SUBMARINES: CONSTRAINTS AND OPPORTUNITIES

Synergy Consulting Group

Mick Mahy (Partner, Synergy: MMahy@synergygroup.net.au),
Anne Edwards (Executive Director, Synergy: AEdwards@synergygroup.net.au),
Dr. Jiao Wang (Executive Director, Synergy: JWang@synergygroup.net.au),
Dr. Jan Drienko (Senior Manager, Synergy: JDrienko@synergygroup.net.au),
Sian Phillips (Senior Manager, Synergy: SPhillips@synergygroup.net.au).

INTRODUCTION

The announcement of the AUKUS trilateral partnership between Australia, the United States and the United Kingdom is significant for its explicit focus on cooperation in the Indo-Pacific region. Its first initiative, to support Australia to acquire nuclear-powered submarines and infrastructure – while maintaining commitments to the *Non-Proliferation Treaty* and International Atomic Energy Agency safeguards regimes – challenges Australia's strategic, socio-political, economic, and legislative environment. Among this set of challenges, workforce sustainment and supply chains are sources of extant risk to national security outcomes. When the Department of Defence acquires major capital equipment, it faces an array of internal and external forces and influences that create significant difficulties to navigate. They include comprehensive planning and scoping; risk management (from beginning to end); integration complexity; good project management; industry capability and capacity; an increasing lack of skilled workforce; complex contracting arrangements; through-life support considerations. The most important conduit between these forces and influences is the ubiquitous relationship between the capability manager, the delivery group, the receiving service, and industry that is essential during every stage of the capability lifecycle. The sheer size of the program to acquire and sustain nuclear-powered submarines (SSN) should not be underestimated. But will the organisation learn from past experiences to address the constraints and opportunities that acquisition of a nuclear-powered submarine fleet presents?

Defence has extensive experience in the development of large-scale platforms. For example, the Joint Strike Fighter (JSF) known as *AIR 6000—New Air Combat Capability* (NACC) in procurement nomenclature, was conceived as replacement for five types of aircraft (the F-16 Falcon, F-15E Eagle, A-10 Warthog, F/A-18 Hornet and AV-8B Harrier). The Program is a coalition of eight partner nations who joined to fly, produce, and maintain the JSF. Its success is contingent on a common design (with three variants) and the requirement to share 80 per cent of JSF parts. The undertaking has been so complex that it has been plagued by numerous delays and cost increases. We now know this was because of unrealistic cost estimates, an aggressive program schedule, immature technology and an insufficient budget to integrate the technology. In short, the complexity of the project was so immense that trying to gain commonality from disparate partner needs meant that the cost and schedule slippage was suffusive. For the Hunter class Frigates, the aggressive timeline is likely to be the infractor. Production is expected to start in 2024; but, this will be tight due in no small part to the requirement to include design aspects from the British Royal Navy. Add to this, Australia's preference to use the Aegis (US Combat System) and CEA radars (a Sovereign Industrial Capability Priority) and already the vessel will be heavier with a decrease in range. To this end, a schedule delay of 18-months was accepted by the Defence Minister in July 2021[1]. Lessons may also be learned from a more traditional large-scale construction project such as the Collins Class Submarine in the 1980s[2]. We know that the Collins submarines were plagued by technical problems from its original design and throughout its early life. But the *Coles Review* did not find these technical issues fundamental to the Program's broader issues[3]. Rather, it found management and the inability of the Royal Australian Navy (RAN) to retain sufficient personnel to operate the submarines were the problem and by 2008, only three vessels could be crewed.

The AUKUS agreement is not settled and the terms of an agreed capability transfer for Australian purposes are still unknown. However, there are some conclusions that may be drawn from examination of what may be needed to develop a supporting construction and infrastructure strategy to enable the nuclear submarine capability. The development of solutions requires new ways of thinking to maximise opportunities and leverage capabilities in Australian interests. This paper identifies opportunities to strengthen outcomes for maritime security. It draws on large-scale platform design and expertise in nuclear, maritime,

and infrastructure to demonstrate divergent thinking on some of the fundamental inputs to capability to maximise efficiency in a new naval, defence, and foreign policy environment. The new maritime capability also requires whole of government effort extending far beyond that of build choice and delivery. It must be informed on a broader scale to maximise solutions and outcomes. This requires a shift in foreign, defence, and national security policy to shepherd it to completion. Even with the support of the United States and United Kingdom, plans for eight nuclear-powered submarines are already under intense scrutiny. The challenges include where to build, who will develop, sustain and maintain them, and how will they be crewed. Thinking beyond traditional processes for capability acquisition may alleviate pressure on key decisions: particularly if we examine how to build and sustain the infrastructure workforce. This should be done in parallel with Navy recruitment and crewing options.

