Marine Industries

Demand Study

Report

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Contents

1 Executive Summary

This report documents the findings of the Plymouth and Peninsula City Deal **Marine Industries Demand Study**; a market research study to identify areas of high growth and innovation in the marine industry and specific opportunities to support investment and jobs in the south west of England and the development of a marine cluster "**Marine Industries Production Campus**" at Plymouth South Yard and a number of other sites in the south west peninsula.

1.1 Market Assessment

The marine industries have been identified as having high growth potential by both the UK Government and European Commission. The UK's Strategy for Growth in the Marine Industry and the EU Commission's recent studies looking at the "Blue Economy" concur that the marine industries could see significant growth over the coming decade.

The factors influencing growth include: the increasing globalisation of world trade and emerging markets, exploitation of new marine technologies, the need for greater resource efficiency and to meet the challenges of climate change, the commercial application of marine sciences and the development of the wider "Blue Economy" including marine leisure, tourism, fishing and aquaculture. Recognition of this growth potential has led many countries, and maritime regions, to adopt strategies based around establishing marine clusters, developing new "Blue Tech" and encouraging "blue Growth".

Innovation and technology development is apparent across all marine markets. The highest growth potential is anticipated in new and emerging sectors including offshore renewable energy, biotechnology, aquaculture, mineral resources and coastal and maritime tourism. "Traditional" marine markets in oil and gas, defence, shipbuilding and commercial shipping will continue to be important because of their market size, however these markets are subject to significant change, and prospects for growth will depend on key factors such as oil price volatility, defence spending and global trade.

1.2 Opportunities from innovation, new technologies and services

The start of the 21st Century has seen rapid development in the marine science, information technology, communication, robotics, electronics and materials. This has had a profound impact on the marine industries and this trend is expected to continue and accelerate in the coming decade.

Section 4 of this report highlights the innovation and technology development that is happening in areas such as offshore wind, wave and tidal energy, remote and autonomous vehicles, information technology & communications, remote monitoring, data capture & analysis, green vessels & propulsion systems, advanced materials & composites, electronics & instrumentation and visualisation & virtual applications. Innovation is also a key feature of more traditional marine activities from new vessel designs and sub-sea installation to fleet management and personnel training.

Of particular relevance to Plymouth is the expected growth in the commercial application of marine, environmental and climate sciences in areas such as bio-med, energy, protective coatings, climate, remote monitoring and data analysis. The study has already identified a large number of companies working in these technology and service areas who could have an interest in expanding their business in Plymouth and the peninsula.

1.3 The Plymouth and South West offer

The case study based comparison of the Plymouth and South West offer to the marine industry – covering its existing marine industry, skills, capabilities, port and R&D facilities – highlights that the combined assets of the region present a compelling proposition to support indigenous industry growth and inward investment.

Key strengths include the existing supply chain of marine companies, many of whom are actively engaged in innovation projects, the technology R&D capability of the universities and research organisations, port infrastructure and engineering capability. The cluster of science organisations in and around Plymouth – including Plymouth and Exeter Universities, PML, Alistair Hardy Foundation, MBA and Met office is world class.

The region does however have a number of potential weaknesses and constraints, most notably the perception of being small scale and the distance/connectivity to centres for the marine markets in oil and gas, offshore wind and commercial shipping. These areas of weakness mean that the region will have to work hard to market it offer, and to ensure it attracts and nurtures the right sort of companies. The region's opportunities will probably lie in developing areas of strength in marine science and engineering and encouraging specialist and high-value marine enterprises.

Plymouth & the South West Marine Industry Capability – See Section 5 Capability Matrix	
Key areas of strength	**Gaps and areas of potential weakness**
• Supply chain and SME Capability • Marine Engineering • Innovation and technology development • Academic collaboration and applied research • Marine and environmental sciences • Higher level – graduate skills • Variety of port infrastructure • Business and living environment	• Perception of small scale • Distance/ connectivity to some marine markets • Brand and identity, market knowledge • Transport connectivity • Depth and breadth of skills in some areas • Land space and port access constraints for larger projects

1.4 Opportunities and recommendations for South Yard

Considering the existing capability in the south west and the expected innovation and growth opportunities in the marine industry, the outlook to develop a marine cluster based around the MIPC at Plymouth South Yard and other south west sites is very positive.

The demand study did not include a full market survey but did engage informally with a number of companies who responded very positively both to the concept of the MIPC and the opportunity to expand their business in the South West. To form an effective marine energy cluster the MIPC should support the growth of traditional and established marine industries, alongside new "blue tech" and innovation based companies.

The concept of creating a business environment to support technology and service development from "innovation to commercial deployment" was well received and fits well with the physical attributes of the South Yard site.

The proposal to offer a mix of office, workshop, industrial and quayside space was seen as very attractive. Equally several firms clearly saw the opportunity of having a facility within Devonport, near major clients including the MOD, Princess Yachts and Babcock as a clear advantage. The flexibility offered by short and long-term leases, innovation and shared space and the potential "pay-per-use" assets and equipment will be important selling points.

There was strong feedback that the quayside and dock facilities in Area 5 of South Yard should be retained for marine use and a recommendation that at least one of the dry docks should be reinstated, complementing the larger dock facilities in Falmouth, by providing support for smaller vessel servicing, project deployment and technology development.

There was also strong support to establish a technology demonstration zone in Plymouth Sound – for example for remote and autonomous vehicles, communication and remote monitoring.

A note of caution from the study is that the demand for "office only" accommodation may be more difficult to market until there is a marine cluster established. Financial incentives will help, but the key attraction for companies moving to South Yard will be its industrial and quayside space and position next to key customers. This may mean that the first development of Area 1 East is more difficult to fill until Area 1 West and Area 5 are developed alongside.

The potential for the MIPC concept to be taken a further step to become part of a new UK "Catapult Centre" for the marine industry should be explored. Catapults are now a key part of the UK innovation landscape and look set to grow and expand from the present 7 to perhaps 30 by 2030. Given the opportunities for innovation the marine sector would seem a good candidate for a future Catapult although this is likely to take the form of a cross-cutting technology (for example Autonomous Vehicles) rather than a sector catapult.

It will be important therefore that Plymouth engages with the industry and organisations like Innovate UK who are shaping the Catapult strategy. It will very likely be necessary for Plymouth to form a collaborative partnership with other port cities in order to offer a national offer. A potential catapult for "Marine Science Applications" would play to Plymouth's core strength.

1.5 Conclusions and key recommendations

1.5.1 Developing a successful marine industry cluster in the City Deal region

The anticipated growth in the marine industry, particularly in areas of new technology, innovation and the marine sciences – coupled with the core maritime capabilities and assets in the region – provides Plymouth and the South West Peninsula with a great opportunity to develop a significant marine industry cluster.

To realise this opportunity the Plymouth City Deal and their local authority and local enterprise partners will need to:

1) Focus and prioritise regional and local investment and business growth funding towards the marine sector and allied infrastructure in ports and manufacturing – including the MIPC sites across the region.

2) Create a strategic (3-5 year) programme to develop the peninsula marine industry as a cross LEP initiative. The priority for this programme should be to:

   - Integrate and co-ordinate support and investment activities related to the marine sector
   - Greatly increase the profile of the marine industry - establish a brand and market the wider south west marine industry offer at a national and international level.
   - Engage with and influence regional, national and EU stakeholders and decision makers in the marine industry
   - Establish a strong marine industry network (business and research)
   - Channel business support and funding towards the sector
   - Help integrate commercial, innovation and research activities
   - Support & create export and trade opportunities
   - Support development of the MIPC at South Yard and the other sites across the peninsula
   - Support Inward Investment – working with Invest In Cornwall, C&IoS LEP, HoSW LEP, LAs

3) Establish a stronger and more integrated collaborative partnership between academia and industry in the marine sciences sector. The PRIMaRE group is a good vehicle for this collaboration.

4) Aim to be a partner in the development of a cross sector 'marine industries catapult'

5) As a priority, commit resource to engage with Innovate UK, BIS, MOD and other government agencies on the future technology needs and potential to create a marine focused catapult.

1.5.2 Development of the Plymouth South Yard MIPC

The first phase of the South Yard MIPC (@ 7.5 hectares) is relatively small compared to other port developments however the South Yard offers a unique and compelling opportunity to create a new marine industry cluster and attract high value businesses into the city.

A key challenge will be during the first stage of development when it will be crucial to attract early tenants to the MIPC and to leverage the full South Yard potential.

To realise this opportunity, the South Yard development team should:

1) Market the whole South Yard potential – including those areas not yet transferred from MOD (as part of a wider south west marine sector offer).

2) Focus Area 1A on innovation, with offices and shared workshop/light engineering space

3) Continue to implement an "innovation to commercial deployment" approach by offering a mixed use site of office, shared space, workshop facilities, industrial units and dock/quayside.

4) Develop a flexible range of lease and rental options from very short term "innovation space" and pay per use facilities, short term rental, short leases and long term leases (for co-investors).

5) The approach above implies some form of overall site/facilities management service.

6) Retaining the maritime use of the docks and quayside will be important. There is also a strong case – pending a technical and commercial feasibility study – to re-instate one or more of the dry docks.

7) Target companies for the South Yard site should include "traditional" marine companies to provide core capability as well as "blue tech" innovation based companies

8) As a start targeting some of the companies identified in Appendices 1&2 – for example inviting groups of companies on site visits

9) A package of financial and business support incentives will be critical – especially to attract first tenants - attractive rent, reduced rates, investment tax allowances, grant funding.

2 Introduction

2.1 Plymouth and South West Peninsula City Deal

The Plymouth and South West Peninsula City Deal was officially launched in January 2014, the culmination of a ground-breaking deal between government and local partners to deliver economic growth in the south west of England.

The geographic scope of the City Deal covers the bi-LEP area of the Cornwall and the Isles of Scilly (C&IoS) and the Heart of the South West (HoSW) Local Enterprise Partnerships (LEPs) including Plymouth, Cornwall, Devon and Somerset.

The key objectives of the City Deal include increasing rates of productivity, skills development, supporting high growth businesses and increasing export penetration by enhancing the peninsula's strengths in all sectors but with a key focus on the marine industries and advanced manufacturing.

Find out more about the: Plymouth and South West Peninsula City Deal

Working closely with the C&IoS and HoSW LEPs the City Deal team are now progressing a number of initiatives including three key priorities:

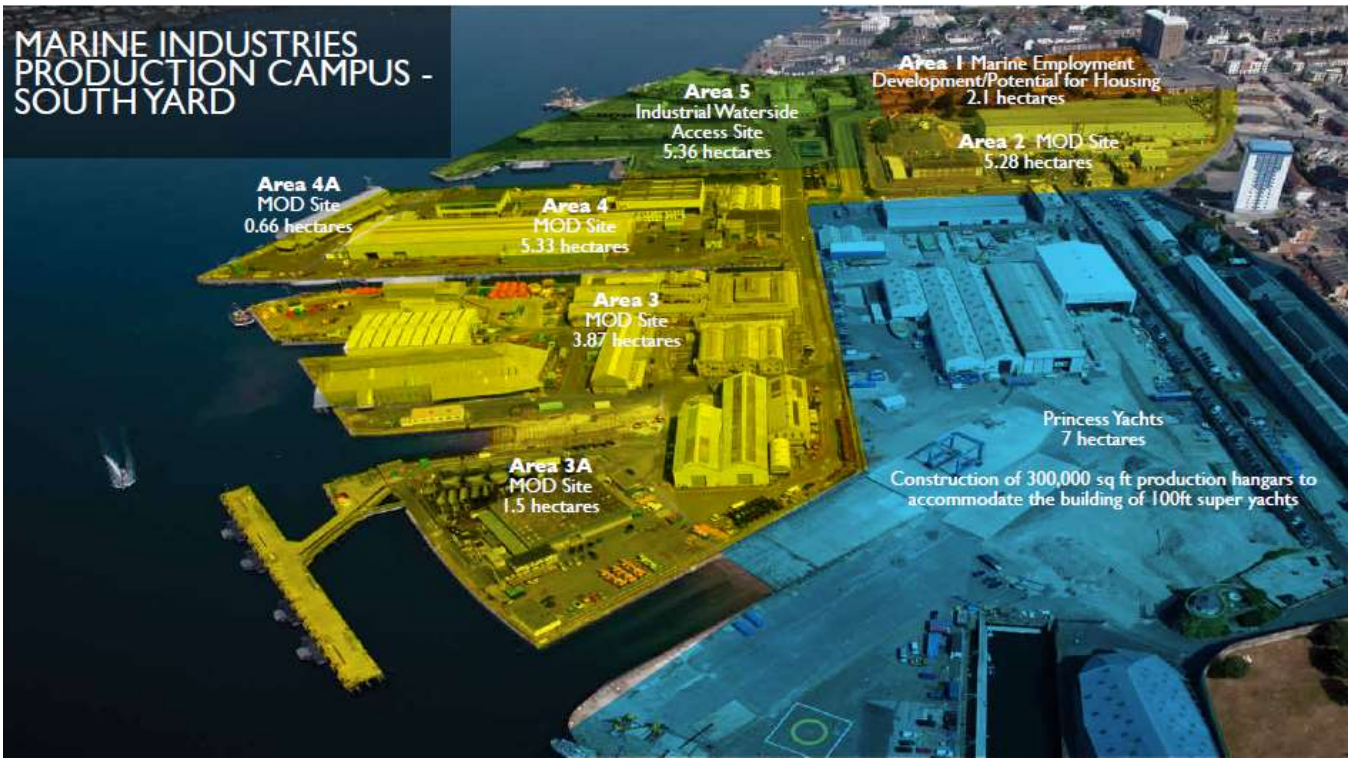
- Creation of a **Growth Hub** to enhance productivity and support new enterprises through grant schemes and be enabling local businesses and entrepreneurs to access a range of support providers and schemes through a single Growth Acceleration and Investment Network portal.
- A Youth Deal to help young people to get into work and to achieve more in their careers and employment.
- The re-development of the Plymouth Devonport South Yard site – and a number of other marine sites in the region to create a Marine Industries Production Campus

Find out how the City Deal programme has progressed: City Deal review booklet

2.2 Marine strategy within the Plymouth and Peninsula City Deal

There is a strong marine theme across all the initiatives that have been undertaken by the Plymouth and Peninsula City Deal (City Deal). This reflects the central City Deal proposition that the development of marine industries, marine sciences and new marine technologies is a key strategic opportunity for Plymouth and the south west to drive both growth and productivity.

The rationale to focus on marine as a priority sector is based in part on exploiting the existing assets, capabilities and businesses that are already present in the region, and is also in recognition that marine industries, and development of new marine technologies and services, offer opportunities for both high growth and innovation.



The City Deal includes the long term development of the Plymouth Devonport South Yard site as the flagship project to establish a **Marine Industries Production Campus** across a number of sites in the south west peninsula. The vision and potential development opportunity for South Yard is discussed in detail in Section 7 of this document. The intention is to transfer areas of land from the Ministry of Defence (MoD) to public ownership, invest in new buildings and infrastructure to bring the site up to a "commercial spec" and then seek private sector tenants, leaseholders and co-investors to establish a centre for marine related businesses and technology development. The vision of the South Yard being part of a "Production Campus" reflects the opportunity to utilise its unique waterside location to create a vibrant marine cluster focused around new technologies, innovation, marine engineering, marine sciences including biomed and other applications and advanced manufacturing.

In total the South Yard is over 34 hectares of which 7 hectares have already been sold (2011) to Princess Yachts to expand their superyacht manufacturing facility. Princess Yachts future expansion plans includes a £35m investment to create new production hangers and office accommodation.

The rest of the site, which contains a mix of under-utilised industrial buildings, quayside space and docks, has been divided into 5 development areas which are planned to be transferred to public/private ownership in phases. Areas 1 and 5 will be the first to be developed and plans are well advanced to transfer area 1a to Plymouth City Council ownership in April 2015, area 1b in April 2016 and area 5 in April 2017.

Successful delivery of this strategy has the potential to deliver 1800 jobs and £85m of investment.

2.3 Marine Industry Demand Study – Objectives and Approach

To support the marine based strategy, Regen SW has been commissioned by the Plymouth and Peninsula City Deal to conduct a short market study to look at the areas of opportunity, market growth and innovation across the marine industries. The study scope was broadly to look at market opportunities across the key marine industry markets and sub-sectors, but specifically to look at those areas which have potential for growth and inward investment for Plymouth and the south west peninsula. This potential may be because there is a connection with existing companies and capabilities within the city region or because there is an opportunity to leverage and expand its core assets and resources.

The objectives of the demand study were to:

- Identify areas of opportunity, innovation and market growth to help prioritise and focus marketing and inward investment opportunities for Plymouth and the south west.
- Highlight existing strengths, gaps, and future requirements in the Plymouth & south west city deal offer using case studies from other successful marine clusters.
- Identify areas of synergy, overlap and opportunities for collaboration between Plymouth South Yard and other port locations, facilities and assets around the south west peninsula.
- Inform the vision/strategy for the development of Plymouth South Yard to inform land-use,
- Provide an evidence base to support future investment proposal.
- Identify specific opportunities, technologies, companies that could be targeted.

In addition to market analysis, Regen SW has also been asked to collate recommendations regarding facilities and land usage at South Yard, enterprise and funding support, supply chain development and skills, marketing and inward investment.

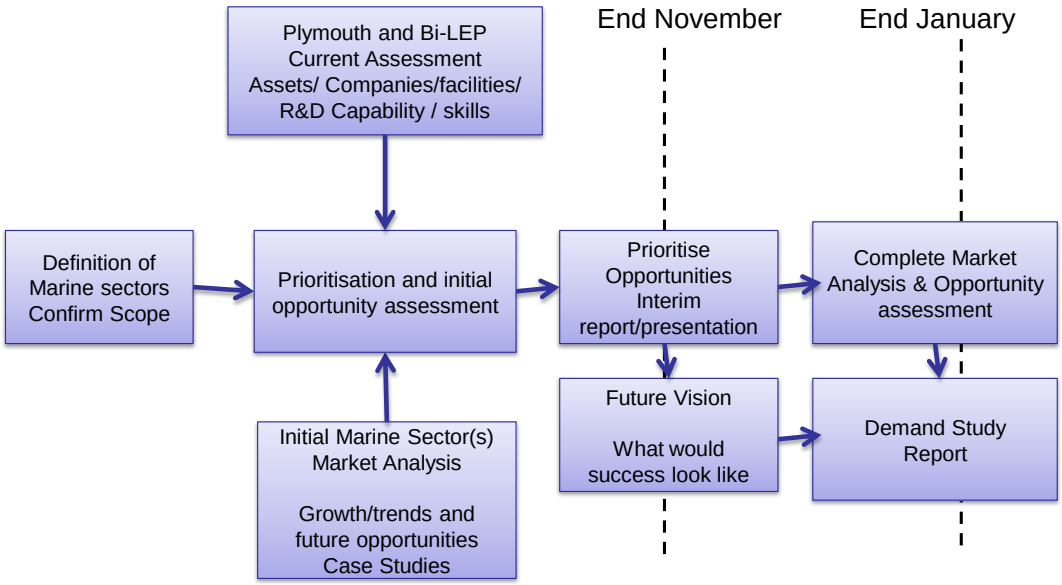
The study approach was largely desk based and, owing to time constraints, did not include a full market survey. The study team did however informally consult with over 20 companies who had expressed an interest in the South Yard site. These are listed in section 8.

An interim report/presentation was held in November with Plymouth City Council and a number of stakeholders and industry members including HoSW LEP, Plymouth University, Plymouth Marine Laboratories and GoBe Environmental Consultants. The aim of the workshop was to present the initial findings of the study, agree priority areas and identify further opportunities.

The approach we have taken is based on the steps set out below:

Marine Sector Demand Study

Overview of study



2.4 Marine Industry Demand Study – Structure of the Report

Rather than duplicate data and information that has already been produced we have tried to make the report as interactive as possible with links to supporting documents, web links and references.

The remainder of the report is structured as shown in the table below:

Section 3 **Marine Industries Market Analysis**

This section looks broadly at the major marine markets identifying market trends, the outlook for growth in "the blue economy" and an overview assessment for each of the key marine markets.

Section 4 **Analysis of Key Services and Technologies**

Gives a more in-depth review of the key areas of innovation, new technology and sector development – with a particular focus on those services and technologies that may be relevant for expansion in Plymouth and the South West.

Section 5 **Building a Successful Marine Industry Cluster**

This section summarises the case study analysis looking at a number of port cities in UK, Europe and North America and highlights the key success factors of a successful marine industry cluster.

Section 6 **The Current Plymouth and South West Marine Industries Sector Offer**

This section gives an overview of the existing elements of the Plymouth and south west marine industries sector identifying key assets, resources and capabilities which make up the offer. This section of the report also identifies some of the gaps and areas of weakness that were highlighted by the study.

Section 7 **The Opportunity for Plymouth– Marine Industries Production Campus**

This section brings the analysis together and presents a vision of what the successful creation of a marine industry cluster at South Yard could look like.

Appendices Including a list of potential cluster companies, potential events for marketing opportunities, full list of south west assets and a list of companies consulted with in this report.

3 Marine Industry Analysis

3.1 Scope of the Industry – Markets, Technologies and Services

There are numerous definitions of the term 'Marine Industry' owing to the potential scope and diversity covered by the subject. Definitions vary depending on the purpose of the analysis and target audience. The European Commission for example does not include defence/naval activity under its definition of the "Blue Economy" but does include the full range of coastal/seaside tourism which would not normally be considered a marine industry.

