UK Marine Industries
Technology Roadmap 2015




IfM Education and Consultancy Services

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on behalf of the MIA with support from Innovate UK, BIS and KTN.

UK Marine Industries Alliance

Innovate UK

Department for Business Innovation & Skills

KTN the Knowledge Transfer Network

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Executive summary

The UK marine industry is globally competitive with strengths across a variety of technologies. This roadmap underpins the common vision and strategy of industry and government working together to develop export-led growth.

The 2015 Marine Industries Technology Roadmap examines those parts of the industry building vessels or supplying equipment and services for the commercial, leisure, naval and marine science sectors. By presenting the technology priorities of the industry in a single document, it:

- acts as a focal point around which to **engage** the marine industry community and adjacent industries
- identifies the key opportunities in which industry and government should **invest** to provide export growth through to 2020 and onwards to 2030
- maps the key technical capabilities that need to be developed for the successful exploitation of those opportunities
- supplies a clear map to **inspire** innovation and collaboration to deliver those capabilities

The roadmap was developed with expert input from 77 organisations across the major segments of the UK marine industry:

- Design, manufacture and supply of marine equipment
- Shipbuilding, boatbuilding. Repair, refits and conversions
- Design and consultancy services for the build and equipping of vessels

Building on the Marine Industries Technology Roadmap of 2011/12, the work reflects latest developments in global drivers and future marine markets. In exploring UK capability to exploit opportunities it provides new levels of detail in key areas.

Global trends and associated opportunities in the industry are driven by economic, environmental, social, technological and political/regulatory factors, notably:

- 'Green shipping' driven by energy price fluctuation, environmental awareness and regulation, demanding ongoing cost management
- Growth of lifecycle cost analysis and management
- Changing, more fragmented profile of leisure sector customers
- Increasing resource extraction and operations in more extreme environments
- Changing shipping patterns driven by shifts in demographics and economic development, and increases in shipping levels
- Ongoing safety regulations
- Changing maritime security needs, with growth in piracy and increasingly fuelled by competition for natural resources

These global trends drive associated trends in technology development and vessel design. Vessel efficiency is enhanced by innovation in propulsion and energy systems, fuels, hull design and hydrodynamics, and weight reduction through new materials and manufacturing techniques. Increasing digitisation of vessels and fleets is driving a new engineering approach in which intelligent integration of on-board systems (power, propulsion, auxiliary and electrical) offers improved functionality and performance. Improvements are demanded in ship-to-shore integration to enhance decision support systems, while enhanced comfort and ease of use are becoming increasingly important, notably in the leisure and naval sectors. The marine industry is increasingly investing in autonomous systems to reduce costs, increase efficiency and improve safety or mitigate risk.

British industry and the research base are competitively positioned to exploit the opportunities provided by these trends. The UK has strong international standing as a centre for design, engineering, marine equipment and research, coupled with its position as the world's leading maritime financial, professional and business services hub.

In particular, the country has recognised excellence and high market rankings by value in design and manufacture of luxury leisure vessels, commercial and naval refits, supply of marine equipment and design, and construction

and project management of complex warships and submarines. Existing market share coupled with strengths in design and integration of complex vessels and systems, management of complexity and risk, and a range of pioneering technologies (from composite materials to marine coatings to autonomous systems) place the industry in a strong position for growth.

Given such strengths in key growth areas within a global industry valued in excess of £100bn pa[1], the four per cent compound annual growth rate targeted by the Marine Industry Leadership Council (MILC) can be achieved by focusing on the following priorities:

1. Whole-vessel integration to deliver more affordable and optimised running with reduced staff and minimised through-life costs
2. Design, integration, manufacture and operation of autonomous vessels and systems
3. Design, manufacture and refit of superyachts, high-end powerboats and high-end sailing yachts
4. Extended use of composites and other novel materials
5. Design and manufacture of specialist vessels for support of the offshore energy and naval sectors
6. Through-life operation and insertion (including refits and conversions) to improve vessel efficiency
7. Decision support systems – including integrated voyage optimisation to deliver just-in-time arrival at port at lowest cost, secure situational awareness and next-generation command and control systems

To support these priority opportunities, investment is recommended in the following five areas of technical capability:

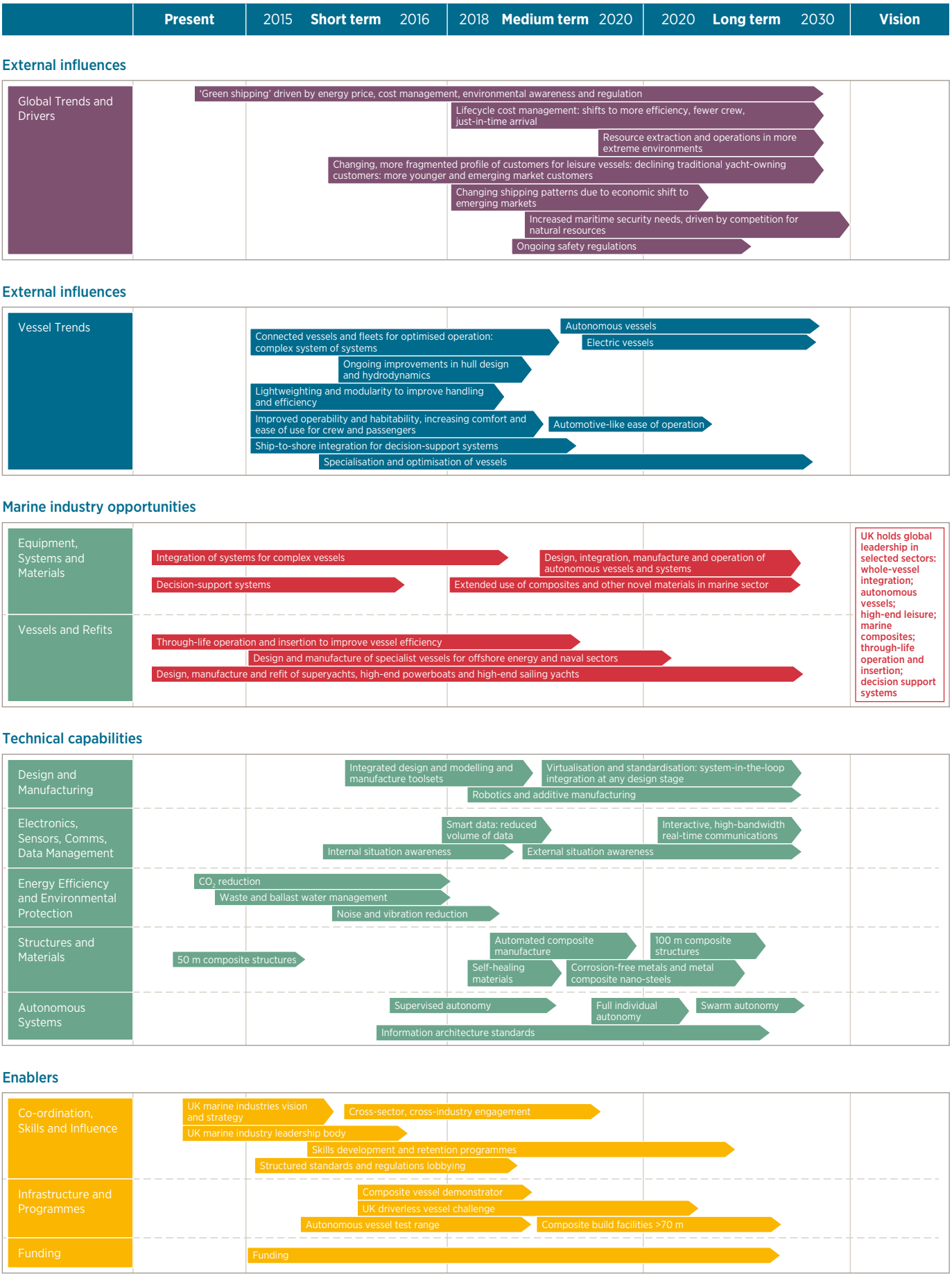
- Design and manufacturing techniques
- Electronics, sensors, communications and control, data management and big data analytics
- Energy efficiency and environmental protection
- Structures and materials
- Autonomous systems