Defence infrastructure contains assets in the military domain that support the effective functioning of the Australian Defence Force (ADF). The Civilian Critical Infrastructure (CCI) sectors represent a significant part of the production, supporting effective and interconnected industrial functioning of the Australian economy. Critical infrastructure assets are shared resources: where the Department of Defence priorities are geared towards operability: civilian assets are driven by economic objectives. We will examine the intersection between defence and civilian infrastructure and the services that can support this shift in Australian defence capability. To that end, this paper positions Department of Defence and CCI services as critical to raising and maintaining the nuclear-powered submarine capability. Key to success will be reconciliation of efforts to integrate defence and civilian workforces and capabilities, while adhering to some of the strictest regulations an ADF platform has ever been developed under. This is the overwhelming issue our modelling identifies – it is the “Achilles Heel” for the development of ANY defence infrastructure asset. Workforce constraints and supply constraints across all facets of development, deployment, sustainment and infrastructure are the defining challenges of securing this capability.

The paper provides an overview of the extant shipyard infrastructure and considers the development opportunities and constraints that may arise if these bases were used as interim, primary, or additional shipyards for the nuclear-powered capability. This is followed

by detailed workforce analysis for the submarine infrastructure based on one of these shipyards – demonstrating the value of the site location of the future east coast base when announced. We conclude with an examination of what persistent risks and opportunities may mean for the future supply chain – through the development, use, sustainment, and maintenance of the new submarine fleet. This paper does not draw any definitive conclusions given ongoing trilateral efforts to establish AUKUS capability transfer. Instead, workforce modelling is used to explore critical success factors, from which to meet some of the criteria the government may need to realise its strategic objectives.

CRITICAL INFRASTRUCTURE

On the 7th of March 2022, Prime Minister Morrison announced that three sites on the Australian eastern seaboard were being considered to develop a deep-water submarine base that would complement Fleet Base West.[4] This is reminiscent of the long-standing strategic objective of the Defence White Paper's *Two Ocean Navy* policy of 1987;[5] which initiated a period of unprecedented infrastructure, force structure recapitalisation, and redeployment of the RAN (when HMAS *Stirling* becoming the home of the Navy's Collins class submarines). An east coast base supports naval recruitment and retention strategies and provides a degree of redundancy in capability that acknowledges geo-strategic shifts in Australia's regional security environment.[6] Build choice and strategy will have considerable impact on the critical infrastructure needed for the new submarine capability.

The new development, "supports basing and disposition of the future nuclear-powered submarines… [This base] would provide homeported submarines with specialised wharfs, maintenance facilities, administrative and logistics support, personnel amenities, and suitable accommodation for submarine crews and support staff. It would also enable the regular visiting of US and UK nuclear-powered submarines."[7] The three possible base locations – Brisbane, Newcastle and Port Kembla – are sound choices due to their proximity to extant industrial infrastructure; populations centres that could grow and attract a submarine workforce (which would include uniformed and civilian crew and support); proximity to maritime training facilities; be strategically safe from potential threats.[8] While the decision to select a new naval base on the east coast is based on the need to transition away from the Collins Class, there are lessons to be learned from the extant sovereign base capability. There

are currently two major ship building yards in Australia – Osborne in Adelaide and Henderson in Perth. Currently, Osborne is Australia's largest 'naval' shipbuilding hub. It has demonstrated its success at building large naval vessels including the Collins Class Submarine, the Air Warfare Destroyer and it will soon begin to build the Hunter Class Frigate. It may also be a possible contender to build the Nuclear-Powered Submarine. Henderson is a 'commercial' Shipbuilding precinct but is positioning to become the Australian sovereign shipbuilding capability powerhouse into the future.

To determine lessons available from Australia's sovereign base capability, our economic modellers conducted a feasibility study to understand if there was a need for an interim naval base and/or a model for the new naval base. To achieve this, the current construction and (deep) maintenance infrastructure already existing at Osborne and Henderson was analysed to establish if they are both fit for purpose. Our feasibility study demonstrated that while any potential upgrade of infrastructure is dependent upon the design choice of the submarine, Osborne's submarine build history presented as a critical strength in its favour. The downside is that it is constrained by its older physical infrastructure and constant inability to maintain a skilled shipbuilding workforce for ship building and sustainment.

There are clear challenges to realising Australia's intent to maximise in-country support for submarine capability. Defence and CCI hold similar, and at times, symbiotic physical assets and systems that functionally enable the operation of critical services in Australia, see *Figure 1*. There are two key components of civilian and defence critical infrastructure inter-dependency. The first is defence critical infrastructure contains assets in the military domain critical to the effective functioning of the ADF. The second is that CCI represents a significant part of production, supporting effective and interconnected industrial functioning of the Australian economy. Therefore, efforts to prepare existing and future maintenance facilities to receive the submarine fleet should be put in place concurrently with development of a new base on the east coast. Preparing these facilities requires infrastructure upgrades and new construction irrespective of the technological design selected. Any delays to critical infrastructure preparedness will result in maintenance of the first submarines having to be undertaken outside of Australia. Significant reconstruction and upgrades of the Osborne shipyards and surrounding support facilities should be the priority among a set of projects to

enable onshore maintenance and porting capabilities. Our modelling indicates that the compounding effect of state committed infrastructure developments and associated delays creates a significant shortage of available capital assets, materials, and personnel to conduct works on infrastructure upgrades.

