GUARDING OUR EDGE
Building and sustaining the future submarine in Australia
Foreword

Why build submarines in Australia? The answer is simple - we can’t afford not to.

In choosing the procurement strategy for our future submarines, our Government has a unique opportunity to determine and deliver Australia’s maritime defence capability into the next century.

Submarines – and necessarily large submarines at that - are our most important strategic deterrent and defence asset, integral to self-reliance in the direct defence of our island continent and its trade routes. Australians cannot expect guaranteed and unconditional assistance from our allies in times of crisis, despite the strength and closeness of many of these relationships.

There are two clear paths. Do we outsource the design, development, build and maintenance of our submarines - and in doing so, surrender our sovereign independence and gift an entire industry to another country? Or, do we back ourselves and commit to long-term investment in building a robust indigenous capability to deliver and sustain our Navy’s future submarines, in perpetuity?

There is only one choice. If we are to protect and strengthen our self-reliance, we must design (or at a minimum control the design), develop, build and maintain the future submarines in Australia. This is no ordinary defence project – but this is not a difficult decision.

All factors must be considered though. Short-term fiscal considerations alone may erroneously lead Government to an off-the-shelf option, superficially attracted by a marginally cheaper front-end purchase price – for a submarine that won’t meet Australia’s unique needs. This is short-sighted thinking, for it notably ignores the larger cost of sustaining the submarine fleet through its life, a markedly more complex and costly task with an offshore purchase.

If the acquisition decision - as it must - truly takes into account whole-of-life costs, development and protection of national intellectual property for a critical strategic capability and flow on benefits to other Australian industries, offshore purchase is simply not an option.

Australians need full control of our submarine program. Achieving and maintaining technological and operational advantage in conventional submarine operations is absolutely essential. It’s our edge. Assembly of an overseas design is one thing, but Australian-control of the design provides the ability to upgrade and modernise over time and is absolutely fundamental to providing our Navy with the capability it needs to fight and win.

The combat and weapons systems – the heart of a submarine’s fighting capability – must be installed and integrated in Australia. Our relationship with the US provides unique and valuable access to the world leading practitioner’s design capability. Retrofitting US systems into a submarine built overseas, if indeed feasible and agreed to by the Americans, would be extremely high risk, costly and time-consuming.

Again, this is no ordinary defence project – it won’t have an end date. Carefully managed, building submarines in Australia will create a new national industry, with continuous workflow for a century or more. It will spawn new skills and technologies that can be applied to other industries.

We must not be averse to capacity building, nor allow our political system to stifle investment in nation-building initiatives. Naval shipbuilding and sustainment could and should be a cornerstone of Australia’s advanced manufacturing future, generating real economic and social returns. Let’s back ourselves. The far-reaching rewards should be ours, not exported offshore.

Own the design, build in Australia, think and act long term. It’s how we’ll guard our edge.

General Peter Cosgrove AC MC
Chairman, Defence SA Advisory Board
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Submarines are covert, agile, have great reach, and deploy a powerful set of weapons and sensors. To those who might aspire to control the sea, they are a powerful deterrent and effective counter.
Australia is fundamentally good at building submarines. In an evolving and often volatile project management environment, Australia successfully built and subsequently rectified many of the unexpected, complex and challenging technical issues associated with the Swedish-designed Collins class submarines. This result was more than just a set of noteworthy achievements.

The high quality national industrial capability that the Collins project spawned is now a significant and strategically vital Australian national asset. The shortcomings in some of the Collins class systems are well documented, but their genesis was in a flawed and ever-changing procurement strategy. Building the submarines in Australia was not a factor that handicapped the program. In fact, the decision to build in Australia, and the later critical decision to secure Australian design authority over the platform, were together key enablers for the realisation of Collins as a world-class conventional submarine.

If the past lessons are heeded and appropriate changes made, Australia’s national industrial base can build and sustain the Navy’s future submarines to the full satisfaction of the Federal Government. And it is undoubtedly in Australia’s strategic and economic interests to pursue this approach, for it will maximise the breadth and depth of the potential benefits to the nation and provide the greatest overall return on investment. The future submarine project will create an industry that could last for a century or more. An industry that will generate flow on benefits by building skills for other industries and creating technology that can be applied elsewhere. An indigenous capability in Australia that can design, develop, build and maintain submarines is a national imperative given the absolute need for Australia to have sovereign control over its submarine capability. But it is not something that we can or should do on our own.

Australia’s Strategic Interest
The most recent Defence White Paper states that Australia’s basic strategic interest is the defence of Australia against direct armed attack. This interest is a function of Australia’s geography and the level and nature of regional military capabilities. Before we attend to anything else, we must address this strategic interest.

Submarines are a Critical Australian Capability
The oceans play a critical part in the global economy. Around 90 per cent of world trade is carried by the international shipping industry. Over 90 per cent of Australia’s trade is transported by sea. Australia has critical oil and gas resources located offshore that are major contributors to the national economy. National exports of liquefied natural gas (LNG), all transported by sea, could more than triple by 2016-17 and Australia is on track to become the world’s second largest exporter of LNG by 2015.

Changes emerging in Australia’s strategic setting raise important questions as to the possibility of military attack upon Australia and its offshore interests, and how any such attack might be countered. Such a possibility of attack is often dismissed out of hand given the strength of Australia’s allied relationships, regular political dialogue and commitment to Coalition operations, but Australia cannot expect guaranteed unconditional assistance from its allies in times of crisis.

Building and sustaining the future submarine in Australia
Countries will act in accordance with what they perceive to be in their own national interest at the time. If that perception happens to align with Australia’s national interest, all well and good; if not, Australia has a potential problem. Control of Australia’s defence capabilities must be such as to allow the Government to act independently.

Current Government policy espouses that ‘the most effective strategic posture continues to be a policy of self-reliance in the direct defence of Australia, as well as an ability to do more when required, consistent with our strategic interests and within the limits of our resources.’ In this context, self-reliance means having the capabilities to address Australia’s unique strategic interests. It does not mean having a full suite of capabilities for every occasion. Nor does it preclude a degree of dependence on others through ‘classified collaboration’ on certain critical technologies.

