



## **Australian Nuclear-powered Submarines: making Australia's naval dreams a reality**

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ROYAL AUSTRALIAN NAVY

# SEA POWER

## SOUNDINGS



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### Introduction

Australia's ambitious decision to transition from a diesel-electric submarine (SSK) fleet to a nuclear-powered submarine (SSN) fleet is a significant advance in naval capability that will come with many challenges. Without an adequate crew and good maintenance, a submarine is an expensive metal tube, and, at worst, a watery tomb. The provision of solutions to workforce, sustainment, and nuclear technical capability to achieve a successful capability transition are key challenges that the Royal Australian Navy (RAN) will face over the coming decade.



*HMAS Collins leads a Task Group formation while sailing in the Bay of Bengal as part of AUSINDEX 2019.  
Photographer: LSIS Jake Badior.*





### Workforce size

Not every SSN will need to be crewed simultaneously, as Defence operates its capabilities by rules of thirds: deployment rotation, maintenance, and deployment workups. The size of the future submarine workforce will be based on several factors including vessel crew size, and requirements for shore postings to enable rest, training, and professional development. Table 1 displays a comparison of the diesel-electric Australian Collins class submarine with the in-service SSN from the United States Navy (USN) and the Royal Navy (RN). There is a significant difference in both vessel size and crew numbers between an SSK and SSN. Given that Australia will develop its SSN with the US and UK, a theoretical-based assumption is that size and capability will be similar to that of the Virginia or Astute class. Based on the Astute crew, the crew size for an SSN Collins replacement will need to increase by approximately 260% per boat which leaves a significant task for the RAN in terms of augmenting Australia's submariner workforce.



*HMAS Rankin conducts helicopter transfers in Cockburn Sound, Western Australia, as part of Rankin's training assessments to ensure the boat is ready to deploy. Photographer: LSIS Richard Cordell.*



*Table 1 Comparison of Collins with Virginia and Astute class submarines*

Submarine Class	Submerged Displacement	Length	Beam	Crew Size (% size compared to the Collins class)
Virginia Class (USN)	7,900 tonnes	115 m	10 m	134 (319.05% larger)
Astute Class (RN)	7,400–7,800 tones	97 m	11.3 m	110 (261.90% larger)
Collins Class (RAN)	3,350 tones	78 m	8 m	42

### Existing ADF recruitment

The 2019–20 Defence Annual Report highlighted that naval-related occupations such as submariners require targeted recruitment and retention to counter the diminishing submariner workforce.<sup>1</sup> Defence has employed a range of methods to broaden the submariner talent pipeline, including tours of Navy ships; science, technology, engineering and mathematics partnership programs; fitness preparation programs; and a national competition that rewards applicants with a tour of a submarine.<sup>2</sup> Raising the public profile of submariners is challenging – after all, it is called the ‘Silent Service’ for a reason. Australia can look at the ways in which the UK is able to raise the profile of the submariners, while not compromising the security restricted environment.

### Royal Navy recruitment

The RN and RAN both advertise training, travel, financial incentives, and crew culture as key incentives for joining the submariner workforce. RAN recruitment lacks the hook that differentiates submarine service from the rest of the fleet. The RN has differentiated submarine service from the rest of the fleet and captures public imagination through nomenclature for the force, and uses the highly classified nature of service as a recruitment drawcard. The terminology by which the RN refers to its submarine force is crucial, referring to its ballistic missile submarines (SSBNs) as the *Protectors of Peace*, emphasising how their nuclear deterrent keeps the nation safe.<sup>3</sup> RN recruitment highlights the highly secretive nature of nuclear submarine service, with recruitment websites showing loading text as redacted,<sup>4</sup> making the reader feel as though they are entering the world of a spy film filled with mystery and excitement.