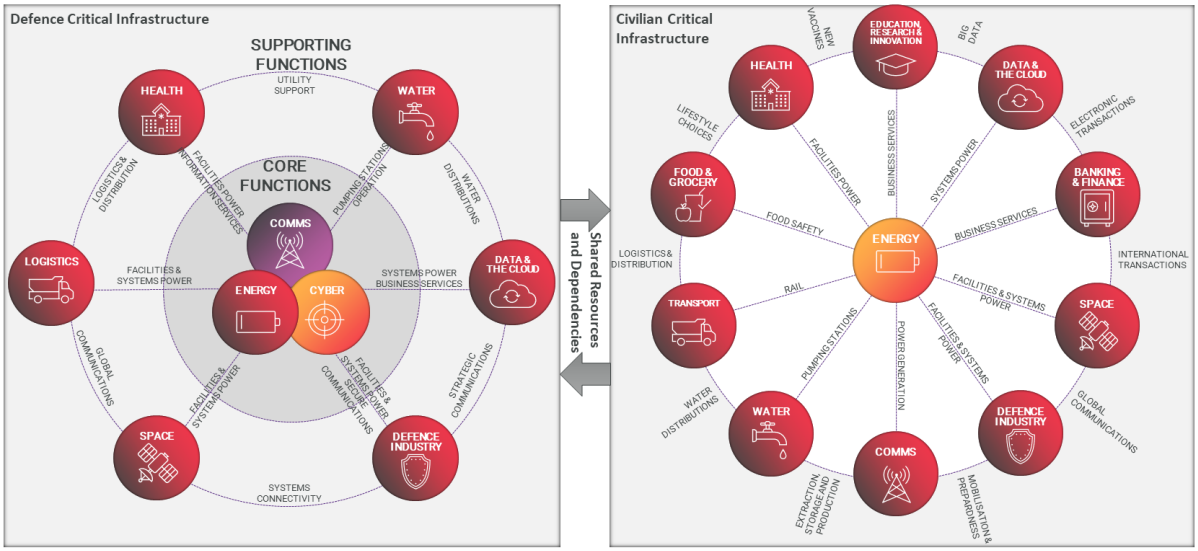

Figure 1 – Critical Infrastructure Inter-dependency – Defence vs. Industry

Tailored ecosystem modelling focuses on a system-wide approach to sector functionality and accounts for inter-dependencies between civilian and defence domains to support clearer strategic pathways to sovereign capability acquisition and sustainment. Therefore, it is essential to improve understanding of the interconnections between defence and civilian critical services such as defence key and enabling assets, CCI assets, and government as a regulator. Modelling presents the likely outcomes of external impacts to defence capabilities, industry functionality and the flow-on implications for other parts of the economy.

The scope of what is required to maintain a deep platform for the submarines is an important milestone because it informs the initial and long-term contracting arrangements required to secure these capabilities. Two adjacent priorities to scope are maturing Australian industry capability, and long-term opportunities for academic research and innovation. Both can generate the expertise required to fulfil future capability development activities. Long-term commitment to academic partnership is also critical to the success of delivering innovation, research, and development. Such partnerships can be leveraged to drive the uptake of

technology insertion; shaping and incentivising Australian industry and technology partners to build products and services that can be incorporated into the design stages of the submarine program.

WORKFORCE

Prime Minister Morrison raised an important criteria to meet the objectives for the submarine base – the ability to, "attract, recruit and retain the substantially larger uniformed submarine workforce we are building to crew and support the future submarines."[9] Skilled workforces play a critical role in the function and operation of the critical infrastructure and industry sector in terms of skill type, accessibility, and supply/demand balance. The government may seek to map the skills needed in quantity and for how long over the lifetime of the submarine fleet. We used our workforce model to indicate what this might look like. The occupation skills index is an indicator of over supply or under supply in the external labour market in the private economy. It is defined as a percentage deviation from the demand of skill requirement[a], or:

$$\boldsymbol{Skills\ Index} = \frac{\boldsymbol{Skills\ Supply} - \boldsymbol{Skills\ Demand}}{\boldsymbol{Skills\ Demand}} \times \mathbf{100}\%$$

The Australian and New Zealand Standard Classification of Occupations (ANZSCO)[b] classifies both core and non-core occupations in maintenance, training, digital support, and the associated ground infrastructure support. The availability and shortage of certain skills and occupations in the wider labour market drives the likelihood of obtaining the required skills to deliver core and non-core skills. The skill index shows the difficulty of obtaining new skills from the external labour market. Significantly large negative figures demonstrate a high-level of difficulty in obtaining workers to support specific program functions. Core occupations are closely aligned to the job families critical to the delivery of projects; often representing very specialised skills which need to be maintained over the long-term – even during periods of reduced demand. Non-core job family skills present a more generic part of the workforce with skilled labour available in the market. This modelling is based upon skills, industries, and job

[a] If the skill index is positive percentage, it means skill surplus, while vice versa.
[b] Up to 6-digit ANZSCO Occupations, ABS#1220.0

families that are currently not under the same strains and penalties as those required to work with the most sensitive of nuclear technologies. Yet, we can draw some conclusions that allow some visibility of the constraints that workforce capability may face. *Figure 2* demonstrates selected occupations at *4-digit ANZSCO* level in terms of skill index – shortfall gap vs. surplus – to present a dynamic labour market in Western Australia. The skills gap is shaped by a diverse range of global and local drivers. A highly imbalanced difference between skill supply and demand generates risks for employers presenting as a skill shortage. An ideal market environment should have a skills gap as close to zero as possible, alternatively represented as a small percentage of the workforce.