As an island nation, Australia’s air and sea approaches are its defensive bulwark and Australia must be capable of denying an adversary freedom of operations within those approaches as and when needs demand.

Submarines are our most important strategic defence asset. Whatever future course the debate on Australia’s security takes, that the Government of the day requires an affordable, effective and enduring conventional submarine force capable of successfully prosecuting the submarine mission, rightfully has strong bipartisan consensus. The current Opposition has indicated that within 18 months of taking office, it would make the decisions necessary to ensure that Australia has no submarine capability gap and has also indicated a clear preference to buy Australian.

Accepting the obvious national security constraints, the nature of the submarine mission must be clearly defined by Government, for it drives the design requirement of the capability and the appropriate acquisition strategy to be adopted.

Respected strategists consider the submarine to be the sea denial platform par excellence, especially for operations distant from the coast, and the submarine fleet to be perhaps the most important single capability for the independent defence of Australia. Submarines are covert, agile, have great reach, and deploy a powerful set of weapons and sensors. To those who might aspire to control the sea, they are a powerful deterrent and effective counter. History is replete with examples of submarines having achieved disproportionate influence. For Australia, with a small population and limited tax base, having a modest submarine fleet capable of asymmetric military influence is eminently sensible.

**Australia Needs Full Control of its Submarine Program**

To be credible, Australia’s key military capabilities must have a discernible ‘edge’ over those of potential adversaries. The vital deterrent role of an effective submarine force and the critical contribution of submarines to the Government’s response options in times of tension or conflict, mean that achieving and maintaining technological and operational advantage in conventional submarine operations (‘our edge’) is absolutely essential.

Because of that requirement, strategic and operational management of Australia’s submarine program demands exceptional and constant attention. Understanding and controlling the management of design, engineering, procurement, integration, pre-testing, construction, reliability and continuous improvement processes are all critical factors in delivering a future submarine capability on time, within budget and with a credible through-life support plan that guarantees operational availability and a technological ‘edge’.
Production and delivery of the capability is one thing, but control of the design provides the ability to upgrade and modernise over time and is absolutely fundamental to giving the Navy the submarine capability that it needs to do the job. Sustaining this critical ability for the long term will minimise sustainment costs, but is only possible with in-country build and a sympathetic, rapidly responsive supply chain. In that regard, Australia is well placed.

The essence of control is in the nature of the chosen procurement strategy. The Government is currently considering four options for acquiring a future submarine capability, from evolutions of European ‘off-the-shelf’ models through to new designs. The ‘off-the-shelf’ options will not cut it for Australia. Such an acquisition would deliver a submarine not only significantly less capable than that of the Collins class, but also unable to satisfy the Australian strategic and operational requirement. The need is for a stealthy, operationally effective submarine fleet capable of long range and long endurance. Such demands would most likely lead to future submarines of similar size to the Collins class or larger.

As recently argued by Senator David Fawcett, ‘the ability to evaluate and, where necessary, repair or modify and certify leading edge military technology to a chosen standard is one of the things separating a third world and a first world nation,’ and Australia aspires to the latter, particularly in the evolutionary development of its most critical strategic capabilities, such as submarines. Fawcett goes on to state that ‘many of Australia’s procurement problems stem from the growing gap between Australia’s perceived and actual ability in this regard.’ In its future submarine, Australia should have the best available combination of platform and systems that the nation can afford whilst maintaining sovereign control, meaning simply that Australia should not place itself in a position where it has ‘no option but to accept the level of capability, risk, cost, safety and availability another nation may deign to provide Australia at their convenience’. Australia could choose to embrace a foreign design, but would then be obliged to incur the cost of securing control over that design, assuming it is possible to do so. Not securing design authority of a critically important capability has long-term negative consequences of which Australia has some bitter experience. In the context of the Armed Reconnaissance Helicopter and the Joint Strike Fighter (JSF), Australia had no alternative but to accept the constraints imposed by foreign design, for Australia has no ability to design and build advanced helicopters or fifth generation combat aircraft. This is not the case for conventional submarines – arguably Australia’s most critical military capability – where an extremely capable indigenous submarine building and sustainment industry exists. For JSF, the unique US-Australia defence relationship is a mitigating factor. For the in-country integration of its submarine capability, Australia has the added, significant benefit of privileged classified access to US combat and weapons system data.

Strategic and operational management of Australia’s submarine program demands exceptional and constant attention.
The ‘Design Authority’ is the organisation responsible for the development of the design or modification and preparation of engineering data for materiel intended for Australian Defence Force use. Without design authority, Australia is beholden to the foreign design owner and is not at will to enhance the platform. An overseas-based design authority leads invariably to an overseas-based supply chain, the immediate consequences of which being to drive up costs, lengthen supply time and compromise sovereign control. Design authority over the new submarine is key to the achievement of self-reliance.

Past lessons point to the establishment in Australia of a resident design team to pull together the best combination of platform and systems to meet Australia’s future submarine needs. That design workforce exists only in part in Australia, but with collaboration with international design partners, a resident team of appropriate capability is easily within reach. The product of that team would be an Australian owned design informed by the very best of international experience and knowledge – the ideal outcome for Australia, providing it with the necessary control of the most critical of its national military capabilities.

The Importance of the United States Relationship

The Government has made it clear that it ‘intends to continue the very close level of Australia-US collaboration in undersea warfare capability crucial to the development and through life management of the future submarine.’

The United States continues to have the largest and arguably, the most capable and technically advanced military industrial capability in the world, backed up by significant public and private advanced research and development investment in highly relevant leading edge technologies. Australia’s special defence relationship with the United States allows privileged access to considerable elements of this impressive capability.

In the past, Australia has received special if not exclusive access to previously unavailable American submarine-related systems and technologies. The submarine systems dialogue continues to this day, but its continuance should not be taken for granted.