For the purpose of the Demand Study, the marine industry has been divided into a matrix structure containing:

- **Marine Markets** and sub sectors
- **Marine Services** which support those markets
- **Marine Technologies** which enable the delivery of those services

Major Marine Markets	Key sub-sectors
Offshore Renewable Energy	Offshore Wind
	Marine Energy (Wave and Tidal)
Oil and Gas	Exp & Prod (E&P), Decommissioning
Marine Science	Biomed, Bio Tech, Climate Science, Environmental
Marine Leisure	Marine Recreation, Yachts, marinas, cruise tourism
Defence	Naval, Marine Security
Commercial Shipping	Coastal, Deepsea, Container, Bulk
Primary Industries	Aggregates, Aquaculture, Fishing
Tele-communications	
Other	

Key Services and Technologies

Key Services	Ship building, repair modification
	Vessel chartering
	Manufacturing and components
	Engineering
	Consultants
	Marine Operations, Installation and Subsea Support
	Survey, warranty and inspection
	Ports and port services
	Training and skills
	Professional services
	Assest management and maintenance
	Health and Safety
	Decommisioning, waste management and disposal
	Meterology and oceanography
	Environmental monitoring
	Security

Key Technologies	Autonomous Vehicles (AxVs)
	Marine energy converstion technologies
	Green shipping
	Marine ICT (software applications)
	Ship building and repair
	Composites
	Electronics
	Condition monitoring equipment
	Propulsion systems
	Environmental monitoring equipment
	Health and saftey equipment

3.1.1 Marine industry opportunity matrix

Key Services and Technologies	Major Marine Markets								
	Offshore Renewable Energy		Oil and Gas	Marine Sciences	Marine Leisure	Defence	Commercial Shipping	Primary Industries	Tele-communication
	Offshore wind	Marine Renewables (Wave and Tidal - Ocean Energy)	Exploration Production Decommissioning	Biomed, Bio Tech, Climate Science, Environmental	Marine recreation, Marinas, Boatbuilding, Superyachts	Naval, Security, Coastguard	Coastal, Deepsea, Bulk, Container	Fishing, Aggregates, Aquaculture	
Ship building, repair modification									
Vessel chartering									
Manufacturing and components									
Engineering									
Consultants									
Marine operations, installation and subsea support									
Survey, warranty and inspection									
Ports and port services									
Training and skills									
Professional services									
Assets management and maintenance									
Health and Safety									
Decommissioning, waste management and disposal									
Meteorology and oceanography									
Environmental monitoring									
Security									
Overall market potential									
Autonomous Vehicles (AxVs)									
Marine energy conversion technologies									
Green shipping									
Marine ICT (software applications)									
Ship building and repair									
Composites									
Electronics									
Condition monitoring equipment									
Propulsion systems									
Environmental monitoring equipment									
Health and safety equipment									
Overall market potential									

Figure 1 Matrix of major marine markets against services and technologies that serve them highlighting areas of opportunity

3.2 High Growth and Innovation Potential

A review of recent reports and market assessments from the UK and Europe (and around the world) confirms a general consensus that the marine industries offer a high growth potential from expanding markets and export opportunities, and from the commercialisation of new technologies and services. Many analysts now refer to the buzz words of "Blue Economy", "Blue Growth", "Blue Tech" etc.

The common themes across all the recent studies include:

- Increasing globalisation of world trade and emerging markets
- Exploitation of new marine or "Blue Tech" technologies
- Resource efficiency, renewable energy and meeting the challenges of climate change
- Application of marine sciences and information technology
- Renaissance and growth in the wider "Blue Economy" including marine leisure, tourism, fishing, aquaculture etc.

3.2.1 UK Marine Industry Strategy

The opportunities for growth, innovation and technology development in the marine industry has become a high priority for the UK government and its agencies, and has been the subject of a number of recent and on-going studies including the publication in 2011 by the UK Marine Industries Alliance of the UK's first Strategy for Growth for the UK Marine Industries.

According to the UK Marine Industries Alliance the marine industries in the UK in 2011

- Include over **5,000 companies**
- Employ nearly **90,000 people**,
- Generate nearly **£10bn turnover**, (this figure exclude "maritime services" Inc. Ports)
- Contribute over **£3.5bn Gross Value Added** to the nation's GDP

The Strategy for Growth reports argues that greater cooperation across the marine industries and maritime services sector could see their value to the UK economy rise 4% per annum from £17 billion a year in 2011 to **£25 billion** a year by 2020.

The strategy document identified growth opportunities across all sectors based on the expansion of the UK market in areas such as offshore renewable energy and the export of UK maritime technology, products and capability to emerging markets. The strategy document identified the principle growth drivers as being new technology, drive for energy efficiency and combating climate change and the rapid growth of emerging economies.

The UK strategy has since been taken forward by a number of agencies including Innovate UK (part of BIS) who have begun working through each of the industry sub-sectors to understand particular technology needs and market opportunities.

A similar analysis has been given in a more recent report compiled by Lloyds Register and partners looking at very high level global trends – demography, economy and resources – which will impact

on the marine sector out to 2030. The Global Marine Trends report points to a "positive marine world in 2030" with a growth in world trade coupled with investment in new energy efficient technologies.

3.2.2 European Strategy for Blue Growth

The UK's positive outlook for the marine industries is also reflected in the European Commission's strategy to encourage "Blue Growth" and the development of a "Blue Economy".

The EU's **Blue Growth Strategy** "Opportunities for Marine and Maritime Sustainable Growth" published by the EU Commission Maritime Affairs in 2013 sets out the EU's long term strategy long term strategy to support sustainable growth in the marine and maritime sectors.

The report estimates that the 'blue' economy (which excludes naval and defence) represents roughly 5.4 million jobs and generates a gross added value of almost €500 billion a year across the EU.

Size of the European Blue Economy		
Sub Sector	Jobs	GVA million €
High Growth Potential		
Coastal and Maritime Tourism	1,614,968	€ 51,234
Aquaculture	90,464	€ 1,633
Offshore Renewable Energy	20,465	€ 2,640
Mineral Resources/Aggregates	2,034	€ 228
Biotechnology	185	€ 9
Traditional Industries		
Fisheries	732,239	€ 22,978
Transport	520,281	€ 66,943
Shipbuilding and Ship Repair	362,126	€ 17,891
Offshore Oil and Gas	19,748	€ 14,344
Source: EU Commission Maritime Affairs Infographic		

The EU commission, Blue Growth strategy has identified 5 keys sectors of high growth potential: renewable energy, biotechnology, aquaculture, mineral resources and coastal and maritime tourism.

Support for the EU Commissions Blue Growth strategy is now coming through a number of initiatives including:

- Horizon 2020 funding which includes themes around Blue Growth, biotechnology, marine innovation, marine science and renewable energy
- Establishing a sustainable process ensuring that marine data is easily accessible, interoperable and free of restrictions of use
- Delivery of a multi-resolution map of the entire seabed of European waters
- Creation of an information platform on marine research across the whole Horizon 2020 programme as well as information on nationally funded marine research projects
- Creation of a Blue Economy Business and Science Forum
- Creation of an Ocean Energy Forum
- Encourage the development of a marine Sector Skills Alliance 2014-2016 The Commission looks forward to the opinion
- Development of Action Plans for each maritime area – see for example: Atlantic Action Plan

Great example of recent South West Horizon 2020 success:

Mojo maritime and partners secure Euro 1.2m to develop an ROV solution for the tidal energy sector

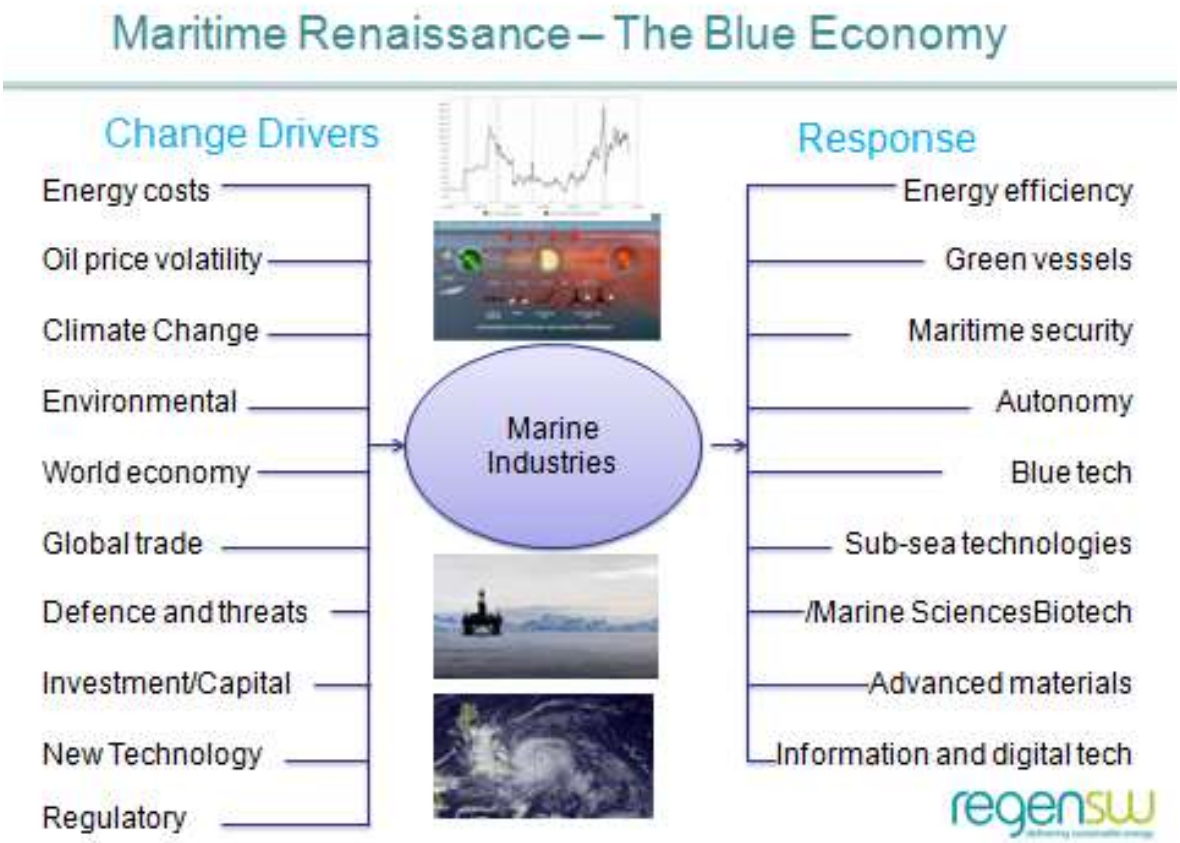
3.2.3 Other international studies

There are a large number of similar studies from a number of countries, including:

- South Africa
- United Nations
- Australia
- US San Diego
- US Mississippi
- EU Fisheries Commissioner

3.3 Change and Growth Drivers for the Marine Industry

The focus and priority that is being given to the marine sector and the development of the marine based economic strategies reflects the high levels of change, innovation and technology development that the sector is currently experiencing.



Source: Regen SW

3.3.1 Market change and uncertainty

Some of the change drivers could be viewed as threatening for the marine markets. Oil price volatility is a potential threat to investment in the oil and gas sector, with the North Sea exploration and production (E&P) sector at particular risk. On the other hand, the decline in North Sea production is accelerating decommissioning which has now become a major sub-sector in its own right.

Changes in defence spending – in response to asymmetrical threats and new technologies - is potentially threatening the traditional dockyard related industries which have been based around ship building and the servicing of naval vessels. However, the new structure of the defence industry is creating new opportunities in areas like autonomous vehicles (AxV s) and communications.

An assessment of the maritime industries growth potential must also recognise that the industry and its sub-sectors face a number of uncertainties.

Marine Market	Market Uncertainties
Oil and Gas	• Oil price volatility • OPEC's strategy • Geopolitical impacts • Decarbonisation and impact of "stranded carbon" assets

Defence	• Defence budget cuts and strategy • Impact of new technology
Marine energy	• Technology readiness • Rate of commercialisation • Growth projection post 2020
Offshore Wind	• Commitment of governments to decarbonisation • Rate of cost reduction • Growth projection post 2020
Marine Leisure	• Consumer disposable income • Economic growth • Even the outcome of sanctions and tax regulations
Marine Sciences	• Regulatory changes • Scientific innovation
Commercial Shipping	• Economic growth • Changes in world trade patterns – emerging markets • New technology – bigger vessels, autonomy • Security threats and political unrest
Primary Industries	• Regulatory • Economic Growth
Communications	• Technology

3.3.2 Drivers of growth

Despite these uncertainties there are a number of strong drivers for growth across the marine markets. These include:

Marine Industry Growth Drivers	
Technological innovation	Areas such as robotics, autonomy, submersible technology, data capture, ICT – which is enabling new innovations in the way in which the marine industry operates
Decarbonisation and climate change	Driving the growth in offshore renewable energy to replace fossil fuels as well as energy efficiency and green propulsion systems, climate science and flood/coastal defence
Conservation of the environment and our marine natural resources	Shaping the regulatory environment, including marine conservation and fishing, but are also opening up new opportunities for sustainable development, aquaculture, marine tourism and marine sciences
New applications for the marine sciences	Such as Biomed and pharmaceutical application, climate sciences, satellite applications and remote sensing
Globalisation	Opening up new markets in developing countries but is also introducing increased competition and forcing cost reduction across the industry

As part of the market analysis, the Demand Study has completed a high level survey looking at each of the main marine industry markets to identify growth trends, areas of innovation and key opportunities for Plymouth and the South West.

3.4 Oil and Gas

Since the discovery and exploitation of North Sea oil reserves in the late 1960's, the Oil and Gas sector has been the key driver of growth and innovation in the marine sector. This has led to a rapid expansion of offshore operations hubs and port infrastructure on the east cost of the UK – for example: Aberdeen, Peterhead, Tyneside, Lowestoft – and to the development of a much wider supply chain across the UK.

Technological innovation in offshore exploration and production has led to the development of new capabilities in

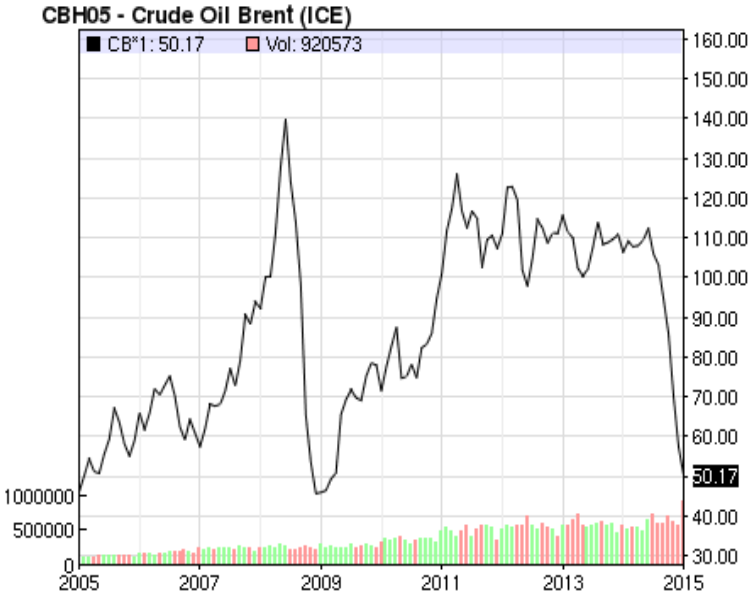
- Rig design and large structures
- Vessels design including dynamic positioning (DP) capability and semi-sub
- Subsea operations and deep sea drilling
- Diving and ROVs
- Geotech and geophysical
- Cable and pipeline

http://www.subseaexpo.com/ is one of the largest subsea exhibitions in the world

The tragedy of Piper Alpha in 1988, and the controversy surrounding the disposal of Brent Spar in 1995 has also established new standards in health and safety and environmental responsibility which has had a far reaching impact across all marine sectors.

3.4.1 Projected decline in North Sea E&P

North Sea exploration and production (E&P) activity has varied with periods of intense expansion ("Dash for Gas" for example in the 1990's) coupled with periods of retrenchment and intense cost reduction. In the past decade the rate of production in the North Sea has declined and fewer new fields have come on stream. There has therefore been a focus on increasing production efficiency and a downward pressure on costs.



The significant oil price fall over the last 6 months to less than $50 a barrel, has accelerated the reduction in investment in the North Sea and other higher cost offshore fields around the world. This has already led to significant job cuts and reduced investment from companies like BP, Talisman, Conoco, Shell, Halliburton and many others.

Continued volatility in the oil price, decarbonisation and the risk of "stranded carbon assets" means that the outlook for the industry – and higher cost offshore producers in particular is one of reduced investment. See Regen SW briefing paper: Oil Price Fall – Not All Bad News for Renewable Energy

On the positive side the decline in North Sea E&P activity has led to an increase in Decommissioning which has now become a major industry market which is estimated to be worth between £35b and £50bn over the next 30 years as almost off of vthe 470 offshore installations in North Sea's UK Continetal Shelf are taken out of production, see: Oil & Gas UK's Economic Report 2013.

The multi-billion dollar project to decommission the Brent Field, announced recently by Shell, will entail lifting over 22 thousand tonnes of steel and representes a significant engineering, logistical and environmental challenge.

3.4.2 Opportunities for Plymouth and the South West

While the south west has never experienced the sort of economic boom which has been generated by the oil and gas sector on the east coast, a significant number of south west based marine and specialist manufacturing companies have formed part of the wider supply chain. The south west also provides a significant number of oil industry employees.

Examples of south west companies who have been active in the Oil and Gas sector include: A&P, Seacore, LDD, Valeport, J&S, Seiche Measurements, Pipex and Falmouth Divers as well as companies involved in maritime training, consultancy, surveying, engineering and components and manufacturing.

Valeport is a good example of a specialist sout west company exporting high precision oceanographic, hydrographic and hydrometric instrumentation to the oil and gas sector (and other markets) around the world.

Oil and Gas	
Size of market	Across the EU the oil and gas sector is estimated to be worth over €14bn GVA per annum for the marine industries. Oil and Gas UK in 2014 estimated the sector is worth about £35bn to the UK economy and employs 450,000 people in more than 3,000 companies

	(45% of jobs are based in Scotland, 21% are in south east England 6% in north west England, 5% in the West Midlands, 5% in eastern England the rest 18% across other regions). UK Capital Investment expected to be above £10 billion a year in 2014 and 2015 – although this is likely to have fallen for 2015
Growth potential	Oil and Gas on the UK continental shelf and globally will continue to be a significant industry for some years. The industry strategy is now based on maximising the recovery of existing reserves, maintaining jobs and economic value, and preparing a strategy for decommissioning. See Wood Report February 2015 Decommissioning will become a major growth market.
Key issues	• Oil price volatility • Decline in UK production • Increasing cost competition • Risk of "Stranded Carbon Assets"
Opportunities for innovation	The Oil and Gas sector will continue to drive innovation in the marine industry through: • Propulsion systems and green vessels • Electronics, navigation, communication and control systems • Large scale composite structures • Subsea operations – drilling, pipe and cable laying • Remote and autonomous vehicles • Personnel training, health and safety • Condition monitoring • ICT – especially integrated maintenance and control systems • Decommissioning and thru life asset mgt • Environmental sciences • Subsea survey • Satellite applications

3.5 Defence and Security

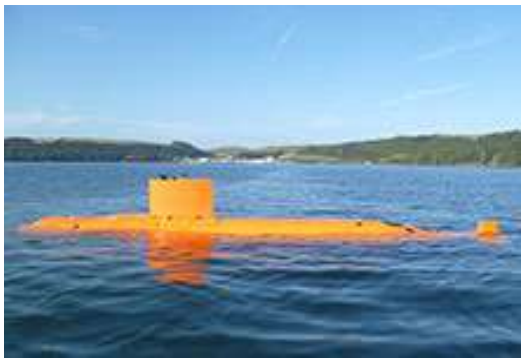
Whilst public spending on defence and security is under increasing pressure from budget cuts to the Ministry of Defence, the value of the industry to the UK economy is high at £22 billion and growing year on year through increasing exports and innovation in private sector security technologies and services. The UK is the number one exporter of defence equipment and services in Europe and second only to the USA in the global market.

The UK sector directly currently employs 155,000 people in the UK, plus a further 145,000 people in the supply chain, including scientists, engineers, apprentices and manufactures. Much of the employment in the sector is provided by a small number of very large companies.

The majority of the sector operates in 5 major water front sites including Rosyth, Portsmouth and Plymouth and has a turnover of approximately £4bn/year. Whilst the UK has lost significant areas of industrial capability over the past sixty years, the expertise and capability required to deliver the full life-cycle spectrum of the naval defence industry's needs, from research and concept development through to vessel manufacture and servicing have been retained and developed.

3.5.1 Opportunities for innovation

While spending in the traditional defence markets is down, the sector is evolving through the development of new technologies including the development of unmanned vessels (UxVs – the x stands for various applications, such as inspection, and various modes of operation, such as flying, underwater etc). In 2014, £120 million was jointly committed by the French and UK defence ministers to a programme of work around the systems architecture and definition of simulation methods of unmanned vessels in combat.



Source: Msubs, Plymouth

Due to the defence spending cuts putting pressure of Royal Navy vessels, the UK has had to scale back its commitments on areas such as international counter pirac application in tackling piracy by reducing costs and risk associated with manned vessels. Unmanned vessels are used to track ships and provide intelligence to manned maritime forces.

Source: mSubs, Plymouth

The UK Ministry of Defence has committed to developing a new generation of UxVs (also referred to as 'drones') after the success of their aerial counterparts for anti-submarine warfare and missile attacks on enemy ships, having seen how effective UxVs have been for NATO. UxVs will aid the delivery of many tasks deemed too 'dangerous, repetitive or dirty' for personnel to carry out and will significantly support the decreasing fleet of manned vessels. While the potential of this new technology is not disputed, there remains a lot of work surrounding the technology and the legal and ethical issues using such technology presents.

Cyber security, the protection of networked information systems, has grown in importance in recent years with applications in many sectors including defence, banking, general computing and finance. Investment in the cyber security companies has increased accordingly and the UK government have launched an accelerator for start-ups in the sector, plus an export strategy for UK companies to benefit from the growing global market. The 2011 National Security Strategy set an overarching strategy to ensure the UK is safe against threats of all kind, including in the defence sector. Increasing the use of autonomous vessels in the defence sector will require well defined regulatory framework, in order to minimise the risk to national security, and this in itself presents an area of innovation and growth.

3.5.2 Opportunities for Plymouth and the south west

The south west of England is the largest aerospace, advanced engineering and defence cluster in the UK, providing 59,000 jobs and sales of £5.5billion, of which £64 million is spent in the south west, £2.6 billion is in the wider UK and £2.75 billion is exported overseas. A large number of key companies in the defence sector supply chain have bases in Plymouth and the south west, including Babcock (Appledore and Plymouth), BAE (Bristol) and BMT (Bristol and Plymouth).

