Defence Youth STEM Outreach – Inspiring the Next Generation

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SYNOPSIS

This paper focuses on the need to build a solid foundation of skills which the future maritime workforce can build on to provide the innovation and exploitation of new technologies that the Royal Navy requires. This need sits within the wider strategic context of the national engineering skills shortage, reflected recently in the EngineeringUK report: 'The State of Engineering 2018.' [1] The report forecasts as a conservative estimate an average shortfall in engineering graduates (level 4+) of 22,000, with the impact of Brexit upon these figures yet to be determined (the UK relies on attracting talent from the EU and beyond to help meet current shortfalls). The situation regarding Level 3 – A levels, Highers, and Advanced apprenticeships reflects a similar shortfall. This issue is exacerbated by the fact that only 12% of engineering and technology employees in the UK are women; highlighting that access and availability, including gender diversity remains a challenge for this sector. It is against that backdrop, that the MOD, is collaborating across many areas; one specifically being on inspiring the next generation to undertake Science, Technology, Engineering and Mathematics(STEM) as subjects of choice initially, moving thereafter onto more informed careers awareness and ultimately onto career options. Such foundation building is manifest in Defence's Youth STEM engagement strategy which is whole force by design, with several major developments to date following its launch in 2016, including the establishment of formal strategic partnerships with three national STEM outreach providers; notably: Primary Engineer; Tomorrows Engineer (replicated by Energy Skills Partnership in Scotland) and STEM Learning (replicated by SSERC in Scotland) each with niche capabilities. They sit alongside all four Services within Defence and key other government departments including the devolved administration in Scotland, in the form of an implementation group to take the strategy forward. The purpose is to inspire sufficient young people to study STEM subjects, to ensure that the appropriate national talent exists from which Defence can recruit its future technical people. Several initiatives are expanded upon with illustration of the benefits, ranging from impact in the classroom (both teacher and pupil) to Defence personnel as STEM ambassadors. The paper closes with the social mobility agenda and the potential thereof from Youth STEM outreach.

INTRODUCTION

1. The Engineering UK report for 2018, estimates an annual shortfall of 37,000 to 59,000 personnel to meet 'core' engineering roles requiring level 3+ skills[1]. This position is exacerbated further when considering the demand against engineer 'related'[2] roles, bringing the total estimated shortfall to between 83,000 and 110,000[3]. This presents a national strategic challenge for the UK all within a changing political and economic landscape. Such a challenge has implications for the Ministry of Defence (MOD) as a predominantly bottom fed organisation, where it recruits, trains and employs circa 55,000 engineers and technicians, all of which are drawn from a relatively smaller talent pool than that available outside of the Defence sector given the security requirements placed and societal sensitivities associated with such a career. This national challenge demands a multifaceted approach, incorporating the core components of the employment life cycle, notably: inspire/attract, recruiting, training and professional development (i.e. mid-career upskilling) and retention. In response, the MOD has taken such an approach, characterised through its collaboration with Industry, Government and the Professional Institutions across a range of programmes. One such programme, is that of Youth STEM outreach, to ensure that the STEM skills pipeline from early years to early careers is primed sufficiently to meet the National demand and within it the Defence need. Such an approach is fundamental if Defence outputs are to be sustained for the future, including its maritime contribution.

Author's Biography

Captain Mike Rose joined the Royal Navy in 1982 as an Artificer apprentice. Specialising in Marine Engineering, he applied his trade at sea and ashore in the rank of Petty Officer before then being selected for commission as an Officer in 1988. During his career he has undertaken several sea assignments, with his last one being in HMS ALBION as Cdr(E) where he saw operations in 2011 during the Arab Spring. In between his sea appointments he has undertaken positions in engineering support, acquisition and HR, interspersed with RN sponsored academic development. This included reading for an MSc in engineering at the University College London and then some years later for an MA in strategic studies at the Joint Services Staff and Command College, Shrivenham. Promoted

[1] Engineering UK 2018 -the state of engineering.
[2] Engineering UK 2018 report – 'related roles requiring a mixed application of engineering knowledge and skill alongside other skill sets'
[3] Ibid.

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to Captain in February 15 he assumed the inaugural role of Defence Engineering Champion Team leader, responsible for bringing a clarity of purpose and coherence of approach to the many engineering skills initiatives and activities currently underway across the Ministry of Defence.