The report provides road maps showing how each priority opportunity may be achieved, gives further details of the technical capabilities identified for investment, and specifies recommendations for enabling actions to support sustainable industry growth. The recommendations, aimed at industry stakeholders and funders, encompass:

- Strengthened role for MILC as a focus for a single and compelling vision, also maximising participation in European Union (EU) programmes
- Demonstrator or marine challenge projects to encourage collaboration across the leisure, commercial, marine science and naval sectors to address technical, regulatory and cultural issues that are blocking key changes
- More facilities for test and demonstration of new technologies in real-world conditions created at affordable cost
- Investment in enhanced manufacture and test infrastructure as an important component of growing the sector
- Industry engagement with the standards and regulatory bodies to accelerate the acceptance and adoption of innovation that underpins the UK Marine Industries Technology Roadmap 2015
- Engaging further with adjacent sectors, maritime industries and regulators to facilitate the cross-fertilisation of technology

The following diagram summarises the key trends, drivers, opportunities, capabilities and enablers identified through the roadmap development process.

1 *Competitive Position and Future Opportunities of the European Marine Supplies Industry*, BALance Technology Consulting 2014, commissioned by the European Commission.


Present
2015 Short term 2016
2018 Medium term 2020
2020 Long term 2030
Vision
External influences
Global Trends and Drivers
'Green shipping' driven by energy price, cost management, environmental awareness and regulation
Lifecycle cost management: shifts to more efficiency, fewer crew, just-in-time arrival
Resource extraction and operations in more extreme environments
Changing, more fragmented profile of customers for leisure vessels: declining traditional yacht-owning customers: more younger and emerging market customers
Changing shipping patterns due to economic shift to emerging markets
Increased maritime security needs, driven by competition for natural resources
Ongoing safety regulations
External influences
Vessel Trends
Autonomous vessels
Connected vessels and fleets for optimised operation: complex system of systems
Electric vessels
Ongoing improvements in hull design and hydrodynamics
Lightweighting and modularity to improve handling and efficiency
Improved operability and habitability, increasing comfort and ease of use for crew and passengers
Automotive-like ease of operation
Ship-to-shore integration for decision-support systems
Specialisation and optimisation of vessels
Marine industry opportunities
Equipment, Systems and Materials
Integration of systems for complex vessels
Design, integration, manufacture and operation of autonomous vessels and systems
Decision-support systems
Extended use of composites and other novel materials in marine sector
Vessels and Refits
Through-life operation and insertion to improve vessel efficiency
Design and manufacture of specialist vessels for offshore energy and naval sectors
Design, manufacture and refit of superyachts, high-end powerboats and high-end sailing yachts
UK holds global leadership in selected sectors: whole-vessel integration; autonomous vessels; high-end leisure; marine composites; through-life operation and insertion; decision support systems
Technical capabilities
Design and Manufacturing
Integrated design and modelling and manufacture toolsets
Virtualisation and standardisation: system-in-the-loop integration at any design stage
Robotics and additive manufacturing
Electronics, Sensors, Comms, Data Management
Smart data: reduced volume of data
Interactive, high-bandwidth real-time communications
Internal situation awareness
External situation awareness
Energy Efficiency and Environmental Protection
CO_2 reduction
Waste and ballast water management
Noise and vibration reduction
Structures and Materials
Automated composite manufacture
100 m composite structures
50 m composite structures
Self-healing materials
Corrosion-free metals and metal composite nano-steels
Autonomous Systems
Supervised autonomy
Full individual autonomy
Swarm autonomy
Information architecture standards
Enablers
Co-ordination, Skills and Influence
UK marine industries vision and strategy
Cross-sector, cross-industry engagement
UK marine industry leadership body
Skills development and retention programmes
Structured standards and regulations lobbying
Infrastructure and Programmes
Composite vessel demonstrator
UK driverless vessel challenge
Autonomous vessel test range
Composite build facilities >70 m
Funding
Funding

1. Introduction

1.1 Background

The purpose of the Marine Industries Technology Roadmap is to identify future priorities, gaps, opportunities and capability needs in order to underpin the UK's marine growth strategy.

The original Marine Industries Technology Roadmap of 2011/12 achieved key objectives, including engagement and consensus for priority opportunities, capabilities and technology needs. That consensus informed and led to a number of government initiatives:

- The Vessel Efficiency Programme funded by Innovate UK and the Defence Science and Technology Laboratory (Dstl) was directly informed by the roadmap's focus on green shipping
- Maritime autonomous systems research groups and funding calls were informed by the identification of autonomy and sensors as cross-cutting technologies in the roadmap
- The Transport Systems Catapult incorporated the opportunity for integrated transport and logistics
- The Offshore Renewable Energy Catapult directly aligned to the opportunities identified in that area

In taking forward the original roadmap, the 2015 refresh strengthened the industry focus on the need to:

- **engage** with stakeholders and those beyond the sector to increase awareness of the industry's capacity for innovation and growth
- **invest** in a competitive sector with good opportunities in global markets
- **inspire** further innovation and collaboration, to take full advantage of the opportunities that the roadmap and market present

1.2 Objectives and scope of the 2015 roadmap

The 2015 refresh of the Marine Industries Technology Roadmap was commissioned by Innovate UK on behalf of the Marine Industries Leadership Council to:

- provide continued focus for engagement across the marine industries community
- prioritise areas for marine industry R&D
- reflect the latest developments in external drivers and future marine markets
- provide more detail on timing and supporting technology requirements in key areas
- explore further the available UK capability

The scope of the marine industries for the refreshed roadmap was defined as those parts of the industry building vessels or supplying equipment and services for commercial, leisure, naval and marine science purposes.

1.3 Approach

This report provides the consolidated output of the series of four Marine Industries Technology Roadmap workshops[2] that took place from February – April 2015. In all, experts from 77 different organisations contributed to the development of the revised roadmap. Those organisations include: national and international companies, large and small, representing commercial marine, leisure marine, marine science and naval sectors; industry bodies; government organisations; universities and research institutes.

IfM roadmapping techniques were used to identify global trends and drivers and vessel trends with potential impact on the UK marine industry. Following review of the UK's competitive position, opportunities were identified and prioritised based on their fit to UK strengths and trends and drivers. The report focuses on trends with the highest impact on UK opportunities, plus the key areas of technical capability and enablers. Finally, the report details the consolidated recommendations and actions identified by workshop participants and consultees.

2 During the fourth – the Roadmap Consolidation Workshop – a broad stakeholder group including members of the MILC Technology & Innovation Group validated the combined output of those workshops and provided enhanced detail on each identified opportunity and technical capability timelines.

2. Global trends and drivers

Volatile but generally increasing energy prices, environmental legislation, and pressure on lifecycle costs, combine to highlight the critical importance of vessel efficiency.

