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Marine Renewables Research in the Low Carbon Research Institute

Miles Willis
Project Manager LCRI Marine



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Overview



- Low Carbon Research Institute
- Identifying the challenges
- Sites
- Large scale effects
- Environmental interactions
- Engineering interactions
- Surveys
- Knowledge Transfer



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Low Carbon Research Institute for Wales



“Uniting and promoting energy
research in Wales”

- Photovoltaics
- Hydrogen Energy Systems
- Marine Energy
- Bioenergy
- Low Carbon Built Environment
- Large Scale Power Generation



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LCRI Marine Academic Partners



- Aberystwyth University
- Bangor University
- Cardiff University
- Pembrokeshire College
- Swansea Metropolitan University
- Swansea University

7 Professors, 15 academic staff, 19 Research Assistants,+ PhD and Masters students



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Knowledge “bottle-necks”



Effect of Devices on Environment

- Multi-use environment
- Site selection
- Large scale effects
- Coastal processes
- Marine mammal, fish, bird, cetacean interactions
- Underwater noise
- Water quality

Effect of Environment on Devices

- Engineering considerations, loading, materials
- Device optimisation
- Turbulence and wave modelling
- Device design and assistance to SME's
- Oceanographic surveying in hazardous conditions



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Sites (Swansea University)

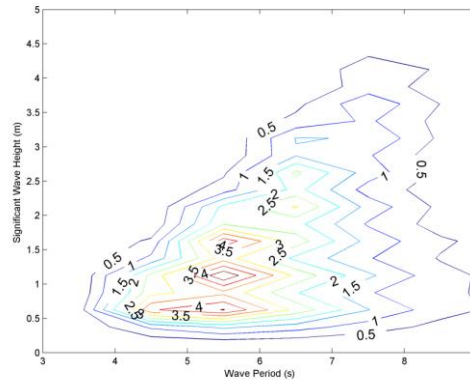
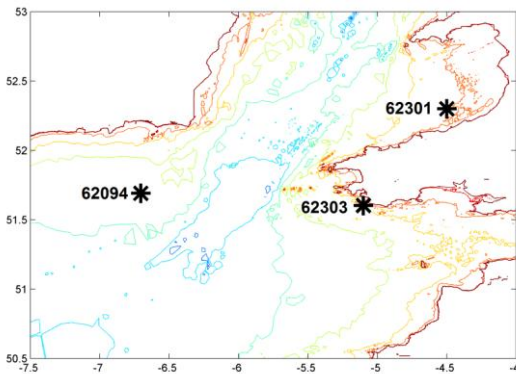


- Conduct research to assist site selection
- Wave and tidal
- Strategic Environmental Assessments
- Impact monitoring
- Research to inform policy
 - Requires dialogue with Welsh Government, NGO's, Industry and Crown Estate
- Economic considerations

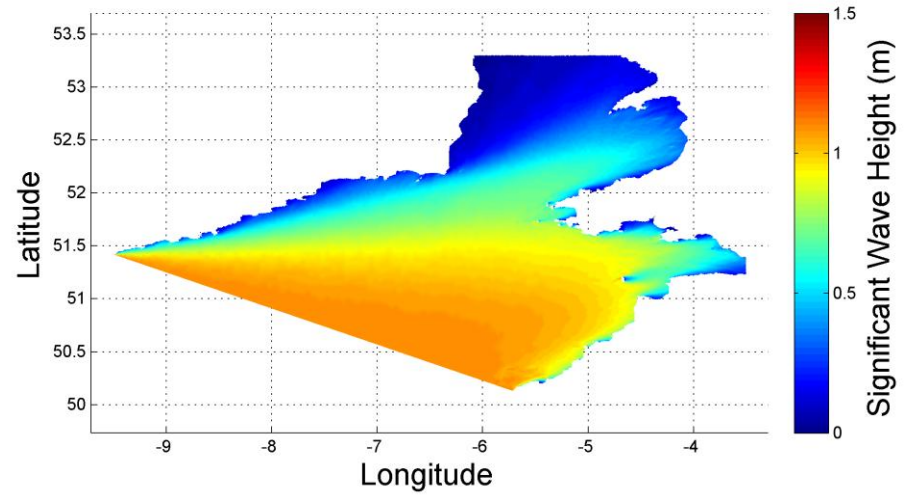
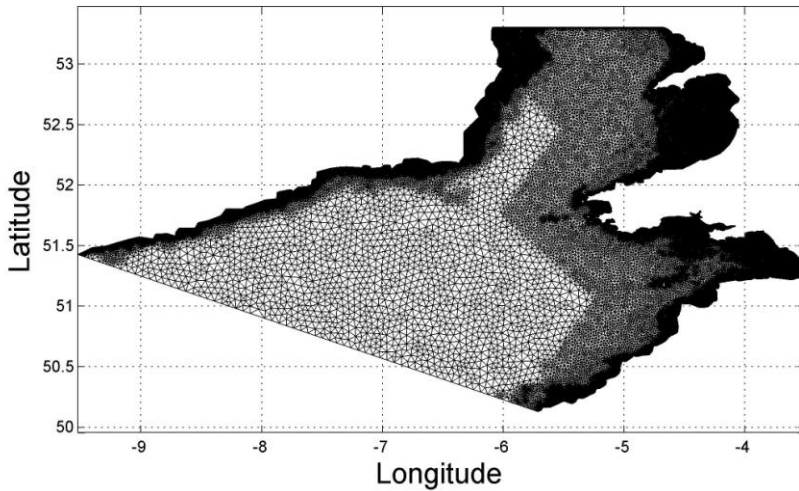


