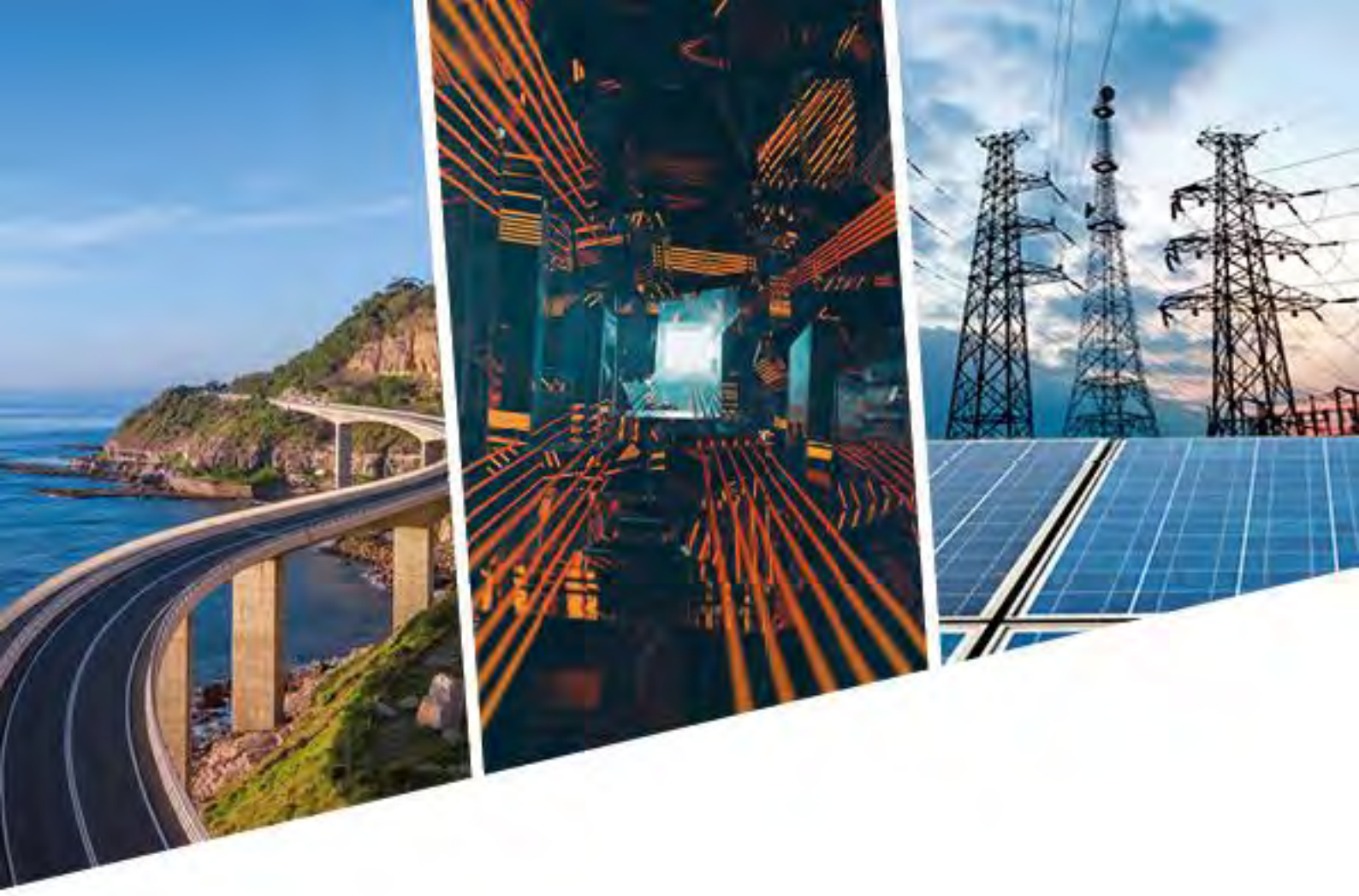

ENGINEERS AUSTRALIA

CELEBRATING OUR CENTENARY

Naval Shipbuilding Strategic Workforce

Submission in response to the discussion paper

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1. Introduction

1.1 About Engineers Australia

Engineers Australia is the peak body of the engineering profession. We are a professional association with about 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.