Source: Babcock, Plymouth

With continued advancement in UxV technology, south west based marine consultants BMT have formed a partnership with Plymouth based MSubs to develop a test range, located off the Plymouth coast to test these new technologies. When built, the test range will feature sensors within fixed buoys, environmental sensors, GPS, Wi-Fi (for tracking, communications and navigation) and will help developers test their technology in real conditions. The south west has been chosen as the most practical location in the UK for the test facility, due to the presence of Plymouth based MSubs and BMT and in part due to the low shipping density in the region. The future aim of the range is to enable a series of UxVs working in the air, surface and subsurface domains to coordinate with each other with little or no human intervention whilst being constantly monitored from the shore control facility.

Despite cuts in the UK Government defence expenditure there are also significant opportunities for South West companies to export products and services overseas. For example Babcock in Appledore has now received orders for two Offshore Patrol Vessels (LE Samual Beckett and LE James Joyce) for the Irish Navy. This class of vessels has global export potential. Similarly Supacat, is now finding customers for its Jackal all terrain vehicle in markets from Australia to India and the Middle East.

Defence	
Size of market	The defence market is worth over £22 billion to the UK economy annually.
Growth potential	High, if the new areas of innovation are prioritised - UxVs and cybersecurity. Exporting expertise and technology overseas is also crucial for the growth of UK based companies.
Key issues	• Cuts in traditional spending areas such as frigates • Changing nature of the defence business requires changes in business approach and investment
Opportunities for innovation	**Autonomous vessels** **Remote sensing/sensors** **Communications** • Technological advances in communication methods • Secure networks and cybersecurity **Composites**

3.6 Marine Renewable Energy

The UK is currently at the forefront of the development of marine renewable energy technology, including wave, tidal stream and tidal range technology both in terms of technology development and deployed capacity. The south west is playing a significant role in this new global industry with three of the leading tidal turbine technology developers based in Bristol, and employing approximately 200 people – currently the largest marine renewable energy technology development cluster in the world.

For those regions, and companies that are able to invest to grow their businesses in the sector, marine energy has the potential to create thousands of high value jobs in areas of technology development, professional services, marine engineering, operations and manufacturing.

Although the sector has a high degree of potential as a future part of the energy mix, it is currently in a state of significant flux due to political uncertainty and a lack of investment support for developers. Recent months have been turbulent for the sector, with the news that industry leaders Pelamis Wave Power had gone into administration and Siemens' decision to divest from Marine Current Turbines in order to exit the tidal stream sector. However, the marine renewable energy sector has strong potential all over the world, presenting a significant future market for UK companies that succeed. Particular countries of interest include Korea, Japan, China, France, Canada, Ireland and the USA. UK and global projects include:

- the MeyGen project, the first commercial scale tidal stream array project which recently reached financial close, having secured £51 million (for the first 6 MWs of the project). Onshore construction at the site in Pentland Firth commenced in January 2015.
- Technology developer project pipelines such as OpenHydro's list of planned projects across the world
- Newly announced pilot tidal energy projects in France
- Wave Hub is fully reserved by developers with a potential 3- 10MW of projects set to be deployed in the next few years
- A tidal range lagoon project planned for Swansea Bay is at an advanced stage in the planning system, with a decision from the Secretary of State due in May 2015

Marine renewable energy has been identified as a key priority area for the European Commission, outlining an ambition to generate 100 GW by 2050. While this does create competition for UK based companies, the globalisation of the marine energy sector also presents a significant export opportunity for UK companies.

If successfully brought to commercialisation, wave and tidal energy has the global resource potential to generate as much as 2500 TWh/year, making a valuable contribution to the growing demand for clean low carbon energy. It is estimated that with political support and clarity, by 2035, the UK marine energy market could be worth up to £6.1 billion per annum and could be supporting 19,500 jobs, while contributing £800 million to the UK economy.

3.6.1 Opportunities for innovation

While wave and tidal energy share a lot of the same technical challenges and are consequently often grouped together, the two technologies are at different stages in their development. Tidal stream technology is at a more advanced stage of development, with companies such as Atlantis and Alstom Tidal Generation Limited having successfully deployed full-scale prototype devices and the first commercial tidal energy projects due to come online in the near future. Access to capital is arguably one of the greatest barriers to the commercialisation of the wave and tidal stream sector. However despite the challenging investment climate the MeyGen project recently raised the necessary capital for the first, 6MW stage of the project, albeit with a high percentage of enabling finance.

Innovative new methods of capturing the energy generated from tidal range are being investigated, including the development of lagoon structures. Lagoons are large civil structures that compound water along a stretch of coastline and although there are currently no known lagoon generating schemes in operation, there are advanced plans for the first one, which would be built in Swansea Bay.

Low head turbines that can generate on both the ebb and flood tides have an application with lagoon schemes and companies such as Rolls Royce/Atkins have been developing the technology.

The design of foundations for installation of tidal turbines presents an area of innovation for the marine energy sector. Isle of Wight based marine engineering company, Sustainable Marine Energy Ltd have developed a tidal energy platform, PLAT-O to reduce the costs of the delivery of

tidal stream energy. A number of tidal developers are looking at novel foundation structures, including multi -turbine structures (such as Tidal Energy Ltd), gravity foundations and bridge structure mounted (such as Tidal Stream Ltd)

In addition to platforms, innovation is being seen in the design of tidal turbine, as new smaller tidal turbines are being developed, with fixed pitch blades, passive adaptive blade design and direct drive (no gearbox) generators. Turbine developers exploring and demonstrating this approach include Schottel, Tocardo and Verdant Power.

3.6.2 Opportunities for Plymouth and the south west

Due to a combination of excellent offshore wind, wave and tidal energy resource and an established industry and academic cluster, the south west was identified as the UK's first Marine Energy Park in 2012. The designation provides the region with a priority focus for marine energy technology development, energy generation projects and industry growth. Over £100m has been invested in the south west to drive the development of marine renewable energy, including in the Wave Hub test facility, the Plymouth University COAST test facility, Falmouth Bay Test Facility (FaBTest), Dynamic Marine Component Test Facility (DMaC) and the South West Mooring Test Facility (SWMTF).

Marine Renewable Energy	
Size of market	Wave and tidal stream technology still pre commercial and the industry has faced turbulence recently. Wave Hub is fully booked with 3-10 MW in the pipeline
Growth potential	The UK industry is potentially huge with estimates suggesting it could be worth up to 6.1 billion per annum.
Key issues	• Political certainty • Finance and funding • Proving technology • Warranties and guarantees for technology developers
Opportunities for innovation	• New technologies, wave and tidal device design and development • Hydraulics and instrumentation • Installation vessels and methods • Array electrical infrastructure • Insurance

3.7 Offshore Wind

After more than ten years of commercial scale development, the offshore wind sector is now an established part of the energy mix in Europe, with approximately 8 GW currently installed. The UK leads the world in terms of installed capacity at 4.1 GW in January 2015 with an additional 4.9 GW in planning. Current figures show that each megawatt of installed offshore wind capacity represents £3m investment, although relatively low UK supply chain content in the offshore wind industry means that only 25% of this value is retained in the UK. For projects currently installed and those in planning, this equates to £6.8 billion of value to the UK. The UK government is working to increase this percentage to 50%.

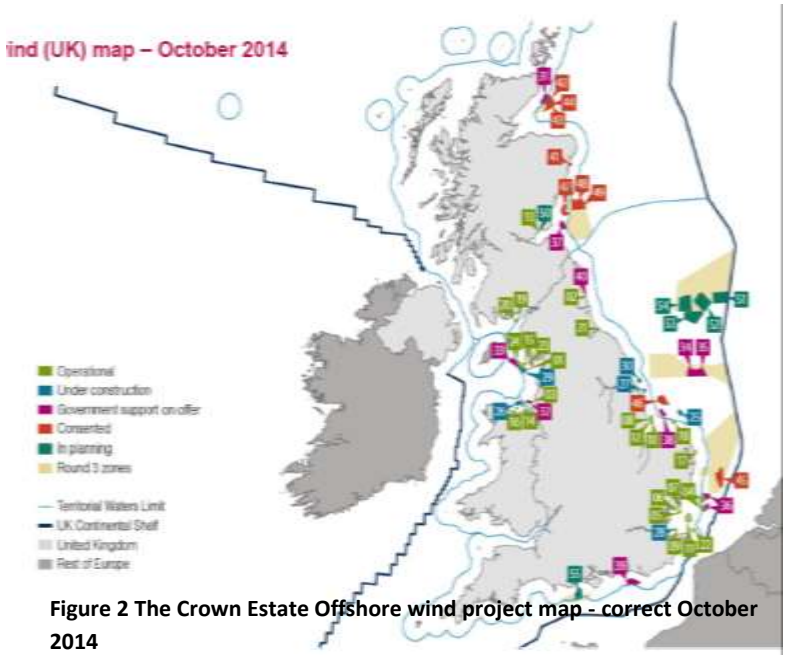
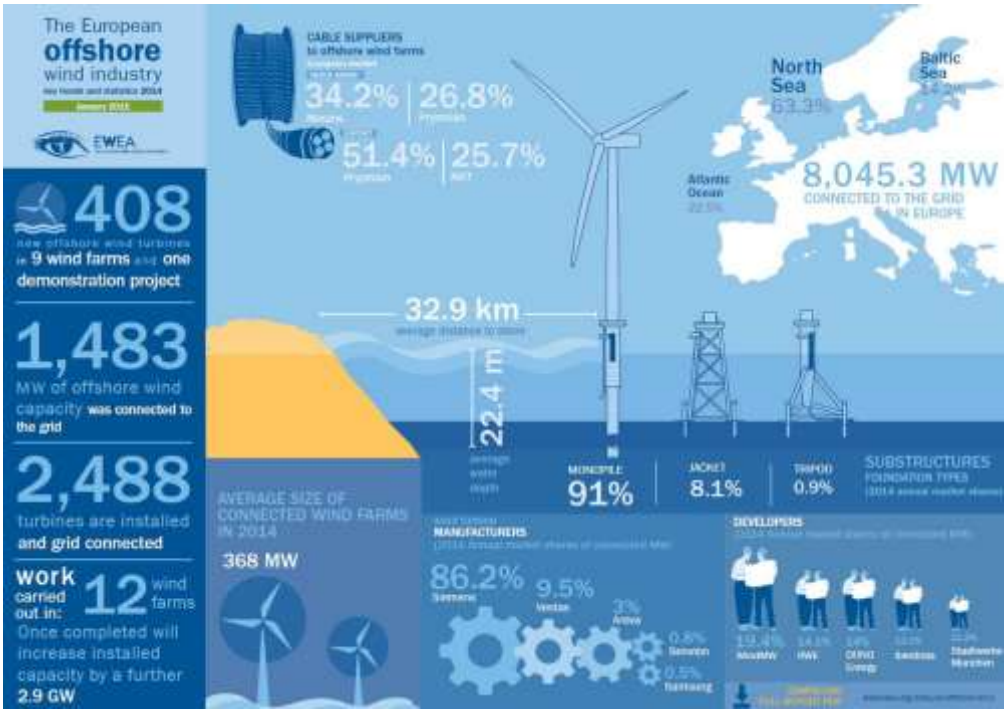


Figure 2 The Crown Estate Offshore wind project map - correct October 2014

Despite the large amount of offshore wind deployed and the significant amount still in the planning system, the future of the offshore wind sector in the UK looks uncertain. Over the past year a large number of projects have been cancelled (totalling 11.3 GW). This is likely to be partially as a result of the governments reduced ambition for offshore wind, reflected in the contracts for difference budget. The governments revised roadmap to 2020 outlines a reduction in ambition, from 25 GW deployed offshore wind to between 8 and 15 GW, with a more central estimate of 10-12 GW.



Source: European Offshore Wind Industry

Significantly for the south west, the Atlantic Array, a 1.2 GW development planned for the Bristol Channel, was cancelled in November 2013 by developer RWE. More recently, the Navitus Bay development, a planned offshore wind farm off the coast of Dorset has submitted an additional mitigation plan to the planning inspectorate, scaling back the project from 970 MW to 630 MW. This mitigation option is likely to have been triggered by negative public perception of offshore wind in the area. A decision on the Navitus Bay development is expected in June 2015.

The map Figure 2 shows that there is a lack of projects on the western seaboard and that the majority of the projects are off the east coast of the UK, in the North Sea area. For this reason, Siemens, the dominant offshore wind turbine supplier throughout Europe, have plans to invest £160 million in wind turbine production in Green Port Hull, which would directly create 1,000 new jobs in the Hull region. This is a positive step for the UK economy and will help to firmly cement the UK's position as world leader in offshore wind.

3.7.1 Opportunities for Innovation

Companies such as Supacat, a defence company who have innovated to take advantage of the opportunities in the marine and offshore wind sector have developed technology to serve the sector. The SMV- 24, an offshore wind support vessel, has been designed to provide a cost effective multi role high performance solution for operating in the marine environment.

Floating foundations represent a significant area of future innovation in the wind energy sector as a method of reducing costs and opening up new resource to development – see Section 4.6 Offshore Renewable Energy Technology.

3.7.2 Opportunities for Plymouth and the South West

While the lack of an offshore wind pipeline on the west coast and in the south west means it is unlikely that turbine developers would choose to invest heavily in ports (as in the case of Siemens in Hull) there are still many opportunities for the south west in offshore wind.

The SMV-24 offshore wind support vessel. Source: Supacat.

The reasons cited by RWE for the cancellation of the Atlantic Array were "commercial and technical challenges", particularly with regards to seabed conditions. The latter provides an opportunity for the south west of England in the development of innovative floating offshore wind foundations which have the potential to reduce costs, increase the depth in which offshore wind can be installed and also overcome challenging seabed conditions. The Wave Hub test facility off north Cornwall was announced by the Energy Technologies Institute (ETI) in 2013 as the chosen location to test the Pelastar Tension Leg Platform and the deep waters that surround the south west coast line make it the perfect test bed for innovative floating technologies.

Offshore wind	
Size of market	UK offshore wind market is over 4 GW installed in UK, more than rest of world combined
Growth potential	Although recently curtailed through government budget cuts to subsidies for offshore wind development, the UK still has a significant pipeline of offshore wind projects. Floating offshore wind platforms could unlock 2.5 GW of potential within 50km of the south west coastline. Innovation to reduce costs and increase resource availability will be key in order to enable the industry to continue to develop.
Key issues	• Lack of projects on the western seaboard • Relatively low UK content in offshore wind project and turbine technology supply chains • Political support uncertainty • Cost reduction
Opportunities for innovation	**Foundations** • Floating- i.e. Statoil Hywind, Pelastar Tension Leg Platform (TLP Poseidon **Installation and operation and maintenance vessels-** • Supacat SMV 24 and • Mojo Maritime Hi Flo 4 **Operation and maintenance scheduling including weather window**

3.8 Marine leisure

The marine leisure industry includes the global leisure boating (including powerboats), water sport and luxury superyachts industry. In 2014 the UK marine leisure sector generated £2.93 billion and supported 31,500 full time jobs, an increase of 2.7% on 2013.

The growth of the UK marine leisure sector is heavily dependent on the health of the wider UK economy. As a result of this, the recession played its part in the British leisure market suffering a 6.2% reduction in 2008. However, post-recession, the UK leisure market has recovered well and has seen a steady upwards trend in turnover, reporting combined spends of £6.2 billion in the UK economy in 2012-2013 and industry revenue of £2.9 billion.

One particular part of the marine leisure industry that has experienced recent growth is the globally recognised UK Superyacht industry, which had a turnover of £460 million and employed over 3,600 people in 2012/2013. This industry is of particular importance to Plymouth and the south west due its location as the home of Princess Yachts at South Yard and its role as one of the largest employers in the city, employing over 2000 people. In recognition of its importance to the city, the internationally renowned luxury boat builder secured £5m investment from the Regional Growth Fund to develop a major new facility in South Yard.

The marine leisure sector is comprised mostly of SMEs with the nine largest companies representing just 25% of the market. The UK leads the world in quality powerboat production, and produces a range of high value sailing yachts. The export market of all parts of the marine leisure industry is strong and throughout 2014 the UK exported goods and services from the marine leisure industry worth over £1billion.

In recent years the leisure marine sector has been recognised by the Government as a manufacturing success story and a growing and valuable contributor to the UK economy. The UK's marine manufacturing sector produces many of the world's leading brands of boats and marine equipment.

3.8.1 Opportunities for innovation

Requirements outlined in 2006 by the International Maritime Organisation stating that all marine leisure vessels must produce fewer emissions presented many innovation opportunities for the supply chain, through the design of new combustion engines that are more efficient to the creation of new greener fuels to power the vessels. This has been supported by the UKs innovation body, Innovate UK, who launched a £5 million competition for collaborative research and development projects to stimulate the development of these systems. Exeter based operation and maintenance consultancy Safeguard Nautica Ltd were part of a consortium that were awarded funding under this competition to develop an efficiency system optimised for small commercial vessels. The consortium designed a novel maintenance codification system realising the benefits of condition based maintenance for smaller vessels, which could have an application in the leisure sector.

Combatting the effects of biofouling on leisure vessels, and all high value assets in the sea is a key area of innovation. Biofouling, the accumulation of microorganisms on wet surfaces, causes hydrodynamic drag which increases fuel consumption and accelerates the rate of corrosion, which can result in the loss of structural integrity and increased maintenance costs. The research field of biofouling was given a priority focus in 2011 when the International Maritime Organisations published guidelines regarding the control of biofouling to avoid the transfer of invasive species. Plymouth Marine Laboratory Applications carry out work in understanding the effects of biofouling and investigating methods to block the process by developing novel anti fouling technologies.

In recognition of the economic impacts of biofouling to the Super Yacht industry, the International Council of Marine Industry Associations (ICOMIA) has formed to provide technical guidance on the acceptable coatings for Super Yachts.

Other innovation opportunities in the marine leisure industry include:

- Remote navigation – opportunity to
- Composites – sails and fixed wing sails
- Biofouling methods to protect yacht exterior from colonisation of biological organisms
- Innovative coatings of superyachts in order to maintain quality of finishing

3.8.2 Opportunities for Plymouth and the south west

The marine leisure industry is particularly important to Plymouth and the south west, not least because it is home to two of the largest super yacht manufacturers in the world, Princess Yachts (Plymouth) and Pendennis (Falmouth). Princess Yachts, the 4th largest yacht builder in the world has enjoyed steady growth over the past 5 years, seeing their order book increase as the UK started to come out of the global recession. In the financial year 2013-2014 the yacht builder saw the number of boats in their order book increase from 22-33.

Princess Yachts, Plymouth			
Year	**2012**	**2011**	**2010**
Turnover (£million)	£249.9	£228.6	£207.8
Employees	2056	1911	1716

Turnover and employee numbers courtesy of Princess Yachts, Plymouth

As high value leisure vessels age, the refit market becomes increasingly important part of the revenue stream for ship build, refit and repair service companies. This trend will only increase as the growing superyacht fleet continues to age.

The export market presents significant opportunities for Plymouth and the wider south west, particularly in the export of luxury super yachts to countries with a 'growing middles class' including Brazil, Russia, India and China. However, there are barriers to exporting to these countries, for example, Russia has a short summer season which limits the usage of marine leisure equipment and in Brazil, and tax issues hinder sales from the UK to Brazil.

Leisure	
Size of market	In the UK in 2014 the marine leisure market was worth 2.93 billion and supported 31,500 full time employees.
Growth potential	Export opportunities to overseas markets Refit market will grow as marine vessels increase in age
Key issues	Restrictions on export to major markets (Brazil, Russia) Fluctuates with the state of the global economy
Opportunities for innovation	**Green vessels** • Propulsion systems • Propeller design • Advanced engines • Hydraulics **Coatings** • For vessels and other high value assets **Composites manufacturing** **Naval architecture** **Electronics, navigation, communication and control systems** **Hi spec components - internal** **Finishing's, interiors and carpentry**

3.9 Marine sciences

In 2011 the marine science and technology sector was estimated at £1billion and was dominated by small and medium size enterprises. In the context of this report, the marine science sector encompasses the real world application of science, linking academic research directly to end user needs. These end users gain knowledge and insight that will influence generations to come, providing evidence to societal issues including the impacts of human activity on climate change, pollution and others. The marine sciences industry offers export opportunity for the UK, exporting knowledge and expertise to customers in the pharmaceutical, phycology, meteorology and oceanography industry.

In recognition of the importance of the marine sciences sector to wider society, the government created a 15 year framework in 2010 to provide support, coordination and focus to the marine sciences industry with the aim of prioritising research into 'clean, healthy, safe and productive seas'. The framework ensures that funding in marine science programmes is directed effectively to high impact areas.

3.9.1 Opportunities for innovation

In recognition of the growth of private sector need for marine sciences, a number of organisations have developed programmes of work to take advantage of this. Plymouth Marine Laboratories Applications is a wholly owned subsidiary of Plymouth Marine Laboratories that facilitates the application of research from PML and similarly, in Scotland, the Scottish Association for Marine Sciences have a commercial arm (SRSL) exists specialising in delivering consultancy work to the private sector, in the fields of renewables, mining, aquaculture and marine services.

Changes in the ocean that occur as a result of global climate change present research opportunities, as the consequences on the marine ecosystems are investigated. A particular example of an area that needs to be understood is the effects of ocean acidification in order to ascertain the implications on ocean biogeochemistry, ecosystems and biodiversity.

The UK is currently undertaking a marine spatial planning exercise across all of the UK seabed to enable multiple uses of the environment, and in doing so, an increased understanding of the implication on management options is essential. This requires research into systems interactions and excellent monitoring methods. New technologies, including remote operated vessels offer significant opportunities in improving the quality of monitoring work.

