

***Progress with the Future
Submarine***

Submission to the ANAO

by

Submarines for Australia

23 June 2019

CONTENTS

FOREWORD	3
SUMMARY AND CONCLUSIONS	4
1. Introduction	7
2. Deep engagement with a 'design partner'	9
3. Emerging risks of eliminating competition	13
4. Technical risks to FSM capability	19
5. Introducing competition	22
Attachment: Proposal to the PM by 'Four Admirals'	26

Foreword

This Submission to the ANAO is made by *Submarines for Australia*, an entity with a website owned and operated by Gary Johnston, founder and CEO of Jaycar Electronics Pty Ltd.

Over the last three years, Mr Johnston has generously supported significant research by Insight Economics Pty Ltd and others into Australia's future submarine project, SEA 1000. As both a substantial Australian taxpayer and a supporter of the ADF, he is motivated by two overriding considerations:

- The need to acquire a powerful but cost effective submarine capability for the RAN in an acceptable timeframe
- While accepting that all ADF personnel undertake a certain level of personal risk in the course of their duties, to seek to ensure that Submarine Force personnel go into harm's way on platforms that both incorporate the most advanced level of technology that Australia can afford and offer them the highest possible level of survivability in what is often a dangerous operational environment.

Mr Johnston considers that the way in which SEA 1000 is being delivered addresses neither of these criteria in a satisfactory manner.

Mr Johnston is pleased to acknowledge Insight Economics' significant contribution to this submission. He also greatly appreciates the contributions from the members of a reference group that has developed around this project, distinguished Australians with strong relevant expertise and/or experience who have joined the group voluntarily and 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 head of the Australian Public Service
- Hugh White AO, Professor of Strategic Studies at the Australian National University and former Deputy Secretary of the Defence Department
- Rear Admiral (Retired) RAN, 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
- Rear Admiral (Retired) RAN, Rowan Moffitt AO, former Deputy Chief of Navy, Fleet Commander, Deputy Chief of Joint Operations and Director of SEA 1000
- Commodore (Retired) RAN, Paul Greenfield AM, former Engineering Officer in the Submarine Force, *Collins* Project Director (the two fast-track submarines) and a principal of the Coles Review into *Collins* class sustainment
- Commodore (Retired) RAN, Terence Roach AM, former commanding officer of two *Oberon* class submarines, former Director Submarine Policy and Warfare, Director, Director General Naval Warfare and Director General Maritime Development
- Dr Andrew Davies, Senior Fellow, Australian Strategic Policy Institute.

While all these experts have been extremely generous in contributing their views and expertise, the responsibility for the material contained in this submission lies with *Submarines for Australia* and Insight Economics Pty Ltd.

Finally, from time to time in this submission we use the German proposal under the CEP as a benchmark. This is because tkMS were the only contender that offered a guaranteed fixed price; early delivery; high local content; no price premium for a local build; and apparently acceptable terms and conditions for ownership of IP. But we are agnostic as to which design should have been selected, although we strongly believe two should have been taken forward.

SUMMARY AND CONCLUSIONS

The theme of this submission to the ANAO by *Submarines for Australia* is that the decision by the government, on Defence's advice, to eliminate competition in the SEA 1000 program at the very early, pre-concept design stage, exposes Australia's largest ever defence acquisition to very substantial risks.

The ANAO has previously suggested that eliminating competition removes incentives for the contractor to produce a more economical and efficient build. In response, Defence has stated that rather than competition it believes that 'deep engagement' with its design partner, Naval Group, can provide the best balance of capability, cost and schedule.

Risks in eliminating competition

We consider the ANAO's concerns around lack of competition are entirely justified and we take issue with Defence's approach. We believe that 'deep engagement' will not be effective simply because the objectives of any profit maximising contractor are most unlikely to coincide with the goals of the purchaser, Defence. Having been gifted a monopoly position at the very start of the project, a rational approach by Naval Group would be to maximise the commercial benefit it will derive from the project. Under the current program, unless the government is willing to re-start the whole SEA 1000 process, it is difficult to see how Defence can prevent this.

The underlying fundamental problem is that Naval Group can be expected to maximise the price it charges for the submarines themselves. This is made easier by the fact that the government required only a non-binding estimate of cost during the competitive evaluation process (CEP) and announced early in the program a budget for SEA 1000 that was widely regarded as extravagant. A rational monopolist will also maximise the price it charges for the design of the submarine and for Australian access down the track to the intellectual property (IP) embodied in it. The contractor would also be expected to pursue an extended delivery schedule for the submarines, so as to maximise revenues over time and better manage the risks to the company in designing and building a highly complex *ab initio* submarine.

Turning to capability, during the CEP Naval Group may well have proposed the incorporation in the submarine of highly advanced technologies. Yet having won the contract and in the absence of any binding commitment, it would be in the company's interests to embody less challenging technologies in the submarine, again so as to minimise its own commercial risks in terms of delivery.

Finally, a particular potential problem arises because the selected contractor is majority owned by a foreign government. A rational objective for Naval Group would be to act in the interests of its main shareholder by minimising Australian content in the submarines so as to maximise wealth and job creation in France. Even if this costs more, as a monopolist Naval Group can just demand a higher price for the submarines.

Evidence to date: meeting the milestones

The first two audit criteria refer to whether Defence is meeting the planned milestones for the future submarine, and whether the approved expenditure to date (\$5,959 million, including outlays to date of \$779 million) is likely to be effective in achieving the milestones.

Because of a lack of transparency in Defence's processes, we are unaware of the precise nature of the milestones in this project. But already some disturbing evidence is emerging in terms of the following issues:

- **Program cost.** At the time of the CEP, the budget for SEA 1000, excluding the combat system, was \$50 billion in future or out-turned dollars. Little more than two years later, in mid-2018, the program Director announced that this had been changed to \$50 billion

Submarines for Australia: Submission to the ANAO on the Future Submarine

in *constant* prices, equivalent to \$79 billion in out-turned dollars. At a very early stage in a 40-year program, this amounts to an increase of around 60 per cent in the budget.

- **Design cost.** We understand that payments for the design of the submarines amount to around \$500 million to date. Somewhat naively, we believed that outlay covered the entire cost of the design. Yet in April 2019 the Director of SEA 1000 stated that an additional \$4,500 million would be required to complete the design of the *Attack* class. This seems excessive.
- **Capability.** We believe that the French proposal to incorporate pump-jet propulsion, as used on power-rich nuclear submarines for enhanced stealth, was an important factor in the selection of Naval Group. Yet in October 2017, the CEO of Naval Group suggested that *Attack* class might instead employ a propeller, a far less risky choice for a diesel-electric submarine. Overall, despite the aspiration for a 'regionally superior' submarine, Defence has stated that only currently existing technologies will be used in the first batch of submarines. While this may benefit the contractor in terms of reducing risk in the construction phase, this may come at the cost of compromising operational capability and even survivability. In the 2030s and beyond, without air-independent propulsion or modern batteries, the *Attack* class may well have an unacceptably high indiscretion ratio.

In terms of **schedule**, we do not know whether there are any changes to the projected delivery of *Attack* in the mid 2030s, after the final *Collins* class submarine reaches the end of its design life. Because it is a very complex, *ab initio* design a delay of around five years would not be unexpected. While tkMS undertook to deliver submarines from 2028 so as to avoid a capability gap, Naval Group's proposed schedule did not.

There are substantial concerns around a gap in RAN submarine capability in the 2030s and beyond. This will have a major impact not only on national security, but also, the longer the gap lasts, on the RAN's capacity to populate the Submarine Force with sufficient trained personnel in the future. As evidenced by the capability gap in the transition from the *Oberons* to *Collins*, such a reduction in time at sea can lead to a critical deficit in trained crews available to the Submarine Force that can take years to unwind. Navy only recently advised that a life of type extension (LOTE) for 'at least five' of the *Collins* class will be required. The LOTE will be risky. It may not deliver submarines that can responsibly be deployed 'up threat' in the challenging tactical environment of the 2030s. It may have a deleterious impact on availability. It will be expensive and as yet it has no budget.

Evidence to date: a fit-for-purpose strategic partnership

The third criterion identified by the ANAO for this audit is whether Defence has established a fit-for-purpose strategic partnership in accordance with government requirements.

Again we are not privy to the content of the recently concluded strategic partnership agreement (SPA) between the Australian and French governments. One concern is that the SPA for SEA 1000 took nearly three years to conclude, compared with just a few months for SEA 5000 acquisition, which involved a much more competitive process. Together with the fact that the agreement was concluded with some urgency just before Australia's recent federal election, this could suggest that the power imbalance between Defence and Naval Group has led to significant difficulties in negotiating a mutually satisfactory agreement and that, perhaps, some of the more difficult issues have yet to be resolved.

Two of the more critical issues that would be expected to be included in the SPA concern Australian industry content and access to IP. Without the ability to apply competitive pressure, these constitute matters of major concern:

- **Local content.** The main reason why Australia chooses to build submarines in country is to reduce the risks and lower the costs of sustainment. But to undertake local sustainment efficiently requires around 70 per cent local content broadly defined in the

Submarines for Australia: Submission to the ANAO on the Future Submarine

build process so as to develop the necessary competencies in the supply chain. The announcement that 4000 jobs would be created in France and 2,900 in Australia as a result of Naval Group being successful in SEA 1000 caused consternation. The then CEO of Naval Group Australia promised at least 90 per cent Australian content. After he departed, that fell to 60 per cent. Now even that seems no longer applicable. The latest estimate of Australian jobs created from SEA 1000 is 2,800. We do not know the current situation, or what, if anything, was agreed in the SPA.

- **Intellectual property.** Experience with *Collins* class sustainment suggests it is imperative to negotiate an acceptable protocol on IP in order to have the ability to sustain the submarines efficiently and upgrade them. The agreement finally achieved with SAAB Kockums in 2013-14 provides an acceptable model. We do not know what access to *Attack* class IP is likely to cost or what, if anything, has been achieved under the SPA.

Conclusion: the need to restore competition

Defence's strategy of fostering 'deep engagement' with Naval Group is not an effective substitute for competition. The very substantial cost for designing the *Attack* class suggests that already Naval Group is exhibiting monopolistic behaviour. The effective increase of 60 per cent in the SEA 1000 program budget just two years into a 40-year program is ominous in the extreme. Some aspects of the capability to be embodied in a vastly expensive submarine that is intended to be regionally superior in 15 years time appear conservative, suggesting that the submarines may even be obsolescent by the time they enter service. There is a very real prospect of a capability gap, with serious implications for populating the Submarine Force in the 2030s and beyond. Silence around local content and IP rights only adds to the concerns.

As time goes by and Naval Group sees no possible challenge to its monopoly, the situation is only likely to get worse.

Our submission shows it is not too late to restore competition to the process. The work done by the Four Admirals has led to a substantial proposal to provide a preliminary design study (PDS) for an evolved *Collins* class platform. This would be delivered in parallel with the evolving design for the *Attack* class. We believe *Collins* 2.0 could provide a comparable capability to the *Attack* class at a lower cost, with earlier delivery and high local content and far less program and technical risk. IP protocols have already been agreed. Additional benefits include substantial synergies between *Collins* 2.0 and the essential *Collins* class LOTE and the very real possibility of a competitive fixed price tender. Overall, the benefits of building on an existing and hard won sovereign submarine capability rather than attempting to re-build this with a new partner, particularly one majority owned by a foreign government, appear to us to be very attractive.

