

Scoping Workshop – Future Marine and Maritime R&D

16th June 2014
BIS Conference Centre, London

Summary of Output

Overview

This document provides a summary of the output from the Marine & Maritime R&D Scoping Workshop held on 16th June at the BIS Conference Centre. IfM Education & Consultancy Services facilitated the workshop and the detail in this report summarises the input from delegates. Following further analysis the output from the workshop will be used to provide support to the structure of the refresh of the roadmap and to give background to the scope for the planned 2015 marine/maritime CR&D competition.

Proposed Roadmap Themes

Participants were given an overview of eight proposed opportunity themes for the update of the Marine Industries roadmap. Delegates were asked to make comments on each theme in response to the following questions:

- Why is technical leadership in this theme important to the UK Marine Industry?
- Which market sectors will be impacted by the development of this theme?
- Are there specific opportunities for the UK in this theme? Can those opportunities be quantified?
- What are the main technical challenge areas to success in this theme?
- Where is the UK Capability to address these challenges?

Participants were asked to score each theme in terms of importance and the UK's capability to deliver technical leadership in that theme over the next 5 years. Comments on the validity of the theme were also invited: no participants commented on alternative themes.

PROPOSED ROADMAP THEMES

	Importance of Theme					Average	Ability of UK Marine Industry to deliver technical leadership within 5 years					Average
	1	2	3	4	5		1	2	3	4	5	
Marine Data and Decision Support Systems			1	6	8	4.47		1	4	3	6	4.00
Vessel Efficiency			4		9	4.38	1	2	6	1	3	3.23
Autonomy		1	1	9	3	4.00		2	4	6	3	3.67
Naval Equipment and Services	1		3	4	3	3.73	1	1	1	1	9	4.23
Marine Services		2	2	9	1	3.64		1	1	4	6	4.25
Multimodal Transport	1	5	3		4	3.08		6	2	3	2	3.08
New Vessels	1	3	6	4		2.93		5		6	3	3.50

Note: offshore services was mistakenly missed from this chart.

According to the participants' responses the top ranking themes by importance were:

- Marine Data and Decision Support Systems
- Vessel Efficiency
- Autonomy

The top ranking themes by UK capability were:

- Marine Services
- Naval Equipment & Services
- Marine Data and Decision Support Systems

The following key points were captured during discussions. Please note that these points do not cover the full extent of the discussion points and should be considered as a high level summary.

Autonomy

- Important because we have the opportunity to maintain a leading global position and gain first mover advantage.
- Main market sectors identified were naval, marine science and offshore applications. The development of an increasing amount of autonomy was highlighted.
- Opportunities identified reflected the market sectors above: naval, marine science and offshore service requirements.
- Technical challenges included sensors, endurance, communications, safety, security, data capture/analysis, human systems integration and reliability. Regulations, public perception and modularity also featured.
- A wide range of large and small companies and Universities have capabilities in the area.

New Vessel Construction

- Important because we have leadership in design and integration. The question was raised whether we can compete versus overcapacity in the Far East.
- Market sectors that were identified focused on the specific technology areas in shipbuilding- possibly reflecting our consulting role in new vessel construction.
- Opportunities included offshore service vehicles, naval vessels and leisure craft.
- Technical challenges and UK capabilities reflected many of the areas discussed in other themes. These include energy management, emissions, human systems integration, multifunctional materials, automation/manufacturing technology, noise/vibration, modularity, embedded sensors, hydrodynamics, aerodynamics, recycling, efficient prototype manufacture, propulsion systems and standardisation.
- The UK has broad capability in design and systems integration.

Offshore Services

- Important as the UK is currently a leader in the development of offshore systems.
- Many of the markets and opportunities identified focused on offshore assets themselves, rather than the development of services to exploit and maintain those assets. Autonomous intervention and support craft were highlighted.
- Main challenge areas include fuel conversion, energy, autonomous systems and increased use of composite materials.
- A range of large and small companies and Universities have capabilities.

Marine Services

- Important as seen as key to the UK staying competitive against other nations in all market sectors.

- Opportunities and challenge areas included environment monitoring and management; data services, security (shorter timeframe than identified), and training.
- Comments on capability were broad-ranging including software, defence and UK space industry.

