Resource efficiency
<b>Duration</b>	44 months
<b>Month 1</b>	August 2017
<b>Project manager</b>	Michael Togneri   Swansea University
<b>Work package leader</b>	Carly Tait   European Marine Energy Centre
<b>Work package number/name</b>	WP2   Project Communication
<b>Date of submission</b>	12.07.2018

# MONITOR Consortium

Organisation name	Country
Coláiste na HOllscoile Corcaigh	Ireland
European Marine Energy Centre	UK
Magallanes Renovables S.L.	Spain
Offshore Renewable Energy Catapult	UK
Région Normandie	France
SABELLA S.A.S.	France
Swansea University (lead partner)	UK
Universidade do Algarve	Portugal
Université Le Havre Normandie	France

## Copyright notice

© Copyright 2017-2021 by the MONITOR Consortium

This document contains information that is protected by copyright. All Rights Reserved. No part of this work covered by copyright hereon may be reproduced or used in any form or by any means without the permission of the copyright holders.

# Contents

1	Developer Forum at ICOE	1
1.1	Format of Developer Forum	1
1.1.1	Presentations	2
2	Promotion of the Developer Forum	3
2.1	Invitations	3
2.2	Press Release	3
2.3	Website	4
2.4	Social Media	4
2.5	Email Marketing	4
2.6	ICOE Programme & Website	4
2.7	ICOE Partner Presentation	5
2.8	MONITOR stand at ICOE	5
2.9	Promotional Leaflet	6
3	Summary	7
4	Appendix	7
4.1	Breakout Session Notes	7
4.1.1	Lab Modelling	7
4.1.2	In Sea Testing	9
4.1.3	Computer Modelling	13

## List of Figures

Figure 1   Project Partners preparing for Developer Forum. ....	1
Figure 2   Presentations from Swansea University, Sabella and Magallanes Renovables .....	2
Figure 3   Breakout sessions.....	2
Figure 4   Invitations.....	3
Figure 5   MONITOR website <a href="http://www.monitoratlantic.eu">www.monitoratlantic.eu</a> .....	4
Figure 6   Promotion on social media .....	4
Figure 7   ICOE website .....	5
Figure 8   ICOE Session on MONITOR.....	5
Figure 9   MONITOR stand at ICOE.....	6
Figure 10   Promotional Leaflet.....	7

## Abbreviations

Abbreviation	Definition
ATLANTIC AREA	AA
TIDAL ENERGY CONVERTOR	TEC
VARIATION MODEL EFFECT ANALYSIS	VMEA
INTERNATIONAL CONFERENCE ON OCEAN ENERGY	ICOE

## 1 Developer Forum at ICOE

The first Developer Forum to launch the MONITOR project was held at the International Conference on Ocean Energy (ICOE), from 12<sup>th</sup> – 14<sup>th</sup> June 2018, at Cité de la Mer in Cherbourg, Normandy, France.

ICOE is a prestigious international event focused on the industrial development of ocean energy. ICOE is supported by the International Energy Agency through Ocean Energy Systems.

ICOE aims at gathering stakeholders from the sector of ocean energies and sharing the most recent experiences on research, technology transfer efforts and technological demonstration. The purpose of the event is to accelerate development by stimulating collaboration between companies, researchers and development centres. It also targets engagement of operators with experience in related marine and power industry sectors.

Due to the ICOE being such a key marine renewables event, it was decided by the consortium that it would be an ideal platform to launch the project and hold the first developer forum.



Figure 1 | Project Partners preparing for Developer Forum.

### 1.1 Format of Developer Forum

The Developer Forum was held on Wednesday 13<sup>th</sup> June, from 13.00 – 15.00 at the Cité de la Mer. Holding the Developer Forum at ICOE ensured maximum exposure of MONITOR and allowed the project partners to target investors, project developers and the research community. The forum also ensured that the TEC industry was given the opportunity to input into the project.

