

Future Skills Requirements for a Global Centre of Maritime Training and Education: Skills Challenges for the Solent

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EXECUTIVE SUMMARY

1. The aims of this report are to consolidate the findings of surveys, reports, and local government/national agendas regarding maritime skills and career opportunities. It also aims to provide a view of perceptions of the supply and demand for marine and maritime (M&M) skills in the Solent region. It considers whether there are any perceived skill gaps or shortages, and which changes are seen as most likely to be disruptive.
2. Existing reports on skill trends in marine and maritime industries stress that these industries are undergoing technological and environmental transitions that have far-reaching implications. They highlight three main drivers of change: digitization and automation; the drive for greater environmental sustainability; and global competition and upgrading into more knowledge intensive activities. The UK's *Maritime 2050* Strategy states that the maritime sector is an increasingly high-tech industry with a highly skilled workforce. New skills in IT digital and mechanical systems technology (e.g., electro-technical officers), as well as softer skills will be required to complement traditional skills. The report highlights the problems of attracting young people into the sector.
3. The Solent LEP's (2019) analysis of their local labour found small numbers of skills shortage vacancies, indicating that aggregate skills supply and demand are in balance. It found no significant skills shortages in manufacturing in the LEP, although it did not examine M&M in depth.
4. This study used a short online survey of M&M firms and education and training providers plus online interviews with other firms and institutions. The survey was distributed via the networks associated with the Solent Maritime Enterprise Zone (SolentMEZ) in late 2020. 19 responses were received and of these 16 were private employers, and 3 were public sector employers. This survey was supplemented by in-depth interviews with 29 organizations, including some of the largest maritime employers in the area. The results are based the views of over 40 firms and institutions involved in the Solent cluster.
5. Just over half of respondents indicated that skill problems are inhibiting their activities. The majority of shortages referred to types of engineering and science-based skills including: electronics, software, robotics, mechanical engineering, marine and system engineers, and environmental scientists. This included a shortage of young design engineers/naval architects. They also included many less-specifically marine skills in engineering, data science, and robotics where it was felt that M&M businesses are not competing well with other high-skilled sectors such as aerospace and aviation. Shortages in high-skilled marine roles were mentioned including experienced draftsmen and specialist boatyard skills. Several firms reported that they are risk of losing traditional fit out and fabrication skills for boat builders. The prevailing opinion is new technologies are disruptive and that skills will need to adapt rapidly to new demands.
6. Our results found appreciation that education and training systems are adapting in order to respond to the growth of new technologically related skills. Local institutions' plans for new M&M courses on digital and electrical development, computing, AI and cyber security were not widely known, however. The prevailing view was that the training and skills landscape has been slow to change, that there is much duplication and fragmentation, that the competitive funding system gives little incentive to collaborate, and that it is hard for anyone to discern clear pathways through courses and careers.

7. Respondents called for an appraisal of existing training coursework to identify redundant components; such as out of date metalwork skills. Providers feel that the level of technology in training equipment is inferior to other sectors such as aviation.
8. The **challenge of attracting and retaining employees is a strong theme**. Only a small minority of school pupils have had any contact with sailing or boats. A similar complaint was also applied to the Solent's FE colleges which are seen as lacking a strong M&M specialisation. As well as more engagement with maritime, however, it was argued that FE needs to offer foundation courses in engineering and digital systems, data and security, but there is evident uncertainty about exactly what skills are in demand.
9. Interviewees often stated that, despite some problems with matching, apprenticeships are in reality much better than their perception. Similar to the maritime industry broadly, apprenticeships suffer due to negative perceptions.
10. Respondents suggested that engineers and highly skilled workers tend to enter other sectors either because they are not interested in maritime, or unaware of potential roles in the sector. Competition for high-skilled workers is fierce in advanced engineering skills, AI and cyber security. Skills recruitment issues are closely tied to the branding and visibility of M&M sectors in the Solent.
11. The findings have implications for all levels of education. At the lower levels, there was a strong call to provide pupils with the experiences necessary to build their/an interest in maritime, rather than the introduction of any specific courses. Indeed, general and soft skills are deemed more important as they prepare pupils for the type of 'portfolio' career that will be commonplace in the future.
12. Similar concerns were found regarding FE institutions which were considered inadequate in providing the experiences and enthusiasm necessary to attract students into maritime and marine. While some believe T-levels are a good opportunity to offer more technical content, employers highlight general and foundational skills in digital and electro-mechanics that they can mould to their needs.
13. At HE levels, there is a vigorous debate about how to introduce training for key technologies in autonomy, robotics and digital data and systems, where various combinations of (interdisciplinary) modules and courses are needed. Again, it was argued that students need to be capable of the broad systems-level understandings of technologies necessary to incorporate cross-sector innovations and apply them to the unique settings of M&M firms.
14. A consensus appeared around **three interrelated sets of priorities needing investment – autonomy, digital and carbon reduction**. There is significant overlap between these technological areas which reinforces their potential value.
15. The prevailing view is that many firms will certainly need more advanced skills in autonomy, electrical software and robotics given the rapid advance of more autonomous platforms and systems. **The Solent has some expert capabilities in this area particularly in small and subsea vessels, sensors and drones**. It was felt that a focus on skills for more specialist and smaller platforms would bring benefits. Beyond this, however, there was not a great deal of clarity about which aspects of autonomy and robotics skills will be most needed.
16. A second priority area for skills development was in maritime data systems and the communication, analysis, management and interpretation of digital data. These skillsets have the widest application as they are essential to shipping and port operations and business services. This of course, includes cyber security which was often emphasised and described as intrinsic to safety. The key obstacle is the shortage of skilled personnel in data systems and software who typically have to be attracted from other sectors. Firm appreciation of the potential value of digital systems should also be increased through a Made Smarter Programme.
17. Most comments in this area referred to power and energy systems to replace and supplement diesel. Power supply and management were repeatedly linked to autonomous

vessels. However, there is little consensus on types of power to focus on as there much debate about what alternative fuels should be pursued. Demand from the small vessel sector for such technology was described as low, but it is expected that regulatory changes will soon compel manufacturers and shipping and port industries to be greener.