With no delays to the current program and at a cost of 0.1 per cent of the SEA 1000 program budget, we believe this would be money very well spent.

1. Introduction

This submission to the ANAO from *Submarines for Australia* reflects a number of major concerns regarding the SEA 1000 program.

We understand that the ANAO does not include in its reviews any assessment of the merits or otherwise of particular government policies. Rather a performance audit, such as this one of a major acquisition program, must as always focus on its value for money. Does the proposed acquisition continue to be fit for purpose (and any variations to that purpose that may since have emerged), and does it represent the most cost-effective response to the perceived threats? ANAO audits also have a significant and appropriate focus on risk, as well as monitoring whether programs are likely to be delivered within approved timelines and budgets.

While this submission is designed to comply with these requirements and avoid policy issues, at the outset we should flag our greatest area of concern with the SEA 1000 program is whether Australia's largest ever defence project will deliver submarines fit for purpose, whether that purpose is changing, and whether the submarines will be available when needed. In recent years, just when the ADF needs to become more self-reliant in light of Australia's deteriorating strategic environment, our Defence White Papers (DWP) have shifted their emphasis away from self-reliance (a major focus of all previous White Papers since 1976). Increasingly, Australia's force structure continues to be optimised for coalition warfare alongside the United States.

This is particularly true of the SEA 1000 program, in which the US has played a significant consultancy role. Our conventional submarines provide a complement to the US Navy's powerful force of nuclear submarines in this region. Yet there is a possibility, identified by Hugh White and other strategic experts, that the United States will retire from the competition with China for dominance in the Asia-Pacific and focus more on its global role. This may occur long before the first future submarine enters service (even if all goes well) in the mid-2030s. As Andrew Davies wrote recently, "The assumption of continued US primacy that permeated DWP 2016 looked heroic at the time. It seems almost foolishly misplaced now."¹

In that case, Australia will need to become much more self-reliant. This would require additional expenditure on defence and bringing a sharp eye to value for money in any acquisitions. We may well need a different force structure and in particular there is a high risk that Australia could be acquiring the wrong submarine to suit our very particular future requirements. We have serious doubts as to whether it is worth spending \$55 billion in order to be able to station one conventional submarine 'up threat' at any time in an increasingly dangerous operational environment, and even then not until the mid-2050s. In particular, we think it is important that the submarine acquisition program has the flexibility that it can be expanded so that Australia can purchase more submarines earlier and at a reasonable cost, if that proves necessary.

Putting that to one side, our main focus in this submission is on the more manageable risks around the acquisition process for the *Attack* class.

As the ANAO pointed out in its initial (2017) audit of the Competitive Evaluation Process for the Future Submarine, this is a very high-risk program. We are especially concerned that the

¹ Davies, Andrew (2019), "A new DWP wouldn't be worth the white paper it's written on", *The Strategist*, 19 June, https://www.aspistrategist.org.au/a-new-dwp-wouldnt-be-worth-the-white-paper-its-written-on/?utm_medium=email&utm_campaign=Daily%20The%20Strategist&utm_content=Daily%20The%20Strategist+CID_3e8ba3bc7bbd1fa9ea96ead53756f3f2&utm_source=CampaignMonitor&utm_term=A%20new%20DWP%20wouldnt%20be%20worth%20the%20white%20paper%20its%20written%20on

Submarines for Australia: Submission to the ANAO on the Future Submarine

elimination of competition at a very early stage of this project exposes the government and the taxpayer to a number of very substantial risks and a contingent liability that is enormous both in financial terms and also in respect of the delivery of what is a vital defence capability. These risks were pointed out by the ANAO in its 2017 report:

The approach taken by Defence for the Future Submarine program removes competition in the design phase, and removes incentives for the international partner (DCNS) to produce a more economical and efficient build. This places the onus on Defence to ensure that its approach to the Future Submarine's design and build phases, where final costs and schedules will be determined, returns value-for-money to the Commonwealth in the absence of a competitive process.²

Our purpose in this submission is to show how these risks emanating from the premature closing off of a competitive process are now starting to emerge. First, acknowledging the ANAO's earlier comments on the implicit risks in abandoning competition, on the basis of the principles of industrial economics we evaluate what we would expect the consequent challenges to be against each of the key program requirements. Then, while we have limited information on the SEA 1000 progress to date in meeting milestones, we show how risks are already emerging that the program will not deliver its objectives.

This analysis suggests to us that it is time to have a rethink. We therefore propose what we consider to be a better way forward and show that it is still possible to introduce genuine competition at a low cost and without unnecessarily delaying the current schedule. Four retired senior RAN officers have developed this approach in detail within our reference group.

Finally, a continuing source of frustration for anybody legitimately analysing Defence procurement issues in the interests of the taxpayer is the lack of transparency in Defence processes. While clearly some aspects of acquisitions need to be protected for reasons of national security, most do not. In fact, if Defence were to embrace a more open and transparent culture, the need to explain some of their decisions in public might have a beneficial impact on the quality of those decisions and encourage a greater degree of accountability.

² ANAO (2017), "Future Submarine — Competitive Evaluation Process", Performance Audit Report, 27 April, para 3.31, <https://www.anao.gov.au/work/performance-audit/future-submarine-competitive-evaluation-process>

2. Deep engagement with a 'design partner'

We consider the key risk overlying the delivery of the SEA 1000 program is the judgement by Defence that the department does not have the resources necessary to oversight a competitive process in the design phase of the submarine. This is in contrast to the SEA 5000 future frigate program, where three competing designs were evaluated.

A report by Insight Economics in September 2017 suggested “it is difficult to see as time goes by why Naval Group will not increasingly have Defence over a barrel. As Kym Bergmann has pointed out:

“If Defence plans to sign a production contract three years after selecting a preferred designer, they leave themselves open to enormous risks. Put simply, without commercial leverage the Commonwealth will either have to pay whatever the designer wants—or start the entire process again. ...The only way to protect against those sorts of possibilities is to have at least two bidders to choose from and maintain competitive pressure for as long as possible.”³

As the ANAO points out in the passage cited above, the elimination of competition “places the onus on Defence” to ensure the program provides value for money. But how does Defence intend to achieve this? It seems clear that Defence’s approach to meeting this objective will be on the basis of close engagement with the design partner:

Rather than competition, it remains the view of Defence that the most appropriate balance of capability, cost and schedule is derived through deep engagement with the designer throughout the design process, alongside focussed preparations for construction.⁴

In our view, this is problematic and unlikely to provide the desired outcome in almost every dimension of the project. Nevertheless, its success depends on the selection of a design partner whose objectives, values and culture are most congruent with those of Australia. It should also be noted that historically the relationships between Defence and some of its prime contractors have not always been harmonious and sometimes have broken down.

Choosing the 'most suitable international partner'

Defence has stated that:

The purpose of the Future Submarine Competitive Evaluation process was to select the most suitable international partner to work with Australia to develop and deliver the Future Submarine.⁵

While Defence has stated that this was the objective of the CEP, we do not understand on what basis the design partner was selected. We see little evidence that the focus was on the attributes and relative merits of the French, German and Japanese designers and builders of submarines. If it had been, for example, wouldn't the SEA 1000 team have engaged with current customers of the three contenders and sought detailed feedback on issues such as recent design experience for advanced conventional submarines (not only export models); cost; shipyard technology and productivity; efficiency in meeting milestones; delivery; local content; technology transfer and rights to IP? Shouldn't they have had a great interest in finding out how risk was managed and allocated between the partners? Wouldn't they appropriately have sought detailed information on accusations of corruption when the contenders had entered design and build contracts in other countries? Particularly after the recent issues with Navantia on SEA 4000, wouldn't they be interested in exploring the

³ Insight Economics (2017), *Australia's future submarine: Getting this key capability right*, September; Bergmann, K., (2015), “Australia's next generation submarine: where to now?”, *The Strategist*, Australian Strategic Policy Institute, 14 December, <http://www.aspistrategist.org.au/australias-next-generation-submarine-where-to-now/>

⁴ ANAO (2017), *op. cit.*, page 9.

⁵ *Ibid.*

Submarines for Australia: Submission to the ANAO on the Future Submarine

compatibility of their workplace culture with Australian practices and how easy the companies were to work with? Surely a visit to friendly powers that had recently acquired submarines, such as India and Malaysia (Naval Group) and South Korea (tkMS), would have seemed almost obligatory, particularly when Australia is selecting a partner worthy of our trust for a period extending for nearly four decades.

One particular issue that should have given pause for thought was whether the contender was government owned. As is discussed in more detail below, a Prime contractor owned by a foreign government could have very different objectives to Defence particularly in terms of Australian industry content, which would feed into the value for money equation as well as sustaining a sovereign capability. The UK, which has similar market-oriented drivers in defence procurement to Australia, saw the problems of engaging with State-owned partners in a failed collaborative frigate acquisition ('Project Horizon'), even where the Royal Navy had a requirement for many more platforms than the other two nations put together. As the House of Commons Select Committee on Defence noted:

Differences in procurement procedures between the UK and the other partners were clearly at the very heart of the difficulties encountered with Horizon, and the other partner countries highlighted for us the difficulty of reconciling the UK's market approach with their own focus on work-shares. Such differences in approach were ultimately dictated by whether the relevant defence industries in each country were privately or publicly owned. With hindsight, it seems clear that the Italian and (in particular) the French governments were never going to be prepared to embrace the MoD's focus on competition, value for money and contracting for system performance. Indeed, 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.⁶

We do not know to what extent the SEA 1000 assessment team examined the credentials of the contending design partners. Almost the entire focus appeared to be on the platform proposed by each contender and the capability and technologies it would be likely to embody. If indeed the CEP was aimed at selecting a platform, this was undertaken without any of the checks and balances that had been mandated for Defence acquisitions as a result of the manifold problems encountered in the last few decades. Instead, the choice of Australia's most expensive military platform ever was based on an assessment of competing pre-concept designs. If this is correct, the likely capability of each platform could be exaggerated by its designer, with assurances made during the selection process being non-binding and perhaps later in the process found to be unachievable.

Objectives of the partners: 'same bed, different dreams'?

While competition *may* be unnecessary if both parties in a strategic partnership have similar objectives, this is unlikely to be the case if their goals differ. In this case, the value of "deep engagement" between the parties is likely to be low because the objectives of Defence and Naval Group may well be very different in almost every important aspect of the program:

- **Cost.** Defence's objective here should be aimed at minimising the cost of the SEA 1000 program consistent with delivering the required capability in a timely manner. Yet Naval Group, like any commercial enterprise, will have a profit maximising objective and will charge the highest price the market will bear. Under a competitive process this imbalance is resolved because if one contender quotes too high a price in a tender process, other things being equal they will not win the tender. But in this case, Naval Group have

⁶ House of Commons, Select Committee on Defence Eighth Report, paragraph 20, <https://publications.parliament.uk/pa/cm199899/cmselect/cmdfence/544/54404.htm#note67> . DCN is now Naval Group.

