

Senate Economics References Committee

**Inquiry into Australia's Sovereign Naval Shipbuilding
Industry**

**Submission
by
*Submarines for Australia***

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Executive Summary and Conclusions

This Submission to the Senate Economic References Committee's inquiry into Australia's Sovereign Naval Shipbuilding Industry Capability is put forward by Submarines for Australia, a group founded and sponsored by Gary Johnston.

In its recent Defence Strategic Update, the government has recognised that Australia's strategic circumstances have deteriorated significantly since 2016, when the last Defence White Paper was published. This requires both an increase in the Defence budget and a significant adjustment to the ADF's force structure. The three major acquisition projects, however, SEA 1000, SEA 5000 and AIR 6000, totalling around \$155 billion in out-turned dollars, were excluded from consideration in the new Force Structure Plan. Having now seen the outcome from the FSP, we consider that a review of at least the two major naval programs is warranted to ensure they still meet the ADF's requirements in the context of the new strategic reality:

- The concept of 'warning time' has been discarded and instead "that future is now" – this is a problem for the two major naval programs, both of which are still at the design stage and have lengthy delivery schedules:
 - for SEA 1000, where the prospect of a capability gap looms large, the first new submarine won't be operational until 2035 and the 12 submarine force announced in 2009 will not be achieved for another 35 years
 - the schedule for SEA 5000 takes delivery of the nine frigates well into the 2040s, requiring further upgrades to the Anzac frigates.
- The government proposes the need for a strong offensive capability for deterrence and forward defence and places a considerable emphasis on the need for a powerful submarine force
 - which, in the context of a greatly enhanced ASW capability on the part of the PLA, can in our view only be provided effectively and with an acceptable level of survivability by nuclear-powered attack submarines.

In addition, it is not clear that as presently configured Australia's naval shipbuilding industry can deliver the advanced naval platforms the RAN needs:

- At an acceptable cost relative to global benchmarks
 - currently we are building the most expensive naval platforms in the world, while the Anzac and Collins programs were delivered at or near the world price.
- With an acceptable level of local content, given that
 - the COVID-19 crisis has made clear the need for a greater degree of self-reliance in strategic supply chains
 - a greater level of capability on the part of Australian companies substantially enhances our capacity to sustain the ADF's platforms and systems effectively and efficiently.

We consider that the review of SEA 1000 in the context of the new Force Structure Plan should address the following issues:

- As a priority, how to help ensure that the Collins class life of type extension (LOTE) both
 - enhances the submarines' capability to a level where they can continue to be deployed 'up threat' and
 - can be completed within the two-year window of the full cycle docking process (two-year major upgrade) in order to avoid a capability gap.
- Whether the Attack class will be fit for purpose in a theatre where at least four other nations operating in our region regularly deploy nuclear-powered submarines
 - the review of submarine technologies flagged in the 2016 DWP should be brought forward and considered in this review.
- Whether the Attack class will be cost-effective and offer value for money at an out-turned cost of \$89.7 billion, noting that
 - because of long transits and the slow speed of conventional submarines, the Navy will be able to deploy only one submarine on station continuously over a prolonged period
 - even by the time the first Attack class submarine is delivered, conventional submarines will be challenged in terms of operating in a high intensity environment against a capable major power adversary.
- If the Attack class will be unable to meet these challenges, is it time for a Plan B and perhaps the introduction of some competition.

We believe a review of SEA 5000 is justified because:

- The specification changed significantly during the CEP selection process, with the move away from a dedicated ASW platform to a general purpose platform embarking Aegis, CEAFAAR, the SAAB interface and a powerful air warfare capability with the provision for anti-ballistic missile capability down the track.
- The British Type 26 platform was favoured because of its ASW capability
 - but the decision to equip the Australian version with extensive American sensor and weapons systems never before integrated onto a UK-designed platform carries with it very high risks
 - we understand that since the selection of the UK Type 26 platform Defence's capability requirement has increased again
 - at least one existing military off-the-shelf (MOTS) platform that already embarks much of this expanded capability was excluded from the original CEP when its focus was purely on ASW.
- The already very high cost of SEA 5000 has just increased by over \$10bn in out-turned dollars, apparently reflecting a decision to deliver them at a slower drumbeat and for a higher unit cost.
- It has become apparent that while a weight problem with the first British Type 26 already emerged a year or so ago, the problem is accentuated on the Australian design, with its higher equipment levels
 - to the extent that the shipbuilder has suggested that we now require a new design while some informed commentary suggests

we are now looking at a ship exceeding 10,000 tonnes, around a 25 per cent increase on the original displacement.

- The program has been moved onto the projects of interest register and it is evident that it is now of high risk.

Finally and perhaps most importantly in the context of this inquiry is the state of Australia's sovereign naval shipbuilding industry. There is much here that needs to be examined, including:

- Why the costs for Australia's two major naval acquisitions are projected to be some of the highest in the world and delivery so tardy when in the past the industry has been able to build warships of world-class quality at approximately the world benchmark cost and with a rapid drumbeat.
- The reluctance of foreign-owned Primes to genuinely engage with Australian industry and build extensive local supply chains
 - without a much higher Australian industry content in SEA 1000 and SEA 5000 than presently seems likely, the word 'sovereign' should not be used to describe the naval shipbuilding industry.

We believe a review of the industry's governance and performance is urgently required to consider such issues as whether:

- Senior ADF officers, however outstanding their military careers may have been, have the experience and training required to direct major investment projects so as to deliver them on time and on budget
 - by contrast, Australian industry overlooks some of the largest and most complex and risky investment projects in the world (such as offshore LNG projects) and their expertise should be transferable to the Defence domain.
- A more traditional purchaser-provider relationship can be re-established when currently Defence is heavily involved both as the customer (purchaser) and in oversighting the operations of the industry (provider).
- A more competitive framework for selecting new assets should be established, including taking at least two contenders to a preliminary design study and to competitive tender, leading ideally to a fixed price contract
 - with tenders being assessed on the basis of cost, delivery and Australian industry content.
- We should move away from selecting risky and costly *ab initio* projects in favour of evolving existing platforms, as other shipbuilding nations generally do, and thereby working on an ongoing basis with a single overseas partner for submarines and another for major warships
 - this would allow ASC to develop a deep relationship with a capable overseas Prime and, hopefully an extensive Australian supply chain
 - as well as making it much easier to privatise ASC as two entities, one specialising in submarines and the other in warships.
- If this approach around privatisation is rejected, a government company – perhaps the Australian Naval Shipbuilding Corporation – should oversee the industry with the responsibility for delivering naval projects on time and on budget.

1. Purpose of the Submission

The formidable strategic uncertainty we now face results in the requirement for an incomparably stronger and much more offensive ADF. It must be capable of denying any adversary from using military force—either directly or indirectly—against us.

Professor Paul Dibb¹

Over the last three years, *Submarines for Australia*, founded and sponsored by Gary Johnston, has undertaken major research and produced several substantial reports and submissions on Australia's future submarine project. *Submarines for Australia* is supported by a significant reference group of experts, including retired senior naval officers and public servants, as well as industrialists and academics specialising in strategic policy and public policy more generally. This Submission has a broader scope, encompassing naval shipbuilding projects more generally. Mr Johnston's letter to the Chair of the Committee covering this Submission is shown in Appendix A. The membership of the reference group is shown in Appendix B to this submission.

The terms of reference for this inquiry cover a lot of ground and many complex issues. The objective of this Submission is not to address all these issues in great detail but rather to focus on some areas where we believe significant problems are emerging, in part because they have been given insufficient attention by suitably skilled and experienced people. Having briefly identified the problems, we also propose some avenues to addressing them that the Committee may wish to investigate further. Should this be the case, we would be pleased to attend a public hearing and respond in more detail to any questions the Committee may have.

The main issues we discuss are:

- Future submarine capability, including:
 - the very high risk of a capability gap
 - the very high risks in the SEA 1000 FSM program
 - whether SEA 1000 will deliver, when we need it, a capability that is fit for purpose, as well as being cost effective and with acceptable Australian industry content.
- Future frigate program, including
 - the costs and risks around the program
 - whether the selection process should be re-opened, given the emerging weight problems, which appear to be substantial, and low Australian industry content with the Hunter class.
- The Naval Shipbuilding Plan, including:
 - the efficiency and competitiveness of the industry
 - the low level of Australian industry content in recent and future acquisitions compared with Australia's past achievements
 - the need for more of a national focus on the industry to build resilience and sovereign industry capability.

We note that the Committee is evaluating these major issues in a context where the strategic environment has changed since these programs, including the Naval

¹ Dibb, Paul (2020), *The Strategist*, 9 July,

Shipbuilding Plan, were conceived. The Defence Strategic Update and the Force Structure Plan (FSP), released on 1 July 2020, make it clear that Australia's strategic circumstances have become considerably more threatening in the four years since the release of the last Defence White Paper (DWP) and, indeed, that the strategic threat is greater than at any time since the Second World War. In addition, the threat is assessed as being as of now, with the previous notion of at least ten years 'warning time' consigned to history.²

Although a new strategy has yet to be set out in detail, it seems clear that three main elements in the future strategic approach are designed to enhance the ADF's ability to:

- Engage a major power adversary, if necessary without the military support of the United States, hopefully on the back of closer strategic and military relationships with other important regional powers.
- Deter an attack on Australia by developing the capability to strike an adversary in the Indo Pacific at a range significantly beyond the bounds of our exclusive economic zone (EEZ).
- Defend deployed forces against ballistic missile attacks.

