STRATEGIC INSIGHTS
ASPI

ASPI
AUSTRALIAN STRATEGIC POLICY INSTITUTE

48

How to buy a submarine:
Defining and building Australia's future fleet

Sean Costello and Andrew Davies

Overview

The next Australian submarine

The recently-released Defence White Paper has identified the strategic effects that the government sees as necessary for Australia's security. A new fleet of submarines to be built in South Australia is a major part of the proposed force structure. And, although steel won't be cut on the new boats until 2016/17 and they won't enter service until the mid 2020s, the White Paper catalogues the attributes that they will have. If built to those high-level specifications, the resultant submarines would almost certainly be large, complex and expensive—and a bespoke Australian design.

Collins class submarine, 2008. © Defence Department

October 09

However, the ambition of the new submarine program will necessarily be bounded by the harsh realities of financial, industrial and engineering constraints and by workforce capacity. This ASPI paper argues that the capabilities of the new submarines should be determined by those realities, and that we may have to temper our capability desires against our threshold for accepting risk in some instances.

The cost of the new fleet is also likely to be a significant consideration in future decisions. If the new submarine is to have all of the White Paper-mandated capabilities, they are likely to be significantly more complex, and larger, than their *Collins* class predecessors. If—like the *Collins*—the cost of the program follows historical trends, the fleet could cost as much as $36 billion (in 2009 dollars).

Should the capabilities posited for the new submarines in the White Paper prove to be unachievable without unacceptable risk, then other elements in the force structure will need to provide the strategic effect. Avoiding the capability gaps that could ensue would require sufficient warning time for planning and acquisition to occur. It therefore makes sense (and is consistent with the Kinnaird process for defence procurement) to retain a lower-risk project option.

Because of the potential for risk and cost to cause some future government to have second thoughts, it makes a lot of sense to keep our options open as far as possible. The ability of the world market to provide an off-the-shelf solution as the basis for the new fleet should not be abandoned early. For example, an acceptable compromise might be the spiral development of a smaller, but still lethal, submarine based on an existing design. It could be the case that even this modest suggestion will push us to the limits.

Our 'Plan A' should be to acquire the most capable submarines possible with the investment we are willing to make. But we need to make sure that the plan is as realistic as possible. Delays in delivering the *Collins* boats (and, subsequently, their full capability) had impacts on the manning and capability of the submarine fleet that are still being felt today. We need a 'Plan B', at least in the early stages of design and selection.

In order to have a boat in the water for sea trials by 2022 and in service by 2025, Australia has barely seven years in which to determine the design and capability of the *Collins* class replacement. In that relatively short time, decisions have to be made about the capabilities of the boats and the technologies that will be incorporated into them. Experience in major military R&D projects the world over suggests that entering the build phase with changeable requirements and/or unproven technologies will significantly increase the risk of cost and schedule blowouts.

Project risk is an important consideration because there is an accompanying downside strategic risk if Australia's future submarines fail to deliver the desired capability, or if there are significant delays in delivering that capability (such as those we saw in getting the *Collins* into full operational service). The difference between the capability of the *Collins* and other conventional submarines in the region is narrowing already. Without a replacement in train, by the early 2020s there is a real prospect that our capability edge will have been eroded entirely.

The next twenty years will be a crucial time for Australia to be clear in its thinking on its submarine fleet (and indeed the composition of the Navy more broadly). States around the Indian and Pacific Ocean rims are themselves acquiring sophisticated submarines at the cutting edge of exportable capability. There are also some aggressive R&D programs underway. It is not being overly dramatic to say that a failed development project could lead to a permanent loss of our regional comparative advantage in submarine matters.

Industrial considerations

Getting the submarine design right is only one condition for a successful project outcome. Getting the structure of the project team right and the correct industrial capacity in place are equally important.

At one end of the spectrum of possibilities, we could pursue a policy of largely unfettered competition, relying on the market to produce the best solution. At the other end, we could invest heavily in a government-owned staff and facility that would become the national submarine builder, with custody of all steps of the process along the lines of the old Cockatoo Island shipyard. For different reasons, neither of those possibilities is likely to be the model adopted for the submarine project.

A consideration that will impact on the decision-making process is the government's decision to retain ownership of ASC Pty Ltd (formerly the Australian Submarine Corporation). There are some positive consequences of that decision, but it means that there are now some difficult choices to be made regarding the engagement of ASC in the process.

Despite earlier plans for privatisation, ASC has been kept in government ownership and taxpayer money has been spent in transitioning the firm from a builder of submarines into a capable submarine support company. (At the very least, that was the aim.) The engineering constraints inherent in submarine building and maintenance necessarily require ASC to sustain a significant level of submarine design expertise. ASC is also the prime contractor to the Navy's largest current surface ship construction program in the air warfare destroyer project, but this is not a substitute for submarine expertise.

Making the right technical design decisions will require the Commonwealth to have substantial submarine design expertise inside the Project Office. Given the path that has been chosen for the ownership of ASC, it is difficult to justify leaving them 'outside of the tent' as they provide the Commonwealth with a ready-made (and owned) source of expertise. However, engaging ASC in this way introduces additional complexity when running competitions for the project—which will necessarily involve many other companies. ASC also has a claim to participation in other elements of the project, not least of which is as builder. There is therefore some tension between a desire for competition and the need for government-owned expertise. This paper examines the options for managing the role of ASC in the project.

There are two options that seem to offer more advantages than the rest. One is to restructure ASC and integrate the submarine business into the government's industrial capability. Through this 'integrated' model the government may then engage ASC as a 'thin-prime' contractor. This model enables government to contract ASC as both direct adviser and also contractor for certain sensitive works. It also empowers government to select and control various partners in systems integration, design and build roles in what will be a very large supply chain. Even under this thin-prime model, the sheer scale of the project may require ASC to expand modestly from its present size.

The other option discussed here is one in which ASC is declared from the outset to be the preferred builder of the submarines, with only sub-contracting work up for open competition. While seemingly a dramatic departure from the competitive model, the difference between that and (possibly) contracting another builder is that there would be only one monopoly submarine builder and maintainer in Australia between now and 2030, rather than two. However, there are good reasons to resist this model, especially in the early stages of the project.

Whatever approach is taken, finding a fix for today's problems should not make tomorrow's worse. Given the importance of Australia's naval power in government thinking, it is important to be thinking strategically. The industry policy settings put in place for the extensive shipbuilding projects announced in the White Paper provide an opportunity to fix many of the problems that have bedevilled the sector for many years.

Finally, if we get the policies right, this is an opportunity to produce an enduring strategic national capability. With the numbers being discussed, a 'rolling production' model is a possible solution that would allow us to avoid in future the 'stop-start' approach to submarine building that is complicating the current deliberations.

Introduction

In the recent Defence White Paper, the Australian Government announced plans to at least double the size of the submarine arm of the Royal Australian Navy. While the hard decisions on the precise type and capability of the future submarines are still years away, as is the big expenditure, it is clear that this project has been identified as a critical part of the national response to Australia's strategic circumstance.

We are in the early stages of a lengthy process, and this ASPI *Strategic Insights* is not concerned with the specifics of the hardware solution that will emerge in the years to come. Instead, this paper examines the crucial, and contentious, topic of the acquisition strategies that could be pursued to define, design and build Australia's future submarines.

There is no single model for such a strategy. The variables include the degree of government ownership and control of the various players, the extent to which the submarines are 'off-the-shelf' as opposed to custom designed, the yard in which the submarines will be built (and who will build them) and whose intellectual property will be accessed, shared and/or owned by the Commonwealth.

There are many possibilities. At one end of the spectrum, we could pursue a policy of largely unfettered competition, relying on the market to produce the best solution. At the other end, we could invest heavily in a government-owned staff and facility that would become the national submarine builder, with custody of all steps of the process along the lines of the old Cockatoo Island shipyard.

For entirely different reasons, neither of those models is likely to prove attractive. The former would mean that it would be harder to make use of technology transfers facilitated by the strong government-to-government and navy-to-navy relationships that Australia has fostered. (It also assumes an international free market for submarine technologies that simply does not exist.) The latter has been shown to produce an inefficient outcome far removed from shipbuilding best practice.

The project that will produce the new submarines is also an opportunity to create an enduring national capability—either by consolidating an existing industrial base or by starting afresh.

