National/EU Innovation Programmes – Approach, Activities, Research Priorities

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Catapults: A long-term vision for innovation & growth

- Established and overseen by the Technology Strategy Board
- Bridging the gap between business, academia, research and government
- Long-term investment to transform the UK’s ability to create new products and services
- Open up global opportunities for the UK and generate sustained economic growth for the future
- Delivering the ‘know-how’ economy

7 Catapults

£1.4bn private and public sector investment
Why do we need Catapults?

- UK research sector one of the top performers worldwide, but excellence fails to translate into business opportunities
- Technology & innovation centres proposed by entrepreneur Hermann Hauser in report for Government, March 2010
- Proven European model
Offshore Renewable Energy Catapult

Our Vision: Abundant, affordable energy from offshore wind, wave and tide

• Building a centre of deep technical expertise
• Identification, development and commercialisation of innovative technology
• Research, development, demonstration, testing and asset assurance
• Driving collaboration between Government, industry and academia
• Market access for SMEs and new technologies
• Leveraged funding model (1:1:1)
External Funding Sources

Current

- EU (FP7 & Eurostars)
- RGF
- ERDF
- TSB
- DECC
- ORE Catapult

~20 active projects

Future

- H2020
- RGF & ARCH & MAS
- Innovate UK (TSB)
- >20 active projects
- ERDF (RETA 2?)
- DECC
- ORE Catapult
Going Forward – Funding Sources

R&D Pipeline Strategy

Funding Sources

- European
  - H2020
  - Eurogia
  - Eurostars
  - ERDF
  - ESF
  - KIC InnoEnergy
  - INTERREG
  - BIS
  - RGF

- UK
  - DECC
  - Innovate UK
  - Scottish Enterprise
Going Forward – Influencing Calls

R&D Pipeline Strategy

- Funding Sources
- Pipeline Plan

Influencing Calls

- Working Groups/Advisory Boards

R&D Pipeline Strategy

- Proposal Ideas

- Standards Bodies

- IEA
- IEC

Other Organizations:
- TPWind
- TiPOcean
- EERA
- EUREC
- Scotland Europa
- RenewableUK
- EWEA
- EU-OEA
# Research Priorities – Knowledge Areas

<table>
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<tr>
<th>Knowledge Areas</th>
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<tr>
<td>Wind &amp; Ocean Conditions</td>
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<td>Blades</td>
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<td>Drive Train</td>
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<tr>
<td>Electrical Infrastructure</td>
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<tr>
<td>Operations &amp; Maintenance</td>
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<tr>
<td>Foundations &amp; Substructures</td>
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<td>Installation &amp; Decommissioning</td>
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Externally Funded R&D Track Record

- We have an established R&D portfolio funded from external sources
  - Circa 20 live projects with value of ~£4million
    - In 2010, this was circa 3 projects worth ~£1million to Narec
  - Further projects are under contract negotiation
  - Additional EU/UK proposals have been submitted in 2014 and are under evaluation
    - Successful projects will commence in 2015

- All values quoted are values to ORE Catapult rather than total project values which currently equates to a live portfolio of £33.1million
## Putting into Practice on the Blyth Assets – Externally Funded R&D Project Matrix

<table>
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<tr>
<th>Knowledge Area</th>
<th>Past</th>
<th>Present</th>
<th>Future</th>
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<tbody>
<tr>
<td><strong>Wind &amp; Ocean Conditions</strong></td>
<td>Snapper (CPTC &amp; Docks)</td>
<td>NOAH (BOD)</td>
<td>HIGHROC (NOAH)</td>
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<tr>
<td><strong>Blades</strong></td>
<td>RGF (BTF2)</td>
<td>Dual Axis KTP (BTF1)</td>
<td>EMRP? (BTF1/2)</td>
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<td><strong>Drive Train</strong></td>
<td>Oyster (CPTC &amp; Docks)</td>
<td>OPTIMUS, TIDAL-EC (CPTC &amp; Nautilus)</td>
<td>GrILOW (Nautilus)</td>
</tr>
<tr>
<td><strong>Operations &amp; Maintenance</strong></td>
<td>NHUMS (CPTC)</td>
<td>OPTIMUS (CPTC)</td>
<td>OFCMS (Docks)</td>
</tr>
<tr>
<td><strong>Electrical Infrastructure</strong></td>
<td>DERLAB (CPTC)</td>
<td>RETA, NGHN, OPTIMUS (CPTC &amp; Docks)</td>
<td>GrILOW, IntElect4Wind (Nautilus &amp; CPTC)</td>
</tr>
<tr>
<td><strong>Foundations &amp; Substructures</strong></td>
<td>OFCMS (Docks)</td>
<td></td>
<td>LIFES50+ (NOAH)</td>
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Tidal Turbine Powertrain Reliability Project
- Project Overview

Background:
- To support the tidal turbine industry to reduce the LCoE, ORE Catapult has initiated this project to develop a Design for Reliability (DfR) methodology and a simulation model
- Core grant fund: Up to £2.2 mil.