Captain Dave Joyce joined the Royal Navy in 1988 and served in a variety of ships and shore establishments during the first stage of his career as a Weapon Engineer Officer. Professional highlights during this period included anti-submarine patrols in the North Atlantic, disaster relief in the Caribbean and operations in the Arabian Gulf. In his second stage career he has specialised in Human Resources with successive assignments responsible for training requirements, engineering training delivery, strategic HR and financial planning. In addition to his engineering degree, he holds three Master's degrees, is a Chartered Engineer and Member of the Institution of Engineering and Technology. He currently heads the team responsible for the Royal Navy's engagement with University Technical Colleges and their equivalents across the UK, and the Royal Navy's contribution to the promotion of Science, Technology, Engineering and Mathematics to young people.

SCALE OF THE CHALLENGE

2. The review of engineering skills by Professor John Perkins in 2013 highlighted the need to 'improve the long-term talent pipeline'[4] given the capacity issues in respect of meeting future demand. It was a call to arms with the report citing 'time for concerted action by the profession, industry and Government to achieve the engineering goals we all share'[5]. Although his progress report of 2014[6] revealed such action to be underway, successive Engineering UK Reports into "the state of engineering" paint a bleak picture in respect of supply (Figure 1), demonstrating the long-term nature of the challenge. Although it is difficult to 'predict with confidence the future supply and demand for engineers' given the 'sensitivity to modelling assumptions' as cited by Professor John Perkins,[7] the predicted skills gap is consistent between 2015 and 2017. [8]

[4] Department for Business Innovation & Skills, Professor John Perkins' Review of Engineering Skills, Nov 2013.
[5] Ibid.
[6] Department for Business Innovation & Skills, 'Engineering Skills: Perkins Review Progress Report', Nov 2014.
[7] Department for Business Innovation & Skills, Professor John Perkins' Review of Engineering Skills, Nov 2013.
[8] Drawn for Eng UK state of engineering reports 2015 -2017. In 2016, Tier 2 and Tier 3 postgraduate supply figures were omitted from the calculations in error, leading to the Level 4+ supply being underestimated (see Fig 1). This was identified and rectified in the 2017 report. The Level 4+ supply estimates quoted in 2015 and 2017 are therefore much more representative of the true figures.

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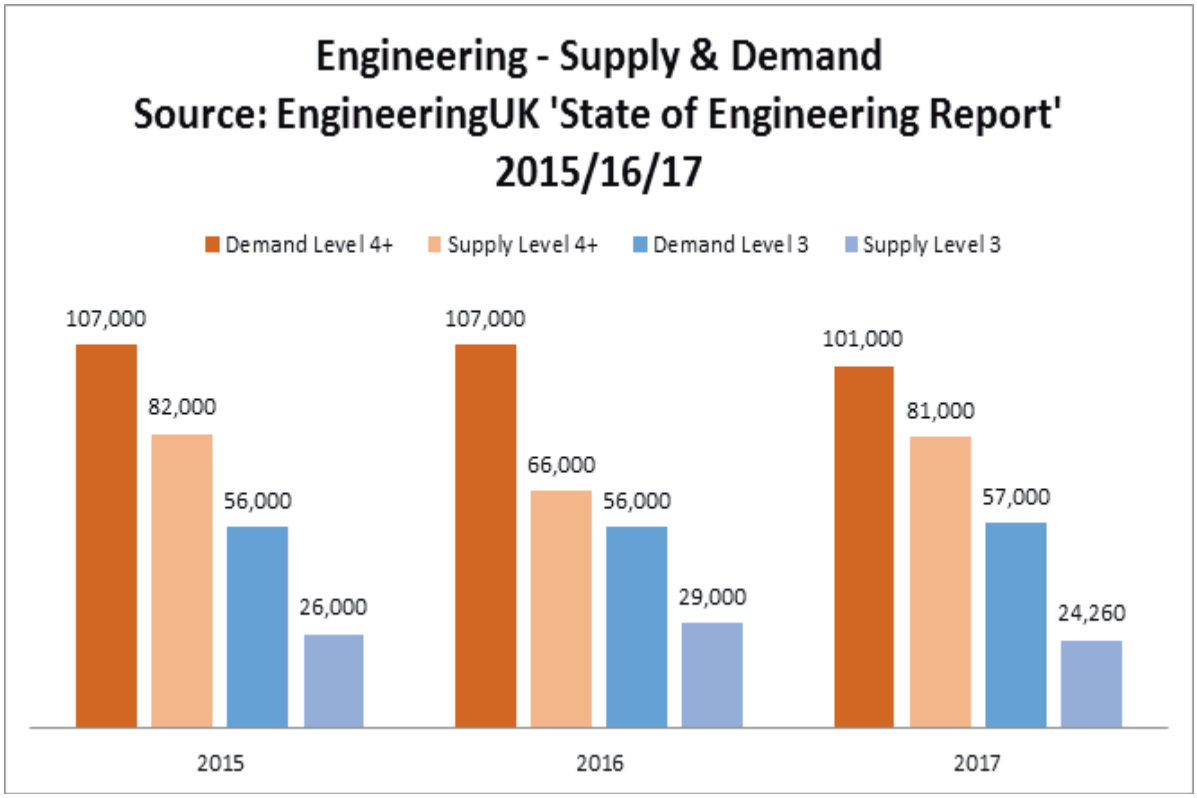
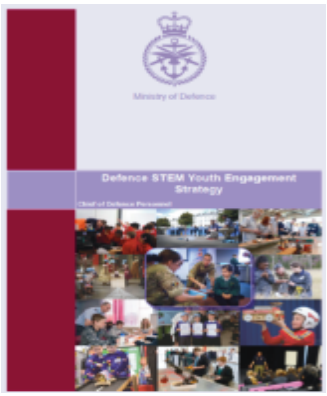