The best approach will doubtless prove to lie somewhere along the continuum between those extremes. Australia will use market forces where appropriate to improve the value for money for the taxpayer but will accept that building a major strategic capability is sometimes best served by a higher degree of government direction and control. The project that will produce the new submarines is also an opportunity to create an enduring national capability—either by consolidating an existing industrial base or by starting afresh.

Even if ASC—the builder and maintainer of the *Collins* class boats—were to get the job of building the new boats, the gap between the construction of the *Collins* class and the next boats means that there will be a degree of re-learning required. As shown later in this paper, maintaining submarines necessarily requires some of the skills needed to design and build them. But the degree of corporate knowledge retained from the *Collins* program does not provide a self-sufficient capability. Managed properly, the expansion of the fleet to twelve could result in a national capability to design, build and support submarines, while also producing economies of scale that reduce the unit cost of ownership.

But the road to a future submarine will be a long one and the Defence White Paper announcement is merely the beginning. If we are to get it right, we need to have the right project structure. Even more critically, we will need the right people with the right skills to oversee and steer the project. And we need to understand the lessons that other experiences can teach us. That is why this paper begins with a history lesson—the path to the contract to build Australia's air warfare destroyers (AWD).

A recent lesson: the AWD experience

Australia's present procurement system is modelled on the recommendations of the Kinnaird Review. Projects are approved in a 'multiple pass' process in which significant investment (up to 10% of project costs) can be made before final approval in order to identify and, hopefully, retire risks. This approach is designed to treat projects in business-like terms, while including the military (the eventual end users) in the development of the proposal(s) that will go to government. Projects are built in an iterative fashion, focusing on government engagement and buy-in, preservation of the government's commercial position and on developing an understanding of the risks and actual scope of its commitment. This gives the National Security Committee of Cabinet multiple opportunities to consider proposals working their way through the system.

One of the first major tests of the Kinnaird process is the AWD project, which went through the two-pass process and saw hundreds of millions of dollars invested in design and risk reduction work before the final approval in 2007. In many ways it is simply too early to tell whether the project will go on to be a success. Some of the risks identified in the approval process won't be retired until the ships are at sea conducting trials and being accepted into service. But it is worth exploring some aspects of the pre-approval phase to see what they might portend for the submarine project.

In re-visiting the recent history of the AWD project, the first observation—and a valuable lesson in itself—is that commonly-held preconceptions about the AWD program did not stand up to scrutiny when tested. The ship design and the shipbuilder outcomes were not those identified as the 'early favourites' by industry observers. Had that 'group think' become accepted wisdom, the AWD project would look very different from the one currently underway.

In particular, on announcement in May 2005 that the Navantia F-100 frigate would be retained as a design option, many people simply dismissed this option as a benchmarking exercise, or worse still as the creation of a 'stalking horse'—an option retained in order for the illusion of competition to be maintained while the 'preferred' evolved *Arleigh Burke* ship made its way to final approval. History now shows that the stability, and hence lower risk, of taking an existing design into the build phase was a consideration that overrode other (mostly capability-based) concerns for a project with no shortage of other 'firsts'.

Indeed, many considered the whole project to be the 'wrong-way-around', with sequential selection of a combat system, systems integrator, shipbuilder and, finally, a ship designer. But in reality this was the most appropriate path when weighed against our unique circumstances. For example, the early purchase of the *Aegis* system by government through a US Foreign Military Sales contract bought precious time, delivered the core capability, enabled design and builder selection (but not at the exclusion of competition) and retired a key risk.

The original 1999 vision (which was reflected in the 2000 Defence White Paper) was for an essentially 'off-the-shelf' build of an existing European frigate design. But in 2000, Navy put forward a requirement for a ship capable of firing the *Standard-2* missile. This change of scope saw the estimate of $3.5 billion in the White Paper become 'between $4.5 billion and $6 billion' in the 2004–14 Defence Capability Plan. As we now know, that figure was still optimistic.

The Kinnaird process revealed the true cost of the project and proved that a commercially contracted cost is more credible than any earlier estimates.

The Kinnaird process revealed the true cost of the project and proved that a commercially contracted cost is more credible than any earlier estimates. There are two chief observations about the final $8 billion price tag for three ships. Firstly, costing as an exercise is plagued by a culture of (misplaced) optimism in Defence and industry. (This is by no means unique to Australia.) Secondly, although it was well over the original budget, the Kinnaird process preserved the option to either re-scope or re-tender the project before a contract was signed—albeit with the loss of over five years.

Finally, the Kinnaird process demonstrates to the broader body-politic that a robust process is behind their taxpayer funded investment. This is especially important for avoiding opaqueness and politicisation and for building confidence in the decisions affecting the program. The future submarine project, which is likely to run well into the 2030s, will be presided over by a succession of governments, probably of both political persuasions. So it must be politically bi-partisan—or run the risk of modification or even cancellation at some later stage.

What kind of submarine?

When the government (and, for that matter, several of its successors) sits down to consider the SEA 1000 submarine project, some of the same thought processes that guided the AWD decision will play out. In particular, containment of risk will be high on the agenda. One way to ensure that a project is 'high risk' is to remain ignorant about its characteristics. That is what the Kinnaird process is designed to avoid. In the Kinnaird model, an ill- or un-informed decision is indistinguishable from a high risk one. For a developmental project option to emerge as a winner ahead of an 'off-the-shelf' option, significant time, money and manpower is needed well before the final deliberations. All of these considerations should caution those prepared to speculate about the cost and design details of the future submarine.

There seems to be an early consensus developing around the future submarine as a deeply-bespoke design. And ASPI has written before about the reasons that make this a very plausible option, given the geographical and capability drivers.[1] Similar reasoning almost certainly underpins the seemingly-definitive statements about the submarines and their capabilities in the 2009 Defence White Paper:

> [It will] have greater range, longer endurance on patrol, and expanded capabilities compared to the current *Collins* class submarine. It will also be equipped with very secure real-time communications and be able to carry different mission payloads such as uninhabited underwater vehicles.
>
> [It] will be capable of a range of tasks such as anti-ship and anti-submarine warfare; strategic strike; mine detection and mine-laying operations; intelligence collection; supporting special forces (including infiltration and exfiltration missions); and gathering battlespace data in support of operations.[2]

However, the capabilities described must be contemplated concomitantly with considerations of design risk and overall project cost. In some instances, it may be the case that demanding the inclusion of a specific capability on the submarine begets risk and cost disproportionate to the gain. In that case it would be better to look for alternative ways to provide the effect from elsewhere in the force structure.

It is important to get the requirements stabilised and technologies selected before entering the build phase.

It is important to get the requirements stabilised and technologies selected before entering the build phase. The history of complex programs is replete with lessons of the impacts of immature technologies and shifting requirements. Annex A contains some historical data compiled by the US Government Accountability Office (GAO) that clearly shows the potential pitfalls.

Just as was the case with the AWD project, the government must not remain ignorant about what can be achieved with 'off-the-shelf' hardware. Presently-available in-service foreign submarines and their planned descendants are steadily growing in capability. While these boats are typically smaller than those envisaged in the White Paper and are less capable in some respects than our bespoke requirements demand, they may yet prove a credible option once crew size, logistic support (including forward basing), potentially greater numbers at sea and other factors—not least of which are project risk and cost—are considered. The bottom line is that if an existing submarine design can defend the nation and support national strategy at a lower cost to the taxpayer, the government must consider it. However, an existing design is not automatically low risk, especially if (for example) modifications to a European boat for the fitting of a US-sourced combat system, weapons, or other features for interoperability with the US Navy are required.

The price tag

Until we know what the submarines are to do and how they will be built, we simply do not know what they will cost. But, despite that caution, it is worth making some simple estimates—not least because it makes the scale of the enterprise obvious.