1.2 About this submission

Section 2 of this submission provides material relevant to the following key issues:

- Domestic supply of engineers
- Overseas-born engineers as a skills supply option
- Workforce diversity
- Education and training
- Key engineering disciplines
- Design workforce
- New vessel construction and sustainment

Section 3 of the submission includes responses to a selection of the 'Suggested Discussion Questions'.

1.3 Contact details

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

2. Key issues

The vision to establish a long-term, continuous national naval shipbuilding enterprise is strongly supported by Engineers Australia. The shipbuilding program must be sustained so that those who invest in the specialist skills have continuity of employment. A long-term commitment by successive governments to this vision and the program, which has the potential to smooth out the steep peaks and troughs in shipbuilding activity that has made sustaining a naval shipbuilding industry so difficult in the past, is essential.

Historically, many workers who acquire valuable skills through working in this industry are forced to seek employment elsewhere when projects wind down. Those who find employment in non-defence industries often don't return to naval shipbuilding, which leads to much expense in training new people on a cyclical basis.

Continuous shipbuilding will have a positive effect on engineers moving to locations where shipbuilding will be done, attracted by continuity of employment and long-term career prospects.

The discussion paper recognises that the national naval shipbuilding enterprise is wide in scope; it covers the design, construction, operation and sustainment of Australia's new warships. It also covers the development of infrastructure to support naval shipbuilding, such as the upgrades to the Osborne precinct in South Australia. It is accordingly important to recognise that engineering is a vital capability in design, construction, and sustainment and in the development and sustainment of infrastructure and capabilities to support the fleet.

2.1 Domestic supply of engineers

Engineers Australia analysis of the 2006, 2011 and 2016 census shows that the number of engineers working in the shipbuilding and boatbuilding industries increased from 753 engineers in 2006, to 1,011 in 2011 and grew only slightly to 1,016 in 2016. Engineers working in these industries are increasingly concentrated in New South Wales and South Australia.

In 2016, almost 37% of engineers working in this industry were in South Australia, which shows how important this industry is to South Australian engineers. At the same time, the numbers in Victoria fell significantly from 2011 to 2016, and the state's share of these engineers has dropped from 18% to just 4%.

Western Australia is a third state with a significant share of ship and boat building engineers. In 2016, the state held 20% of the national total. The WA shipbuilding and marine construction industry is important because many naval ships and boats are maintained and modified at the Common User Facility at Henderson. The situation in Western Australia is especially noteworthy because the sector will compete for labour with the mining industry, which has the potential to pay higher wages and thereby make it more difficult for naval ship builders to attract and retain skilled workers.

Looking at the engineering profession more broadly, the census in 2016 appears to have coincided with a low point for the engineering workforce in terms of both low supply of engineers and even lower demand for their skills. Analysis of more recent data from the Australian Bureau of Statistics (ABS) Survey of Education and Work indicates that, in 2017 and 2018, demand and supply of engineers across all industries and disciplines has begun to recover.

It should be noted that while in those two years performance is above the long-term trend, it is not yet clear if it is an enduring change. For example, engineering job vacancy numbers show that national growth in demand for engineers to work in engineering roles slowed markedly in 2018, most notably in NSW where there has been very little growth since January 2017.

One area of particularly good news relates to the need for communications engineers and the prominence of cyber-related technologies. Computer system design engineer numbers have consistently grown from about 9,000 in 2006 to more than 16,300 at the time of the 2016 census. Growth is uniform across jurisdictions (NT excepted). Most are in NSW and Victoria, followed by Queensland and Western Australia, and about 82% work in engineering-specific occupations. This growth is likely to be driven by skilled migration. This growth means that the IT-related capabilities via the Computer Systems Design engineer workforce is a capability strength for Australia.