An introduction and overview of the project was provided by lead partner, Michael Togneri, followed by presentations from tidal developers and project partners Magallanes Renovables and Sabella.

Participants were then split into three groups for breakout sessions, each of which were led by a project partner.

To conclude the forum, the next steps of the project were explained, and the project partners encouraged participants to provide feedback on the event and to contribute to the project going forward.

### 1.1.1 Presentations

An introduction and overview of the MONITOR project was provided by Michael Togneri, lead partner from Swansea University.

Pablo Mansilla from Magallanes and Erwann Nicolas from Sabella, both then provided an overview on their devices that are being monitored as part MONITOR.



Figure 2 | Presentations from Swansea University, Sabella and Magallanes Renovables

#### 1.1.1.1 Breakout Sessions

Participants were then split into three groups for breakout sessions, each lasted one hour and were led by project partners as detailed below.

1. Computer modelling: Michael Togneri, Swansea University
2. Lab modelling: Grégory Pinon, Université Le Havre
3. In sea modelling: André Pacheco, Universidade do Algarve



Figure 3 | Breakout sessions

The breakout sessions allowed for group discussion and debate on the different modelling techniques and enabled project partners to elicit feedback from the participants. Notes on the breakout sessions were taken and the key outcomes will be circulated to all project partners and added to the project website [www.monitoratlantic.eu](http://www.monitoratlantic.eu)

### 1.1.1.2 Developer Forum attendees

The Developer Forum was attended by 22 participants, 12 of which were not linked to the project. The target set for the project was for five developers to attend, so this developer forum has exceeded the target set with an additional 7 participants. A record of all participants, their organisation and signature was collected as evidence of their attendance.

## 2 Promotion of the Developer Forum

To highlight MONITOR as one of the most ambitious research projects in the tidal energy industry and to also encourage participation in the Developer Forum, dissemination was achieved through a multi-touch point campaign.

The communication tools used to disseminate information on the event included promotion on the following channels; website, social media, direct mail, press release, leaflets and promotion on the EMEC exhibition stand at ICOE.

### 2.1 Invitations

Invitations were produced to promote the Developer Forum at ICOE. The invitations were double sided, with the agenda on the reverse.



### LAUNCH EVENT INVITATION

at International Conference on Ocean Energy (ICOE)

Custom Room, 1<sup>st</sup> Floor, Centre des Congrès

13.00 – 15.00, Wednesday 13<sup>th</sup> June

RSVP – [carly.talt@emec.org.uk](mailto:carly.talt@emec.org.uk) to book your space and to receive further information on the event.

**The MONITOR project is investigating the reliability of tidal energy converters (TECs), and will work with industry to develop tools to improve device reliability.**

**Input into the project is valued by the project consortium and we would like to invite you to the MONITOR launch.**



**Project partners:**



[www.monitoratlantic.eu](http://www.monitoratlantic.eu)



### MONITOR Launch Event Agenda

Time	Presentation / Breakout session	Speaker / Facilitator
13.00 – 13.15 (15 min)	Introduction and overview of MONITOR project	Michael Togneri, Swansea University (Project lead)
13.15 – 13.25 (10 min)	Magallanes overview on MONITOR progress	Magallanes
13.25 – 13.35 (10 min)	Sabella overview on MONITOR progress	Sabella
<b>Breakout sessions:</b>		
13.35 – 14.35 (1hr)	* Please indicate on your RSVP which breakout session is of most interest to you.	
Breakout sessions will be supported by ORE Catapult and University College Cork.	1. Computer modelling	Michael Togneri, Swansea University
	2. Lab modelling	Grégory Pinon, Université Le Havre Normandie
	3. In sea modelling	André Pacheco, Universidade do Algarve
14.35 – 14.50 (15 min)	Next steps	
14.50 – 15.00 (10 min)	Q&A	Michael Togneri, Swansea University
15.00	Close	

Figure 4 | Invitations

### 2.2 Press Release

A press release promoting the Developer Forum was created and circulated via EMEC's press distribution list comprising of over 380 media contacts, spanning engineering and environment publications, local, national and international publications, including TV and radio.