In 2004, in a submission to the Australian Senate, respected Australia-born strategic analyst Gregory Copley noted that ‘Australia’s commitment as a partner to both the F-35 Joint Strike Fighter and ballistic missile defence programs, led by the US, offer(ed) significant opportunities for Australia to participate in defence industrial opportunities at the highest technological levels. As well, they offer(ed) Australia the opportunity to participate in the planning and contextual thinking behind the programs.’ Copley expresses concern that Australian defence industrial capability is understated and, on occasion, has been deserving of a higher status than subordinate partner.
Copley goes on to observe that ‘the 1985-86 Australian Government decision to once again achieve a measurable balance of defence industrial self-sufficiency led to a world-class submarine construction capability, which is now being sought by US corporations.’ It is Copley’s view that ‘Australia’s extremely capable and innovative approaches to defence systems has been insufficiently studied with a view to preserving national independence and national export capabilities, as well as skills which could be passed to other, civil sectors.’

Irrespective of current politico-strategic developments in the Asia Pacific and the growing strategic importance of China and India, Australia’s defence and security alliance with the United States and the relationship between respective armed forces and intelligence communities remains of utmost relevance.

The closeness of the relationship notwithstanding, the desire, indeed requirement for Australia to have systems interoperability with US forces and the benefits that potentially accrue to the Australian Defence Force through joint and combined operations and training do not compel Australia to buy American.

However, Australia would be foolish not to avail itself of the best available combat and weapons system for its future submarine. The extent of a submarine’s operational advantage over an adversary is entirely dependent on its combat and weapons system – the smart, highly complex software that combines sensors, weapons and submarine controls to deliver combat winning performance. Combat and weapons system design is a science and an art, of which the United States has long been the leading practitioner. Australia, through the nature of its relationship with the United States, has a unique opportunity to secure ongoing access to this design capability and to benefit in both combat effectiveness and economic terms.

An American system, approved for Australian use, would probably only be released by the US for installation and integration in Australia. Should the Government embark on overseas design and build of the platform, the combat and weapon system would need to be subsequently fitted in Australia. Such activity would be extremely high risk, costly and time consuming, if indeed it was feasible at all, given the nature of modern submarine construction.

Australia, through the nature of its relationship with the United States, has a unique opportunity to secure ongoing access to combat and weapon system design capability and to benefit in both combat effectiveness and economic terms.
If the choice of combat and weapon system was other than American, Australia would still need to gain, maintain and evolve sufficient intellectual capital in the system in order to maximise its utility and adaptability, and ensure low-risk integration within the platform, an outcome that would only truly be possible by building the submarines in Australia.

The Government’s posture of self-reliance entails the maintenance of alliances and international defence relationships that enhance our own security. It is the strength of Australia’s relationship with the United States, and successive Governments’ belief in the relationship, that allowed the eventual fitting in the Collins class submarines of a proven American, ‘off-the-shelf’ combat and weapons system.28 The ‘classified cooperation’ inherent in that special relationship, and the benefit that accrues to both nations as a consequence, would logically lead to the conclusion that there is only one option when considering the combat and weapons system for the future submarine.

The choice of combat and weapons system, and the manner in which it may be used, ultimately shape decisions about the physical characteristics of the submarine. The earlier these decisions are made, the earlier significant submarine procurement, planning and design work can begin.29

**Design in Australia to Build in Australia**

Australia’s maritime industry extends across many Australian states and is truly a national endeavour. Australia has an unprecedented opportunity to expand this already capable industry to take advantage of a managed build, integration and sustainment program for Australia’s future naval requirements. As a total program, these requirements represent an enormous chunk of national investment. The future submarine project is but one critical component of a broader national development strategy.

For large complex projects or programs, other nations have demonstrated that by minimising the level of required investment and maximising the return from that investment, the net cost to the taxpayer is reduced; some have shown the investment can ultimately return a net benefit.30

As a nation, we must not be averse to capacity building, nor allow short-term political perspectives to shun the beneficial development of nation-building initiatives.31 Especially in defence, the Australian government should have a clear preference to buy Australian.32 Given the Government’s existing multi-ship long-term procurement program, naval shipbuilding should be one of the cornerstones of Australia’s advanced manufacturing future, generating real economic and social returns that would otherwise be exported off-shore, solely to the benefit of other nations.

Fundamental to the value of Australian owned intellectual capital33 is the experience and knowledge of how to use it so as to be able to identify and correct deficiencies and weaknesses, and to improve a capability over time without the need for recourse to third parties. Such experience and knowledge is hard-earned, but most meaningfully gained by owning and being intimate with the product design, building and sustaining the product in-country and continually improving the product over time through innovation.

Australia has invested heavily in the development of its naval shipbuilding infrastructure and its national skills base – now is not the time to let it dissipate.34
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Where the Costs Lie

The affordability of a capability is directly related to the priority that it is given by Government and the degree of sacrifice that the Government is willing to make within other programs to achieve it. The level of required military capability is defined by a continual assessment of risk to national security and national interests in both the short and long term. No Australian government should make savings in defence that would compromise national security interests.35

In considering relatively high cost strategic capabilities such as submarines, the ability of the nation to control system evolution as well as production rate, whilst simultaneously maintaining the health of the national industrial base, provides Government with flexibility. This can only be achieved through local build and local systems integration.

Producing, maintaining and evolving an effective submarine capability is an endeavour enduring over many decades and, typically, the cost to operate and support a military capability accounts for over 70 per cent of the total cost over a system’s lifetime.36 Whilst much of the initial debate rightly addresses the design and build aspects, when it comes to cost/benefit there must be a ‘whole of life’ consideration if the Government is to make appropriately informed decisions.

It is a myth that having Australia’s submarines built in Europe provides greater net national benefit than building them at home.

So, what price a submarine? Predicting a unit price for a future submarine is difficult and validated data is hard to come by, but it is possible to get a broad indication of cost per tonne for physical construction. But as a single indicator, is this the most relevant or helpful measure? The project procurement strategy and the value for money that it seeks to deliver is better judged by comparing investment and return over the entire life of the capability and assessing return in more than just initial project procurement cost terms.

Ninety per cent of the discretionary decisions that affect the outcome of a project are made within the first 12 per cent of its life,37 emphasising the volume of effort that should be applied at the very early stages to detailed whole of life planning in order to allow Government to make timely and effective decisions. Despite its importance, the design phase in terms of dollar expenditure historically accounts for no more than two or three per cent of the total investment through life.