In our view, the evolving strategic circumstances have considerable implications for the Committee's inquiry into Australia's naval shipbuilding industry and, in particular, for the two most expensive Defence projects in Australia's history, namely SEA 1000 (future submarines) and SEA 5000 (future frigates). The combined budget for these two programs has now reached over \$135 billion in out-turned dollars. It is difficult to comprehend the extent of this cost in comparison to previous acquisitions, particularly in light of the fact that previously the 72 aircraft F-35 joint strike fighter program, which other participating middle powers regard as a very expensive project, has a budget of just over \$17 billion.

However, the nation's three largest defence programs, SEA 1000, SEA 5000 and the F-35 project were all excluded from the review of the force structure. Given the importance of these programs and their dominance in terms of the capital budget outlined in Defence's Integrated Investment Program (IIP), this is difficult to understand. In the context of the nature of the evolving threat and the speed at which it is developing, there is, in our view, a need to revisit these programs within the context of the FSP and evaluate at least five issues:

- Will the technologies embedded in the platforms currently being designed for SEA 1000 and SEA 5000 still be relevant in terms of the rapid development of the size and technological capability of the military forces deployed by a potential major power adversary?
- Will the major naval programs make a sufficient contribution to the revised capability required from the ADF as set out above?
- Is the timeframe in which the new capabilities will be delivered sufficient in the context of the Minister's statement that the concept of future 'warning time' no longer applies and "that future is now"?
- In the context of a new era of re-armament where there are also many more demands on the Commonwealth budget as a result of COVID-19, will these

² Hon Linda Reynolds [2020], Minister for Defence, Address to ASPI, July, <https://www.minister.defence.gov.au/minister/lreynolds/speeches/speech-australian-strategic-policy-institute>

two projects provide value for money and, if not, what measures can be taken to address this?

- Will the level of Australian industry content in these programs be commensurate with the identified need to provide a greater level of self-reliance in terms of the procurement and sustainment of technologically advanced military assets?

One important issue, therefore, is how much new money underpinned the announcement. The answer may be “not very much”. But this could change in the future as we emerge from COVID-19 and, in any case, the increase in spending on the IIP over the next five years looks to be significant. According to an estimate by ASPI's Marcus Hellyer, the \$270bn expenditure in defence capability contained in the update is \$75bn more than the estimate in the 2016 DWP. Hellyer estimates “the nominal increase in Defence funding will be 7.2 per cent, 9.2 per cent and 9.0 per cent in the three years from 2020-21 inclusive.”³ Over the three years, this represents an increase of 28 per cent.

There is a significant downside to this, however. Over the decade, new capability acquisition rises from 34 per cent to 40 per cent of the Defence budget while investment in personnel falls from 32 to 26 per cent. In our view this significant relative decline, which will inevitably constrain tightly a long overdue growth in ADF numbers, is not only unsustainable but also highly undesirable. Even in an era of greater automation, you cannot substantially grow the nation's defence capability while constraining ADF personnel below the numbers necessary to operate that capability effectively in combat. We return to this issue, from the perspective at least of the RAN, later in this Submission.

³ *The Weekend Australian* (2020), page 14, 4-5 July.

2. Submarine Capability

Although the Rudd government announced a decision to acquire 12 new submarines in 2009, a design partner for the submarines was not selected until 2016 – seven years later. This had two important consequences:

- Because of this delay and the selection of a radical *ab initio* design for the FSM, the first Attack class submarine will not be in service until around 2035 if all goes well (which, with an *ab initio* project, it generally does not).
- The Collins class boats begin arriving at the end of their design life in 2025-26 and all six will require a comprehensive life-of-type extension (LOTE).

Two concerns arising from this are:

- There is a substantial risk of a gap in submarine availability in the late 2020s and 2030s and even perhaps of a total capability gap
 - this would have a negative impact not just on the ADF's order of battle but also on the ability of the Submarine Force to recruit and retain sufficient trained submariners.
- The doubling of the number of platforms in the Submarine Force, announced in the more benign strategic circumstances that existed over a decade ago, will not now be achieved until the mid-2050s.

2.1 Collins class LOTE

Two imperatives for the LOTE are:

- If the submarines are to continue to operate in a theatre where the anti-submarine warfare (ASW) capability has increased substantially (and is continuing to do so), the LOTE has to be comprehensive and must not only address reliability issues but improve overall the capability of the submarine so as to deal with more advanced threats.
- If availability of the submarine force is to be sustained, the LOTE needs to be completed within the two-year window when the full cycle docking (FCD) major maintenance is being undertaken.

Both these requirements raise significant challenges and justify an early, detailed planning phase that, judging by the ANAO's recent comments, is now overdue.

First, although Collins is now an excellent submarine with world-class availability, it is approaching obsolescence in terms of its ability to undertake high-intensity operations. In particular, and in common with all conventional submarines even those with air-independent propulsion, its low sustainable speed and its indiscretion ratio have a negative impact on both its effectiveness and survivability. We note the Royal Navy withdrew its conventional submarines from high-intensity ASW operations in the North Atlantic over 30 years ago. If Collins is to continue to be able responsibly to be sent up threat after its LOTE, it will need to receive a major transfusion.

Major upgrades to systems are already underway:

- New sonars.
- A major command, control and communications (C3) systems upgrade.

We understand the Navy's plans for the LOTE also include:

- New diesel generators.

- A new permanent magnet main motor.
- New switchboards and a new AC electrical distribution system.
- Potentially the replacement of existing lead-acid batteries with new technology.
- Possible introduction of optronic mast(s) to replace optical periscope(s).

Although the work already underway has been the subject of lengthy planning and preparation, the last five items have not. Together, replacement of these major systems represents a very substantial task that carries with it significant risks. According to an expert member of our reference group, the work involved is so extensive and complex that it is akin to building a new design of submarine in the areas concerned. There is, therefore, a need to begin with a concept design and work the detailed design up from there. For example, the installation of new generator sets, possibly with four units replacing three, and a new main propulsion motor on their own are enough to warrant this.

While being necessary if the Submarine Force is to continue to be able to undertake high intensity operations against a major adversary, an upgrade of this scale presents some very considerable challenges:

- The design task is very complex – although ASC is designated as the design authority for Collins, the company has no experience in such major changes and submarine designers are in high demand in Australia
 - ASC may well need to contract SAAB Kockums for substantial design support (assuming the Swedish company has the necessary resources) and would in any case be wise to do so.
- A LOTE on this scale will need a major budget commitment – previous estimates by ASPI have ranged up to \$15bn – while the current commitment is said to be only around \$3.5 billion for all six boats, a budget breakdown has yet to be published.
- Even were substantial additional highly skilled tradespersons to be recruited by ASC – scarce resources in both Adelaide and Henderson – the sheer scope of the proposed upgrade makes the delivery of these very substantial works, which are additional to the regular FCD major maintenance, within the same two-year window a difficult challenge.

These accumulating risks increase the probability of a capability gap. In light of previous experience of substantial upgrades involving the integration of advanced contemporary technologies with last century platforms, this is a risky endeavour. There is a possibility it will not succeed or will only be partially successful, with the outcome that the life extended submarines may be capable of undertaking only low or medium intensity operations. In this event, the risk of a capability gap is very high. There is also a risk that the LOTE will not be completed within the two-year window, which could cause a cascading impact on submarine availability and hence the production of submariners – in effect, a capability gap.

2.2 Attack class future submarine

As acknowledged by both the ANAO and Defence, SEA 1000 is a high-risk program. Before even a preliminary design study has been completed, the project is already subject to a number of delays, although Defence has stated these will not retard the overall program if further delays can be avoided – noting that the

impact of COVID-19 on the design progress has yet to be advised. Difficulties and tensions in the relationship between Naval Group and Defence are an additional challenge. This has even led the Naval Shipbuilding Advisory Board to suggest earlier that the government should consider walking away from the project. A fundamental problem is that the absence of any competition for Naval Group since the end of the CEP has given the contractor a monopoly position in its negotiations with Defence over critical issues such as cost, schedule and Australian industry content.

A Submission to the Parliamentary Joint Committee on Public Accounts and Audit made by two senior ASPI analysts in March 2020 succinctly proposed some major risks around the SEA 1000 project. These are presented in Exhibit 1 below.

EXHIBIT 1: ASPI – DOES THE GOVERNMENT UNDERSTAND THE RISKS AROUND SEA 1000?

Currently, while there is extensive public commentary in the media and strategic policy community, there is no agency or entity which has a mandate to provide independent advice to the government on the broader risks associated with the undersea warfare capability transition based on all available information.

These risks include:

Operational risk. For example, will the program deliver enough boats to sustain adequate presence in the areas we need to operate? Will this level of presence actually make a strategic difference? Just as importantly, can conventional submarines do what Defence expects of them? Put another way, are the requirements for the future submarine program reasonable in the first place? Or are they driving the development of the largest, most expensive submarine in the world that will fall short of meeting those requirements anyway?

Force structure risk. Does the massive investment in submarines distort the ADF force structure? Is it forcing Defence to delay or reduce investment in other key capabilities? We know already that Defence has delayed expenditure on many other projects in order to fund SEA 1000. We also know that Defence is fundamentally underinvesting in key emerging technologies such as autonomous systems. It is dangerous to regard submarines as a silver bullet that justifies any cost, no matter how high.

Technological risk. Will new technologies render the investment in submarines nugatory? While there may not be inventions in the short to medium term that will make the seas transparent, it is highly likely that with the proliferation of cheap, small drones carrying sensors (and potentially weapons) that can aggregate their signal data, even the undersea domain will become extremely dangerous for manned submarines.

Source: Marcus Hellyer and Michael Shoebridge, Submission to the JCPAA, March 2020.