Shipping patterns and routes are altering as a result of shifts in demographics and economic development, climate change and increases in freight levels. In the leisure vessel sector, the changing profile and increasing fragmentation of customers and the high expectations of quality set by the luxury goods sectors challenge the industry. The dominance of traditional yacht-owning customers is being challenged both by younger customers (increasingly from emerging market economies) and by an older demographic.

The expansion of resource extraction and operations in more extreme and hostile surface and deep sea environments in the medium term is driving a requirement for rapid technological development.

In addition, the marine environment is of course hostile: the industry must at all times maintain the very highest standards of safety. Moreover, growing competition for natural resources in the longer term, together with the increased threat of piracy, fuel the challenges for maritime security.

Further information about the global trends and drivers identified as key in the short, medium and long term is given in the Appendix, page 17.

3. Vessel trends and drivers

The global trends are leading to associated trends in technology development and vessel design:

- Vessel efficiency is enhanced by developments in propulsion and energy systems, new fuels, hull design and hydrodynamics, as well as weight reduction through the application of novel materials and manufacturing techniques (lightweighting)
- The increasing digitisation of vessels and fleets is leading to the need for a complex system of systems[3] engineering approach where intelligent integration offers improved functionality and performance
- Improvements are demanded in ship-to-shore integration to enable decision support systems including the optimisation of the vessel's route and time of arrival
- Improved comfort and ease of use for both crew and passengers is becoming increasingly important, particularly so in the leisure and naval markets
- The marine industry is increasingly investing in autonomous systems to reduce costs, increase efficiency and improve safety or reduce risk

More detail about vessel trends and drivers impacting in the short, medium and long term is given in the Appendix, page 17.

3 System of systems engineering seeks to optimise a network of various interacting systems; on board a vessel this includes the power and propulsion, electrical and auxiliary systems.

4. The UK competitive position

The UK marine industry is estimated to generate £8.1bn pa of gross value added, including approximately £3.3bn of direct revenue, and support 175,000 employees including 74,000 directly employed within the industry[4].

Despite the dominance of the Far East (China, South Korea and Japan) in large-scale shipbuilding, the UK:

- retains an acknowledged position as a centre for design, engineering, marine equipment and research
- is the leading international financial and professional services hub
- remains the main global centre for maritime business services

The country has a recognised excellence in the design and manufacture of luxury leisure vessels – it is ranked fifth globally in superyacht manufacture by length[5] – and is also the home to the majority of the world's most successful large yacht designers. The UK is also a significant European player in commercial and naval refits, is ranked number four in Europe for the supply of marine equipment[6] and has world-leading expertise in the design, construction and project management of complex warships and submarines.

According to analysis sponsored by the Marine Industries Alliance and UK Trade & Investment (UKTI) in 2014, the vessel market in which the UK is competitive includes an addressable global forward order book for non-defence complex vessel systems of around $48bn 2014–2020. Current UK penetration in this market is estimated at around 10 per cent.

The roadmapping workshops considered the increasingly competitive global market and identified competitive strengths of the UK marine industry in the following areas:

- *High value 'soft' technical skills:* design and integration of complex vessels and systems; management of complexity and risk; design, build and fit-out of high-end leisure vessels and yachts
- *Workforce and skills availability:* flexible workforce; research centres and universities; strong marine/naval reputation and skills base
- *Existing market share and presence:* marine equipment, fourth in Europe; repairs and refit, sixth in Europe; two of top five yards globally in superyacht manufacture
- *Global centre of maritime industries:* marine insurance sector; Lloyd's Register; International Maritime Organisation (IMO)
- *Specialist technical strengths:* composites; marine coatings; waste/ballast and emission control systems
- *Offshore energy infrastructure and market:* the UK is a global leader in offshore wind farms and tidal array development

Competitive weaknesses focus on supply chain and workforce factors:

- *Supply chain:* low number of major ship yards; limited major manufacturers of main equipment; fragmented industry and supply chain
- *Workforce and skills availability:* high wage economy; ageing skills base; public perception of marine as a 'sunset' industry; the ability to attract overseas marine talent given the UK visa controls

4 Oxford Economics,*The economic impact of the marine and maritime sector on the UK in 2011/12*, January 2013, p. 21; GVA and employment relating to: shipbuilding and repairs; equipment; leisure and small commercial; technical consultancy.

5 *ShowBoats International Global Order Book 2014*. Ranking calculated by total length of leisure vessels built.

6 BALance Technology Consulting, 2014.

5. Priority opportunities

By aligning the current strengths of the UK marine industry with trends in vessel design and operation, seven priority opportunities were identified and ranked. It is recommended that the UK marine industry and stakeholders focus on developing strength and further competitive advantage in the following areas:

1. Whole-vessel integration to deliver more affordable and optimised running with reduced staff and minimised through-life costs
2. Design, integration, manufacture and operation of autonomous vessels and systems
3. Design, manufacture and refit of superyachts, high-end powerboats and high-end sailing yachts
4. Extended use of composites and other novel materials
5. Design and manufacture of specialist vessels for support of the offshore energy and naval sectors
6. Through-life operation and equipment insertion (including refits and conversions) to improve vessel efficiency
7. Decision support systems – including integrated voyage optimisation to deliver just-in-time arrival at port at lowest cost, secure situational awareness and next-generation command and control systems

5.1 Priority opportunity roadmaps

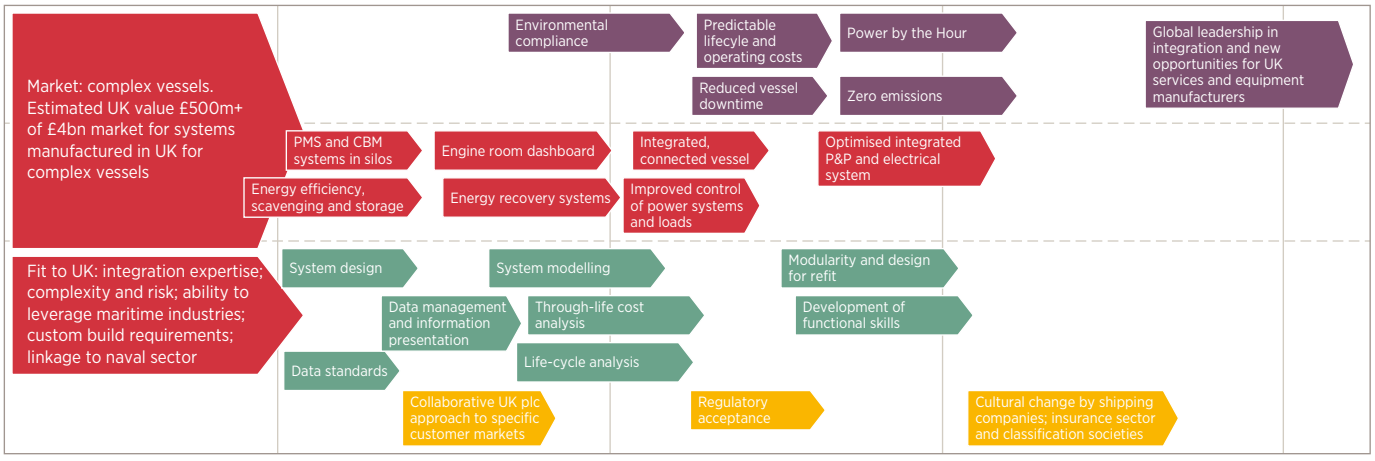
For each opportunity workshops developed a roadmap showing: milestones; the market pull; technical capabilities that need to be provided; and key enablers to deliver the opportunity.