18. On the one hand, many respondents argued that the Solent region needed to identify specialisms in the new technologies in order to build a distinctive focus, in order to provide momentum in research and innovation. At the same time, many of the **new skills essential for development in these three interlocking domains are cross-sector or transversal**. While specific M&M research-level skills will be required, this needs to be set within a broader strategy to develop cross-sector skills in the new technologies. Many responders felt that there is not yet sufficient demand from M&M alone to provide substantial numbers of students in all three types of areas. Cross sector courses, with distinct M&M components, would allow students to learn emerging skills from other sectors and this cross-fertilisation is crucial to innovation across all these areas.
19. Many argued that **skill development needs to be supported by other measures to encourage and build the cluster**. Cluster branding should build on advanced technology, robotics, autonomous assets and capabilities, and especially the technologically intensive SMEs. It was argued that the cluster needs to build a better system of support and finance in place to grow these companies.
20. Many would welcome more opportunities for cluster collaboration around problems and challenges. Busy SMEs would welcome a cluster intermediary or an 'enabler'. It was also felt that the Royal Navy could provide more help to SMEs by repurposing estate, allowing use of its facilities, and reviewing its procurement process. The provision of a multi-user boatyard which SMEs could rent and share, linked to an innovation centres, would be greatly beneficial by allowing knowledge sharing and skilled labour pooling.

1. REPORTS ON MARINE AND MARITIME SKILLS

A number of reports have addressed changes in skills and training in marine and maritime (M&M) industries. They indicate that marine and maritime industries in industrialised countries are undergoing technological and environmental transitions that have far-reaching implications for skills provision and development. These reports highlight three main drivers of change in marine and maritime industries.

- The first is the impacts of digitisation and automation, including the use of robotics, sensors, data analytics and new communication systems, which will have numerous consequences in marine and maritime supply chains.
- The second is the drive for greater environmental sustainability and the need to adopt carbon and greenhouse gas emission reducing technologies, fuel efficiency and greener shipping.
- The third is global competition in these industries and the need for mature marine and maritime sectors to upgrade into more knowledge intensive and research-based sectors in order to compete with lower cost competitors.

The impacts of these three drivers over the next few decades will lead to significant changes in the demand for marine and maritime skills. We first review discussions of the implications from international reports, before turning to reports on the UK.

1.1 International Reports

As noted by the OECD (2016), the maritime economy is in the throes of remarkable scientific and technological change, and requires rapid regulatory change to become higher-skilled and knowledge based. Similarly, MATES (2019) reports that a wide series of ‘paradigm shifters’, including digitalisation, the exploitation of alternative fuels and renewable energy, drones, green retrofitting, vessel automation and advanced robotics, will restructure marine work and occupations by 2030. It predicts that by far the most extensive impacts will be from digitalisation and vessel automation and emphasizes that there is an urgent need for educational and training programmes in digital domains, in green technologies and soft skills, all adapted to specific requirements of the marine and maritime sector (also SkillSea, 2019). The European Marine Board (2018), however, observes that training

providers are rigid and slow to change and marine programmes often suffer from a lack of marketing.

Most of these reports understand the M&M economy as consisting of a long value chain of inter-related sectors ranging from production through to shipping and ancillary business services. For example, a Norwegian SINTEF (2020) report divides maritime sector into six main parts 1. Mechanical equipment; 2. Electric and electronic equipment; 3. Design of vessels; 4. Shipbuilding; 5. Shipping; and 6. Support services (business services insurance). The key drivers are noted to have varying effects in different parts of the chain. However, SINTEF (2020) argues that electrical and electronic equipment providers are becoming increasingly important as they are essential for combining existing competences with digital technologies. They find that across the value chain, nine out of ten firms report that digital competences are already important for their operations, and seven out of ten firms report that they lack sufficient skills in such technologies.

Many reports focus on maritime technology industries as key enablers of the M&M supply chain as they provide the technologies, vessels and structures needed for all maritime activities. SeaEurope and IndustriaAll (2017) explain that, in the context of global competition, European shipyards have specialized in more high technology vessels and high-value vessels, and that the increasing complexities of products has created an additional demand for highly skilled staff. It finds that there is a pronounced scarcity of skilled personnel that is challenging sector growth, and suggests that the UK is one of the countries where the problem is most severe. The report estimates that 50% of employees have a technical University degree and a further 30% are highly skilled workers with vocational education and training (VET). It recommends greater transfers between education and industry systems, and more dual education (VET plus University degree) and apprenticeships. USWE (2020) highlights that small and medium shipyards have more difficulties in coping with the new technologies and face more ageing workforces. It concludes that cross-sector, digital and green skills are becoming more important in shipbuilding but notes that there is some confusion and lack of clarity about these. Lim's (2018) analysis of innovation policy in the Singapore maritime sector reports that the Maritime Industry attachment programme, which immerses engineering, IT and science students from tertiary research institutes in the maritime industry, has been key to the diversification of traditional shipbuilding into offshore construction and marine engineering services. It suggests that skill development needs to be part of a broader process of cluster upgrading involving investments in innovation, port upgrading and research programmes.

Several reports note some of the traditional difficulties faced by skills systems in M&M. Scully (2015) for the Marine People Partnership reports that Canadian shipbuilding and repair sectors face transformational change but argues that the marine skills ecosystem has in the past been heavily disrupted by unpredictability and instability, which creates a lack of trust, and reluctance to invest in inter-related marine sectors. This report again argues that investment and building a more skilled workforce need to proceed at the same time.

1.2 UK Reports

The Department for Transport (2019a, b) Maritime 2050's People Route Map echoes some of these themes. By 2050 it argues that the maritime sector will be an increasingly high-tech industry with a highly skilled workforce. New skills in IT, digital, and mechanical systems, and softer skills will be required to complement existing skills. The strengths of the skills system in the UK lies in the world-leading maritime training programmes in colleges and universities, and in workplace apprenticeships. However, the report highlights the problems of attracting a young people into the sector because of relatively poor conditions in some occupations, the lack of career progression, low diversity, and the general lack of visibility of the M&M sectors (which have long been recognized, see Mackinnon Partnership, 2009). There is a need for more recruits with STEM based skills and for a more diverse labour force. It identifies a shortage of seafarers and engineers especially in shore-based operations and welcomes the introduction of graduate apprenticeships but notes that numbers in 2017-18 were still low.