The cost of building conventional submarines rose dramatically in the late 1980s with the introduction of sophisticated combat and weapons systems and stealthy materials, offering enhanced capability options to governments and leading to fundamental changes in the way submarines operated at sea. In the western world, the size of production runs reduced significantly, making economies of scale less available than they were in the first two thirds of the 20th century. In the modern era, close examination of the cost for submarine construction shows a relatively consistent dollar cost per tonne (the globally accepted metric), irrespective of where the build is undertaken.38 As a percentage of overall investment, submarine construction accounts for approximately one third of the total and of that third, only 15 per cent or so are shipyard costs, the remainder being allocated to materials and systems for which all Western nations’ builders pay similar prices to the relatively small number of global suppliers.

As with the majority of major projects, more than two thirds of overall investment in the future submarine project will be spent on the support of the system once in service. In construction, shipyard labour amounts to no more than 15 per cent of the cost, whereas sustainment is much more labour intensive with the percentage being 50 per cent or higher.
Submarine sustainment is a combination of regular ‘line maintenance’ and ‘deeper level maintenance’, the latter of which comes into play once a submarine has been in service for some years and then eventually reduces as the submarine approaches its end of useful life. To estimate the cost of sustaining submarines in order to produce a meaningful benchmark, it is essential to compare like with like. Few nations, if any, are obliged to operate conventional submarines in the same way as Australia and therefore do not confront the same maintenance demands.

It is vitally important to recognise the differing complexity of the submarines being compared and the varying levels of maintenance activity and intensity during a particular submarine type’s life. It is also critical to estimate cost over the full predicted life of the platform. A snapshot of costs at any given time of a submarine’s life is unlikely to reveal a true picture of total cost through life unless extrapolated appropriately.

There is currently no authoritative benchmarking analysis publicly available, but anecdotally, the sustainment cost of conventional submarines in Australia compares favourably with those of other nations, noting, however, that few, if any, of the overseas shipyards are maintaining conventional submarines of the size and complexity of the Collins class.

In terms of sustainment and overhaul, and if non-recurring and infrastructure costs are left to one side, costs of Swedish submarine yards appear relatively low, but this is a good example of low and relatively undemanding submarine usage leading to a concomitant maintenance regime. In comparison to Oberon maintenance costs of some years ago, present day costs have reduced significantly, with those of the United States, Germany and Australia for modern similar type platforms seeming to be generally on par with each other, whereas France and the United Kingdom trend towards being a little more expensive.

So the key points that emerge from this analysis are that costs should be considered with a whole of life perspective, the cost of submarine construction is generally comparable across the world, and with sustainment over the life of the platform accounting for 70 per cent of total investment, the cost/benefit equation invariably favours in-country sustainment founded on in-country design and build.

Whilst much of the initial debate rightly addresses the design and build aspects, when it comes to cost/benefit there must be a ‘whole of life’ consideration if the Government is to make appropriately informed decisions.
A Solid Foundation

Australia has been operating submarines for nearly 100 years and has 25 years of modern submarine building experience. This strong foundation of significant submarine expertise and shipyard infrastructure positions Australia as a world leader in conventional submarine build and sustainment, able to readily adapt to technology shifts and guarantee sovereign independence.

The Future Submarine Project will undoubtedly test industry’s capacity to deliver. In the short term, that could require a ‘spend to save’ approach and a well conceived and implemented plan to ensure the necessary skills and infrastructure are in place to meet the anticipated demand. Already, the Government has taken positive steps in this regard by calling for a ‘Future Submarine Industry Skills Plan’ and a report on its initiatives by the end of 2012.39

Australian company ASC (formerly the Australian Submarine Corporation) has a good record for building submarines. ASC produced all the Collins class submarines, mostly from scratch, without a major mishap and developed a capacity to deliver one submarine per year, a rate faster than that achieved by Dutch and British yards in delivering their boats that were contenders for the Collins class program. Only one section of the first boat (HMAS Collins) was manufactured offshore, which ultimately required major rework by Australian welders as it contained an unacceptable number of welding defects which, incidentally, appeared nowhere else in the program.40

It is fair to say that from the moment Collins routine sustainment came into play until the present day, ASC has had to be more concerned with addressing design flaws, badly planned obsolescence and unforeseen program changes not of its making, than it has traditional maintenance activity. The findings of the recent Coles Review 41 into submarine sustainment were not entirely surprising. Had the original program featured a prototype-style, evolutionary development under Australian design control, the subsequent shortcomings may either have not emerged, or would at least have been more effectively managed.42

In June 2012, in response to the recommendations of the Coles Review, the Government put in place with ASC a new, performance-based in-service support contract (ISSC) for the maintenance of the Collins class submarines. Successful execution of this contract is vital for Australia’s security. The ISSC goes a long way towards rebuilding Government and public confidence in Australia’s ability to efficiently and effectively sustain not only the Collins fleet, but also the future submarine. In so doing, it ensures confidence in the availability and reliability of a critical military capability.
The new ISSC is a rolling five-year contract with options to be exercised subject to satisfactory performance. By working closely in partnership, the Government, ASC and its supporting sub-contractors will increase platform availability to meet operational requirements, reduce the cost of ownership, ensure technical integrity and be better positioned to enhance the capability as and when required. It is a model that must work given the length of time that issues have continued unresolved and it will provide a firm basis for designing the future submarine support concept.

The Collins class submarines were delivered to the RAN by an Australian builder more efficiently than the last of the Australian Oberons, which were built in United Kingdom yards with a workforce that had considerable experience of the task. Submarine programs globally are replete with examples of major cost and schedule overruns, as well as the occasional cancellation. Many defence organisations worldwide acknowledge their own failings in their major acquisition projects.

Japan and Sweden, having built up a national capability over time, have had relatively successful domestic submarine programs founded on a concept of small batch production of evolving capability, incorporated where necessary in a changed design to avoid operational obsolescence. Australia is well placed to emulate that approach in nurturing its industrial capability and developing its future submarine, with potential for cooperation in niche areas with both of these nations.

The building of a prototype in-country prior to starting full production of the future submarine could reduce risk of emergent failures that, if allowed to occur, invariably result in increased budget demands and a delay in schedule. Minimising risk of failures deep into the construction phase would prevent the workforce being diverted from the core business of construction and sustainment.