Figure 1 Engineering Supply & Demand 2015-2017

3. The demand and shortfall figures for the Eng UK report for 2018 are not directly comparable with their previous reports due to the adoption of a revised engineering footprint with its refinement in the demand and supply methodology, including the non-engineering sector.[9] Nevertheless, the figures still reveal a significant challenge for Defence as described in para. 1. This not only risks the sustainability of outputs for the future it also risks driving adverse, competitive behaviour for skills within the sector, necessitating a collaborative approach to address. It is this 'coalition building' against a common purpose which defines the MOD approach, exemplified through its Youth STEM engagement programme.



GETTING ORGANISED

4. Developing a Strategy. The Defence Engineering champion team brought together outreach leads from the RAF, RN, Army, DSTL[10] and the DE&S[11] drawing on their collective experience to form a Youth STEM engagement strategy for Defence[12]. Consultancy included the Department for Business Energy and Industrial Strategy (BEIS)[13] given their considerable experience in this area. Three strategic STEM partnerships were formed during the consultancy phase, drawing on niche capabilities, notably: STEM learning and their STEM ambassador programme; Engineering UK (Tomorrows

[9]Engineering UK 2018 -the state of engineering. 'These changes aim to foster greater consistency in the sector going forward, and take into account the considerable need for engineering skills outside of industries traditionally deemed to be engineering'.

[10] Defence Science & Technology Laboratories

[11] Defence Equipment & Support

[12] Defence Science Technology Engineering and Mathematics (STEM) Youth Engagement Strategy Issue 1.0, Jul 16.

[13] Formerly Department for Business Innovation and Skills (BIS)

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Engineers programme) and their resourcing of companies to deliver STEM outreach in secondary schools; and thirdly Primary Engineer and their resourcing of Primary teachers. The vision is for 'Defence, in conjunction with others, inspiring sufficient young people to study STEM subjects to ensure that the appropriate national talent exists from which Defence can recruit its future technical people.' It is very much linked to BAME[14], D&I[15] and Social Mobility and in effect acts as a 'permissioning document' to the single Services[16] within Defence.

5. Developing the Network. Since launch of the strategy in 2016, the relationship with STEM delivery charities has expanded to include the Scottish Schools Education Research Centre (SSERC) and the Energy Skills Partnership (ESP); both of which are strategic partners of STEM Learning and Engineering UK (Tomorrows Engineers) in Scotland respectively. This collaborative approach has also seen relationships built cross government, ranging from supporting the Department for Transport led Year of Engineering 2018 initiative, to consultation on the Scottish Government's STEM strategy and more recently membership of the cross-Government STEM board, chaired by the Department for Education. The engagement network also includes the Professional Engineering Institutions (PEIs) and is embodied within the recent launch of the Defence Engineer Professionalisation Strategy where it draws out the specifics of youth STEM engagement in its objectives, placing onus on the institutions and their members. Partnering with industry is equally fundamental to addressing the STEM challenge in a coherent and effective manner. This is manifest in a Maritime context through the Royal Navy's membership of UKNEST[17] and its contribution across several joint initiatives. It is this wide-ranging network that has enabled the MOD and within it the Naval Service to build momentum into its outreach programme.

BUILDING THE MOMENTUM – MOD STEM OUTREACH - CAPABILITY DELIVERY

6. MOD delivery is best illustrated through the lens its strategic STEM delivery partners, describing what they do and the outcomes they achieve.