The Maritime Skills Commission's (August 2020) Labour Market Intelligence report appears less certain and notes that few parts of the sector have any up-to-date and comprehensive analysis. Engineering is repeatedly highlighted as a problem area by firms, but the nature of problem is seldom defined with much precision. There is little evidence of the adequacy and sufficiency of skills development, but in the longer term many sectors expect difficulty recruiting engineers. The report suggests that there is little evidence of recruitment difficulties serious enough to impede businesses in short term, and that the only part of M&M with short-term issues is the marine leisure boat-building. It does note, however, that marine firms have difficulty in finding engineers, specialist roles in boat building, underwater technical skills, port agents and stevedores, and engineering fitters. It also identifies a need to improve the Merchant Navy cadet programme.

UK NEST (2013; 2018) have reported that naval engineering in defence is highly dependent on a small number of courses in naval architecture and mechanical engineering, that graduate recruitment will have to be increased to compensate for an ageing workforce, and that there are challenges in recruitment for specialist graduate subjects. In particular, recruitment in naval

architecture, mechanical engineering, electrical and electronic engineering, and systems and software engineering, will be difficult against a wider background shortage of STEM graduates. These reports also state that technological change and the move to robotics will mean naval sectors require skillsets from emerging degree courses such as computer science with AI, Robotics, drone technology, and network and cyber security. The reports call for engineering firms to engage more closely with Universities to deliver these skills.

A recent Global Marine Technology Trends 2030 Report (2017) emphasises that the development of autonomous systems means an increased requirement for highly specialised crews and employees with expertise in technology and IT systems (e.g. electro-technical officers). It predicts that employees will need to be highly skilled in boundaries and connections between physical machine and computer networks. They will require skills that enable: greater levels of digital and technical competency; seamless collaboration with autonomous and robotic systems; virtual and remote working; managing cyber hygiene and threats and; and managing fleets from remote control centres.

2. MARINE AND MARITIME INDUSTRIES IN THE SOLENT

This report focuses on marine and maritime (M&M) industries in and around the Solent LEP region. It focuses mainly on this area but also includes some of the views of firms and institutions in neighbouring Counties. The M&M cluster in the Solent, including the two major ports and Naval Base, is recognised as a key part of the UK's maritime, port, leisure and tourism sectors. It acts as an international gateway and plays a key facilitating role in the UK's international trade (CEBR, 2019). The Stevens Review (2014) estimates that the M&M cluster accounted for 20.5% of the GVA of Solent LEP and 5% of the area's private sector jobs. However, its economic impact is difficult to quantify as some parts cannot be identified in SIC-based industry data. The CEBR (2019) report on its impact, found that the M&M cluster is responsible for £5.8bn contribution to GVA and a further £2.5 billion contribution to wages and salaries. It provides direct employment of 29 thousand plus further indirect employment of 121 thousand people (CEBR, 2019). Despite the UK-wide reduction of employment and output in manufacturing the cluster grew during the period between 2010 and 2019, and, prior to the impact of the COVID-19 recession, was forecast to grow further with the expansion of shipping and tourism.

The Solent M&M cluster has been subject to a number of reviews and recommendations for cluster initiatives and proposals for support schemes, but there is a consensus that these have not

progressed further than consultation and discussion. The Stevens Review (2014), for example, criticised the Solent skills system for being too supply-driven and outlined a series of business support and innovation proposals including a Marine Autonomous Systems cluster around the National Oceanography Centre (NOC), an incubation centre in Portsmouth and an Isle of Wight Enterprise Zone.

The Solent LEP's (2019) analysis of their local labour market found small numbers of skills shortages and suggested that aggregate skills supply and demand are in balance. It found no significant skills shortages in manufacturing in the LEP, although this may underplay those in advanced manufacturing. It also notes that the development of autonomous maritime systems will demand more highly qualified STEM students.

3. METHODS

The aims of this study were to consolidate the findings (surveys, report, local government/national skills agendas) regarding maritime skills (and career opportunities), and to consider the potential of a local *Made Smarter* programme focusing on a critical shortage of digital engineering skills (BEIS, 2017). A second aim was to establish a 'directory' of maritime skills, education and training providers and related facilities within the Solent including key facilities in neighbouring regions of Dorset and Hampshire beyond the strict bounds of the Solent LEP.

The first methods were to review existing literature and policy reports on M&M skills. These reports provide a strong picture of the wider context, but little information specifically on skills changes in the M&M sectors in the region. In order to provide an introductory overview of local perceptions on changes in skills and the local education and training landscape, the study used a short online survey of M&M firms and education and training providers plus online interviews with other firms and institutions. The survey was sent to individuals via the networks associated with the Solent Marine Enterprise Zone. The firm survey was completed against the difficult background of COVID-19 disruptions in November and December 2020 (Appendix A). 19 responses were received and of these 16 were private employers and 3 were public sector employers. This was supplemented by interviews with 29 organizations, including some of the largest maritime employers in the area (Appendix B). The interviews lasted between 45 minutes and an hour and answers were supplied with an assurance of anonymity. Of these 29 interviews 15 were with private firms, 10 with public sector employers and organizations, and 4 with educational and training institutions. There were three overlaps between responses to the survey and interviews, so in total the results are based on

the views of over 40 private and public sector organizations involved in the Solent M&M cluster. Additionally, the study collated a directory of skills providers and innovation facilities relevant M&M industries.

4. SURVEY AND INTERVIEW FINDINGS

4.1 Perceptions of Skill Shortages and Changes

The firm survey showed that there are varying degrees of consensus between stakeholders on the adequacy of skills provision for the M&M industries. The prevailing view is that the Solent skills and training landscape is good and extensive, with the proviso that it could be significantly improved. There is a minority highly critical view that it is too dominated by a narrow set of institutions and out of date, which we discuss below. Most responses indicated that they agreed to some degree with the statement that 'The Solent region provides a strong supply of qualified people for this business'. Most also showed some agreement with the statement that 'Higher education institutions and Universities in the Solent are responding well to the changing skill demands in my business sector'. (see Table 1). There is clear evidence that recruitment from local skills training and education is important. 16 out of 19 recruited from training, vocational and degree courses. Replies on apprenticeships were somewhat less positive with 7 responders indicated that current apprenticeships to some degree satisfy their requirements. The majority of responses (11 from 19) make use of local training in their career development, with Warsash Maritime (Solent University) figuring prominently.