The need for suitable infrastructure and facilities to support the design, construction, integration, testing and sustainment of future submarine is, in large part, already met through recent investments by Federal and State governments in the establishment of world class shipyard and common use facilities as well as skills centres and program management infrastructure. Similarly, development of a supplier’s precinct is well advanced as is preparation of a suitable site to accommodate the integrated propulsion and energy test facility identified as a critical deficiency within the RAND study.
Australia has a strong foundation of significant submarine expertise and shipyard infrastructure to be a world leader in conventional submarine build and sustainment.
Not Forgetting the Benefits

Naval shipbuilding brings great economic benefits to the nation. Local build results in increased GDP from capital investment; new infrastructure, employment and enhancement of the skilled labour market; extensive technology transfer; export potential of parts and services; contributions to through life logistic support; and, increased self reliance for repair and maintenance.\(^{46}\) Nowhere was this more evident than in the highly successful ANZAC ship project. With more than 80 per cent local content, the project delivered benefits way beyond the military value of 10 naval ships. Analysis has shown that the project:

\[\text{helped grow Australia’s GDP by at least $3 billion and created more than 7,500 full-time-equivalent jobs among 1,300 Australian and NZ suppliers.}
\]

Companies became more innovative through access to foreign technology... and acquired skills and capabilities which opened the door to further opportunities in Australia. Navy benefited from the creation of a high-quality local support base which was estimated to save over $500 million in through-life support costs and which... enhanced readiness and sustainability, and made possible the various ANZAC upgrades to be done in-country, providing crucial measure of Australian control over the processes, costs and outcomes. ANZAC Ship project built up confidence within Government that Australia could handle and deliver major, complex defence projects and that Australia’s defence industry can adapt, build and support major, complex equipments.\(^{47}\)

The program contributed to improving the quality of Australian manufacturing on a national scale. ASC... (built)... submarines from components provided from across Australia. When the project began there were only 35 Australian companies certified to the quality levels required for defence work. By 1998 there were 1500. Not all of this can be credited to the submarine project but, together with the contemporary ANZAC frigate and other programs, naval shipbuilding provided for sections of Australian industry the modernising influence claimed by its proponents at the beginning of the submarine program in the early 1980s. In the process of building the Collins class, ASC successfully integrated many areas of technology which are equal to, or better than, that existing elsewhere. Finally, it cannot be thought insignificant to exceed the goals originally set for local content of the project. Seventy per cent of the value of physical work and 45 per cent of its electronics was performed in Australia. Thus, of the $5.1 billion cost of the original program, $4 billion was spent in Australia. At its peak, the project supported 7500 jobs in Australia.\(^{48}\)

The benefits from the Collins project in particular are not just economic. A key lesson from the Collins experience is that ultimately the Commonwealth cannot leave it to suppliers to solve problems in major defence acquisition projects, as over a lengthy acquisition it is the Commonwealth alone that maintains an abiding interest in reaching a successful outcome.\(^{49}\) By ASC ultimately gaining the role of submarine design authority, it was able to control the design process and effectively address the emergent issues resulting from defective overseas design and supply. More importantly, the company was able to sustain and grow its technical capabilities as a result of undertaking design modifications. That deep experience is now available to support in-country design, build, sustainment and development of the future submarine and, if necessary, to extend the life of Collins.

Similar stories resulted from the Mine Hunter and Bushmaster projects and no doubt, if an in-depth analysis of the Collins project’s contribution to the national economy as a whole was to be undertaken, it would carry a similar positive message. As it was, the project achieved 70 per cent Australian industry content when Defence generally was struggling to achieve a 10 per cent offset in major acquisition contracts with overseas primes:
Whilst the potential should not be overstated, extremely detailed analysis by Professor Gunnar Eliasson\(^5\) has shown that a major industrial government project of appropriate complexity has the potential to generate a flow of technology spin-offs which, depending on the capacity of local industry to exploit, could produce an economic return to match, or partially offset the level of government investment in the original project. Through his analysis, Eliasson has demonstrated that the Swedish JAS 39 Gripen aircraft project generated, over and above opportunity costs, an additional return to the Swedish economy of at least 2.6 times the original development investment over a 25 year period, equating to an average investment per year of 0.17 per cent of GNP against an annual return of 0.43 per cent. In effect, the Swedish people got one of the world’s most advanced combat aircraft systems for free.

The future submarine project is certainly a large, complex and highly technical project that should generate technology spin-offs. The readiness of Australian industry to exploit these potential opportunities and indeed the nature of the likely spin-offs have yet to be quantified, but Eliasson identifies them as originating predominantly during the product development phase. For such potential benefits to be realised by Australia, rather than other nations, design, prototyping, integration, testing, construction and sustainment of the future submarine must be conducted in Australia.

A number of emergent technologies have been evident in past Defence projects, all of which have had potential application to other industry sectors both in Australia and beyond. For example, from the Collins project, advanced welding techniques and modular submarine construction, which made possible what was previously considered impossible; from the ANZC ship project, systems integration in land based test sites and modular warship construction; from the Minehunter project, advanced fibreglass construction; and from the Hydrographic ship project, complex survey system suite integration.

### Seizing the Opportunity

Australia has the perfect opportunity to maximise its learning from past experience and pursue in Australia an effective and globally cost competitive submarine program fully capable of delivering the nation’s next generation submarines. Key to achieving success are control of the design; planning from the outset of all aspects of the capability including support and evolution through life; an open, competitive and transparent industrial activity program; pre-integration and land-based testing of systems; modular construction; and well-informed, timely decision-making.\(^5\)

As noted in the recent Senate Inquiry, ‘dragging out decisions allows skills, workforce and knowledge to dissipate, thereby driving up risk’.\(^5\) Giving adequate time to the design process and the associated Government decisions is important\(^5\), but it should not be to the detriment of the nation’s standing military capability or its supporting industrial base.

By engaging appropriate levels of foreign assistance in the design of the future submarine and building on the proven strengths of Australia’s local defence industry – importantly seeing those strengths as a critical part of the national security capability – Government can embrace a ‘build in Australia’ strategy, thereby minimising the level of required investment and maximising the return.