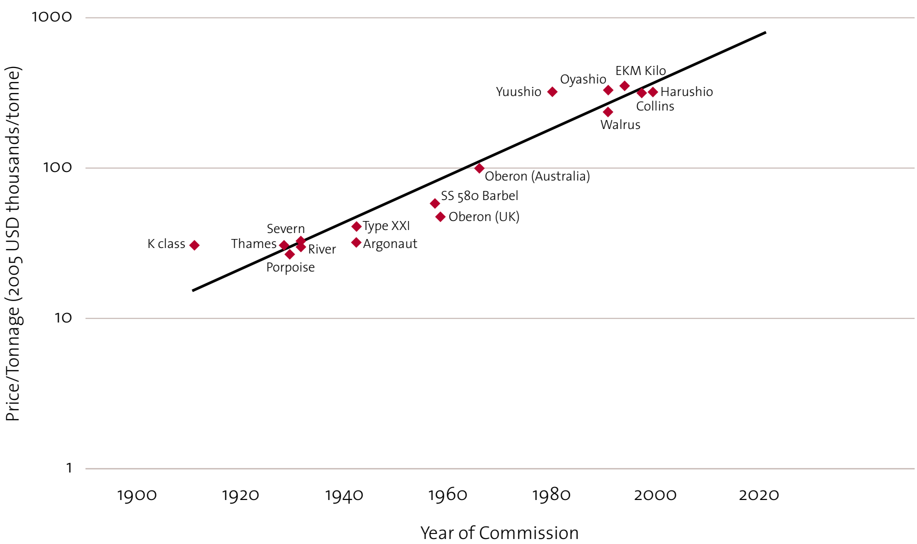
The simplest estimate can be obtained by drawing on the *Collins* class experience. The 3,050 tonne (surfaced) *Collins* boats cost approximately $1 billion each (total program cost of over $5.7 billion in 2006 Australian dollars).[3] We could, in principle, produce more *Collins* submarines at around the same price, but there would be little to be gained by doing so—a 1980s design, however capable, is not going to be the submarine of choice in 2030 and beyond.

If the new submarines are to be fitted with the full suite of capabilities described in the White Paper, they are likely to be significantly larger than the *Collins*. The Submarine Institute of Australia has estimated that they may need to be over 4,000 tonnes.[4] Given that the construction of the replacement class will essentially begin anew due to the considerable time that will have elapsed between the classes, the best possible case would be that the new submarines would cost the same per tonne as the *Collins* class (approximately $360,000 in 2009 dollars), which would result in a unit cost of $1.4 billion in today's dollars. A build of twelve such boats would therefore cost around $16.8 billion—more than the cost of the proposed purchase of Joint Strike Fighters for the RAAF— making the future submarine the most costly Australian defence project yet.

However, there are good reasons to expect that the actual cost would be higher, and quite likely considerably higher. The basic *Collins* design is now over twenty years old and the new boats will be more complex in many respects. The suite of capabilities will be larger and the sheer size of the boat—the largest conventional submarines ever—means that design and construction is likely to be more challenging. The physics of submarines will also preclude any simple scaling up of existing designs.

Historical trend data provides a basis for estimating the cost. Figure 1 shows the cost per tonne of conventional submarines above 2,000 tonnes since 1916. Plotted on a semi-logarithmic scale, the data shows an increase in real cost per tonne of approximately 3.8% per year over the period (during which the average weight of designs has increased a little over 1% per year). Clearly the additional capability built into conventional submarines over time has come with an associated increase in both cost and weight.

Figure 1: Submarine real unit prices 1900–2010 and beyond



Source: Defence Materiel Organisation

If we proceed with a bespoke design, especially one that incorporates many more features and systems than did its predecessor, we should expect the new submarine to conform to the historical trend, just as the *Collins* class did. The result from such a calculation is daunting. The 3.8% annual growth in the two decades that will separate the commissioning of the first *Collins* boat from that of the replacement class can be expected to double the price per tonne on its own. And the proposed 30% increase in tonnage will add commensurately on top of that. The net result is a staggering $3.04 billion (in 2009 dollars) per boat. For a fleet of twelve, we are therefore looking at a cost in excess of $36 billion.

There are objections that can be raised to this admittedly coarse calculation. However, the trends in the cost of military equipment have proven to be remarkably resistant to the efforts of designers and program managers to produce 'more affordable' (for which read 'less expensive') state of the art products. In a review of Pentagon cost-estimation techniques, the US Congressional Budget Office observed that 'parametric cost-growth estimating based on historical data does a much better job [than in-program estimates] of projecting what costs will actually be'.[5] Examples of programs that aimed to come in well below the historical trend line—but failed to do so—include the lightweight fighter project that produced the F-16 and, more recently, the Littoral Combat Ship and Joint Strike Fighter programs.

Table 1 summarises the cost estimates. To put the cost of the capability that is being advocated into perspective, the table also includes for comparison the likely cost of a fleet of off-the-shelf European submarines. (The latter figure arrived at by taking the average cost for sales of German Type 212/214 submarines on the world market over the last decade—around US$550 million per boat—and applying the same 3.8% annual cost growth.)

Whichever way the project proceeds, the Defence Materiel Organisation (DMO) strategy is designed to gather enough information for the government to make an informed decision that weighs the risks, costs and advantages of different designs.

Table 1: Cost estimates for the future submarine fleet

Submarine	Cost of 12 (2009 A$ billion)
New build Collins	12.0
4,000 tonne boat at Collins cost/tonne	16.8
4,000 tonne boat at historical trend	36.5
Type 212/214 equivalent in 2020	8.8*

* assumes exchange rate of A$1 = US 75c

And, regardless of the outcome of the design selection process, the boats will be built in Australia. The following sections therefore focus on the process that is in place to define and select the future submarine, and the industrial factors that will inform the process.

If we pursue an Australian-unique design, we will want to avail ourselves of cutting-edge technologies when they provide a capability edge worth the cost but we will also want to ensure that we prudently manage the risks of doing so.

An evolving acquisition strategy

Because this will be a very complex and expensive project, it should be no surprise if the acquisition strategy takes some time to develop. We do not have the information at hand today to make all of the necessary decisions. In fact, it would be surprising if we thought we could design and build a submarine for the 2030s and 2040s with only the knowledge we have now. There are difficult issues to be sorted out in the technical, legal, industrial, intellectual property and security realms—and there are complex interdependencies between them. So the strategy will have to evolve as decision points are reached and, as described above, at some point a decision will have to be made about a bespoke solution vis-a-vis an off-the-shelf boat.

If we pursue an Australian-unique design, we will want to avail ourselves of cutting-edge technologies when they provide a capability edge worth the cost but we will also want to ensure that we prudently manage the risks of doing so. Sometimes the risks will be technical—we might find ourselves wanting to fit technology from one supplier to a hull designed by another, with all of the engineering complications that would follow. And, quite apart from technical matters, there will also be risks arising from delicate intellectual property and/or security issues.

The interaction between the sensors and the combat system on the *Collins* class is a good case-in-point. Some of the sonar arrays on the *Collins* boats are sourced from Thales Underwater Systems, a publicly listed French-owned company. Because of requirements to quarantine the sensitive US-sourced combat system, full integration of the combat system and sonar is not possible. A work-around solution involving stand-alone processors and a 'data diode' allowing one-way movement of information provides the necessary separation. Given that we will again, in all likelihood, be looking to source equipment from a range of sources, we should expect to face similar issues in the future submarine project. Clearly, choices will have to be made and compromises reached between what we desire and what we can realistically achieve.

We need to be confident that our deliberations properly balance the costs, risks and benefits of the available options. The best approach would be to take the time to study the available range of submarine designs and the technologies to integrate into them. As the process continues, designs could be refined in tandem with the evaluation of existing and promising new technologies. As well, the technologies to be incorporated into the submarine will depend on the operational concept for their use. For the systems engineering process to actually identify the optimum cost capability trade-off, it is important that the Navy's requirements be agreed as early as possible. Failure to do so is likely to result in cost and schedule overruns. Fortunately, this is what the Kinnaird process is designed to do.

The strategy adopted by the DMO for the new submarine project reflects the sort of evolutionary approach that is required. The Defence Capability Plan 2009 explains that:

> The project will undertake a competitive, staged acquisition process to acquire this capability. It is expected that the phases of the project will be:
>
> - Initial Definition Phase (currently in progress). This will complete in December 2009 and identify the top level requirements for the future submarine.
> - Phase 1—Design. This comprises Concept Design Phase (Ph 1A, 2011–13), Preliminary Design Phase (Ph 1B, 2013–16) and Detailed Design Phase (Ph 1C, 2013–16). Funding and commencement of each design stage will be approved separately by Government.
> - Phase 2—Construction Phase. This will commence around 2016; and
>
> Phases 1 and 2 also intend to define and integrate the primary requirements for the weapons capabilities, including a precision strike capability, with the weapons to be acquired in later phases.[6]

The Project Office advises that it is using a slightly different breakdown of phases[7] but, regardless of the exact structure, this is a good start. Doubtless there will be some missteps along the way, but a phased approach of this sort is the only practical way a large scale development project can succeed and avoid major troubles. The sheer scale of the project is also bound to produce some significant management challenges; 'quantity has a quality all its own'.