We share these concerns and feel this Committee should take full account of them. In their Submission, the two ASPI analysts also stated “at the moment it is impossible for the Australian parliament and public to develop a view on what the government’s \$200 billion investment program actually is, let alone its coherence or achievability”.

According to our analysis, as discussed in the recent [report](#) published by Submarines for Australia, there are four fundamental challenges with the SEA 1000 program:

- Will the capability provided by the Attack class be fit for purpose?
- Will the capability provided by the Attack class be cost-effective?
- Will the delivery schedule provide a much more powerful Submarine Force in the timeframe required to address a more immediate threat than envisaged in previous DWPs?
- Will Australian industry content in the program be sufficient to provide the essential level of sovereign capability throughout the life of the submarines?

2.3 Capability: will the Attack class be fit for purpose?

First, there is a major question mark as to whether this very expensive program will deliver a submarine that is fit for purpose. The Minister in her recent speech to ASPI emphasised the importance of submarines in the ADF's order of battle:

“Submarines are fundamentally important to our defence strategy. They are a unique and powerful deterrent to any adversary, and they are critical to protecting our national security interests. Submarines secure Australia's strategic advantage – through leading-edge surveillance and the protection of our maritime approaches. Our sophisticated level of interoperability with the United States is a critical aspect of our submarine operations in our region ... Submarines are also the vanguard of strategic lethality and deterrence. With substantial firepower, with stealth, with endurance and also with sustained presence.”

In light of the Defence Strategic Update and the FSP, with the emphasis on the acquisition of assets embodying the latest technology, taken together with the Minister's emphasis on the importance of the offensive capability that the RAN's submarines provide, this is a highly pertinent issue for the SEA 1000 program. The submarine is being designed to specialise in ASW and, in peacetime, to undertake high intensity intelligence, surveillance and reconnaissance (ISR) operations, including those in close liaison with US forces in the South China Sea, adjacent waters and elsewhere in the region as required.

Problems with this include:

- The main reason Australia requires a large and unique conventional submarine is that its main area of operations (AO) is 3,500 NM away in the northern hemisphere
 - the transit time to the AO and back takes up over half of a 70-day operation – is this an efficient use of a very high value asset?
 - the AO is characterised increasingly by much improved ASW capability on the part of the potential adversary – for example, the PLA Navy commissioned six new ASW corvettes in the first half of 2020 and is reportedly laying seabed sensors around the recently militarised artificial islands in the SCS – making a conventional submarine in particular more vulnerable to detection because of its need to snort periodically and its inability to disengage from threatening tactical situations at high speed
 - in designing a submarine to operate in this AO for 50 years from the mid-2020s, we are assuming that US forces will still be around – Australian submarines could not operate there without access to the American C3 systems and extensive infrastructure for gathering and distributing essential intelligence in real time.

As we have pointed out in previous reports, it is difficult to see how the Attack class will be fit for purpose when it comes on stream. In her speech to ASPI following the release of the Defence Structure Plan, the Minister emphasised the importance of Australia maintaining its capability edge, and preparing for the complex and high-tech conflicts of the future. Yet the Minister still argues the Attack class will be a regionally superior submarine, while it likely will not. In a high-intensity theatre where at least four countries operate nuclear-powered submarines, any conventional submarine will be challenged in terms both of its effectiveness and survivability relative to a SSN:

- Even if new battery technologies are employed in the Attack class (and current Defence statements do not suggest they will be), the main beneficial impact will be on the indiscretion ratio rather than providing a sustainable high speed
 - The very long transits required for Australian submarines deploying to their AO and back mean that the time on station for a conventionally-powered submarine is substantially constrained
 - If detected by hostile forces, a conventional submarine will have a lower level of survivability than a SSN because of its far lower sustainable speed.

We would argue that if crewed Australian submarines are going to undertake high intensity operations in the much more challenging tactical environment in the 2030s and beyond, they will need both to be nuclear-powered and to have the capacity to deploy advanced autonomous underwater vehicles (AUVs).

2.4 Budget: will the Attack class be cost-effective?

To address the second issue, of cost-effectiveness, we first need to know how much the submarine will cost. There is significant confusion on that question. At the time of the announcement of Naval Group's selection, the evidence as presented suggests the cost was \$50bn in what Defence terms out-turned dollars (Exhibit 2).

EXHIBIT 2: DOES PARLIAMENT KNOW HOW MUCH THE ATTACK CLASS WILL COST?

When the government announced in April 2016 that the French company DCNS (later Naval Group) had won the contest to design Australia's future submarine, it stated that the cost of the program was \$50bn. It was understood that this figure was expressed in what Defence calls out-turned dollars – that is, the amount that will be paid in then current dollars through the length of the program with inflation and exchange rates taken into account. It was estimated that this represented an equivalent cost of around \$31bn in 2016 constant prices. The reasons for believing this was expressed in out-turned dollars are:

- The Secretary of Defence told Parliament in October 2015 that the \$50bn estimated cost of the SEA 1000 program was expressed in out-turned dollars
- The Defence Integrated Investment Plan (IIP) published with the White Paper at end-February 2016 stated the budget for SEA 1000 was \$50bn in out-turned dollars, excluding the combat system.

The problem with this came when a Defence official told the Senate in May 2018 that "the acquisition cost of the future submarine as quoted in the IIP is \$50 billion on a constant price basis" rather than out-turned dollars. *Prima facie*, this represents an increase in the budgeted cost of around 60 per cent, or \$30bn in out-turned dollars. In evidence to the Senate in May 2020, the same official told the Senate that the change to a constant price estimate of \$50bn had occurred during the CEP process and before the announcement of Naval Group as the successful bidder.

The trouble with this story is that it is at odds with the facts as we understand them:

- The Secretary of Defence at the time of the announcement was the same individual who had testified in detail six months earlier that the cost was expressed in out-turned dollars—surely he would have ensured that if a 60 per cent increase had occurred this would be part of the announcement
- Contrary to the May 2018 statement by Defence, the IIP makes it clear (pp 89-90) that the \$50bn is expressed in out-turned dollars, not constant prices
- As to timing, when journalist Robert Gottlieb wrote a piece **after** the announcement on the high cost of the acquisition, he was called by a very senior Minister, who was deeply involved in the Cabinet process and the announcement, to say that he should acknowledge that the price was expressed in out-dated dollars – Gottlieb revised the story as a consequence.

Does this matter? Well, yes. We have no idea how much the submarine will cost and, whether knowingly or not, Parliament appears to have been misled.

Source: Insight Economics.

Yet Defence, more recently supported by a statement in the Senate by the Minister in May 2020, continues to state that at the time of the announcement the cost was \$50bn in constant 2016 dollars, an increase of 60 per cent. We have no interest in assigning blame for this confusion – our view, as always with such imbroglios, overwhelmingly favours error over conspiracy – but it is an extremely important issue and one that needs to be resolved. If the budget really has increased by 60 per cent from what was already considered by many to be an expensive acquisition:

- The cost effectiveness of the SEA 1000 acquisition is highly questionable and the value for money calculus needs to be reviewed.
- The cost appears extraordinarily high by world standards.
- The opportunity cost is also very high and may crowd out some other more efficient acquisitions.
- Whether or not there has been an effective 60 per cent increase in the budget, the contractor, as a rational monopolist, will set their price at the maximum level.

Nevertheless, the cost of the program has now been confirmed in the FSP as \$89.7 billion in out-turned dollars and \$50 billion in constant 2016 prices. Yet even with a 12 submarine force, not achieved on the present schedule until the mid-2050s, because of the long transits, slow speed of conventional submarines and regular maintenance schedules, this very high cost program would enable the Navy to deploy only one submarine on station continuously over a prolonged period:

- It must be questionable whether this is a cost-effective use of highly expensive assets.
- This efficiency/cost-effectiveness issue also helps to make the case for nuclear-powered submarines – if the Navy acquired 12 SSNs it could deploy around three times the number of submarines on station.

We may be asked, reasonably enough, on what basis can we say that a cost of \$50bn in constant 2016 prices is a “hugely expensive program” when Australia is procuring an *ab initio*, unique blue water conventional submarine? One indicator of an efficient cost is that the German company, tkMS, bidding against the French and Japanese in the CEP made a public offer to deliver 12 submarines of a similar size as the Attack class for a guaranteed, fixed price acquisition cost of \$20bn at constant 2016 prices. Although this was the acquisition cost rather than the program cost, which includes infrastructure, training, weapons, etc, even if we include a reasonable estimate for those items, this bid was less than half the present program cost estimate of \$50bn at constant prices. In terms of capability, the tkMS contender would have needed to meet the RAN requirements as stated in the CEP documentation, in the same way as Naval Group. In addition, tkMS also committed to build the submarines in Adelaide for the same cost as in Kiel with a guaranteed minimum Australian industry content of 70 per cent.

Another indicator of how expensive the SEA 1000 program has become is to look at a parallel program in the US to acquire nine Virginia class submarines. The American Submarine Force has been in decline as a consequence of decisions taken at the end of the Cold War. Yet the rapid rise of China in recent years has prompted a much more rapid response than that of Australia. In December 2019, the US Navy ordered nine new Virginia class nuclear-powered attack submarines.

Eight of these are very large submarines – at 10,200 tons in the Block V version is 30 per cent bigger than the current Block IV version and over twice the size of the Attack class (see Exhibit 3).

