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Defence Industry Skilling and STEM Strategy

Engineers Australia submission

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Introduction

About Engineers Australia

Engineers Australia is the peak body of the engineering profession. We are a professional association with over 100,000 individual members. Established in 1919, Engineers Australia is a not-for-profit organisation, constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community. Engineers Australia represents the engineering team, comprising Professional Engineers, Engineering Technologists and Engineering Associates.

About this submission

This submission introduces some baseline data to help the government understand the size of the potential workforce, identify some cohorts of engineer who may be underutilised, and potential shortages. It explores issues important to grasp in any plan to build a bigger domestic workforce, and introduces skilled migration with its benefits and risks. It introduces a mechanism for helping to ensure Australia has a high quality engineering workforce that attracts the best and places appropriate controls on the work of the engineering team working at their various levels of competence. Finally, short responses to the five specific questions posed in the discussion paper is provided.

Contact details

To discuss the issues raised in this submission further please contact Jonathan Russell, National Manager for Public Affairs, on (02) 6270 6565 or JRussell@engineersaustralia.org.au.

The existing workforce

The Defence Industry Skilling and STEM Strategy will need to be clear about what sorts of skills, at what level and in what quantity is needed. This will define the scope of training, retraining and migration programs.

The engineering team is an essential component of the defence industry workforce, and engineering is a profession for which STEM skills are fundamental. To form a defence skills strategy, it is important to understand some of the numbers that explain the foundation on which a larger defence-related engineering workforce can be built.

Engineers Australia notes the intention by Defence to undertake a Defence Industry Skills Survey. To assist respondents to this survey, particularly in terms of the enabling engineering disciplines, provision of data on expected levels of investment through the Defence Integrated Investment Plan and expected timings across each of the sectors as well as the nominated sovereign capability domains will be necessary.

Information available in the Defence Industry Capability Plan lacks the level of fidelity required to undertake a thorough analysis.

Workforce shortages, as well as reducing university entry and completions in enabling disciplines, are already evident for a number of the sovereign capability domains identified in the Defence Industry Capability Plan. This is in fields such as electronic, electrical and software engineering and naval architecture, which will affect the advanced signal processing capability in electronic warfare, cyber and information security, and signature management technologies and operations and Continuous shipbuilding program (including rolling submarine acquisition, sovereign industry capability priorities.

The size of the existing engineering workforce and its composition also varies from state to state. State variances in available engineering workforce would therefore need to be considered when making decisions to recruit or locate work in any particular state.

In addition to addressing the defence industry workforce, the size, experience and capability of the Department of Defence workforce will also need to be addressed. Lessons learnt from previous programs indicate that an

inexperienced engineering team within defence, particularly during the design phase, usually results in costly rework and schedule delays.

STEM in schools, university graduates, and new bodies like the new Naval Shipbuilding College are essential to get right and will deliver results for the five-plus year phases. The lead time from university entry to a qualified engineer at the 'Chartered' level is typically 10 years. In the meantime, there is a relatively small pool of qualified and experienced workers available and therefore a risk that major participants will start competing heavily for existing workforces. If not managed well, there will likely be cost blowouts with increased staff wages and staff churn (much as we saw in the mining boom) plus schedule delays. This will most certainly have an effect on current sustainment operations and therefore defence capability.

Size of the Australian engineering workforce

The following numbers are drawn from Engineers Australia analysis of the 2016 census and includes some comparison with data from the 2006 and 2011 census.

From 2016 census data there are 329,957 engineers in the Australian labour force (this includes all engineers with at least an associate degree or advanced diploma in engineering). This compares with 263,880 in 2011 and 200,621 in 2006.

Just 6,177 engineers self-identified as working in the defence sector. Of these, only about 400 were in the private sector. This means that most engineers who work in the defence industry identify themselves in other ways. For example, as working in the manufacturing or consulting sectors. This demonstrates the difficulties in making definitive estimates for the number of engineers working in defence-related roles.