As a minimum, Australia must have design authority over its new submarine, an appropriate level of technical knowledge and expertise, and ready access to a local supply chain – which already exists – all of which lead to the conclusion that Australia’s future submarine can and should be designed, built and sustained in Australia.
Construction in Australia is key to protecting our growing submarine intellectual property base and our ability to effectively manage and evolve the submarine throughout its life, including the integration of new or upgraded systems. When all aspects of the strategic, operational and broader economic benefits are taken into account, a future submarine capability produced in Australia as a continuous build in evolutionary batches and locally sustained represents the best investment return for the Australian tax payer. Moreover, Australia maintains its essential technological superiority in conventional submarine operations.

One cannot ignore the potential of the future submarine project, conducted in Australia, to take a central supporting role in the national agenda for a sustainable advanced manufacturing future with its emphasis on high-end, high-value, low volume activities. The alternative of offshore-build, with large amounts of foreign content locked-in for the long term (and potential lock-out of classified US technology), would leave Australia facing unnecessarily high sustainment costs and wrestling with all the strategic risks previously identified.

Future submarine is but one highly important element of a broader national development strategy, which is not about job creation, but about job quality. It’s about unprecedented opportunity to leverage Australia’s highly capable and vibrant maritime industry. It’s about the multiplier effect, which doesn’t just happen on its own – we have to recognise it, create it and fuel it.

The government of the day should be confident that the development, building and sustainment of future submarines in Australia represents value for money and is cost effective. To build offshore would introduce unacceptable risks to national security by potentially diminishing the value, usability, effectiveness, sustainability and future evolution of arguably Australia’s most important and strategically influential military capability.

What is value for money if not a balance of cost and benefit? Own the design, build in Australia, think and act long term. It’s how we guard ‘our edge’.

Australia must have design authority over its new submarine, an appropriate level of technical knowledge and expertise, and ready access to a local supply chain.
Notes and References

1. The valuable assistance provided by the US Navy in addressing some of the issues is acknowledged.

2. ‘The Collins project’s initial risk control strategy was to select a design that, at the least, was based on a submarine in service or in the process of entering service with the parent navy. However, the RAN, having decided on the design criteria discovered that, as we now know, no existing design could meet its requirements. This being so, the assessment teams rigorously determined the probability, cost and other considerations in raising the deficient aspects of each design to the standard of the RSC. The very logic of the processes for adjudicating the best combination of platform and systems performance, industrial program, price and schedule appears to have obscured the project’s move away from its risk management strategy. It is now obvious that the project had clearly become a developmental vehicle for a unique class of submarine and that the acquisition strategy no longer reflected the nature of the project. This development was compounded by a deteriorating economy where the government’s fiscal priority was to reduce its spending.’


3. Hon Jason Clare MP, Minister for Defence Materiel in a speech to the Submarine Institute of Australia 6th Biennial Conference, Canberra, 14 November 2012 – abridged extract


5. Seaborne trade continues to expand, bringing benefits for consumers across the world through competitive freight costs. Thanks to the growing efficiency of shipping as a mode of transport and increased economic liberalisation, the prospects for the industry’s further growth continue to be strong. There are over 50,000 merchant ships trading internationally, transporting every kind of cargo. The world fleet is registered in over 150 nations, and manned by over a million seafarers of virtually every nationality. www.marisec.org/shippingfacts/worldtrade


8. In White H. ‘A Middling Power – What’s the ADF meant to do exactly?’ The Monthly, September 2012, Dr Hugh White supports Australia having a robust and effective submarine capability, but argues that the ADF’s overall force structure requires deeper analysis: ‘What kinds of forces we would need exactly, and how much these might cost, are then the critical questions of military strategy for Australia’s defence. We would expect the ADF and the Defence Department to devote much effort to answering them. My impression is that they have done no such thing. Like the rest of us, they find it hard to take the possibility (the risk of direct attack on Australia) seriously, and have not yet woken up to how the changing strategic setting makes it essential that they do so.’

9. Professor Ross Babbage, one of Australia’s leading strategic thinkers and founder of the Kokoda Foundation, a defence and security think tank, has stated that ‘The PLA’s emerging capabilities should not be viewed by Australian national security planners as a challenge in a forward theatre but rather as a rising challenge to the direct defence of Australia itself’, R. Babbage, *Australia’s Strategic Edge in 2030*, Kokoda Paper 15, February 2011.


11. ‘Submarines are our most important strategic defence asset ... (they are) a very real deterrent to any country thinking about harming us ... (our submarines) need to be able to undertake extended clandestine patrols over the full distance of our strategic approaches and in operational areas ... a large submarine to defend Australia is an extensive enterprise, but an important one. There are no shortcuts.’ Hon Jason Clare MP, Minister for Defence Materiel in a speech to the Submarine Institute of Australia 6th Biennial Conference, Canberra, 14 November 2012.

Within range of airbases, aircraft are cheaper, but beyond that range, submarines are the sea-denial platform par excellence, because they are so difficult to find. That makes them perhaps the most important single capability for the independent defence of Australia, because the further from our shores we can start to deny the sea to an adversary, the further its costs and risks rise. …If we want the ability to use armed forces to protect our wider strategic interests in a major-power conflict, submarines could be the only option we have. What Australia needs is large numbers of good, quiet, lethal boats optimised solely for the task of sinking ships'.


The submarine force was the most effective anti-ship and anti-submarine weapon in the entire American arsenal during WWII. Though representing only two per cent of the U.S. Navy, submarines destroyed over 30 per cent of the Japanese Navy. They also destroyed over 60 per cent of the Japanese merchant fleet, crippling Japan’s ability to supply its military forces and industrial war effort. During the Falklands War of 1982, British submarines were the first warships to reach the islands. The sinking of the light cruiser ARA General Belgrano by HMS Conqueror early on in the war caused the Argentine Navy to recall its ships to port, including its only aircraft carrier, for the remainder of the war, thereby removing a significant threat to the British Task Force.