EXHIBIT 3: AUSTRALIAN AND AMERICAN SUBMARINE ACQUISITION PROGRAMS

Submarine Program	Program Commencement	Deliverables	Delivery First Boat	Delivery Last Boat	Program Cost (AUD)	Cost per Boat (AUD)
RAN Attack Class	April 2016	12 4300 ton SSKs	2033	2052	\$50bn	\$4.2bn
US Navy Virginia Class	December 2019	9 10,200 ton SSNs*	2025	2029	\$33bn	\$3.6bn

* One Virginia class boat will be a Block IV submarine at 7,800 tons

Source: *Insight Economics*

Comparisons of this nature are always fraught because of the need to compare apples with apples and it is never clear what is included in these estimates. In this case, we are comparing a *program* cost for SEA 1000 with a *contractual* cost for the delivery of nine Virginia class submarines in the middle of a 66-boat program and built in parallel in two shipyards. We do not know whether weapons are included. On the basis of private American advice, we believe the reactors are included in this comparison, whereas in the previous [2014] Virginia class contract – “the [then] most costly shipbuilding contract in history” – they may not have been. On the other hand, the end product is very different as well, including the fact the US submarines are twice the size of Attack. Although we may quibble about what is and isn’t included in these estimates, on the crude numbers it seems ridiculous that we are paying 16 per cent more per platform for 12 slow, conventional submarines than is the USN for nine powerful nuclear submarines, over twice the size of Attack, with a far greater capability, a much higher speed and no effective limit to their endurance.

Some may argue that it is unfair to compare delivering an established design of submarine like Virginia with an *ab initio* design like Attack. Well, not really. The Americans tend to improve existing designs in service and then evolve an existing class for their next platform – this leads to lower costs, much lower risks, a reduced training requirement and earlier delivery. This is what they have done, for example, with the Flight III version of Virginia (and also with the DDG51 Arleigh Burke destroyers). It is a sound policy that most countries with a naval shipbuilding industry tend to follow. Australia did not have to select an *ab initio* design for its future submarine and Ministers should have pushed back against such an approach. The Navy could have elected to evolve the successful Collins class at a lower cost and with a much earlier delivery. Defence chose not to do this.

2.5 Delivery: will the Attack class be delivered when we need it?

This segues into the third issue, delivery. As the Minister said in her speech to ASPI in July 2020, “that future is now”. There is a significant problem here, due to delays under both governments when admittedly the strategic need for new submarine capability was less apparent than it is today. Yet in addition to the government’s delays, the preference by Defence to undertake an *ab initio* program

to replace Collins was always going to risk an extended delivery schedule. This was exacerbated by the decision to establish a continuous build program with a two-year drumbeat, meaning that it will not be until the 2040s that the Navy will have more than six submarines in commission and not until the mid-2050s that it will get 12.

This is surely not what the planners behind the 2009 DWP – entitled *Force 2030* – had in mind, in a far more benign strategic environment, when they determined that the Submarine Force should double to 12 boats. There is a serious risk of a capability gap and, even if that doesn't eventuate, of an availability gap, where the Navy will not even be able to maintain one submarine on station for half the time.

This is a critically important issue.

2.6 Australian industry content: can we develop local capabilities?

Finally, on the fourth point, there is a powerful argument for acquiring submarines in Australia in order that we have the sovereign capability to sustain them. If they are to be sustainable in times of conflict, Australian industry content in the supply chain needs to be high. Australia's requirement is for a long-range, blue water conventional submarine that is not available 'off-the-shelf'. If we are to have a sovereign submarine capability, being at the end of a long supply chain from Europe for components that potentially nobody continues to make is highly undesirable – it has implications not only for the ability to put submarines to sea but also for the cost of sustainment. These costs were very high with the British built Oberon class submarines, where Australia was also on the wrong end of an embargo on spares during the Falklands War. This led to building Collins locally, with Australian industry content of over 70 per cent increasing to over 90 per cent currently in the sustainment process. We should also note that 90 per cent local content has not impeded ASC in meeting global benchmarks for sustainment in recent years, including in terms of cost per available sea day.

Without nailing down a local content requirement during the CEP and with no further competition in the acquisition process, Defence is having a very difficult job in achieving satisfactory local content in SEA 1000. It should have been understood from the get-go that Naval Group, majority owned by the French government, would have an interest in maximising expenditure and jobs in France. Due diligence would have revealed that French contractors had form in this regard. For example, a proposal for a joint frigate project between the UK and France and Italy foundered on this very issue. A House of Commons report stated that: "France's DCN appears to have had every intention of buying certain equipment from sources close to home, whatever the requirement or the equipment competitions might have otherwise suggested."

To the surprise of many industry insiders, Naval Group states that it has found a dearth of Australian competencies in the provision of technologies, goods and services. Given that an increasing numbers of Australian defence contractors, such as Pacific Marine Batteries, are international leaders in their field, this is difficult to understand. In the 1990s, a new company in Adelaide, a city that had never built a naval platform in a country that had never built a submarine, managed to develop a substantial supply chain and achieve greater than 70 per cent local content. Two Australian CEOs of Naval Group Australia, who were very familiar with local defence industry capability, lost their jobs after promising high levels of local content – indeed, 90 per cent was the figure quoted during the CEP. Naval

Group's current offer of 60 per cent AIC lacks credibility because it is not underwritten by any commitment. The local content also has to be genuine and directed towards creating and developing local technological, engineering and manufacturing capability. Naval Group has previously published a list of Australian companies with whom they do business, but many of these are in the service sector and do not contribute to developing Australian competencies in defence manufacturing industry. When it comes to genuine Australian industry content, contracts to Australian services firms for accounting or retreats in the Barossa Valley just do not cut it.

2.7 Way forward: review of future submarine requirements

Although the SEA 1000 program was excluded from Defence's recent review of the ADF force structure, the new directions and priorities set out in the Defence Strategic Update and the FSP have profound implications for Australia's Submarine Force. They pose fundamental questions as to whether the future submarine's proposed role can be efficiently discharged by the Attack class and whether the scheduled in service availability of the Attack class is consistent with the Defence Minister's statement that there is no future warning time any more and "that future is now". In addition, and underlying this longer term analysis, is the acute current risk of a capability gap and the associated possibility of a sharp decline in the number of trained submariners at a time when the Navy needs to substantially increase the complement of the Submarine Force.

We consider that an independent Review should address the following issues, grouped into three main areas for urgent consideration.

First of all, the FSP and the Minister's statement placed the Submarine Force at the heart of Australia's future capability to deter an attack on Australia by operating 'up threat', presumably in and beyond the 'air-sea gap'. Yet while submarines provide a powerful means of prosecuting this role, and thereby ideally offering a credible deterrent, it is not clear that the Attack class will provide a suitably efficient and effective means of providing the necessary capability. Even with a force of 12 submarines, (on the present schedule not to be achieved until the mid-2050s), because of the long transits required to the submarines' primary area of operations (AO) in the northern hemisphere and the slow sustainable speed of a conventional boat, the Navy will be able to deploy only one submarine on station continuously over a prolonged period:

- In our view, this is not a sufficiently powerful force to present a credible deterrent
 - particularly in the future if the US Navy withdraws from undertaking high intensity operations in the South China Sea and its considerable intelligence infrastructure is no longer available to us.
- At a cost of \$89.7 billion (in out-turned dollars) the opportunity cost of being able to deploy one Attack class submarine on station at any time will be so high that it will not provide a cost-effective use of available resources.
- With a substantial and ongoing improvement in the PLA's ASW capability, both the operational effectiveness and survivability of any conventional submarine operating up threat in the South China Sea in the mid-2020s and beyond will be increasingly compromised.

- we should note that the Royal Navy withdrew its conventional submarines from ASW operations against the Soviet Red Banner Fleet in the North Atlantic nearly forty years ago because of their lack of effectiveness and concerns about survivability in a high intensity theatre.

Secondly, in light of these conclusions, what is the alternative to the Attack program for the Submarine Force? We consider that there is a strong case for the acquisition of nuclear-powered submarines for the RAN, always provided they would provide a cost effective capability:

- The emphasis on acquiring leading edge military technologies for the ADF suggests that the review of future submarine technologies, flagged in the 2016 DWP for later in the decade, should be brought forward
 - the proposed review should consider whether, in principle, the Navy needs to acquire SSNs
 - if the government agrees, it should initiate a conversation with the US Navy in the first instance to discuss a possible way forward
 - while not expecting that the USN would agree to supporting the acquisition of American nuclear submarine technology by the RAN, it would be very helpful if they would agree in principle to the acquisition of British technology (the USA has some lien over the UK's nuclear reactor technology under the 1958 treaty between the US and UK), noting that France has already offered to supply Australia with SSNs
 - although those parts of the submarines incorporating the nuclear reactor would need to be built offshore, there is no reason in the longer term why nuclear-powered submarines could not be consolidated in Australia by local industry provided the requisite investments in hard and soft infrastructure had been made.

Finally, the Minister's statement that the "future is now" is at clear odds with the present program that will not equip the Submarine Force with the 12 submarines announced in the 2009 DWP for another 35 years. Indeed, with a capability gap looming, there is the distinct possibility that in the 2030s Australia will be left with a lesser submarine capability than now, at a time when the size of the Submarine Force will need to double in size.

In order to avoid a capability gap, the immediate priority is to determine a detailed plan and budget for undertaking the Collins class LOTE. If the submarines are to continue to operate up threat, the LOTE will need to provide an advanced capability and the budget should reflect this. In addition, the life extension upgrade will need to be completed within the two-year FCD window if a capability gap is to be avoided. In regard to the LOTE, the Review should consider and report on the following issues:

- Whether the LOTE should be undertaken in South Australia or Western Australia
 - the government has probably already made a decision on this but it needs to be announced.