Marine Data and Decision Support Systems

- Important as it is key to a number of areas such as autonomy, command & control, and intermodal integration, and the UK has a major strength being based on the world’s most complex sea spaces.
- Naval and commercial sectors were identified as key, with many opportunities focusing on architecture, standardisation and security.
- Technical challenges included bandwidth, the transition to interconnected systems and security.
- Other comments focused on marine culture transformation, other opportunities in marine environment and research and the close connections with autonomy.

Naval Equipment and Services

- Important because we need to maintain a naval sovereign capability; because we are a world leader currently; and because technologies transition into commercial markets.
- A wide range of opportunities were identified, with an equally broad set of technical challenges. An alternative view was that naval markets are niche and shrinking.
- A broad range of UK capability was highlighted.

Multimodal Transport

- Important as we need to maintain leadership; competition from EU ports and the move to short sea shipping.
- Specific opportunities bringing commercial value to the UK were not identified.
- Challenges focused on infrastructure requirements, freight transfer and tracking and the need for a whole systems approach.

Vessel Efficiency Challenges

Technical Challenge Categories for the delivery of vessel efficiency were considered in more detail and in line with the All at Sea workshop from November, 2013. A simple ranking of those categories showed Energy Management as the most important theme with Electric Ship, Performance Monitoring and Ship Design being the next three. Comments invited on each challenge category focused on UK capability areas to address each challenge.

VESSEL EFFICIENCY THEMES

	Importance of Theme					
	1	2	3	4	5	Average
Energy Management			1	4	6	4.45
Electric Ship		2	3	2	5	3.83
Performance Monitoring		1	3	4	3	3.82
Ship Design			3	6	1	3.80
Retro Fitting		1	3	5	2	3.73
Emissions Regulation	1	2		1	4	3.63
Coatings			6	2	1	3.44
Composite Materials		3	2	7		3.33

	Ability of UK Marine Industry to deliver technical leadership within 5 years					
	1	2	3	4	5	Average
		2	2	4		3.25
			4	2	1	3.57
		1	1	8		3.70
		2	2	4	1	3.44
1	1	2	4	1		3.33
	1	1	4	1		3.71
		1	3	2		3.17
1		3	4	1		3.44

The eight themes were closely grouped when judged both on their relative importance and UK capability.

A summary of the additional comments on Vessel Efficiency is provided below:

Efficient energy management; Green- emissions; Further work needed on Autonomy; Human Factor key with technology challenges; Continue research into earlier subjects so they get pulled through; Skills shortage; Human Systems integration; Human centred design philosophy; Requires customer pull to offset likely increased procurement costs with through-life savings.

Energy Management

ENERGY MANAGEMENT CHALLENGES

	Importance of Theme					Average	Ability of UK Marine Industry to deliver technical leadership within 5 years					
	1	2	3	4	5		1	2	3	4	5	Average
Reduction in Waste Energy Output				2	4	4.67			1	1	2	4.25
Reduction in End-User Energy Demand	1			1	5	4.29				3	1	4.25
Improved control of Power Systems, HVAC and Loads			1	1	2	4.25			1	2	2	4.20
Increased Efficiency Energy Scavenging			1	2	2	4.20			2	2		3.50
More robust systems to reduce crew members			1	2	1	4.00		1	1			2.50
Increased efficiency generators and motors		1		3	1	3.80			1	2	2	4.20

A summary of the additional comments on Energy Management is provided below:

Demand side management; Hollistic approach; Behaviour changes in more efficient use of energy; Energy storage including fuel cells; Naval market may not be large enough for industry to justify investment - needs government funding; International collaboration - UK not the only country looking at this; Improving energy efficiency especially waste heat recovery from engine; Combined heating and power systems; Auto-cleaning; Electrical machine efficiency is one aspect- size and weight are perhaps more important; Converting of HVAC technologies from large buildings to ships.