‘Complex project management is seldom done well. Research by an international management consultancy firm, involving some 3000 protects, found that only 10 per cent performed better than expected and around 50 per cent failed to achieve their objectives. A little understood characteristic of project management is that a focus on the production and delivery phases of equipment programs misses the crucial aspects governing success. Experience indicates that 90 per cent of the discretionary decisions that affect the outcome of a project are made in the first seven to 12 per cent of its life.’ Robert Cooper, Project Management in Australia, Sea Australia 2000, conference proceedings presentation 22.3, The Institution of Engineers Australia, Sydney, February 2000 in D. Woolner, Getting in Early: Lessons of the Collins Submarine Program for Improved Oversight of Defence Procurement, Research Paper 3 2001-02 Foreign Affairs, Defence and Trade Group, 18 September 2001.

Heavy dependence on overseas suppliers, and consequential high costs and schedule delays, have featured prominently in the maintenance of both Oberon and Collins submarine classes; for Oberon, 85 to 90 per cent of its supply chain companies were located overseas. D. Woolner, Getting in Early: Lessons of the Collins Submarine Program for Improved Oversight of Defence Procurement, Research Paper 3 2001-02 Foreign Affairs, Defence and Trade Group, 18 September 2001.

A key lesson from the Collins experience – ‘One feature that stands throughout the Collins project, especially during the period where its problems were being overcome, is that the Commonwealth must command its own access to the means to rectify problems if it intends to have projects achieve their objectives.’ D. Woolner, Taking the Past to the Future: The Collins Submarine Project and Sea 1000 in Security Challenges, Vol. 5, No. 3 (Spring 2009), p67.

Brief analysis of each option is contained in Submarine Acquisition Options – Impact for Australia, Defence SA, July 2012.

Historically, European boats have been designed to sustain a deployment to a distance of about two-thirds that required by the RAN. The Collins class can maintain a 42-day patrol after deploying 2510 nm (see: ‘The Performance Advantages of Size’). A design that is typical of the level of technology submitted in the early stages of the Collins submarine program is that of the French-designed Agosta 90B of the Pakistani Navy (the variant ordered by Pakistan has been modernised). At around the 1510 tonnes (surfaced) it is also typical of the size of most of the early responses. The Agosta can maintain a 40-day patrol after deploying 1680 nm to the patrol area. In Australia’s region of defence interest, potential patrol areas are more distant than this. Richard Scott, ‘Agosta 908 Surfaces for the Pakistan Navy’, Jane’s Navy International, May 1999, p. 37 in D. Woolner, Getting in Early: Lessons of the Collins Submarine Program for Improved Oversight of Defence Procurement, Research Paper 3 2001-02 Foreign Affairs, Defence and Trade Group, 18 September 2001.
The Tiger Armed Reconnaissance Helicopter (ARH) Project Air 87 provides but one example: ‘The project was approved to provide for a new and significant all-weather reconnaissance and fire support capability for the Australian Defence Force (ADF). The Project contracted for delivery of 22 aircraft, with supporting stores, facilities, ammunition and training equipment. The first four aircraft were manufactured in, and delivered from France; the remaining 18 aircraft were manufactured in France, and assembled in Brisbane. Australianisation of the weapons and communications systems was a differentiating characteristic of the Australian Tiger ARH, compared to the French Tiger Variant. In 2003, the DMO became aware of production and acceptance delays with supplying Tiger helicopters to France and Germany. The French Government accepted its first production aircraft in March 2005, four months after the DMO. The lead Australian Tiger ARH aircraft (ARH 1 and 2) were the first of this type of aircraft to undergo production acceptance by any nation’s Defence Force, and were delivered into service as an aircraft type more developmental than that which was originally intended by the initial requirement. Consequently, the DMO was obligated to make its own assessment of over 71 unresolved design issues. The ARH acquisition transitioned to become a more developmental program for the ADF, which resulted in heightened exposure to schedule, cost and capability risks, both for acquisition of the capability, and delivery of through-life support services. ... The ANAO found that prior to the Through-Life-Support Contract signature, the DMO did not expect the Contractor would apply for a significant real increase to the costs for support of the capability. In September 2004, the Contractor sought to substantially increase the costs associated with supporting the capability, which the DMO calculated would add in the order of $625 million to the whole-of-capability costs required to support the capability over the life of the Through-Life-Support Contract.’ Management of the Tiger Armed Reconnaissance Helicopter Project – Air 87, ANAO Audit Report No. 36, 2005–06 Performance Audit, Auditor General, May 2006.

The Design Authority may be a Commonwealth or State statutory authority or private contractor.

Virtually linked if necessary to a pool of international expertise.

‘The Commonwealth of Australia will need a domestic workforce of roughly 1,000 skilled draftsmen and engineers in industry and Government to create and oversee the design of a new, conventionally powered submarine for the Royal Australian Navy. Although a workforce of this size and capabilities does not exist in Australia today, under the right circumstances one could be cultivated over the next 15 to 20 years. However, the Commonwealth could shorten the duration and lessen the costs of designing a new submarine if it were to collaborate with foreign design partners rather than rely exclusively on a domestic workforce to design the vessel.’ RAND, Australia’s Submarine Design Capabilities and Capacities: Challenges and Options for the Future Submarine, prepared for the Australian Department of Defence, 2011.

Whilst there has been considerable political dialogue between Australia and the United States recently, comments made by Gregory Copley in a submission to the Australian Senate in 2004 are still apposite: ‘Australian diplomatic and Defence/Armed Services personnel, by insisting on virtually only sustaining working-level relationships with their career or uniformed counterparts in the US, have consistently rejected the opportunities to embrace relationships with either Congress (on a meaningful and ongoing basis) or with the highly-professional and well connected non-governmental policy networks which pervade Washington. There has been a wilful neglect by Australian officials — based on prejudices developed from the way policy is formulated in Canberra — to understand how defence and strategic policy is shaped in the United States. Even when Washington ‘think tanks’ are engaged by the Australian diplomatic or defence process, they are not effectively or necessarily wisely engaged: there is little understanding of which institutions can help with which tasks. By failing to embrace and systematically address the overall complexity of the US strategic policy arena — which includes the Congress as a priority of equal stature to the White House; the ‘educational’ base which includes ‘think tanks’; the media at many levels; as well as the Administrative labyrinth of defence and intelligence offices — the Australian strategic community fails to adequately command US priorities. Equally, Australian leadership, if it is to improve the benefits to Australia, needs to elevate the defence relationship with the US to a level of constant dialogue between heads-of government — as is the case between, say, the US and the UK — in the knowledge that all other forms of political and economic bilateral benefit will flourish beneath this umbrella.’