- Whether SAAB Kockums should be retained by ASC to oversee the overall design aims and process as well as assist with system and detail design of the LOTE
 - noting that ASC has never undertaken such a substantial submarine design task and the scarcity of available skilled resources in Australia.
- An early contract award would also enable a detailed planning process of how the LOTE can be completed within the FCD process, including whether additional shipyard resources need to be retained by ASC.

The Review should also report on how to bring new submarines into service in a timeframe more consistent with the exigencies of Australia's strategic situation.

For example:

- Do we need a risk mitigation strategy – a Plan B – to introduce some competition to the Attack program under which Naval Group has been gifted a monopoly position?
 - were the review to recommend the government acquire SSNs, how can we best acquire six new conventional submarines first so as to build up the Submarine Force to the size and capability required to operate a nuclear-powered submarine force?
- How can the delivery of new submarines be brought forward, either with Attack or a different class of submarine?
- How can the cost of the submarines be brought down to a level approaching international benchmarks?
- How can the level of Australian industry content on the future submarine be increased to the level (≥ 70 per cent) in the supply chain required to effectively sustain the submarines in service?

3. Future Frigates

Under the SEA 5000 program, BAE Systems has been selected to design and build nine Hunter class derivatives of their Type 26 general purpose frigates for the RAN at a cost of \$45.6 billion in out-turned dollars with delivery beginning in the late 2020s. Because of the deteriorating budget situation and Australia's more threatening strategic circumstances, together with the existing and emerging high risks around the Hunter class, we believe there is a strong case for the acquisition to be reviewed.

The nine Hunter class ships are to replace eight of the much smaller Anzac frigates, delivered between 1996 and 2006. In terms of shipbuilding performance, the Anzac frigate program was highly successful:

- Ten ships were delivered on budget and on schedule at a globally competitive cost.
- They were built at a rapid drumbeat, with one ship being commissioned each year on average from 1996.
- The first of class, HMAS Anzac, was commissioned just two years and six months after the keel was laid.
- Australian and New Zealand industry content was over 70 per cent, with an extensive nationwide supply chain and modules being built in shipyards around Australia and in New Zealand.

Between the Anzacs and the Hunter class came the three Hobart class air-warfare destroyers. These were delivered late at a cost of \$9.1 billion, giving them the unfortunate distinction of probably being the world's most expensive warships of their size ever built, at least until now.

Four major issues around the Hunter class are:

- Will the Hunter class be fit-for-purpose?
- How risky is the Hunter class project?
- Will the Hunter class be cost-effective?
- Will the ships have a satisfactory level of Australian industry content in the supply chain?

3.1 Capability requirement

On the first point, large surface combatants are becoming something of a threatened species:

- The development of large oceanic area surveillance systems that are pervasive, persistent and precise, coupled with very long range anti-ship ballistic and hypersonic missiles, has compromised the effectiveness and survivability of warships, particularly larger platforms.
- Unless part of a battle group or task force, it is difficult to see that Australia would deploy frigates up threat in a conflict with a major adversary and, while they do have utility beyond warfighting, their deterrent value is relatively low.
- As ASW ships, the critical capability is provided by aircraft, mainly helicopters in the context of frigates and destroyers

- but we can expect UAVs to increasingly play a role in the future, and embarking a mixture of crewed and un-crewed aircraft is a likely scenario
- a platform able to embark a larger number of mixed aircraft types would be attractive but the Hunter class will carry only one helicopter, with additional hangar space for a small future UAV.
- A major role for larger warships is area air defence, including anti-missile defence
 - a larger platform is required to mount a sufficient battery of missiles in VLS and to accommodate the longer SM3 and SM6 long-range missiles used in the anti-ballistic missile (ABM) role.

SEA 5000 was first intended as an acquisition program for an ASW frigate. On this basis, the process down selected to three platforms – the Spanish F-100, the Italian FREMM and the British Type 26 Global Combat Ship:

- The F-100 is the same platform that Australia was then building as the Hobart class air-warfare destroyer (three ships) – it already had a sophisticated ASW capability including a Seahawk Romeo helicopter and both hull mounted and towed array sonars.
- The FREMM is a specialist ASW frigate, including a hangar for two helicopters while the other two ships have just a single hangar.
- While the Type 26 is a general purpose frigate, it has an advanced ASW capability.

3.2 Risk

Turning to the second point, Defence could have substantially mitigated the risk of the SEA 5000 program class but instead, presumably in a bid to maximise capability, they ended up selecting the highest risk option available. In part because of its risk, Defence has already placed SEA 5000 on its list of projects of interest.

In many ways the selection process was less risky than the SEA 1000 program because the three options taken forward – the Spanish F-100, the Italian FREMM and the British Type 26 Global Combat Ship – were all existing designs (although the Type 26 was unproven with the first of class at an early stage of construction in the UK). But we need to remember that the three designs were selected for the CEP on the basis that they were ASW platforms. When the design parameters were amended to include Aegis, CEAFAR and an area anti-aircraft and potentially an ABM capability, the game changed and yet the competitors under the CEP did not.

The issues making the Type 26 the riskiest contender of the three are:

- It is the only platform that has not been proven in service – for this reason the US Navy excluded it from consideration for its new FFG(X).
- Unlike the Spanish F-100, the Type 26 original design does not include Aegis, which has never been integrated on a British platform, whereas the Spanish ship already does
 - BAE Systems acknowledges that the “Australian version is much more complex than its British parent”
 - Australia has experience in building the F-100 and in working in partnership with Navantia – after many years of travail, ASC claims

that the final ship was built to benchmarks that are comparable to other Aegis platforms worldwide.

Some serious risks with the Hunter class are already beginning to emerge. These are largely the result of choosing a platform that was unproven in service, unlike the more cautious American policy in selecting the FFG(X). In mid-2019, Submarines for Australia was advised that there were problems with the weight of the first Type 26 frigate under construction in the UK. This has now been confirmed.⁴ The problem may well be greater for Australia because of the requirement to make substantial changes to the combat system, sensors and weapons on the British designed platform. The Australian designed CEAFAR radar, for example, while improving the capability, is also heavy and sits high in the ship. An industry source, cited in the above article by Andrew Tillett has said:

"Australia purchased a design concept and the design is changing significantly – that is going to increase risk to the program ... the frigate's weight was on track to exceed 10,000 tonnes, necessitating the need for the hull to become bigger, which could affect its speed, acoustic performance and ability to conduct stealthy anti-submarine warfare operations."

If a conventional contingency weight margin of at least five per cent is added to accommodate in-service development and upgrades, the change to the design will need to be substantial and the risks will be much higher. The fact that, as the shipbuilder acknowledges, we are now looking at a new design, this argues for a major review of the project. At this early stage, without knowing details of the contract with BAE Systems, it may be that the option remains open to change course and re-visit the selection process. One option would have been to continue building the Spanish ships, which we had just learned to build efficiently. Alternatively we could have worked with the US on the acquisition, since both countries are seeking new frigates in a similar timeframe and based on existing European platforms. The US Navy has selected the Italian FREMM ship for the FFG(X). Although selected two years after Australia made its choice, the FFG(X) will be in service earlier than the first RAN ship.

Another approach would be to explore the option of building Flight III DDG-51 [Arleigh Burke class] destroyers in Australia. In reality this is a MOTS option that would meet virtually all Australia's capability requirements including ASW capability – unlike the Type 26, the DDG-51 class has hangar space for two Seahawk Romeo helicopters and is being retrofitted with towed array sonar to complement its hull-mounted sonar. It would likely be about the same size as the re-designed Hunter class or smaller. With much of the equipment specified by the RAN already integrated and 87 DDG-51s already in service or approved for construction for the USN, they would be far less risky. Finally, Defence is required to include a MOTS option in the acquisition process if a viable off-the-shelf option exists. If the process were to be re-opened, the DDG-51 merits serious consideration,

3.3 Cost

On the third point, although the Anzac class frigates were delivered at approximately the world price, since then Australian acquisition costs for naval platforms have blown out significantly. The Hobart class destroyers, for example,

⁴ Tillett, Andrew (2020), "Sinking feeling: frigate heads back to drawing board", *Australian Financial Review*, 26 June.

cost more than twice as much each as the larger and more capable American DDG-51 class.

Exhibit 3 (below), provided by a US expert, contains a comparison of the cost of large surface combatants – destroyers and frigates – currently being developed or acquired. The usual issues with such comparisons arise – whether these are project or program costs, whether in constant or out-dated dollars, whether weapons and combat systems are included, etc – but we believe these are the best available estimates in the public domain. The Australian warship's cost is based on the recent increase to \$45.6 billion in out-dated dollars converted back to constant prices.

EXHIBIT 3: COST OF NEXT GENERATION LARGE SURFACE COMBATANTS

Warship Characteristics Comparison

	FFG(X)	MKS180	UK Type 26	RCN Type26	RAN Type 26	DDG51 Fl. III	Maya
Country	USA	FRG	UK	RCN	RAN	USA	Japan
Disp: tons	6700	9000	8000	8000	8000	9600	10,450
Price: USD	\$1,280M	\$1,250M	\$1,540M	\$2,666M	\$2,700M	\$2,100M	\$1,500M
KUSD/Ton	\$191K/Ton	\$139K/Ton	\$193K/Ton	\$333K/Ton	\$338K/Ton	\$219K/Ton	\$144K/Ton
VLS Cells	32 VLS cells	TBD	72 VLS cells	72 VLS cells	72 VLS cells	90 VLS cells	96 VLS cells
Helo	one	one	two	two	two	two	one
Gun	1-57mm	1-127mm	1-5"54	1-5"54	1-5"54	1-5"54	1-127mm
Price: AuD	\$1,870M	\$1,825M	\$2,250M	\$3,890M	\$3,940M	\$3,065M	\$2,190M
KAuD/Ton	\$279K/Ton	\$203K/Ton	\$281K/Ton	\$486K/Ton	\$493K/Ton	\$319K/Ton	\$210K/Ton

Source: Tim Nichols, President, Ubiquitech LLC, for a future article on the next-generation of naval ships.