3.9.2 Opportunities for Plymouth and the south west

Plymouth has a global reputation within the marine sciences sector, through its track record of excellence, contributed to by the following institutions that form the Plymouth Marine Sciences Partnership:

- Plymouth University Marine Institute
- Plymouth Marine Laboratories
- Sir Alister Hardy Foundation for Ocean Science
- Marine Biological Association
- Diving Diseases Research Centre
- National Marine Aquarium
- The Blue Environment
- Flag Officer Sea Training Group

More information about each of the individual organisations can be found in **Error! Reference source not found.**.

The Partnership for Research in Marine Renewable Energy (PRIMaRE), a network of research institutions across the west, south and south west of England, undertakes research to develop understanding and address challenges in the marine renewable energy industry. The regional network is closely aligned with industry and is managed by a steering board featuring the five universities, Wave Hub and the South West Marine Energy Park (SWMEP).

The Plymouth University Marine Institute is the first and largest marine research organisation in the UK, representing 3000 researchers, students and staff. The Marine Institute provides an

external portal to an extensive pool of world leading experts and facilities. The institute produce world leading multidisciplinary research targeted at producing solutions, in fields such as Marine Protected Areas, rip currents and optimising container usage at sea.

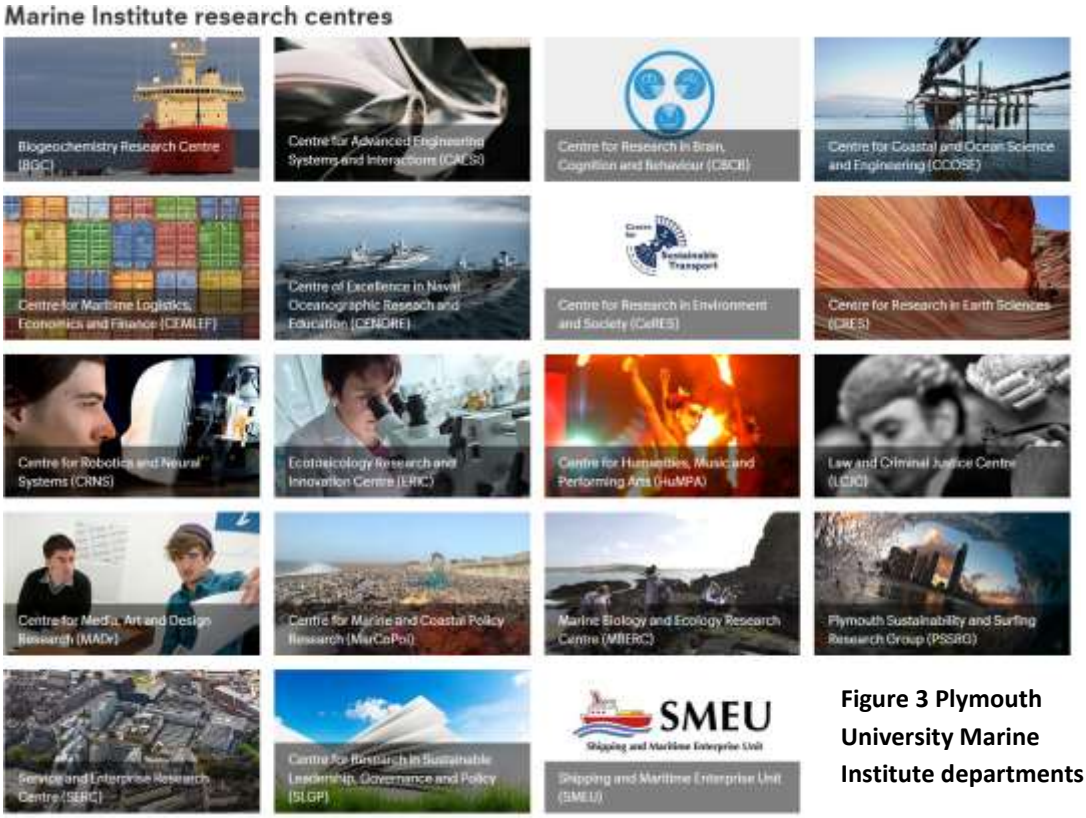


Figure 3 Plymouth University Marine Institute departments

Plymouth Marine Laboratories has a proven track record of over 40 years, employing over 150 people and with over 350 partners across 45 different countries. PML are a niche service provider with a consultancy arm, providing services to the private sector. With over 40 years of experience, PML have positioned themselves as leaders in the fields of ballast water management, biofouling, survey work and remote sensing, all growing areas in fields such as marine renewable energy, the marine leisure industry and commercial shipping.

Other areas of research PML are involved with:

- Ecotoxicology
- Biomedical sciences
- Aquaculture

Marine sciences	
Size of market	In 2011 the marine sciences sector was worth £1 billion per annum to the UK The sector is currently dominated by innovative SMEs and university organisations providing private consultancy services- public spending in marine science was £170.5m in 2012/2013

Growth potential	Growth in areas such as: • Climate change, • Renewable energy • Coatings • Pharmaceuticals • Biomedical Sciences
Key issues	Working across multiple groups of stakeholders Cost of vessels to carry out work
Opportunities for innovation	**Climate sciences** • Coastal processes research (flood defence) • Climate change **Biomedical and pharmacological science** **Bio-fouling and protective coatings** **Remote sensing and marine surveying/environmental monitoring** **Ballast water treatment** **Floating offshore wind** **Green vessels and logistics**

3.10 Commercial shipping

More than 90% of the world's trade is transported by sea, making the shipping industry crucial to the global economy. For this reason, the shipping industry is experiencing expansion, due to the need to meet the demands of globalisation and as a result, over the last 40 years maritime trade has quadrupled. Transporting goods by sea is the currently the most cost effective method of transport. The UK shipping industry, including ports and the maritime business sector is worth £31.7 billion to UK and supports 537,500 UK jobs as well as providing £8.5 billion in tax to the UK treasury.

Thanks to the UKs long legacy of ship building, merchant shipping has been a major source of growth for the UK economy over the last decade, following a dynamic revival of the UK shipping fleet.

A key component of Regional Port Strategy is the role of short sea and coastal shipping, in reinvigorating a number of the region's gateway ports and promoting a sustainable method of transporting goods in and out of the region. In broad terms, short sea shipping is defined as shipping services between the United Kingdom and Ireland/Continental Europe, whilst coastal shipping refers to shipping services between ports along the United Kingdom coast inland waterways. The development of coastal shipping in the south west of England holds an opportunity for Plymouth, which could be play an increasing role both as a source and destination for coastal shipping.

3.10.1 Opportunities for innovation

The global impact of climate change is recognised as an urgent environmental challenge and reducing greenhouse gas (GHG) emissions is one of the biggest challenges facing the global shipping industry, despite it already being the most carbon efficient means of transportation (currently contributing 2.7% of GHGs globally).

The challenge of reducing emissions provides an area of growth an innovation in the supply chain that supports the global shipping industry. Complying with environmental regulations is hugely challenging for the sector, particularly as complying with the requirements will need step changes in technical solutions.

In order to reduce the GHG's and comply with new regulations, a number of technical changes need to be made to each vessel, including fitting emission scrubbers in vessels to remove sulphur oxides (SOx) from exhaust gases and catalytic converters to reduce nitrous oxides (NOx) and fitting emission monitoring equipment. Other areas of innovation are in the development of ballast water treatment systems and particulate matter filters.

The Ballast Water Management Convention carries more restrictions for commercial shipping vessels, by enforcing all ships to implement a ballast water and sediment management plan. All ships now have to carry out ballast water management procedures to reduce the spread of invasive species.

An international requirement that all fuel must be 0.1% low-sulphur fuel in 2015 could impact negatively on the shipping industry, with some officials estimating a 50% shift of freight traffic from sea to land, owing to the significant increase in fuel price (85% higher than 2014 prices).

The requirement for ships to be as energy efficient as possible presents innovation opportunities for naval architects in the south west. One such company, BMT group, who have a base in Plymouth and Bristol, are a leading naval architecture and design consultancy, providing services across a wide range of vessel designs, including cargo and commercial vessels. The company have been responsible for developing novel hull forms and propulsion systems.

Commercial shipping	
Size of market	Over 90% of the world's trade is transported by sea. The UK shipping industry supports over 537,000 jobs and contributes £8 billion to the UK economy.
Growth potential	Huge growth potential in the industry, particularly in combatting the environmental impacts of shipping. This provides opportunities for ship builders, naval architects, propulsion system companies, green fuel providers and more. In the past 40 years, maritime trade has quadrupled, making commercial shipping a high growth sector.

Key issues	Environmental regulations and increasing costs.
Opportunities for innovation	• Green shipping • Propulsion systems • Intelligence systems • Marine ICT • Autonomous vessels • Environmental management and licensing • Logistics • Green fuels • Hull forms

3.11 Primary industries

For the purposes of this study, the primary industries market has been broken down into the following two sections:

- Marine aggregate extraction (Section 3.11.1)
- Commercial fishing (Section 3.11.4)

3.11.1 Marine aggregate extraction

Marine aggregates extraction includes sand, gravel, crushed rock or mineral mixtures that are used as the main component of concrete and are primarily used in construction and civil engineering. The marine aggregate industry is one of the UK's main suppliers of sand and gravel, with over 20 million tonnes a year being dredged from less than 1% of the UK seabed each year, which in turn provides around 20% of sand and gravel sales in England and 48% per cent in Wales.

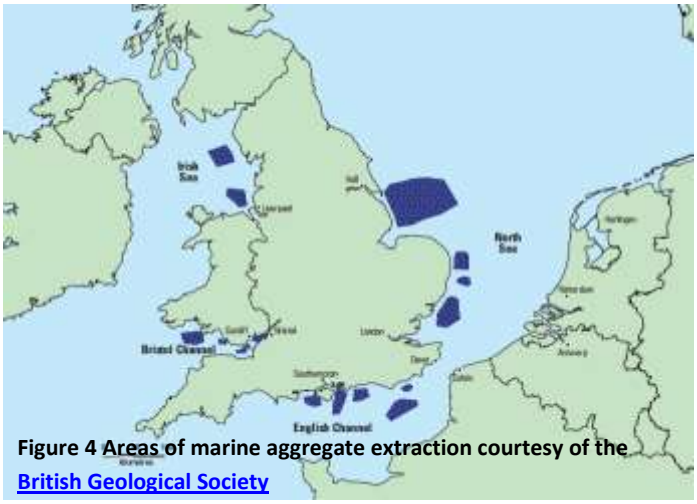


Figure 4 Areas of marine aggregate extraction courtesy of the British Geological Society

The marine aggregate industry is an essential supplier to the construction industry in the UK and is expected to continue to play a key role in supporting the successful delivery of major infrastructure construction projects such as those associated with Government policies related to energy security and climate change. Another crucial use of marine aggregates is in coastal defence, with over 38 million tonnes of extracted sand and gravel from the marine environment having been used since 1990 in large scale coastal defence and beach replenishment projects. In the face of climate change and the increase in occurrence of flood incidents this is likely to continue.

Significant investment in the sector has been called for, particularly in relation to dredging vessels which make up an increasingly ageing fleet. Dredging vessels work in notoriously challenging, high

wear conditions, and with 26% of UK dredging vessels over 25 years old, investment will be needed to ensure the sector can carry on operating at the required capacity.

3.11.2 Opportunities for innovation

Innovation in the marine aggregates industry centres on the need for best practice with regards to monitoring the seabed in order to protect the environment and to monitor the seabed's response to aggregate dredging. A number of environmental monitoring companies in the south west have the capabilities required by the industry. This mature industry has entered a new phase due to permitting under the Marine Bill and Marine Spatial Planning Act. Entering this new phase provides areas of innovation in the sector based on new requirements in environmental monitoring and seabed sampling.

3.11.3 Opportunities for Plymouth and the south west

Although in comparison to the south east of England the south west has a number of reasonably small marine aggregate resource areas, located in and around the Bristol Channel the area is important due to the significant accumulations of medium to coarse sands in the area.

There are currently 68 aggregate landing wharves in 48 UK ports, including 5 wharves in the south west.

The company behind the planned Swansea Bay Tidal Lagoon, Tidal Lagoon Power, have detailed their intentions to source aggregates from quarries in Cornwall and have stated that this will create approximately 60 jobs over 3 years. The project is currently in the planning system and a decision is due in the spring of 2015.

Primary industries- marine aggregates	
Size of market	The UK Marine aggregate industry is one of the largest in Europe and in the world.
Growth potential	There are a number of sources of future pressure on the marine aggregate industry that are likely to create significant growth in the coming decades: • Protection against flooding and coastal erosion – climate change • Significant expected growth in the UK housing market is expected to put pressure on marine aggregate businesses to scale up operations • Opportunities to provide aggregates to large construction projects such as the tidal lagoon planned for Swansea Bay
Key issues	Balancing the environmental requirements and marine spatial planning with the need to extract aggregates for

	growth in construction projects. Maintaining and replacing the UK's aging dredging vessel fleet and the investment needed to do this.
Opportunities for innovation	**Geophysical surveying** • Side scan sonar • Bathymetric surveying **Fleet management** **Environmental monitoring** **Licensing** **Monitoring** • Sediment tracing techniques to assess sediment transport • Beach profiling to assess impacts of marine aggregate dredging on the coast

3.11.4 Commercial fishing

Due to depleting fish stocks, the UK fishing industry is widely considered to have been in decline since World War II, with trawler fish landings peaking in 1937, at over 14 times the bottom living fish being caught in 2010 . In an effort to protect depleting fish stocks, the European Union imposed its Common Fisheries Policy (1983) which introduced controversial fishing quotas on fishing companies. This has been updated many times, introducing legally binding commitments to only fish at sustainable levels and banning fish discards. Strict regulation on the industry makes it increasingly difficult for fishermen to continue working in the industry, with low quotas on the amount of fish that can be caught making it hard to run a profitable business, particularly with operating costs of vessels simultaneously increasing.

Although the sector is in decline, it does still support a large number of employees - in 2013, the UK fishing industry supported 12,150 fishermen and a fleet of 6,399 fishing vessels. However, this is in comparison with over 7000 fishing vessels just ten years before (a 10% reduction). In 2013, UK vessels landed 624 thousand tonnes of sea fish (including shellfish) into the UK and abroad with a market value of £718 million.

Despite the national decline in the industry, fishing in the south west of England is still very important to the south west economy and in terms of landings, the region is the most active in England. Ports in the south west of England perform well on a national level and have contributed significantly to sustaining the industry, through investing in new market facilities. Both Brixham and Plymouth have invested in developing new handling facilities, reflecting their commitment to the future of the sector. In 2014, in Plymouth alone there were more than 600 people directly employed as a result of the fishing industry, plus many more employed in wider supporting industries. In 2013 Brixham port handled 13,000 tonnes of fish (representing a value of £24 million) which was the largest quantity of landings in England and 4th in the UK. Although, this is significant to the regional economy, the figure does represent a 14% decline on the previous year.

Plymouth was ranked as having the second highest amount of landings (6th in the UK) with 12 thousand tonnes, though these landings were of much lower value in comparison with Brixham (£14 million to Brixham's £24 million). Interfish limited, a large fish processing company in Plymouth currently employ over 200 people.

TABLE 1.1 Landings by UK vessels into key ports: 2013

	Quantity ('000 tonnes)				Value (£ million)			
	Demersal	Pelagic	Shellfish	Total	Demersal	Pelagic	Shellfish	Total
England								
Brixham	4.7	2.3	6.5	**13.5**	12.1	0.5	11.4	**24.0**
Plymouth	1.9	6.2	3.5	**11.6**	5.5	2.0	6.0	**13.5**
Newlyn	6.7	2.0	2.1	**10.8**	17.1	0.7	3.9	**21.6**
Wales								
Holyhead	..	-	4.3	**4.3**	..	-	2.7	**2.7**
Milford Haven	1.6	..	1.6	**3.3**	4.3	..	2.6	**6.9**
Saundersfoot	..	-	2.1	**2.1**	0.1	-	1.6	**1.7**
Scotland								
Peterhead	48.3	62.5	2.6	**113.4**	62.8	42.2	6.9	**112.0**
Lerwick	11.1	37.2	0.6	**48.9**	17.1	29.0	1.4	**47.5**
Fraserburgh	7.1	12.5	5.2	**24.9**	7.9	8.5	14.6	**31.1**
Northern Ireland								
Ardglass	0.2	5.3	2.4	**7.8**	0.1	2.3	4.5	**6.9**
Kilkeel	0.8	0.1	4.3	**5.2**	0.9	..	6.7	**7.7**
Portavogie	0.3	..	3.1	**3.4**	0.3	..	5.3	**5.6**

Source: Fisheries Administrations in the UK

Figure 5 Source: UK Sea Fisheries Statistics 2013

3.11.5 Opportunities for innovation

As with many of the marine sectors reliant on vessels, an area of innovation in the commercial fishing will be in response to regulations regarding vessel emissions and a requirement for vessels to become more environmentally friendly.

Particular areas of innovation in this sector include:

- Rolls Royce has designed an innovative fish transporter vessel, specifically for transporting live fish. The vessel incorporates latest developments in hull design to ensure fuel efficiency and cost effective operations.
- Innovation in aquaculture and environmentally friendly, commercially viable methods for increasing fish stocks in order to combat the problem of depleting fish.
- Aquaculture production in England for all species is 11,373 tonnes and is dominated by rainbow trout and mussels.
- Development of technologies for exposed and offshore cage production of fish is advancing and pilot-scale assessment of this technology for English waters may be appropriate. Semi-submerged long line production systems may also present new opportunities for aquaculture development in England
- In collaboration with aquaculture company Marine Harvest (Scotland), innovative wave energy company Albatern , have deployed their WaveNET technology to power

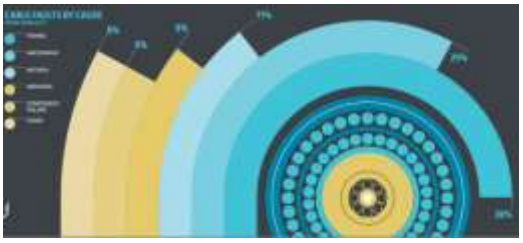
infrastructure for the remote Am Maol Salmon fish farm off the north east coast of the Isle of Muck (west coast of Scotland).

- Plymouth University runs a postgraduate course in aquaculture systems to prepare individuals for work in the fastest growing sector of agribusiness.

Primary industries- fishing	
Size of market	UK fishing industry is in decline due to over fishing/depleting fish stocks, but is still a very significant part of the south west economy, directly employing over 600 people. Approximately £40 million of fish and shellfish are landed in the south west every year.
Growth potential	There is minimal growth in the market in its current state but innovation is required to maintain and optimise the industry including improving aquaculture.
Key issues	Depleting fish stocks have led to increasingly stringent quotas forcing many out of the fishing industry.
Opportunities for innovation	• Fleet management • Vessel repair and refurbishment, more energy efficient vessels • Sustainability management • Aquaculture • Offshore renewable energy – fishing vessels can be utilised for offshore wind/tidal projects as in the case of Kilkeel

3.12 Telecommunications

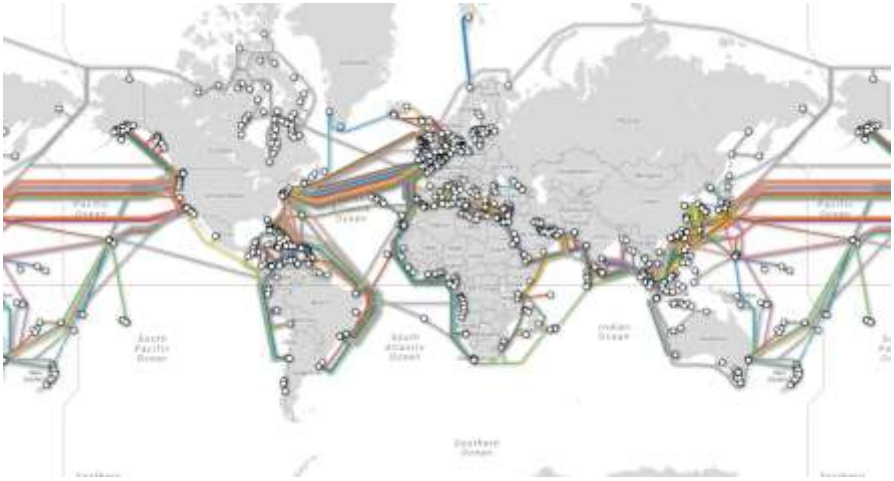
Subsea cabling is crucial to the world's information and power transportation infrastructure. Approximately 95% of all transnational internet and telephone traffic travels through subsea cables. In UK waters, nearly 200 fibre optic submarine cables are buried below the surface of the seabed and provide the fastest, safest and most reliable form of trans-ocean communication available.



Submarine telecommunication cables are typically comprised of delicate fibre optic cables, a copper core (needed to transmit power to signal boosting equipment), steel armour wires and a coating of polyethylene insulator. Although these cables are designed to be resilient, they are at significant risk of damage through scouring, fishing and anchorage. In the UK

Continental shelf alone there were 37 cable faults reported in 2013. Most incidents happen in sub-150m water depth. Approximately 40% of cable faults are caused by fishing anchors. For this reason, cables must be designed with additional protection in these shallow waters and require more frequent maintenance and replacement.

The submarine cable industry has developed to take advantage of increasing capability in Autonomous Inspection Vehicles (AIVs) and Remote Operated Vessels (ROVs) for the identification and repair of cables. Once a damaged cable is reported, the cable must be cut in order to bring it to the surface and a piece of stock cable is spliced into the original cable before being re submerged. This latter stage is carried out by ROVs which rebury the cable using pressurised jet water or by using trenching and ploughing equipment that has been developed to provide a solution for burying cables, with applications in the offshore wind and offshore power cable installation market.

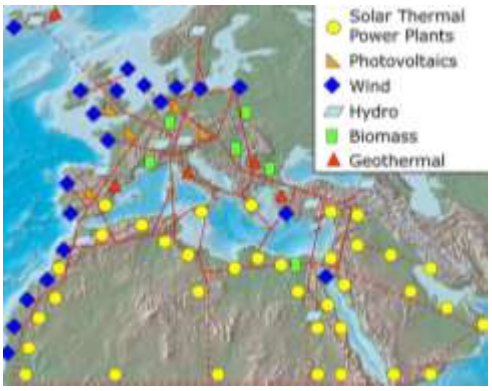


3.12.1 Opportunities for innovation

Areas of growth in the subsea telecommunications sector primarily centre on methods to ensure the safety of cables and preventing damage from other marine users including commercial fishing, oil and gas and offshore renewable energy. Once cables have become damaged, innovation in methods to repair and reinstate the cable provides opportunities for subsea engineering companies.