Submarines for Australia: Submission to the ANAO on the Future Submarine

essentially been gifted a monopoly position. They have also been given a strong pointer as to what the market will bear because of the well-known existence of an extravagant budget for the project.

- **Schedule.** Defence's objective here should be to accelerate delivery of the new submarines in order to minimise the capability gap that will occur as a result of delays in the SEA 1000 program. Naval Group on the other hand may well want to take their time in delivering the submarines, particularly the first of class (FOC) boat. One reason for this is that they have proposed an *ab initio* design of great complexity. Rather than sharing Defence's concerns about the risk of a capability gap they will want to minimise any design or shipbuilding risks for which they may be held accountable. In addition, the two-year drumbeat mandated by Defence so as to facilitate continuous build also suggests that successive flights of the submarines will need significant design changes to counter likely obsolescence. That all means more work, revenue and profit for Naval Group. For a company in a monopoly position, a project that runs for 40 years rather than 20 may well offer greater financial rewards for shareholders and will provide ongoing revenue similar to an annuity with a low risk but very high yield.
- **Local content.** In order to establish a cost-effective base for sustainment, Defence should have the objective of maximising Australian industry content consistent with providing value for money. Under circumstances where the Prime contractor was a company in the private sector, this may be one objective it would share. In the longer term, it could well benefit from including competitive Australian sub-contractors in its global supply chain, while logistically in both the build and sustainment phases it would benefit from having a much shorter supply chain than if all components had to be shipped from Europe. But Naval Group is majority owned by the French government, with the French defence contractor Thales being the only other significant shareholder. The French government will have a different but quite rational objective of maximising French industry content so as to create jobs and increase wealth in France. Even if this costs more, a monopolist will be able to increase the price accordingly. It seems unlikely that Thales would have a different view, but even if it did it is a minority shareholder.
- **Intellectual property.** Defence needs access to Naval Group's IP at least cost so that it can maintain the submarines and upgrade them efficiently. Australia will have parent nation responsibility for the *Attack* class, as it has for *Collins*. Lack of experience in this role was the fundamental reason why Australia ended up with a poor outcome on IP for *Collins*, which dogged the sustainment program for a number of years. But Naval Group will have the rational objective of maximising the value of its IP in SEA 1000 and, given its monopoly position, it will have a very strong negotiating position.
- **Capability.** Defence has a somewhat contradictory position on capability. On the one hand it seeks a 'regionally superior capability' for the *Attack* class (it has never explained how this can be achieved when four nations in the region operate nuclear powered submarines). On the other, as Marcus Hellyer of the Australian Strategic Policy Institute (ASPI) suggests, "the project is adopting a low-risk approach to key technology, so only currently existing technologies will be used in the first batch. ... [but] does the future submarine's low-risk approach to technology, while good for project management, push risk into the resulting capability delivered by the submarines?"⁷ Defence should have a goal of embodying advanced superior conventional submarine technology tempered by value for money and technological risk. On the other side of the partnership, Naval Group will likely want to minimise risk where, in a very high cost area, it may be held accountable if things go wrong with a significant contingent liability. Other things being equal, the rational strategy for Naval Group would be to promise a very high level of

⁷ Hellyer, Marcus (2019), "The cost of defence, ASPI's Defence budget brief, 2019-20", ASPI, June, page 77, <https://s3-ap-southeast-2.amazonaws.com/ad-aspi/2019-05/Cost%20of%20Defence%202019-2020.pdf>

Submarines for Australia: Submission to the ANAO on the Future Submarine

technological accomplishment in the non-binding CEP so as to win the contract, but then to seek to embody low risk, existing technologies when building the submarine.

None of this is intended in any way as a criticism of Naval Group. If the company behaves in the way that industrial theory suggests it will, its behaviour will be entirely rational and to be expected in light of the parameters that have been established by Defence for the SEA 1000 program. But in the absence of competition, it is very difficult to see how Defence will achieve its objectives, in Australia's national interest, on the basis of 'deep engagement with the designer' when the designer is motivated by very different economic drivers.

3. Emerging risks of eliminating competition

One of the issues being examined by the ANAO in this review is whether Defence is meeting its scheduled milestones in SEA 1000 to date. Our ability to contribute to this discussion is limited by a lack of publicly available information as to whether they are or not. But we can point to some emerging evidence, even at this very early stage, that some problems are becoming apparent as a result of abandoning competition so early in the acquisition process. We discuss below the emerging effects of lack of competition on risks around:

- The cost of the *Attack* class submarine's design
- The timely delivery of the submarine
- The cost of building the submarines
- Australian industry participation and local content
- Australian access to and ownership of critical intellectual property.

Design cost

Currently, approved expenditure on SEA 1000 is \$5,959 million, including outlays to date of \$779 million. Presumably, most of this expenditure to date (say ~\$500 million) is on design. But in addition, the Director of SEA 1000 told the Senate that the budget to complete the design process would be 'in the order of \$4.5 billion'.⁸

Our research, including discussions with Australian shipbuilders, suggests that a complete design of a contemporary submarine should not cost more than around \$500 million. Admittedly, however, this cost represents what you would expect to pay for an evolved design, which is what most submarine builders around the world seek to undertake because of the much lower risk. In many cases, around 60 to 70 per cent of systems used in these designs are already proven in existing submarines. If indeed the designers of the *Attack* class are starting with a clean sheet of paper, however, it seems clear that the process would be more intense and take a much longer time.

It would also be much more risky. This is another significant problem with selecting an *ab initio* design. It now appears that the Shortfin Barracuda, initially presented as a diesel-electric version of the French Barracuda class SSN and then an evolved version of the Scorpène (of which details of its performance were leaked to the world's media), is in fact rather more of a "new" design than were the other two contenders. Even so, to pay \$5 billion for designing a SSK seems excessive. Given that Defence told us that the rough order of magnitude project price presented by the three contenders were fairly close, it seems extraordinary that design costs could account for around 25 per cent of the overall cost of a program to deliver 12 very large submarines. Perhaps the simple answer to these imponderables, as one retired senior naval officer told us in regard to the pump-jets, is that "our guys just had the wool pulled over their eyes".

But if Naval Group is exploiting its monopoly position there is little Defence can do about it.

Another major risk in terms of the design task concerns the possibility that the specifications may be subject to significant change. As discussed later in this submission, the current design excludes AIP and modern batteries as well as including power-hungry pump-jet propulsion. Should the requirements change in regard to any of these features, perhaps as a result of land-based testing, a very substantial re-design would be required. This could give rise to a considerable delay. In addition, if lead acid batteries are embodied in the first 'flight' of three or four submarines, it is almost inevitable that much more energy-dense batteries would be incorporated in the second flight. This would also require a major change in the design. For

⁸ Hellyer, Marcus (2019), "The cost of defence, ASPI's Defence budget brief, 2019-20", ASPI, June, pages 82-83, <https://s3-ap-southeast-2.amazonaws.com/ad-aspi/2019-05/Cost%20of%20Defence%202019-2020.pdf>

example, lead acid batteries play a second role in providing the submarine with the required ballast, but lithium-based batteries are lighter.

Timely delivery and the capability gap

According to the current delivery schedule, the 12 submarines of the *Attack* class will enter service with the RAN between 2035 and the mid-2050s. This is if all goes well. But all is very unlikely to go well with an *ab initio* design of a submarine; the experience of other countries shows they are always delivered late. as was the *Collins* class. The *Suffren*, FOC of the French nuclear powered Barracuda class, which is the reference design for the *Attack* class, is already running five years late. Even the delivery of the Naval Group program to deliver six Scorpène submarines, an established design, to India is running five years late.⁹

One of the main risks is of a gap in the RAN's submarine capability. The tkMS proposal was designed to obviate the need for the risky and expensive *Collins* life of type extension (LOTE) with delivery of the FOC in 2028 and the option of a twelve-month drumbeat for the first six submarines. Only in the last year has Defence acknowledged that the selection of Naval Group under the CEP means that action needs to be taken to avoid a capability gap. With the *Collins* class reaching the end of their design life between 2026 and 2033, before the first *Attack* class boat enters service, all six submarines will need a ten-year LOTE to reduce the extent of the capability gap. This needs to be added to the cost of SEA 1000. As yet the government has not approved the LOTE and there is no budget for it in the Integrated Investment Plan. Estimates of the cost of the LOTE range between \$6 billion and \$15 billion, but we do not know yet how extensive it will be.

In addition, there are considerable risks around the proposed LOTE. First, if it is not to affect submarine availability, it will need to be undertaken within the two-year major refit in the full cycle docking schedule. With the LOTE requiring a major upgrade, almost certainly including new diesels and a new main motor, this will be particularly challenging. Even if *Collins* sustainment is moved to Western Australia, there will still be pressure on national resources of skilled labour with construction of the *Attack* class occurring at the same time. There is also a high risk that the LOTE will not provide sufficient advanced capability to enable the *Collins* class to be deployed in a high threat environment in the 2030s if not before. It is unlikely, for example, that the LOTE will include equipping the boats with air-independent propulsion (AIP) or modern high energy density batteries that could significantly reduce their indiscretion ratio. With some other countries in the region already greatly increasing their capability in anti-submarine warfare (ASW), the survivability of the extended *Collins* boats while operating 'up threat' would be called into question. Even in 2008, the Submarine Institute of Australia was concerned about this issue:

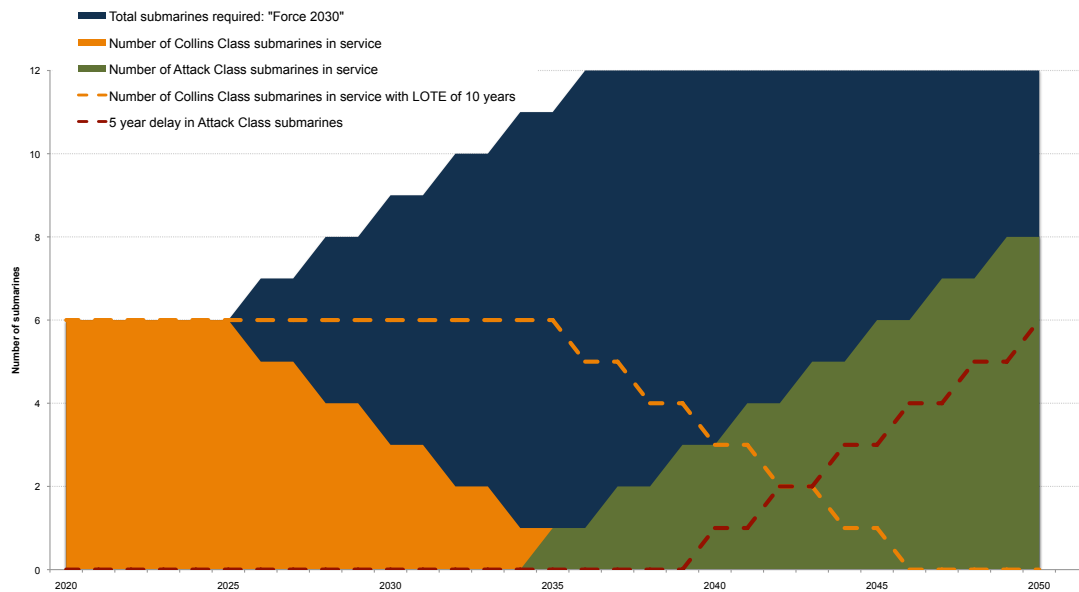
There is a rising risk from deploying *Collins*, without Air Independent Propulsion, into high threat, sensitive areas as regional ASW capabilities rise. Given the lead time required to overcome this shortcoming, urgent resolution is required to assess when this risk becomes unacceptable and to determine the best option for avoiding the resultant capability gap.¹⁰

Even if the LOTE is successful, the last *Collins* class submarine should be retired around 2043. If the *Attack* class does run late, there may very well be a significant capability gap from the mid-2030s. This is shown in Exhibit 1 below.