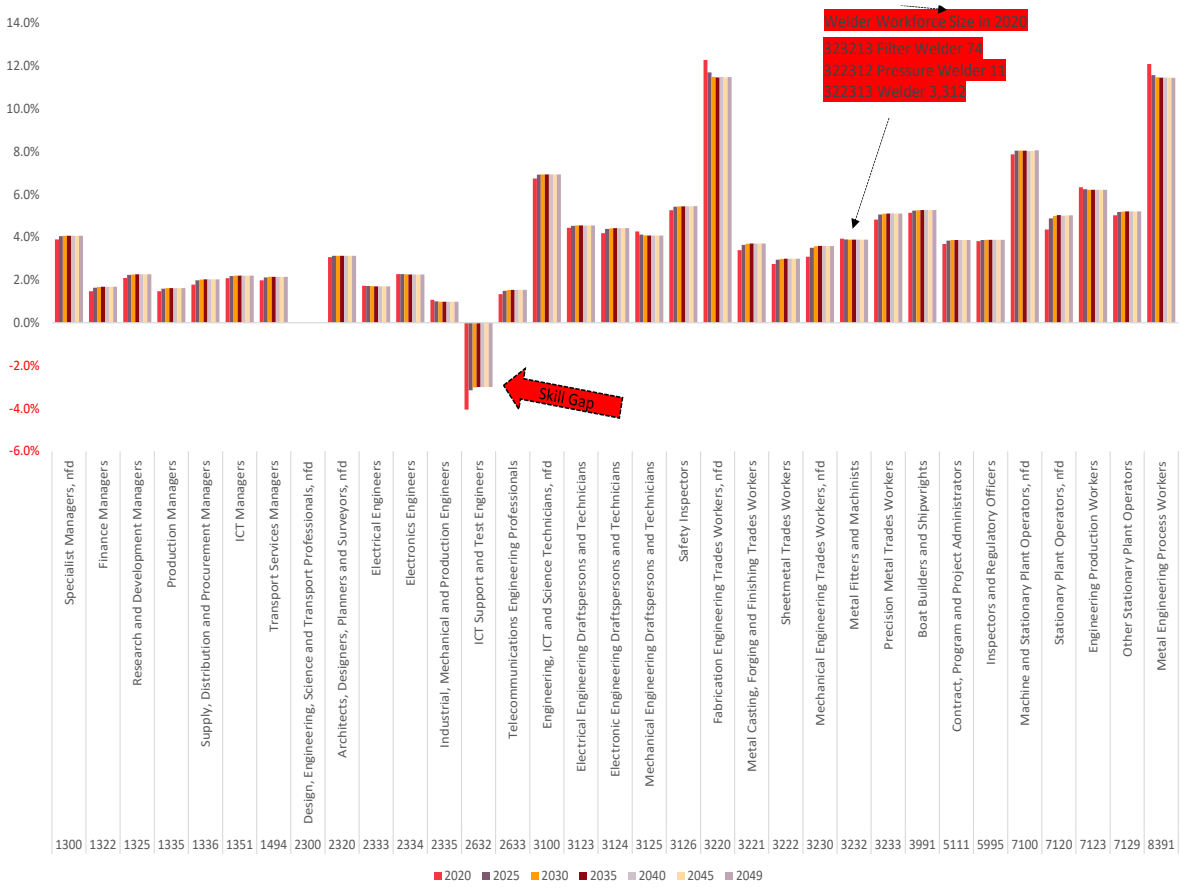

Figure 2 - Skill Gap Analysis on Selected Shipbuilding ANZSCO 4-digit Occupation in WA

Our modelling identifies that the severity of workforce shortages will impact capability readiness differently over time. This can be managed using Agile methodologies to plan, maintain and develop critical skills required over the long-term. The identification of gaps in local capabilities and skillsets as early as possible is fundamental to their resolution. It will also

be necessary to forward manage industry capability and skillsets that are essential to technology releases, intellectual property, and technical data.