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Sites (Swansea University)



Primary wave resource
offshore of South West
Pembrokeshire





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Hydro-environmental Modelling (Cardiff University)



- Coarse grid model of Welsh coast
- Fine grid models of S and N Wales
- Physical model studies
- Sediment studies
- Predicting interactions of devices and the Severn Estuary – Corlan Hafren



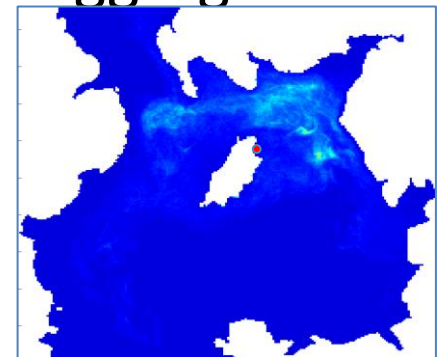
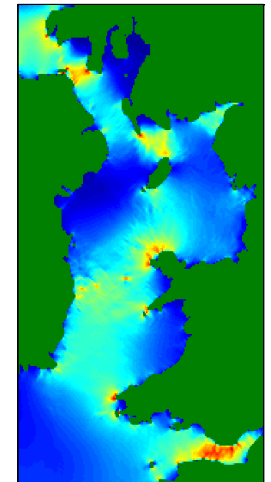
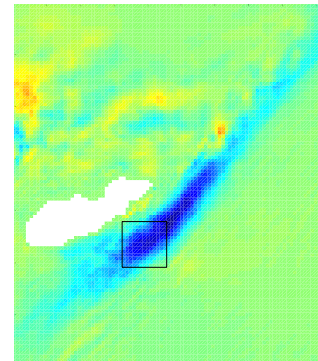
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Long Term Effects

(Bangor University)



- Resource assessment (waves, tidal streams)
 - Inform a Welsh “marine hub”
- Environmental impacts
 - Sediment dynamics
 - Larval dispersal
- Environmental opportunities
 - Morphodynamics: coastal defence, marine aggregates
 - Aquaculture
- Marine energy network & database