On this basis, the projected cost of the RAN's Type 26 is higher than all the other platforms, in some cases substantially so. Some of the programs have much bigger production runs than others, offering significant economies; for example, 67 DDG-51 class destroyers have been delivered to the US Navy since the 1980s and another 20 are under construction or approved. In this context it should also be noted that none of the American, British or Canadian shipbuilding industries are considered to be particularly efficient in global terms. The Japanese and German industries perform better, as is shown in the comparison with the Hunter class. On a per ton basis, the Australian ships are estimated to cost over 135 per cent (or two and one-third times) more than the German or Japanese platforms.

As with the submarine, the cost blow-out for the Hunter class is difficult to explain. The original \$35 billion program cost in out-dated dollars shown in the Naval Shipbuilding Plan already seemed excessive. The possible reason for the recent increase to \$45.6 billion, as revealed in the Force Structure Plan, is explained in a footnote which suggests that in order to facilitate the continuous build policy, the ships will be delivered later than previously scheduled and presumably at a higher unit cost. This seems a counter-intuitive reason for a very substantial increase in the projected cost of the program and one that should be subject to scrutiny.

The excessive cost of the program is a major problem, with implications for the Defence budget and, once again, opportunity cost, with the possibility that other acquisitions will be 'crowded out' some time down the track.

3.4 Local content

The level of Australian industry content that will be achieved on the Hunter class is not clear and we understand that no particular level of local content has been mandated. Yet we know from the Anzac frigate acquisition that it is possible to build a warship in Australia at a competitive international benchmark cost (the comparison then was with the cost in Germany) with over 70 per cent ANZ content in the supply chain, and to maintain very complex naval platforms (submarines) at a world benchmark cost even with 90 per cent Australian industry content.

We understand from industry observers that BAE Systems is showing no greater enthusiasm than Naval Group for engaging with Australian suppliers. This is not surprising. Global shipbuilding corporations have developed their supply chains with players whom they trust, who understand their requirements and generally speak the same language. Their host governments generally require them to develop in-country supply chains. If they are not contractually required to engage with Australian suppliers during the detailed design of the first of class and, indeed, incorporate some of them in their global supply chains, there is no reason why they should be expected to do so. BAE Systems has recently acknowledged that it has agreed with the Commonwealth that the new design will integrate the British supply chain at the expense of Australian industry content and capability.

The need for a reduced degree of reliance on overseas supply chains has been demonstrated as a result of the COVID-19 pandemic. While total self-reliance is economically unachievable, there is still a requirement to make strategic defence equipment in Australia if we can at a reasonable cost. If an acceptable level of Australian industry content is to be achieved in the supply chains, the requirement needs to be written into both the Strategic Partnership Agreement and the contract, perhaps with a minimum level being specified.

3.5 Way forward: proposed review of SEA 5000 program

The RAN has selected a platform for the future frigate that was rejected for consideration by the US Navy because it was not yet in service and was therefore too risky. While Defence's requirement to replace most of the European sensors and weapons with American and Australian systems was justified, it has also increased the risks around the acquisition. As the shipbuilder has acknowledged, the Australian specifications have created a more complex ship than the original British design. Some of these risks have already emerged, with the acknowledgement that the ship is overweight and the probability that it will need a major re-design to enable it to meet the RAN specification, probably with a substantially greater displacement. Indeed, the shipbuilder's comments suggest that we are really looking at a new design for the Hunter class.

In addition, these problems with the design have led to BAE Systems using their British supply chain, rather than Australian industry, to supply components for the first three ships, which will have a very low 'genuine' Australian content. Of course, once a supply chain is in place for the first batch of the frigates, it will be very difficult for Australian contenders to gain any significant foothold in the program in the future.

We consider that SEA 5000 should be subject to an independent review. The case for such a review rests on the changes that have occurred since the original CEP process for SEA 5000 was established:

- The requirement for the future frigates was initially for an advanced ASW capability, but then this was changed during the CEP process to a general purpose capability, with the new specification including the American Aegis and SM-2 systems and the Australian CEAFAAR radar and SAAB interface, adding a greater level of capability but also more complexity
 - yet the three contenders under the CEP remained the same even though only one of them (the Navantia F-100) already incorporated the American systems
 - the revised specification could perhaps have been best met by an existing MOTS design, the American DDG-51 platform that had been excluded from the CEP process when it was established in order to acquire an ASW frigate
 - in terms of the acquisition guidelines now well established in Defence, a MOTS option should have been considered in the process if an appropriate platform was available.
- It has become clear that the first British Type 26 frigate, which is under construction in the UK, is already overweight although it has a less complex specification than the Hunter class
 - the Royal Navy has form in this regard – both the Type 42 destroyers and the Type 22 frigates grew in size significantly from the original designs
 - it appears that the design of the Hunter class will need to be changed significantly to meet the Navy's requirements – indeed the shipbuilder has suggested that a new design is required
 - it may emerge as a significantly larger ship, which could then involve a series of consequential changes and additional cost
 - clearly the ability to meet Navy's requirements within the dimensions and tonnage parameters agreed at the time of the CEP is now likely to be compromised.
- The cost of the Hunter class, as shown above, is excessive by global standards and may place unacceptable pressure on a defence budget already under some stress
 - the review should examine ways in which the cost could be brought under control.
- At least at this stage, the level of Australian industry content in the Hunter class program appears to be very low
 - in the new international trading conditions, with disruptions to global supply chains and a greater emphasis on military self-reliance, this is unacceptable.

Among other things, the Review should consider the potential benefits of standardising the RAN's large surface combatants on an American platform, probably the DDG-51, always provided we could achieve a true partnership with significant Australian industry content. The advantages would be that:

- In its current re-armament program, the ADF will become increasingly focussed on acquiring leading edge American systems, particularly in long-range missiles but also in areas like ballistic missile defence and hypersonic technologies

- access to advanced American systems and platforms may be the most important benefit Australia gains from the alliance in the near term
- almost all the advanced systems that Australia requires in its future surface platforms are already incorporated in the DDG-51 design.
- As new versions of the platform are introduced in the US, Australia could incorporate them in its continuous build program, including in the replacement for the Hobart class.
- The shipbuilding advantages of engaging with a single overseas design partner – perhaps Bath Iron Works, which already has a relationship with ASC – rather than a series of new ones each time a new design is introduced, should not be underestimated:
 - the gains in terms of using common systems, including digital shipyard technologies, would be far reaching
 - the advantages of developing a deep Australian supply chain for a single, evolving platform should also be significant, rather than local suppliers needing to adapt to a different overseas Prime every few years.

4. Naval Shipbuilding Plan

4.1 Acquisition process – pre-construction

While the construction process is of central importance to any acquisition of a naval platform, many of the critical decisions have been made and later problems embedded before that stage is reached. In our view, insufficient local advice is sought in these prior stages, where input from those with experience in the shipbuilding industry in Australia could be valuable in many areas but where it is only rarely drawn upon. Insufficient analysis of how much things *should* cost as well as a lack of emphasis on value for money are also evident.

The selection of a platform to deliver a required capability provides an example of this. It is at this stage that some of the major acquisition problems have occurred in previous years and the process has been the subject of numerous inquiries into how to improve Defence procurement. Problems can include:

- Too great a focus on acquiring world-beating capability without taking sufficient account of cost and risk
 - the RAN in particular often seeks to mix and match systems with platforms that were not designed for each other – for example, even changes to the combat system on the Hobart class, which already incorporated Aegis, caused a series of major problems for the shipbuilder
 - the biggest risk of all is to acquire an *ab initio* design, particularly for a highly complex asset like a submarine, rather than evolving what you already have in service
 - without doubt, the cost of locally produced naval platforms has become excessive, with no apparent effort to establish an appropriate cost of the asset by reference to overseas benchmarks, against which bids should be compared in evaluating value for money.
- Delaying starting the acquisition process to the extent that a capability gap arises, or a risky, costly and potentially unsuccessful upgrade of an existing platform is required
 - this was the case with both the Hobart class air-warfare destroyers and now the Attack class submarines, together with, potentially at least, the Hunter class frigates.
- By-passing previously successful processes to reduce the procurement risk in favour of increased celerity because the process commenced too late
 - perhaps SEA 1000 is the prime example of this, with no second pass (at least to date), the selection of an *ab initio* design and no further competition following the selection of only a concept design.
- The selection of the platform does not appear to be informed by the particular competencies of the Australian shipbuilding industry and its supply chain; for example, in the SEA 5000 process it is not clear whether sufficient consideration was given to the fact that:
 - Local industry was currently building three ships of the F-100 class (one of the three contenders for SEA 5000)

- Over time, Australian industry had established a good relationship with Navantia over two recent major programs, whereas neither BAE Systems nor Fincantieri had previously built a naval platform in Australia
- Although the record in building the first two ships was poor, ASC then made significant progress up the learning curve and completed the final ship with much greater efficiency
- The F-100 already deployed American Aegis and SM-2 missiles, which the other two did not
- Therefore, the risks of selecting the F-100 platform for SEA 5000 (and probably the cost) would be substantially lower.