Partnering with industry to deliver the submarine capability presents a broad set of challenges. An active and ongoing dialogue with Australian industries on materiel and services at every stage is crucial. Sharing sensitive nuclear technology will likely preclude many stages of the development from being discussed with the wider industry; but, early consideration should be given as to how industry partnerships can be leveraged. These partnerships can provide the space for strategic engagement to drive skills development. For example, the Defence Industry Policy Division should be working closely with the Nuclear Submarine Task Force to identify future workforce skills gaps, policy levers and incentives to mitigate these gaps. Access to a skilled Australian workforce will be essential to the success of the program's Australian industry strategy. Notwithstanding the sensitivities and the highly educated workforce needed to operate and maintain the submarines, there is a need to insert some pragmatism into policy discussions about required onshore capabilities and those supported by international partners. Workforce shortages will be directed in the short- to medium-term by a significant absence of specialist skills and knowledge within the national support base. In the longer-term, workforce shortages may be characterised by an ageing population, difficulty in incentivising the existing skilled workforce to remain, and the suitability of highly skilled personnel. A long-term view of a sustainable industrial base supported with the workforce skills and development pipeline to realise this effort is achievable. It is normal for industry to experience frequent changes in demand for skilled workers from other sectors and procurement processes cause workforce inefficiencies. Strategic defence engagement can support industry to grow beyond its current capacity by addressing these inefficiencies as part of its Nuclear Submarine Task Force.

The recent commitment of the government to increase capital investment and the advancement of nuclear technology does not change the fact that the skills required to achieve this on a sustained basis does not yet exist. There have been some attempts to address the limited number of workers in the field by releasing a significantly greater number of scholarships to develop a pool of talented and highly skilled workers in the future. But the number and the geographic concentration of learning facilities continues to significantly limit

the growth of newly available personnel. The workforce modelling identified conditions where policy levers could focus Australia's education intuitions' efforts to produce more graduates in specialised fields to address current and future skill gaps. Proactively dealing with these issues will mean Defence will have strategic relationships across Australian industry to ensure the required workforce is available to support this and future programs in public or private sectors in pursuit of defence objectives.

SUPPLY CHAINS

The Australian government has long leveraged Naval shipbuilding as a platform for a competitive local defence industry. Alongside historic support for a sovereign defence industry base, the Australian Government has centred defence industry as a critical component of Australia's COVID-19 economic recovery. This approach reflects a broader transition to reinforce economic and strategic goals as mutually dependent and builds the foundations of strengthened national resilience and preparedness for a changed geo-strategic environment. Within this context, COVID-19 has shaped a national discussion about sovereign capability – when, and in what industries should a greater degree of self-sufficiency become an explicit strategic choice in Australia's interests. Sovereign capability discussions are also inherently about the strategic shaping of supply chains to deliver in Australia's interest. Now, Australia finds itself at a critical juncture in its design of nuclear naval capability – our sovereign capability and supply chains have the highest dependency on manufactured imports and lowest levels of extant manufacturing self-sufficiency in the OECD.[10] Australia's Naval industry is exposed through its supply chains to a variety of risks that can dampen industry drivers, increase costs, cause schedule delays, and ultimately undermine Australia's national interests as capability acquisition is delayed or underperforms.

While supply chains are complex systems designed to deliver consistency and regularity as their complexity increases – their transparency decreases. The state of global supply chains, under pressure for some time, has been exacerbated by ongoing implications of the COVID-19 pandemic. In Australia, industry struggles with increasing costs, decreasing freight availability, and drastic changes to the global business environment. This is compounded by pressure within air and maritime logistics industries to manage freight movement, and significant changes in consumer behaviour. Within this framework, industry continues to

adapt – reviewing their business models to leverage specialisation and economies of scale, adopting agile ways of working, and value chain transformation to manage supply chain disruption. Differential global recovery from the pandemic within and between geo-strategic regions and the repercussions of regional conflicts, further sharpen the demand for Defence to consider the ways it can adapt capability acquisition strategies to manage risk and leverage opportunities in the 'new normal' for supply chain centrality to asset acquisition and sustainment.

We know that business supply chains that lack flexibility, demonstrate geographic clustering, and have long supply chains – are more prone to risk. For policymakers concerned with market-level supply chain risk, Australia's imports are most vulnerable to disruption in health, water, and energy industries.[11] Our model uncovered differential availability of skills, materials, and infrastructure accessible to Defence as it moves from acquisition to maintenance functions for these capability platforms. For Defence, the key to alleviating some of the now chronic challenges embedded into Australia's naval supply chain is strengthened collaboration and real-time learning between services acquisition officials and industry – built around strategic clarity outlined in the *2017 Naval Shipbuilding Plan* and expanded under the *2020 Force Structure Plan*. As the Government's new Nuclear Powered Submarine Taskforce takes shape, its recommendations should inform treatment of supply chain risks to mitigate implications for Australia's national interests, capability to support Allied activities, and lead regional response efforts.