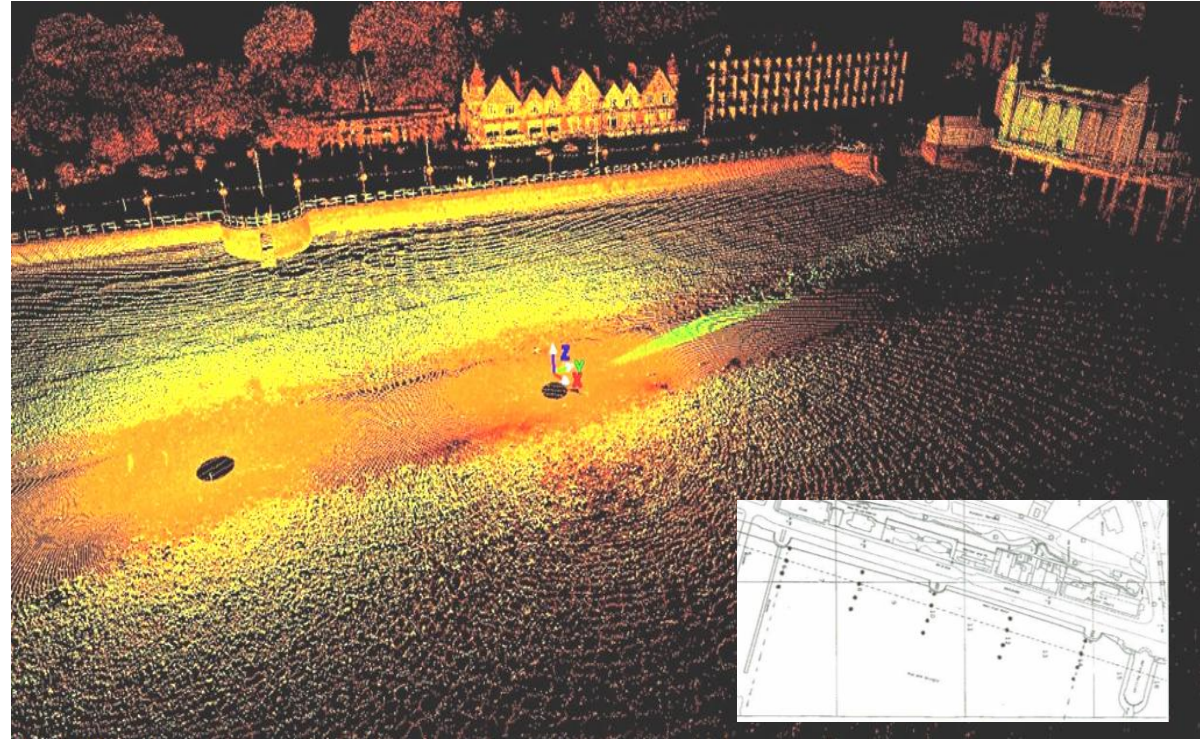
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Coastal Processes

(Swansea Metropolitan University)



High definition
surveying,
Penarth



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RESEARCH INSTITUTE

Cyngor Cyllido Addysg
Uwch Cymru
Higher Education Funding
Council for Wales

hefcw



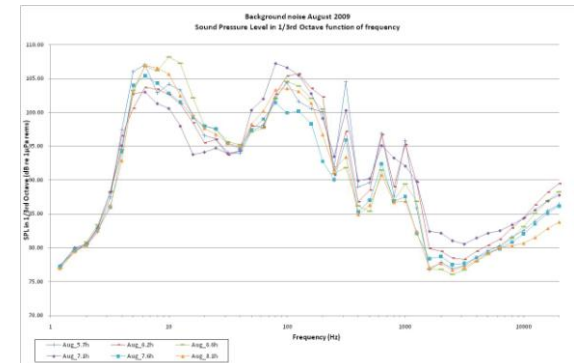
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Environmental Interactions

(Swansea University)



- Acoustic:
 - Underwater acoustic recording / processing / analysing
 - Noise impact on marine species
- Interactions between renewable energy convertors and fish/marine mammals
- Scouring & Sedimentation





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Interactions with Marine Wildlife

(Pembrokeshire College)



- Porpoise numbers and distribution in Ramsey Sound
- Seal pup production on Ramsey Island and north Pembrokeshire
- Seal haul out and in water usage for Ramsey Sound
- Analysis
 - Trends and correlations.
 - Sensitivity of methods



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Blade lifing

(Cardiff University)