The ORE Catapult have announced a new piece of work with GnoSys Global Ltd focussing on improving subsea cable performance for power transmission by developing a new insulation material for power cables with the aim of reducing costs and improving efficiency which will be of particular importance to the offshore renewable energy sector.

Opportunities in the insurance of cables is growing due to an increase in damages to the cables, although telecommunications cables are mostly self-insured due to the nature of the industry, power cables associated with offshore renewable energy are in the commercial insurance market.



Other areas of innovation in the telecommunications and subsea cable industry:

- 'Supergrids' - High Voltage Direct Current (HVDC) networks that connect onshore and offshore Supernodes. This is increasingly important with more marine energy and offshore wind projects coming online. This technology is also capable of being deployed on land where there are gaps in energy capacity

- FABlink - the development of a connection between France, Alderney and Britain which will be used to transport energy between France and Britain and will allow power generated by tidal energy in Alderney to be exported to Europe.

3.12.2 Opportunities for Plymouth and the south west

The most significant impact on the south west is related to the active submarine telecommunications cables surrounding most of the UK, with the waters off the south west of England being of particular importance to the Trans-Atlantic system and consequently has a high density of cables.

A number of companies working in the subsea cable industry are based in the south west including Bristol based Viper Subsea, who carry out work in asset management of installed equipment, subsea electrical integrity, system maintenance, consultancy and engineering support and Plymouth based Manuplas, who manufacture Sub-Tectors which provide impact and abrasion protection for subsea cables. As with all markets that operate within the marine environment, there is a need to reduce the environmental impacts of the activity on the environment, from the laying of cables to maintenance.

Telecommunications	
Size of market	Difficult to measure the size of the telecommunications market but in 2012 the internet industry contributed £121 billion to the UK economy.
Growth potential	Deploying new cables capable of carrying high bandwith channels is an area of growth in the market Another area of growth in the subsea telecommunications market is in repairing damaged cables – damaged either through installation or incident. A further area of growth will be in the requirement to rebuild and upgrade aging cables.
Key issues	• Accidental damage of cables • Cost of repairing cables • Maintain safety standards and reduce risks to all seabed users and the marine environment
Opportunities for innovation	**Vessel efficiency (for operation and maintenance/installation)** • Green shipping • Propulsion **Installation techniques and operation and maintenance**

	• ROVS – http://www.fibre-systems.com/feature/submarine-cables-know-no-boundaries **Cable design** • Coverings for cables to reduce risk of damage • Materials used for construction of cables **High Voltage Direct Current networks**

4 Analysis of key services and technologies

4.1 Decommissioning

Decommissioning has emerged as a major service in the marine industry in the last decade and was identified as a key area of growth in the "Marine Industries Roadmap" published in 2011, due in part to the increasing number of oil and gas platforms that require decommissioning in the next ten years. More and more high-value, complex marine assets are being placed in the sea in the UK and around the world, suggesting that decommissioning services are likely to be a reliable future area of market demand.

As well as the physical and technical dismantling, removal and disposal of offshore structures, decommissioning in the marine environment requires a broad range of skills and capabilities in the fields of environmental planning and consultancy, health and safety, surveying, engineering design, project management, legal and finance. It also increasingly requires specialist equipment and technology. The below roadmap, courtesy of Totnes based D3 Consulting, outlines a step by step overview for decommissioning planning and implementation to UK regulatory compliance standards which highlights opportunities within the process.

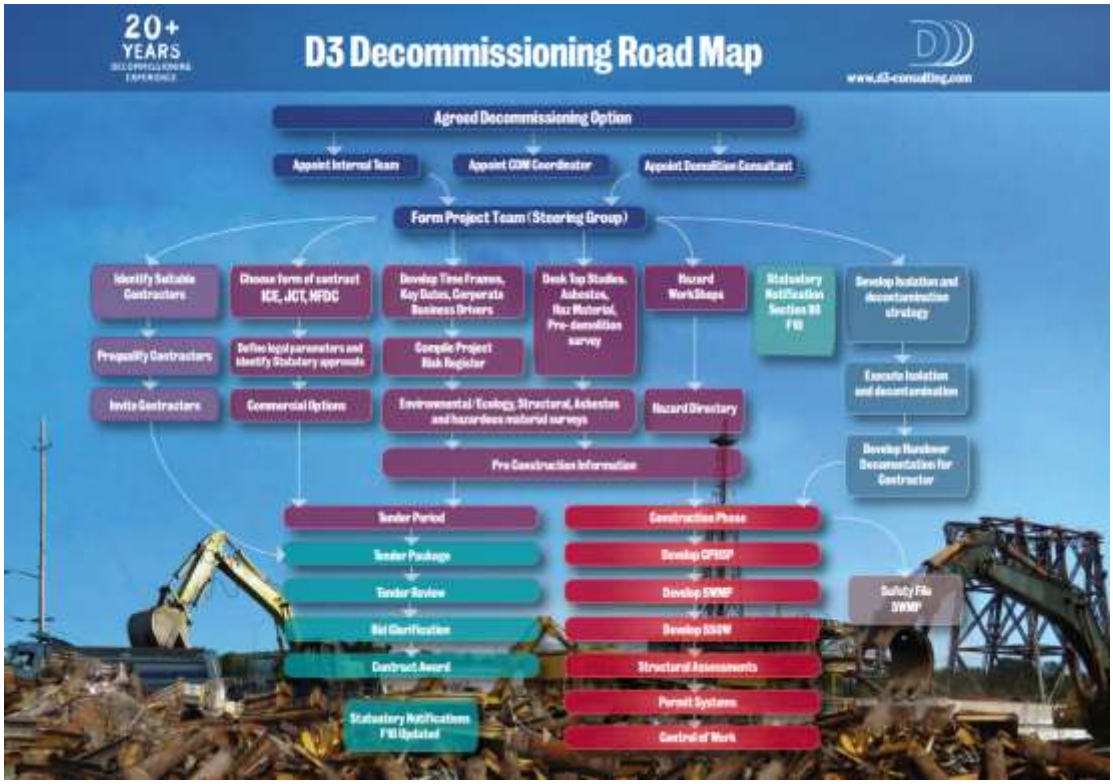


Figure 6. Decommissioning road map- source D3 Consulting

Decommissioning nuclear submarines presents an opportunity for Plymouth and the south west, following a decision by Babcock to decommission submarines between the Rosyth and Plymouth sites and the subsequent development of a trial crane structure, for use within a new Reactor Access House (RAH).

Decommissioning	
Applicable sectors	Oil and gas Marine renewable energy Offshore wind Defence Nuclear
Specific opportunities for Plymouth and the South West	**Consultancy services** • Technical advice • Environmental management • Environmental surveying • Project management • Work in smarter end of life processes to reduce costs and reduce environmental impacts- reusing, remanufacturing and design for reparability **Remote operated vehicles** See section 4.2

4.1.1 Companies already in the peninsula working in the decommissioning sector

4.1.2 Example potential inward investment companies

4.2 Autonomous vehicles

Autonomous vehicles (UxVs) is the collective name given to the entire range of unmanned and remotely operated vehicles - notably surface, underwater and air vehicles and vessels in the marine environment, including:

- Autonomous Surface Vehicles (ASVs)
- Autonomous Underwater Vehicles (AUVs)
- Unmanned Air Vehicles (UAVs)
- Remote Operated Vehicles (ROVs)
- Unmanned Surface Vehicles (USVs)
- Unmanned Underwater Vehicles (UUVs)
- Autonomous Inspection Vehicles (AIVs)

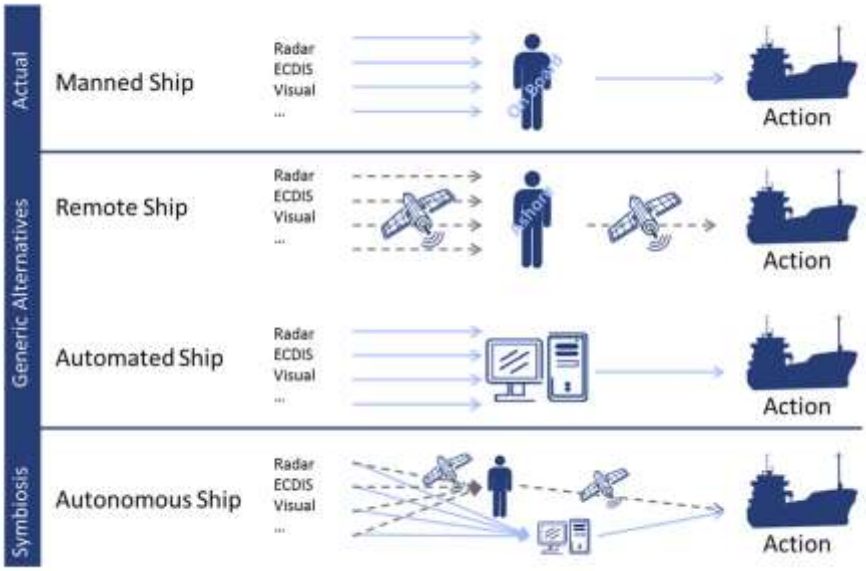


Illustration courtesy of MUNIN, a project developing an autonomous ship

As highlighted in the UK Marine Industries Roadmap, and as identified in the 8 Great Technologies speech, 2013 by David Willets MP (Department of Business, Innovation and Skills), the UK government has ambitions for the UK to become a leader in the field of autonomous vehicles, in recognition of their many cross-sector applications. The Maritime Autonomous Systems subgroup of Innovate UK's Robotics and Autonomous Systems Special Interest Group has been established as part of the UK Marine Industries Alliance Robotics group with a view to encouraging technology development around networking autonomous systems. Ultimately, the future aim of autonomous technology is for a series of UxVs to be able to interact and coordinate with each other with little or no human intervention, as illustrated above.

Autonomous vehicles	
Sectors applicable to	Defence Marine Sciences Oil and gas Marine renewables Offshore wind Primary industries Telecommunications Commercial shipping

Application of the technology	• Clearing mines for nuclear submarines • Mapping of harbours • Submarine locating • Seabed mapping • Explosive ordnance disposal, intelligence, surveillance • Environmental surveys • Cost reduction in oil and gas underwater pipeline inspection • Marine and environmental monitoring- measurements for meteorological purposes • Remote command and control of vessels • Monitoring of emissions and plant maintenance • Search and rescue • Upgrading physical infrastructure • Decommissioning • Systems training • Remote monitoring and assessment of offshore wind farms • Inspection and surveying of subsea infrastructure (oil and gas)
Specific opportunities for Plymouth and the South West	• Testing of autonomous vessels • Insurance, ethical and legal issues to be resolved surrounding use of autonomous technology • Design of vessels – use of new materials, composites etc. • Risk management- physical collision risks and risks associated with security • BMT have formed a partnership with Plymouth based MSubs to develop a test range, located off the Plymouth coast. When built, the test range will feature sensors within fixed buoys, environmental sensors, GPS, Wi-Fi (for tracking, communications and navigation)

4.2.1 Companies already in the region

BMT Group "Where will our knowledge take you?"

MSubs underwater vehicles & equipment

4.2.2 Example potential inward investment opportunities

ASV unmanned marine systems

SMD

MOST (Autonomous Vessels)

4.3 Marine ICT

Marine Information and communications technology (Marine ICT) encompasses control systems, satellite technology, software for crew management, data management, visualisation, data analysis and radar Marine ICT is growing rapidly, in keeping with the rapid, cross-sector growth of terrestrial and satellite applications of ICT and the increasing prevalence of both equipment (the 'internet of things') and users being networked through the internet. The growth in Marine ICT is also being driven by new legislation.

Satellite communication systems used for transporting data from ship to shore have developed and the roll out of specialist mobile satellite technology (MSS and VSAT) means more efficient communication from shore to sea is now available.

Other innovative marine ICT applications that are likely to experience growth include:

- innovation in systems for high-value cargo tracking,
- surface and sub-surface communication,
- marine radar systems for sonar, radar, weather and satellite imagery,
- navigation and positioning
- tracking of pirate craft
- crew management methods

Marine ICT	
Application of the technology	• cargo tracking, • radar, surveying, • crew management, • risk management, • environmental monitoring, • maritime safety and security, • training, • accident investigation • navigation, • satellite communications (ie Mobile Satellite Services), • tracking of vessels, • communications (SeaFi), • safety management, • visualisation • control systems
Specific opportunities for Plymouth and the South West	Plymouth University Marine electronics companies already in the region: Plymouth Marine Electronics specialise in navigational electronics and audio visual control SM Group- UK leading distributor of marine electronics including monitoring systems, GPS Systems, and communication methods such as VHF, AIS etc.
Sectors applicable to	defence offshore renewables, primary industries, telecommunications, leisure, marine sciences , maritime training commercial shipping,

4.3.1 Companies already in the peninsula

4.3.2 Example potential inward investment opportunities

4.4 Green shipping and propulsion

Green shipping and propulsion encompasses a broad range of areas of technology and service innovation aimed at improving the sustainability of the shipping industry. Much of this work is driven by requirements to improve vessel efficiency in line with mandatory international legislation on reduction of SOx and NOx emissions from ship exhausts and regulations on the Energy Efficiency Design Index (EEDI) for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships already in service. These regulations are driving up costs in traditional shipping and consequently driving innovation in areas to improve vessel efficiency, from planning and logistics to hull design, propulsion and greener fuels.

In 2012, the Committee on Climate Change launched a report proposing inclusion of international shipping in the UKs carbon reduction targets. These improvement drivers are creating an area of high growth in the ship building and refurbishment market.

Energy efficient propulsion methods, including electric and hybrid systems that reduce emissions and optimise fuel consumption are being designed by world leading engineering companies including Rolls Royce and innovative vessels with LNG (Liquid Natural Gas) engines that produce zero particulates are being developed by companies such as Becker Marine systems and General Dynamics.

To support implementation of greener shipping Innovate UK have announced a competition offering grants of £7.5million for businesses to develop ways of improving energy efficiency in marine vessels and a recent funding call under the Horizon 2020 programme provided investment of up to £3m in collaborative projects, building on the GRIP (Green Retrofitting through Improved Propulsion) project funded under FP7.

Green shipping and propulsion	
Applications	• naval architecture companies working on hull design, • design of scrubbers to be fitted to engines • electric propulsion systems (rim driven propellers), • innovation to produce more cost effective greener fuel • ship simulation • monitoring to ensure regulations met

Specific opportunities for Plymouth and the South West	Naval architect companies - BMT Ship simulation opportunities linked with Plymouth University Plymouth university has expertise in marine logistics and offers a range of courses in Maritime Business and Maritime Transport and Logistics Ship refurbishment and retrofit linking with the university on research of electrical propulsion systems, Consultancy on green logistics and operational efficiency including weather routing
Sectors applicable to	• Primary industries • Leisure • Commercial Shipping • Oil and gas

4.4.1 Companies already in the peninsula

4.4.2 Example potential inward investment opportunities

4.5 Composites

Over the past decade, the composites industry has shown strong global growth, growing at over 8% between 2011 and 2014, from £12.9 billion to £14.0 billion worth of global sales (composite end products). Marine applications of composite materials accounts for approximately 4% (£0.56 billion) of global sales – a market share that is expected to continue over the coming five years as the industry grows. The value of global composites sales is expected to rise to more than £23 billion by 2019 corresponding to sales of £0.92 billion in marine applications.

This growth is driven by a reduction in material and manufacturing costs, which has enabled composites to become an increasingly common place alternative to metals and other more traditional high-strength materials. Where composites were once restricted to high-cost,

performance driven sectors such as defence and motorsport applications, they are now appearing in everyday applications.

Whilst a huge variety of composite material types exist, for the purposes of this study, we have focused on the dominant material in the market – fibre (glass and carbon) reinforced plastics (epoxy and polyester). Innovation in greener composite materials which use natural fibres (such as cotton, wood, hemp, etc.) and vegetable oil based plastics is a growing industry.

Composite materials have a number of characteristics that makes them highly suitable to applications in the marine environment including a high strength to weight ratio; the ability to create seamless, complex structures; good chemical / salt water resistance (with correct finishes) and good durability in high frequency loading environments (a feature of many marine structures where wind, wave and currents create highly variable loads).

Composite Materials	
Application of the technology	Current applications of composite materials in the marine environment include: • Motor and sailing yacht hulls (particularly large and high performance vessels / super yachts) • High-pressure vessels including deep sea submarines • Offshore wind turbine blades • Offshore super-structure components for oil and gas and offshore wind equipment • Oil and gas subsea infrastructure including riser pipes, well head systems and pressure vessels Areas of innovation and future application of composite materials in the marine environment includes: • New automated manufacturing and fabrication processes (such as Automated Fibre Placement AFP) are reducing manufacturing time and cost associated with more traditional manual methods • Marine renewable energy applications including tidal turbine blades and wave and tide energy device structural components • Container ships – large composite hull sections • Ship propellers • Military vessels including high-speed lightweight craft, explosion protection, submarines and radar detection evasion technology, autonomous surface and sub-surface vessels
Specific opportunities for Plymouth and the	ACMC

South West	The Plymouth University **Advanced Composites Manufacturing Centre** is a leading composites R&D facility based in the School of Marine Science and Engineering (SMSE). The ACMC is active in a wide range of projects including the optimisation of composite materials for marine environments, and aims to bridge the traditional gap between academic R&D and the needs of industry – a key asset to future developments in composite materials in the Region. The **National Composites Centre (NCC)**, based in Bristol is one of the UK's High Value Manufacturing Catapult centres focused on the development of composites manufacturing techniques and material science. The NCC may soon host the world's first dedicated composite tidal blade test facility. These two organisations and the regional companies they support make innovation in composite material science, numerical modelling and testing, manufacture and new applications an important area of opportunity for Plymouth. A cluster of specialist composite materials companies exists in Southampton, serving the aerospace, marine, and energy sectors – Plymouth has the potential to build a similar competing / complementary cluster around composite materials products and services. Plymouth and the wider peninsula is home to a number of key companies dealing in large quantities of composite materials – companies include Pipex, Princess Yachts, Pendennis Yachts, Anglo Krempel
Sectors applicable to	**Offshore Renewables** – turbine blades and superstructure components **Oil and Gas** – pipe risers, well heads and superstructure components **Commercial** – hull forms, superstructure components **Leisure** – high-performance, lightweight motor and sail yachts **Defence and Security** – surface and submarine vessels

4.5.1 Companies already in the peninsula

4.5.2 Example potential inward investment opportunities

4.6 Offshore Renewable Energy Technology

Offshore Renewable Energy (ORE) technology covers both Marine Renewable Energy (MRE) and Offshore Wind (OSW). In this context, 'technology' principally refers to energy conversion technology – i.e. technology converting the motion of the wind and sea (waves and tides) to electricity. The development of supporting technology is however an important part of the supply chain activity in the south west and includes:

- The development of specialist vessels such as Falmouth based Mojo Maritime's HF4 vessel
- Development of installation, maintenance and operation systems
- Floating foundation systems
- Site characterisation and surveying equipment
- Device performance and condition monitoring
- Electrical infrastructure

Tidal energy conversion is sub-divided into tidal stream technology which extracts (kinetic) energy from flowing water and tidal range technology which extracts (potential) energy from changes in surface height caused by the rise and fall of the tides. Both approaches represent an opportunity for the south west through the resource in the Bristol Channel.

Whilst the UK currently leads the world in the development of wave and tidal energy conversion technology, the technology is still generally at a highly innovative, pre-commercial phase, although there are commercial, tidal projects on the horizon including MeyGen (see Section 3.6) and Swansea Bay Tidal Lagoon.

Wave energy technology development is further behind tidal and still needs to demonstrate performance reliability and future cost reduction to engage the investment community in commercial-scale, array projects.

In addition to abundant ORE resources in the south west and the portfolio of the regional assets for test and demonstration of technology (see **Error! Reference source not found.**), the region plays a key role in MRE technology development - approximately half the jobs in the MRE sector in the South West (~450) are directly related to technology development. A large part of this work force is engaged in the tidal energy cluster in Bristol.

The multi-billion UK OSW technology industry is approximately 20 years ahead of MRE technology development. However, in contrast to MRE, the technology required to deliver OSW is almost exclusively developed and manufactured overseas with only subsidiaries of the major OSW technology providers based in the UK. Whilst the UK supply chain benefits from significant project development activity, there is relatively low UK supply chain content in the development and manufacturing of OSW technology. The Government is attempting to address this gap through programmes such as GROW Offshore Wind and through the use of compulsory supply chain plans as part of the application for an offshore wind farm exceeding 100 MW in size.

A particular area of technology innovation in offshore wind is the development of floating foundations aimed at reducing the cost of offshore wind and opening up resource in deeper water and with more complex ground conditions than can be accommodated with current foundation technologies. The south west has the potential to participate in the development of floating foundation technology and also benefit from the future deployment of floating offshore wind in the region's primarily deep water resource.