7. STEM Learning through the National STEM Learning Centre and Network supports teachers of Science, Engineering Technology and Mathematics equipping them to deliver world leading STEM education for all young people across the UK. Their programmes include provision of high impact, STEM-specific Continuing Professional Development (CPD) to teachers either locally through the network of Science Learning Partnerships and partners in Scotland, Wales and Northern Ireland, or transformational residential experiences at the National Centre in York. They have a particular emphasis on supporting hard to reach schools including financial assistance through 'Project Enthuse' which provides bursaries to state-funded schools to aid engagement with CPD. They also provide opportunities for teachers to experience the world of industry and university through short one or two-week placements under the 'STEM Insight' programme, with the MOD seeking opportunities 'within the wire;' this includes Naval establishments. STEM Learning also provides a National repository for curriculum linked, quality assured teaching resources, both physical and on line. Of prominence is the STEM Ambassador (SA) programme with its associated induction training and deployment of Defence personnel. This not only ensures appropriate training such as safeguarding, it also provides for a more coherent approach in the deployment of SAs. They operate in Scotland in partnership with SSERC. The strategic importance of SSERC to Defence is therefore equally of note. As an example, SSERC will be leading (in partnership with Science Centres and Science Festivals) the development and management of a STEM Youth Leader programme. This will be formally developed and in place by end of year, and recognises the work undertaken by learners at all ages relating to STEM. There will be formal accreditation (for 15-17 year learners) and informal accreditation for early years and lower secondary schools. The STEM Youth leader programme will provide progression opportunities for young people who have a passion and enthusiasm for STEM ultimately leading to STEM Ambassador status.

[14] Black Asian Minority Ethnic
[15] Diversity and Inclusion
[16] Royal Navy, Army, Royal Air Force, Civil Service.
[17] United Kingdom Naval Engineering Science and Technology

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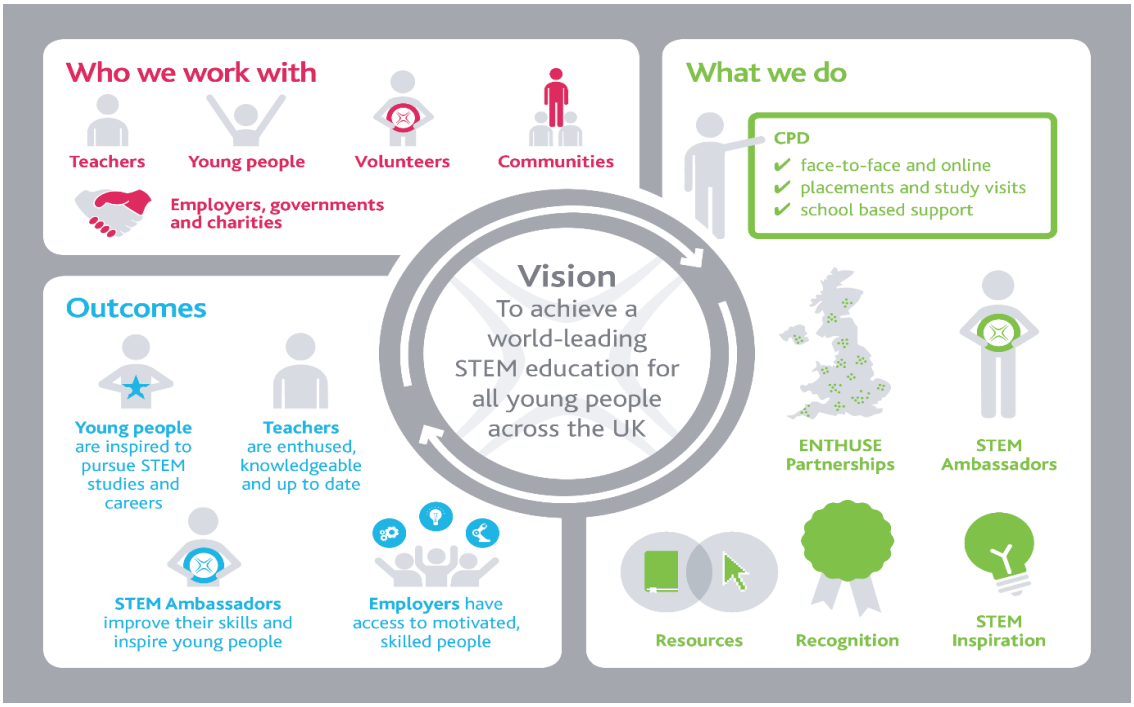

Figure 2 – Illustration of STEM Learning Activity

8. The **Tomorrows Engineers** programme is led by EngineeringUK in close liaison with its partners, Royal Academy of Engineering, the PEIs and wider engineering stakeholders. It provides information and resources about the careers available in engineering for young people aged 11 to 19-year olds. They also run a schools programme to help inspire the next generation of engineers. Working with businesses, not-for-profit organizations and charities, the programme is made up of several initiatives, comprising: industry visits, workshops, STEM Ambassador partnerships and careers resources, to help schools to incorporate engineering into the current curriculum and plant the seeds needed to grow local engineering talent required by businesses. Their emphasis therefore is on resourcing employers to deliver STEM activity; including Defence as a major UK employer. Further niche elements comprise: specific focus on secondary education; evaluation of effect and finally a direct linkage to the Professional Engineering Institutions (PEIs) from which they can draw on cutting edge resources and ideas. An illustration of employer support is at Fig.3.