⁹ <https://www.navyrecognition.com/index.php/news/defence-news/2019/june/7192-project-75-scorpene-subs-of-indian-navy-to-get-delayed-due-to-serious-defects.html>

¹⁰ Submarine Institute of Australia (2008), Submission to Defence White Paper Community Consultation Panel, *Australia's Strategic Sting*, (August), page 5, http://www.defence.gov.au/whitepaper/2009/submissions/14_Various/SIA.pdf. The main authors of this submission included a number of former submarine officers including the then President of the SIA, RADM (retired) Peter Briggs, RAN, AO, CSC.

EXHIBIT 1: POTENTIAL GAP IN SUBMARINE CAPABILITY



Source: Insight Economics

The main assumptions underlying the chart are:

- The 12 new submarines announced in the 2009 DWP Force 2030 were intended to start coming on stream in 2025, with the Submarine Force building up to 12 boats by the late-2030s
- The *Collins* class LOTE will be successful and completed within the scheduled FCD period for each submarine
- Two alternative assumptions around delivery of the *Attack* class are that they are either delivered on schedule or delivery of the FOC is delayed for five years.

The worst possible outcome would be if the LOTE were unsuccessful and the *Attack* class were delayed. The capability gap would then be total and would last for several years. This would have major implications not only for national security but also for the ability of the Submarine Force to sustain its highly trained cadre of people who need extended periods at sea in order to sustain their skills. In a situation where the population of the Submarine Force will need at least to double in order to provide crews for a fleet of 12 submarines, this is a very serious prospect. The looming problem could well be worse than the situation with the transition from the *Oberon* to the *Collins* class, which resulted in problems in recruiting, training and crewing that took the Submarine Force 15 years to unwind. That occurred in a far more benign strategic situation than Australia is likely to face in the 2030s and 2040s.

While it is now too late to avoid the need for the *Collins* LOTE, there is still an imperative to bring new submarines on stream as quickly as possible so as to minimise the capability gap. We note the German contender in the CEP, tkMS, provided not only a fixed price tender for their Type 216 submarine, but also guaranteed delivery of the first submarine in 2028 with the option of a much more rapid drumbeat than that currently planned for the *Attack* class. But without the ability to apply competitive pressure to Naval Group, there is no incentive for that company to raise performance levels so as to accelerate delivery of the *Attack* class.

Value for money

Under the CEP, each contender was required to provide a non-binding, rough order of magnitude of their submarine’s overall cost. We understand these came in at approximately

Submarines for Australia: Submission to the ANAO on the Future Submarine

the same level – not surprisingly because the estimates were non-binding and the three contenders, as well as Defence, would all have known the approximate benchmark cost per tonne of building a submarine. Although tkMS publicly offered a guaranteed fixed price, the others may have pitched at a similar level, being confident they could quote a much higher price later if successful when monopoly status had been achieved. A rational monopolist would be loath to leave money on the table, particularly in a rare instance where the customer had thoughtfully published a program budget that would have appeared generous to the point of extravagance.

When the initial budget for the FSM of \$50 billion (excluding the combat system) was announced, it caused many eyebrows to be raised. Compared to what other nations spent on acquiring conventional submarines, this seemed excessive, even after accounting for the large size of Australia's FSM. Yet that budget was framed in terms of what Defence calls future or out-turned dollars, meaning that it allows for inflation at an assumed annual rate of 2.5 per cent until the completion of the program in the mid- 2050s. In June 2018, however, Defence announced that while the headline figure for the *Attack* class budget remained the same, it was now expressed in constant dollars. This implied that the previous \$50 billion in out-turned dollars had become \$79 billion overnight. Only a couple of years after the decision on the CEP and before even a concept design of the submarine had been produced, the budget for SEA 1000 had increased by nearly 60 per cent.¹¹ We have found no clear explanation for this. Perhaps it reflects the reality of working with a monopoly.

In evaluating whether the submarines will provide value for money, the key question is: how much should submarines cost? A paper by the Kokoda Foundation published in 2012 suggests that the cost of the *Collins* class reflected contemporary international benchmarks, even though Australia had no prior experience in building submarines.¹² Extending this analysis, at the time of the CEP, it was estimated that the then current benchmark cost of submarines per tonne was about \$450,000 in 2016. The German proposal by tkMS was to build 12 Type 216 submarines in Australia with a high local content for a fixed price not to exceed \$20 billion, or a maximum of \$1,667 million per boat at 2016 prices. At 4,200 tonnes surfaced displacement, this amounts to \$400,000 per tonne, equivalent to eleven per cent below the estimated global benchmark cost.

With an overall budget for SEA 1000 of \$50 billion excluding the combat system, if we allow a very generous \$10 billion for ancillary items such as infrastructure, that leaves us with \$40 billion for the delivered cost of the submarine, double the cost of the German proposal equivalent to \$3,333 million per boat. For the *Attack* class, with a surface displacement of 4,200 tonnes, this equates to \$794,000 per tonne, or 76 per cent higher than the 2016 global benchmark. We understand, however, that by 2018 the estimate of the global submarine benchmark cost had increased to \$500,000/tonne. On that basis, the projected cost of the *Attack* class would still exceed the benchmark by nearly 60 per cent.¹³

Not only does this clearly not represent value for money, but since Naval Group knows what the budget is, it gives them a free hit. Like any rational monopolist, Naval Group will set a price consistent with the budget, possibly even up to \$50 billion. Already the cost of the design is excessive and in a couple of years or so when the construction contract will need to be signed, Defence will have little capacity to resist. As Bergmann suggests in the passage quoted above, “without commercial leverage the Commonwealth will either have to pay whatever the designer wants—or start the entire process again”.

¹¹ Hellyer, Marcus (2018), “Senate estimates, submarine escalates”, *The Strategist*, ASPI, 6 June, <https://www.aspi.org.au/senate-estimates-submarine-escalates/>

¹² Pacey, Brice (2012), *Sub Judice: Australia's Future Submarine*, Kokoda Papers, No. 17, January, page 50, <https://www.regionalsecurity.org.au/Resources/Documents/KP17.pdf>

¹³ Per tonne cost estimates based on correspondence with CDRE (Rtd) Paul Greenfield RAN, who contributed to the Kokoda report.

Submarines for Australia: Submission to the ANAO on the Future Submarine

Based on discussions with Australian shipbuilders, we also strongly disagree with the RAND group's assessment that the cost of having naval platforms built in Australia exceeds the global benchmark by over 100 per cent. The RAND study reflected the experience with the only substantial platform being built in Australia at the time RAND undertook its analysis, the *Hobart* class air warfare destroyers under SEA 4000. There were several particular reasons as to why the acquisition process for those three ships was highly inefficient, to the extent that they are the most expensive warships of their size ever constructed in the world. But the preceding two substantial RAN platforms – *ANZAC* frigates and *Collins* class submarines – were built at a cost that was roughly on a par with the global benchmark and with a local content probably nearly double that of the *Hobart* class.

In addition, a highly professional company like tkMS would not have offered the same fixed price to build the Type 216 in Osborne as in Kiel had they not made a very detailed study of the capability and costs of the Australian naval shipbuilding industry. Interestingly, one of the reasons given for rejecting the German bid was that Defence didn't believe they could deliver the submarines for this price. Never mind that tkMS was offering a fixed price contract as well as significant technology transfer with high local content. Never mind that accelerated delivery of the Type 216 was designed to obviate the need for a costly and risky LOTE for the *Collins* class. Given that Defence recognises the very high risks around the Naval Shipbuilding Plan, any opportunity to shift risks to the contractor surely should have been seen as a positive.

Perhaps the very high risk of paying an excessive price for the future submarine is the strongest of the many arguments for the need for competitive pressure.

Local content

As background to the discussion on Australian Industry Participation (AIP) as well as intellectual property rights (contained in the next section) it is necessary to understand why the highly risky decision was taken in the 1980s to build the new class of submarines in Australia. Experience with the preceding *Oberon* class submarines, which were acquired off-the-shelf in the UK, showed the disadvantages of being on the end of a very long supply chain for spare and replacement parts. (Supply was cut off completely during the Falklands war.)

Also, as proposed by CDRE (Retd.) Paul Greenfield:

Another major factor was to reduce the in-service support costs. For example, with the *Oberon* submarines, one data point – OVENS' 3rd refit - cost more than the asset value itself. And the last two refits at Garden Island were so excessive in costs that the Government cancelled the 3rd refits for both *ORION* and *OTAMA*. The Navy believed that by building all the *Collins* boats in-country, the cost of maintenance would be significantly reduced, through transfer of technology, establishment of infrastructure, and establishment of the supply chain and technical support networks, in-country, from the word "go". The take-away from all this is that the major driver behind building all the *Collins* boats in Australia was to reduce the cost of maintenance.¹⁴

It was decided in the interests of national security that Australia needed a sovereign submarine capability so as to ensure the efficient and cost-effective sustainment and the required level of availability for the Submarine Force. One criterion underlying SEA 1000, therefore, is the need to build such a sovereign capability. An obvious question is why we need to build sovereign capability all over again with a new entrant with no experience of Australian industry and majority owned by a foreign government not allied to Australia. After the expenditure of great effort and substantial funds over three decades, with many disappointments along the way, we finally have achieved sovereign capability as embodied in

¹⁴ Greenfield, Paul (2015), "Engineering considerations of sourcing Australia's Future Submarine off-shore", Address to the Royal United Services Institute, Submarine Summit, 25 March, page 3.

Submarines for Australia: Submission to the ANAO on the Future Submarine

the publicly owned ASC and its associated supply chain. The risks around trying to replace this hard won capability with a new supplier do not seem to be generally understood. There is the definite prospect of experiencing *déjà vu* all over again, and not in a good way.

In any case, in order to achieve these goals and self-reliantly sustain the submarines, a high level of local content is required. The original *Collins* class were built with over 70 per cent local content broadly defined. In sustaining them, over 90 per cent of the budget is spent in Australia. Ministers have stated that there will be a high level of local content in the SEA 1000 program. But currently little seems to be happening on the ground. While companies are understandably reluctant to go on the record, some highly capable, innovative Australian firms report an ominous lack of interest in their capabilities on the part of Naval Group.