Offshore Renewable Energy Technology	
Application of the technology	The application of offshore renewable energy technology is principally about the exploitation of the south west's abundant offshore renewable energy resources: • wind - all around the south west peninsular • wave - focused on the north coasts of and tide • tide – focused in the Bristol Channel Wave energy in north Cornwall, Devon and the Isles of Scilly
Specific opportunities for Plymouth and the South West	Plymouth and the south west is already participating in the development of ORE technology development, particularly in wave energy technology through: • Active regional supply chain companies including technology developers • Plymouth University, Exeter University and the wider PRIMaRE group • The Plymouth University COAST laboratory

	• The University of Exeter's South West Mooring Test Facility (SWMTF) and Dynamic Marine Component (DMAC) test facility • The Falmouth Bay scale test facility for wave energy devices – FaB Test • Wave Hub – a subsea cable, connection point and consented area of seabed to support 4 array demonstration projects up to a total capacity of 48 MW This work and associated cluster should be fostered and bolstered through inward investment activity in the region – particularly encouraging project and technology developers to set up projects and operations. • Project development activity • Technology design • Technology integration (and potentially manufacture) • Marine operations for installation phase (general south west ports opportunity including Plymouth) • Marine operations for maintenance phase (less likely to be Plymouth due to transit time to resource).
Sectors applicable to	Marine renewable energy Offshore wind

4.6.1 Companies already in the peninsula

4.6.2 Example potential inward investment opportunities

4.7 Ship building and repair

The UK ship building, repair and conversion industry has a turnover of £1.6 - £2.0 billion per annum and employs over 16,000 people. The growth of the ship building industry across the EU will be driven by a number of specific market trends and new regulations including:

- The need to retrofit existing vessels and build new vessels in-line with stricter emissions standards

Regulatory-driven trends

- The market potential from the regulatory trend towards NOx abatement
- The global market potential for SOx abatement technologies is estimated at € 10 to 31 billion until 2030
- The regulatory drive towards CO_2 abatement initiatives, has an estimated overall global market potential of approximately € 3 billion per year from 2015, rising to approximately € 10 billion per year in 2030
- With regard to ballast water and sediment treatment, the IMO has adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments

All seagoing vessels periodically require scheduled (~75%) and unscheduled (~15%) intervention and repair work:

- Scheduled repairs / service (75% of all ship repair work) are driven by the need for regular class inspections (normally every five years) and maintenance cycles. Owners usually have the time and freedom to choose the repair facility location.
- Unscheduled repair and maintenance work (15% of all ship repair work) can be driven by at sea faults or storm damage. These are less predictable and ship-owners may have less flexibility in the timing and choice of location. Unscheduled repairs can either be driven by Port State control authorities announcing inspections or can also come from 'conditions of sale' for vessels, where transactions require evidence of a recent dry-docking by the vessel.

Ship building and repair	
Application of the service	Ship repair Ship conversion Ship building
Specific opportunities for Plymouth and the South West	**Falmouth** Shipbuilding and conversion facilities at Falmouth port owned and operated by A&P Falmouth. Falmouth is the largest ship repair complex in the UK with 3 large docks and deep water berthing providing capacity for vessels of up to 100,000 tonnes. A&P Falmouth has expertise in traditional ship repair and fabrication and has recently diversified into marine energy device fabrication. **Plymouth** The South Yard development contains a number of docks that could be converted for vessel repair, conversion and building. The existing Dock 4 at South Yard is the most likely candidate for conversion into a dry dock and could be used for servicing and repairs of small vessels. It is unlikely that such a facility would compete with Falmouth, instead serving smaller vessels such as ferries and fishing vessels. **North Devon- Appledore**
Sectors applicable to	All sectors which require maintenance and repair of vessels

4.7.1 Companies already in the peninsula

4.7.2 Example potential inward investment opportunities

4.8 Marine operations and installations

The south west has a number of innovative marine operations companies, undertaking work around the UK across a variety of sectors. Innovation is required in the provision of marine operations services to deal with increasingly complex offshore activity in increasingly challenging environments. The drivers for innovation in marine operations and installations are interlinked:

- Cost – reducing costs associated with vessel and crew hire. Vessels often used in the oil and gas and offshore wind industry are expensive to hire due to their size and availability.
- Safety – ensuring crew and vessel safety in challenging environments, often sites with high tidal flow
- Time – increasing the operational window is crucial. Often slack water periods required to carry out operations can be less than 15 minutes in high energy sites, suitable for tidal energy projects.

Figure 7 Mojo Maritime HF4 vessel

The south west is home to a cluster of innovative marine operations and installation companies, who are addressing the issues driving innovation, including:

Mojo Maritime – marine operations company with years of experience in oil and gas and offshore wind have innovated into marine energy:

- HF4 – a high performance dynamic positioning vessel capable of operating in extreme environment
- Mermaid – a software toolkit developed to consider the impact of scheduling and metocean conditions on marine operations, thereby uncovering risks and critical operations prior to going offshore.

Insight Marine – an independent subsea survey contracting company specialising in hydrographic surveying:

- Cubit – Insight Marine developed Cubit, an integrated online navigation system offering multiple levels of redundancy and automatic failover in order to reduce costly failures.

Marine operations and installations	
Application of the service	• Environmental surveying • Geotechnical and geophysical surveying • Installation of tidal turbines and wave energy devices • Installation of foundations for devices

	• Installation and maintenance of subsea cables • Through life services - installation, operation and maintenance, monitoring and inspection and decommissioning of marine energy projects • Deployment of buoys and moorings • Subsea services- specialist ROV and diving services
Specific opportunities for Plymouth and the South West	• Deployment of marine energy technology off the south west coast at sites including Wave Hub, FaBTest and Demonstration Zones • Export opportunities for south west companies to be involved in marine energy projects in Scotland and overseas.
Sectors applicable to	Offshore wind Marine energy Telecommunications Oil and gas

4.8.1 Companies already in the peninsula

4.8.2 Example potential inward investment opportunities

4.9 Marine science

Demand for marine sciences commissioned as a professional service by the public and private sector is increasing rapidly as industry interacts more and more with the marine environment. Research work from early stage fundamental work to services that directly impact commercial

Marine science services can be broadly categorised into the study of exploitation and extraction of value from the marine environment and the study of changes in the marine environment, both as a consequence of natural systems and human activity, both on land and in the marine environment directly.

- Understanding changes in the marine environment
    - Biodiversity and ecosystem modelling and monitoring
    - Geophysical and geotechnical surveying
    - Coastal processes
    - Sea-level rise
    - Marine chemical composition such as acidification and gas exchange
    - Ocean meteorology

- Extracting value from the marine environment
    - Industrial phycology
    - Biofuels
    - Marine energy
    - Fishing and aquaculture
    - Pharmaceuticals
    - Aggregates and minerals

Plymouth has significant capability in the provision of applied marine science services that have a direct impact on commercial activity. The cluster of marine science providers including Plymouth University, Plymouth Marine Laboratories, the Marine Biological Association and more have a focus on the provision of applied marine science. Their expertise is recognised and employed on projects all over the world. Plymouth University's strapline – 'The Enterprise University' highlights the organisations focus on outward facing research:

Our aim is to become the enterprise university, truly "business-engaging" and delivering outstanding economic, social and cultural benefits from our intellectual capital. Pivotal in a city acknowledged as the enterprise capital of the South West.

Marine sciences equipment and services	
Application of the technology/service	**Monitoring** • spill monitoring **Research and development** • academic research **Surveying** • seismic • hydrographic • port surveying • marine mammal surveying, • oceanographic **Measurements** • acoustic • oceanographic- including temperature, salinity, turbidity, conductivity, pH, CO2, nutrient content, velocity, pressure, wave height, O2 levels, trace metals **Meteorology and climate change** • Air quality measurement – airborne particulate measurements **Technology** • Video technology • Probes • Remote sensing • Super computers • AxVs **Dredging** **Diving operations**
Specific opportunities for Plymouth and the South West	• Met Office - supercomputers and world leaders in research of climate and weather science • Plymouth University – marine institute • PML • The AstraZeneca environmental laboratory and all its state of the art equipment was recently donated to Plymouth University to be used as a global scientific research and education facility.
Sectors applicable to	Marine renewable energy Offshore wind Marine sciences, Defence, Oil and gas

4.9.1 Companies already in the peninsula

4.9.2 Example potential inward investment companies

5 Building a successful marine industry cluster

By looking at international case studies of similar city ports, the Demand Study was asked to identify the key elements and pre-requisites which are required in order to create a successful marine industry cluster.

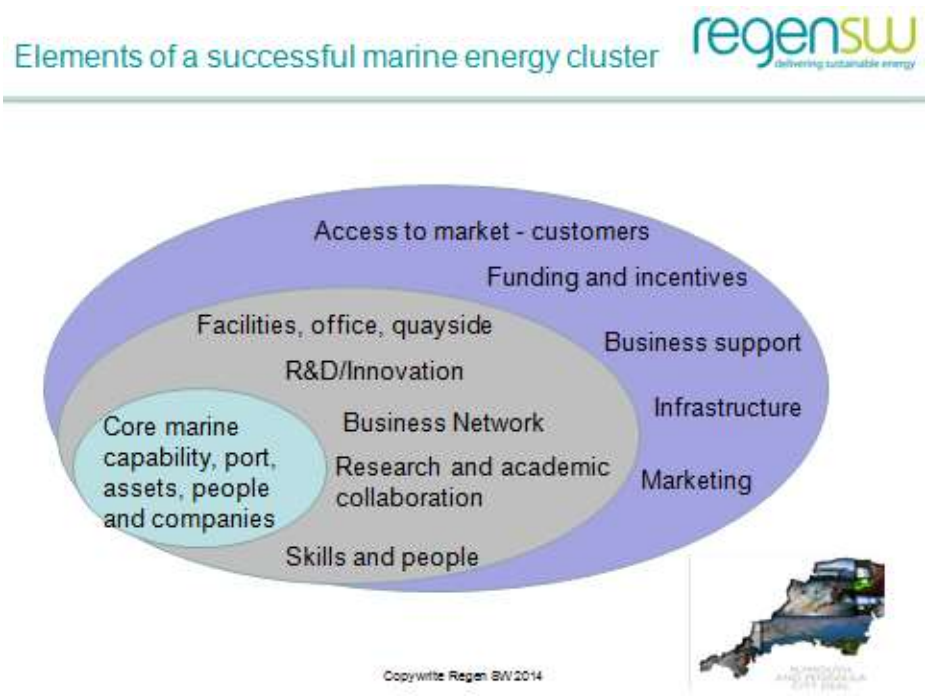
These were then mapped against the assets and capabilities already present in Plymouth and Peninsula City Deal region, in order to identify areas of strength and opportunity as well as gaps or weaknesses in the existing offer.

Details of the case studies, and further links to the port cities that were assessed, can be found in **Error! Reference source not found.** or by using the links in the table below

Port City Case Study	Link to Case Study
Belfast NI	**Error! Reference source not found.**
Lowestoft/East of England Cluster UK	**Error! Reference source not found.**
Brest, France	**Error! Reference source not found.**
San Diego US	**Error! Reference source not found.**
Woods Hole, Massachusetts	**Error! Reference source not found.**
Portsmouth/Southampton UK	**Error! Reference source not found.**
Other south west port cities looked at: **Falmouth** **Bristol** **North Devon**	

5.1 Key elements of a successful marine energy cluster

From the case study analysis it is possible to identify a number of common elements which underpin the development of a successful marine industry cluster.



All the case studies confirmed that the starting point for a successful marine cluster is a pre-existing core capability in the marine sector. There are examples of clusters developing very rapidly from small beginnings – Aberdeen developed as an oil boom town in the 1970's for example – but generally it is easier to build on and enhance existing capability and marine businesses.

For the marine sector a port infrastructure, waterside facilities, marine engineering and operational companies; supported by a cadre of specialist consultancy and marine specialists (engineering, hydraulics, composites, electronics, boat building and ship repair); are the basic building blocks.

In addition to these core elements, the marine industries cluster requires a vibrant business network, workspace and facilities, support for innovation, access to funding and business support.

In the case of Woods Hole, Massachusetts (and Plymouth) there is the added dimension of a very strong marine science and research capability. For a focus on new marine technologies it is also important to provide support for R&D and innovation, including collaboration with academic and research institutes. The successful clusters also feature a strong sense of identity, expressed through a common brand and marketing.

The study found that each port city is unique but many have similar characteristics to Plymouth in terms of their history, economy, demographics, physical assets and/or business culture. Port cities with a naval dockyard heritage such as Brest, Portsmouth and San Diego provided the closest match with Plymouth, and face some of the same challenges in the face of a downturn in defence expenditure and the need to improve employment productivity.

Interestingly all of these port cities are implementing, or are attempting to implement, a marine industry strategy, while several are encouraging diversification from the naval to civilian application of marine technology. A vision of "Blue Grow", "Blue Tech" and "Blue Economy" run

strongly through their economic development plans, and there is inevitably a degree of convergence and overlap on the same areas of innovation such as remote vehicles and robotics, composites, green ports and vessels, marine ICT, marine energy and the commercial application of marine sciences.

5.2 Summary extract from the case studies

(See Error! Reference source not found. **for more)**

5.2.1 Case study extract - San Diego

San Diego, on the west coast of California, has a similar heritage to Plymouth with a strong US Naval presence and a large number of traditional dockyard and related marine companies. It also has a significant marine science research capability through organizations such as the Scripps Institution Oceanography, SDSU Marine Institute and several US Navy research facilities. The role played by the US Navy is supporting both military and non-military marine research and technology development is significant in areas such as ocean energy, robotics, climate science and marine sciences.

San Diego's marine sector is about three times the size of Plymouth with around 48,000 marine related employees (2010) and it now has a growing "Blue Tech" sector in areas such as: **Aquaculture**, **Biomedicine, Desalination**, **Ocean Energy**, **Ocean Science & Observation, Robotics and Submarines, Very Large Floating Platforms and Weather & Climate Science.** In part the growth of these new technologies has been supported and encouraged by investment in portside facilities, innovation space and shared use facilities plus a strong marine sector network.

Sunny San Diego – A good match with Plymouth	Opportunity for Plymouth
	The mix of naval dockyard, new blue tech industries and research organisations in San Diego is a good match with Plymouth. Plymouth already has a good relationship with partner organisations in San Diego through the strong links between Plymouth University and the Maritime Alliance cluster in the city. (See Conclusions and key recommendations)

5.2.2 Case study extract – Belfast

Although not a naval dockyard, Belfast, in Northern Ireland, is also a good example of a port city that is in the process of reinventing itself based on advanced manufacturing and new marine industries. With a heritage in shipbuilding and traditional heavy engineering centred on Harland

and Wolf and Belfast Port, in recent years the Belfast Harbour (a trustee port covering an estate of over 2,000 acres) has invested over £60m to create new facilities to support the deployment and assembly of offshore wind farms and is now targeting the wave and tidal energy sector as well as new marine industries.

Next to the port there is a growing cluster of marine and aerospace related industries including composites, electronics and marine supply chain companies.

Note of caution: the cancellation of the Celtic Array, County Down Windfarm and Argyle Array has affected Belfast badly. There is a risk that Belfast Port's key windfarm tenant, DONG Energy, will vacate or reduce their presence upon completion of their existing Irish Sea windfarms.

5.2.3 Case study extract – Woods Hole, Massachusetts

Woods Hole was chosen as a case study because, although it does not have the same naval dockyard history or socio-economic profile as Plymouth, it is recognised as a worldwide centre for the marine sciences and research.

Woods Hole Research Cluster	Physical Assets at Woods Hole
WH Oceanographic Institution **Marine Biological Laboratory** **WH Research Centre** **WH Science Aquarium** **US Coast Guard Research Centre** **US Geological Survey, Coastal and Marine Science Centre** **NE Fishing Science Centre**	

The Woods Hole example shows the advantage of having a group of research and scientific organisations within close proximity as a means to foster collaboration and attract the best academic and research people. The Woods Hole cluster shows the potential strength of a south west marine research cluster – including Plymouth and Exeter Universities, PRIMaRE, PML, Marine Biological Association, Sir Alister Hardy Foundation (plus the Met office and UK Hydrographic Office nearby).

The Woods Hole case study is also interesting because the physical facilities at Woods Hole – research centres, laboratories, waterside facilities, vessels and a dry dock - are very similar to what could be provided in Plymouth through additional facilities at Exeter, Falmouth and Brixham.

5.2.4 Case study extract – Portsmouth/Southampton

Of the case studies looked at Portsmouth/Southampton was, as expected, the closest match to Plymouth in terms both strategy and the mix of companies, assets and facilities.

The Portsmouth/Southampton City Deal also focuses on the development of marine industries, transfer of landscape from the MOD and the creation of a marine cluster.

Extract from Southampton and Portsmouth City Deal Exec Summary

Across Southampton, Portsmouth and the Solent, the marine and maritime sector already accounts for over 20% of gross value added and provides 40,000 jobs locally.

Over the next 12 years this sector is expected to grow by 5%, driven in part by key assets such as the Port of Southampton, Portsmouth Naval Base; and the Solent Marine Cluster – which includes Lloyds Register and the Southampton Marine and Maritime Institute.

Advanced manufacturing is also an area of strength, growing during the recent recession and creating almost 5,000 new jobs. The flagship proposal for this City Deal will support further growth in these sectors by unlocking two high profile sites within Southampton and Portsmouth – one of which involves Ministry of Defence owned land. These sites, once developed, will provide: new employment space; new housing; and lever in significant amounts of new private sector investment into the economy. To complement this, the City Deal will also implement programmes to: align skills provision to employer needs; tackle long term unemployment and youth unemployment; and enable small and medium enterprises to grow through the provision of effective business support.

Over its lifetime the Solent Local Enterprise Partnership predict the City Deal will deliver:

- *Over 4,700 permanent new jobs focussed in marine, maritime and advanced manufacturing.*
- *Over 13,000 construction jobs.*
- *Unlock 107,000 square metres of new employment floor space with a focus on supporting growth in the marine, maritime and advanced manufacturing sectors.*
- *Support SME's to grow through better business support over the next three years.*
- *Provide £115m of local and national public sector investment.*
- *Lever in over £838m of private sector investment through site development, skills and unemployment schemes; and business support services.*

Inevitably there is overlap with Plymouth in terms of the opportunity areas that have been identified including large composites structures, remote and autonomous vessels, ICT and advanced marine engineering.

There is a question therefore to what extent Plymouth tries to differentiate its offer from Portsmouth – by focusing on marine sciences for example – or seeks to forge a closer collaboration to create a combined offer along the lines of a dual location Catapult – see Recommendations.

5.2.5 South West Marine Clusters – Falmouth, Bristol and North Devon

As well as looking at marine clusters overseas it is also important to consider the relative strengths of marine clusters which are already established within the south west and how, by combining these within the MIPC concept the overall marine industry sector in the region can be made stronger.

Falmouth for example already has an established cluster of marine engineering and marine operations companies with firms lie A&P, Fugro Seacore, Mojo Maritime, KML, Falmouth Divers and LDD – plus a number of marine consultancies – based in the city.

The Bristol city region has a different mix of companies reflecting its strength in aerospace, manufacturing and specialist areas such as composites, tidal energy and electronics.

Elsewhere in Devon there are established clusters in manufacturing (including North Devon and Plymouth) and marine industries in Brixham/Torbay and around Appledore/Bideford.

5.3 Case Study Comparison - Core Capabilities

Key

0 Minor Capability
1 Some Capablity
2 Core Capability
3 A National Centre or Asset
4 World leading/Recognised Internationally
5

Case Studies	Physical Assets		Core Marine (Existing Capability)									R&D and Innovation				Strategy		Access to market			Key Marine Markets
	Port/Quayside	Industrial Landspace	Ship Build/repair	Marine Engineering / Design Engineering	Naval/Defence Dockyard	Boat building (Commercial & Leisure)	Composites	Marine Specialists - Operations	Marine Specialists - Manufacturing	Consultancy and Professional Services	Marine Sciences	Marine Technology Innovation Companies	R&D and Test facilities	Strong Links to Acamedia	Strong marine vision/strategy	Marine identify/marketing	Links to other Industries eg Aerospace	Connected to Wider Regional/National cluster	Access to market	
Brest, France	4	4	4	3	4	2	2	3	3	2	2	3	3	2	4	4	1	3	3	Defence
San Diego US	5	4	3	3	5	4	3	3	3	3	4	4	4	3	4	4	3	3	4	Defence, Leisure, Fishing, Marine Science
Woods Hole, Massachusetts	2	0	0	1	0	1	0	1	1	3	5	4	5	5	3	3	2	2	1	Marine Sciences
Belfast NI	4	3	4	4	1	1	4	2	3	1	2	2	2	2	3	3	3	2	3	Commercial, Oil and Gas, Offshore Wind
Lowestoft/East of England Cluster UK	3	3	1	2	0	2	1	4	2	3	1	2	2	1	3	3	4	3	4	Oil and Gas and Offshore Wind
Aberdeen	3	4	2	4	1	1	2	5	4	4	2	4	4	2	4	5	3	3	5	Oil and Gas and Offshore Wind
Portsmouth/Southampton UK	4	4	3	4	4	3	4	3	4	3	3	4	4	3	4	4	3	3	3.5	Commercial shipping, Defence, Offshore Wind
South West Marine Clusters																				
• Plymouth	4	3	3	3	4	4	2	3	3	3	4.5	3	4	4	3	3	2	3	3	Defence, comercial shipping, Marine Leisure,Fishing
• Falmouth	4	2.5	4	3	3	3	1	4	2	3	2	3	3	4	3	3	2	3	3	Defence, Commercial, Fishing Tourism, Marine Energy
• Portland	3	3	2	2	2	2	1	2	2	2	1	2	1	1	1	1	2	2	3	Defence comercial shipping, Ofshore Wind Navitas
• Bristol	4	4	1	2	1	1	4	2	2	4	1	3	4	2	3	1	4	3	3	Tidal and Commercial port and shipping
• North Devon Ports	2	2	3	3	2	2	1	2	2	1	1	2	1	2	2	1	3	2	2	Tourism, Fishing

* Matrix illustrates the case study core capabilities but is **not** intended as a literal ranking and does not fully consider the relative scale of each port city. For example: Portsmouth, Plymouth and San Diego all have good capabilities in the naval/defence sector, but San Diego's marine/defence sector is approx. three times as large as Plymouth.

6 The Current Plymouth and South West Marine Industries Sector Offer

6.1 Core Marine Capability

Plymouth and the south west peninsula already has many of the critical assets and capabilities which are required to support a successful marine industry cluster and to exploit new opportunities from the development of marine technologies and services highlighted in Section 4.