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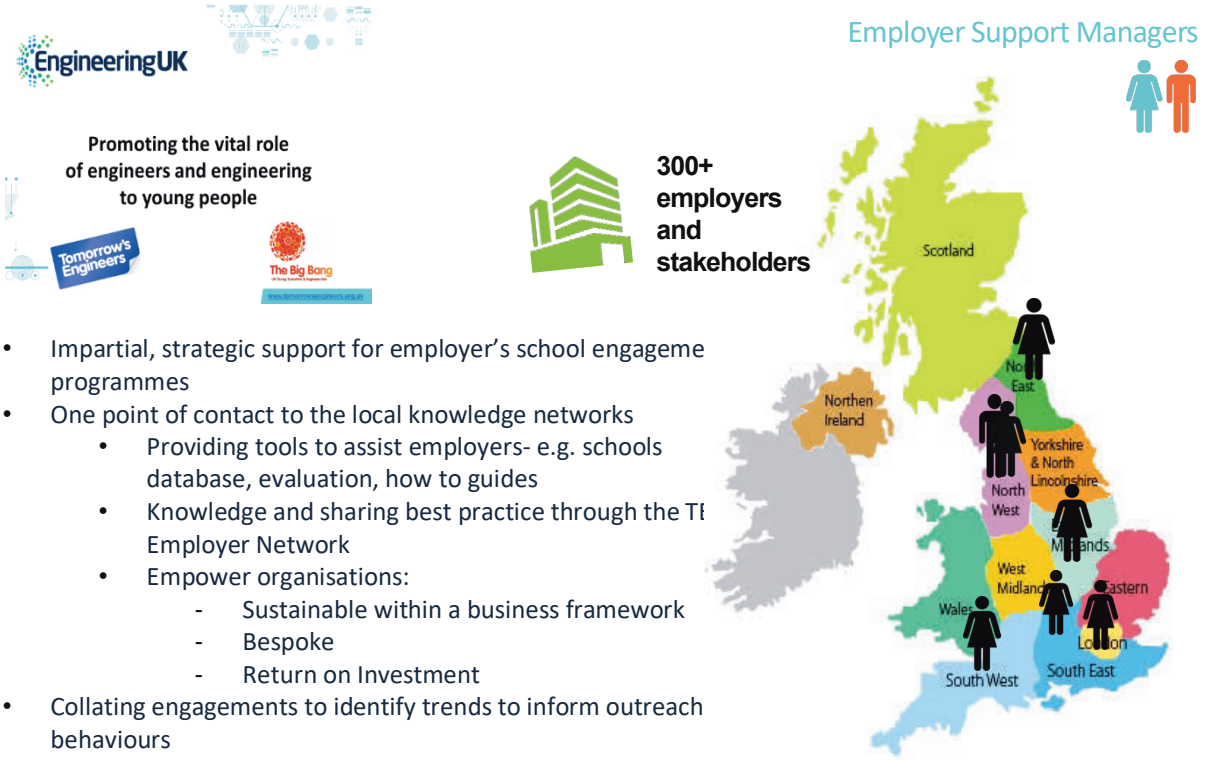

Fig 3 Illustration of Tomorrows Engineers Support to Employers

9. The Tomorrows Engineers programme works with the **Energy Skills Partnership (ESP)** in Scotland including events such as the Big Bang Fair in Scotland which is a scaled model of that held at the NEC Birmingham. One feature of ESP is its work with 21 regional college STEM hubs (Fig.4). Each hub is run by a regional college who in turn engage with their local schools to undertake STEM related activities. ESP have worked with colleges across Scotland to roll out a range of scalable activities that are sustainable in the long term. They operate in collaboration with Industry, Education Scotland and SSERC and now Defence with the Naval Service to become further integrated as a regional as well as national employer.