Project partners also disseminated the release to their media contacts in their respective countries.



The press release and invitation were also circulated to approx. 130 public sector contacts and 600 industry contacts via EMEC’s developer newsletter.

## 2.3 Website

The MONITOR website [www.monitoratlantic.eu](http://www.monitoratlantic.eu) was launched the week prior to ICOE and was included on all the dissemination activity.

The website acts as a central point for communicating the projects key messages, news, photographs, events and will be updated with information on the project as it progresses.

The details about the Developer Forum were promoted on the Events and News section of the website.



Figure 5 | MONITOR website [www.monitoratlantic.eu](http://www.monitoratlantic.eu)

## 2.4 Social Media

The Developer Forum was promoted via EMEC’s social media channels and then shared by project partners to maximise exposure.

EMEC promoted the Developer Forum via their Facebook, Twitter and LinkedIn accounts, which has a combined audience of approx. 6,800 followers.



Figure 6 | Promotion on social media

## 2.5 Email Marketing

The Developer Forum invitation and information on the project was issued to EMEC’s mailing list consisting of over 600 key contacts in the marine renewables sector.

## 2.6 ICOE Programme & Website

The Developer Forum was promoted with a listing in the main ICOE programme catalogue and website, which provided extra exposure to the event.

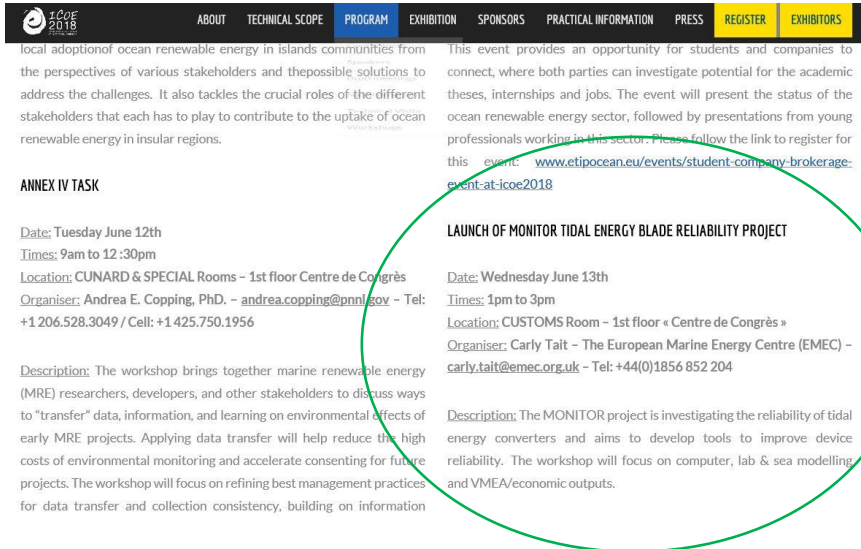


Figure 7 | ICOE website

## 2.7 ICOE Partner Presentation

Project partner Gregory Pinon from Université Le Havre Normandie gave a presentation on MONITOR. As well as providing the audience with an understanding of the projects aim and objectives, he was also able to promote the Developer Forum and encourage delegates to participate. The invitation was promoted on the auditorium main screen and the MONITOR promotional banner was also set up outside.



Figure 8 | ICOE Session on MONITOR

## 2.8 MONITOR stand at ICOE

The MONITOR project was represented on the EMEC stand at ICOE. EMEC's stand was 72 square meters and was in a central location at the conference, which in turn provided excellent exposure for the project.

The MONITOR stand consisted of promotional free-standing pod, along with a poser table to carry out meetings. The new MONITOR leaflet was also promoted on the stand and project partners were present to discuss the project with delegates visiting the stand.