We need to be confident that our deliberations properly balance the costs, risks and benefits of the available options.

SEA 1000 in today's NSR sector and procurement system

Getting the design process right is only part of the challenge. The project team must have the right skills to be able to develop the design, and we need the right industrial structures in place to efficiently turn the design into hardware. This section looks at the policy options the government has for making best use of the assets it owns, and the Australian Naval Shipbuilding and Repair (NSR) sector more generally. (The evolution of the NSR sector to its current state is described in Annex B.)

The White Paper has set out the aspiration—if not the details—for a substantial increase in Australia's maritime capability. As well as the submarine program, there will be larger surface combatants to replace the

ANZAC class, new offshore patrol vessels much larger than the current patrol boats, and other watercraft. This level of demand will require the NSR sector to deliver more ships and submarines, each of greater capability, than are presently in service. The consequence is likely to be one or more of: a very long production cycle, a large offshore production effort or a considerable growth of the Australian NSR sector compared to that required to complete the AWD and amphibious ship programs.

If managed properly, this may provide the stability of demand to avoid peaks and troughs of activity in the NSR sector, which induce much risk and inefficiency. This step-up in activity will, in part, be able to build upon the development of common user infrastructure in Australia's shipbuilding centres. Over the past decade Australian taxpayers, through various states and the federal government, have funded a range of facility works that have changed the supply side arrangements of the NSR sector.

Today, government-owned infrastructure in Henderson (WA), Osborne (SA) and, (technically) Garden Island (NSW) can be made available to almost any company seeking to participate in the NSR sector. The underlying reasoning is that companies will be able to compete on core competencies such as the efficiency of their production process, rather than factors such as access and upkeep of their own shipyard. Over time, the DMO aims to test companies for value for money in build processes.

Under this approach, incumbency will be less of an advantage when competing for new projects; winners of today's projects will not have the 'inside rail' in future, and they will have to give way should a competitor provide a more cost-effective service. The potential downside is that it may become an unattractive commercial proposition for a company to re-invest profits for long-term growth if it may be easily picked off by new entrants. It is against this background that decisions will be made for the contracting of the design and build phases of the future submarine.

The government and ASC

In the past twenty-five years, governments in Australia have sought to divest themselves of ownership of businesses as diverse as transport, finance and defence, to the extent that they could without adversely affecting the delivery of essential services. Often the result of such privatisation was a significant improvement in overall efficiency and a reduction of prices in the respective sector. It was therefore against the prevailing trend for the Howard Government to choose to nationalise what is today Australia's premier NSR contractor.

There are two broad options that could be pursued; government could either persist with elaborate probity structures to keep ASC at arms-length or it could restructure ASC for the long term.

For a host of very good reasons connected to national security and the successful completion of the *Collins* class Submarine project, the government chose to exercise its step-in rights and acquire ASC Pty Ltd (then the Australian Submarine Corporation). The national security arguments were compelling and the worldwide submarine design and construction sector is far from a free market in any case. It should be no surprise that many of the reasons that drove this departure from whole-of-government privatisation policy are already resurfacing in the new submarine project.

HMAS *Collins* transits through Cockburn Sound at sunrise, 7 December 2007. © Defence Department

Until recently, the government's policy towards its self-inflicted conflict of interest as both customer and provider in the NSR sector was to place a complex probity framework around dealings with ASC, with a view of divesting the company at the first available opportunity. Over a sufficiently short time period, that approach was more or less workable. But now that the sale has been postponed indefinitely, the government is likely to look at other arrangements. There are two broad options that could be pursued; government could either persist with elaborate probity structures to keep ASC at arms-length or it could restructure ASC for the long term.

The first of those options is essentially the status quo—but perceived unfairness on other participants in the NSR sector could result in market distortion. The most significant shortcoming of today's arrangements is the circumspect attitude of potential new NSR sector investors towards competing against the government, which results in the NSR sector remaining in an unhealthy state of suspended animation. At the moment, ASC constitutes—for all intents and purposes—a monopoly supplier for support of the *Collins* submarine fleet. Further, competition policy—usually a useful tool for getting the taxpayer a fair deal—does not seem to work in this case because of the very high corporate knowledge and experience hurdle that any would-be competitor would face. Under the current arrangements, should the government compete contracts derived from SEA 1000, it would then be faced with the unhappy choice of either creating a second monopoly for the future class with a private firm or extending a monopoly with, effectively, itself.

The current structure, with separation of 'owner' and 'customer' between Finance and Defence Departments respectively, was a necessary suffrage in order to transition ASC to private ownership, but it does not look to be a sustainable model. So the second option is the more logical one—it essentially involves the admission that ASC will remain government-owned and is a certain participant in the future submarine project as an integral part of the government's industrial capability, rather than an entity to be treated at arms-length. This option, which in this paper is called the 'integrated option', has two chief benefits, but also some risks.

The first benefit is that Defence and ASC can better avoid situations where their interests are at cross-purposes, and can develop a sufficiently close working relationship to allow them to negotiate the vagaries of through-life submarine maintenance. All companies must meet customer expectations and do it at a competitive price, and that should not change, but the sole-source contracting environment between Defence and ASC requires more flexibility and cooperation between the parties than is usually encountered in the business world. Where the relationship is complex and the business activity is hard to contract, business usually opts for remedies such as joint venturing. In the case of government and ASC, clear, effective and enforceable governance might be a better way.

The second benefit is that the government obtains a commercial and industrial vehicle with which to evaluate and manage sensitive and high priority elements of submarine policy. As discussed in a later section, accepting that ASC will be involved in the project as part of government means that the resources and capabilities resident in ASC may immediately be brought to bear in the interests of SEA 1000, rather than be kept at arms-length to ensure competition at future phases.

The questions then becomes: how is the integration of ASC into government to be achieved and what is the extent of ASC's involvement in the various stages of the project?

Implementing the integrated model

A 'light-touch' to integrating ASC into government is the best approach. The ability of ASC to operate as an economic entity, capable of pricing its activity and operating in a market environment, is both worthwhile and a pre-requisite for it to continue as a contracting party to the AWD Alliance and ongoing *Collins* support and capability enhancement programs.

However, there are some simple adjustments that might increase the ability of the DMO and ASC to work in a more integrated manner in the future:

- The ASC Board's independence could be reduced commensurate with the reduction of the arms-length relationship with government. While a Board of Directors capable of supervising and steering a complex economic entity like ASC will of course be needed, moving the Board closer to its client seems advisable. This could include redefining the company's constitution to include customer representatives, from Defence, Navy and the DMO, as Board members.
- Most importantly, the integrated model requires a government policy that defines the limit of ASC's commercial boundaries. The central theme of this recommendation is avoiding devising policy fixes for today's problems that exacerbate tomorrow's. This principle should come to the fore if there is temptation to default to simply giving work to ASC; thereby slowly (and unintentionally) expanding the role of government to a point where being a competitor becomes uneconomic. Any reconstitution of the Cockatoo Island Dockyard should not happen by accident.

Becoming a smart buyer

One of the benefits of having ASC as a part of government is the expertise that it can provide the SEA 1000 project. To see why, a short digression on the vagaries of submarine design is in order.

The team that forms the nucleus of the Project Office is critical—the system engineering reviews designed to provide confidence in the project cost and schedule estimates will only be as good as the team conducting and analysing them. No modern combat platform is simple, but submarines are more complex than most. As well as the usual issues that come from the integration of sensors and weapon systems, there is a delicate interaction between weight, stability and space factors. Changing one small requirement can mean hundreds of flow-on design changes which sap time and drive additional cost and risk into the project.

Reserves of buoyancy in submarines are low. Consequently, design margins are tight, particularly for upgrades. This is an unavoidable consequence of building a neutrally buoyant craft. To illustrate the point, a *Collins* class boat weighs a little over 3,000 tonnes but takes only a further 280 tonnes of seawater into its ballast tanks to achieve neutral buoyancy, with a reserve of about 40 tonnes to compensate for changes in water density due to depth, temperature and salinity changes. The distribution of weight is also critical.

This has the consequence that design begins to take on the attributes of a 'zero-sum' game. Once detailed design and construction begins, if something needs to go in then something else must come out. Carrying extra ballast to provide an extra design margin or for as yet unthought-of capability is problematic, especially for conventional submarines, which rely on overall system efficiency for their war fighting effectiveness. The same criteria are more relaxed in building surface combatants, which have more scope to grow in overall tonnage throughout the design, production and in-service upgrade phases.