The ABS-defined industries likely to be most relevant to the defence industry are "Professional, Scientific and Technical Services" and "Manufacturing". Respectively, at the 2016 census these sectors had 62,836 engineers (inclusive of 16,358 in the "computer systems design" subsector), and 38,803 engineers.

The number of engineers in the consulting sector is rising, though the proportion of the engineering workforce who work in that sector is falling. For the manufacturing sector, both the number and the percentage share of all engineers is falling.

Given the stated scale of planned Defence investment, and the current size and mix of the Australian engineering workforce, it is likely that, at least in the initial years, defence and defence industry will be more reliant on skilled migration and/or the conduct of design and initial production work to be conducted overseas if the schedules contained within the Defence investment plan are to be achieved. Challenges associated with this are discussed in a later section.

Overseas-born engineers

It is noteworthy, due to difference in scale to other professions and the community at large, that 58.5% of the Australian engineering workforce is overseas-born. Just 39.6% of people working in other similarly-qualified occupations were overseas born in 2016. Looking again at engineers alone, in 2011 the proportion was 53.9% and in 2006 it was 48.4%.

The fact that overseas-born engineers are overrepresented in the unemployment figures is of concern. At the 2016 census, Australian-born engineers had an unemployment rate of 3.7%, compared with 7.6% for those born overseas.

What this data shows, however, is a cohort of engineers who potentially present a large pool of untapped talent. In determining its skilling strategy, government could develop ways to better engage new migrants in the defence-related workforce.

It is acknowledged that there may be issues related to security clearances for non-citizens, and this will need to be addressed as part of any plan to engage those in Australia as permanent residents in transition to citizenship.

Female engineers

Engineering is not known as a gender-diverse profession, and indeed the percentage of women in the engineering profession is low, at 13.6%. However, the numbers involved are nonetheless significant, at almost 45,000.

The unemployment and workforce participation rates for Australian-born women are comparable with Australian-born men. The situation for overseas-born women is very different. For example, in 2016 they are much less likely to be in the labour force: 81.1% participation for the Australian-born, compared with 70.8% for the overseas born. Of those women who are in the workforce, they are much more likely to be unemployed: 3.8% for Australian-born women, and 11.3% for overseas-born women.

The causes for this are not known, but it again identifies a cohort of engineers who are currently underutilised and they could form a large pool of potential talent.

Retraining and relocation

There will be people who can be retrained from the mining or auto sectors (amongst others). However, many have already transitioned to other careers, many do not have suitable backgrounds, and while some defence industry roles are relatively easy to retrain for some, submarine work for example, is much more specialised.

In terms of finding suitable workers willing to relocate to defence industry hubs, experience through the mining boom shows that it is very hard to convince an Australian to relocate. There will need to be very strong incentives to make this happen. Care will be needed to stop costs blowing out if the incentives are predominantly money-based.

An impediment for engineers to move is the risk that the defence-related work may exist in peaks and troughs. A long-term defence industry policy and support for defence industry to succeed will go a long way to reducing this factor, though it needs to be acknowledged and hesitancy by individuals to relocate due to the risk of career/work intermittency needs to be frankly addressed.

With this in mind, it is worth considering where engineers currently live. The distribution of qualified engineers throughout Australia is broadly in line with the gross product share of jurisdictions, modified by the effects of the resources boom. Within jurisdictions, the distribution of qualified engineers varies widely but a common feature is heavy concentrations in capital cities.

For example, in 2016 NSW accounted for 32.9% of the overall Australian engineering labour force, compared with 32.7% of the nation's gross product. Of these engineers, 80.4% are located in metropolitan Sydney.

Closer examination of this data to the sub-regional level will help the government identify the location of concentrations of qualified engineers and, hopefully, those with skills relevant to the defence industry.

Finally, the discussion paper notes that a survey will be undertaken to assist the development of the skills strategy. It is recommended that a workforce motivation survey be considered, to understand what drives engineers to change their planned career path and location.