Inquiry into Australia’s Defence Relations with the United States, Submission 3, Australian Senate Joint Standing Committee on Foreign Affairs, Defence and Trade, Defence Sub-Committee, February 2004.

The Minister’s reasoning (for selecting a US system) was that ‘a comprehensive arrangement with the US Navy on submarine issues is in Australia’s best strategic interests’ and he went on to note that the Australian and US navies were entering a ‘Statement of Principles arrangement’ to maximise cooperation on submarine matters.’ D. Woolner, Getting in Early: Lessons of the Collins Submarine Program for Improved Oversight of Defence Procurement, Research Paper 3 2001-02 Foreign Affairs, Defence and Trade Group, 18 September 2001.

‘It makes sense to make the (combat, sensors and weapons systems) decision early as we did with AWD... Trying to design platform and combat systems simultaneously is very difficult, and typically results in increased risk and schedule delays.’ Hon Jason Clare MP, Minister for Defence Materiel in a speech to the Submarine Institute of Australia 6th Biennial Conference, Canberra, 14 November 2012.


‘Australia has a system of public expenditure that is averse to capacity building and for which ‘budget rationing rather than budget maximising has become the Australian creed’. This is a culture that is likely to prejudice nation-building initiatives as reckless adventures and to shun large publicly funded infrastructure projects and capacity building. We see then that we must again understand and use the economy in exactly the same way as our great ‘Nugget Coombs’ generation of nation-builders did, namely as a set of practical instruments for improving the lives of a national and now global population. What is the use of money if it makes you poorer?’ M. Pusey, In the Wake of Economic Reform ... New Prospects for Nation-Building? in J. Butcher (ed), Australia Under Construction, nation-building – past, present and future, ANZSOG series, ANU E Press, 2008.

Hon Tony Abbott MP, Leader of the Opposition, in a speech to the Returned and Services League, Sydney, 25 September 2012.
Developing intellectual capital requires an amalgam of personnel skills, industrial capacity, and the organizational structure and doctrinal concepts of the operating Service, formally captured as knowledge. The development of superior intellectual capital is one of the reasons why a military force can defeat another using similar equipment or can continue to achieve superior performance from systems whose origin may be decades old.’ D. Woolner, *Getting in Early: Lessons of the Collins Submarine Program for Improved Oversight of Defence Procurement*, Research Paper 3 2001-02 Foreign Affairs, Defence and Trade Group, 18 September 2001.

In 1997, the United Kingdom initiated a program to develop a nuclear attack submarine. But some five to six years into the program, it became clear that neither the prime contractor nor any other British firm had the necessary design and production skills to build the new submarine. Without a domestic ability to produce submarines, the United Kingdom was forced to look abroad in order to complete their project. Fortunately, the British were able to look to the United States and employ one of its shipyards to provide the missing skills and expertise. With American help, the Astute class was completed in February 2010. However, by then the cost for the first three Astute-class submarines had reportedly grown by 90%, and the first of the class was some four years late. Sustaining Critical Sectors of the U.S. Defense Industrial Base, Center for Strategic and Budgetary Assessments, www.csbaonline.org/wp-content/uploads/2011/09/2011.09.20-Defense-Industrial-Base.pdf

‘No Coalition government would ever make savings in defence that would compromise our national security interests or reduce the operational capabilities of our defence force’. Hon Tony Abbott MP, Leader of the Opposition, in a speech to the Returned and Services League, Sydney, 25 September 2012

All 12 RN Swiftsure and Trafalgar class nuclear attack submarines were once withdrawn from service because of problems in their nuclear reactor cooling systems. Lead boat of the Dutch submarine design, Walrus, was launched at the end of 1985 but caught fire the following year whilst being fitted out by the shipbuilder. All internal fittings and cabling were destroyed and completion of the Walrus was delayed for three years. The British Type 2400 suffered a three-year delay, largely due to faulty torpedo tube hatches and safety concerns with the power plant. In 1994, the British Government scrapped the Type 2400s to save money. They were eventually purchased by Canada. Two of the Thyssen TR 1700 class were built for Argentina in the contractor’s German yard and kits for four more were shipped to Argentina. Twelve years after the commissioning of the first submarine, the first Argentinian built boat was only 52 per cent complete. The yard was then sold, work on the submarines abandoned and the parts retained for spares. In Dec 1981, HDW, with the most extensive record of overseas sales and production programs, signed an order to supply four submarines to the Indian navy, two them to be built in India. In the event, these two submarines were delivered five and six years late, cost twice as much as the two built in Germany and were the subject of disputes about the adequacy of technical support from HDW and the costs of spare parts and support packages. Proposals to build a further two HDW submarines in India were never pursued, India instead turning to the purchase of the Russian-built Kilo (despite subsequently assessing them as inferior in performance to the HDW submarine) as the means of developing its submarine capabilities.

RAND, Australia’s Submarine Design Capabilities and Capacities: Challenges and Options for the Future Submarine, prepared for the Australian Department of Defence, 2011.


‘The committee is concerned that even at this Needs phase of SEA 1000 there are worrying indications that government and Defence have not heeded lessons from past experience, especially the critical importance of basing decisions on a sound and clear-eyed understanding of potential costs, benefits and technical risk. The tardy start to upfront investment for capability studies, the prescriptive nature of the project’s inclusion in the White Paper and the short timeframe in which to acquire the requisite skills do not bode well for project SEA 1000. The committee accepts the view that no solution will be perfect or simple. An important lesson for government to consider is that, except in the specific case where another military is already using equipment that is good enough for Australia (for example C17), evolution is lower risk and lower cost than leaping to a new standard via evolved ‘military off the shelf’ or new build. Procrastination and hoping to reduce risk by dragging out decisions allows skills, workforce and knowledge to dissipate thereby driving up risk.’


The design phase is important not only because it defines the design of the platform and its combat system, but it also calls for detailed design of the procurement strategy, the capability management structure, the construction capability, the long term sustainment arrangements and the method of upgrading the capability over time.