Technology choices have flow-on effects and create interdependencies for other systems. Even an apparently simple matter such as the type of battery fitted to the submarine is strongly linked to other aspects of the design. Lead-acid batteries have long been the mainstay of the world's diesel-electric submarines. Today lithium-ion batteries have the potential to replace them as a more efficient source of electrical power storage. But many working assumptions about other systems need testing, including generation, propulsion, power control and distribution and safety. As well, the new batteries are substantially lighter than their antecedents, producing design challenges for ballast and stability.

It should now be obvious that considerable design expertise is required in all aspects of the submarine life cycle, not just in drawing up the blueprints initially, but also in the through-life support process.

These and other considerations will play out in the selection of the design for Australia's future submarine. It should now be obvious that considerable design expertise is required in all aspects of the submarine life cycle, not just in drawing up the blueprints initially, but also in the through-life support process. And, importantly for our purposes, even selecting a submarine design—particularly if it is an amalgam of components from different sources—will require substantial submarine design skills to be resident in the Project Office.

The required level of expertise will not be easily achieved. There has been a general deterioration of government in-house naval design and technical expertise over the past two decades. In part this is a natural consequence of the evolution of shipbuilding policy, as private industry has taken over from government as the supplier of these skills. While Defence does not have a significant body of submarine design skills in-house, the skills are not lost, but rather they have been transferred to private companies. As supporter of the *Collins* class, ASC has some of those skills—probably insufficient to produce a detailed design for a new submarine, but certainly enough to make the Project Office a smarter buyer.

With the retention of ASC in government ownership, there is an obvious opportunity to use the skills resident in ASC for the purposes of the SEA 1000 Project Office. Specifically, the Project Office should consist of the following elements:

- professional project management staff from DMO
- submarine design specialists from ASC
- technical specialists from the Defence Science and Technology Organisation
- representatives of the customer for the capability to be delivered—Navy.

Presently, the Project Office has only three of the four key enabling skill sets. With the resources of ASC at hand, the Project Office will be well set up to follow the best practice suggested by the GAO as described earlier. The Navy's requirements can be refined and scrutinised in the light of engineering criteria, and the project can progress through the appropriate systems engineering stages with the best chance of achieving a rigorous outcome.

There are signs that the need for such skills has been recognised by government. In August of this year, the Minister for Defence announced a study that was intended to examine Australia's submarine design capabilities. The aim was to 'identify and explore all the options to ensure we have the appropriate design capability to support our submarines throughout their life'.[8]

Two broad options for ASC involvement

In much the same way that design decisions in one part of a submarine can influence the options in another part, incorporating ASC into the Project Office has a knock-on effect in the development of competitions for the design and build processes. Given the above argument for including ASC capability in the Project Office structure, this paper demonstrates that there are two options for proceeding. In either model ASC would not be on the same competitive footing as other potential contractors.

The first approach, which this paper's authors tend to favour, is to restructure ASC into a 'thin-prime' company. This model enables government to contract ASC as a direct adviser and also as contractor for certain sensitive works. It also empowers government to select and control what will be a very large supply chain. The management of sensitive government-to-government and navy-to-navy technology transfer would be facilitated by this approach.

One downside is that ASC will be engaged as a SEA 1000 participant through sole-source conditions rather than competition. But that is a small price to pay. The benefit of running a competition without sufficient expertise to assess the responses seems questionable and runs the risk of the process devolving into a bragging contest between competing companies. And, as noted earlier, ASC's

A *Collins* submarine in build at the Australian Submarine Corporation. Courtesy of ASC Pty Ltd presence in a competitive process while still in government hands could have a dampening effect on the competition. Even under this thin-prime model, the sheer scale of the project may require ASC to expand modestly from its present size.

The other option is to declare ASC to be the preferred builder of the submarines, with only subcontracting work up for open competition. In many ways this is how other countries run their submarine building enterprise—a single supplier provides the home navy with its boats; HDW in Germany, Navantia in Spain, Kockums in Sweden etc. While seemingly a dramatic departure from the competitive model, the difference between pre-selecting ASC and contracting another builder is that there would be only one submarine monopoly in place in Australia between now and 2035, rather than two running concurrently (without any obvious mutual benefits)—one for *Collins* and another for the new submarine.

In this context, it is important to note that the European builders also build submarines for the export market. The consequent competition for international sales has the effect of producing efficiencies in the submarine building sector. A deeply-bespoke Australian submarine, especially a very large one, is unlikely to provide much of a 'jumping-off point' for an Australian entry into the world market. (A glance at the prices in Table 1 will suggest why that is likely to be the case.)

There are two good reasons to avoid following this path, especially early on in the process. Firstly, the SEA 1000 contract must reflect the risk in the project. Given that the risk cannot begin to be quantified until the Kinnaird process is well underway, the award of major contracts must be an outcome and not a driver of the process. The *Collins* project provides some salutary lessons. Secondly, we intend to build twelve boats, a total of somewhere between 25,000 and 50,000 tonnes. In 2018 Australia will not have built a submarine in over fifteen years. The submarine sustainment industry we have today will look nothing like the submarine design, construction and sustainment industry of 2025.

A deeply-bespoke Australian submarine, especially a very large one, is unlikely to provide much of a 'jumping-off point' for an Australian entry into the world market.

New submarine infrastructures will be built, capable of handling the present demand for *Collins* through-life-support as well as the SEA 1000 build, and possibly funded under common user models. Expanding ASC could be the most efficient path to realising this new landscape, but we should bear in mind that such a strategy locks us into a sequential activity rather than a parallel one. It is not the capacity of today, but the rate of development of new capacity from today that is the key for the build phase. It may be that a suite of companies, collectively providing the requisite skills and personnel, will provide a robust supply chain for the SEA 1000 boats. Allocating commercial control of this supply chain is a decision to be made with information we don't have now, and won't have for several years.

Note that our arguments apply primarily to the submarine sector. Australia's submarine requirements are complex and demanding. The world market might be able to provide a solution, but that is far from guaranteed and, as hopefully was made clear earlier, having submarine design and sustainment expertise in-country is important. That is less true of warships. The world market provides a range of capability options that we could consider (as the AWD process showed, where the Navantia F-100 design with relatively small modifications proved successful). Consequently, there is a less compelling case for the retention in government ownership of the ASC surface ship building business, known as ASC Shipbuilder.

Rolling production

It is also worth thinking even beyond the next submarine. If the submarine arm of the Navy is to be an enduring national strategic asset, it is necessary to consider how the project now underway can be structured to consolidate a national support capability in perpetuity.

By leaving an 'air gap' between the Collins and the next generation of boats, we have created a challenge for the future.

Some of those skills already exist in Australia as a legacy of the *Collins* build program and the ongoing support and enhancement of that class. But they are not on the scale required for a production program. By leaving an 'air gap' between the *Collins* and the next generation of boats, we have created a challenge for the future. And it is not just creation and maintenance of the workforce that is a challenge. Stopping and starting between classes has a financial impact as well. New build projects invariably incur a range of start-up costs. Tools must be fabricated, facilities constructed and, perhaps most challenging of all, a skilled workforce put in place and suppliers of the components to be assembled into the boat must be found (or created).

It is worth taking a look at the economics of the AWD project as an example of the sort of overheads that can accrue during the ramp up of a new shipbuilding effort. While there is no precise breakdown of costs per hull over the production of the currently-approved three vessel build, there is enough information in the public domain to make an informed estimate. The data points available are the total cost of the project ($8.1 billion), the marginal cost of a fourth ship ($1.5 billion) and the cost of the Aegis combat system ($400 million each). The only other piece of information needed is the 'learning rate'—the cost savings on the construction of later vessels as production matures. Estimates of the relevant parameter vary in the literature, which results in some variance in the calculated overhead costs (but does not change the general conclusion).[9] For the purposes of this paper a median value is used. Table 2 below shows the estimated breakdown of the AWD project costs.

The project overheads that have been incurred in the AWD program are almost the cost of another ship. Or, to put it another way, we are getting three AWDs for the price of four. Of course, if the option of a further ship (or more) is taken up, the fixed costs will be amortised over more hulls. (ASPI will return to the subject of the future shape of the surface fleet later, but it is worth noting in passing that building more AWD hulls to provide the 'larger than ANZAC' surface combatant of the White Paper offers economic advantages.)