However, there was less consensus around current skill shortages that may inhibit business operations and plans. In reply to the question 'Is your business inhibited in its operation by any key skill shortages?' **10 of 19 clearly indicated that they are experiencing specific skill issues.** Of the remaining 9 some replies were ambiguous and pointed to areas where the firms were looking to recruit. This indication of skill shortages is in line with the literature on the pressures on M&M industries. The shortages identified were of two types across different levels. The majority of shortages referred to types of engineering and science-based skills including electronics, software, robotics, mechanical engineering, marine and system engineers and environmental scientists. This included a shortage of young design engineers/naval architects to replace the experienced current workers, in what is described by some as a 'demographic time bomb'. However, it also included many less-specifically marine skills in engineering, data science, and robotics where it was felt that M&M businesses are not competing well with other high-skilled sectors such as aerospace and

aviation. Secondly, some high-skilled marine roles were mentioned including experienced draftsmen and specialist boatyard skills, and roles such as crane operators and boat lifters. Several firms reported that they are at risk of losing traditional fit out and fabrication skills for boat builders and added that it is important to retain these or the remaining manufacturing and servicing will shift abroad.

In this provisional survey then, around half the replies identified skill issues that to some degree at least impinged on their current activities.

Turning to technologies that are expected to be disruptive on operations, **14 out of 19 replies indicated that they expected either digitisation, robotics, mechatronics and automation, or carbon-reducing technologies, such as new batteries and alternative fuels, to be disruptive.** Most replies stated that these are either impacting now or would strengthen over the next ten years but there was some variation on views on which of these would first impact on current activities and strategies. Most anticipated future skills reflected three broad areas – automation and robotics, digital and IT skills, and skills in aspects of power and decarbonisation. There was also evidence of general agreement that most responders would welcome help with a programme to support digitisation and digital training. However, this did not appear to be a key imperative as agreement was not strong. Hence there appears to be scope for increasing firms' understanding of the importance and potential benefits of digitisation. One of the strengths of the Made Smarter programmes in the North West, for example, has been to increase firms' understanding of the potential benefits and value of digital systems.

In summary then, the survey indicates that most responders see the Solent skills landscape as a good asset and important to their business but with scope for improvement. Second, there are divided views on current skills shortages with about half of replies indicating some stress, but most replies expecting the technological transitions, identified in prior reports, to be significant in the immediate future and during the next decade. In line with existing reports, the prevailing opinion is that M&M in the region have started to undergo several profound technological transitions, and that skills will need to adapt rapidly to new demands, as well as retaining and upgrading valued existing skills.

TABLE 1: SUMMARY OF SURVEY RESPONSES

Number of responses

	Yes	No	Unclear/no reply
1. Does your recruitment make use of training, vocational or degree courses offered in the Solent region? If so, which ones? If not, why?	16	3	
2. Does your training and career development depend on training or vocational or degree courses offered in the Solent region? If so, which ones?	11	8	
3. Do you employ apprentices? If so, how many and at what levels or standard? Alternatively, why not?	8	8	3
4. Do the current apprenticeships on offer satisfy your business requirements? Why, or why not?	6	3	10
5. Is your business inhibited in its operation by any key skill shortages? If so, in what occupations/specialisms?	10	5	4
6. Is your business experiencing any shortages of digital skills, if so, in which specific areas and specialisms?	6	9	4
7. Which emerging technologies do you think will be most disruptive to your industry and when do you think this will occur?	Robotics - mechatronics Automation of vessels. <ul style="list-style-type: none"> • Cyber and communications, AI, And ML • Digital systems and remote automation in operation systems • Net zero carbon • Digitised maintenance, net zero carbon • Autonomous vessels • Autonomous Shipping. • Decarbonisation • Battery and LED 		

	<ul style="list-style-type: none"> • electric motors • IT capability • Use of automation and AI
8. What technologies do you plan to incorporate into your business over the next 10 years?	<ul style="list-style-type: none"> • Vessel monitoring and efficiency • mechanical design, electronics, software, • Automation and use of drones for building maintenance. • Automatic gate system for lorries • AI & ML new manufacturing techniques. New materials • AI, Data security • digital technologies for remote surveys online simulations • Condition-based monitoring, new low carbon fuelling and autonomous systems support • Online meetings, training sessions and courses • New energy and power • Cyber • More digital / online customer interaction. • Hand held devices • Cloud computing • Digital design technologies and the use of AI in engineering support services.
9. What skills do you plan to incorporate into your business over the next 10 years?	<ul style="list-style-type: none"> • More customs clearance import/export skills • AI ML • Digital Skills, up skilling of asset managers, more Risk Practitioners • Marine Engineering, Marine Electrical Engineering • More digital skills • IT skills • leading a team remotely, increasing over all IT capability, developing experts in SAP • Digital and systems architecture, computer aided design.

Strongly disagree 1 2 3 4 5 6 7 Strongly agree

10. The Solent region provides a strong supply of qualified people for this business:	5.37
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11. Higher education institutions and Universities in the Solent are responding well to the changing skill demands in my business sector	5.05
12. Digital and web-based technologies will significantly change skills needed in this business	5.16
13. Automation will significantly change the skills needed in this business:	5.21
14. This business would welcome a programme of digital training and support for digitisation	4.89

Below we highlight several strong themes in the interviews.

4.2 Attracting Young People and Skilled Workers

A recurrent theme was the challenge of attracting and retaining employees. Several interviewees perceived this difficulty at the level of school-leavers. It was frequently remarked that most people were ‘sea-blind’ and that only a small minority of school pupils had ever received any contact with sailing or boats. The decline of marine manufacturing has worsened this problem in coastal communities. The complaint was also applied to the Solent’s FE colleges. One interviewee in education noted that there are 14 FE colleges in the region, but all lack a strong M&M offer. It was suggested that even in Colleges with engineering specialisms, aerospace and other industries offered more attractive demonstrations, examples and opportunities. At the same time, it was argued that FE needs to offer foundation, rather than M&M specific, courses in engineering and digital systems, data and security, and there were some doubts that the content of current curricula were up to date with new demands and requirements. Despite strong involvement of employers in networks, there was uncertainty shown about exactly what skills will be demanded by the private sector.

The broad consensus that it is difficult to attract and then retain highly skilled individuals, both for financial reasons but also because of how maritime is viewed as ‘old’, ‘traditional’, and simply ‘not very sexy’. Respondents frequently mentioned that there are plenty of engineers and highly skilled

workers coming out of the Solent training system, but they enter other sectors either because they are not interested in maritime, or unaware of potential roles in the sector. Competition for high-skilled workers is fierce in advanced engineering skills, AI and cyber security. Several respondents argued that the lower profit margins typical of M&M firms will make it hard for them to compete in terms of the level of salaries offered. When asked about how businesses had been successful in attracting highly skilled workers, firms reported that it was often a case of recruits having a personal interest in sailing or a related leisure pursuit. Others had found success marketing the role and their company as robotics or AI related, as an advanced technology company solving advanced technological problems, rather than as a specifically maritime company.

