Future of Naval Shipbuilding in Australia

Choices and Strategies

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Report to the Government of Victoria
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Executive summary and conclusions

Executive summary

In February 2005, The Allen Consulting Group delivered to the Victorian Government its first report on naval shipbuilding, Building the Air Warfare Destroyers: How does Williamstown Rate? This second report focuses on the longer-term issues and strategic choices that will determine the future of the naval shipbuilding industry in Australia. Overshadowing this is the contest to consolidate the three new Air Warfare Destroyers (AWDs) and Landing Ships, Helicopter Dock (LHDs), contracts worth up to around $10 billion in total. While the significance of the AWD selection is so profound for the industry that there is, unavoidably, some overlap between the two studies, the emphasis of this second report is on national issues and the future of the industry across Australia.

The Australian naval shipbuilding sector should be considered in the context of an international industry characterised by substantial barriers to trade. Government purchasing policy and subsidies have distorted the global market for warships to an extremely high degree and no matter how internationally competitive a particular shipyard may be, the lack of anything resembling a level playing field means it is very difficult for it to succeed internationally. Tenix’s success, in the face of strong international competition, in winning the contract to re-build much of New Zealand’s Navy under Project Protector is both very rare and a tribute to the competitiveness of Australian industry.

In both Europe and the United States, the naval shipbuilding industry has been subject to substantial consolidation and rationalisation since the end of the Cold War. While the complexity and costs of naval platforms and weapons systems have greatly increased, some shipyards, particularly in the United States, have been able to take advantage of long production runs to benefit from significant scale and learning economies. (Both General Dynamics’ Bath Iron Works and Northrop Grumman’s Ingalls shipyard, for example, will have built more than twenty DDG-51 Arleigh Burke class destroyers by the end of their contracts.) Despite the pressure for rationalisation, the most efficient shipbuilders clearly see benefits in specialisation in their shipyards, with surface warships generally being constructed in a different location to submarines. Industry consolidation can also bring its problems: in Britain, for example, there have been tensions between the Ministry of Defence and BAE Systems that have clearly arisen as a consequence of that company’s increasingly monopolistic position in the UK defence industry.

The evaluation of the Australian industry reveals a record of relative success since the industry was revitalised in the mid-1980s with the major orders for locally built Collins class submarines and ANZAC class frigates. Although the Collins program was beset by difficulties, the Australian Submarine Corporation (ASC) has established a capability in submarine construction and support. By contrast, the ANZAC frigate program ran smoothly throughout, with no blow-out in the delivery schedule or cost. As a result, Tenix has established a strong capability at its Williamstown shipyard in building and upgrading major surface combatants. Unlike ASC, Tenix has also been successful in export markets, as suggested above.
In New South Wales, while there are two shipbuilders with a capacity to build large steel warships, ADI and Forgacs, neither yard has built one in the recent past. In addition, the performance of ADI’s marine division is under scrutiny because of major delays to the FFG upgrade program.

Apart from Tenix, the other shipbuilder with a strong record of success in international markets is Austal Ships in Western Australia. Unlike other naval shipbuilders, Austal is an aluminium specialist that unexpectedly won the contract to build twelve (now fourteen) Armidale class patrol boats for the Royal Australian Navy (RAN) and is well-placed, with General Dynamics, to win a major contract for the US Navy’s new Littoral Combat Ship.

Apart from the fact that Austal is excluded (its successes in naval shipbuilding have come relatively recently), the present capabilities of the industry are summarised in a Table published by the Defence Materiel Organisation (DMO) in 2002:

<table>
<thead>
<tr>
<th>Company/ facility</th>
<th>Major Surface Ships</th>
<th>Submarines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consolidation/ Final Assembly</td>
<td>Modular Fabrication</td>
</tr>
<tr>
<td>Tenix, Williamstown VIC</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tenix, Henderson, WA</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ASC, Osborne, SA</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>ADI, Garden Island, NSW</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Forgacs, Newcastle operations, NSW</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Forgacs, Cairncross, QLD</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>


The information in this Table is revealing in that it illustrates DMO’s belief (in 2002 at least) that only Tenix has the capability to consolidate and upgrade major surface combatants (at its Williamstown facility), while ASC is the only player with the capability to consolidate and upgrade submarines.