Entry-level education

A focus on STEM studies in schools, university output, and the operations of new bodies like the new Naval Shipbuilding College are essential to get right and will deliver results for the five-plus year phases.

Debate on school funding, curriculum, teacher quality and student performance are a mainstay of public discourse. For the government's vision for a domestic defence industry to succeed, however, some short term action is required whilst any other macro reforms are implemented.

The discussion paper notes the COAG Education Council's National STEM School Education Strategy. Engineers Australia supports this strategy and urges all Governments to appropriately fund and implement the Strategy. The defence and industry portfolios of government should see themselves as stakeholders in this work and could consider ways to support it.

One aspect of the Strategy with which Engineers Australia has some involvement is the STEM Partnerships Forum. In April, the Forum released its final report of an inquiry into optimising STEM industry-school partnerships. There is scope for the defence sector to assist with implementing some of the report recommendations. For example, Recommendation 1 on skills needs mapping, Recommendations 4, 7 and 8 relating to industry engagement and, perhaps most importantly for securing quick gains in engagement with STEM-based studies and careers, Recommendation 6:

> *Governments and industry should work together to focus the narrative for primary and secondary students on how STEM skills and knowledge can solve real world problems. Having been motivated by real world problems, students should be introduced to the applicable subjects, skills and jobs that will afford them career flexibility as they contribute to meeting the needs of our future society. There should be particular effort to engage student cohorts underrepresented in STEM fields.*

Skilled migration

There is widespread acknowledgement that, in the early years of major defence projects, there will be a need to utilise overseas talent. The selection of such talent will require careful management.

As described in earlier sections, many who come to Australia fail to participate in the Australian labour market—especially women. This indicates that, in situation where skilled migration is necessary, there may be a need for greater use of employer-sponsored migration or better targeting of independent migrants with the right skills and experience.

For the latter, some fundamental changes may be required to the skilled migration framework. This includes changes to the points-based system for determining the most suitable candidates for independent skilled migration.

If large numbers of employer-sponsored migrants are needed there is a risk that, in the race for sufficient talent, quality controls or checks on potential applicants may fall short. At present, individual company human resources teams or hiring managers hold responsibility for verifying the claimed qualifications and experience of applicants. Especially for small or growing companies, skills in performing such verification may be limited. It is recommended that third-party verification be established, similar to what is performed for applicants for independent skilled migration visas.

Professional bodies like Engineers Australia have established schemes in place to conduct verification of applicants. This presents an opportunity to introduce a solid risk management regime.

Further to the verification of basic qualifications, industry-wide adoption of a capability framework based on registration of engineers and Chartered status is highly recommended. See the following section for more details.

Finally, it must be noted that over-reliance on skilled migration leaves Australia open to the risk of competition for talent from other nations with strong defence programs. It also reduces the effect of efforts to build a strong local workforce. At all times, the goal should be to develop a solid population of engineers capable of supporting the defence industry, with skilled migration and adjunct to such efforts.

Capability framework

Engineers Australia recently worked with defence to develop an internationally recognised engineering capability framework for aviation-sector defence personnel. The program has many benefits that are outlined below. It is recommended that consideration be given to rolling such a capability framework out to all engineering streams within defence, and that defence industry be required to demonstrate their adherence to similar programs. Doing so will raise the bar for defence industry engineering skills and enhance the nation's position as a centre of expertise for engineering and innovation in defence.

The following material is based on information first shared in a Defence Aviation Safety Authority newsletter in March 2018.[1] As part of their ongoing employment in defence, senior aviation technical personnel are recognised by

[1] *ADF technical personnel will soon be receiving recognition from Engineers Australia meaning their skills will be*

Engineers Australia as meeting and in some cases exceeding the international benchmarks of competency in the Washington, Paris and Sydney accords (the international accords that set the standard for engineering qualifications).

This program not only validates their skills in the wider Australian civilian aviation community, but also provides the necessary competency assessment for key aviation appointments in defence, and provides the international recognition that is needed to support modern aircraft under global support arrangements.