For the most recent Engineers Australia analysis of engineering job vacancy trends, visit the organisation's website here: https://engineersaustralia.org.au/Government-And-Policy/Statistics.

The ebb and flow of supply and demand for engineers is important to consider, because it influences the attractiveness of the profession to young people. If young people do not choose to study engineering at university, it has a profound effect on longer term supply.

Data on engineering student numbers at university is therefore cause for alarm. The overall population of students in engineering courses peaked in 2015 and has since fallen. Completions of entry level courses rapidly slowed two years ago and in 2017 fell for the first time in a decade. With an effect that won't start to be fully felt for a few years (when new students start to graduate) commencements of domestic students in university engineering courses have fallen since 2013, a trend that has affected both entry level and post-graduate courses.

For more details, see the Engineers Australia report, "*Australia's Next Generation of Engineers*," available online at https://bit.ly/2Nwxbth.

Once engineers do enter the workforce, they are very likely to live and work in metropolitan NSW and Victoria. At the time of the 2016 census, 60.7% of the engineering labour force was in those two states. Just 5.5% was in South Australia, and 13.8% was in Western Australia.

It is widely acknowledged that Australians are not highly mobile, and there will need to be very strong incentives to encourage workers to move to the ship building locations. Care will be needed to stop labour costs becoming too high if the incentives are money-based.

2.1.1 APS engineers

While the paper indicates that it has a Naval Construction Australian Public Service (APS) recruitment strategy, the discussion paper does not articulate how the Department of Defence will address its immediate need for highly skilled engineers to oversee the shipbuilding projects. Nor is it clear how engineering graduates will attain the necessary skills to undertake their roles.

Engineers Australia members have advised that the department has had considerable leakage of its experienced APS engineering workforce over the last three to five years and has also seen a reduced intake of engineering graduates over the same period. Engineers Australia's experience indicates that graduates would typically need around five years working with qualified and experienced engineers to attain the necessary skills to be considered competent to undertake complex engineering tasks.

In naval shipbuilding this would ideally include graduates and young engineers being seconded to the ship design and build companies undertaking design and production planning. This is to gain experience in design processes and systems and production planning not normally undertaken by Defence so that they may acquire the skills necessary to effectively manage contractor performance. Attainment of Chartered Engineer status is also recommended.

2.2 Overseas-born engineers as a skills supply option

The evidence below demonstrates that here is a need to focus on developing more engineering capability through the traditional school-to-university pathways. It should also be noted, however, that the minimum time to turn a school-leaver into a practicing professional engineer who does not require supervision is about nine years: four years of study, followed by about five years of practical experience. Therefore, for a sector that has a current shortage and significantly increasing demand, more efficient use of skilled migration options is necessary.

The discussion paper notes that industry is making use of the Temporary Skills Shortage visa and Temporary Work (Short Stay Specialist) visa to fill key positions, particularly for engineering roles. The need for such short-term visa-based supply is obviously due to low numbers of suitably experienced workers in Australia.

Historically, as well as the short-term visa options, domestic supplies of engineers have been supplemented with permanent skilled migration. 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 at the time of the 2016 census.

Reliance on overseas-born engineers for long-term skills supply has limitations. For example, a requirement for a security clearance is often a barrier to entry to the defence industry for non-citizens. Engineers Australia research suggests that US export controls for military items means that those born in countries proscribed by the USA are unlikely to achieve a security clearance above baseline vetting. From 2007 to 2016, at least 18.5% of Australia's overseas-born engineers came from proscribed countries.

One further aspect that isn't often raised in discussion of skilled migration is that senior overseas personnel are likely to be bringing their families with them. The government should consider a more active role in assisting families to move to Australia.

2.3 Workforce diversity

The engineering workforce is incredibly diverse from a country-of-origin perspective. However, in terms of gender diversity, and the degree to which Aboriginal and Torres Strait Islander Australians become engineers, the situation is different.