4.2 Building the new ships

The overriding problem underlying the major new naval acquisition programs is the lack of expertise within Defence in developing and managing very substantial investment projects. Australia is good at developing major investment projects in the resources sector – the Gorgon LNG project, for example, cost around US\$55 billion (currently equivalent to over A\$80 billion). Some of these projects effectively ‘bet the company’ and they are subject to ongoing risk-adjusted investment appraisal modelling before the final investment decision (FID) is put to the Board. By comparison, if we equate the National Security Committee of Cabinet (NSC) to a private sector Board, major investment projects for the ADF do not face the disciplines that are customary in the private sector:

- Unlike commercial enterprises, the NSC does not mandate a maximum investment cost of a Defence project on the basis of detailed, risk adjusted investment appraisal financial modelling
 - in contrast to the approach in the 1980s and 1990s, it seems the contemporary approach is for Defence to advise the government of the cost of acquiring new capability and for the government to approve it
 - a better approach would be to imitate the private sector and only approve projects that generated a risk-adjusted positive net present value (NPV), with delivered capability substituted for the dollars used in a commercial project
 - in addition, commercial enterprises investing in major projects run a competitive tender process for contractors to deliver the projects, with risk appropriately shared between the parties on the basis of who is best placed to manage it.

Immediately following the Anzac frigate acquisition, which came in at approximately the world benchmark price, the three air-warfare destroyers of the Hobart class at an average cost of over \$3 billion apiece were at the time the world's most expensive warships of their size. Lessons need to be learned from this:

- The Anzacs were built under a fixed price contract, while the Hobart class were provided with a very large initial budget and what is reality was a ‘cost-plus’ contract.
- The Anzac class was procured under a conventional ‘purchaser-provider’ model with the Australian-owned Prime contractor operating strictly at

arm's length from the customer and with the design sub-contracted from a proven overseas designer

- by contrast, the Hobart class was built by a novel alliance-based arrangement (the so-called ABTIA, or alliance based target incentive priced agreement) that included the purchaser (Defence) but not the overseas designer and appeared to have no clear lines of accountability.
- With a ten ship program, the Anzacs benefited from scale economies and a steep experience curve, while the three ship Hobart program did not.
- The 70 per cent plus local content achieved by the Anzacs was subject to substantial cost control and independent auditing and did not compromise the overall price of the frigates
 - the Hobart class was not required to meet any particular level of local content and the real level of Australian industry content may have been only around half that achieved on the Anzac frigate program.

Finally, the continuous build policy, as presently implemented, requires the delivery of new platforms at a relaxed drumbeat so as to avoid so-called 'valleys of death'. This can be at odds with the principle that the overriding priority role for the naval shipbuilding industry is to deliver new capability when it is required by Defence in the interest of national security. Lengthening the drumbeat can imply that ADF personnel are required to be sent into harm's way in obsolete platforms or that existing platforms require a lengthy, risky and costly upgrade. This can be an example of the political tail wagging the national security dog. It is also an example of placing a greater emphasis on civilian labour (to build the ships) than new jobs in the Navy (to populate the new, more numerous and bigger ships). With the possibility of deploying larger crews, it may be possible to acquire more established platforms with fewer risks and lower costs. The financial benefits of this could more than compensate for the additional costs of recruiting and retaining more RAN personnel.

The continuous build policy needs to be revisited. It should be possible to design a system that provides a better balance between the needs of the RAN for delivered capability and the requirements of the shipbuilding industry to retain concentrated resources, or to utilise distributed diversified resources, and avoid the 'valley of death'. This might mean a more variable drumbeat throughout the project and, perhaps, an accelerated replacement program, with a shorter life for the ships of perhaps 20 years and an avoidance of the risky and costly major mid-life upgrades and life extensions that have been unavoidable in the past. This may also allow a greater defence export program, focussed on selling still capable ships to friendly navies not seeking the absolute latest in naval technology, although this is unlikely to generate substantial revenue.

4.3 Industry organisation

In our view, there is a serious problem with the governance of the naval shipbuilding industry. On the one hand a monopsony, Defence, confronts a monopoly supplier, ASC across two domains, warships and submarines. Not only is competition eliminated, but the purchaser-provider model is compromised by the fact that Defence is not only the customer (purchaser) but also exerts

significant operational control of the contractor (provider). The shareholder, namely the Department of Finance, appears to impose little control over the management of what is a major commercial enterprise where, in the private sector, there would be a strong shareholder interest in building an efficient and highly competitive operation leading to the maximisation of profits.

The Australian Naval Shipbuilding Plan is currently based on:

- The concentration of the industry in South Australia.
- Inviting successful overseas contractors, such as Naval Group and BAE Systems, to establish (or take over existing) facilities in Australia to build platforms here.

This is very different from the experience with the Anzac frigates and Collins submarines consolidation, where Australian-owned prime contractors subcontracted proven overseas designers and broadly distributed the vessel building work (including modules manufacture) with high levels of Australian content in the supply chains in a continuously competitive environment.

Although South Australia is now the centre of Australia's naval shipbuilding industry, it is not sustainable for all of the major work to be focussed there. Australia as a whole will need to dig deep to deploy the full gamut of engineering and high-tech resources required to meet the substantial requirements of the naval shipbuilding plan and the idea that everything could or should be undertaken in South Australia is unrealistic. It demonstrates a lack of understanding of industrial organisation and, indeed, industrial relations. The value of competition should not be underestimated in both the product market and the labour market.

While consolidation of most naval platforms will occur in Adelaide, every State can make a contribution to the program and should be allowed to compete on an equal basis. Companies located in any part of the Federation should be enabled to bid for work on naval shipbuilding projects – supplying manufactured components, services and entire modules on these projects without discrimination. The inescapable truth is that we will need them all for this plan to succeed. Furthermore, a distributed and competitive approach will reduce the cost and risk of the projects and enable every State to benefit from the program. With the major projects being consolidated in Techport at Osborne, there will always be plenty of work for South Australia and in all likelihood that State's capacity will be stretched.

On the second point, inviting overseas contractors to enter the market so as to design and build 'their' platforms is different to the approach followed by most advanced naval shipbuilding nations and carries a number of disadvantages:

- We have already seen how the local industry developed its relationship with Navantia over two major projects and significant teething problems only to see it end when it was working efficiently and well.
- The overseas contractor may see little benefit in integrating its operations and developing a close relationship with local suppliers because they are likely to be here for only one project, even if over a number of years.

In principle, the model used with the Anzac project in particular worked well. The prime contractor was a privately owned Australian shipbuilder (first Transfield and latterly Tenix), which owned no proprietary defence IP and so could work closely with overseas suppliers such as the vessel's designer, Blohm and Voss. The

contractor could and did develop close relationships with local sub-contractors and built up an impressive supply chain.

But the succession of overseas primes with which the Australian naval shipbuilding industry has been required to partner has caused many problems. Over the last three decades, the industry has partnered for its major platforms with seven different overseas groups from six countries:

- Todd Shipyards (US) – FFG7s.
- Kockums (Sweden) – Collins class submarines.
- Blohm and Voss (Germany) – Anzac frigates.
- Navantia (Spain) – Hobart class destroyers.
- Naval Group (France) – Attack class submarines.
- Lürssen (Germany) – Arafura class offshore patrol vessels.
- BAE Systems (UK) – Hunter class frigates.

ASC in particular has worked with both Kockums (now part of SAAB) and Naval Group on submarines. Both companies have different philosophies, they now have different systems for digitalising their shipyards and moving from one platform to a quite different one meant that all the years of work in establishing an Australian supply chain with high levels of local industry content for building and sustaining the Collins class had to be set aside. Had the government done what every other submarine-building country does and selected an evolved version of the existing platform for the successor class rather than *ab initio* design of a radically different platform from a different country of origin, the risks would have been significantly reduced, not least in terms of the shipbuilding task and its supply chain. Perhaps it is not too late to rectify what we perceive to be a major strategic error.

In terms of major warships, in 2006 the Navy wanted Arleigh Burke class ships from the US to replace the DDGs as air-warfare destroyers. But switching from Tenix, which had performed admirably with the Anzac class, to ASC, which had never built a surface ship was a strange decision, as was partnering with Navantia, a shipbuilder with which we had never worked before. The reason for choosing the Spanish ship rather than the Arleigh Burke was apparently based on its smaller crew size. Yet the very substantial premium we paid for the Spanish F-100 class rather than the significantly more capable Arleigh Burke would have dwarfed the costs of a larger crew over many years.

In choosing a successor to the Anzac class with a greater emphasis on ASW, the best solution from a shipbuilding and risk perspective would have been the F-100, which ASC was by then building with much better productivity and on which the Aegis system was already integrated. But the weight problem with the Hunter class offers Defence a chance to re-think the acquisition. After all, if the Hunter class needs to be re-designed as a 10,000 tonne ship, its capability will resemble that of an Arleigh Burke, although a less powerful and much more risky version. A less risky and probably less costly solution would be to acquire Flight III DDG-51 class destroyers. They are very powerful ships, their ASW capability is acceptable – they are being equipped with new towed-array sonar in the USN and can accommodate two large ASW helicopters rather than one – while almost all the systems that the RAN requires are already integrated on the platform.

4.4 Way forward: proposed review of the Naval Shipbuilding Plan

We believe that a review of the Naval Shipbuilding Plan is also warranted.

Despite its earlier successes with the Collins and Anzac programs, the Australian shipbuilding industry has a recent record of delivering ships late, at an excessive cost and with inadequate local content. In addition, Defence has faced challenges in effectively managing major investment projects, evaluating and managing risk, containing cost and driving major contractors to engage with local industry. Defence also has form in falling out with a succession of overseas Primes, leading to a tendency to develop a new platform rather than to evolve an existing one. This leads to all the risks and excessive costs with an *ab initio* design, which also can give rise to increased costs down the track if the new platforms are unable to be deployed initially on high intensity operations and, in the worst case, existing obsolescent assets need to be retained in service past their use by date or even upgraded.