At the time of the announcement of the result of the CEP process, President Hollande suggested that thousands of jobs would be created in France as a result of the “historic contract”. According to an article in *Le Monde*, 4,000 jobs would be created in DCNS (now Naval Group) and its 200 sub-contractors, while 2,900 jobs would be created in Australia.¹⁵ This imbalance created some consternation in Australia. Soon after, Sean Costello, the then CEO of Naval Group Australia, promised ‘at least 90 per cent’ Australian content. He left Naval Group shortly afterwards. That commitment dropped to ‘at least 60 per cent’ and now it seems as if there is no requirement for a set level of local content at all. In this context it is interesting that the latest estimate of Australian jobs created in constructing the *Attack* class is 2,800.¹⁶

It would have been expected that the requirement for Australian content would have been contained in the Strategic Partnership Agreement (SPA) between the two governments. If it was, no announcement was made. We suspect that the issue may still be unresolved. The two parties involved in the negotiations clearly have divergent interests. Naturally enough, the interests of the French government, majority owner of Naval Group, is to maximise economic activity and employment in France as a result of the project. Yet that would contravene Australia’s requirement for a sovereign submarine capability.

Had the SEA 1000 team been genuinely focussing on the relative attributes of overseas design partners/shipbuilders during the CEP rather than the potential capabilities of pre-concept design platforms, they would surely have come to understand the risks in selecting a partner owned by a foreign government with a record of a highly nationalistic approach to work sharing. But now, without Naval Group being subject to competitive pressure, they hold all the cards in any negotiation about Australian industry participation.

Intellectual property

The inadequacy of Australian rights to relevant IP was a thorn in the side of *Collins* class sustainment for a very long time. The failure to negotiate appropriate IP protocols in the first place was a result of Australia’s lack of experience in acquiring major complex platforms for which it had parent nation responsibility. It has now learned that lesson. Appropriate rights to IP are vital in terms of both sustaining the submarines and undertaking upgrades.

As with local content, IP protocols would generally have been included in the SPA. But if so, we do not know whether an outcome satisfactory to Australia was achieved.

Once again, it is in the interests of the French to maximise the value of the IP that they own. If Naval Group play hard ball, in the absence of competitive pressure it is difficult to see how Defence will be able to negotiate an acceptable outcome.

¹⁵ Gallois, Dominique et Taïx, Caroline (2016) “Sous-marins vendus par DCNS à l’Australie: les coulisses d’un contrat ‘historique’”, *Le Monde*, 26 April, https://www.lemonde.fr/entreprises/article/2016/04/26/le-francais-dcns-remporte-un-megacontrat-de-sous-marins-a-34-milliards-d-euros-en-australie_4908510_1656994.html

¹⁶ Hellyer, Marcus (2019), *op. cit.*, page 79.

4. Technical risks to FSM capability

We have discussed above the technical risks around the *Collins* class LOTE, where the likely high indiscretion ratio in the extended submarines may not be consistent with survivability in a high threat operating environment where the potential adversary's ASW capabilities are developing rapidly. Arguably, the People's Liberation Army Navy (PLAN) has already established a powerful sea denial capability in the South and East China Seas, as well as the Taiwan Strait. The PLAN is now working with characteristic energy to achieve a step change in ASW capability so as to establish what they call an 'underwater Great Wall' and deny submarines access to sensitive areas in China's littoral. If Australian submarines are to survive in the likely tactical environment in the 2020s and beyond, therefore, they will need to embody advanced stealth technologies. Above all, they will need to exhibit the lowest possible indiscretion ratio.

Although flagged as a 'regionally superior submarine', the *Attack* class may not embody advanced technologies even compared to other conventional submarines. As ASPI's Marcus Hellyer has pointed out: "even though the schedule seems to be extremely long compared to other conventional submarine projects, Defence has said that the project is adopting a low-risk approach to key technology, so only currently existing technologies will be used in the first batch. Therefore, Defence has said it will still use traditional lead-acid rather than higher density lithium-ion batteries, despite the latter being used on a recently launched Japanese submarine."¹⁷ There is a clear tension here between reducing risk in the design and construction of the submarine and the need to minimise operational risks and increase survivability.

In addition, although Defence has suggested that the *Attack* class *may* deploy AIP, the current presumption is that, because of the weight penalty, it will not. This is a controversial decision. While incorporating AIP may lead to penalties while in transit, it also provides substantial advantages in terms of survivability. While this is valuable mainly while on patrol, AIP can also be of value in transits that are contested or while passing through areas where counterforce interdiction is more likely, such as the choke points in the Indonesian archipelago.

Defence also seems determined to fit the submarines with pump-jet propulsion, which provides some acoustic advantages and is increasingly used on nuclear submarines. If the main reason Defence selected the French offering was the acoustically superior performance (under certain scenarios) of its pump-jet system, they may not have understood the possible downside of their choice. An obviously well informed article by Cameron Stewart suggests that superior stealth in a particular tactical scenario (possibly the need to break contact at high speed when detected) favoured the DCNS pre-concept design. According to Stewart, the Germans were told their pre-concept design would have an unacceptable level of radiated noise on a particular frequency. The use of pump-jets combined with an electric drive system rather than turbines arguably give French nuclear submarines an acoustic advantage over those from other countries. Again according to Stewart, DCNS presented to the Defence team an impressive demonstration of the superior acoustic performance of a French nuclear submarine with propulsors and electric drive compared to a submarine with propellers.¹⁸

When the decision in favour of the French submarine was announced, DCNS went on the front foot and declared propellers on submarines to be "obsolete". This was presented as a breakthrough technology on the Shortfin Barracuda. On the DCNS website at the time, it was stated that:

¹⁷ Hellyer, Marcus (2019), *op. cit.*, page 77.

¹⁸ Stewart, Cameron (2016), "The sound of silence – why Germany lost its subs bid", *The Australian*, 30 May, <https://www.theaustralian.com.au/nation/defence/the-sound-of-silence--why-germany-lost-its-subs-bid/news-story/4b3d69b49a8371e9837ed59e4f0faac2>

Submarines for Australia: Submission to the ANAO on the Future Submarine

Pump jet propulsion means the Shortfin Barracuda can move more quietly than submarines with obsolete propeller technology. In a confrontation between two otherwise identical submarines, the one with pump jet propulsion always has the tactical advantage.”

The problem with all this is that despite some experiments in the past using pump-jets on Russian and French conventional submarines, the downside is that a pump-jet propulsor is more power-hungry than a propeller, at low speeds significantly so. While this has no downside for a power-rich nuclear submarine and can even be a benefit, it is a critical issue on a conventional submarine with restricted power supplies. Other things being equal, pump-jets will increase the indiscretion ratio, perhaps considerably, as well as reducing range.

Submarines for Australia has supported research in this area by Aidan Morrison, a physicist with expertise in marine propulsion systems. Morrison stated that:

Unless the French have achieved a quantum leap in pump-jet technologies in the past few years and none of the previous physics or experimental results apply, it seems that the choice of a pump jet is curious indeed. Exactly what kind of advantage would justify accepting such a penalty in terms of dived range, dived endurance, indiscretion ratio and overall range is quite hard to imagine when building a ‘regionally superior’ submarine.¹⁹

Despite numerous examples in Senate committee hearings of ongoing support by Defence for pump-jets, we believe there are substantial concerns about using them on a conventional submarine with limited power resources. In October 2017, a senior executive in Naval Group said that the *Attack* class might use a propeller, only to be instantly refuted by Defence where RADM Sammut stated that they wanted the pump-jet system demonstrated to them by the French during the CEP process. He also claimed that pump-jets could be more efficient through the whole speed range, which is quite contrary to our sponsored research. But as Hellyer recently pointed out, “Defence also has not been able to provide a compelling plain English explanation to counter the arguments of some analysts who have suggested that expecting a conventionally powered submarine to perform better with a pump-jet than with a traditional propeller defies the laws of physics”.²⁰

With the *Attack* class presently being designed for lead acid batteries and no AIP, the use of pump-jets could convert an already uncompetitive indiscretion ratio to one that constitutes a threat to survivability. Ultimately, probably following land-based testing, this may well be understood and the design will need to be changed so as to accommodate a propeller. But because of weight distribution issues, this will be no easy task, possibly requiring changes amounting to one third of the submarine’s design. The risk here is that the already lengthy delivery schedule for the *Attack* class will be further delayed, possibly significantly, and depending on contractual arrangements, the cost may increase.

If all three of these issues – lead acid batteries, no AIP and pump-jet propulsors – play out as presently appears likely, the *Attack* class will have an indiscretion ratio that is likely to be no better than that of *Collins* and may be worse. It will also be higher than most submarines operating in the Asia-Pacific in the 2030s, which will either be nuclear powered or, if not, will incorporate AIP and/or modern batteries. We have already pointed out that the indiscretion ratio even of a life extended *Collins* may preclude it from being sent into harm’s way in the 2030s. Will this also apply to the *Attack* class? ASPI’s Marcus Hellyer also raises the question of “how the design is being ‘future-proofed in order to adopt emergent technologies and capabilities, such as un manned and autonomous systems, that are likely to mature before 2035 ... does the future submarine’s low-risk approach to technology, while good for project

¹⁹ Morrison, Aidan (2018-2), “A pump jet for the future submarine? Not so fast (or slow)”, *The Strategist*, 14 February, <https://www.aspistrategist.org.au/pumpjet-future-submarine-not-fast-slow/>

²⁰ Hellyer, Marcus (2019), *op. cit.*, Footnote 99.

Submarines for Australia: Submission to the ANAO on the Future Submarine

management, push risk into the resulting capability delivered by the submarines?”²¹ Indeed, one former *Collins* class commanding officer advised Insight Economics that if the *Attack* class does not at least embody modern batteries, the first submarine “will be obsolete before it hits the water”.

In conclusion, these risks are significant and generally reflect choices made by Defence. The introduction of contestability could have a beneficial effect on the technological choices made in the course of the acquisition program. As a Senate committee noted:

This reluctance of overseas countries to relinquish their most advanced technology means that Australia needs to apply competitive pressure to ensure that it is best placed to obtain the cutting edge technology it is seeking to acquire. Again this need to test and encourage designers and builders to devise the best option for the future submarine is another compelling reason for having a competitive tender.²²

²¹ Hellyer, Marcus (2019), *op. cit.*, page 77.

²² The Senate Economic References Committee (2014), *Future of Australia’s naval shipbuilding industry: Future submarines*, November, page 42.

5. Introducing competition

We are only at the beginning of a 40-year journey with Naval Group, a journey that may eventually feel twice as long by virtue of the fact that, on the advice of Defence, Australia has acceded to a high risk commercial arrangement that effectively places almost all of the negotiating power in the hands of a foreign government.

The question is what can be done. The only effective remedy would be to introduce competition, but at this late stage this may seem impossible. After all, more than three years after the CEP outcome was announced, it is too late to return to the German or Japanese contenders. In any case, since they were found wanting in 2016 there would be no reason to suppose that Defence would find either of them acceptable now. Alternatively, bringing in a MOTS design to compete would be like propping up a straw man. We have been convinced by the submarine community that no off-the-shelf design can satisfy Australia's very demanding requirements for submarine capability, particularly the lengthy operations of 70 days or more. A MOTS option would not provide effective competition to the *Attack* class.

Nevertheless, one highly credible alternative is available. In December 2018, four retired RAN officers of flag rank (the 'Four Admirals') wrote an open letter to the Prime Minister:

We are writing to you about the Future Submarine Program, reflecting our profound concern about a lack of submarine capability in the future as well as with the excessive costs and risks of the program. We are strongly of the view that the government should evaluate a second option, at very low cost and without impeding the present approach. The alternative option, that we believe could be cheaper, quicker, less risky and offer a greater level of Australian industry participation and sovereignty, is to build an evolved version of the *Collins* class.