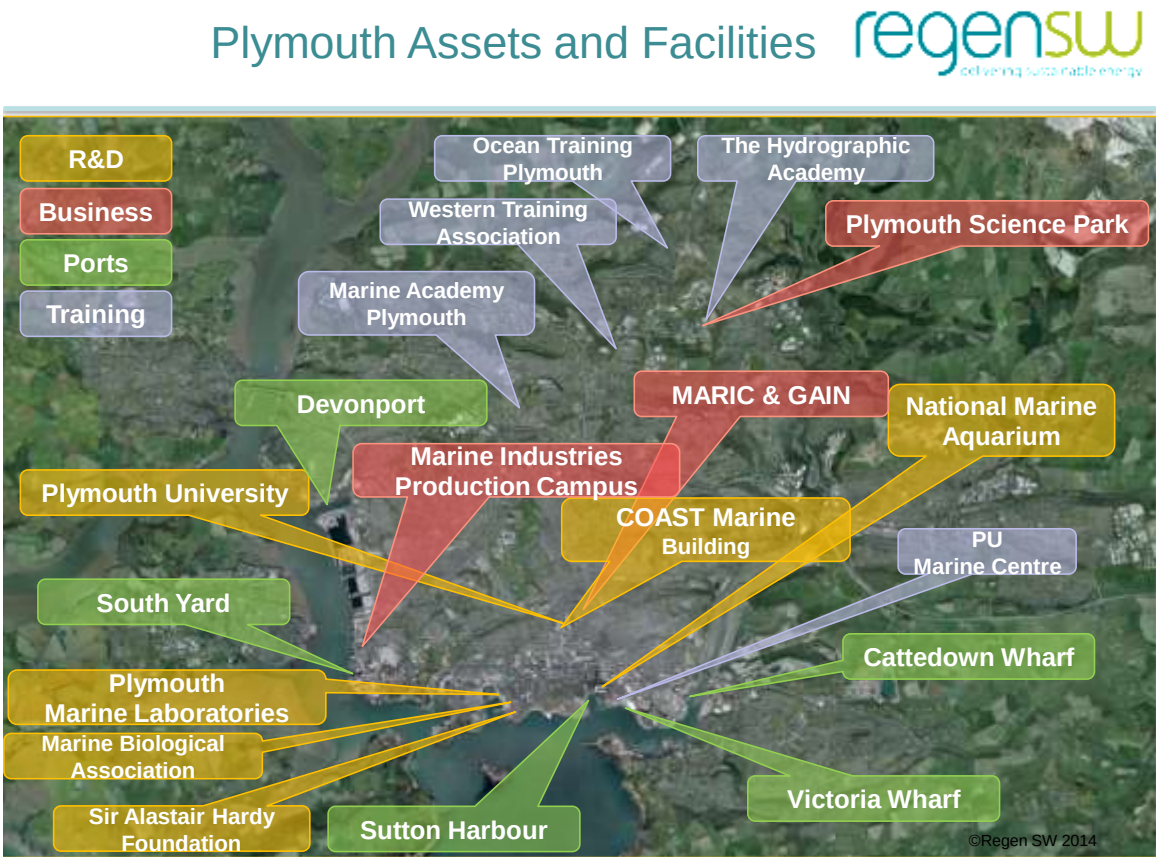
Key Strengths of Plymouth and SW Marine Industries Offer
✓ **maritime capability** - Royal Navy & marine engineering, ship building, sub-sea & civil engineering, fishing, boat building, marine leisure, communications (piracy and smuggling☺)
✓ Good **port infrastructure,** engineering and dock facilities at Plymouth, Falmouth and Appledore - other waterside facilities at Hayle, Truro, Brixham, Yelland and other port locations.
✓ Excellent **marine supply chain capability** with specialist companies in marine energy, marine operations, subsea, design engineering, consultancy and marine environmental sciences
✓ Allied **manufacturing companies** in engineering, composites, electronics, ICT, condition monitoring, hydraulics , components parts
✓ Very strong **partnership between industry and academic** institutions focus on collaboration, applied research and technology development
✓ A world leading **cluster of marine science** institutes and research facilities and Exeter and Plymouth University, PML, SAHFOS, MBA and Met Office
✓ **Technology development**. R&D, test and demonstration facilities
✓ Very strong capability at **graduate and post graduate** level in areas such as engineering, environmental and marine sciences
✓ Good skills at **marine technician & operational level**, supported by a number of technical and marine colleges and apprenticeships schemes – but numbers low
✓ Availability of funding and **investment support** – especially in Cornwall – through UK innovation funding and EU regional development funding
✓ Overall **business and living environment** • Overall lower labour costs (in certain skill areas) • Vibrant business network and culture • High quality of living

6.2 Features of the Current Plymouth Marine Industry

The Plymouth marine cluster is centred on the University of Plymouth, the research institutes at Plymouth Marine Laboratories, Marine Biological Association and Sir Alister Hardy Foundation, Devonport Naval Base and Dockyard, and other waterside locations including the new Princess Yachts facility at South Yard, and a cluster of training organisations.

The Devonport Naval Base and Dockyard has been supporting the Royal Navy since 1691. The vast site covers more than 650 acres and has 15 dry docks, four miles of waterfront, 25 tidal berths and five basins. The base employs 2,500 Service personnel and civilians, supports around 400 local firms and generates around ten per cent of Plymouth's income. Devonport Dockyard is operated by Babcock, employing over 4000 people it has been designated by the MOD as a Centre of Excellence for deep water maintenance and infrastructure support.

6.2.1 Physical assets around Plymouth (See Error! Reference source not found. for links and details)



6.2.2 World class centre for marine sciences

A combination of marine industries and marine sciences is not unique but it does put Plymouth and the south west amongst the top rank of the global centres for marine research and science. Exploiting this capability, and building on the worldwide network research centres which this gives access to, will be a key part of the marine strategy.

The potential to create a world class marine science cluster

Plymouth University Marine Institute

The new COAST Laboratory and new Marine Sciences building at Plymouth University opened in 2012 and represents a £19 million investment in a state of the art research centre. This building houses dedicated technical support and office facilities for up to 150 marine institute researchers and technology developers.

At the heart of the building, coastal, ocean and sediment tank labs are available for university research and private sector technology developers.

The marine institute specialises in

- **coastal engineering**
- **physical oceanography**
- **resource characterisation**
- **sustainable coastal and marine management**
- **environmental and biodiversity impacts**
- **safe operations and navigational risks**
- **maritime training**
- **socioeconomic factors**

Plymouth Universities Marine Station was opened in 2014 Located on the city's waterfront at Coxside, between the National Marine Aquarium and Queen Anne's Battery, the £4.85 million, two-storey building, has bespoke facilities such as wet labs and aquaria where students will be able to study and store samples they collect in the field.

Plymouth University has also acquired laboratory facilities in Brixham (formerly AstraZeneca's facility) which could now be used to support marine science research and private sector companies.

Plymouth Universities High Performance Computing Centre

Includes state if the art supercomputing capability to support marine related research

(Image courtesy of Plymouth University)

(Image courtesy of Plymouth University)

Plymouth Marine Laboratory (PML) is an internationally renowned independent provider of high quality marine research with centres of expertise in marine systems modelling, marine ecology, marine policy and satellite remote sensing.

As well as research on the environmental impacts of climate change, ocean acidification, manmade

chemicals, coastal erosion and flood protection and the effects human activities from fishing to commercial shipping, PML has been helping to develop new applications and services to take advantage of the resources providing by the marine environment and reduce environmental impacts.

Examples of potential new application areas include:

- **Biofouling and protective coatings**
- **Ballast water decontamination**
- **Energy from Algae**
- **Biomed and pharmaceutical**
- **Mineral oils**
- **3 D Visualisation**
- **Remote sensing**

PML is also conducting world class modelling, satellite remote sensing, and cost benefit research to aid decision making on where to site marine renewable installations

PML was listed 8th in the world in the latest Thomson Reuters top 30 Research Institutions in Oceanography

(Images courtesy of PML)

Marine Biological Association

The Marine Biological Association is an internationally renowned learned society, which conducts world-class research and publishes an academic journal; the journal of the Marine biological association of the United Kingdom. Based in Citadel Hill Laboratory in Plymouth some thirteen Nobel prize-winners and 170 fellows of the Royal society have undertaken research at this centre which has one of the most complete marine biological and oceanographic libraries in the UK.

(Images courtesy of Plymouth University)

Sir Alister Hardy Foundation

The Sir Alister Hardy Foundation for Ocean Science based in Plymouth is one of the oldest oceanographic research centres in the world. Its extensive experience in conducting a continuous marine biological survey since 1931. inputs directly into understanding the marine ecological dimensions of marine

The Partnership for Research in Marine Renewable Energy (PRIMaRE) is a network of world-class research institutions based in the west, south, and south west of England who undertake research and development to address challenges facing the marine renewable energy industry at the regional, national and international level.

Key areas of research have included:

- **resource characterisation**
- **marine renewable energy systems**
- **environmental and biodiversity impacts**
- **safe operations and navigational risk**
- **underwater and surface electrical systems**
- **socioeconomic factors**

http://www.primare.org/

6.3 Capabilities in the wider South West peninsula

Plymouth sits between the Cornwall and Isles of Scilly and Heart of the South West LEP areas, providing access to wider assets and facilities which are listed **Error! Reference source not found.**

Selection of south west assets and facilities (See Error! Reference source not found. **for full listing)**	
CORNWALL & ISLES OF SCILLY LOCAL ENTERPRISE PARTNERSHIP HEART OF THE SOUTH WEST Local Enterprise Partnership	**For More Information on Plymouth, Cornwall and the South West's marine capabilities See** Error! Reference source not found. • Heart of the South West LEP • Cornwall and IoS LEP • Invest In Cornwall • Plymouth City Deal
South West Marine Energy Park **Designated in 2012 the South West is the UK's first Marine Energy Park. This provides priority focus for the development and deployment of marine energy technology in the region.**	

Wave Hub 	**Wave Hub** is the largest and most technologically advanced, fully consented, grid-connected site for the testing and development of marine energy devices. This £42 million facility provides shared offshore infrastructure for the demonstration and proving of arrays of wave energy generation devices over a sustained period of time. Located 16 km off the north Cornish coast in one of Europe's best wave climates, Wave Hub provides an electrical hub on the seabed to which arrays of wave energy devices can be connected.
FaBTest 	The **Falmouth Bay test site (Fab Test)** is a one quarter scale, fully consented, wave energy test site developed in response to industry requests for an area to test scale models of wave energy devices in real and dynamic environments. It allows for up to three devices to be deployed concurrently and while not grid connected it does provide an extremely accessible and cost effective nursery facility as a stepping stone from proof of concept to full scale deployment at Wave Hub.
Exeter University, a Russell Group university, with campus facilities at Exeter and Tremough Campus in Cornwall is a world leading research and teaching institution with relevant specialisms in engineering, marine sciences and the environment, climate change and renewable energy. **Key university assets include** • **College of Engineering, Mathematics and Physical Sciences** • **Environment & Sustainability Institute** • **Renewable Energy Group** • **Camborne School of Mines** • **South West Mooring Test Facility** • **Dynamic Marine Component Test**	The **South Western Mooring Test Facility (SWMTF)** in Falmouth Bay is a unique mooring load and response test facility which has been constructed, launched and operated by the University of Exeter.   Also located in Falmouth is the custom built **Dynamic Marine Component Test Facility (DMaC)**. This one-of-a-kind rig builds upon data gathered from the SWMTF buoy to replicate the motions and forces that are applied to the component parts of marine renewable energy devices and other marine components.

Facility	
 **The Met Office's new £97m supercomputer will be able to perform more than 16,000 trillion calculations per second and will cement the UK's position as a world leader in weather and climate prediction.**	The UK's national weather service, the **Met Office** plays a central role in forecasting coastal and marine weather conditions and conducts research into climate science, meteorological monitoring, modelling and research. Part of the Ministry of Defence but servicing the private and public sectors, the **UK Hydrographic Office** based in Taunton produce the most trusted and reliable range of electronic and paper nautical charts available.

6.4 Ports and industrial land space – see Error! Reference source not found.

The facilities and opportunities at Plymouth South Yard are discussed in detail in Section 7 below.

The south west has a wide variety of port infrastructure available to marine engineering, ship building and repair, manufacturing, installation and ongoing operations and maintenance for the marine related projects and project cargo handling as well as fishing, marine leisure and tourism.

Larger dock and engineering facilities are located at Plymouth, Falmouth and Appledore. Several smaller ports offer potential for project support and operations and maintenance. There is also industrial land space available at the Hayle Marine Renewables Business Park, Yelland, Brixham, Appledore, Truro and a number of sites in Plymouth including Millbay and Cattedown Wharf.

6.5 Companies and Supply Chain expertise

The south west has a very broad and varied business community with core strengths in areas such as marine operations, sub-sea engineering, marine surveys, fabrication, engineering design, naval architecture and marine sciences - as well as specialist technical and general marine consultancies. There is also strength in depth in supporting technologies such as hydraulics, electronics, ICT, remote sensing, condition monitoring and composites.

For a useful listing of companies engaged in the marine sector please see:

Regen SW Marine and Offshore Wind Supply Chain Directory which lists over 400 south west companies involved in the offshore energy and marine sectors

Cornwall Marine Network supply chain directory and

Plymouth Chamber of Commerce

6.5.1 Larger companies

The marine supply chain in the south west is typically characterised by smaller specialist companies however there are a number of larger national and multinational companies including:

A&P	Falmouth port & shipyard - owned and operated by **A&P Falmouth Ltd** (part of the A&P Group). A&P Falmouth has extensive facilities including dry-docks, wharves, workshops, cranes and cargo handling and skills for steel fabrication, marine and electrical engineering and composites. As well as maintaining contracts with the MOD, A&P has successfully transferred its capability to work with technology developers in the marine energy sector such as Seatricity and Fred Olsen
PRINCESS	Princess Yachts International, the world's 4th largest Superyacht manufacturer, employs over 2000 people and exports a range of leisure and super yachts around the globe. Princess Yachts is investing £30m in South Yard to build a new line of 100ft plus super yachts.
babcock	Babcock International's marine division has a significant south west presence in Devonport and Appledore. These shipyards specialise in services to the British nuclear submarine fleet, maintenance for surface ships and civil marine contracts. Babcock are already offering services to the Offshore Wind Sector, including through life asset management and engineering support, and are now well placed to diversify into other marine industries

6.5.2 Supply chain capability

Although dominated by small and medium size enterprises Plymouth and the south west has a very good mix of innovative and entrepreneurial marine based companies. It is noticeable that a number of these companies are already engaged in new marine technology and the development of new products and services.

Examples of companies engaged in technology innovation	
Company	**Areas of Innovation**
Supacat	Marine Renewable energy, New design for Supply Boats, Launch vessels, propulsions systems
Manuplas	Composite structures
Finetubes	Precision engineering
Beran Instruments / CMG	Condition monitoring
J&S Marine	Through water communications and sub-sea electrical connectors
Mojo Maritime	New installation vessels, sub-sea drilling, planning tools, floating platforms, sub-sea drilling rigs, software, ROV's
Insight Marine	Data capture and control systems
Severn Subsea	Sub-sea data capture and control systems
Pipex	Composite structures
mSubs	Subsea remote and Autonomous vehicles
Valeport	Environmental monitoring and sensors

LDD	Drilling rigs and survey, data and software
Seiche Measurements	Acoustics and environmental monitoring
Teignbridge propellers	Propulsions systems
Armada Hydraulics	Hydraulic systems and controls

6.5.3 Manufacturing Capability

The marine industries are supported by a significant number of manufacturing companies who are based in the region.

For more information about manufacturing in the region there are a number of useful network websites including:

- The Plymouth Manufacturers Group
- Plymouth Chambers of Commerce
- North Devon Manufacturers Association
- Cornwall Chamber of Commerce

6.6 Skills and people

Alongside the universities the South West has a large number of skills and training providers with a focus in the maritime and engineering sector. These include technical colleges, specialist marine colleges, private companies and apprenticeship schemes.

There are however a number of skills/training gaps which means that companies and individuals have to go outside the region to secure deeper competencies in areas such as: subsea operations, offshore qualifications, power systems, manufacturing and electrical engineers.

Skills and Training Providers	Core Marine Industry Skills Requirements
Marine and Maritime Colleges	**Design/consultant engineers**
Falmouth Marine School	**Power systems and electrical engineers**
Maritime Training Plymouth	**Mechanical engineers**
Marine Academy Plymouth	**O&M technicians**

Ocean Training Plymouth **Western Training Association** **Cornwall Marine Network** **Aquos Ltd** **The Hydrographic Academy PU** **Plymouth University Marine Institute** **Marine Centre Plymouth University** **Engineering and Technical Colleges** **Petroc College** **Bridgewater College** **Cornwall College** **University Technical College**	**Environmental sciences, Marine sciences** **Health and safety** **Project/construction managers** **Marine and subsea operations** **Offshore qualifications** **IT and computing** **Manufacturing Capabilities inc** • **Steel fabrication, welding,** • **composites,** • **hydraulics,** • **electrical electronics** • **carpentry** **Finance, legal, planning** **Business skills - financial, management, commercial, export**

Apprenticeships – High quality but not enough

Alongside colleges and training providers a number of both large and smaller marine companies in the south west offer high quality apprenticeships. These include Babcock, Princess Yachts, A&P and the Royal Navy and a large number of smaller companies e.g. see CMN.

However the number of engineers coming through apprenticeship schemes is still below target – this is an issue common across other parts of the UK. Although not the lowest region in terms of overall numbers, the rate of growth in the South West since 2009 @31% has been lower than in other regions. See http://www.parliament.uk/briefing-papers/SN06113.pdf

6.7 Gaps, constraints and areas of weakness

While the report has so far focused on the strengths of the region there are clearly some gaps and weaknesses within the Plymouth and South West marine industries offer. Some of these weaknesses have already been identified by the City Deal team – low productivity/growth, low export penetration, low commercialisation of new technology and skills - and where in fact part of the rationale for the City Deal proposal. Other perceived weaknesses were highlighted by companies that the team spoke with as part of the demand study.

6.7.1 Perceived lack of scale, distance to market, big projects

The geographic location of the south west peninsula – although it brings advantages – creates issues in terms of its distance to key marine markets and other marine industry clusters, especially those located on the East Coast and North Sea. In discussions with companies, who could be potential inward investors, this was expressed in a number of ways:

- *"I'd love to set up an office in the south west, but we just don't have any big projects down there"*
- *"I will come down and see you –but it's a long way perhaps I can tie it in with a visit to Bristol/meet in London/meet at All Energy etc."*
- *"There is a feeling that once you go past the Isle of Wight you are out of the commercial hub of the marine sector"*

6.7.2 Distance to markets

The region is well located for fishing, marine leisure and defence (naval) markets. It also has the potential to exploit the significant marine energy (wave and tidal) resources in the Bristol Channel and off Cornwall. It is however true that the South West is not well placed to directly serve the oil and gas sector and, unfortunately with the demise of Atlantic Array, Celtic Array and other western seaboard projects, the bulk of the growing offshore wind sector is also in the North Sea.

Markets Proximate to the South West	Markets "Distant" from the south west
• **Fishing** • **Marine Leisure** • **Defence (Naval)** • **Potentially marine energy – wave and tidal**	• Oil and Gas E&P (North Sea) • Oil and Gas decommissioning • Offshore Wind – especially with cancellation of Atlantic Array • Commercial ports

6.7.3 Lots of SME's but a lack of larger multinationals headquartered in the South West

The perceived lack of scale in the south west affects both companies and individuals. For companies the issue is whether there is sufficient commercial activity to warrant having a presence in the region, for individuals there is a question of whether they can develop their career within a smaller pool of companies and the distance/time it would take to reach potential customers

Although the south west marine energy sector does have a small number of larger companies – for example A&P, Babcock and Princess Yachts – there is a general bias towards the smaller specialist SME's. Fewer big companies and multinationals means fewer tier one customer in the supply chain and fewer opportunities for career progression for senior and mid-level management.

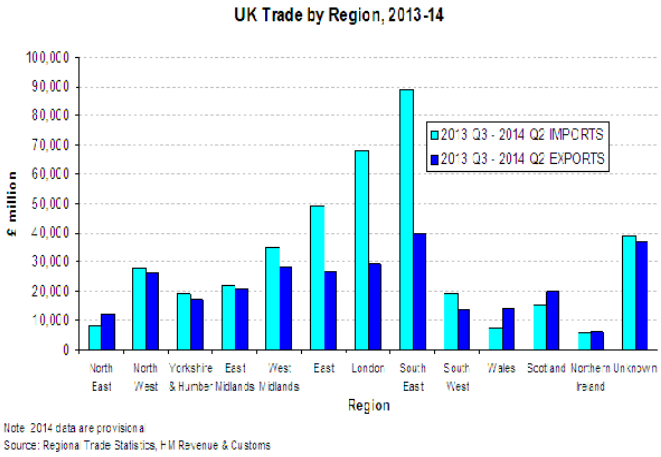
It is also the case that larger companies with a presence in the region are not necessarily headquartered in the south west, or they may be part of a wider group of companies. The tendency for south west companies to become part of a wider group headquartered elsewhere

also affects some of the smaller companies; LDD for example is now part of the Acteon Group, Seacore is now part of Fugro and J&S Marine is now owned by Cohort Plc.

Of course merger and acquisition activity is not necessarily a bad think and can be a route for smaller specialist companies to achieve a greater market presence and growth.

6.7.4 Low export penetration

It is known that the south west performs relatively poorly in terms of export and trade activity. Without analysis of raw data it is difficult to give precise figures for the marine related industries in the City Deal region, but anecdotal evidence suggest that export amongst this sector will also be relatively low.



There are however a number of notable exceptions and companies like Valeport, Supacat, Princess Yachts, Seiche Measurements and several other specialist companies are export exemplars.

6.7.5 Transport links - Connectivity

It has been well documented that the transport links – road, rail and air transport - to the south west peninsula have been a constraint on economic growth. This is an issue for the marine industry in particular which because of its nature requires easy access to both national and international markets. The long discussed improvement to train and road links to London, Bristol and the midlands is critical.

In recent years the provision of direct flights to destinations likes Aberdeen, Edinburgh, Newcastle, Belfast, Paris, Amsterdam, Hamburg and Renne has been reduced, re-routed or made seasonal. The loss of a number of direct flights to Aberdeen, Edinburgh and other Scottish destination – now routed via Manchester – is a particular issue for offshore renewable energy and Oil and Gas markets.