We propose two alternative approaches to addressing these problems.

Our preferred approach to re-introduce competition where possible, at least with two contenders being taken to a preliminary design study for all major acquisitions and then to a competitive tender process and a fixed price contract. Both design studies would be funded by Defence. Wherever possible, one of the two designs would be an evolution of an existing platform with the bid led by ASC. Success in the tender process would be based on cost, delivery and Australian industry content. The expectation would be that the evolved design would be successful, based on its reduced risks, hopefully its lower costs and the availability of an experienced Australian supply chain. But having at least one alternative would provide competitive pressure, while the benefit to the other contender, even if unsuccessful, would be the ability to evolve a design or develop a new design at Australia's expense.

Supporting this approach, ASC would be partnered by one experienced overseas designer, but likely a different one in its warship and submarine businesses. This would allow ASC to work with a single digital shipyard system and to develop a dedicated supply chain over time. Partnering with just one overseas designer, rather than a succession of foreign companies, and focussing on continuing to evolve familiar platforms would carry with it substantial benefits, including greatly reduced risks, lower costs and a delivery schedule that would dovetail well with the retirement of existing platforms.

If government will not accept this approach, an alternative way forward would be to establish a regulated purchaser-provider model with a government-owned Australian Naval Shipbuilding Corporation established to be responsible for the acquisition of new naval assets and their delivery on time and on budget. The Corporation would be staffed, inter alia, by experienced shipbuilders and engineers as well as experts in project finance and the management of large, high-risk investment projects.

Our preference is for the first option. We recommend the proposed review should explore engaging a single overseas designer as a partner for future major surface platforms, including SEA 5000 and later the Hobart class replacement. If an American platform were selected, this should have significant benefits for the

naval shipbuilding industry and its supply chain. It would also substantially reduce the risk in future acquisitions, including:

- Eliminating the need for the Australian shipbuilder to learn to work with a new overseas designer, including the use of a single digital platform and a familiarity with the designer's systems, standards and overall modus operandi.
- Greatly reducing the risk in integrating the American C3, sensor and weapons systems with platforms for which they were never designed because these systems would already have been integrated.
- Providing greater opportunities for Australian suppliers to work closely on an ongoing basis with an Australian-owned prime partnered with a single overseas designer, with the aim of generating higher local content as well as greater opportunities to participate in overseas supply chains.

This is also our preferred model for submarine acquisitions. However, uncertainties around future platform technologies suggest a delay in this domain.

Appendix A: Covering letter to the Submission

SUBMARINES FOR AUSTRALIA

Senator the Hon Alex Gallacher
Chair
Senate Economic References Committee
Parliament House
Canberra ACT 2000

16 July 2020

Dear Senator Gallacher

I am pleased to present a Submission from Submarines for Australia on the current matter before the Committee you chair, namely Australia's sovereign naval shipbuilding industry. I should note that Submarines for Australia is supported by an extensive reference group of experts in a number of fields, including naval operations, naval engineering, defence strategy, strategic policy, economics and defence industry. Further detail is shown in Appendix B of our Submission.

While the major naval projects, SEA 1000 and SEA 5000, were excluded from consideration in the new Force Structure Plan, we consider it is essential that they are now reviewed. With their very large budget requirements, we need to understand how well they conform to the requirements of the FSP, including whether the platforms will be delivered in a timely manner, whether they will be acquired at an acceptable cost, whether they will be fit for purpose and, particularly in terms of the recently demonstrated need for secure supply chains, whether they will be delivered with sufficient local content to justify the adjective "sovereign" when applied to our naval shipbuilding industry.

In our view, the Australian Parliament should have major concerns about both SEA 1000 and SEA 5000. Similar concerns could be presented about AIR 6000, the F-35 program, but that lies outside your Committee's terms of reference.

In regard to SEA 1000, we can only view the Attack class program as a slowly unfolding train wreck:

- Delays in the program are further pushing out the already unacceptable delivery schedule, under which the twelfth submarine won't be delivered for another 35 years *if all goes well*, and we face the looming probability of a disastrous capability gap
- The cost has increased by 60 per cent in real terms, seemingly on the basis of a miss-statement
- The submarines will not be fit for purpose in terms of effectiveness and survivability
- Australian industry content is on track to be quite unacceptably low
- If Defence is to deliver the submarine capability the Minister says we need, the government must bite the bullet on nuclear-powered submarines, while building up the number of conventionals to 12 as quickly as possible.

SEA 5000 also gives rise to major concerns. The choice of the British Type 26 global combat ship was apparently based on its advanced ASW capability, but the Navy's requirement [rightly] changed during the process so as to embrace a much broader capability, including embarking Aegis, CEAFAR radar and SM missiles so as to provide an advanced fleet air defence capability and being fitted for, but not with, an anti-ballistic missile capability.

Some concerns are:

- The already excessive cost of the program has recently blown out by a cool \$10.6 billion – the only reason for this we can find is a footnote in the DSP that suggests this will enable the same ships to be delivered over a longer timeframe and with a higher unit cost
- Not only have these American and Australian systems never before been fitted on a British platform, but the weight of the ship has blown out perhaps by 25 per cent, leading to a requirement for a new design
- The trouble is that the new ship, at around 10,000 tonnes, looks very much like a less capable version of the US DDG-51 (Arleigh Burke class) destroyer which would be a far less risky and less costly acquisition, with all the latest American systems already embarked, with more VLS missile launchers and with two hangars, rather than one, for the MR-60 Romeo helicopter with its advanced ASW capability.

Since the Navy has, very wisely in my view, determined a strong preference for American sensors and C3 equipment (including Aegis) together with weapons (SM missiles) now and in the future, surely the logical approach is to acquire American platforms, like DDG-51, that already embody them. The Navy wanted the DDG-51 when the Spanish F-100 platform was selected. This was rejected on the grounds of cost, specifically the cost of a larger crew. Given that the Hobart class ships were the most costly warships of their size ever constructed and far more expensive than the DDG-51, this seems to have been a false economy. Also, in current circumstances, building up the size of the Navy seems a very good idea.

In terms of the naval shipbuilding industry, I have noted that over the last 35 years it has had one-off partnerships with seven different overseas contractors – from the US, Sweden, Germany, Spain, Germany (different contractor), France and the UK. This does not make for an efficient industry, with one digital shipyard system and with the ability to build a deep supply chain. If, where possible, we did what other countries do and evolved new platforms from the existing one, ASC as the single Australian prime contractor could engage in deep relationships with two long term overseas design partners – one for submarines and one for warships. *Ab initio* designs with new and unfamiliar partners are not the way to go, particularly in our current strategic circumstances.

Finally, I appreciate that your Committee has an extremely important role to play in very difficult circumstances. The US Congress, and to a lesser extent the British Parliament, undertake more detailed scrutiny of Defence spending than does the Australian Parliament. The reason is that our Defence department does not welcome meaningful scrutiny and provides insufficient information to facilitate it. As two ASPI senior analysts stated to the Joint Committee on Public Accounts and Audit in March 2020:

“At the moment it is impossible for the Australian parliament and public to develop a view on what the government’s \$200 billion investment program actually is, let alone its coherence or achievability. This means that ANAO reports on Defence projects are conducted in a contextual vacuum. They may be able to assess whether projects are being delivered on time and budget, but they do not and cannot assess whether they make sense in the first place.”

I wish your Committee every success. We would be very happy to present evidence at a public hearing should you invite us to do so.

Yours sincerely



Gary Johnston
Submarines for Australia

Appendix B: Submarines for Australia and Reference Group

Submarines for Australia is an entity with a website owned and operated by Gary Johnston, founder and CEO of Jaycar Electronics Pty Ltd. Mr Johnston has no commercial interest in the SEA 1000 program or Defence projects more generally. Over the last three years, Mr Johnston has supported significant research by Insight Economics and others into Australia's future submarine project. We are extremely grateful for Mr Johnston's sponsorship of this important public interest work.

Mr Johnston is also keen to acknowledge the contributions from the members of an expert reference group that has developed around this issue. These individuals include distinguished Australians with strong relevant experience who have contributed their time and expertise in the national interest.

Inter alia, this group includes:

- Dr Michael Keating AC, former Secretary of the Department of Prime Minister and Cabinet and Secretary of the Department of Finance
- Professor Hugh White AO, Emeritus Professor of Strategic Studies at the Australian National University and former Deputy Secretary of the Defence Department
- Rear Admiral RAN (Retired), Peter Briggs AO, former commanding officer of Oberon class submarines and CO of the Submarine Force, Director of Submarine Warfare and Head of the Submarine Capability Team
- Commodore RAN (Retired), Paul Greenfield AM, former Engineering Officer in the Submarine Force, and a principal of the Coles Review into Collins class sustainment
- Commodore RAN (Rtrd), Terence Roach AM, former commanding officer of two Oberon class submarines, former Director Submarine Policy and Warfare, Director General Naval Warfare and Director General Maritime Development
- Dr John White, former CEO of AMECON (builder of the Anzac frigates)
- Dr Hans J Ohff, Visiting Research Fellow at the University of Adelaide, former Managing Director and CEO of the Australian Submarine Corporation
- Dr Andrew Davies, Senior Fellow, Australian Strategic Policy Institute
- Mr Jon Stanford, Director, Insight Economics Pty Ltd.

The quality of this Submission has been greatly enhanced by the expert views of members of this reference group. Individual members of the group may not agree with every statement in the Submission, however, and responsibility for the material contained in this document lies with *Submarines for Australia*.