Electric Ship

ELECTRIC SHIP CHALLENGES

	Importance of Theme					Average	Ability of UK Marine Industry to deliver technical leadership within 5 years					
	1	2	3	4	5		1	2	3	4	5	Average
Electric fault protection					5	5.00		3	2			2.40
High density energy storage				1	6	4.86	1	4	2			2.14
Resilience of ships to electrical faults or fire damage			1		4	4.60		2	1	1	1	3.20
Management of transitory loads				2	1	4.33		2			1	3.00
Future Electric systems architecture: AC or DC	1				3	4.00	1		1	1	1	3.25
Management of ride through power supply			2	1	1	3.75		2		1		2.67
Electric propulsion systems such as rim drives			2	1	1	3.75	1			1	2	3.75

A summary of the additional comments on Electric Ship is provided below:

Education - electrical engineering; Difficult trade off between efficiency of electric propulsion system whole ship electrics vs increase in size of hull to accommodate electrical system; Superconducting technology; No particular skill in UK industry; Availability of rare earth materials; Energy supply ie recycling; International collaboration; Energy storage chemical not just electrical; Diesel/electric hybrid drives; DC development could have wide commercial applicability; Fire fighting in HV spaces.

Performance Monitoring

PERFORMANCE MONITORING CHALLENGES

	Importance of Theme					Average
	1	2	3	4	5	
Data Management and Information Presentation				3	7	4.70
Integrated Performance Monitoring			1	5	3	4.22
Retrofittable Flow Sensors			3	4	1	3.75
Nano Scale Sensors	1		3	2	1	3.29

Ability of UK Marine Industry to deliver technical leadership within 5 years					
1	2	3	4	5	Average
			6	4	4.40
			6	3	4.33
		1	7		3.88
		3	2		3.40

A summary of the additional comments on Performance Monitoring is provided below:

Training and education; Intellectual property; Conservative maritime culture; Fuel flow sensors are an enabler for future EU emissions regulations; Clarifying what performance is needed and how to define it; Include prognostics; Data handling is the biggest issue - needs to process onboard; Collaborative data environments for fleet support (owner/supply chain/operation/customer); Performance monitoring – automation; Sensor connectivity.

Ship Design

SHIP DESIGN CHALLENGES

	Importance of Theme					Average
	1	2	3	4	5	
Low cost, low volume production				2	4	4.67
Reduced time between design and build			2	2	2	4.00
"Off Design Condition" prediction techniques			2	3		3.60
Building low drag hulls			3	2		3.40
Accurate free surface hydrodynamics and CF modelling			4	1		3.20
Adjustable hydrodynamic features: through life optimisation		1	3	1		3.00
Improved fatigue performance		2	1	2		3.00

Ability of UK Marine Industry to deliver technical leadership within 5 years					
1	2	3	4	5	Average
	1	4			2.80
		4	2		3.33
		1	3		3.75
		2	2		3.50
			3		4.00
		3	1		3.25
			4		4.00

A summary of the additional comments on Ship Design is provided below:

General material and equipment degradation - understanding FMEA for effective deployment of condition monitoring for prognostics; Modularity; Complexity of design increases design and build time => how to limit complexity eg cabling for comms and power; Use 3d printing technologies with production materials used in hull structures; Condition monitoring; Signature management; Cross fertilisation of tech/goods/services - how to buy in high volume from high volume distributors; Design optimisation; Requirement for testing facilities at material & large structural level to assess fatigue characterisation.

Retro-Fitting

RETRO FITTING CHALLENGES

	Importance of Theme					Average
	1	2	3	4	5	
Design ships to be upgradeable through life (modular)				2	6	4.75
Management of ageing ships (identification of maintenance requirements pre dry-dock)			1	2	4	4.43
Cost-effective retro-fitting of efficient technologies (partic power control semi-conductors)				7		4.00
Novel recoating or replacement techniques (particularly piping)		1	5		1	3.14

Ability of UK Marine Industry to deliver technical leadership within 5 years					
1	2	3	4	5	Average
	1	1	2	3	4.00
		2		3	4.20
	1	3	1	2	3.57
		1		4	4.60

A summary of the additional comments on Retro-Fitting is provided below:

Very specific to ship types and owners; Tools and models help manage change/reduce risk/optimize performance; Development and demo at non-docking maintenance; How to deploy today's technology in yesterday's platforms; Configuration Management is a key enabler for cost-effective upgrades and retrofitting; Composite/mixed material repairs and life extension; Wiring can be a key cost/time consideration for upgrades and retrofitting; health & safety; Assessment of remaining life of the structure; Challenge to incorporate changing requirements and new legislation; Configuration control by owner/operators.