6.7.6 Constraints on portside land space, quayside and deep water access

Although the range of ports is the South West has been highlighted as a potential strength – and the region has some very good port facilities - it is also the case that all the south west ports have some constraints either in terms of land space available, quayside, water depths, tidal access restrictions, road transport links, and/or proximity of housing.

The experience of working with RWE and the Atlantic Array confirmed the difficulty of supporting very large scale projects; requiring extensive land space, minimum water depth with 24hr access. Examples of portside facilities that have successfully targeted the Offshore Wind sector include

- Mostyn Port North Wales
- Belfast Harbour
- Green Port Hull – Siemens Super port
- Bremerhaven
- Ijmuiden
- Cuxhaven

More recently an offshore floating wind developer at Wave Hub, Pelastar, planned to have their foundations fabricated at Port Talbot because of a lack of water depth at south west ports although they did choose two Cornwall based companies (KML and LDD) to be their marine contractors.

The feedback from marine contractors familiar with the region is that the constraints at south west ports should not be exaggerated since working solutions can often be found; but clearly this is a challenge when targeting larger companies and multinationals who have a greater choice of port location across the UK, and for the very large engineering and fabrication projects associated with Offshore Wind, Oil and Gas and decommissioning.

6.7.7 Skills and workforce constraints – training and retaining our best people

The position on skills is mixed. The south west has very good skills at the graduate and post-graduate level thanks to the marine and engineering related courses at both Exeter and Plymouth universities. It is noticeable that several of the marine engineering and consultancy companies in the region – for Mojo Maritime and LDD – have recruited extensively from the universities.

Keeping graduates in the region – offering well paid jobs and affordable housing – is however a long term issue. The demographics of the region - particularly in rural and seaside locations – is getting older as employment moves towards hospitality, tourism and care provision.

The south west peninsula also has good skills at the technician and operational level (NQV 3) – supported by training providers including technical and maritime training courses, apprenticeship schemes and business bodies such as Cornwall Marine Network and the Chambers' of Commerce.

The number of specialists trained in marine and engineering disciplines is however low when compared to other parts of the UK and Europe. Several companies in the sector – A&P, Princess Yachts, and Cornwall Marine Network run high quality apprenticeship schemes but the numbers are comparatively low when viewed at a national scale.

Although the number of engineers coming through apprenticeship schemes is still below target – this is an issue common across other parts of the UK. The south west is not the lowest region in terms of overall apprenticeship numbers; however the rate of growth in the South West since 2009 @ 31% has been lower than in other English regions.

For apprenticeships by region and sector see http://www.parliament.uk/briefing-papers/SN06113.pdf and for more detail see https://www.gov.uk/government/statistical-data-sets/fe-data-library-apprenticeships

Gaps in training provision which will need to be addressed include some of the deeper qualifications needed by O&M technicians, marine and subsea operations, manufacturing, offshore qualifications, power and electrical systems.

7 The opportunity for Plymouth - Marine Industries Production Campus

7.1 Overall opportunity

The market analysis in this report coupled with the review of marine technologies and services confirms the overall City Deal strategy to focus on the development of marine industries and the high growth area of marine science and technology.

The core capability that exists in Plymouth, anchored around marine engineering, support for innovation and its world class marine science cluster (coupled with the wider capability in the south west peninsula) provides the basis to establish a successful marine industries cluster (MIPC).

However the geographic location of Plymouth, and it's distance to key marine markets (such as oil and gas, offshore wind and commercial shipping), coupled with constraints on land space, suggests that the nature of the MIPC marine industry cluster will not be based on either large scale manufacturing or large scale project deployment.

Instead it is very likely that the development of a marine industry cluster, focused on South Yard and the wider MIPC, will be achieved by:

1. Growth from **existing south west based marine businesses** – especially those engaged in technology development, innovation and export markets.
2. Expansion and commercialisation **of research, and the commercial application marine sciences,** in areas such as biomed, energy, environmental and climate applications.
3. Support for **start-up companies** and technology developers
4. Attracting **inward investment** and relocation from companies that want:
    a. to take advantage of the **R&D**, academic and research capability of the region (including demonstration and test facilities) to commercialise their products/services
    b. to be co-located and collaborate in a **vibrant marine industry cluster**
    c. to be located **near key customers** such as Princess Yachts, MOD, Babcock
    d. to take advantage of investment support and **financial incentives**
    e. to access **new market opportunities** such as marine energy, nuclear and marine science applications
    f. to access the **quayside and dock facilities** at South Yard and other port locations in the south west. This is an important part of the offer.

7.2 Feedback from marine companies

The Demand Study did not include a full market survey, however the study team did informally consult with over 15 companies from the south west, UK and overseas to find out their attitude to the south west and the creation of a marine industries cluster. A list of these companies and some of their initial feedback is given in **Error! Reference source not found.**.

(Note Alder King have also carried out a market survey on behalf of the City Deal looking at the demand requirements for South Yard and we understand that the feedback is very similar).

Overall the feedback from companies approached was very positive and in fact a significant number would welcome an opportunity to come down and see the site. (See Section 1.4 Recommendations).

Positive feedback	General Themes
Growth potential in the marine sector	• Generally very positive about the growth opportunities in the marine industries especially amongst those companies engaged in technology development and research • Some caution and frustration from those impacted by reduction in oil and gas investment or waiting for the commercialisation of marine energy
Support for a marine cluster	• Positive about being part of a marine cluster and the opportunities for collaboration – this applied as much to south west based companies • Business networking and collaboration • Benefits of shared marketing, trade and promotion
Attractiveness of Plymouth and the south west	• Amongst those companies from outside the region the response to the south west offer was very positive. Several companies already have strong contacts with the region and would like to do more business • There was fairly good recognition of the South West's assets although probably less informed • Especially R&D, test and demonstration facilities and universities
Shared facilities, assets innovation space	• Proposals to include provision of shared facilities, innovation space and shared assets was positively received
Attractiveness of South Yard	• Overall pitch of transferring MOD land to create a new marine focused industry cluster was very positively received. • Individuals with links to Plymouth and the south west (of which there were a surprising number) were especially passionate about the opportunity. • The opportunity for some was to be located within the dockyard with access to MOD, Babcock, Princess Yachts • Several companies were especially interested in the docks and dockside facilities in Area 5 (Areas 3 & 4 also)
Dry Dock and Plymouth Sound Demonstration Zone	• Several companies highlighted the potential benefits of reinstating at least one of the Dry Docks to service smaller commercial vessels and technology development • Tech developers were supportive of a nearby marine technology

	demonstration zone in Plymouth Sound.
More cautionary feedback	
Location and Scale	• As discussed in Section 6.7 a number of companies referenced Plymouth's geographic location and perceived lack of scale as a potential issue
Demand for pure office space	• The key attraction of South Yard was its waterside location, engineering and workshop facilities and proximity to docks, Devonport, etc. • By implication companies seeking just office space are likely to be (initially) less attracted to the site until a marine industry cluster has been established. • So it could be more challenging to populate Area 1 East until some early seed tenants are in place
Size of the South Yard site (areas 1 and 5)	• The size of the initial offering @ 7.5 hectares is relatively small – compared to other marine cluster sites – see Case Studies • It will therefore be important to continue to market the whole South Yard opportunity and to link this to other South West sites in the wider MIPC
Need for investment & enterprise support	• Several companies enquired about investment support, grant funding, rate support • Competition in this area from other UK and EU port locations

7.3 South Yard Development Timetable

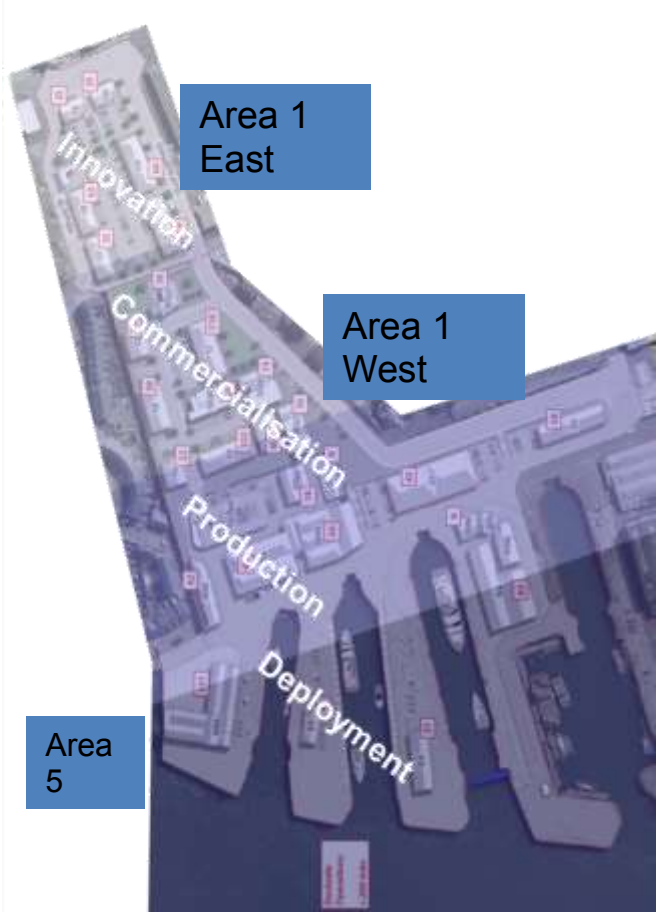
In total the South Yard is over 34 hectares of which 7 hectares have already been sold in 2011 to Princess Yachts to expand their super yacht manufacturing facility. Princess Yachts future expansion plans includes a £35m investment to create new production hangers and office accommodation.

The rest of the site has been divided into 5 development areas which are planned to be transferred to public/private ownership in phases.

Areas 1 and 5 will be the first to be developed and plans are well advanced to transfer Area 1a to Plymouth City Council ownership in April 2015, area 1b in April 2016 and area 5 in April 2017.

7.4 MIPC Concept – Innovation to Commercial Deployment

The overall concept of the MIPC marine cluster is to create a development pathway from innovation to commercial deployment.

South Yard Site (Areas 1&5)	Proposed land use
	The MIPC concept lends itself to the physical attributes of the South Yard site. It is intended when the South Yard site is developed it will support • Reception and • Office space • Shared space – networking, meeting rooms, training rooms and IT/design facilities • Innovation and short term lease space • Workshop space • Laboratory space • Light industrial/manufacturing units • Larger industrial units • Quayside laydown and deployment • Docks – and a dry dock facility The top of the site Area 1a East lends itself to office and innovation space, while Area 1b West is suitable for workshops and light industrial use and Area 5 the dockside and larger industrial use

7.4.1 Balance of "traditional" marine industries and new "blue tech" technologies

While the focus of the MIPC concept has been on innovation, and creating new business opportunities, it will important to ensure that the MIPC also attracts companies with core marine industry capability.

The feedback from industry, and review of the marine cluster case studies, strongly supports the argument that to develop a successful marine industry cluster requires an integrated approach which combines both traditional or core marine industry capability as well as a focus on new technologies, products and services.

In many ways it is artificial to draw a distinction between new "blue tech" and "traditional" marine industries since the lines are extremely blurred and in many cases new technologies require a coupling of old and new capability. This also applies to individual companies who often combine innovation and the development of new products/services alongside a core marine business.

Taking this approach forward the ideal make-up of a marine cluster would combine companies and capabilities from core industries alongside technology developers, service companies, innovation companies and those involved in the commercialisation of marine science applications.

An initial listing of potential companies that could be interested in expanding their business to the South Yard and other MIPC sites is given in **Error! Reference source not found.**.

"Traditional" Marine Capability	"Blue Tech" and new capabilities
Marine Industries • **Marine engineering** • **Marine Civil Engineers** • **Marine operations/installation** • **Port services** • **Sub-sea specialists** • **Workboats, towage** • **Vessel building, repair and service** **Allied components and manufacturing** • **Composites** • **Fabrication** • **Hydraulics** • **Electrical** • **Condition monitoring** • **Communications** **Marine Services** • **Naval architects& marine consultants** • **Marine warranty and assurance** • **Financial and insurance** • **Legal, Planning and environmental** • **Training providers**	Marine energy wave and tidal Floating wind Remote and autonomous vehicles Marine ICT, data capture and analysis Satellite communications Remote monitoring Green vessels/propulsion systems Advanced materials/composites Electronics and instrumentation Visualisation and virtual applications Subsea installation New vessel design Environmental survey Application of marine sciences e.g. • Protective coatings • Bio-med, Pharma, energy Climate Science and forecasting Aquaculture

7.4.2 Mix of quayside, industrial, innovation and office space

The overall concept for the South Yard MIPC is for a mixed use site providing Hi-spec office space, design suites, workshop facilities and larger industrial units.



Example Hi-spec Hybrid Buildings

©Practical Developments



7.4.3 Docks and Dry Dock

Several companies have expressed interest in the quayside areas, docks and the potential to re-instate a dry dock facility.

Docks and Dry Docks Area 5	Dry dock specification

Dock Specification

	LENGTH	WIDTH [1]		DRAUGHT [2]
		Max	Min	
Dock 2	190.25 m	29.36 m	24.38 m	-7.7 OD
Dock 3	152.63 m	29.13 m	29.10 m	-9.3 OD
Dock 4	118.11 m	NDA	19.69 m	-3.9 OD

NOTE (1) At Quay docks are stepped. Some cross sections available.
(2) 2007 data to mud. Current survey being undertaken.

Docks 2 and 4 are “stepped”
Dock 3 is not stepped
Depths are approximate
Caissons were removed circa 2010

This reflects the shortage of waterside industrial facilities in the South West and along the south coast generally.

Several companies supported the reinstatement of at least one of the Dry Docks since at the moment there is no dry dock facility on the south coast between Falmouth and Portsmouth. The lack of dry dock facilities has also been evidenced by the successful re-launch of the Swansea Dry Dock and other facilities on the south coast such as Shoreham

A dry dock in Plymouth would complement the existing larger docks at Falmouth and would potentially be used for:

- Smaller commercial ship repair, conversion and servicing including fishing vessels, workboats, leisure boats and ferries
- Fabrication of offshore structures
- Project mobilisation and deployment
- Deployment and assembly of offshore technologies
- Demonstration and testing of offshore technologies

A dry dock facility could also be an added benefit to attract a marine engineering company to establish itself in the South Yard site – potentially as a co-investor in the dock facility.

Example: Dry Dock operators	
A&P Group	UK
Babcock	UK
KML	UK

Penzance Dry Dock	UK
Marine and Towage Services	UK
Merseyside ship repairers	UK
Harris Pye Group	UK
Burges Marine	UK
Ship Repairers and Shipbuilders Ltd	UK
Forth Group	UK
Avonmouth ship repairs	UK
Swansea dry-dock (Dunn Brothers)	UK
MMS Ship repairs	UK
Damen Ship repair	Holland
Navantia	Spain
Van Brink	Holland
Hellespont	Germany
Lisnave	Portugal
AHB Service	Poland

Access to a large slip was also identified as a useful addition to the MIPC and it was noted that there is currently a large slip owned by Princess Yachts which could potentially be available at commercial terms.

Note: The Demand Study scope did not include either a technical or a commercial feasibility study of the potential to re-instate a Dry Dock at South Yard. Completion of such a study is one of the recommendations highlighted in the recommendations.

7.4.4 Plymouth Sound Demonstration Zone

The study found that there was strong support for the establishment of a Plymouth Sound Demonstration Zone for the testing and demonstration of marine technologies including ROV's,

Autonomous Vehicles, sub-sea communications, remote sensing, survey and monitoring (e.g. Acoustics) and potentially other technologies.

7.5 Commercial model, Investment support and enabling actions

7.5.1 Ownership and business models

Overall the MIPC concept described above would lend itself to a flexible commercial model with a combination of:

- Very short term rental contracts and pay-per-use "innovation" and start-up space
- Shared space "pay-per-use" workshops, meeting rooms, design rooms etc.
- Rental and short term lease 1-5 years
- Long term lease for co-investment partners

There is also the potential to offer pay-per-use for cranage, equipment, IT services, event services etc.

7.5.2 Funding, Investment and Enterprise Support

A package of financial and business support incentives will be critical in attracting companies to locate at the site, particularly with the first tenants. Incentives should include:

- attractive rent,
- reduced business rates,
- investment tax allowances,
- grant funding

7.5.3 Potential integration with a new Marine Industry Catapult

Taking the concept of a marine innovation hub/cluster a stage further there is the potential that the South Yard MIPC could for part of a new UK Marine Industry Catapult.

"Catapults" are a relatively new initiative from Innovate UK (part of BIS) to support technology development and increase UK productivity. https://www.catapult.org.uk/. The Catapult initiative came as a response to the Hermann Hauser report (2010), which in summary said that the UK was good at innovation but extremely bad at commercial development of new technology, and later analysis by UK Government on the UK's Innovation Performance

Currently there are 7 Catapults set up in the UK covering:

- the Cell Therapy Catapult (https://ct.catapult.org.uk/) in London
- High Value Manufacturing Catapults (https://hvm.catapult.org.uk/) across multiple sites
- the Offshore Renewable Energy Catapult (https://ore.catapult.org.uk/) in Glasgow and Blyth
- the Satellite Applications Catapult (https://sa.catapult.org.uk/) in Harwell

- the Digital Catapult (https://digital.catapult.org.uk/) in London
- the Transport Systems Catapult (https://ts.catapult.org.uk/) in Milton Keynes
- the Future Cities Catapult (https://futurecities.catapult.org.uk/) in London

Two more are in development: the Precision Medicine Catapult and the Energy Systems Catapult.

The Catapults come in slightly different forms; some provide direct R&D capability and physical assets others are more orientated towards providing technical or business support expertise. A common theme across all the Catapults is a "1/3 a 1/3 a 1/3" funding model which is based on a central grant, private sector funding and funding from other EU, national or regional sources.

The National Composites Centre – part of the High Value Manufacturing Catapult provides world class R&D facilities and access to cutting edge equipment alongside deep expertise in composites and advanced materials.

The closest example to a potential Marine Industry Catapult is probably the Offshore Renewable Energy Catapult based in Glasgow and Blyth (formerly NAREC). The Blyth facility in particular provides offshore and on-shore test facilities, workshop, test facilities and docks.

In some cases Catapults have been based on pre-existing assets and infrastructure (e.g. High Value Manufacturing Catapult) in other cases the Catapult has been establish from scratch. In the case of the Energy Systems Catapult which is still in development, the management and organisational structure of the Catapult has been established first and it will then decide on a location – possibly Bristol or Midlands.

The number of Catapults being created has also slowed after an initial burst of activity – although this initiative, or something similar, is very likely to be carried forward by the next Government. The current recommendation is that Catapults should be created at a rate of no more than 2 per year with a goal to establish 30 catapults by 2030. See Latest Hauser Catapult Network Review.

Given the level of innovation and opportunities for export growth, the marine industries would make an obvious candidate for a new Catapult or similar model, and there is very likely to be a marine orientated Catapult in the next period. However there is no published plan at the moment to create one and the marine industry (as a sector) does not feature strongly in the Catapult Review Report or Innovation Performance Review.

In part this may be because innovation activity in the marine industries is split across a number of government departments with BIS (Innovate UK), MOD (Defence Science and Technology Laboratory) and the Department of Transport all having an interest. Proposals for future Catapults are also tending to focus on cross-cutting technology themes rather than industry sectors – so for example **Remote and Autonomous Vehicles** may be a candidate for a future candidate covering applications in marine, defence and nuclear.

The current round of marine technology needs (TINA) workshop which are being run across the country will be influential in deciding whether a formal marine orientated Catapult structure is formed.

The ultimate location or multi-location of a Marine Industries Catapult will depend to some extent on the scope of the Catapult and whether it is orientated towards Defence, Transport, "Blue Tech", Oil and Gas and/or marine sciences. Either way there will be competition for Plymouth from port cities in Scotland, North East, North West, Portsmouth/Southampton and possibly South Wales as contenders.

Given the need for a Catapult to have a national remit it is unlikely that Plymouth could form an Marine Industry Catapult on its own and therefore a multi-location model – in partnership with other port cities is a more likely route. Plymouth would also have to focus on cross-cutting technology areas where it has a clear advantage such as "**Marine Science Applications**" and where there are organisations already in place.

To position itself to be part of any future Marine Industries Catapult, or another structure/programme that is likely to emerge, Plymouth needs to move quickly to:

- build a relationship with Innovate UK
- get involved in the discussions with government departments and bodies like the Marine Industries Alliance to help shape the future strategy
- Focus on a cross-cutting technology theme – potentially in marine science applications or remote and autonomous vehicles
- market the MIPC concept nationally and internationally
- partner with other port cities and especially Portsmouth/Southampton
- lobby and influence future Government ministers

7.6 Sector Development and Marketing

As outlined in Section 7.2 the response from companies that the Demand Study spoke with was very positive. The response to Alder King's survey was similarly positive.

It is fair to say however that the South West's marine industry offer and capability is not widely known across the industry and is not recognised at a national or international level.

The brochures and publications which have been produced to support the Plymouth City Deal are good, but these have been produced largely for non-industry and a local audience and they are designed to promote the City Deal programme rather than the Plymouth and South West marine industry brand and capability.

There is therefore a need to significantly increase the marketing and sector development activity to support the MIPC strategy.

7.6.1 Marketing Activity

Effective marketing to the marine industry at a national and international level requires:

- Resource and budget
- A collaborative approach – working with industry and across regional partners
- A dedicated and long term presence – 3-5 years commitment
- Industry knowledge and content

- Clear, joined-up, and holistic marketing messages

Example: South West Marine Energy Park.

The SWMEP – a collaborative partnership between industry and regional partners has established a strong brand for the marine energy sector in the south west.

Marketing Activities

- Collaboration with regional partners – universities, inward investment, LEP's
- Co-marketing with local companies and organisations
- Stands and Pavilions – over several years – at key conferences such as All Energy and RUK
- Speakers and conference presentations
- Side events and networking
- Press and media coverage

At 7.5 hectares the initial industrial and office space available at South Yard will be limited but this must be considered alongside the land space that will be available in Zones 3 and 4 together with the land space already occupied by Princess Yachts and Babcock making a total of 34 hectares.