Women are significant to engineering and there has been a 24.3% increase in their number 42,200 in 2012 to 52,700 in 2018. However, despite this good growth in number, the percentage of the engineering labour force that is female is not increasing and was stuck at about 14.6% at the 2016 census.

There is a very wide range of activities being done by Engineers Australia, governments and many others to increase the number of women who choose to study engineering and increase the number who stick with the profession over the long term. Areas of focus include:

- Encouraging more school-aged girls to study the preparatory subjects of advanced maths and physics. In 2015, just 6% of girls studied those subjects at year 12.
- Motivate more women to choose engineering as a career.
- Changing workplace and professional cultures to ensure that they meet modern expectations for inclusiveness.

Analysis of the 2016 census shows that the number of Aboriginal and Torres Strait Islander engineers has increased strongly since 2006. In 2006 there were 332 in the labour force, which grew to 852 by 2016. However, this means that just 0.3% of the engineering labour force identified as Aboriginal or Torres Strait Islander.

To increase numbers of Aboriginal and Torres Strait Islanders who become engineers, Engineers Australia has created an Indigenous Engineers Group to help identify and assist indigenous engineers with mentoring and networking opportunities. Engineers Australia is also entering a Memorandum of Understanding (MOU) with James Cook University to support indigenous engineering programs within the university and beyond. As part of this MOU, Engineers Australia will launch an Indigenous Engineers Scholarship program which will encourage not only indigenous students, but female indigenous students, into engineering by way of scholarships. The organisation is also in the process of forming an indigenous action group to address critical issues in this area at industry, state and federal government levels.

2.4 Education and training

There is an absence of workplace opportunities for graduate engineers to obtain professional practice experience to enable them to be taken on as experienced engineers. Past practices in term of having engineering cadetships and work experience periods embedded into engineering courses have disappeared largely due to employers not being willing to support them on short-term cost grounds. This leads to the age-old rhetoric around graduates not being job-ready.

An option is to introduce some form of work placement program that would allow graduates to gain experience and be retained in the Australian workforce longer, perhaps through bonded cadetship arrangements. This would help reduce Australia's reliance on experienced migrant engineers. Given the major investment in this long-term and continuous national naval shipbuilding enterprise, it should be possible to find ways to fund such essential schemes.

Engineers Australia is a member of the Naval Shipbuilding Industry Reference Committee (IRC) and these issues were raised by Engineers Australia at the IRC. Although the Department of Education and Training has highlighted that this is not something normally covered by an IRC, it is argued that the Naval Shipbuilding IRC is not ordinary and that, if we continue with the traditional narrow educational responses, nothing will change.

2.5 Key engineering disciplines

Key disciplines that do not appear to be addressed in the discussion paper, particularly for the longer term, include naval architects, systems engineers, communications engineers, combat systems engineers, sensor, weapons and radar systems engineers.

The categories identified in the discussion paper, namely engineering, logistics, procurement and contracting and program/project management positions, are broad and therefore are not particularly useful for workforce planning. Even the critical categories of communications and marine engineers and naval architects identified in the paper need to be expanded into categories that are more specifically related to naval ship building and other defence systems, such as communications.

For example, system integration is critical to the operation of the ship or submarine and therefore to the success of the project. It requires knowledge and understanding of individual sub-systems and how they interface with each other to work effectively as a complete system. Systems integration is a part of the design and construction phase, but it also is the foundation for identifying and solving problems that arise throughout the operational life of the asset.

2.6 Design workforce

The paper does not appear to address the long term need for engineers to be undertaking design to enable maintenance of a sovereign shipbuilding capability.

The discussion paper does state that 'a sovereign and continuous shipbuilding industry relies on Australian universities and firms doing original, innovative research that will flow into future vessels and upgrades, underpinned by strong industry-

collaboration.' However, while universities do undertake valuable Research and Development (R&D), Engineers Australia members have advised that most R&D that is relevant to Defence projects is done by the DST, with a significant contribution by the CSIRO.

Experience with past projects is that by the time a contract has been awarded for design and construction there is little scope to introduce changes based on Australian R&D. However, Australian R&D can be very valuable in solving problems that arise later in the project or to produce enhancements to the original equipment or system.