Emissions Regulations

EMISSIONS REGULATION CHALLENGES

	Importance of Theme					Average	Ability of UK Marine Industry to deliver technical leadership within 5 years					Average
	1	2	3	4	5		1	2	3	4	5	
High density energy storage				1	2	4.67	1	1				1.50
Efficient solutions to meeting emissions regulations		1		3		3.50		1	1	1		3.50
Facilitating the safe use of alternative fuels (eg ethanol or LNG)		1	1		1	3.33		1		1		3.50
Advancing safe, reliable and flexible multi- or alternative fuel solutions and systems		1	1			2.50		1	1			3.00

A summary of the additional comments on Emissions Regulations is provided below:

Solutions for regulations or vice versa; Fuel cells, batteries, capacitors; Flywheels; Cross sector technologies; GTS currently exempt unlikely to last; Energy harvesting devices; Safe storage – refuelling.

Coatings

COATINGS CHALLENGES

	Importance of Theme					Average	Ability of UK Marine Industry to deliver technical leadership within 5 years					Average
	1	2	3	4	5		1	2	3	4	5	
Application of coatings (including contamination resistant) to difficult areas			1	5	1	4.00			1	4	2	4.14
Coatings for propellers that resist cavitation while resisting fouling		1		3	2	4.00		1		4		3.60
Cost effective application of resilient coatings			2	4		3.67			1	4	1	4.00
Slime reducing coatings			2	3		3.60			4			3.00
Low friction hydrophobic coatings			3	3		3.50			5			3.00
Anti-fouling coatings for low speed operations			4	2		3.33			4	1		3.20

A summary of the additional comments on Coatings is provided below:

Embedding of base level antifouling in composite surfaces; Composite propellers; Inherent antifouling; route cause of biofouling is not understood in detail - needs marine science research; Maybe lessons to be learnt from medical areas - cell/substrate interactions - encouragement and avoidance.

Composite Materials

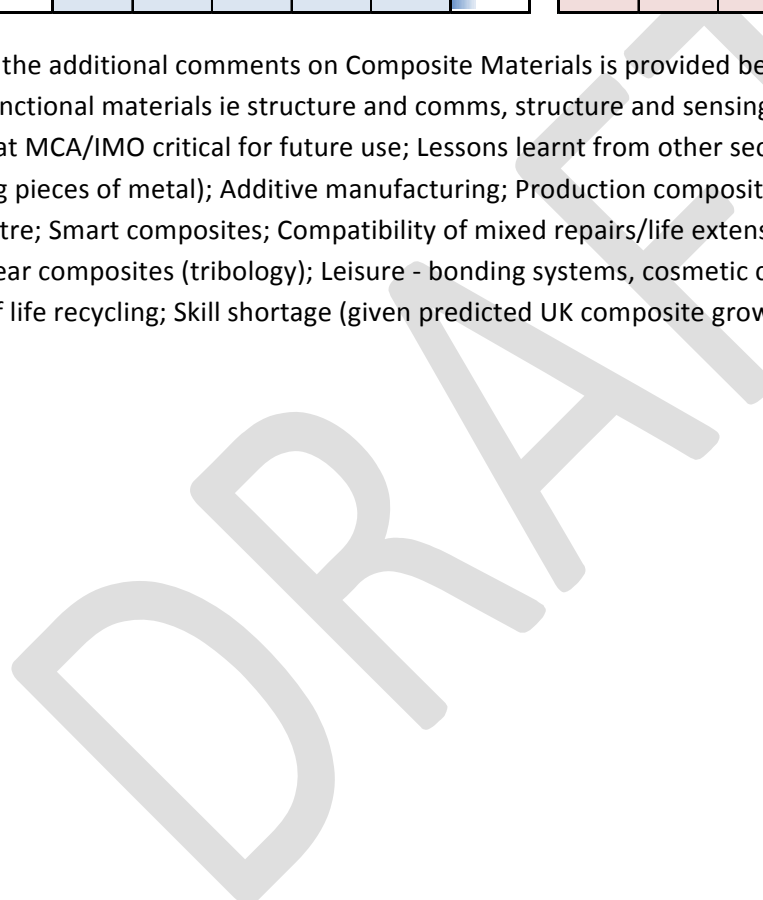
COMPOSITE MATERIALS CHALLENGES

	Importance of Theme					Average
	1	2	3	4	5	
Classification approval				1	6	4.86
Evidence for H&S regulators re IMO/SOLAS compliance				4	1	4.20
Hybrid materials		2		1	5	4.13
Compatibility of production techniques with mixed material vessel construction			1	5	1	4.00
Large area non-destructive examination methods				7		4.00
Greatly reduced cost construction methods			4	1	3	3.88
Reduced mass materials suitable for ship construction			4	4		3.50
Lightweight quiet propellers	1		1	6		3.50
Damage tolerance philosophy			5	1	1	3.43
Self-healing material/structures	1	3	2			2.17