Located at the heart of the EMEC stand was a private meeting room and inside the MONITOR promotional banner was displayed, again this gave the project additional exposure to key industry stakeholders.

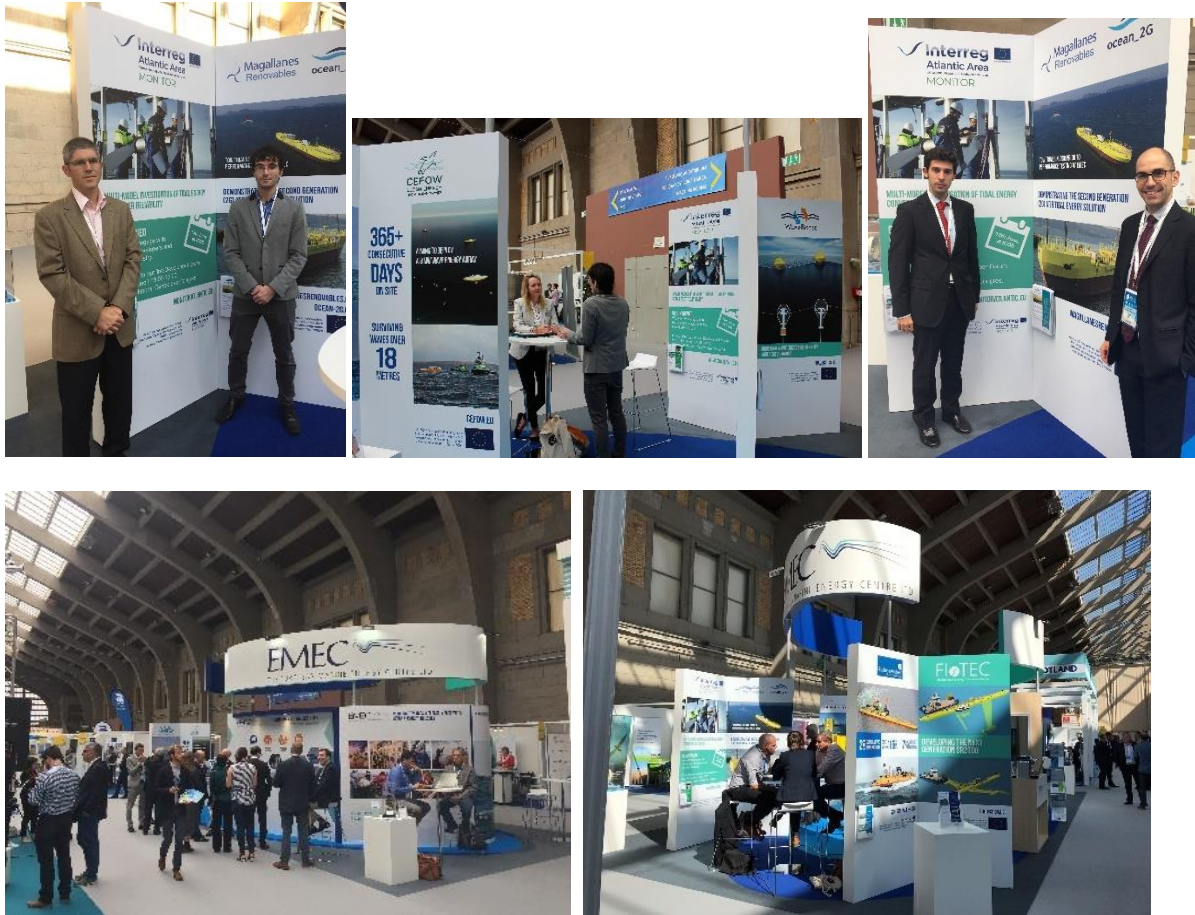


Figure 9 | MONITOR stand at ICQE

## 2.9 Promotional Leaflet

A promotional leaflet for MONITOR was created to provide our target audience with an understanding of the background and objectives of the project, it also featured details on the Developer Forum, encouraged people to sign up to mailing list and provided contacts for the project consortium.