*The Minister for Defence, the Hon. Peter Dutton MP, Minister for Defence Industry, the Hon Melissa Price MP, British High Commissioner Vicki Treadell, CMG, MVO, Chief of Navy Vice Admiral Michael Noonan AO, RAN with crew members of a United Kingdom Royal Navy nuclear powered submarine, at HMAS Stirling in Western Australia. Photographer: LSIS Richard Cordell.*

### **Australian recruitment opportunities**

Although Australia will not acquire nuclear weapons, the SSN will be Australia’s foremost organic strategic deterrent, and ADF recruitment marketing must reflect this fact. ADF recruitment must capture the Australian public’s imagination by highlighting the secretive and exciting nature of submarine service and linking it to an individual’s need for national representation. Highlighting past achievements of the submariner force should involve creating specialised submarine exhibitions and documentaries, which entice avid submariners to the uniform and a career of service.



*Royal Australian Navy Petty Officer Submarine Recruitment Manager Shane Kissick (centre) runs participants through a submarine simulator at Sea Power Conference 19, International Convention Centre, Sydney, 9 October 2019. Photographer: LCPL Brodie Cross.*

Defence should provide additional financial and historical resources, and declassifying, where possible, historical operations that enable the Australian War Memorial to tell the stories of service from Australian submarines. When poorly done, film and television can generate poor perceptions about the reality of service, and many sailors have anecdotally critiqued *Sea Patrol* on this. *Danger Close: The Battle of Long Tan* has shown that film can respectfully raise the achievements of the Army's personnel and their past achievements. The RAN should follow the Army's lead with Australian film and television, giving resources and advisers to enable compelling and faithful stories to be told.





### Operation and sustainment

Though there will be challenges with introducing a new nuclear submarine class, Australia's experience in submarine construction and maintenance positions it well to safely operate and sustain the non-nuclear components of the SSN. Without any experience operating an SSN fleet, Australia is presented with two options for the operation and maintenance of the nuclear power facilities (NPF):

1. Outsource the submarine maintenance to the country of manufacture, and rely on predominantly allied nuclear specialists to operate the NPF; or
2. Build Defence's ability to operate and sustain the NPF domestically through expanding Australia's nuclear workforce.

### Outsourcing and Australian sovereignty

Relying on allied operation and sustainment of the NPF allows Australia to avoid entering the highly contested debate around the use of nuclear power. Overseas sustainment leaves a critical element of the SSN capability dependent on our allies. Further to the logistical problem of travelling to US or UK facilities for maintenance, access to maintenance facilities and resources cannot be guaranteed in times of war. During conflict, an allied state may need to preference their own sustainment to ensure their own fleet's combat capability. There are few reliable ways to guarantee another state will ensure that Australia's SSNs are sufficiently sustained and therefore available when needed.

Overseas sustainment for the SSN would require the Australian public to accept a high level of strategic dependence and risk for what is a critical function of a navy. If Australia is entirely reliant on our allies to operate and sustain the linchpin of the SSN capability, the NPF, it cannot assure submarine availability.

The SSN can silently prowl the waters for six months at a time without needing to surface or refuel.<sup>5</sup> The SSN is a silent threat, difficult to counter in the vast ocean, that creates the fear in an adversary's mind that its attacking force could suffer unacceptable losses, thereby deterring the enemy's attack. Submarines undergoing maintenance aren't a threat as they can be easily found and destroyed. Submarine availability is important as it means they can be deployed without the adversary knowing, thereby triggering the deterrent chain.





Former Prime Minister Kevin Rudd and academics like Dr Andrew Carr have classified Australia as a middle power.<sup>6</sup> Unlike a greater power, like the US, Australia, as a middle power must accept a certain level of strategic dependence. Australia has historically been strategically dependant on the UK and US, which will continue for the long-term and particularly for Australia to retain security under the US nuclear umbrella.<sup>7</sup> The more dependent that we are on our allies for basic functions (e.g., submarine sustainment), the less valuable we are as an ally. As a highly dependent ally, our participation in joint military operations would impose a substantial burden on allies as they must resource both themselves and Australian forces.

Australia's value as a partner derives heavily from its location at the nexus of the Indo-Pacific systems, astride the world's economic and demographic growth centres in Asia. While the location is a fixed variable, there is scope to increase our value as an ally and therefore our strategic leverage with our allies when it comes to negotiating and/or renewing our agreements. If Australia seeks sovereign control of its submarine availability, the operation and sustainment of NPF must be performed domestically. An assessment of Australia's existing nuclear expertise highlights the costs, risks, and options for developing such an industry domestically.