There are a number of reasons why defence is moving towards an internationally recognised structure for its technical personnel. Global credibility and technical rigour are vital in an age of joint operations and global support arrangements. It also links to the Defence Aviation Safety Regulation (DASR) which aligns Australia with a global convention on military airworthiness used by around 30 other nations. Another advantage is the ability to allow blended workforces on both civil and defence aircraft within the one commercial entity – supporting the emergence of a single aviation sector in Australia.

Based on international standards, receiving Chartered status through Engineers Australia means having attained the qualifications and experience to be considered professional, that is, able to carry out tasks in a specialisation, exceeding expectations and behaving with professionalism and respect.

Areas of Practice are subgroups of the engineering profession that practitioners align their skills and work activities with. This can be influenced by formal, informal education and work experience. Members can seek to be Chartered in one or more areas of practice.

As stated earlier, expanding this program to all areas within the defence engineering team, and requiring similar programs to be implemented within the private sector, will greatly enhance the reputation and capability of the domestic defence sector engineering workforce.

Complementing the framework described above that is based on Chartered status, Engineers Australia recommends the greater use of registration for engineers who are suitable experienced to work independently, but not yet at the level required to be Chartered. Registration recognises that someone has the skills and experience to competently provide engineering services in a particular field, and without supervision.

Together, these two systems (registration and Chartered) lead to the following framework for engineering capability: junior engineers working under supervision, registered engineers working independently within their area of competence, and Chartered engineers acting as professional leaders.

It is noted that there is rarely a statutory requirement for an engineer to be registered. Engineers Australia and other organisations do however provide a voluntary registration scheme that the defence sector is encouraged to embrace. Doing so is a sound risk management tool and will form the basis of a comprehensive talent capability framework.

Responses to questions posed in the discussion paper

What are the current and emerging skills needs and issues across the defence industry workforces in meeting Defence capability needs?

From publicly available data current emerging skills needs and challenges are likely to be in the fields of naval architecture, electrical and electronics engineering, software engineering, communications, mechatronics, complex systems integration, autonomous vehicles, cyber, artificial intelligence, autonomous vehicles, systems engineering, systems integration and advanced manufacturing. These are all areas where there are known shortages or where the number of students commencing and completing relevant degrees is declining.

How can government, industry and the education/training sector work together better to manage competing demand for skilled labour and ensure adequate supply to Australian defence industry?

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recognised internationally, Defence Aviation Safety Authority. Accessed 22 May 2018 at: http://www.defence.gov.au/DASP/Docs/Media/DESTRAArticle-DefenceEngineerandSeniorTechnicianAgreement-21Mar18.pdf

Defence participation in the STEM Partnerships Forum, including investment in relevant initiatives, would assist with a whole of government, academic and industry approach and help avoid competition for scarce resources and potential cannibalising of workforces from other sectors.

What current and prospective initiatives and investments can have the greatest impact on meeting defence industry workforce and skills requirements?

Requirements for Australian Industry Capability Plans as part of tendering processes could include guidance on STEM requirements for each sector that will enable the delivery and sustainment of the engineering workforce, for those capability areas, including STEM plans to not only utilise existing engineering workforce but to grow that workforce in a sustainable fashion, with key milestones against which payments would be linked.

What are the challenges/barriers for individuals in turning qualifications in STEM into defence industry careers?

Improve attractiveness for females to undertake engineering as well as work in Defence through education programs that provide community understanding of the breadth and nature of defence engineering opportunities. Engineers Australia would welcome the opportunity to work with Defence in partnership with the Engineers Australia STEM strategy. Skilled migration issues are as outlined above.

What specific defence industry-centric approaches are required and why?

Defence needs to have a plan in place to explain its future skills needs to Australian educational institutions, and work in partnership to develop suitable courses and provide opportunities for experience for students and realistic defence-related projects to assist in the development of practical skills relevant to defence work. This could be done through engagement with Engineers Australia and its networks.

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