Ability of UK Marine Industry to deliver technical leadership within 5 years					
1	2	3	4	5	Average
	1	1	2	3	4.00
			4		4.00
		4	4	1	3.67
	1	3	2	1	3.43
	1	3	2	1	3.43
		3	4		3.57
		2	5	1	3.88
	1	3	3	1	3.50
	3	3	1		2.71
	3	2	1		2.67

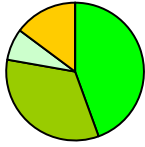
A summary of the additional comments on Composite Materials is provided below:

Use of multifunctional materials ie structure and comms, structure and sensing, structure and power; Current work at MCA/IMO critical for future use; Lessons learnt from other sectors; Changing attitudes (away from big pieces of metal); Additive manufacturing; Production composites; Proposed Solent large structures centre; Smart composites; Compatibility of mixed repairs/life extension and standards; Low friction low wear composites (tribology); Leisure - bonding systems, cosmetic composites, standards for Class A; End of life recycling; Skill shortage (given predicted UK composite growth studies); Fire protection.



Workshop Feedback

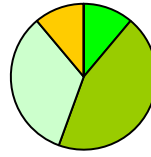
Joining instructions and pre-workshop information



Opening remarks and introduction to the workshop



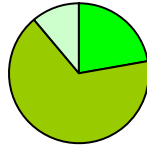
Facilitation of the workshop



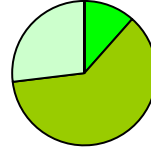
Structure / process of the workshop



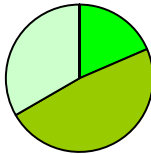
Opportunity to participate and contribute



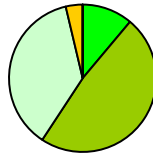
Make-up of workshop participants



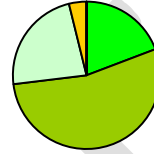
Time keeping



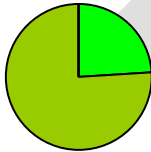
Catering



Venue



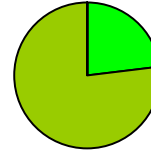
I found the workshop stimulating



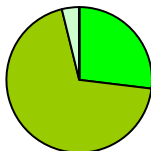
I enjoyed the workshop



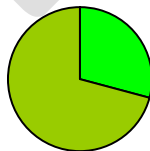
I found my participation worthwhile



I feel I have contributed to the workshop



The workshop provides useful insights



Feedback Comments

Joining Instructions

Could have given some pre-reading to prepare delegates

No agenda ahead of day

Opening Presentations

Gave good background to TSB activities in marine area

Facilitation of the Workshop/Structure and process of workshop

Short of a couple of facilitators. A bit ad hoc

I found the facilitation a bit chaotic. Could have been orchestrated better.

It would have been useful to have some method of dividing the attendees into groups and structuring the discussions at the charts more precisely than the general "wandering" from chart to chart

I would have recommended clearly identified and prepared facilitation of discussion themes and possibly breakout rooms. I know this is easier said than done!

Needed more facilitators

Make up of workshop participants

A bit light in industry numbers

A bigger event with more SMEs and academics would have been better

Representation from SMEs, especially leisure craft mat have opened up our thinking

Met several people that I had not met before and who could be useful contacts in the future

Venue

A few small breakout rooms may have helped the facilitator to control discussions

General

Happy to participate in any composite based activity/work/group/seminar: tim.biswell@wartsila.com

Need to keep this going and keep the momentum going. I will be happy to support future events

Quite a lot of the issues and concerns are very peripheral to my activities as a materials chemist, but provided a good context for my thoughts with regards to composite materials especially.