Using detailed supply chain analysis, we can also determine not only the direct effects of supply chain shocks but also the indirect effects by tracing the interdependency of industries via their supply chains to base materials. For example, a hypothetical critical infrastructure disruption to the energy and transport sectors – where up to half of the liquid fuel supply chain is disrupted and sixty per cent of the transport sector is disrupted (operation of maritime ports) – for a period of just three weeks can generate direct GDP loss of up to one per cent, see *Figure 3.* This may cascade into other industries causing economic flow-on impacts through inter-connected supply chains which are only exposed when supply chains are impacted in this manner (such as critical infrastructure inter-dependency) potentially leading to up to two per cent loss to GDP. To put this into context, the defence budget is just

above two per cent of the national GDP per annum.[c] Should this hypothetical disruption occur, Defence can expect increased acquisition costs and schedule delays without adequate mitigation and adaptation strategies in place to dampen the negative impacts of supply chain disruption on capability acquisition targets.

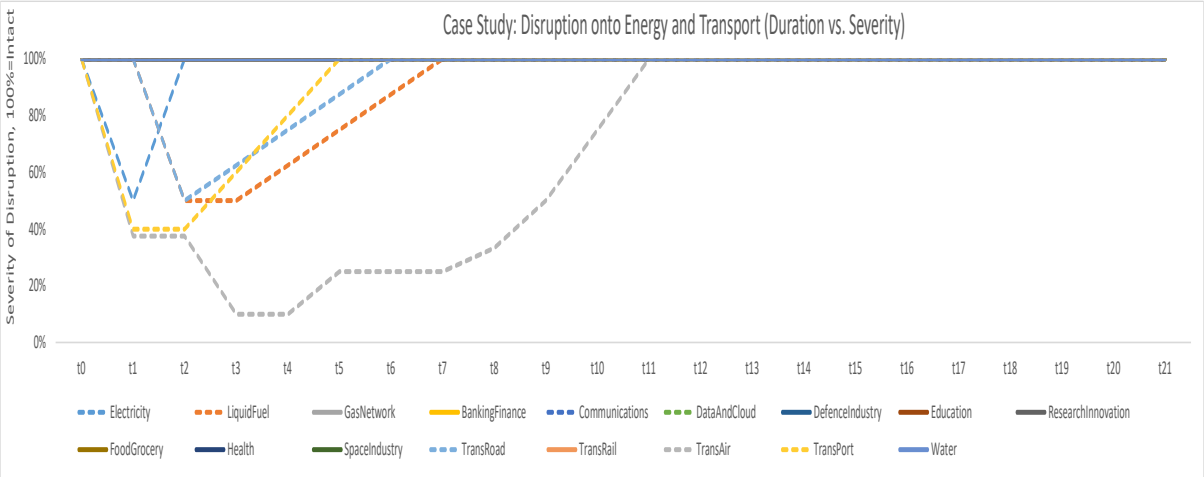

Figure 3: Direct Impact of Disruption and Recovery Profile

Source: Assumption-Driven Parametric Approach

Depending on national strategic priorities, the impacts of market disruptions and recovery profiles between defence and civilian industries may be unequally shared with direct consequences for socio-economic policy and national resilience. Large disruptive events (such as natural disasters, regional conflicts or pandemics) to the market expose these system vulnerabilities. This environment increases the likelihood of a potential market failure as physical susceptibility and economic fragility across the supply chain. A risk and vulnerability measurement can demonstrate the impact of potential disruption scenarios to defence critical infrastructure assets, including the spill-over effects and any cascading impact onto the infrastructure system. Building on the scenario outlined in *Figure 3*, should the disruption event go beyond the maximum capacity threshold of the nuclear submarine capability project to absorb material and resource scarcity, it could result in an irrecoverable situation where a complete rebuild might be required to maintain the pre-disruption level of operation and performance. Risk and Vulnerability analysis could be used to inform defence strategic

[c] Defence budget climbs to $44.6 billion in 2021/22 budget. https://www.aspistrategist.org.au/defence-budget-climbs-to-44-6-billion/ Although this may change, depending on the election outcome of 2022

engagement to strengthen the existing infrastructure system interests (such as upstream and downstream interactions); or to develop construction and infrastructure strategies as Australia's nuclear capabilities are developed.