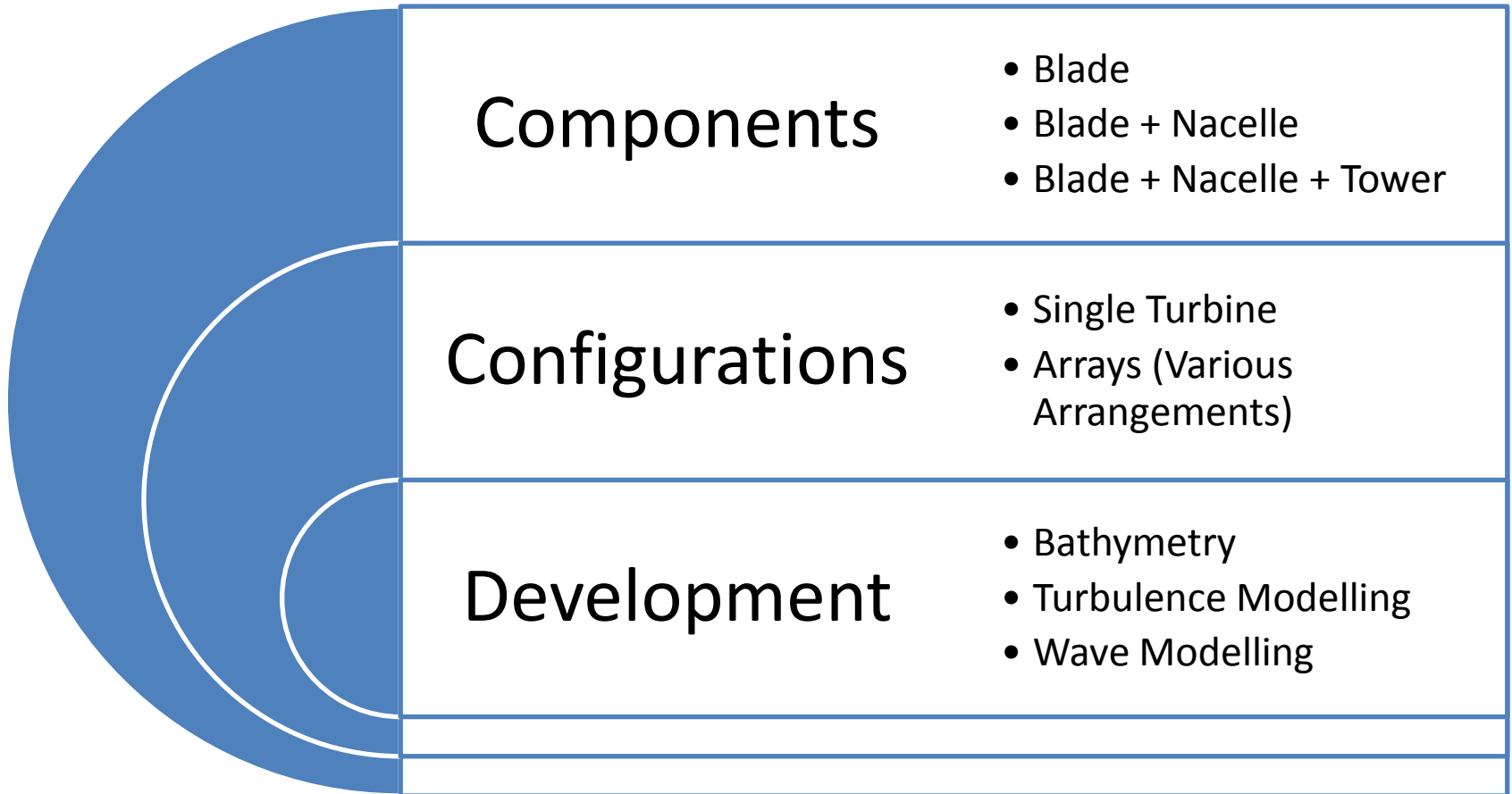


- Fluid solid interactions (ANSYS)
- Turbine stress analysis – non-uniform distributions
- Fatigue life prediction of blades, blade roots, drive shaft and bearings
- Optimum stiffness profiles



Blade Modelling

(Swansea University)





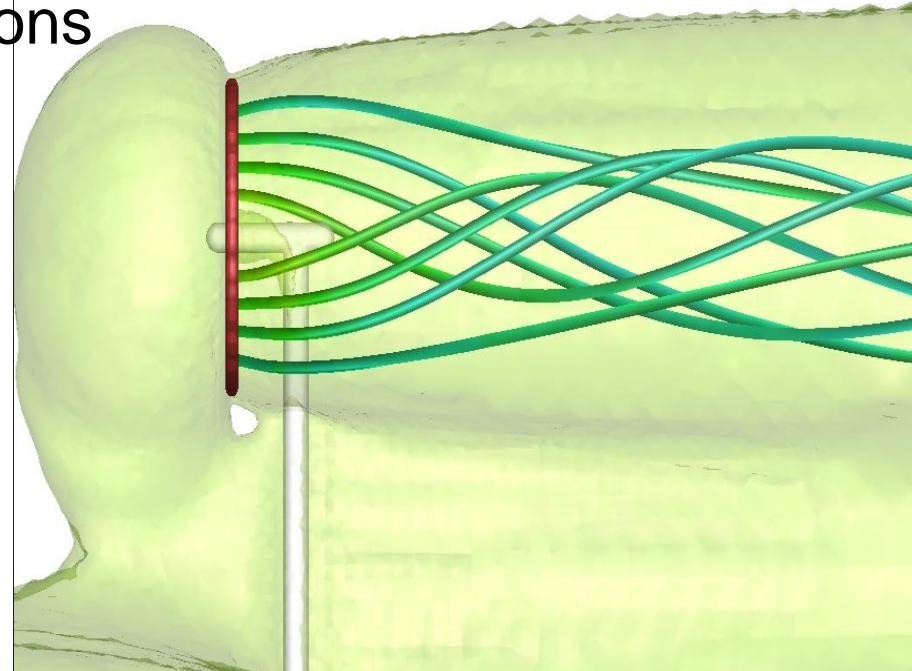
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Blade Modelling