### **Foundation of nuclear expertise**

The Australian Nuclear Science and Technology Organisation (ANSTO) operates the Open Pool Australian Lightwater (OPAL) reactor, producing isotopes for nuclear medicine.<sup>8</sup> The International Atomic Energy Agency (IAEA) has recognised ANSTO as having “good practice in the nuclear industry”.<sup>9</sup> IAEA endorsement reinforces that ANSTO, a government statutory body, can safely operate a reactor without any nuclear incidents, thereby suggesting that Australia has a base of nuclear expertise to safely operate and sustain the SSN NPF. The government must leverage ANSTO's experience as a core foundation of Australia's nuclear knowledge and broaden the talent pipeline for nuclear specialists to support the SSN NPF and in addition to existing ANSTO programs.

### **Expansion of nuclear technical capability**

Developing best practice for NPF operation and sustainment requires leveraging knowledge from a variety of sources, cutting-edge research, and constant innovation from an ever growing workforce. If the available jobs for a nuclear specialist are narrowly confined to defence postings, there will be a considerable challenge in convincing prospective students to choose an educational path in nuclear science/engineering. A civilian nuclear energy industry therefore is a concomitant requirement for building nuclear workforce capability and scaling its capacity.



The opinion against nuclear power is demonstrated in a series of state and Commonwealth legislation to prohibit the operation of a civilian nuclear reactor, but this can be amended if the political will exists. This report will not delve any further into the debate around developing a civilian nuclear energy industry as that requires a paper of its own.

### **Skilled migration**

Government must add nuclear specialists to the priority migration skilled occupation list, to enable nuclear specialists migrating to Australia, thereby growing its nuclear workforce capability. Given that there are over 50 countries that operate nuclear reactors, there is an ample talent pool that Australia can tap into via migration policy.<sup>10</sup> Relationships with some of the nuclear nations, such as China or Russia, are strained, and therefore cannot be relied upon for skilled migration of the nuclear workforce. Australia has strong bilateral relationships and partnerships with many nuclear nations and obvious opportunities include the US, UK, Canada and Japan. A 2019 OECD study identified that Australia is the most attractive OCED country for highly skilled workers with master or doctoral degrees.<sup>11</sup> Although migration flows have undoubtedly attenuated during the COVID-19 pandemic, the long-term trends indicate Australia can use skilled migration to build up its nuclear workforce. Though skilled migration can facilitate the partial development of the workforce, Australia will need to broaden the long-term talent pipeline for nuclear specialists.

### **University partnership**

Australia will need to broaden the talent pipeline for nuclear specialists over the long-term through leveraging higher education institutions such as universities and TAFEs. By developing a partnership with Australia's leading education institutions, Defence can leverage the best of academia to develop high quality training and ongoing professional education of Australian nuclear specialists. Establishing a Centre of Excellence (COE) with an Australian university can allow the creation of specialist undergraduate and postgraduate courses that train nuclear specialists for operating and sustaining NPF. Defence can support the COE by establishing scholarships and offering placements at Defence and Defence industry facilities. The COE can be the focal point for funding from government and Defence industry to enable cutting-edge research and constant innovation. Creating partnerships between universities and Defence and Defence industry can provide clear pathways for education and long-term employment, encouraging students to begin the path.



### Existing Centres of Excellence

University and COE partnerships with Defence are nothing new. In March 2021, the government announced the Electronic Warfare (EW) COE.<sup>12</sup> The EW COE was established to develop the EW talent pipeline, comprising “practitioners and researchers across Defence, academia and industry”.<sup>13</sup> ANSTO already has strategic partnerships with the Australian National University, Monash University, University of Sydney, and University of Western Sydney.<sup>14</sup> ANSTO’s strategic partners are the natural starting place for Defence to establish a COE, providing a long-term expansion of the talent pipeline for Australian students.