Figure 4 College STEM Hubs

10. **Primary Engineer** is a not-for-profit organisation established in 2005 with the aim of encouraging young people to consider careers in STEM-related professions. It believes that STEM subjects in securing positive opportunities and career paths for future generations, begins in Primary school. It offers Primary schools a way to deliver practical Mathematics and Science to Design Technology activities linked to engineering. Whilst the classroom projects are taught by teachers across all primary year groups, mapped to the curriculum, and designed to inspire and enthuse, the projects are contextualised by being supported by engineers. Programmes include teacher training, interactive and paper-based resources, and regional and national competitions as illustrated in Fig.5 below. All projects are linked to practicing engineers to provide a real-world context to the project. Their niche element is the focus on primary schools and in resourcing and training teachers; a known shortfall[18]. The programmes begin in Early Years Settings (pre-school) and continue through to their Master's Level PGCert course where teachers use action research to embed and evaluate engineering in primary classrooms. Primary Engineer has a National footfall, working with councils and industry to provide rolling programmes of training and classroom-based project learning. In 2018 it will launch its own school version of the Professional Engineering Institution's but for children and pupils focusing on mapping skills, and the diversity of engineering, providing young people with a pathway of competencies. Its National Leaders Award competition 'If you were an engineer what would you do?' saw 37,000 primary children (and some secondary) interview engineers, find a problem and draw a solution to it. The gender split of the competition was 50.9 male/49.1female. Nine public exhibitions and 220 winning entries will be linked to universities who select from those awards. 2019 will see

[18] 95% of primary teachers do not have a science background.

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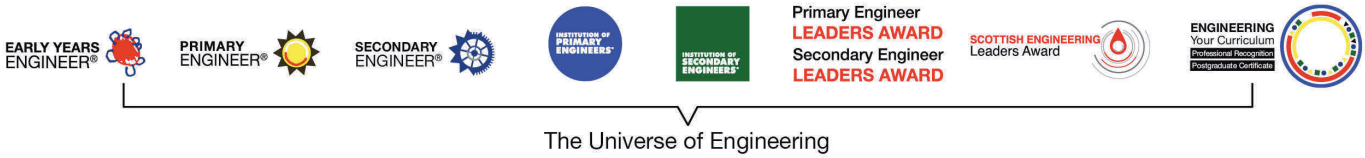
this expanding to 14 regions across the UK. It's range of inter-related programmes falls under the description of a Universe of Engineering. Defence has expanded its footprint in this area particularly






11. Collaboration with Industry. RN collaboration with industry is exemplified in its work with BAES and RAF through a schools' roadshow, utilising two teams and reaching out to 420 schools across the UK. This alone equates to an annual engagement in excess of 101,000 pupils. Another example, lies with the RN's membership of the UK Navel Engineering Science and Technology (UKNEST), where amongst several STEM initiatives lies the establishment of a Naval engineering competition. This inaugural competition was launched formally on 23 Apr in the Palace of Westminster, by Stephen Metcalfe MP, the Government's envoy to the Year of Engineering 2018 (YOE18). It seeks to inspire school students to take a closer look at how rewarding a career in engineering can be, while deliberately encouraging innovative designs which haven't necessarily been influenced by pre-conceptions. Students are asked to "Design a vessel that can rescue 1000 people from the sea" and is open to all ages (5-18 years old) with entries split into primary (KS1&2), secondary (KS3&4), and further (KS5) categories for judging by industry professionals; reinforcing the links to school curriculum. STEM Ambassadors have been encouraged to support teaching staff as appropriate. with support or teachers can deliver the competition themselves.

Figure 6 Naval Engineering Competition

12. Collaboration with Industry and Academia – University Technical Colleges (UTCs). This is perhaps the most bold and progressive of initiatives, with the RN leading the Defence approach. Direct Royal Navy involvement in the UTC movement began with initial engagement between Lord Baker of Dorking[19] and Admiral Zambellas as Chief of Naval Staff in 2014. This revealed a shared concern regarding the future of the technical workforce in the UK and a mutual vision that the UTC movement should be a significant source of inflow to the Royal Navy technical specialisations in the future. The RN is affiliated strategically to 11 UTCs[20] given their regional footprint and skills offering, ranging from engineering through to cyber. RN engagement includes facilitating the Combined Cadet Force (CCF) movement, support to the board of governors and in the case of Portsmouth the provision of a project team to support the development of the UTC resulting in its successful opening in Sept 17. Support is also extended to the full complement of UTCs and other schools through the

[19] Former Secretary of State for Education under Prime Minister Thatcher and founder of the UTC movement.

[20] The affiliates are located at Portsmouth, Plymouth, Aston, Workington (Cumbria), Scarborough, Reading, Derby, Peterborough, Salisbury, Bristol and Newton Abbot. All are engineering specialists; Derby and Workington focus on the nuclear industry while Reading and Scarborough emphasise computer studies and cyber skills.

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'Royal Navy Engineering Challenge' hosted annually at HMS SULTAN in Gosport, in partnership with affiliated employers and Defence Industrial Primes.[21] This year saw 75 teams compete with several enjoying the opportunity to experience 24 hrs of Naval life including a night onboard HMS BRISTOL. This year's challenge was to design and build a remote-controlled vessel that could recover objects from the sea bed to restore port accessibility; all within the context of a disaster relief scenario.