Therefore, it is important that Australian scientists and engineers are involved in design at early stages of the project to gain an understanding of the technologies employed. It is also important that they have access to the intellectual property needed to undertake further R&D.

Australian engineers would need ongoing work to not only address changes to the baseline configuration arising from normal sustainment activities but also to exercise those design skills, acquired during the acquisition phase, in the evolution of designs to meet future Australian (and ideally overseas or other customer) needs. Australian engineers would need access to Original Equipment Manufacturer (OEM) design models and have the rights to use those models to develop evolved designs.

While the paper pays particular attention to the production workforce, less attention is placed on design, evolution of designs, system integration, test and evaluation and operations and maintenance. This would probably require Australian engineers to work within the original designer workforce, overseas if necessary, to get the required understanding. It would also almost certainly require engineers from the overseas designers to spend time in Australia working with Australian engineers on implementation of the design.

2.7 New vessel construction and sustainment

The discussion paper notes that 'The bulk of the growth in the naval shipbuilding workforce will come from the construction of Hunter class frigates and Attack class submarines. These two programs are anticipated to involve 2,600 direct jobs and 4,200 indirect jobs.' These are the projects that present the greatest challenges for workforce planning, primarily because of the greater complexity and advanced technology in these ships and submarines, and consequently the specialist nature of many of the jobs.

The paper also notes that 'In the early stages of the work on Hunter class frigates and Attack class submarines, the key demand is for experienced workers with the skills needed for design and prototyping. Over the next 12 months, naval shipbuilding firms will be recruiting engineers, naval architects, project managers and front-line supervisors with at least 10 years' shipbuilding experience. Currently shipbuilding firms report problems recruiting such employees in Australia.' This statement highlights a major challenge: finding and securing the necessary skilled and experienced people. There are not enough personnel with the required skills and expertise available in Australia at present, so some will have to come from overseas. There is insufficient time for Australians to develop these skills on-shore to meet the project timeframe.

The paper contains the statement '…more work needs to be done to capture and understand the workforce needs of the wider sustainment industry'. An initial comment is that there is no 'sustainment industry' *per se*. Sustainment normally flows from production and construction in the specific industries involved. Skills development and training during the design and construction phase must prepare a workforce for sustainment. Therefore, it is desirable that workers are long-term residents of Australia and not just in Australia for the design and construction phase.

3. Suggested Discussion Questions

3.1 Chapter 2 questions

How should Defence capture the workforce needs of supply chain firms, especially smaller firms?

It is recommended that the Department of Defence work with the prime contractors (Primes), to identify companies involved in the supply chain, their intended role in sustainment of the platforms, and their likely involvement in evolution of the design, and seek input from those companies on workforce needs to sustain the workforce. In particular, determine whether there are likely to be peaks and troughs in workforce requirements that are driven by the naval shipbuilding plan. Identify

opportunities for smaller firms to work with the Primes to have their products or services incorporated into the Prime's global supply chains supporting other customers.

The workforce needs of individual supply chain firms can't really be determined until firms know what work they will be required to do. However, the prime contractors and the major subcontractors should be able to identify items that will be bought in and therefore will be supplied by companies in the supply chain. Defence should therefore seek this information from the prime contractor as early as possible. For example, if the prime contractor indicates that it will buy in pumps and valves and would look for Australian manufacturers that could supply these items, the Department of Defence could then survey potential Australian suppliers to determine whether they needed to develop their workforce to meet this requirement. If it was likely that Australian companies would have difficulty obtaining workers with the necessary skills, then the department could act to help rectify this problem.

A major obstacle to Australian companies undertaking work like this is access to the technology, know-how and intellectual property to enable their workers to develop the necessary expertise. Often this is only available from the OEM. Therefore, it is necessary to put in place arrangements for Australian companies to have access to the technologies, know-how and Intellectual Property and training to enable them to perform the work. The Department of Defence has a very important role to play in putting these arrangements in place because smaller firms often lack the clout to be able to do it.