The letter and an updated version of the detailed proposal it covered are included as the Attachment to this submission.

Most countries that own and build submarines adopt the less risky approach of developing their next design from the existing class rather than designing an all new, *ab initio* submarine from scratch. Of course this does not apply in circumstances where there is a step change in technology, such as the development of nuclear submarines in the 1950s or the shift from submersibles, like the RAN's *Oberons*, which mainly travelled on the surface, to streamlined conventional submarines, like *Collins*, that undertake operations mainly submerged. But that qualification does not apply to our circumstances.

In light of Australia's urgent need for new submarines to replace *Collins*, it may seem strange that the option of *Collins 2.0* was not pursued. In fact, early in the SEA 1000 process Kockums, designer of *Collins*, was commissioned to produce some pre-concept designs that were well-received within Defence at that time. The main reason that Kockums was not included in the CEP, was that at that time Kockums was owned by tkMS and there were legitimate doubts about its capacity with constrained resources to design an advanced submarine.

Those doubts have since been removed. Kockums is now back in Swedish ownership as a subsidiary of the SAAB Group. A major player in Australia's defence industry over many years, SAAB is the designer and integrator of the combat system now employed on all RAN surface warships. More importantly, SAAB Kockum's ongoing competencies in submarine design have recently been demonstrated in the design of Sweden's new submarine, the A26. Of more relevance to our current issue, very recently SAAB Kockums has also produced a concept design for a 3,400 tonne submarine for the Royal Netherlands Navy. The reference design for this submarine is Australia's *Collins* class.

Submarines for Australia: Submission to the ANAO on the Future Submarine

We believe that there would be substantial upside and negligible downside for the government to commission SAAB Kockums to conduct a preliminary design study (PDS) for a Collins 2.0 submarine that would meet all of the Navy's capability requirements under the CEP, incorporating any subsequent developments. This could still be accommodated in the same timeframe as the schedule for the delivery of a preliminary design study for the *Attack* class, due in late 2020.

The Four Admirals state "our initial analysis suggests that the Evolved *Collins*:

- Would have a significantly improved capability compared to *Collins*
- Would be delivered sooner, with the first boat in service by the late 2020s
- Based on public source estimates for the *Attack* class, would have a much lower cost—at ~\$20 billion for 12 boats, possibly even half as much as the Short Fin Barracuda
- As an evolved platform rather than an *ab initio* design, would involve substantially lower risks and achieve operational capability more quickly
- Would embody intellectual property already covered by protocols enabling Australian ownership
- Building on an existing Australian supply chain, would have a higher local content than the *Attack* class with more work throughout Australia much sooner
- Constructed by ASC, an Australian government enterprise, it would offer a greater sovereign capability than the *Attack* class, which would be built by a majority French government-owned company."

A major strategic benefit in Collins 2.0 is that Australia would be building on its established sovereign submarine capability, without needing to seek to re-establish it all over again with a new player, particularly one owned by a foreign government with, perhaps, different priorities. Investing in a hard-won existing industrial capability, including the very extensive supply chain, makes a lot of sense.

In that context, there would be significant synergies between building the Collins 2.0 and undertaking the *Collins* class LOTE. ASC would take the role of Prime in both cases, with the ability to build on its well-established supply chain. Further, both designs would then be in a tender ready state and there seems no reason why both Naval Group and SAAB Kockums could not offer fixed price tenders to deliver the first batch of submarines within a competitive timeframe.

The additional cost of this process has been evaluated in detail. We are confident that, in contrast to the several hundreds of millions of dollars expended so far to bring the *Attack* class to the concept design stage, taking Collins 2.0 to the PDS stage should cost around \$50 million, or 0.1 per cent of the program budget. In return for this the benefits could be high in terms of lower cost, earlier delivery and much improved Australian industry participation and access to critical IP. While Naval Group may win the contest, they would have to sharpen their pencils to get there and offer a much better outcome than presently may be the case. Overall, we are confident that the investment in competition would have a high pay back, easily recouping the \$50 million outlay.

Finally, we understand (but do not necessarily accept) Defence's argument that they are unable to evaluate more than one proposal at the same time. For this reason, the Four Admirals propose that a project team, external to Defence, should be established to drive and manage the Collins 2.0 PDS and tender. This team, which would include experts from Australia and overseas, would report to the Secretary of Defence and the Chief of the Defence Force through the Chief of Navy.

Attachment: Proposal to Prime Minister by 'Four Admirals'

The Hon Scott Morrison, MP
Prime Minister of Australia
Parliament House
Canberra ACT 2600

10 December 2018

Dear Prime Minister

The four signatories to this letter are retired naval officers of flag rank, all with a deep and varied experience of RAN submarines. Three of us are former submariners, of whom one was the commanding officer of the Submarine Force. The other signatory directed the Future Submarine acquisition program until 2013.

We are writing to you about the Future Submarine Program, reflecting our profound concern about a lack of submarine capability in the future as well as with the excessive costs and risks of the program. We are strongly of the view that the government should evaluate a second option, at very low cost and without impeding the present approach. The alternative option, that we believe could be cheaper, quicker, less risky and offer a greater level of Australian industry participation and sovereignty, is to build an evolved version of the *Collins* class.

Our main concern relates to the level of submarine capability that Australia will be able to deploy in the 2030s and beyond. Since the need to double the Submarine Force to 12 boats was identified in the 2009 White Paper, Australia's strategic circumstances have deteriorated significantly. The need for an enhanced submarine capability is now greater than ever. Yet at the end of 2018, we are only just finalising a concept design for the Future Submarine, with the first submarine scheduled to enter service in 2035, if all goes well.

Our experience tells us that, as with any new and technologically advanced military design, all is unlikely to go well. By 2040, the RAN may well have only one new submarine in operational service. Indeed, under the present program, all 12 new submarines foreshadowed in 2009 will not be available until the early 2050s.

Because of the extreme complexity of submarines and the high associated risks involved in an *ab initio* design, evolving an existing platform is the approach followed by all other countries with parent nation responsibilities for submarines. The US Navy originally recommended that Australia follow this course. Kockums produced some concept designs for the Evolved *Collins* in 2013-14, with reportedly high quality results.

Our initial analysis suggests that the Evolved *Collins*:

- would have a significantly improved capability compared to *Collins*,
- would be delivered sooner, with the first boat in service by the late 2020s
- based on public source estimates for the SFB, would have a much lower cost—at ~\$20 billion for 12 boats, possibly even half as much as the Short Fin Barracuda
- as an evolved platform rather than an *ab initio* design, would involve substantially lower risks and achieve operational capability more quickly

Submarines for Australia: Submission to the ANAO on the Future Submarine

- would embody intellectual property already covered by protocols enabling Australian ownership
- building on an existing Australian supply chain, would have a higher local content than the SFB with more work throughout Australia much sooner
- constructed by ASC, an Australian government enterprise, it would offer a greater sovereign capability than the SFB, which would be built by a majority French government-owned company.

Because of the Future Submarine schedule the six existing *Collins* class submarines will need to continue to embody Australia's deployable submarine capability in operations 'up threat' into the late 2040s, confronting a far more challenging tactical environment than they do today.

There would be major synergies between the *Collins* Life Of Type Extension and a new build program for an Evolved *Collins* class, leading to lower costs and risks for both programs.

We propose that without interrupting or occasioning any delays to the Short Fin Barracuda program, the government should commission a Preliminary Design Study of the Evolved *Collins* option. The Study should involve ASC, SAAB and the major equipment suppliers. It should be managed by a dedicated Submarine Capability Team. It is estimated that the study would cost about \$50 million, or 0.1 per cent of the SEA 1000 program budget. This would appear to offer very good value for money, not least in terms of providing competition for the Short Fin Barracuda.

The proposed study would take about two years. If a contract for the study were issued in a timely way, it would enable the government to choose between two options for the Future Submarine in early 2021.

Further details of our proposed approach are contained in the attachment to this letter. We feel sufficiently strongly about this issue that we intend making our concerns public in the next few days. We will do this because we believe it is in the national interest that this situation be given serious consideration. But we also consider it appropriate that the Government be given an opportunity to prepare a considered response. Therefore, we propose an embargo on the contents of this letter and attachment until midnight on Wednesday 12 December 2018 and would request that the government does the same.

We have copied this letter to the Minister for Defence and the Minister for Defence Industry. We would be happy to meet you and other Ministers to discuss our proposal further.

A PROPOSAL TO ASSURE AUSTRALIA'S FUTURE SUBMARINE CAPABILITY

Proposed Recommendations

Ministers **agree** that:

1. The Minister for Defence commission a small team to develop and propose an approach for engaging SAAB Kockums, supported by ASC Pty Ltd and other Australian companies as appropriate, to undertake a preliminary design study (the study) into a new submarine design building on Australia's experience with the Collins class and optimising carry over opportunities that may exist with the work to extend the service life of the Collins submarines. This proposed approach is to include cost and schedule for the study, which is not to interfere with progress on the current submarine programs.
2. The Minister for Defence develop terms of reference for the study in consultation with the Prime Minister and Ministers for Finance and Defence Industry.
3. The study is to commence as soon as practicable, with the outcome to be available for NSC consideration before any decisions are required that would commit the Commonwealth to building the first of any new submarine.
4. The study be funded from within Defence's budget allocation.
5. The Minister for Defence periodically advise the National Security Committee of Cabinet of progress with the study.

Summary

- Deterioration in our strategic circumstances gives rise to concerns that the Future Submarine Program will deliver new submarines much later than we may need them
 - As well as growing the submarine force more slowly than we would want
 - At a cost, in the absence of any competition, which already appears much higher than we should be willing to pay.
- There is a consequent necessity to extend the lives of our existing submarines for a very long time, which
 - Will come at considerable cost, risk and capability impact as well as potentially reducing submarine availability
 - Would reduce Navy's ability to grow more submariners.
- There is an alternative that should be investigated urgently: a new Swedish design evolved from and building on Australia's Collins experience.
- This should be done without diverting effort from Australia's existing submarine programs.
- This investigation, a preliminary design study (PDS) at a very small 0.1 per cent of the program budget, represents good value as a risk mitigation strategy as it

- would inject some competitive tension into the design phase and
- provide an insurance policy at this stage of the largest capital value Commonwealth acquisition in Australia's history.

Situation

The fact that Australia's strategic circumstances are rapidly becoming much less certain is widely acknowledged. Viewed against this backdrop, progress with plans for the Navy's future submarine capability strongly suggest there is a growing risk that Australia will face reduced submarine availability and capability at a time when the need for it is increasing.

The planned schedule and risk of the new Attack class are problematic. The delivery schedule, while consistent with what is required for an *ab initio* design, is no longer appropriate for the circumstances anticipated and the security threat they represent. Accelerating the Attack Program however does not appear to be under consideration, even if doing so is practically possible. Extending the lives of the Collins class submarines is already unavoidable but plans to do so have yet to be announced. Importantly, given the different designs and philosophies, there is little opportunity to maximise the synergies between these two complex and challenging programs, to mitigate the overall risks and minimise the chance of a serious reduction in this capability that has been judged as being critical by successive governments for over a decade.