Purpose:
- Increase reliability, support accreditation, reduce LCoE, reduce finance and insurance premiums by 2018

Project partners:
- Ricardo, DNV-GL, Turbine developers, EMEC, Academia
Powertrain Reliability Project Organisation, Roles & Responsibilities

ORE update on progress to Steering Group and Device Advisory Group. DAG review technical specification.

ORE Chair with Leads from each team.

CTO – Project Technical Lead
Project technical management (including technical risk)
Technical approval of designs
Development of SIM tool

Project team

ORE Project management

Procurement
Liaison with MFA
Scoping phase and Phase 1, 2, 3 funding
Dissemination

ORE Technical lead

Degree of confidence building

Software Developer

SIM tool GUI

Ricardo AEA

Spin off projects e.g. array condition monitoring, nanochip sensor technology, condition monitoring. Read across into wind/wave.

DNV - GL

Certification

Industry Technical Consultant Ricardo

DfR methodology
Drivetrain design

Financiers & Insurers

Degree of confidence building

EMEC

Data gathering through EMEC Developers Forum

Tidal Turbine Developers

Turbine load and component data

University of X

University of Y

University of Z

University of X

University of Y

University of Z

Identify data elements required to inform reliability case, FMEA

Develop generic condition monitoring test rig

Tidal turbine direct drive applications

Collaboration with Academia

Marine Farm Accelerator Steering Group

ORE update on progress to Steering Group and Device Advisory Group. DAG review technical specification.

Project Management (Schedule, time risk, cost risk, project steering group)

Procurement

Liaison with MFA

Scoping phase and Phase 1, 2, 3 funding

Dissemination

Tidal Turbine Developers

Certification

Industry Technical Consultant Ricardo

DfR methodology

Drivetrain design

Financiers & Insurers

Degree of confidence building

Tidal Turbine Developers

Turbine load and component data

Collaboration with Academia
EU FP7 Funded project: Tidal-EC
Tidal Energy Converter Cost Reduction via Power Take Off Optimisation

• 2-year project – started September 2014
• ORE Catapult (Narec) is the project coordinator
• 7 consortium partners from 5 EU member states
• Total project value €1.35million with €1million EC contribution
• Worth up to €575k to ORE Catapult
• Project objectives include:
  • To achieve an understanding of the life cycle performance and thermal profile of a selected tidal turbine PTO
  • To achieve an understanding of the optimum method of PTO integration to improve reliability, efficiency and reduce the LCOE for the selected devices
Offshore Renewable Energy Catapult - Other Selected Projects

- **Marine Farm Accelerator (MFA)**
  - The MFA framework has been established with a project developer steering group, technical working groups and a device advisory group.

- **Scottish Enterprise: Marine Energy Cabling Solution**
  - The project has been set up by Scottish Enterprise to develop a cable protection system for a marine tidal array. Project partners include IHC, Ocean Flow Energy and Tekmar.

Other future developments: Component Failure Testing, Environmental Monitoring Technology
Offshore Renewable Energy Catapult - Other Selected Projects

• **Hydrodynamic Modelling**
  
  Very positive feedback was received on the consultation for the Tidal Array Modelling (TAM) project.

• **Electrical Array Architecture**
  
  Building on the work by SE and SSE to establish a reference architecture and stimulate the supply chain.

• **Wave and Tidal Knowledge Network (WTKN)**
  
  Development of WTKN to support industry knowledge sharing.

Other future developments:
*Component Failure Testing, Environmental Monitoring Technology*
Going Forward - Collaboration Implementation Models

**Joint Industry Projects**
- Facilitated, neutral management
- Potential public/private funding

**Joint Ventures**
- Mutual Interest Development
- Shared risk, cost and benefits

**Knowledge Sharing**
- Industry Forums
- Academic Archives
- Datasets

**Collaborative Funding Calls**
- International Collaboration
- Industry/Research Consortium

- Marine Farm Accelerator
- WavePod
- Wave and Tidal Knowledge Network
- H2020 Work Programme
Going Forward - Future Research Areas

Common Themes across Technology Roadmaps for Wave and Tidal:

- Reliability and Survivability
- Electrical Systems
- Foundations
- Installation
- O&M
- Resource and Yield Modelling
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