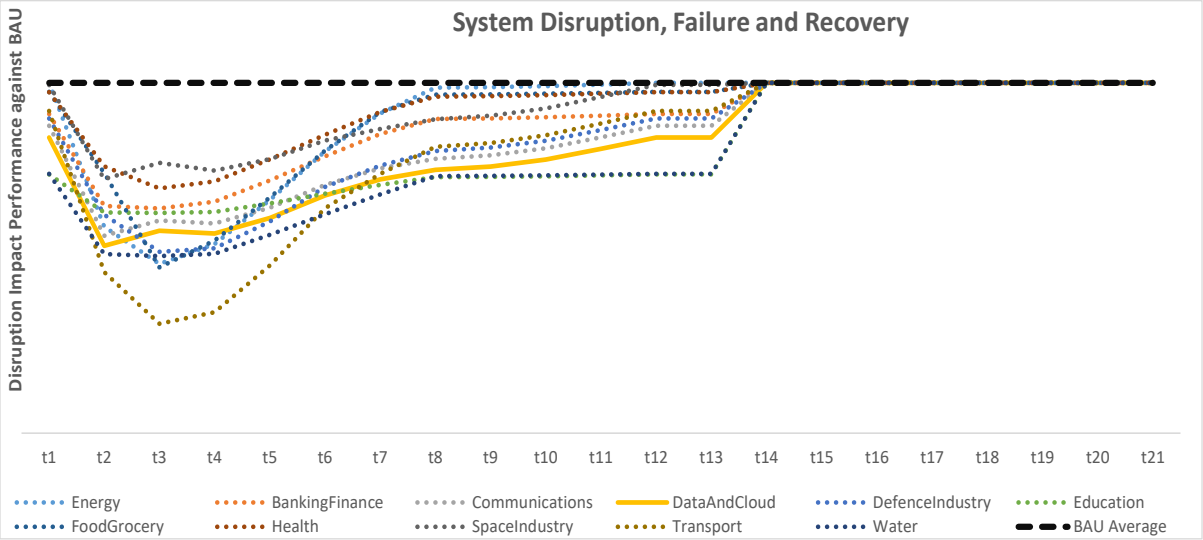

Figure 4: System-wide Impact, Performance Index against BAU

Source: Synergy's Modelling Calculation

Australia's shipbuilding and maintenance industry is import dependent. For example, in the defence sector, Australia has medium-high operation capabilities while low-medium productive capabilities.[12] Using a detailed model, our analysis demonstrates the potential impacts of a hypothetical system-wide event impacting supply chains, see *Figure 4.* Our modelling shows the significant and relative exposure of defence industry to disruption. While the industry has high barriers to entry due to significant capital investment requirements in facilities, the consolidation of talent is less centralised than across industries relying on similar skills. This will become more of a concern when layered with a significant increase in security regulations for a nuclear skilled workforce. There are few prime providers directly involved in delivery of major supply contracts. However, there still exists a network of smaller competitors (who will still need to be aware of their commitments to nuclear regulations and oversight) that supply the primary providers which motivates the aggregate industry to continue to compete and innovate.

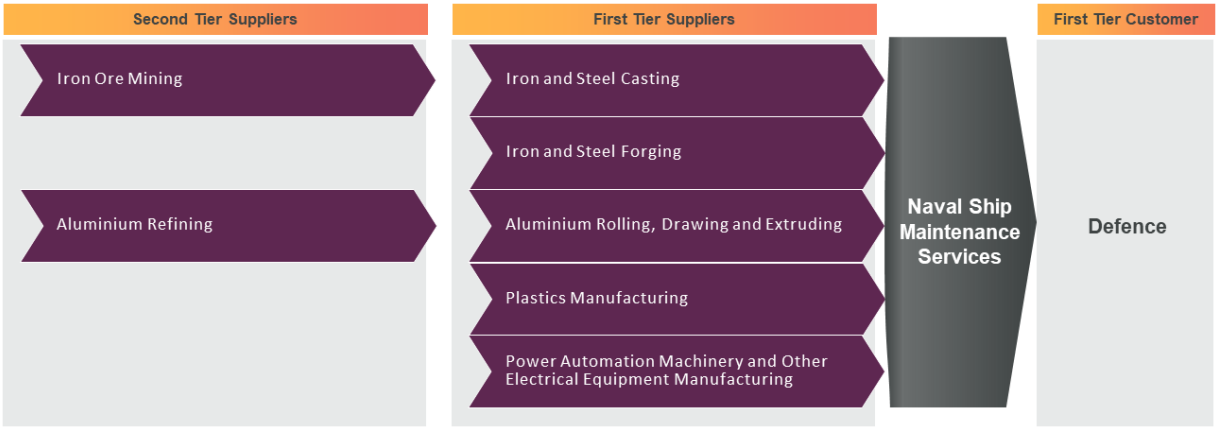

Figure 5 - Suppliers

The nuclear program is expected to operate for at least the next four decades. A priority focus of the program strategy is to deliver defence and industry benefits over the long-term. There is scope to establish an opportunity pipeline for Australian industry. The pipeline could leverage economies of scale resulting from significant optimisation and reduce the risks in supply arrangements. This approach delivers benefit to Defence by providing access to sustainable and efficient Australian industry suppliers at lower costs. Defence may further seek to develop supporting comprehensive strategies based on robust assessment of supply chain domestic industrial strengths and vulnerabilities in Australia. There is scope to inform supply chain optimisation applying scaled maturation processes by developing sector plans to secure local production and address policy challenges to Naval capability.