This suggests that skills recruitment issues are closely tied to the branding and visibility of M&M sectors in the Solent. Developing a high-profile high skill and research-led cluster in the SMEZ would help to make potential recruits much more aware of attractive career opportunities and convey a better sense that the cluster is innovative and forward looking.

There is also evidence for the need to strengthen co-operation with the region's Universities in order to develop clear channels for graduates into the sector. Universities were said to not be as proactive as they used to be in supporting and encouraging engineers' careers in industry, so that it was felt that engineering skills were lost as graduates moved into service sectors. It was also suggested that the research Universities are not encouraging environmental science undergraduates to pursue careers in industry, nor even illuminating them to that pathway properly. A possible solution was to encourage and widen free professional accreditation at IMarEST, which in no way restricts them to the sector but opens more related pathways for them.

4.3 Apprentices and Work Experience

The consensus with apprenticeships is that they are good but could be better. The main criticism is that the education system is not producing work-ready apprentices with the general and soft-skills necessary to learn on the job, instead teaching too many specific skills that are not used in actual employment. Companies prefer apprentices to have a general skillset that they can then develop and specialise. Consequently, it is difficult to convince firms, particularly SMEs, to take on apprenticeships. SMEs appeared to be sceptical about the potential value, primarily not due to cost, but rather because they see training young people who are not work ready as a chore.

Issues were also noted that the Levy has changed the way apprentices are matched with businesses for the worse and has led to the creation of more ill-suited apprenticeships, in which apprentices are

poorly matched to the businesses. Relatedly, there were calls for a rethinking of work experience for students in general. There were calls for more work experience throughout education, as it is seen as one of the ways to attract young people to M&M industries if they can get involved in some hands-on activities in shipyards and engineering facilities. However, there were doubts that the Year 10 general work experience programme does this effectively.

Importantly, interviewees often stated that apprenticeships are much better than their perception, although we did not interview employees who had recently completed apprenticeships. Like the maritime industry broadly, apprenticeships suffer due to negative perceptions and misunderstandings. It is imperative to remedy the misconceptions of apprenticeships as poorly paid and lower skilled, and that they are something you do if you cannot do anything else – these false perceptions lead to a poor image among many young people (and their parents).

4.4 The Need for Transferable and Soft Skills

Existing digital reports affirm that the training landscape needs to be *Industry 4.0* ready in that it is preparing people for a ‘portfolio career’. That is, teaching them not for specific roles but teaching them general skills that prepare them for a career of switching roles, teamwork and interpreting digital system data and upgrading their skills. But there were concerns expressed about soft-skill development related to poor pre-degree provision of transferable skills, and lack of engagement by FE Colleges in the Industry 4.0 agenda. Soft skills were also often highlighted as a skills gap. These broad soft skills referred mainly to problem-solving and analysis, self-management and presentation, socio-emotional and communication skills.

As mentioned, apprentices are coming to firms without the general skills of being ‘work ready’. The issue is not the absence of any particular advanced or specific technical skills, it is the general ability to be able to work and learn the skills required for that specific company. These companies consider the soft skills required to be ‘work ready’ more important than any advanced skills, which they intend to teach them in their own bespoke ways. Commercial skills are also suggested to be lacking in areas like entrepreneurial, communication, business, and contract skills.

SMEs also tend to value soft skills highly because their workers need to have a grasp of a wide set of aspects and tasks in the business, appreciate how their work affects others, and know how to build relationships across the business. It was suggested that apprentices could benefit from undertaking a number of roles across the business to develop more generic and transferable skills.

Several aspects of maritime experiences make soft skills even more difficult to upgrade. Firstly, in sea-based roles there are hierarchical chains of command, which make it difficult to express some of the important soft skills like presentation, communication, persuasion and team discussion. Secondly, it is increasingly difficult to cultivate soft skills offshore due to the reduction of crew sizes. Ships used to have bigger crew sizes with break rooms. In contrast, modern smaller crews of typically 15 people mean that 10 of them are working or sleeping at any one time, and the others are in their cabins. Autonomy and further reductions in crews may only serve to exacerbate this and threaten to cause deteriorating mental health among relatively isolated workers. These issues may generate problems for these workers when they progress to shore-based jobs.

5. IMPROVEMENTS TO THE CURRENT SKILLS SYSTEM

5.1 Perceptions of Current Training Weaknesses

Our results indicated some appreciation that education and training systems are adapting and changing in order to respond to the growth of new technologically related skills. There was recognition that the Royal Navy was improving its training and better connecting with the MCA. Local institutions' plans for new M&M courses on digital and electrical development, computing, AI and cyber security were not widely known, however. The prevailing view was that the training and skills landscape has been slow to change, that there is much duplication and fragmentation, that the competitive funding system gives little incentive to collaborate, and that it is hard for anyone to discern clear pathways through courses and careers.

Respondents called for an appraisal of existing training coursework to understand what is taught that is redundant; some respondents felt there were things (such as metal work) being taught that were 40 years out of date. Training providers feel that the level of technology in training equipment is inferior to other sectors such as aviation. This also means that maritime training centres are not as interesting or exciting, which has notable ramifications for getting young people involved.

It was often argued that the training landscape for sea-based roles is restricted by regulation that it is slow and hard to change and produces 'training for training sake'. This manifests both as training on individual topics that are deemed pointless for the current employment, and in entire courses that replicate other courses. Respondents complained that for maritime qualifications require courses and tests for every type of boat of every dimension when this is unnecessary. There is a strong case for a review of content and simplified training system for mariners, which uses one

course for 'general' knowledge topics that is then topped up by 'on boat' training. For example, safety, anchoring, and navigation are all driven by guiding principles that apply across all vessels.

There is some debate about who is responsible for leading changes to training. Training providers are adamant that they themselves cannot drive new training provisions, rather they act in response to firm demands and need to be sure that demand exists for new courses. Others suggested that national regulatory agencies and professional groups should play a more prominent role in leading changes to education and training provision. Moving forwards there needs to be an acceptance that the skills and training landscape needs to be constantly reappraised, especially in areas most affected by technology, which can change rapidly in only 6 months. While Project Selborne, the new plan for Royal Navy training and education may provide the Navy with skills 2.0, it will not be long before 3.0 is needed and so on.