Table 2: Costs of the Air Warfare Destroyer project broken out by ship

	First ship	Second ship	Third ship	Overheads
Cost	$2.04 b	$1.74 b	$1.57 b	$1.43 b

A new production program necessarily starts at the high end of a learning curve, gaining efficiency only as successive items roll off the production line. And the more that are built, the better that efficiency will become. Figure 2 shows the cost differentials that could, in principle, be gained by producing a larger number of hulls.

In practice it is not likely that a large number of identical ships or submarines will be built sequentially. As new sensor and weapons systems come along, more efficient propulsion or air-independent propulsion technologies mature, new requirements are identified and industrial practices and processes evolve, it is far more likely that progressive changes will be made to the basic design. This is the basis of the 'block' approach to development. In this model, a number of identical vessels would be constructed as Block 1, and then changes would be incorporated to produce a Block 2 configuration. When that happens, there is a certain loss of efficiency in production because of the new skills and inventory required. That means that the first Block 2 vessel will cost more than the final Block 1. But the efficiency does not regress all of the way back to the initial value. Because the underlying design is essentially similar, the experience gained continues to be relevant. Then the learning process again works to bring costs down.

At some stage a major redesign—a 'Mark II' or even an entirely new class of vessel —might be required. Then the costs will jump back up before starting down again. But the existence of a functioning production line means that even the first vessel of the new class will benefit from the infrastructure and skills already in place. Figure 3 shows schematically how such a process might look in terms of costs. Over the entire program, the savings can be considerable.

Figure 2: Indicative learning curve for continuous submarine production
(Calculated as per the NASA learning calculator referenced at endnote 9.)

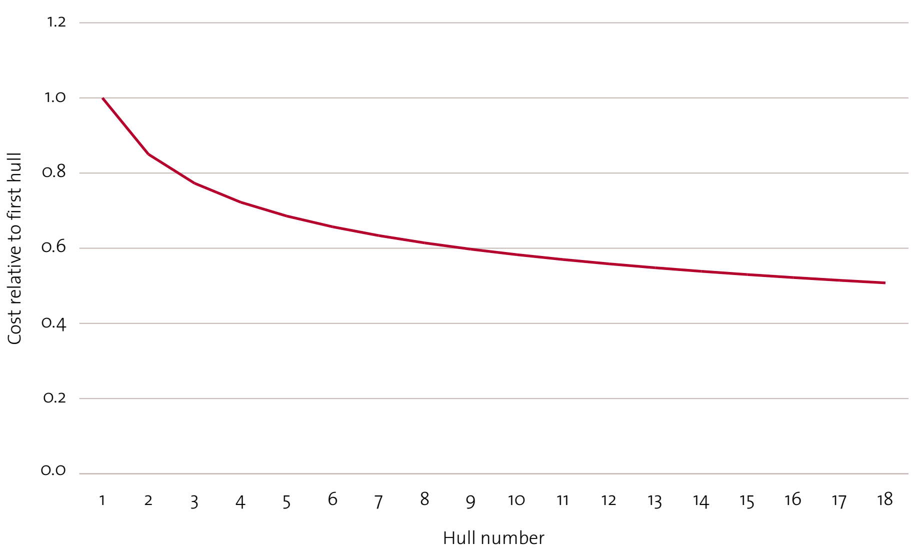
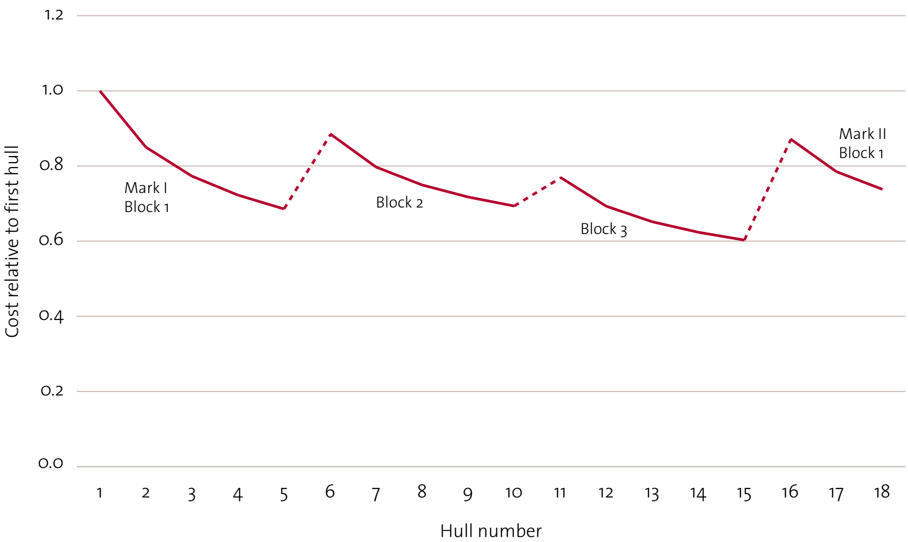


Figure 3: Schematic plot of cost versus hull number for a rolling development model
(Calculated as per Figure 2. The 'steps' between marks and blocks are arbitrary.)



Conclusions

The 2009 Defence White Paper has reasserted the importance to the ADF force structure of the submarine arm of the Navy by flagging a doubling of the fleet size, beginning late next decade. While that might seem a long way away, there is a lot of work that needs to be done to establish a firm decision-making and industrial basis for what is likely to be Australia's largest-ever defence project.

The approach being taken by the DMO—developing the requirements for and design of the future submarines through a number of increments while keeping open the option of a lower-risk option—is the right one. But submarine design is a subtle and highly technical discipline, and a lot of expertise is required in the Project Office to give the best chance of success.

The retention in government hands of ASC provides an opportunity to utilise the expertise of that company to make the Australian Government a smarter buyer. By making the submarine design capability of ASC part of the Project Office, the Commonwealth will be better placed to evaluate the designs proffered in the various stages of the selection process.

ASC should not be handed the build contract as a fait accompli. Indeed, there are good reasons not to do that. But accepting now that ASC will be involved in the project as part of government means that the resources and capabilities resident in the company could immediately be brought to bear in the interests of the project, rather than be kept at arms-length in the interest of maximum competition at future phases.

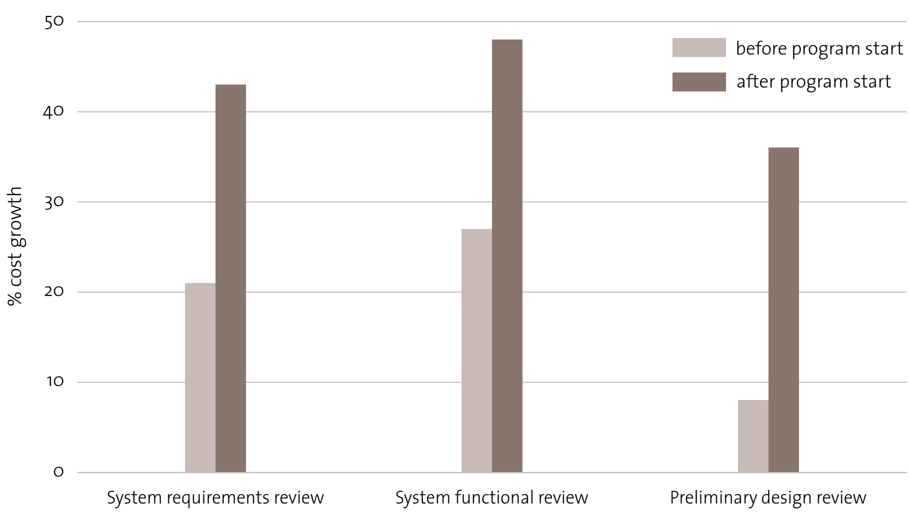
Finally, the scale of the project and the retention of core capability in government hands provide an opportunity to think on a truly strategic scale. The time that will have passed between the delivery of the last *Collins* class boat and the first of the new class means that there are re-learning penalties in both the industrial and the management aspects of the new project. There is potential to avoid this in future by taking the steps required to develop an enduring national capability.