The promotional leaflet was distributed to all participants that attended the Developer Forum and was promoted on the MONITOR stand at ICQE.

The leaflet was also promoted and available for download on the MONTOR website.



**MONITOR PROJECT**

The **MONITOR** project is investigating the reliability of tidal energy converters (TECs), and will work with industry to develop tools to improve device reliability.

Europe's Atlantic coast is one of the most promising regions of the world for the growth of tidal stream energy. However, while the industry is rapidly gaining experience in the deployment of individual turbines and pilot farms, a paucity of available data on device reliability limits investor confidence and makes attracting investment more expensive.

MONITOR will use simulations, laboratory tests and testing at sea to develop a monitoring system that can be applied to any tidal turbine. This will de-risk development, improve reliability and lower energy costs.

**The key outcomes and benefits of the MONITOR project will include:**

**RELIABILITY:** Providing tools and shared learning to developers to improve and optimize reliability of their TECs.

**FEASIBILITY:** Reduce risk in TECs, thus demonstrating feasibility to investors and public bodies.

**COST:** Lower cost to market TECs in the development phase.

**PERFORMANCE:** Contributors to low OPEX and increased TEC performance in the production phase.

**GROWTH:** Development of the tidal industry which will help foster growth of renewable energy sector.

**HOW CAN TEC DEVELOPERS GET INVOLVED?**

We will be holding two Developer Forums at the start of the project to allow developers and other industry stakeholders to input into the project. Input into the project is valued by the consortium and those interested in attending the Forums are welcomed.

*"Fostering renewable energies and energy efficiency"*

**LAUNCH EVENT**

The first Developer Forum will take place on Wednesday 13<sup>th</sup> June, 13.00 – 15.00, Customs Room, 1<sup>st</sup> Floor, Centre des Congrès, ICOE, Normandy. To book your space email [carly.tait@emec.org.uk](mailto:carly.tait@emec.org.uk)

**SHARING PROJECT OUTCOMES**

The outcomes of the project will be shared at a variety of workshops at academic/industry events. This will include the dissemination of the condition monitoring, reliability guidance and software tool developed by the project.

**13<sup>th</sup> June at ICOE**

**JOIN MAILING LIST**

To ensure you're kept up to date with the project and receive invitations to the workshops and events, please sign-up to our mailing list on the project website or email [carly.tait@emec.org.uk](mailto:carly.tait@emec.org.uk)

[www.monitoratlantic.eu](http://www.monitoratlantic.eu)

**MONITOR CONSORTIUM**

The MONITOR project is made up of a consortium of ocean energy experts, with over 30 years of combined practical experience in the sector. The consortium is led by Swansea University and includes the below partners.

**CONTACT US:**

To discuss the project please contact:  
Project Lead: **Dr Michael Togneri**,  
[m.togneri@swansea.ac.uk](mailto:m.togneri@swansea.ac.uk)

**FIND OUT MORE:**

For more information on the MONITOR project go to:  
[www.monitoratlantic.eu](http://www.monitoratlantic.eu)  
[#MonitorAtlantic](https://twitter.com/MonitorAtlantic)

Swansea University, EMEC, CATAPULT, UCC, UAlg, sabelja, Magallanes Renovables

June 2018

Figure 10 | Promotional Leaflet

## 3 Summary

Holding the launch Developer Forum at ICOE, provided an excellent platform to communicate the project aims and objectives. It also allowed the project consortium to gain feedback and guidance from wide range of conference delegates, to ensure the project in focusing on industry needs.

The consortium partners are delighted with the level of engagement from different stakeholders and value their contribution, which will ultimately maximise the impact of the project.

The MONITOR consortium will continue to engage with the contacts made at ICOE through the continued use of the project communications tools which have been developed. It is important that this dialogue is continued, to ensure that the consortium engage with the industry as the project progresses through the next stages.