There is a high likelihood that the work required to extend the life of the Collins class submarines will reduce their availability. This would be a bad outcome, for reasons discussed later. If additional resources are made available to ASC to ensure the life extension to Collins can be completed during scheduled deep maintenance and docking periods, there is a consequential risk that the skilled labour available to Naval Group for construction of the Attack class will be inadequate. Even apart from this, there is a high risk too that the Attack Program will run late as *ab initio* programs seem inevitably to do as proven time and again across the world.

There is a high likelihood that all these risks will become reality, with very serious implications; we will have invested a great deal of time, money and effort in a capability that cannot deliver what we need when we most need it.

Regardless of any contractual arrangements, this risk and its implications lie solely with the Commonwealth.

Examining in more detail the issues of schedule, risk and cost:

Public statements on the **schedule** for the Attack Program indicate:

- The first new submarine will not be ready for operations until 2035 at the earliest, which is 10 years later than the originally planned end of life of the first of the Collins submarines.
- Therefore, to maximise submarine numbers, all the Collins class must be extended in service for a long time. This will involve considerable cost and risk.
- We will not have 12 submarines, the need for which was first identified in the 2009 *Force 2030* White Paper, in service until after 2050.

In terms of **risk**, even if the Attack Program goes smoothly:

- History shows that there is an elevated risk that the first submarines of a new design will be delivered later than planned, at higher cost and with less capability than sought. This was our experience with Collins. That history is being repeated now in France with their *Suffren* submarine program, designed to replace their existing SSN force and on which the Attack class is apparently based, which is running several years late.
- While projects to upgrade some of Collins' systems and address obsolescence issues are funded and underway, life of type extension (LOTE) work appears not yet to have been approved. Collins' original designer has not been commissioned for overall LOTE design, a contribution which industry considers essential. This suggests it may not be fully scoped or costed. That work will have to be done separate from building the Attack class submarines, with little opportunity for carry over between the two because of their different design origins, supply chains and constraints on access to intellectual property from different national sources.
- Meanwhile, the capability of the six Collins submarines will decline compared with potential adversaries as evolving technology outstrips the inescapable limitations of the original design, even with the upgrades planned.

The stated total constant price **cost** of \$50 billion for the 12 new Attack class submarines is concerning too because it looks higher than we should pay.

In this situation, there is an urgent need to do something to mitigate the risk of reduced submarine capability.

Submariners – the critical element

Increasing significantly the number of Navy's submariners, as rapidly as feasible, is urgently required no matter what new submarines we acquire or when they are delivered.

- The large increase in submariners must be recruited, trained and developed by being given experience at sea in submarines in progressively advancing roles, over time. This is challenging and takes a long time.
- For example, growing one competent submarine Captain takes some 15 years, with only one in eight who start on that pathway being successful. The situation is similar for the equally important submarine Engineer Officers.
- Submarine availability is the critical ingredient, after the capacity of the training system, in determining the growth rate that can be achieved. Navy's progress in recent years is outstanding and commendable but the growth is fragile until the new workforce gains the experience at sea that is so critical.
- Avoiding any reduction in submarine availability is therefore vital; indeed the clear need is for more submarine sea days than are achieved now, growing sooner and more quickly.

Regardless of how well planned, efficiently executed and successful it is, the considerable work needed to extend the life of Collins boats will be lengthy,

challenging and complex. The risk of reduced submarine sea days and therefore training capacity is high.

Growing more submariners is the critical path for the larger submarine fleet regardless of the submarine that is acquired. Submarine availability is the critical and limiting element.

Purpose

This paper proposes that Government urgently examine the one available and timely option for mitigating the risk of reduced submarine capability.

The alternative

There is only one alternative because no existing conventionally-powered submarine design can satisfy Australia's operational requirements. That is to examine further a Swedish design, to build on and further develop Australia's existing sovereign capability embodied in the Collins platform.

Early in the Future Submarine Program, Australia was encouraged by the US and others to build on the experience gained from 30 years of the Collins program. Overseas practice reflects this approach because an evolutionary program is cheaper, less risky and more quickly achieved than 'revolution'. Nations that are long term parents of their own submarine capability generally run their programs in this way. The Collins program, which created a unique submarine class for Australia's needs, brought with it those parental obligations.

Involving the original Swedish designer would be necessary to maximise the benefits of building on Australia's Collins experience. This is because Australia does not have the capacity or capability to design its own submarine even though it now possesses useful submarine design expertise. Help from an experienced submarine designer is required and there is only one who could access the associated Swedish intellectual property to enable us to maximise the benefits of building on the existing foundation.

Defence Minister Pyne stated that the option of evolving the Collins design was considered and dismissed by Defence some years ago. While this is true, there is much more to the story. Defence did study updating the Collins design but this was done prior to the competitive evaluation process (CEP) that Australia used to select between France, Germany and Japan who would design its new submarines. Sweden was not invited to submit a proposal during the CEP.

The Swedish option is the only possible alternative now because:

- German and Japanese designs were evaluated during the CEP and rejected; there is no reason to revisit them.
- Government has ruled out 'off the shelf' conventional submarine designs offered in the market (by France, Germany and Sweden, plus Spain and South Korea if their designs were to be available commercially) because they are dramatically less able than Collins to meet Australia's needs.
- Nuclear powered submarines are not considered, given Australia's small submariner base and lack of the necessary infrastructure and safety

protocols to operate them. Therefore, there are no alternatives available from the UK or USA.

Other Government policy objectives, such as a high level of Australian industry involvement as an enabler of greater sovereign control over the capability, are of fundamental importance and underpin the analysis contained in this proposal. Building on over two decades of experience in sustaining the Collins class, with a local industry content of over 90 per cent, which has led to a deep understanding of those submarines in the existing national supply chain is maximised by the approach proposed here.

Other considerations

There are other reasons for examining a Swedish alternative, not least that Defence has already done a worthwhile body of work on it. Defence engaged Kockums in 2013 to investigate evolving the Collins class, through contracts valued at just under \$10m.

- This was in addition to work evaluating the Collins class service life.
- The products and the collaboration with Sweden are reported to have been good.

Importantly, agreement on **intellectual property (IP) rights** was reached with Sweden before that work started, in stark contrast to the problems we had over two decades with IP for Collins and with any uncertainties that may exist regarding Australian rights to IP for the Attack class.

There are important benefits that would accrue from an integrated approach to the Collins LOTE and building a new submarine originating from the same design house. We could reasonably expect lower risk and cost overall, a quicker delivery schedule, greater Australian industry involvement sooner and greater commonality between the old and new submarines because of substantially greater opportunities to 'carry over' lessons from the Collins program to the Collins LOTE, and then into new submarines where there is a common designer and builder.

The inevitable tension between two separate submarine designers and builders involved in upgrading and sustaining Collins and building the Attack class in a new facility competing for manpower and resources would also be limited.

In addition to those benefits, the challenges and costs associated with transition between classes, particularly training requirements, would be reduced and substantially lower sustainment costs would also be achievable. The result would be reduced total cost of ownership of the capability and beneficial impact on the Defence budget in the long term, given that acquisition accounts for only around 30% of the total capability cost.

All these benefits are less likely to be achievable under the current program plan.

This proposal

- Establish immediately a small team to conduct a preliminary design study (PDS) with Swedish designer SAAB Kockums and involving ASC for a submarine designed to meet the original CEP requirements;

- While at the same time engaging SAAB Kockums to assist ASC in planning and executing Collins LOTE, to maximise the potential for carry over between the two.
- ASC Pty Ltd, and other selected companies in Australia's existing supply chain for the Collins class should be involved, to ensure the long experience from building operating and supporting the Collins class are fed back into the design, an important way to keep manufacture, assembly and through life support costs down.
- The primary objective of the PDS would be to understand the capability such a submarine would provide, when delivery could begin and at what rate, and the average price we might expect to pay per submarine based, in the first instance, on a six-boat build.
- An additional objective would be to understand in greater detail the benefits and challenges of running Collins LOTE and a new build program of Swedish design origin in parallel.

This proposal is for a study. A decision now on the future of the Attack program is not being proposed, quite the contrary.

The study is a low-cost risk mitigation activity. The objective is to test whether a viable, competitive and executable alternative to the Attack class exists and is attractive, so that when government must commit to the massive investment of a construction contract it can do so with greater confidence.

This contrasts with the existing situation with the Attack class, with the available choices being to take it, modify it, or leave it. Leaving it would likely mean the end of Australia's sovereign submarine capability because it cannot be sustained without a relevant, competitive and timely replacement for the Collins class. Modifying it would involve more delay and compromising on capability.

The proposed PDS would also put competitive pressure on Naval Group for a better outcome, in Australia's interests, whichever choice government was ultimately to make.

The issue driving this proposal is our grave concern over the risk of reduced submarine availability and capability at a strategically inopportune time. The Attack program delivery rate therefore should be accelerated if possible. Discussions with local industry interlocutors who are engaging now with Naval Group lead us to forecast that they would probably respond to pressure to accelerate delivery by proposing to build the first several submarines in France. Understandably they could do that more quickly than in Australia but a likely consequence would also be maximising the use of French industry and supply chain over Australia's. The maintenance of a high level of sovereign submarine capability remains a key and appropriate requirement of SEA 1000. Competition between a Swedish offering, where satisfactory IP protocols have already been agreed, and the French where they may not have been, would be useful. If the PDS does provide an attractive alternative, a key outcome would be that Australian industry content would be maximised from the start, with all the benefits that would accrue. This is discussed later.

Noting Defence's comments at Senate Estimates suggesting that they do not have the skilled workforce to run more than one design development program, the

proposed PDS should be set up and conducted separately from the SEA1000 program office. Evaluation of the output of the PDS should be done independently of both SEA1000 and PDS project teams because both would be conflicted. The evaluation could be largely resourced from experienced and independent non-government corporations. The significance of what is at stake justifies such a National commitment. Defence's constrained capacity is insufficient justification for not undertaking it.

We consider the proposed PDS needs only a small team, between 15 and 20 people. The cost should be in the order of A\$50m, one tenth of one percent of the budgeted cost for the Attack Program. If started in 2019 an interim report could be expected sometime in 2020, potentially to coincide with the preliminary design review for the Attack class. A final report in 2021 would be available before Government faces the critical decision point of committing to a construction contract on the Attack class, which is scheduled for 2022 (according to detail published by Naval Group in 2017).

Defence's public statements make it clear that the PDS should be undertaken in a way that minimises the risk of diverting resources from current submarine activities or causing any delay or distraction; ie, it should be undertaken as a separate activity.

- Defence's submarine project workforce is fully employed now and there is insufficient suitably skilled capacity in Defence to devote to this additional task.
- Our strategic situation makes it vital that we avoid anything that slows down both the Attack and Collins upgrade and LOTE Programs.
- The PDS envisaged would require a small Commonwealth team to set up and manage the necessary contracts. A few Defence APS support people would be required plus people with specialist submarine skills who could be contracted from among experienced Australians who are no longer working in Navy, CASG, Naval Group or ASC. One or two overseas experts may also be engaged. Keeping the composition of this team mainly external to Defence would help minimise the risk of impact on any current submarine activity.
- Access to existing Defence documents would clearly be necessary.
- Some skilled and experienced industrial advice from outside Defence to guide the team would be valuable.