Key to roadmaps

- Milestones
- Market pull
- Technical capabilities needed
- Key enablers needed

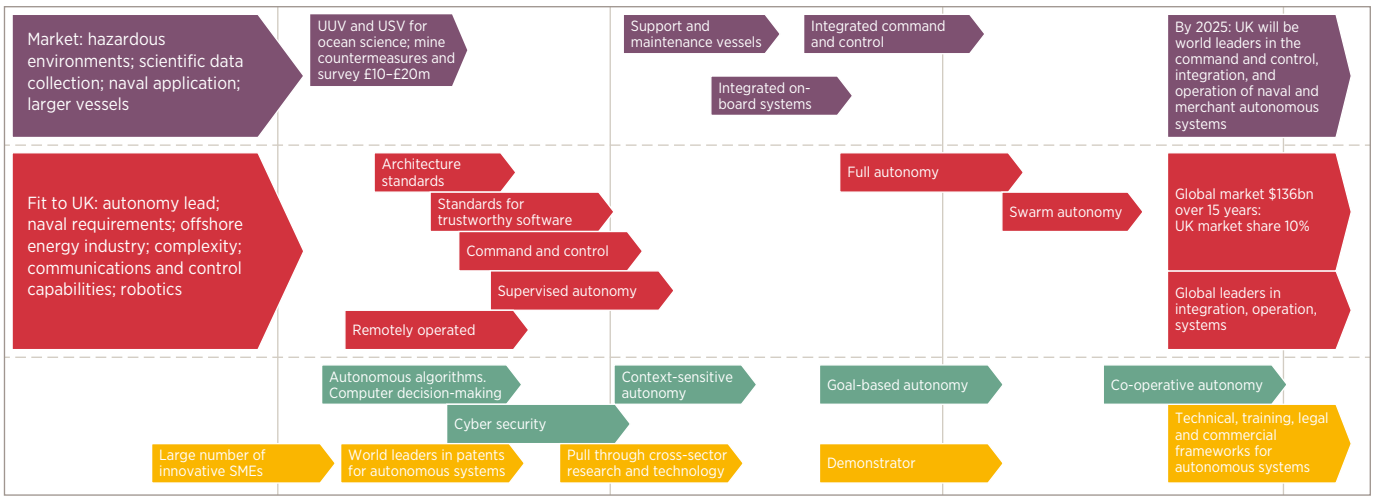
Present	2015	Short term	2016	2018	Medium term	2020	2020	Long term	2030	Vision

1. Whole-vessel integration to deliver more affordable and optimised running with reduced staff and minimised through-life costs

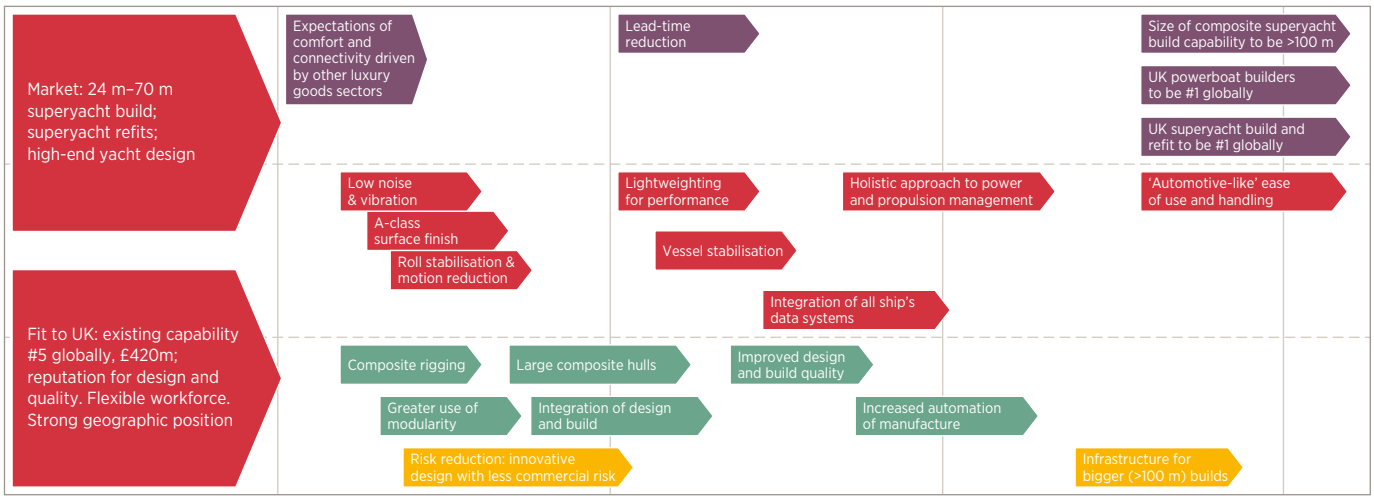


Present	2015	Short term	2016	2018	Medium term	2020	2020	Long term	2030	Vision

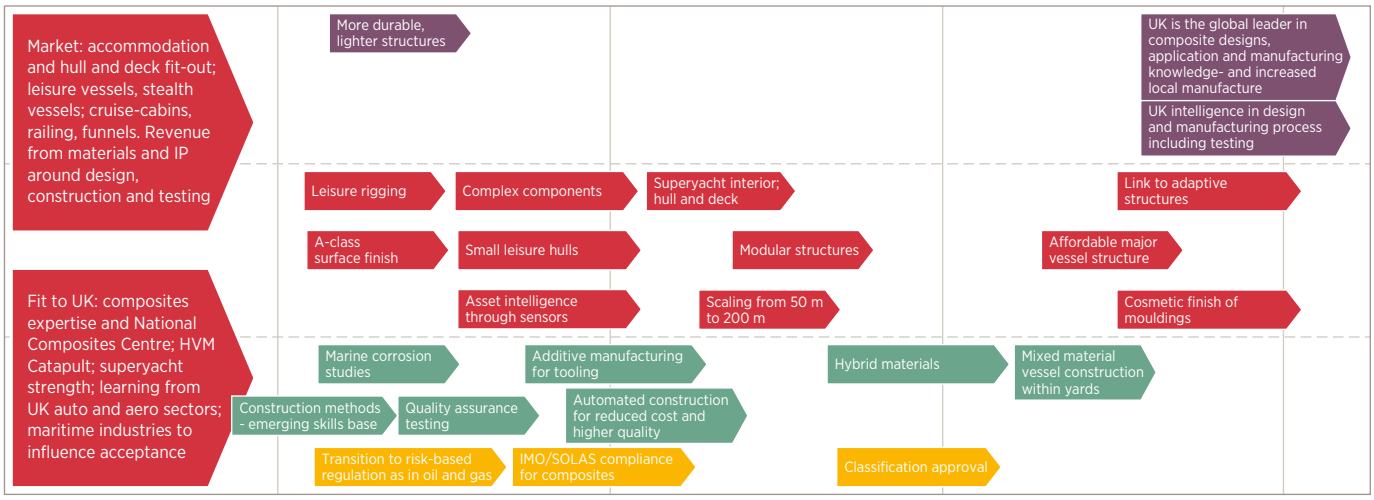
2. Design, integration, manufacture and operation of autonomous vessels and systems