## 4 Appendix

### 4.1 Breakout Session Notes

#### 4.1.1 Lab Modelling

Below is a summary of the feedback received from Jonathan Colby - (CEO Verdant Power/Chair IEC TC-114).

#### IEC Standards

- Jonathan (JC) first comment was that there was no mention of standards (e.g. IEC) in our presentation of the project. This is relevant to all phases (numerical modelling,

lab & in sea testing) but with respect to tank testing, the standards for tank testing of tidal devices have not yet been published and are still under development. He also suggested we have a look at the PT 62600-202, “Marine energy - Wave, tidal and other water current converters - Part 202: Scale testing of tidal stream energy systems”

([http://iectest.iec.ch/dyn/www/f?p=103:14:7155112893663::::FSP\\_ORG\\_ID:11835](http://iectest.iec.ch/dyn/www/f?p=103:14:7155112893663::::FSP_ORG_ID:11835))

- As the tank testing standards are still under development, there is an opportunity for the MONITOR project to contribute to the tank testing standards but also to apply the other relevant standards during our deployments and provide feedback on the applicability and usefulness of the standards.

### **Turbulence Intensity**

- The turbulence intensity used in the testing (12%) would generally be low compared to what would be seen in real world. However, JC agreed that it is difficult to achieve higher figures in tank tests.
- JC recommended a paper (Neary et al. 2013. Turbulent inflow characteristics for hydrokinetic energy conversion in rivers. Renewable and Sustainable Energy Reviews and Gunawan et al. 2014. Tidal energy site resource assessment in the East River tidal strait, near Roosevelt Island, New York. Renewable Energy) which may provide some guidance on the topic.

### **Sampling Frequency**

- The feedback from JC was that the sampling frequency used in the tank test (120hz) was very high. He felt this could be reduced by a factor of 10. He thought that noise may be a problem at this high a frequency and that a sampling frequency of 5-10hz would be sufficient.

### **VMEA**

- JC queried if there were any references available for the VMEA process. He had not heard of it before. He said providing references for the process would give tidal device developers more confidence in the process. He mentioned that the FMEA process, for example is very well established and would have an IEC standard, which Verdant power follows. This provides a degree of confidences in the FMEA process from the developer’s perspective. The uptake of the VMEA process may be difficult for developers if it is not as proven as other existing methods.

### **Other General Comments**

- The choice of developers in the project is good as it is broadly representative of the range of tidal technologies currently under development.
- He expressed surprise that only 1 week of tank testing was being undertaken for each developer. He felt this was short.
- He queried whether any field measurements or wake measurements we're being undertaken in the tank testing. He also asked if any shear profiling was being applied to the tank tests as a flat profile would not be representative of what is observed in real world.
- In terms of blade reliability, he mentioned that Verdant power has had blade reliability issues in the past but these issues were due to problems in the manufacturing process and not due to operational issues.

#### **Future Contact**

- JC, as IEC Chair, is open to any feedback the MONITOR project can provide to the IEC standard development process.
- Verdant power is open to partner with the project and discussing ways they can assist the project.
- Verdant are open to providing data to the project. If the MONITOR project can specify exactly the type of data, we would require (Torque/power etc) then Verdant will assess if this can be made available.

#### **4.1.2 In Sea Testing**

Chair- Andre Pacheco (Universidade do Algarve)

Minutes Anna Southall (EMEC)

Justine McMillan (Rockland Scientific), Chris Burden (SME), Erwann Nicolas (Sabella), Florent Guinot (Naval Energies), Jan Erik Hanssen (1-tech), Mark Ineal (Student at Nante Ecole Central).

#### **Introduction**

Andre introduced the agenda then each individual gave a brief introduction and their interest in the topic.

The Agenda that Andre aimed to cover:

What are the parameter values relating to hydrodynamics that you think are important to measure?

Can you specify equipment, variables you want to measure, acquisition frequency and sampling rates?