Many respondents also highlighted issues with reskilling maritime workers, namely a lack of desire or capability to reskill – with stevedores given as an example. It was suggested that any such reskilling should take place away from the classroom as it is not an environment where maritime workers learn most effectively.

5.2 Routes to New Training Content

While respondents agreed that new training content is needed to keep up with the new skills and technologies that are emerging, there was debate about how best to do this. Three possible options were outlined:

- One option is to add modules to existing maritime courses. An argument for this is that it would be quicker to implement and can happen now, as opposed to spending years getting regulatory approval for new courses. An argument against is that it is unlikely to bring in new recruits who would not have already gone into maritime. This is a significant issue, as maritime is competing with other industries for the supply of new highly skilled workers.
- A second option is to introduce entirely new courses that explore the application of new technologies to maritime. For instance, a maritime AI course, or a maritime mechatronics course. There are examples of courses at the University of Plymouth that the SolentMEZ could learn from, although they are in their infancy. In the long term, respondents felt there is a need for these types of courses because of the vast array of content these technologies will bring, but they also require time consuming national/global standards to be agreed by organisations often outside the Solent and so may take years to implement, and thus may not tackle issues immediately.

- A third option is to add maritime modules into advanced courses like AI or autonomy. This is starting to happen in several of the regions Universities but there much scope for further implementation. It is argued that giving 'industry agnostic' students the option to explore maritime applications, through a potentially optional module like 'maritime applications in autonomy', would help to attract new workers as students become aware of exciting opportunities in the M&M sector.

Several interviews argued that a combination of these approaches at different Levels may be appropriate. For example, adding modules to existing courses may well work at Levels 4 and 5 as this approach will be much quicker and more flexible but, given the scale of technological transitions, it also appears that at Levels 6 and 7 new degree courses and degree apprenticeships will be required if Solent M&M is to be a leading research, intellectual and innovation cluster.

6. SKILLS FOR NEW TECHNOLOGIES

Although there are a wide range of technologies that may impact the maritime sector moving forward, there was consensus around three interrelated sets of skills that the SolentMEZ should focus on. While each of these areas are important in their own right, advances in each of these areas is a significant enabler to the others and the co-ordinated development of these technological areas would be beneficial. For example, autonomous systems are reliant on cyber security to ensure their safety and protection. Autonomous vessels require advances in power technologies to ensure that they can stay at sea for any length of time, and achieving clean maritime and decarbonisation challenges including improved fuel and port efficiencies rely heavily on the use of digital systems and data. While not exhaustive of the potential technological advances in maritime, there is significant crossover between these technological areas which reinforces their potential value.

6.1 Autonomy

As noted above, a widespread view is that the M&M chain will certainly need more advanced skills in autonomy, electrical software and robotics given the rapid advance of more autonomous platforms and systems. There was a widespread view that the Solent had expert capabilities in this area particularly in small and subsea vessels, sensors and drones. It was argued that more significant benefits of autonomy will be realised first in the more specialist platforms, smaller platforms. Beyond this, however, there was not a great deal of clarity about which aspects of autonomy and

robotics skills will be most needed. There was a perception that other countries like Norway and Singapore are ahead in maritime autonomy, largely because they have top-down central government programmes that have driven these agendas. Many interviewees argued that regulation has restricted autonomous activities and there was a need to understand how other countries had negotiated regulatory issues. It was noted that there is much potential for renewing shore-side infrastructure and retrofitting established ports to provide autonomous container interactions. Many respondents suggested that the SolentMEZ and Solent LEP should promote some flagship projects in autonomy to unite stakeholders in the Solent and improve capabilities. It was felt that projects have been limited by a lack of innovation funding.

6.2 Data Systems and Cyber security

A second priority area for future skills development was in maritime data systems and the communication, analysis, management, and interpretation of digital data. In some way these skill-sets would have the widest application across the M&M value chain as they are essential to shipping and port operations and business services. This, of course, includes cyber security which was often emphasised and described as intrinsic to safety. The key obstacles here were not seen as regulation but as the shortage of skilled personnel in data systems and software who frequently had to be attracted from other sectors. It was argued that M&M in the Solent should be effective at building connections with digital clusters elsewhere in the South – such as digital in Guildford, or cyber in Malvern.

While many respondents were keen to point out the importance of cyber security, notably little was known about it, certainly compared to autonomy. Respondents stated that their industries need to learn much more rapidly on cyber security, as it may hold back advances in ship autonomy. There was some consensus that this means competing with many other sectors for cyber security experts, but there was much uncertainty and few comments on how courses in cyber for maritime could be established and developed.

6.3 Carbon-reduction Technologies

The challenges in maritime are seen as particularly difficult compared to other sectors. While large ships such as cruise liners and tankers are some of the biggest polluters, their size means that respondents are sceptical there will ever be carbon-zero clean energy solutions (e.g., batteries, fuel cells) for these large craft. However, while small boats could potentially go completely electric now, demand from the leisure-driven small vessel sector for such technology is currently seen by some as

low, although this is clearly subject to debate. It was widely hoped that action by national and local governments, and implementation of the Clean Maritime PI (Department for Transport, 2019c), in conjunction with regulatory change, will soon compel manufacturers and shipping and port industries to be greener – as has been the case with the automotive industry.

Most comments in this area referred to power and energy systems to replace and supplement diesel. Power management was repeatedly linked to autonomous vessels. However, there is little consensus on types of power to focus on as there much debate about what alternative fuels should be pursued. Some respondents were hydrogen advocates, others ammonia advocates, whereas others were keen to point out that hydrogen would be too difficult to implement in certain areas. Others have suggested that hydrogen fuel cells will be a good option for craft range but interjected that presently hydrogen is both too expensive and insufficiently green. Many respondents mentioned that due to the proximity of the ports to Southampton and Portsmouth, as well as the sensitivity of the Royal Naval base, and the explosive nature of hydrogen, it was impossible to be stored and used at these ports. The high toxicity of ammonia provides additional challenges for ports and ships. Despite the lack of clarity of technological pathways towards low pollution shipping and maritime operations, there is consensus that more needs to be done at all levels to make M&M greener.