3. Design, manufacture and refit of superyachts, high-end powerboats and high-end sailing yachts



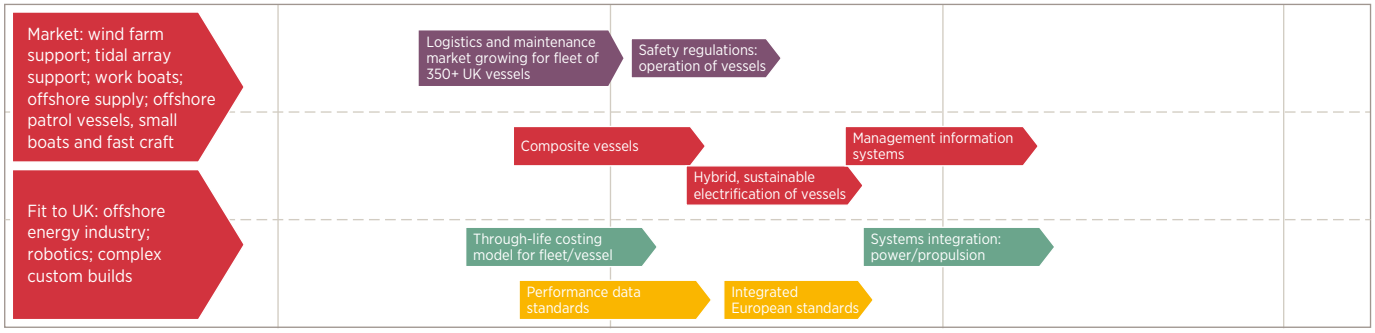
4. Extended use of composites and other novel materials



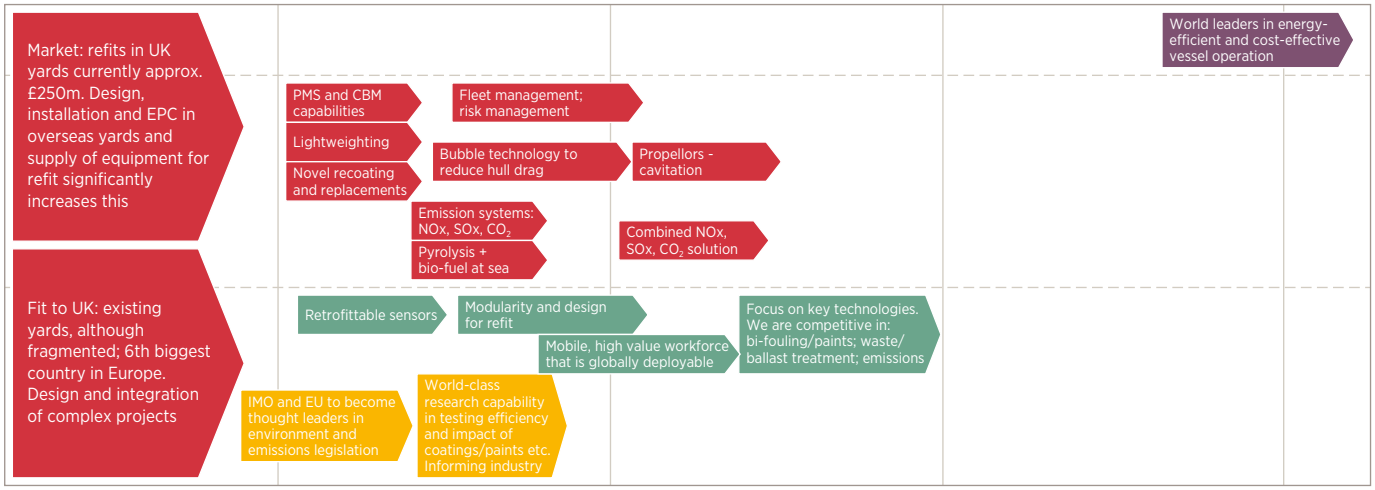
Milestones
Market pull
Technical capabilities needed
Key enablers needed

Present	2015	Short term	2016	2018	Medium term	2020	2020	Long term	2030	Vision

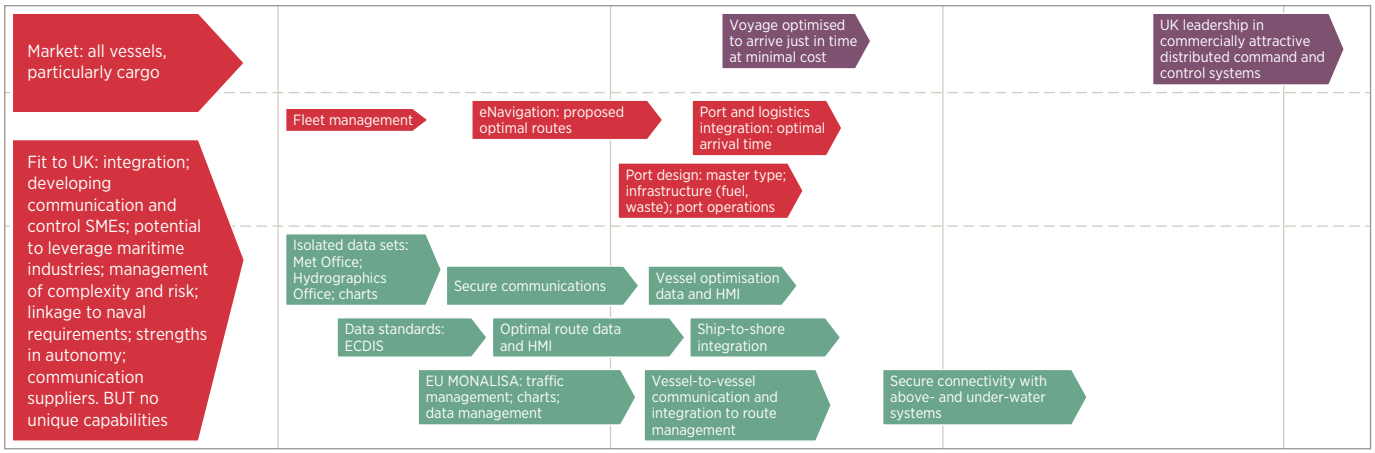
5. Design and manufacture of specialist vessels for support of the offshore energy and naval sectors



6. Through-life operation and insertion (including refits and conversions) to improve vessel efficiency



7. Decision support systems – including integrated voyage optimisation to deliver just-in-time arrival at port at lowest cost, secure situational awareness and next-generation command and control systems



6. Technical capabilities

6.1 Areas for investment

In support of these priorities, investment is required in five areas of technical capability that show exceptionally close alignment with the areas of opportunity:

1. Design and manufacturing techniques

Innovation in design and manufacturing techniques is critically important across all of the priority opportunities.

Investment required in: development of tools, processes and facilities to integrate and improve design, modelling and manufacture, considering overall efficiency, reliability, intelligent user-centred design, the full vessel lifecycle and automation

2. Electronics, sensors, communications and control and data management

These are highly important to whole-vessel integration, design of autonomous vessels, specialist vessels, through-life operation and insertion, and decision support systems and moderately important to superyachts and high-end leisure vessels.

Investment required in: technology to include reduced-cost high-bandwidth real-time communications, internal and external situation awareness to improve vessel operational efficiency

3. Energy efficiency and environmental protection

This area is extremely important to through-life operation and insertion and superyachts and high-end leisure.

Investment required in: technology to improve vessel efficiency covering mechanical and electrical systems, emissions, coatings, waste and ballast water management, and noise and vibration reduction

4. Structures and materials

The area is fundamental to composites and novel materials, and highly important for specialist vessels, through-life operation and insertion, and superyachts and high-end leisure.