Which equipment you have (or plan) to deploy at your test site?

What are the structural characteristics that define your device?

How do you plan to measure load intensities on monitoring system i.e. which instruments/sensors your device has and what are they measuring?

Which parameter values outputted from your control system?

Does your system alert data users of possible problems?

Do you plan to develop event-detection methods using existing data sets to prevent failures? If yes how?

Would your device benefit from the development of advanced models of the loads on the rotors (i.e. instantaneous/fatigue loads?)

#### **Update from Andre Pacheco (Universidade do Algarve)**

Andre is supporting real sea testing in the MONITOR project. Through the project Andre is looking to validate hydrodynamic models of the Fall of Warness and the Fromveur strait, the two test sites being utilised in the project. The key areas of site characterisation/interest include:

- Measurement of inflow velocities
- Turbulence intensity (both site measurement and modelling)
- 3D flow patterns

Then compute load intensities from environmental modelling. Andre will aim to visit both sites, review the monitoring equipment used/available and any impact of the configuration/mounting. Investigate the condition monitoring and data requirements and environmental equipment. In terms of equipment he will use Nortek signature as they are high frequency for Turbulence intensity characterisation.

He would like the group to debate parameter values and hydrodynamic values.

**Action:** Andre and EMEC to discuss what historical data could be available to assist with his model of the FoW. The data will already have been made available to Magallanes. Will EMEC have access to the model/results?

**Action:** Andre, EMEC and Magallanes to discuss what data collection opportunities there are during their deployment.

### **Erwann Nicolas (Sabella)**

Sabella would like to better characterise the site so that they can improve their models, particularly around blade design and the effects of turbulence. As well as working on this through MONITOR they are also involved in the real tide, project lead by Brian Sellar at the University of Edinburgh, which also aims to characterise the Fromveur Strait.

Sabella are interested in the small load variations- Torque and other mechanical loading and impact of power output. They are looking to get one year of ADCP data at high frequency to understand the impact of waves. Looking to record Turbulence Intensity, Wave orbitals, wave current interactions.

Sabella have previous experience at the site. There are no local wave measurements to compare the data they collect to. The nearest wave measurement instrument is 30km away. While the site is sheltered by the island of Ushant island they have experienced swell propagating to the site when the wave period is over 8-9 seconds, it has a noticeable impact on power output despite the site depth of 50m. There may be distortion of the waves, they are also looking to get the radar data set from the lighthouse. There is no met station nearby.

### **Chris Burden (SME)**

SME are a platform developer working with Schottel Hydro who supply the turbines. The blades for this device are fixed but passive adapted technology that flex and deflect. SME recently deployed at Connel and monitored the following:

- Flow Velocity
  - ADCP sentinel V used to measure velocity but not waves as it's a very sheltered site but high turbulence intensity)
  - Vale port
  - ADV
- Platform motions
- Load pins

There next deployment is planned to be at FORCE with SURFTEC, in addition they are looking to strain gauge the carbon blades. Will now look for wave measurements, thrust rpm and torque. Not yet grid connected but will be so interested in cable stability. Also, for longer deployments anchor and mooring line fatigue. To date in terms of experience angular load cells have been troublesome (*not specific as to what the issue was*) but load shackles have been good. SME interest is in understanding best practice of what can and should be monitored and feeding that into their future tests.

### **Justine MacMillan (Rockland Scientific)**

Rockland are an instrumentation supplier and focus on shear probes that sample as high as 200kHz. These are suitable for monitoring turbulence at small length scales but not large length scales. The data collected from the instruments can be used to calculate length scales and dissipation rates as well as working on development of analysis techniques to complement the instrument measurements.



Justine identified an issue in the industry at present is that a lot of data is collected but often not thoroughly analysed. There is a shortage of competent people able to spend time processing the data so that rigorous processing and analysis can be performed. That will be required if the industry is looking to converge on what should be measured, the best configurations and the most useful analysis and metrics. Accurate measurement of turbulence is required so that we are simulating turbulence correctly in the models which are then used for design or resource assessments. There was consensus around the table that there should be less of a focus on quantity of data but more on the quality of the data and detailed analysis.