As Australia develops its Naval capability, effort is needed to reinforce sovereign capability and solidify Australia's commitment to be a member of the global fleet support network. Within this approach persistent risks should be addressed. These include the political inclination to support domestic shipbuilding and maintenance industry, the financial impost of education while the domestic sector builds its sovereign ‘brains-trust’ capability, and public awareness of the nuclear realm writ large. Further consideration should be given to assessment of the competitive and comparative advantage of Australian shipbuilding and maintenance capabilities. Given the sensitivities, global competitors for the nuclear submarines are not a factor; but they will emerge for other platforms among the defence and civilian sectors. This highlights the importance of a continuous evaluation process informing the ongoing capability development needed to secure Australian interests. With appropriate analysis informing comprehensive long-term investment plans, defence and industry have the

foundations to stabilise an increasingly uncertain environment and direct strategic production effort in Australia's strategic interests. Growing stability in the local industry and its support base to mature and provide innovation, advancement in technologies, and enhance Australia's geopolitical leverage in the region requires strengthened structures within Defence to direct industry engagement. Nuclear capability is extremely challenging to establish in Australia, and it may prove even harder to maintain and sustain efficiently and effectively.

CONCLUSION

The AUKUS announcement to build nuclear maritime capability in Australia is a strategic shift in Australia's diplomatic, strategic, and economic posturing in the Indo-Pacific region. The Prime Minister has underscored the importance of sovereign capability to this shift in posture. Any discussion of sovereign capability in Australia must be cognisant of our recent history of deindustrialisation. Our modelling demonstrates that critical infrastructure, supply chains, and the workforce to sustain the submarines will encounter significant hurdles and present challenges to realising the strategic objectives of Australia's Nuclear Submarine Program. There is significant policy opportunity to increase industry engagement, public awareness, and mature long-term strategic planning of inputs to defence capabilities. There is evidence to support thinking differently about these challenges: to not opt for well-worn processes: to apply divergent thinking to develop innovative strategies to overcome a monumental change in Australian foreign, defence, and national security policy and infrastructure.

We know that Defence will continue to face budgetary pressures over the forward years. Concurrency pressures will continue to increase; challenging defence capability to meet domestic commitments and foreign activities. While Australia's national security tasks are almost exclusively assigned to capabilities, this is unlikely to change and the pressures on Defence will continue to grow. The nuclear-powered submarine is a highly sensitive, complex and large program. It will increase capability and workforce pressures – even more so due to the need for nuclear specialised skills in the domestic workforce. This means that fundamental reform is required for Australia to achieve a higher degree of self-reliance, or sufficiency to support a nuclear-powered submarine capability and deliver its broader sovereign industry priorities. This includes supporting submarine maintenance activities,

coordination (within defence and across industry) and management approaches relating to very large and very long-term programs such as this to facilitate a more effective relationship between Defence and its suppliers. Building long-term, outcomes-focused strategic relationships between the nuclear submarine program, a sovereign capable workforce, and its many industry partners will build confidence. This can lead to the best industry and defence capability outcomes. There still remain challenges with Australia's strategic adoption of nuclear-powered submarines including the need to resolve barriers to sensitive technology sharing; the socio-political consequences to changing long-held Australian nuclear policy; legislative change in accordance with nuclear treaty agreements; and growing an educated workforce needed to design, develop, sustain and maintain the capability needed to realise our strategic maritime interests. Ultimately, no matter what submarine design or location for an East Coast Base is deemed fit for Australia's strategic objectives, thinking differently and creatively is the ONLY way to achieve the delivery of a significant part of Australia's defence and national security.

---

[1] Tillett, A, *Government consents to delay in $44b frigate program,* 6 July 2021, Australian Financial Review, Government consents to delay in $44b frigate program (afr.com)

[2]Department of Defence, *Collins Submarine Program*, 12 March 2022, https://www.defence.gov.au/project/collins-submarines-program

[3] Australia. Defence Materiel Organisation, issuing body. (2012). *Coles review: the study into the business of sustaining Australia's strategic Collins Class Submarine capability,* http://nla.gov.au/nla.arc-145830

[4] Prime Minister, the Hon Scott Morrison, *An address by the Prime Minister Scott Morrison: situation on Ukraine, the Indo-Pacific and Australia's response*, speech to the Lowy Institute 7 March 2022, https://www.lowyinstitute.org/publications/address-prime-minister-scott-morrison

[5] The Department of Defence. Defence White Paper, March 1987, *The Defence of Australia,* https://defence.gov.au/publications/wpaper1987_1.pdf

[6] Hellyer, M, *Unpacking the (semi-) announcement of a submarine base on Australia's east coast*, 9 March 2022, Australian Strategic Policy Institute, 12 March 2022, https://www.aspistrategist.org.au/unpacking-the-semi-announcement-of-a-submarine-base-on-australias-east-coast/

[7] Ibid

[8] Ibid

[9] Ibid

[10] Worrall, L, Gamble, H, Spoehr, J & Horace A-L. 2021. *Australian Sovereign Capability and Supply Chain Resilience: perspectives and options, Adelaide*: Australian Industrial Transformation Institute, Flinders University South Australia

[11] Productivity Commission, 2021, *Vulnerable Supply Chains, Study Report*, July accessed https://www.pc.gov.au/inquiries/completed/supply-chains/report

[12] Worrall, L, Gamble, H, Spoehr, J & Hordacre A-L. 2021. *Australian Sovereign Capability and Supply Chain Resilience – Perspectives and Options.* Adelaide: Australian Industrial Transformation Institute, Flinders University of South Australia.