Investment required in: developments to increase acceptance of composite and novel materials including self-healing structures, corrosion-free metals and metal composites to reduce weight and corrosion

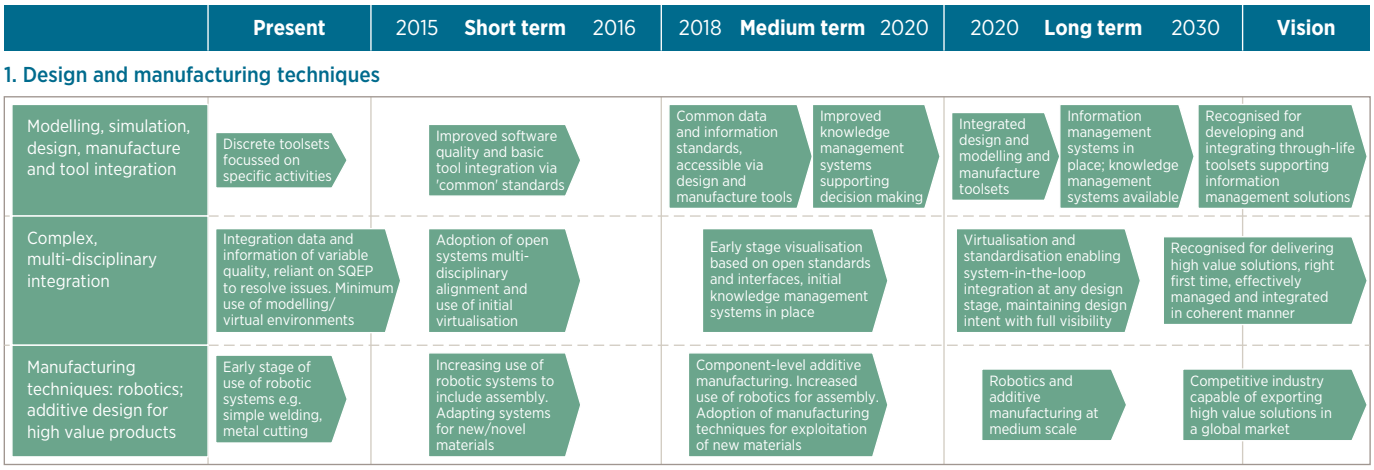
5. Autonomous systems

Autonomous capability is fundamental to both the design of autonomous vessels and decision support systems.

Investment required in: developments in safety, reliability, endurance, communications and regulatory aspects leading to full individual vessel autonomy, with common underlying information architecture standards

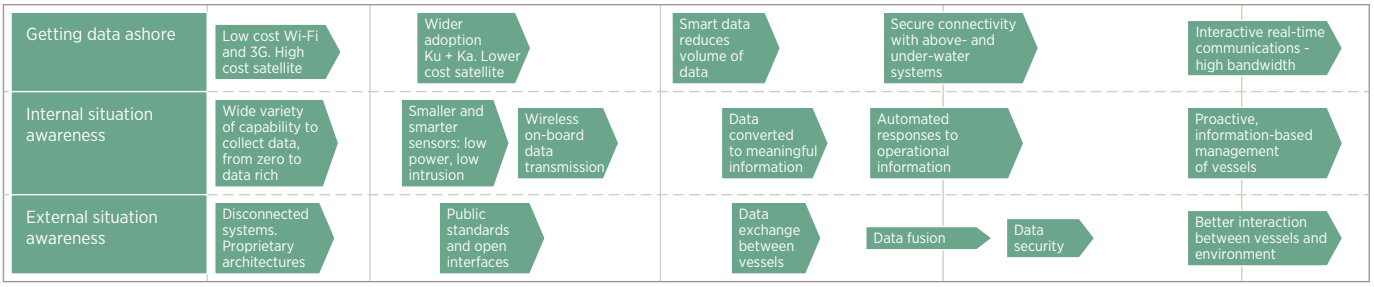
6.2 Technical capability timelines

The following technical capability timelines were constructed to indicate how each area of technical capability may develop to support the priority opportunities.

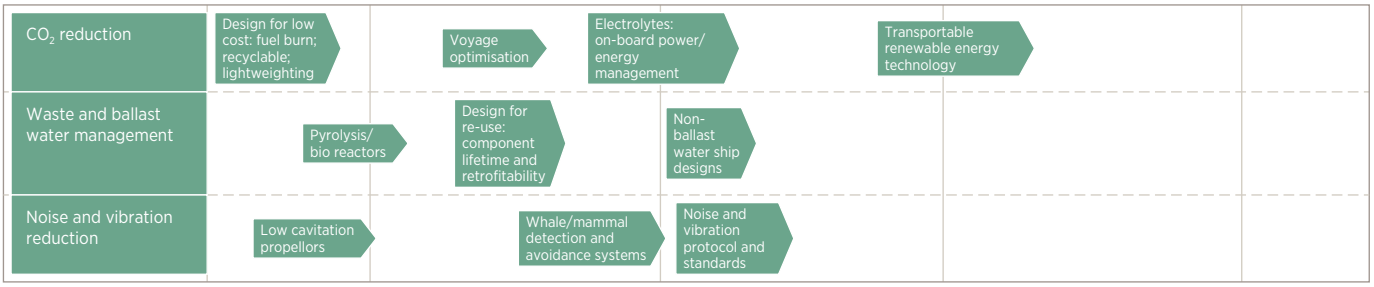


	Present	2015 Short term 2016	2018 Medium term 2020	2020 Long term 2030	Vision

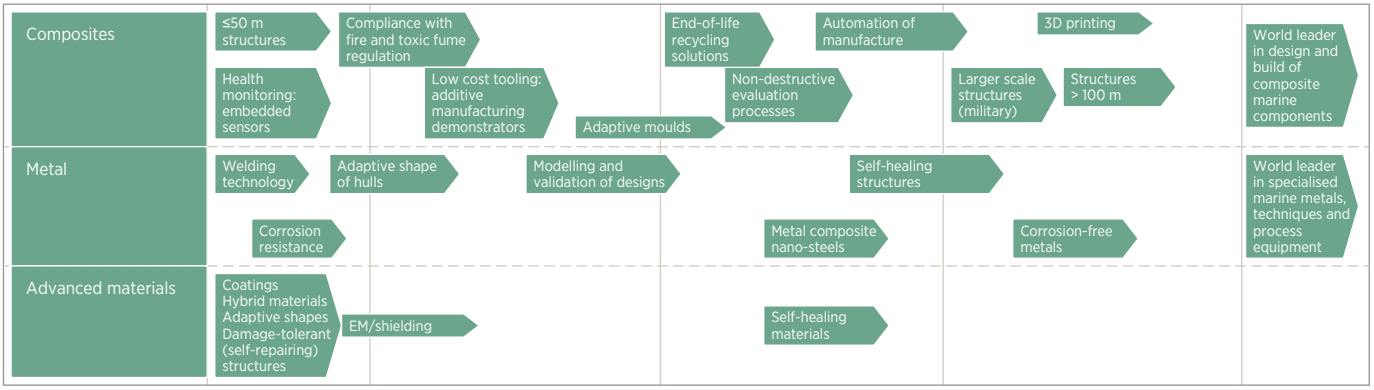
2. Electronics, sensors, communications and control and data management