Justine also commented that the isotropy of the flow is important. Reviewing from a statistical perspective important.

### **Florent Guinot (Naval Energies)**

Florent experience has mainly been around site characterisation for the bottom stability of cable and connectors. Open hydro have also gained experience of hub height monitoring and general characterisation. They have one month of data at 16Hz. It is key that the frame is not shaking and does not move so can't be light. Their experience at this frequency is to avoid the gimbals as it vibrates and moves. It is better to install a fixed instrument in a heavy base and use divers to check it is level.

An additional comment, that again there was consensus around the table on is that when using an ADCP to monitor for turbulence using a unit without a gimbal and checking it is level when it is deployed is important for the quality of the data.

### **Jan Hanssen (1-TEC)**

Engaged in real tide - working on communications package.

### **Mark Ineal (student at Nante Ecole Central)**

Specialising fluid dynamics so attending conference as curios about industry.

### **Additional comments**

Measurement of loads and fatigue analysis and what these are correlated with.

Numerical models

Want to monitor deflection with load cells to calibrate Finite Element Models (FEM)

Blade is stiff with low deflection. Hard to get instruments with the granularity to measure small loads that will be key to assessing high cycle fatigue.

For those going to EWTEC September 2019 there will be a real tide workshop.

### 4.1.3 Computer Modelling

Vicky Coy – ORE Catapult (VC)

Pieter Mathys – University of Ghent (PM)

Michael Togneri – Swansea University (MT)

---

PM - Ghent use a mechanical model of carbon layouts and iso-elastic model of offshore wind blades – coupled together. Looked at 300kW turbine blades. Internal models built by Ghent. Not yet available. Still validating models.– Predict stress and fatigue loads in turbulent flows and physical impacts from floating/semi-submerged objects on blades. They are looking at flexible blades to reduce mechanical stress on shaft, bearing and generator of these stress loads. Optical fibres are embedded in the blades. Not yet tested on marine blades, only 300kW wind turbines. Wait to do CFD modelling to the end (BMT model now to inform lab and at-sea testing). Only use the expensive models at end of pipe. Use the CFD to derive an engineering model. Industry preference is for numerical models that are fast over models that are detailed, as long as their results are validated and reliable.

MT - VPM model at Le Havre isn't full CFD but can predict wakes. Le Havre Uni has looked at wakes from IFREMER tank test with three turbines and validated against models.

PM – How can we combine CFD with deterministic models?

VC – Noted that EnFAIT project will look at wakes and model prediction. It does not look specifically at reliability.

MT – What would you prioritise – low number of high fidelity or large number of low fidelity?

PM – False dichotomy - likely a mix of both, to get the best of both worlds. Feed operational data into BMT model and vice-versa. Look at what certification companies are looking at in order to de-risk through 3<sup>rd</sup> party verification.

MT – What will certification companies accept? What sort of VMEA tool is most useful for industry?

PM – Stand-alone models are in the past. Need a model that would interface with other models. Needs to pre-process boundary conditions. Needs to be able to daisy-chain with other models. It would be useful if VMEA could ease the process of processing boundary conditions.

MT – Where are the biggest gaps in models for predicting reliability?

PM - Error propagation through models, so end up with over-engineered designs. Witnessed this through wind turbines – mismatch between failures and design safety factors.

MT – Are there particular cases where it would be valuable to combine two testing methodologies together? E.g., lab & in-sea?

VC – Likely to seek to combine methods at an early stage in order to make savings at the earliest stage in the design and development process.

PM – Tocardo device tested, but tests were not yet validated.



**This project is co-financed by the European Regional Development Fund through the  
Interreg Atlantic Area Programme**

**[www.monitoratlantic.eu](http://www.monitoratlantic.eu)**