6.4 Cross-sector Skills and Opportunities

There were many comments about how new skills in these three areas are not limited and specific to any one industrial sector. Instead, they include many cross-sector capabilities and new courses should reflect this. Many respondents felt that there is not yet sufficient demand from M&M alone to provide substantial numbers of students in all three types of areas. Thus, it would be preferable to encourage educational institutions to introduce new degrees and courses in these areas that would attract a wide range of applicants and then ensure that such courses included some M&M modules. This might also allow M&M firms to attract personnel with experience of work in these technological areas. Teaching general advanced manufacturing and digital skills in new systems, processes and materials, rather than niche maritime skills, means that workers can pick up emerging skills from other (more advanced) sectors better including aviation, automotive and aerospace and this cross-fertilisation is crucial to innovation in these areas.

There was an apparent tension in respondents' comments on new skills and technologies. On the one hand, many respondents argued that the Solent region needed to identify specialisms in the new technologies in order to build a distinctive reputation and focus, in order to provide more

momentum especially in research and innovation. At the same time, it was also argued that many of the new skills essential for development in these three interlocking domains are cross-sector or transversal. This suggests that while specific M&M research-level skills will be required, this needs to be set within a broader strategy to develop cross-sector skills in the new technologies and to embed M&M more strongly in the development and evaluation of these skills. In addition, it was repeatedly emphasised that skills issues and strategies need to be developed at the same time as accompanying measures to develop a M&M cluster of firms, and that feedback between skills and research and innovation agendas would need to be strengthened, as indeed was emphasised by Stevens (2014).

7. ACCOMPANYING MEASURES TO SUPPORT THE SOLENT CLUSTER

7.1 Cluster Activity

When asked about a maritime cluster in and around the Solent, responses were mixed. A number of respondents did not feel like there was a cluster at all, indeed, one maritime company stated that they moved into the region expecting a cluster but still haven't found it. More generous appraisals suggested that 'there is a bit of everything in the Solent'. There was some consensus that the branding and visibility of Solent M&M industries has been weak (e.g., invisibility of Maritime UK SOLENT compared with Mersey Maritime, Maritime UK South-West) and that if the cluster is to gain more recognition and policy visibility then developing a cluster brand is essential.

Many argued that cluster branding should build on advanced technology, robotics, autonomous assets and capabilities, and especially the technologically intensive SMEs which represent a 'Phoenix industry' resource. It was argued that the cluster needs to build a better system of support and finance in place to grow these companies. M&M SMEs have not been able to secure a great deal of funding support from Innovate UK and this needs to be reviewed. Without this, it was argued that innovative start-ups would follow the experience of ASV and be taken over by multinationals with possible consequences for their future investment and commitment to the region.

Respondents from these SMEs mentioned that they 'knew each other, knew what was going on, and regularly see each other'. However, they also stated that there was not much connectivity between them, that they did not regularly work together, and that they were too busy to engage in many activities. Many would welcome more opportunities for collaboration around problems and challenges. Busy SMEs that find it hard to commit time to workshops, called for a cluster intermediary or an 'enabler'. This person(s) should act to gather business thoughts and needs, and

provide information on opportunities and technology agendas. In this way, there would be more active, intense, engagement. One respondent suggested that these 'enablers' act like a consultancy, going around to collect opinions and ideas, before writing a proposal about what is required for stronger cluster development.

7.2 The Royal Navy

While many respondents welcomed recent moves in the Royal Navy to support the SolentMEZ and the cluster, many felt that the Navy could do much more to encourage firms in the Solent. It was argued that disused dockyards and estate could be made available more rapidly to the private sector. For instance, some stakeholders were frustrated by the fact that plans for the disused Fort Rowner are on hold until 2029. Additionally, there were several comments about planning for repurposing facilities and estate rather than letting them decline. Respondents also mentioned that ship halls and docks have been updated consistently, but cannot be used for commercial purposes due to MoD commercialisation rules.

It was also argued that Royal Navy procurement should do more to connect with SMEs and support rather than ignore technology start-ups. In particular, it was argued that the single Naval procurement channel had led to a tendency to work only with big established firms and caused a narrow engineering supply chain, because of concerns about competition and secrecy. Moreover, it was argued that too much marine work has been offshored due to a preoccupation with costs rather than longer term technology development. In these ways it was argued that more effort should be made by the MoD and Navy to find a way to invest to stimulate activity and firm spin-offs and start-ups. Simplification and greater clarity of the complex web of MOD-RN-dstl-dasa funding streams would make it easier for SMEs to engage in these opportunities and provide a more diverse, responsive and resilient M&M research and innovation sector.

7.3 A Multi-user Boatyard

It was also widely mentioned that the provision of a multi-user boatyard linked to an innovation centre would be greatly beneficial. Some companies who are based inland lamented the lack of suitable spaces on the coast to trial and launch their projects – something that renting a space at a multi-user boatyard could resolve. For many SMEs, renting a boatyard represents a significant cost, and was described as a millstone around their necks. Many respondents suggested having a shared, multi-user boatyard, where SMEs develop projects would provide more flexibility. Having them pooled in close proximity should facilitate learning and discussion, as well as facilitating easy

engagement with the SolentMEZ and other cluster agencies. Furthermore, it would provide a hub for lectures and classes to take place 'in the field'.

It was also argued that such a shared facility and hub would be a way to pool workers that would provide an element of security for the workers themselves, making them more likely to stay in the sector. It was noted that this would be beneficial for craft and manufacturing workers who currently have to be highly mobile due to insecurity of contracts. It was suggested apprentices could be shared by companies in this hub, which would expose them to a more diverse and hopefully interesting work experience.

The autonomy centre at NOC was mentioned in comparison to this potential hub, but while it was noted for having numerous positive impacts, its makeup of offices and lack of engineering facilities meant it was not a substitute. Rather, more suitable examples are COVE in Newfoundland or Makers District in Rotterdam. Some respondents discussed the Fawley Waterside project as an ambitious long-term opportunity, but noted that it requires significant investment and time and any shared boatyard would need to be accessible to SMEs as far North as Surrey as well as to employees in the Solent.

8. CONCLUSIONS

These findings have implications for training at all levels of education. At the school and college levels, there was a strong call to provide pupils with the experiences and course content necessary to spark and build their interest in M&M, rather than the introduction of any specific courses. Indeed, general, **transferable digital and soft skills are deemed more important as they prepare pupils for the type of 'portfolio' career** and continual learning that will be commonplace in the future.