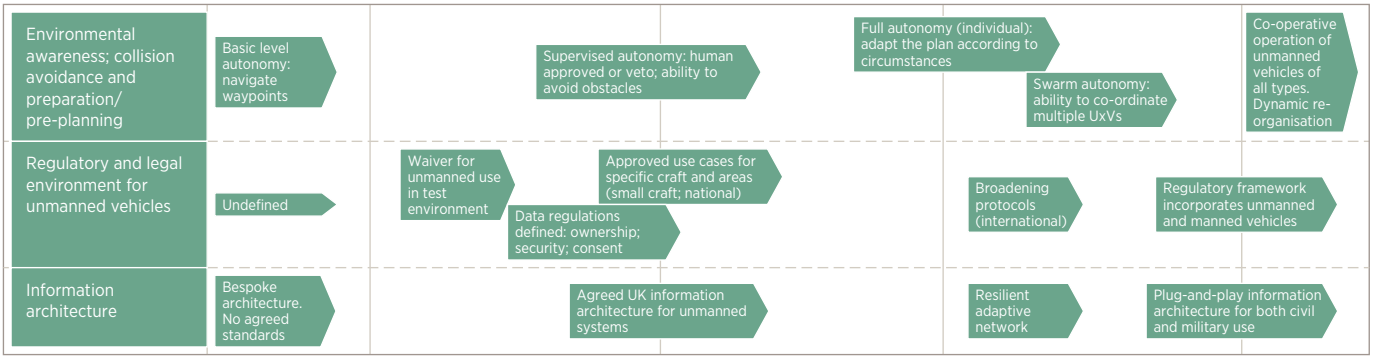
3. Energy efficiency and environmental protection



4. Structures and materials



5. Autonomous systems



7. Recommendations and industry actions

The way ahead requires a combination of:

- funding of key programmes by the UK government and the EU – notably R&D, demonstrator projects, and infrastructure
- effective collaboration, including co-ordination of the marine industry strategy and sector cross-fertilisation to support innovation
- standards development and regulatory change

7.1 Funding for technical capability

To support the priority opportunities identified for the UK, it is recommended that UK R&D funding is focused on:

- timely/accelerated achievement of the technical capability timelines in section 6.2
- the development of UK expertise and intellectual property in each of those areas (design and manufacturing techniques; electronics, sensors, communications and control and data management; energy efficiency and environmental protection; structures and materials; autonomous systems)

A further identified need is that of encouraging the exploitation of EU funding opportunities and influencing the focus of these opportunities.

7.2 Enablers

Developments in technical capabilities must be accompanied by stronger enabling mechanisms. The following recommendations specify ways in which funders and the industry may further support sustainable industry growth. Envisaged timescales for these enabling mechanisms are mapped on the diagram on page 6.

1. Strengthen and support the Marine Industry Leadership Council (MILC)

The industry will continue to collaborate to provide a single unified and compelling vision to ensure the sector continues to prosper in line with the Strategy for Growth for the UK Marine Industries[7]. MILC should be supported to act as the focus of that collaboration:

- Driving the vision based on the opportunities and technical capabilities highlighted in this roadmap
- Maintaining the strategy for delivering that vision and the innovation underpinning the vision
- Owning the task of co-ordinating collaborative UK marine industry programmes
- Co-ordinating and leading on specific EU marine programmes aligned with the UK marine industry strategy with the aim of maximising UK participation and influence

2. Define UK marine industry demonstrator or 'marine challenge' projects

These would have multiple benefits as mechanisms to:

- focus and encourage collaboration across the leisure, commercial, marine science and naval sectors to address technical, regulatory and cultural issues that are blocking key changes
- position the UK as the global thought leader and market leader in key emerging market areas
- engage adjacent sectors, maritime industries and regulators to facilitate change
- increase the visibility of UK marine industries to encourage recruitment, UK government investment and public engagement

Examples of such demonstrator projects may include:

- the design and production of a lightweight, composite vessel with a length in excess of 70 metres as a joint UK project;
- an autonomy challenge, leading to a UK crewless vessel demonstrator acting in UK waters

7 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/31813/11-1310-strategy-for-growth-uk-marine-industries.pdf

3. Consider how best to develop infrastructure to support future marine industries

Infrastructure is an important component for sector growth. Innovative companies have expressed an immediate need for affordable access to platforms and vessels to enable demonstration of new technologies in real-world conditions. A study should be undertaken to further assess this requirement and the level of demand along with priority technologies for demonstration and associated platforms.

Examples of infrastructure needed to support future marine industries are:

- manufacturing facilities for composite leisure vessels in excess of 70 m;
- designation of a test range for autonomous vessels

In addition, greater priority should be accorded to providing businesses with facilities with waterfront access. This would include changes to planning regulations to maintain available waterfront for marine industries.

4. Engage with standards and regulatory bodies to accelerate the adoption of innovation

The industry should engage with the standards and regulatory bodies to accelerate acceptance and adoption of innovation that underpins the UK Marine Industries Technology Roadmap. Particular needs concern:

- Extending the permitted use of composites in vessel manufacturing
- UK and international regulation on the use of unmanned vessels
- Development of data standards to enable communication and interoperability between on-board systems
- Development of leisure vessel installation and operational build standards
- More pragmatic environmental regulation

5. Engage with marine industries and stakeholders to accelerate the adoption of innovation

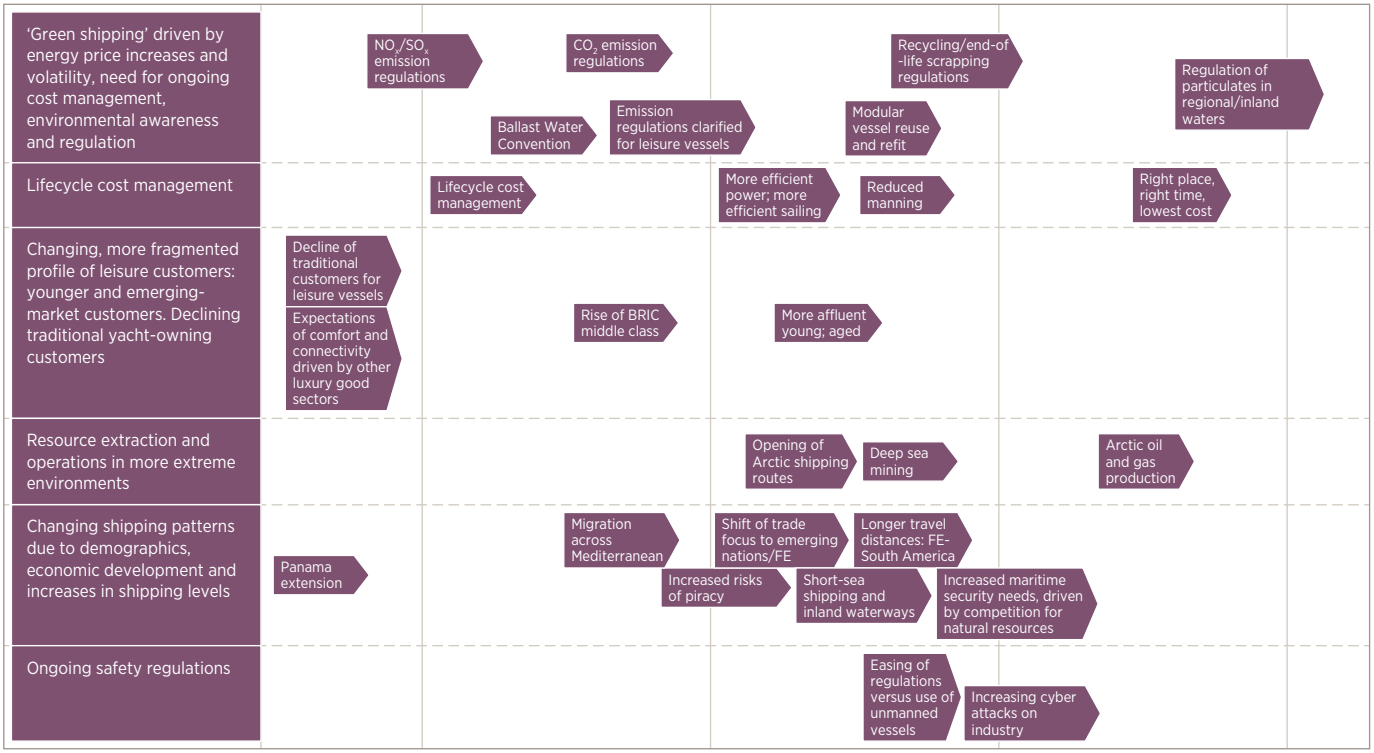
The industry will work closely with a number of organisations including the Knowledge Transfer Network to engage further with adjacent sectors, maritime industries and regulators to facilitate the cross-fertilisation of technology.