Annex A: The importance of getting it right first time

It is intuitively obvious that incorporating mature technologies is less risky than betting on ones that are still in the development stage. But it is instructive to see the quantitative impact of each approach in terms of the impact on project cost and schedule. The US Government Accountability Office (GAO) provides some data that illustrates the point very clearly. The data shows that a sequence of design and requirement reviews will result in more predictable outcomes, if they are carried out *before* cost, schedule and capability estimates are made. (Figure A1)

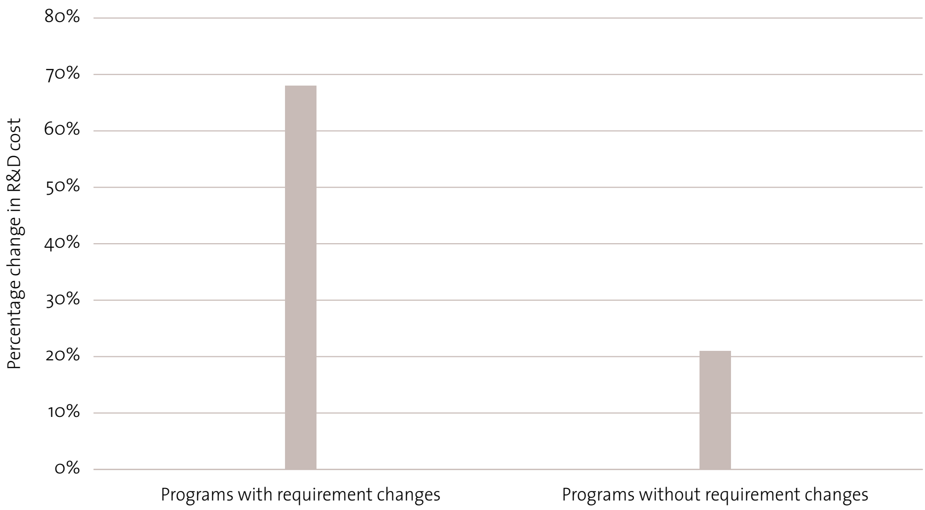
As well, the technologies to be incorporated into the submarine will depend on the operational concept for their use. But that is not a one-way street—it will sometimes be the case that new technology provides the opportunity to use the submarine in new ways. So the planned operational use of the submarine will evolve as the submarine design evolves. It is important that the navy's requirements be stable before the design is finalised—which the Kinnaird process is designed to do. Failure to do so is likely to result in cost and schedule overruns. Again the GAO provides some hard data—requirements changes late in the project could cost an additional 50% in cost overruns and well over a year of delay. (Figures A2 and A3)

Figure A1: The value of performing requirements, functionality and design reviews before estimating costs



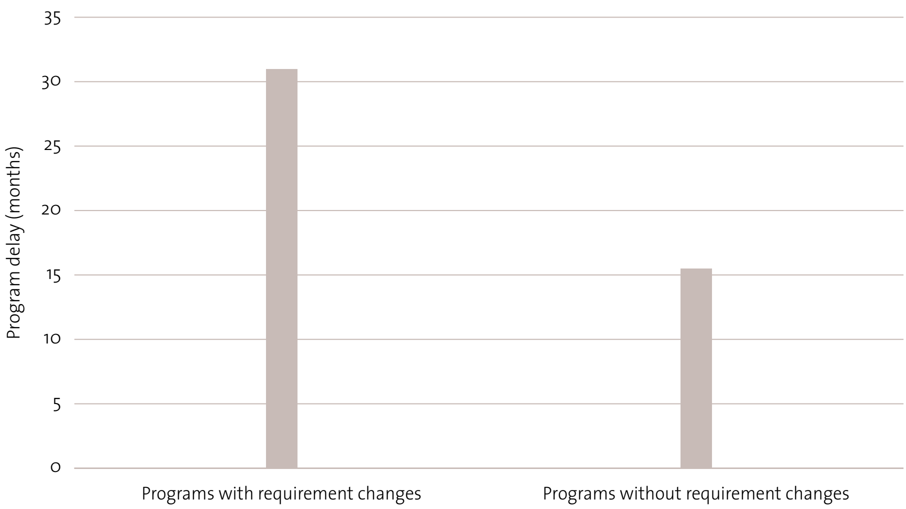
Source: US GAO analysis of US Department of Defense program data

Figure A2: The impact of requirement changes on program cost overruns



Source: US GAO analysis of US Department of Defense program data

Figure A3: The impact of requirement changes on program schedule overruns



Source: US GAO analysis of US Department of Defense program data

Annex B: The Australian Naval Shipbuilding and Repair sector

Australia's industry policy for the naval shipbuilding and repair (NSR) sector today resembles a home built via a process of multiple renovations. It looks sturdy enough from a distance but, on closer inspection, the clashes of architecture, materials and even a few hazards to safety become apparent. The government has an opportunity to knock-down and rebuild these policy structures before the next tenant arrives—the future submarine project.

To see how things might be different in the future, it's worth understanding how we got to the present state. Today's industry policy for the Australian NSR sector is based on the 'managed competition' model. This policy, formulated in 2004, stated that the government would use its purchasing power to manage demand in the sector to sustain at least two credible prime NSR contractors. This policy was viewed through the prism of the then-forthcoming amphibious ship and air warfare destroyer projects, and was designed to get industry through to the end of the present decade.

Like many policies, it was driven disproportionately by challenges of the day. Two of those were the demise of the Naval Shipbuilding and Repair Industry Sector Plan and the 1999 McIntosh–Prescott Review into the *Collins* class project. The former was a response to falling demand for shipbuilding and was perceived by many as risking a monopoly market position in favour of the then Tenix Marine. The latter flagged some serious problems with the *Collins* project and the government had little option but to step-in and acquire ASC. This in turn led to a lengthy dispute, mostly over intellectual property rights with Kockums, the former foreign shareholder of ASC. Whatever the terms of the dispute, the outcome was clear—full government ownership of ASC Pty Ltd. That situation endures today, and the recent announcement from the government that ASC will remain in government ownership for the foreseeable future provides a baseline from which the best way ahead may be discussed.

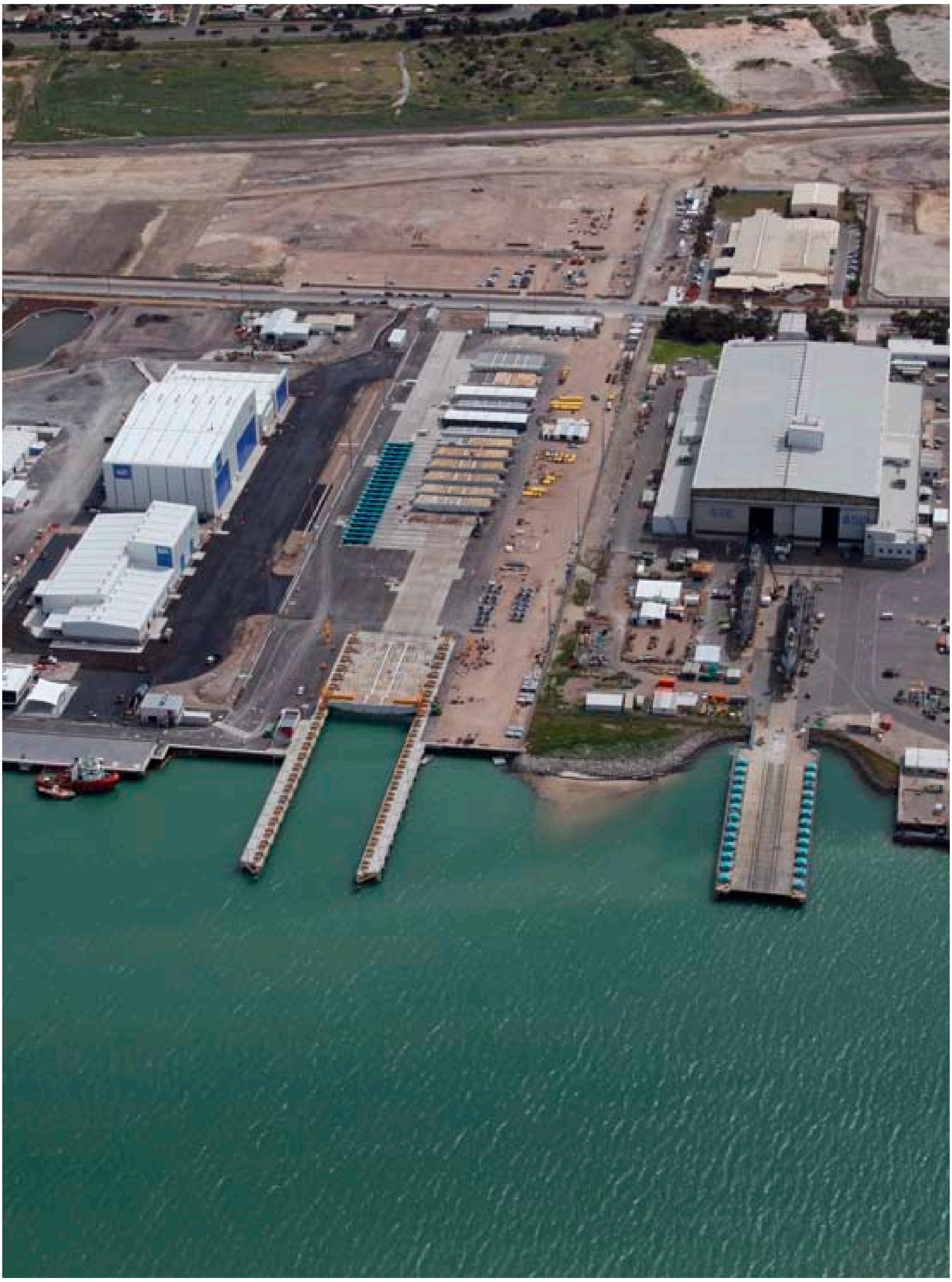
Lessons learnt: Collins, *Kinnaird, Mortimer and SEA 1000*