Attack Program and a Swedish approach compared

History

The Head of the Future Submarine Program in 2013 deliberately imposed a restriction on the investigation of an evolved Collins design that was contracted to Kockums. That restriction was that the existing Collins hull diameter was not to be changed.

- This was done solely to determine whether an evolved Collins design would be materially different from undertaking a new design and to determine if a design and build program could be started quickly with a minimum of drawing changes.

- The results showed an evolved Collins would be a new design in terms of budget, schedule and contingency (according to the ANAO).

There is no debate that a new design would result. None of the existing Collins detailed design artefacts could be re-used. There is also no doubt that a new design is required to meet Australia's needs. But the ANAO's comments do not canvass other important considerations that contribute to a new Swedish design built on our Collins experience being a very different proposition compared with a new design of other origins, particularly an *ab initio* design.

Comparison of risk

Our long history and hard-won experience with Collins, deep knowledge of that submarine and its designer, the established Australian industrial support and local supply chain (none of which we have with Naval Group) suggest that engaging again with Sweden should entail:

- Lower program and capability risk compared with new designs of other origins;
- A quicker time to start the build program and lower total cost;
- Greater investment in the existing Australian supply chain earlier and overall;
- Opportunity for carry over between the new build and Collins LOTE far greater than the alternative;
- Lower likelihood of cost and/or schedule blow out; and
- Lower consequent risk of having to compensate for slippage by extending the Collins submarines in service even longer than currently necessary, with all the risk and cost associated with that.

Comparison of capability

Various comments on the CEP agree that the French bid was superior by a clear margin compared with the Japanese and German bids although the bases for those comments rightly remain closely guarded. But without having been given an opportunity to participate in the CEP, there is no justification for suggesting that a Swedish design could not compare favourably with the capability of the Attack class.

While a critical consideration, capability should not be the sole determinant for such a massive investment as this, especially when comparing designs that do not yet exist and embody a capability that can only be forecast at this early stage. Whole of program Australian industry and supply chain involvement, cost, risk and schedule should also be considered, as should sustainment and the implications of and for the Collins LOTE that is now inescapable. Simply put, the capability is not justifiable at any cost, particularly if the delivery schedule is inconsistent with Australia's strategic threat.

The proposed PDS would provide more clarity.

Comparison of schedule

Our experience with the Collins program suggests that a Swedish design could be delivered sooner and possibly more quickly than Attack, for the same reasons that the risk is lower. An objective of the PDS activity would be to examine this

and provide better clarity but, even accepting the likelihood of delays associated with a new design, based on the rate of delivery ASC achieved with the Collins class:

- The first boat might possibly be operational by 2030 – at least five years earlier than the schedule for the Attack; and
- Based on public statements, four or five new boats could potentially be delivered by the time the first Attack completes test and evaluation – a dramatic improvement.

An observation on the budget

Submarine cost is a complex matter and accurate, comparable and verifiable data is difficult to get. Available analysis suggests a global western benchmark cost of A\$500,000 per tonne of surfaced displacement for submarine acquisitions (2018 \$ value). The Collins class cost just under the benchmark, despite being built by an inexperienced work force in a new shipyard in a country that had never built a submarine before.

- The Attack class at around 4,270 tonnes should therefore cost in the order of \$2.135b per submarine; or
- \$25.6b for twelve submarines, very different from the budget of \$50b, which Defence has stated excludes the combat system (\$6bn), Collins LOTE and Attack sustainment costs.
- Design fees, project management costs, new infrastructure, training systems, weapons, contingency and so on would be in addition to that estimate; but
- Such costs should not add another \$25b to the total.
- This suggests that the planned average cost of each Attack submarine is likely to be substantially higher than the benchmark suggests we should be paying.
- With obvious implications for the Defence Integrated Investment Program if that's the case.

Other considerations

There are other potential benefits in looking at the Swedish option apart from providing Government with options to mitigate risk and injecting some competition into the Attack design process:

- In respect of other policy objectives of successive Governments:
 - Using ASC to lead the construction program would build on existing industrial knowledge, particularly with the efficient Swedish modular construction methods, trained Australian labour force and the existing national supply chain;
 - Achieving in the process a higher level of local industry content, more quickly than could be achieved with the Attack class; while also
 - Achieving greater sovereign capability sooner; and
 - Lower through-life support costs; and possibly
 - Using some existing infrastructure, thereby saving on reinvestment costs.

- All while avoiding a destructive competition between the shipyard resources and workforces required to sustain and LOTE Collins and build the Attack Class.
- Systems being upgraded in the Collins class and those systems that will need to be replaced in future to extend their lives, could be carried over more easily into the new design, reducing risk overall in a program that would inherently lend itself to closer integration with and sharing both between the Collins LOTE and the new design, which would:
 - Reduce risk, cost and schedule, simplify supply chain management and maximise value for money in both programs; and
 - Minimise the challenges and risk for the Navy of training its people for the new submarines (note the earlier section on submariners).

Why was Sweden excluded from the CEP?

The publicly stated reason for excluding Sweden from the CEP in 2014 was that their capabilities and capacity had declined since they designed Collins and they were no longer capable of doing the job.

- Much has changed to show that even if that assessment was correct at the time (which is arguable), it is clearly not valid now. Another reason given was that Defence did not have the capacity to evaluate a fourth CEP option. This is hard to accept given the extent to which external support was contracted in by Defence to conduct the CEP. In any case it is surprising logic when so much is at stake. Defence was able to evaluate seven competing submarine designs in the 1980s and run two funded preliminary design studies in parallel before the Collins design was settled on, although it should be noted that the Department was composed quite differently then and possessed much deeper specialist skills.

There were almost certainly other reasons for Sweden's exclusion that were not stated publicly. Memories and lingering dissatisfaction over the Collins experience and its political fallout would be among them.

Sweden today

The situation today is very different from 2014 in important respects.

- Sweden's submarine company Kockums is now owned by Swedish firm SAAB
 - For the fifteen years between 1999 and 2014 (ie, much of our Collins program) it was owned by German company TKMS who acquired it to neutralise a competitor, probably among other reasons.
 - The change of ownership back into Swedish hands – a key strategic objective for Sweden - took several years and involved both Governments, the EU Parliament and the Swedish Royal family.
- Since the change of ownership, construction of the first of two submarines of a new design for the RSwN has started and is well progressed.
- SAAB has just returned to service one of the RSwN's older submarines after a major upgrade that included inserting a hull extension 'plug', which can be readily achieved with Swedish designs (including Collins). They have been

doing this on Swedish submarines for several decades and plan to do the same with other submarines. The upgrade takes the submarines out of service for less time than our submarines spend in full cycle dockings (currently around two years).

- SAAB is bidding against the Germans to design new submarines for the Dutch, which will be built in the Netherlands. At around 3,000 tonnes surface displacement, the design they are offering is evolved from Collins and is very close to one of the unsolicited concepts offered to Australia in 2014.
- SAAB is still an important partner in Australia's submarine capability as the original designers of Collins and that will continue at least the next two decades. The company is contractually engaged with ASC.

These facts suggest strongly that Sweden has the capability to develop a new submarine design to meet Australia's needs. The question of their capacity in the timeframe we require it is less clear. Both questions would be tested during the proposed PDS.

We note too that Australia has had a relationship with SAAB in Australia for several decades, which will continue indefinitely. The company provides combat and other systems for the Navy's ANZAC class frigates, LHDs, and Collins class submarines. They will be providing core combat and command system elements for the Hunter class frigates and the OPVs, which will make them one of two major providers to the Navy for decades to come.

There is another factor worth considering. Sweden has chosen to devote its national energies to designing jet fighter aircraft and submarines for its own national security in response to resurgent Russian military activity proximate to its borders. This was a key motivation for regaining national ownership of Kockums. Sweden designs conventional submarines for its own defence and the RSwN is a demanding client. France operates only nuclear-powered submarines; their conventional submarine designs are for export.

What about the "Dud Subs"?

Collins' history is problematic and well documented. But it is history and reflects a learning experience not uncommon with a new class of submarines, particularly in a nation that has not previously had parental responsibilities for major military platforms. Circumstances are very different now and those submarines are acknowledged as delivering well on Australia's requirements. Much of that achievement has been a result of local efforts although there has been help from overseas, especially from the US Navy. Australia has also learned a great deal and developed considerable expertise; we have good reason to back ourselves with confidence.

Placing all the blame with Sweden for our difficulties with Collins would be unreasonable and wrong. Australia shares much of the responsibility, having been without experience for such a complex project. That same inexperience was exhibited in Australia's highly ambitious performance requirements. Both factors played a major role in laying the foundation for the problems encountered.

Appendix

The distraction of hull diameter

ANAO Report No.48 of 2016–17 “Future Submarine—Competitive Evaluation Process” mentions the matter of hull diameter. Page 20 of that report states:

“The external review concluded that an enhanced Collins design would require the same budget, schedule and contingency as a new design, and would have significant engineering constraints such as hull diameter. On this basis, Defence determined that a new design was the preferred option for the Future Submarine.”

The matter of hull diameter is a ‘red herring’.

- The investigation of an evolved Collins concept in 2013/14 was specifically designed to determine whether it would amount to a new design in terms of the nature of project the Commonwealth would have to manage.
- Defence needed to know whether to plan for a project that would build a submarine design off the shelf, one that modified or evolved such a design, or execute a completely new design and in each case whether a new partner nation (other than Sweden) would be involved. The size and nature of staff required to manage the project would need to be designed and resourced accordingly.
- The constraint on Collins’ hull diameter was not an engineering consideration - it was imposed by the Head of the Future Submarine Program. He did this because experienced international advice was consistent that when evolving a design, changing the hull diameter meant that the original design drawings could not be re-used; the same amount of work as required for a totally new design would have to be done, with everything that went along with that in terms of managing the program for success. In this case, it is the designer’s approach, experience and expertise that is re-used and built on, not the specific submarine design details (except conceptually).
- The work with Sweden on evolving from Collins was designed to answer a single question; if we fixed all the known problems with the Collins design, with other agreed enhancements recommended by the designer, but did not change the existing hull diameter, would we have to build a project management arrangement suitable for managing a new design?
- The answer was that such an approach would deliver a new design and we would need to manage it accordingly.
- The artificial constraint on hull diameter ceased to have any relevance at that point.
- SAAB Kockums also offered two unsolicited inputs in response to the tasking in 2013, in addition to answering the primary question. The first suggested a design 6m longer than Collins, with hull diameter increased by 20cm. The second was for a larger submarine of around 4000 tonnes (surfaced displacement – apparently very close to the Attack class concept design).

There was no engineering constraint on building on the Collins experience to create with Sweden a new submarine design, as ANAO concluded on the basis of information provided by Defence. Such a statement is difficult to understand. The exclusion of Sweden from Australia's submarine CEP had nothing to do with engineering limitations associated with the Collins design.

Sources

We have used publicly available information on the Attack Program.

Comments about evolved Collins are based on public information and the knowledge and experience of several Australians who have been involved in submarine capability and construction in Australia going as far back as the Oberon class boats. Some of those people are still actively involved in Australia's submarine enterprise.

Analysis by ANAO, ASPI and the Kokoda Foundation has also been drawn upon.