Experience shortages

The discussion paper notes the difficulty in recruiting sufficiently skilled and experienced engineers to work on the design of future vessels. Shipbuilders have reported that they face difficulty recruiting a small number of employees, especially people with around 10 years' experience in naval shipbuilding. While employees with transferable skills can be retrained to work on the later phases of naval construction, the early phases require a core of highly skilled workers with prior experience in naval shipbuilding. Navy Technical Regulations also require engineers with 10 years' experience to sign off on various aspects of shipbuilding work. An experienced core of employees will also be the ones to train and develop other new recruits, particularly those who are new to naval shipbuilding.

These issues are a major concern. Having highly skilled and experienced engineers working on these complex shipbuilding projects is vital to lay the sound foundations on which a successful project depends. It is recommended that the Department of Defence work with the prime contractors and major subcontractors to ensure that experienced engineers with the required expertise are employed on the projects. This must be done at the very earliest stages, especially design and project planning. The likely competition for these skilled and experienced engineers means that the Department and industry might have to be innovative in providing enough incentives and rewards to attract and retain these people.

3.2 Chapter 3 questions

How can Australia shape its employee value proposition to increase global attraction? What is unique about the Australian continuous build?

By world standards, Australia is a very attractive place to live. The continuous build program is not unique—major shipbuilding nations have been doing this for decades—but it is new to Australia. Successive federal governments must support this policy if they are to continue to attract skilled people residing overseas to move to and remain in Australia. This would also help to achieve long-term involvement in the shipbuilding industry by Australian workers.

3.3 Chapter 4 questions

To what extent do funding arrangements in the Higher Education and Vocational Education sectors support the specialised requirements of naval shipbuilding, including bridging programs to support transitions to other sectors?

To aid supply in the longer term there may be merit in funding assistance for bridging programs for high school students who did not undertake the science and maths subjects that are *de facto* prerequisites for entry to engineering studies at university. These usually would cover advanced mathematics and physics. This would be a longer-term strategy because of the time it takes someone to complete post-secondary bridging courses, undertake a four-year degree and then perform about five years work under the direction of experienced engineers to obtain the level of competence required.

Are there opportunities for greater international collaboration on workforce issues, for example, with the UK and Canada noting the selection of a BAE Systems Type 26 frigate variant by both those countries? Would this allow sharing of expertise and experience, instead of competition for key personnel?

While more investigation needs to be done to determine the feasibility of some form of collaboration with the UK and Canada, Engineers Australia supports the concept of posting Australian engineers to relevant organisations in the UK and Canada. This could be achieved through an exchange program. This would broaden the engineers' knowledge of shipbuilding and associated systems such as communications, weapons, and combat systems. For example, it might be possible for Australian engineers to be part of a team, together with members from the UK and Canada, working on the design of some elements of the ship that have much in common across the three national programs. This could have benefits beyond those of more efficient use of the available workforce; other benefits would include greater commonality which would lead to economies of scale and better long-term support of the capabilities.

A second opportunity is to provide automatic, or at least fast tracked, recognition of UK Defence security clearance for the equivalent level of Australian defence clearance. Engineers Australia members have advised that the current process for getting UK clearance recognised in Australia is time consuming and uncertain.

It is possible for government agencies and prime contractors to assist international staff relocate to Australia. Smaller organisations are less able to amortise recruitment costs across the acquisition program. It is currently cost prohibitive for much of the private sector to bring experienced staff from overseas because of the costs of relocation, family and accommodation allowances and other costs and the fact that the market is unwilling to cover those costs.

One of the most significant barriers is the significant delay in obtaining a visa and the fact that its granting is uncertain, particularly for the mid-career and most experienced staff. This means that the SMEs and services sector supporting the Department of Defence and Primes are unable to bring key staff to Australia. Consequently, they cannot be put forward for existing or emerging roles due to the significant time lag of nine, or more, months between identifying the individual and them becoming available. The speed of visa processing therefore requires attention.


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