Figure 7 The Royal Navy Engineering Challenge 2018 – HMS SULTAN

13. Engagement with Cadet Organisations. RN STEM engagement ranges from the Combined Cadet Forces (CCFs) in UTCs to that of the Sea Cadets across the UK. Influencing the cadet syllabus to include STEM material has been one approach; another is the intent to undertake a Sea Cadet Engineering Summer Camp for the first time, where 24 cadets from across the UK will attend HMS Sultan for a week. They will engage in various engineering tasks, leadership training, ship visits and use the facilities and workshops there to attain a civilian recognised Open Award in Marine Engineering. Their week in HMS Sultan will conclude with a small parade to celebrate their achievements. A novel blend therefore of STEM outreach, careers awareness and personal development.

BUILDING THE MOMENTUM – STEM OUTREACH CAPABILITY DEVELOPMENT

14. Establishing a recognised STEM outreach picture. This initiative is essential to ensuring a coherent approach by the various entities within Defence in their outreach activities. The capability will identify both hot and cold spots of Defence activity and avoid duplication of effort. The functionality and accompanying STEM portal have been developed within an existing Management Information System (MIS) used for Defence engagement.[22] At the time of writing this paper, this unique capability is at the testing and acceptance phase with the intent to launch formally in the Autumn, including enablers such as a STEM ambassador's system operating manual and resource guide.

15. The system will enable the adoption of metrics; crucial to optimising the Defence effort and ensuring value for money. As such a baseline set of metrics has been agreed which include output measurements such as teacher engagement, number of activities etc. as well as impact. Metrics will also be drawn from those Service providers where MOD have funded under contract towards a specific event such as Big Bang, teacher CDP etc.

Figure 8 The Defence National Footprint

16. The STEM Ambassador Force. One of the greatest assets within Defence is its human capability. Consequently, an initiative is underway to incorporate STEM Ambassador induction training into the

[21] Babcock and BAE Systems for 2018.
[22] The system is called 'Understanding Civil Engagement – 'UCE'.

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engineering training courses within Defence. The RAF have incorporated it into training for all engineer officers; the DE&S have incorporated it into their Degree Apprenticeship course; the Army are developing a tailored package for incorporation into phase 2 training pan 'engineer cap badge' for Officers and the RN have incorporated into all System Engineering Management Courses (SEMC). This is a significant advancement in the last six months and is indicative of MOD's commitment to the cause. Furthermore, it links to the Defence professionalisation strategy notably an individual's commitment to the profession and the benefits thereof[23].

MORE THAN JUST WIDENING THE TALENT POOL?

17. STEM and Social Mobility. A report by the Boston Consulting Group (BCG), Sutton trust in 2017 defines social mobility as 'breaking the link between an individual's parental background and their opportunities to reach their full potential in terms of income and occupation. It is about better opportunities for each generation and making access to these opportunities fairer regardless of back ground'.[24] Although social mobility in the UK increased from a low base from the 1940s through to the 1970s, it appears to have stalled or deteriorated in terms of social class and income measures respectively.[25] The UK (along with the US) is one of the lowest performing countries for income mobility across the OECD,[26] where real wage growth has stagnated and income inequality grown. Millennials are likely to be the first generation in modern times to earn less than their parents. Large educational gaps remain and entrenched privilege continues in higher education, with students from lower socio-economic backgrounds far less likely to attend university. 'Access to education and job opportunities is an ongoing issue with continued evidence of opportunity 'hoarding' through networks, information asymmetries and social bias'.[27] Without concerted effort, social mobility could deteriorate further due to trends shaping the future of work be it the rise of disruptive technologies, demographics, structural changes to the labour market.[28]

18. Studies also reveal a statistically significant relationship between social mobility and productivity; notably that the gains associated with improved social mobility appear to be considerable,[29] albeit the full impact is likely to accumulate over a long period of time given that social mobility changes tend to occur slowly. Moving on from productivity to that of an economic perspective, it is widely argued that the UK's economic future depends on its ability to compete on a global basis in high value, innovative and knowledge-intensive activities. This in turn relies upon the availability of a highly skilled STEM workforce. In taking these perspectives together, it is argued that STEM outreach and its translation into STEM careers not only is an imperative to future economic growth, in doing so it also offers the opportunity to tackle some of the social mobility problems.