(Swansea University)



- Standard analysis assumes a uniform inflow – this project's model allows various modifications
 - Boundary layer profiles
 - Yawed flow
 - Tower shadow
- Results are used to calculate power outputs and structural loading
- Current work will extend permissible inflow conditions to include waves and turbulence





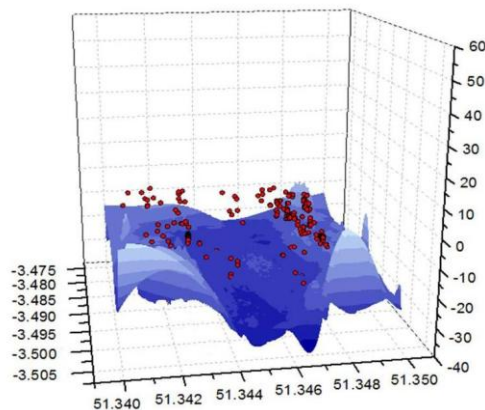
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Environmental Surveys

(Swansea University)



- *RV Noctiluca*
- Based predominantly in Severn Estuary/Bristol Channel
- Fish migrations, abundances, behaviour
- Benthic and pelagic populations
- Using “ships of opportunity”- value for money





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Water Quality

(Aberystwyth University)



- Providing data to hydro-environmental models
- Ecological and health impacts
- Effects of flow on microbial coliform decay



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Putting Research Protocols into Practice



Celtic Odyssey

Pembrokeshire 6th-22nd May 2011

- Practical understanding of LCRI research activities
- Floating laboratories, floating seminars
- LCRI Marine staff, *RV Noctiluca*, *RV Guiding Light*
- Vital data-gathering exercise for understanding environmental effects of extracting energy from the sea
- Fish, marine mammals, benthic communities
- Turbulence, waves, currents beach processes.

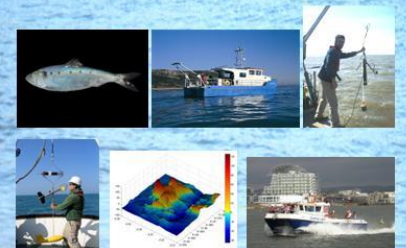
INVITATION TO Celtic Odyssey 6th-22nd May 2011 Pembrokeshire Coast

An exciting and intensive research exercise in the field of marine renewable energy.

Taking place near Ramsey Island to coincide with the May spring tides.

Welsh academic institutions will be demonstrating their various disciplines and delivering seminars as they investigate potential effects of extracting energy from our seas.

This is a prime opportunity for business to gain an understanding of support available from our coastal universities.



meet the experts ∞ technical seminars
experience a survey ∞ business networks

Photo courtesy of Iia Kolm Baradall

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Knowledge Transfer

(Swansea University)



Reactive Mode

- Non Disclosure Agreement
- Initial Meeting
- Idea
- Company Assist Document
- Feasibility Study
 - Description
 - Reality Control Volume
 - Patent Review
 - Outline Numbers (Power)
 - Investment Potential
 - Initial Device Spec
 - Potential Funding Sources
 - Test Facilities
 - Presentation of results



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Knowledge Transfer

(Swansea University)



Proactive Mode

- Building Relationships within the business community
 - Promoting our project work
 - Raising Awareness
-
- 117 Company Assists
 - Development and collaborative R&D
 - 67 jobs within 2yrs