Co-ordinated engagement programmes are recommended, both inside and outside of the UK marine industry, for example:

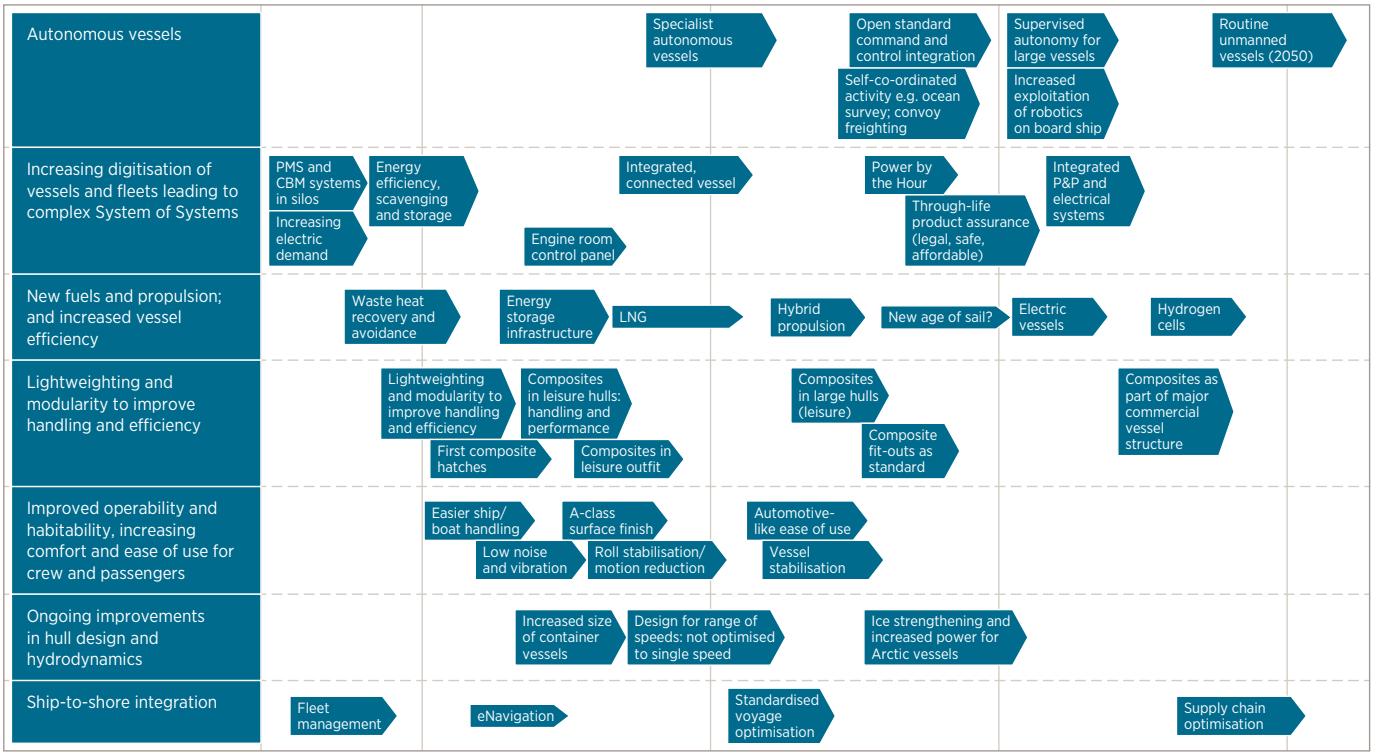
- Cross-sector engagement with aerospace and automotive on common themes including manufacturing techniques, use of composites, and noise and vibration reduction
- Knowledge-transfer events between the marine sub sectors (commercial, leisure, marine science, and naval).

Appendix: Global and vessel trends and drivers

Global trends and drivers



Vessel trends and drivers



Glossary of acronyms

BRIC	Brazil, Russia, India, China
CBM	condition-based maintenance
ECDIS	electronic chart display and information system
EM	electromagnetic
EPC	engineering, procurement and construction
FE	Far East
HMI	human machine interface
HVM	high value manufacturing
IMO	International Maritime Organisation
IMO/SOLAS	International Maritime Organisation International Convention for the Safety of Life at Sea
K_a	radio wave band directly above the 'K' band
K_u	radio wave band directly under the 'K' band
LNG	liquified natural gas
LR	Lloyd's Register
MILC	Marine Industry Leadership Council
MONALISA	EU project on sea traffic management
NOx	nitrogen oxides
P&P	power and propulsion
PMS	planned maintenance systems
SME	small and medium-sized enterprise
SOx	sulphur oxides
SQEP	suitably qualified and experienced person
USV	unmanned surface vehicle(s)
UUV	unmanned underwater vehicle(s)
UxV	unmanned vehicle(s) where 'x' stands for air/surface/underwater/ground

Contributing organisations

A&P Group
ABB Marine Service
AkzoNobel
ASV Ltd
Auriga Energy Ltd
B9 Shipping/Smart Green Shipping Alliance
Babcock International Group
BAE Systems
BMT
BMT Defence Services Ltd
BMT Nigel Gee
British Marine Federation
Carnival
Caterham Composites
Caterpillar Marine Power UK Ltd
Cathay Composites Ltd
Defence Science and Technology Laboratory, Dstl
Department for Business, Innovation & Skills
Ecospeed Marine Ltd
Energy and Emissions Solutions, EnEmSol
Fischer Panda UK Ltd
Frazer-Nash Consultancy
Fugro GEOS Ltd
Gardline
General Electric
Griffon Hoverwork Ltd
HGEN Ltd
HGL Dynamics Ltd
High Speed Sustainable Manufacturing Institute
IMarEST
Innovate UK
Knowledge Transfer Network
Lloyd's Register
Marine South East
Missionkraft
Mobile Internet Ltd
Morson Projects Ltd
MSP Technologies
National Oceanography Centre
Nick Lambert Associates Ltd
NorthLink Ferries
Ocean Resource Ltd
Pendennis
Planet Ocean Ltd
Plymouth University
Pole Star Space Applications
Princess International
QinetiQ
REAPsystems Ltd
Ricardo UK Ltd
Roke Manor Research Ltd
Rolls-Royce plc
Royal National Lifeboat Association
Satellite Applications Catapult
SatOC
Schneider Electric (Marine)
SCISYS UK Ltd
SciTech
Seaspeed Marine Consulting Ltd
Shipbuilders & Shiprepairers Association
Society of Maritime Industries
Southampton Marine and Maritime Institute
Streamline Shipping Group
Supervawt Ltd
Thales UK
Transport Systems Catapult
Trident Energy Ltd
Triskel Marine Ltd
UK NEST
U.S. Embassy
UK Chamber of Shipping
UK Trade & Investment
University College London
University of Exeter
University of Newcastle-upon-Tyne
Vayon Holdings Ltd
Xanthus Energy

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