Similar concerns were found regarding FE institutions which were considered inadequate in providing the experiences and enthusiasm necessary to keep students in maritime and marine. While some consider that T-levels are good opportunities to offer more technical content, employers emphasise that they want **general and foundational skills in digital and electro-mechanics** that they can mould to their needs, and these requirements should be reflected in course content.

At the more advanced HE levels, there remains debate about how to introduce training for key technologies in autonomy, robotics and digital data and systems including AI and cyber-security,

where various combinations of (interdisciplinary) modules and courses are needed in the short and long-run. Again, while the content here will inevitably be growing more specific, it was argued that students need to be capable of the broad systems-level understandings of technologies necessary to incorporate cross-sector innovations and apply them to the unique settings of M&M industries.

Our findings indicate that around half of firms report that they have some difficulties and frictions in skills supply and there is a dominant view that technological and environmental transitions are being felt across many parts of the M&M chain and are accelerating. In general, it is felt that the educational and skills system supporting the sector in and around the Solent is good and extensive. However, it is **not adapting sufficiently rapidly** to these increasing disruptions. It is seen as a complex skills system which has developed by accretions and layers over time, and is dominated by a heady mix of regulation, tradition and competition and has suffered from a lack of co-ordination and direction. Most agree that it has fallen behind technological frontiers and developments in other research-intensive manufacturing.

There is some agreement that new skills in the **three overlapping domains of automation, power and carbon-reduction, and digital systems and cyber are essential**. However, most discussions revealed that there continues to be such **uncertainty about these skills** and not yet much detail on precisely which aspects of these skills will be needed, but improved digital literacy is essential. Future work should target this uncertainty and **work with stakeholders to add more detail and direction to these agendas**. Ultimately this needs to proceed in conjunction with research, innovation and commercial applications in these domains as the skills questions cannot be answered independently of this innovation outcomes.

In line with existing reports, our findings reveal that most firms believe that it is essential to address skill and training issues in conjunction with broader investments in the M&M sectors and in other related technology industries.

It was repeatedly emphasised that **labour supply issues are inseparable from the broader perception of maritime industries and the Solent cluster**. Respondents have suggested it is essential to improve the brand and reputation of the cluster make it attractive to potential high-skilled employees and investors, and that this is just as important as any improvements to education and training.

They recommended that developing the **cluster visibility should focus on high-tech solutions in marine technology** and port infrastructure and the ways in which the region can provide support

and incentives to SMEs in these areas. Despite positive steps it was widely felt that the cluster lacked flagship projects and investments in innovation facilities.

It was also emphasised that many of the **new skills required are cross-sector and that the M&M will need to draw on a wider developing labour market pools in the three domains**. Competition for skilled employees in digital, software, cyber physical system and robotics is fierce and strong improvements to their supply will require collaboration between industry sectors. Cross fertilisation and knowledge transfers across different industries will be key to new digital and automation technologies. Improvements to the labour supply in M&M cannot be addressed by focusing on this sector alone but will need broader strategic investments in these three domains.

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APPENDIX

A. FIRM SURVEY

Please tick (check) this box to indicate that you consent to taking part in this survey.

A. BACKGROUND

Name of firm:

- (a) What is the single most important good or service (in revenue terms) produced by the firm:
(b) what is the second most good or service (in revenue terms) produced by the firm (if any):

Is this site address the Headquarters or a Branch of the firm:

- Ownership:

- Privately owned
- Publicly listed
- Subsidiary of national UK company
- Subsidiary of foreign company

- Number of employees 1-10 10-49 50-99 100-249 250-499
500-999 1000 and over

What percentage of your labour force at this establishment do you estimate are:

- a. Management and professionals
- b. Skilled engineers or research technicians
- b. Semi-skilled machinery and plant operatives
- c. Unskilled employees

B. QUESTIONS

1. Does your recruitment make use of training, vocational or degree courses offered in the Solent region? If so, which ones? If not, why?
2. Does your training and career development depend on training or vocational or degree courses offered in the Solent region? If so, which ones?
3. Do you employ apprentices? If so, how many and at what levels or standard? Alternatively, why not?
4. Do the current apprenticeships on offer satisfy your business requirements? Why, or why not?

5. Is your business inhibited in its operation by any key skill shortages? If so, in what occupations/specialisms?
6. Is your business experiencing any shortages of digital skills, if so, in which specific areas and specialisms?
7. Which emerging technologies do you think will be most disruptive to your industry and when do you think this will occur?
8. What technologies do you plan to incorporate into your business over the next 10 years? Conversely, what technologies do you anticipate becoming obsolete?
9. What technologies or skills do you plan on incorporating to your business over the next 10 years?
10. Please indicate if you **agree or disagree** with the following:
The Solent region provides a strong supply of qualified people for this business:
Strongly disagree 1 2 3 4 5 6 7 Strongly agree
11. Higher education institutions and Universities in the Solent are responding well to the changing skill demands in my business sector
Strongly disagree 1 2 3 4 5 6 7 Strongly agree
12. Digital and web-based technologies will significantly change skills needed in this business
Strongly disagree 1 2 3 4 5 6 7 Strongly agree
13. Automation will significantly change the skills needed in this business
Strongly disagree 1 2 3 4 5 6 7 Strongly agree
14. This business would welcome a programme of digital training and support for digitisation
Strongly disagree 1 2 3 4 5 6 7 Strongly agree

If you have any other comments on the changing nature of skills in your business, please add them below:

Thank you for your time and co-operation

Are you willing to be contacted for a follow-up interview? Yes No

B. FIRM INTERVIEW

QUESTIONS

1. How would you describe the current skills and training landscape in the Solent? Are there any gaps or problems?
2. Are there skills in your workforce that are becoming obsolete? If so which ones?
3. In your industry, which skills will be increasing and most in demand over the next ten to fifteen years?
4. Do you have an ageing workforce? Is your recruitment of young people increasing, stable or falling?
5. Would you like to see any changes to the apprenticeship scheme to ensure its future success?
6. Where do you think government policy on education and skills can be most helpful?
7. Are your innovation activities constrained by skill/research specialist shortages? If so in what areas?
8. What do you think of the UK Maritime 2050 plan?
9. Which emerging technologies do you think will be most disruptive to your industry and when do you think this will occur?
10. What new technologies or skills do you plan on incorporating in your business over the next 10 years?
11. Can the Solent build a global centre of maritime training and education? What are the key obstacles and issues to address?
11. Do you have any other comments that you would like to add?