### Conclusion

The provision of solutions to workforce, sustainment, and nuclear technical capability to achieve a successful capability transition are key challenges that the RAN will face over the coming decade. To accommodate the SSN crew requirements and two additional boats, the RAN needs to significantly increase the submarine workforce. The terminology for RAN recruitment must reflect the SSN’s status as Australia’s foremost strategic deterrent and highlight the secretive and exciting nature of submarine service. The RAN should raise the profile of the submarines by working alongside the War Memorial and Australian film and television to display the calibre of its submarine workforce and its past achievements. If Australia seeks sovereign control of the availability of its submarine capability and to be a valuable ally, it cannot accept outsourcing the operation and sustainment of NPF. IAEA endorsement of ANSTO suggests that Australia can safely operate and sustain the SSN NPF. The government must add nuclear specialists to the priority migration skilled occupation list, to enable skilled migrating, thereby growing its nuclear workforce. For long-term growth of the talent pipeline, government should establish a nuclear specialist COE with an ANSTO university strategic partner. Without the promise of work outside of Defence, specifically a civilian nuclear energy sector, it will be challenging to convince people to become nuclear specialists; however, this can only be adequately covered in a separate report.





### Endnotes

<sup>1</sup> Department of Defence, *Department of Defence Annual Report: 2019–20*, 21/09/2020, p. 123.

<sup>2</sup> Department of Defence, *Department of Defence Annual Report: 2019–20*, 21/09/2020, p. 124.

Defence Connect, 10 May 2021, “RAN Submarine Competition comes to a close”, site accessed 3/10/2021, <<https://www.defenceconnect.com.au/careers1/8014-ran-submarine-competition-comes-to-a-close>>.

<sup>3</sup> Ministry of Defence, “Submarine Service: Made in the Royal Navy”, site accessed 3/10/2021, <<https://www.royalnavy.mod.uk/submariners>>.

<sup>4</sup> Ministry of Defence, “Submarine Service: Made in the Royal Navy”, site accessed 3/10/2021, <<https://www.royalnavy.mod.uk/submariners>>.

<sup>5</sup> United States Naval Academy, “Submarine Warfare”, site accessed 11/10/2021, <<https://www.usna.edu/SubmarineForce/where/deployment.php>>.

<sup>6</sup> A middle power is defined as “being able to provide for our own defence, without having great capacity for coercing others”. Dr Andrew Carr, Australian Institute of International Affairs, “Is Australia a middle Power?”, site accessed 3/10/2021, <<https://www.internationalaffairs.org.au/is-australia-a-middle-power/>>.

<sup>7</sup> Department of Defence, “2020 Defence Strategic Update”, p. 27.

<sup>8</sup> Australian Nuclear Science and Technology Organisation, “Working at ANSTO”, site accessed 3/10/2021, <<https://www.ansto.gov.au/research/facilities/opal-multi-purpose-reactor>>.

<sup>9</sup> D. Vittorio, & K. Lucas (2020), “Periodic safety and security review plan for the OPAL Reactor”. International Atomic Energy Agency (IAEA), abstract, <<https://www.iaea.org/publications/14761/research-reactors-addressing-challenges-and-opportunities-to-ensure-effectiveness-and-sustainability?supplementary=89388>>.

<sup>10</sup> World Nuclear Association, “Nuclear Power in the World Today”, site accessed 9/10/2021, <<https://world-nuclear.org/information-library/current-and-future-generation/nuclear-power-in-the-world-today.aspx>>.

<sup>11</sup> OECD/Bertelsmann Stiftung, “How do OECD countries compare in their attractiveness for talented migrants?” 19, May 2019, p. 4, <<https://www.oecd.org/els/mig/migration-policy-debates-19.pdf>>.

<sup>12</sup> Department of Defence, “Morrison government grows electronic warfare talent pipeline”, 26 March 2021, <<https://www.minister.defence.gov.au/minister/melissa-price/media-releases/morrison-government-grows-electronic-warfare-talent-pipeline>>.

<sup>13</sup> Department of Defence, “Morrison government grows electronic warfare talent pipeline”, 26 March 2021, <<https://www.minister.defence.gov.au/minister/melissa-price/media-releases/morrison-government-grows-electronic-warfare-talent-pipeline>>.

<sup>14</sup> Australian Nuclear Science and Technology Organisation, “How We Work: Partnerships”, site accessed 9/10/2021, <<https://www.ansto.gov.au/about/how-we-work/partnerships>>.