The McIntosh–Prescott report was responsible in no small way for a sober and risk-conscious reassessment by government, and the general public, of defence acquisition more widely. Indeed, the issues and recommendations of the Kinnaird Review (2003) and, most recently, the Mortimer Review (2008) into defence procurement share a lineage which may be traced back to that 1999 work.

To be found amongst the McIntosh–Prescott recommendations are the following, all of which are relevant to the project under study here:

> The sale of Australian Defence Industries and, later, the possible sale of the Government's shares in the Australian Submarine Corporation take careful cognisance of the likely downstream restructuring of the defence shipbuilding industry in Australia and the need for flexibility in selecting among overseas designers for future projects.
>
> Opportunities [should] be found for Defence officers pursuing procurement careers to spend time in large commercial procurement projects and friendly, foreign procurement organisations.
>
> In future major projects, there should be more attention to the Commonwealth's own role and some new approaches in contractual arrangements to achieve better assessments of costs...
>
> The Commonwealth should avoid putting itself on both sides of a contract (as both buyer and seller).[10]

Whenever governments review defence procurement—usually inspired by the latest bad press—the answers are always similar. Kinnaird stressed the need for DMO to become a more business-like organisation, and called for greater Cabinet scrutiny of technology and schedule risks and costs (including whole-of-life). Mortimer supported Kinnaird and added that any decision to move beyond the requirements of an off-the-shelf solution must be based on rigorous cost-benefit analysis.



Aerial photo of Techport Australia, taken early October 2009. ASC on the right, Techport Australia Common User Facility in the centre, ASC Shipbuilding on the left. Photo courtesy Defence SA

Endnotes

1 Andrew Davies, *Keeping our heads below water: Australia's future submarine*, ASPI Policy Analysis, 30 January 2008. Available at http://www.aspi.org.au/publications/publication_details.aspx?ContentID=150

2 *Defending Australia in the Asia Pacific Century: Force 2030*, Defence White Paper 2009, May 2009, paragraphs 9.3 to 9.8. Available at http://www.defence.gov.au/whitepaper/

3 The figure quoted here is approximate. The calculation depends on how much of the 'fast track'/ remediation program funding, including the replacement combat system, is included in the total cost.

4 *Critical issues for the initiation of Australia's next generation submarine project*, Submarine Institute of Australia brief, 31 December 2008.

5 Quoted in 'US DoD receives mixed assessment of its cost-estimating abilities', *Jane's Defence Weekly*, 25 April 2008.

6 *Defence Capability Plan 2009*, Department of Defence, Canberra, 2009. Available at http://www.defence.gov.au/dmo/

7 The most significant differences being that Phase 1C will be 'contract design' and Phase 2 will be 'detailed design and construction'.

8 Minister for Defence Press Release 015/2009, *Future submarine project study*, August 2009. Available at http://www.minister.defence.gov.au/faulkner/media.cfm

9 The learning rate measures the cost reduction when the production number is doubled. Values in the literature range from 80% to 90%. The figure used in the calculations of the AWD program in this paper is 85%. The NASA learning calculator at http://cost.jsc.nasa.gov/learn.html gives a range of 80–85% for shipbuilding.

10 M. K. McIntosh and J. B. Prescott, *Report to the Minister for Defence on the Collins class submarine and related matters*, Commonwealth of Australia, June 1999. Available at http://www.minister.defence.gov.au/1999/collins.html

Important disclaimers

Miller Costello provides commercial advice to parties that may acquire an interest in SEA 1000.

ASPI is sponsored by firms that may participate in SEA 1000 in various capacities.

About the authors

Sean Costello is a partner with defence project consultancy Miller Costello. He is a former Senior Adviser to past Defence Ministers for capability development and acquisition and served in the Royal Australian Navy as a *Collins* class submarine qualified Officer.

Andrew Davies is the Director of the Operations and Capability Program at ASPI. He has written on nuclear proliferation, defence acquisition programs and major Australian capability decisions, including the Air Warfare Destroyers, Joint Strike Fighter and Australia's future submarine.

About Strategic Insights

Strategic Insights are shorter studies intended to provide expert perspectives on topical policy issues. They reflect the personal views of the author(s), and do not in any way express or reflect the views of the Australian Government or represent the formal position of ASPI on any particular issue.

ASPI
Tel +61 2 6270 5100
Fax + 61 2 6273 9566
Email enquiries@aspi.org.au
Web www.aspi.org.au

LESS IS MORE.

It's time to work smarter. With less budget, less staff and less time to show an ROI, the paradox is making less offer more. Businesses and governments need to transform the way they do business—for new efficiencies in cost, reliability and performance with less complexity. Cycles of change create unprecedented competitive opportunities for organizations visionary enough to optimize their spend vs. trying to cut their way to success. The challenge is how to do more with less.

Unisys helps clients make less do more by securing their operations, increasing the efficiencies in their data centers, enhancing user productivity and collaboration, and modernizing their business-critical applications.

Refresh your perspective. Let us show you how less can be more.

UNISYS
imagine it. done.

TELL A FRIEND ABOUT ASPI

Join Australia's liveliest minds writing today on defence and strategic issues. Each year the Australian Strategic Policy Institute (ASPI) will produce up to six issues of ***Strategy*** and six shorter ***Strategic Insights*** and a number of ***Special Reports*** on issues of critical importance to Australia and the Asia–Pacific.

Thoughtful, ground-breaking and often controversial, ASPI leads the public debate on defence and security issues.

JOIN ASPI

Name

Position

Company/Organisation

❏ **Government** ❏ **Non-Government**

Address

City **State** **Postcode**

Country

Telephone

Email

SELECT 3 FREE PUBLICATIONS

- ❏ The human tide: An Australian perspective on demographics and security
- ❏ Sea change: Advancing Australia's ocean interests
- ❏ Global jigsaw: ASPI's strategic assessment 2008
- ❏ The eagle in a turbulent world: US and its global role
- ❏ Tangled webs: Security architectures in Asia
- ❏ Neighbourhood watch: The evolving terrorist threat in Southeast Asia
- ❏ Power plays: Energy and Australia's security

INDIVIDUAL	❏ 1 year *$199*	❏ 2 years *$378*	❏ 3 years *$537*
STUDENT*	❏ 1 year *$99*	❏ 2 years *$188*	❏ 3 years *$263*
CORPORATE (Oct 06+)	❏ 1 year *$649*	❏ 2 years *$1233*	❏ 3 years *$1752*

* (STUDENT ID ______________________________)

To join
1) Subscribe online www.aspi.org.au
2) Mail to Level 2, Arts House, 40 Macquarie St, Barton ACT 2600, or
3) Phone (02) 6270 5100 or fax (02) 6273 9566

❏ **Cheque** ❏ **Money Order** ❏ **Visa** ❏ **MasterCard** ❏ **AMEX** ❏ **Diners**

Payable to Australian Strategic Policy Institute ABN 77 097 369 045

Name on card

Card no.

Expiry Date / **Total Amount $**

Signature

This will be a **TAX INVOICE** for GST purposes when fully completed and payment is made.
Please note specialist publications are not included.

Z00 40353

RRP $5.00 ISSN 1449-3993