19. Social mobility is at the heart of Defence Youth STEM outreach, with individual single Services taking a considered and targeted approach. One aspect is where there are high Free School Meal (FSM) ratios alongside trans-generational unemployment within families. This is about working with STEM partners and industry, setting the context for school subject selection, enabled by careers awareness, leading to informed choices; an ambitious agenda. The RN are developing this from a Maritime Enterprise perspective. The RN's contribution to social mobility is most acutely exemplified in its STEM apprenticeship and undergraduate training. every technical specialisation provides a level 2 qualification through initial specialist training (phase 2) and consolidation in the workplace (at sea). The career path is such that technicians can go on to complete level 3 and foundation degree qualifications within 10-12 years of joining the RN, enabling Engineering Council registration as an Engineering Technician (Eng Tech),' stepping up through senior supervisory roles to that of management accordingly. Engineer Officers require a first degree to carry out their initial roles at sea after which they are eligible for registration as an Incorporated Engineer (IEng). The career path is such that they can progress quickly from middle up to senior management roles, with many having undertaken Masters level education within the Service and becoming Chartered Engineers (CEng). Almost a third engineer officers will have started life on the 'lower deck' as a rating serving an apprenticeship as a technician. This translates across into industry where many will then leave the RN following 20+ years of service. This vignette demonstrates the RN's social mobility credentials, with all re-joining civilian society in a different place from when they left it.

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[23] Qualitative evidence to date shows how engineers engaged in youth STEM engagement have been inspired by their work to 'inspire the next generation' increasing their self-worth as well as contributing to their professional development.

[24] Boston Consulting Group, Sutton Trust, July 2017. 'The State of Social Mobility in the UK'

[25] Bukodi et al 'The mobility problem in Britain: new findings from the analysis of birth cohort data, 2015.

[26] Organisation for Economic Co-operation and Development

[27] Boston Consulting Group, Sutton Trust, July 2017. 'The State of Social Mobility in the UK.'

[28] Ibid

[29] The relationship between social mobility and productivity – Source: Orexa analysis

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FUTURE AMBITION

20. Defence is to deliver Youth STEM outreach in a fully coherent, integrated manner through its STEM partners with an initial review on status by Oct 2019. This is to be underpinned by a resilient management information system with baseline metrics, presenting a recognised Youth STEM engagement picture for Defence. This system is to have seamless accessibility to the STEM partners with Initial Operating Capability (IOC) by December 2018 and Full Operating Capability (FOC) by December 2020. On the STEM Ambassador front, the intent is to have Defence tailored induction training introduced for all Armed Forces (AF) engineer officer phase 2 training and Civil Service engineer under-graduate (& graduate) schemes by January 2019. This is to be followed by a similar introduction to apprenticeship schemes by January 2020. The strategic ambition extends itself to teacher CPD building on the initial work to date, looking to have initiated CPD programmes across all four Services, with the RN playing its part in the use of military establishments and dockyards to provide that CPD Maritime engineering context. Roll out is to be conducted in 2019 and reviewed in late 2020. Threaded throughout is the ambition for further collaboration with the Defence Enterprise and Cross Government, enabling consolidation, coherence and better co-ordination across a busy STEM outreach landscape.

CONCLUSION

21. The UK faces a strategic challenge against the predicted shortfall in engineer skills, demanding concerted action and strategic patience in what is a 'long game'. A clarity of purpose and coherence of approach is required throughout, with arguably a consolidation of initiatives if the challenge is to be addressed successfully. 'One size' does not fit all, necessitating a multi-facetted approach to this strategic issue. Once such approach is that of Youth STEM engagement which seeks to ensure that the talent supply pipe remains flowing sufficiently from early years into early careers to meet and sustain the UK demand. The MOD fully embraces this and has adopted a strategic approach to Youth STEM engagement, building alliances across Government, Industry, the Professional Institutions and schools, as well formalising strategic partnerships with key UK National STEM delivery charities. The MOD STEM engagement programme is ambitious following launch of its strategy in 2016, with the need to widen the talent pool (from which then to recruit) in assuring the future sustainability of Defence outputs. This approach goes much further than merely talent management, reaching right into the heart of the UK social mobility agenda. Such an approach is very much mirrored in the Royal Navy, with opportunity for further collaboration in this respect with the wider Maritime engineering enterprise. The potential benefits are manifold but as alluded to above some will take time to materialise ranging from increased pupil take up in technical subjects to that of translation into STEM careers. Other benefits are more immediate ranging from the wellbeing of pupils to that of the workforce who have become inspired themselves through their work to 'inspire the next generation.' Against such a backdrop, where does the rest of the Maritime sector sit within such a strategic imperative; is the activity sufficiently resourced, targeted and measurable and if yes is the sector confident that there are no cold spots? If the answer to either question is no, then what does the sector and the individual corporate entities therein need to do in response?

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