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Knowledge Transfer

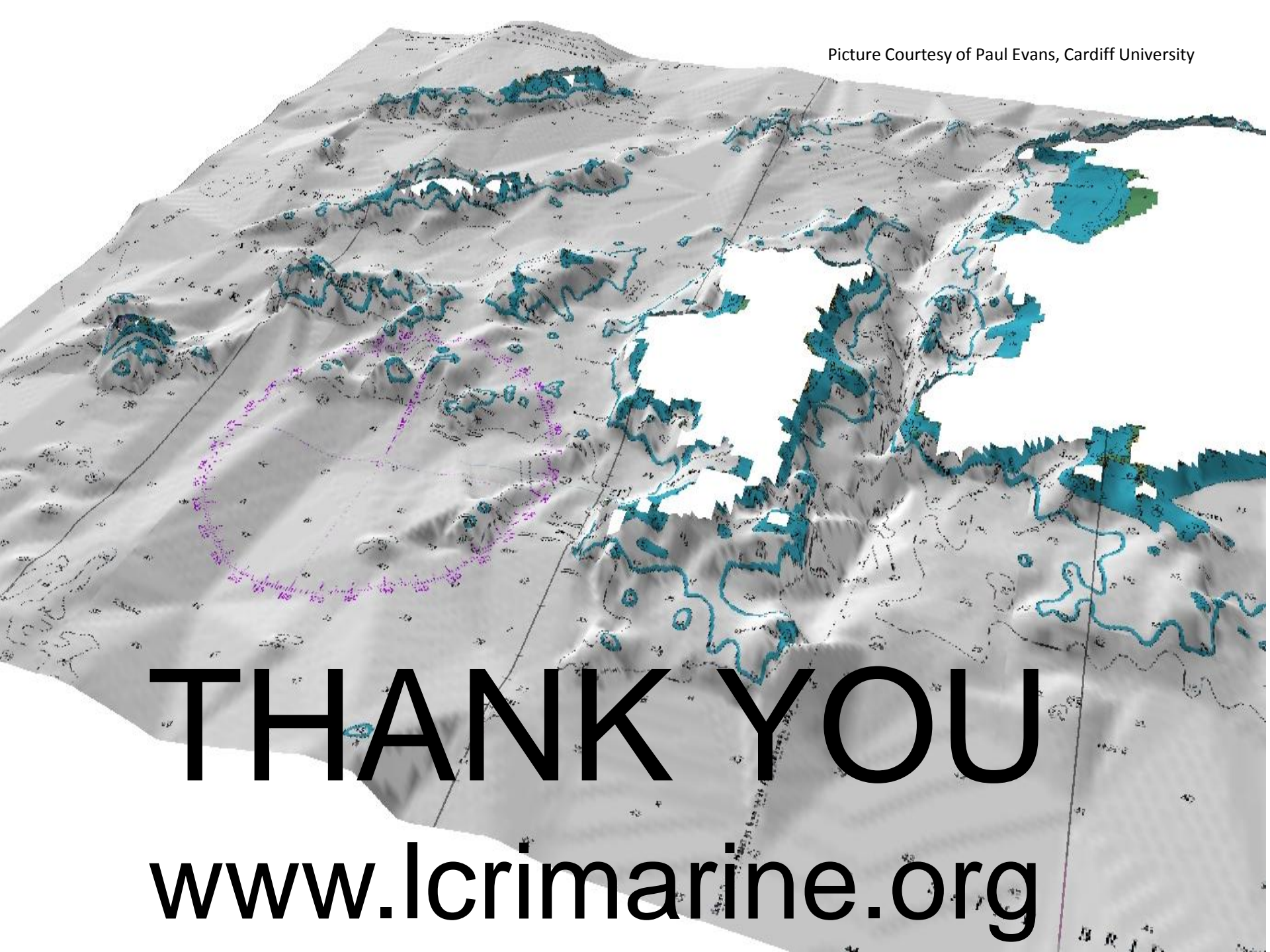
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Proactive Mode

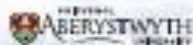
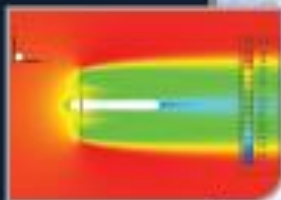
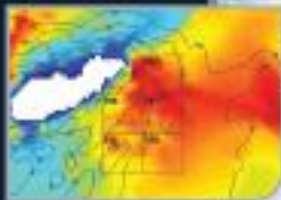
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 - Promoting our project work
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Picture Courtesy of Paul Evans, Cardiff University



THANK YOU

www.lcrimarine.org



“ Independent research to underpin the creation of a sustainable marine energy sector in Wales ”

“ Wales has the potential to produce half of its electricity from the marine environment ”



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