Clearly no South Australian shipyard currently has the capability to consolidate major surface warships. On this basis, it seems somewhat bizarre that of the three Australian bids to build the AWDs, two are from South Australia. If either of these were to win the bid, virtually an entirely new facility would need to be created at public expense. The capital expenditure required to upgrade the Williamstown yard to build these large ships would only be around half this sum.

Importantly, however, it needs to be understood that building a shiny new shipyard does not of itself create capability. Capability is embodied to a large degree in the
skills of the workforce and, as with any advanced manufacturing industry making a complex final product, the existence of an efficient supply chain. The skills of the workforce in Williamstown come in large part from the experience in building surface combatants. Knowledge is gained about numerous mundane practices, such as the most efficient placement of pipes under the deck and the best way of installing cables behind the bulkhead. The number of labour hours needed to build each ship has fallen by one-third over the course of the ANZAC project. A significant part of this learning can be drawn upon in constructing other surface warships like the AWDs. Capability is also embodied in a close relationship between the shipyard and major suppliers, with propinquity an important factor. The overwhelming majority of suppliers to Tenix at Williamstown are based in Melbourne.

The need to recruit a new workforce and reconfigure this supply chain for an Adelaide operation would involve significant costs and risks.

The issue of complexity has also somehow become intertwined with the discussion of relative capability. While the Collins submarines are complex, the upgraded ANZACs are also complex ships and, unlike ASC, Tenix has always been deeply involved in the design and installation of the combat system. Besides, submarines are very different beasts to surface warships and their complexity is based on the need to guarantee the integrity of a pressure hull, on sonar sensors rather than radar and on big electric motors. The ability to build a submarine says nothing about a shipyard’s capacity to build complex surface warships.

Turning to the industry going forward, three key issues will determine the future capability and structure of Australia’s naval shipbuilding industry:

1. the future trade-off between sustaining capability and the relative cost of local procurement;
2. whether or not Defence maintains the principle of competitive tendering; and
3. the identity of the successful tenderers for the AWDs and the LHDs.

In relation to the first issue, the relative costs of local procurement are likely to be higher for the next two large acquisitions because we will be purchasing smaller numbers of ships. Scale and learning benefits may be commensurately reduced. DMO will need to assess carefully the appropriate balance between the additional costs of local procurement and the benefits in terms of capability. One option, for example, is to have the large steel hulls for the LHDs built overseas and fitted out in Australia.

The second issue relates to whether the government should engineer a rationalisation of the industry so that only one major supplier (or major shipyard location) remains. This proposal was put forward in a strategic plan for the industry released by DMO in 2002, but that report was subject to widespread criticism and has not been endorsed by the government. There is a clear case for the alternative view, namely that the market should be allowed to determine the future structure of the industry in response to the level and composition of government demand.

The third issue, namely the identity of the shipyards that win the AWD and LHD contracts, will clearly be the dominant factor in determining the future structure of the industry. Because of the risks involved in any approach that required the re-
location of important industry capabilities, it could also have a critical impact on the future competitiveness of the industry.

Finally, three scenarios for the future of the industry are developed in the report. One factor is kept constant: it is assumed that the hulls for the LHDs are fabricated overseas and they are then fitted out in Western Australia by the Austal/Raytheon consortium. The variable factor is the successful tenderer for consolidating the AWDs which is respectively:

- Scenario 1: Tenix at Williamstown;
- Scenario 2: Tenix at Osborne; and
- Scenario 3: ASC at Osborne.

Under the first scenario, the two projects generate a major national workload. In particular, the States of Victoria, South Australia and Western Australia are allowed to play to their competitive strengths. While Tenix consolidates the AWDs at Williamstown, there is a considerable workload in building modules in South Australia and in NSW, while ASC also continues to benefit from its major submarine through life support program over twenty years. Western Australia’s opportunity reflects the fact that Austal has emerged as an innovative and competitive player in the global industry.

Under the other two scenarios, there would be no balanced national workload. Naval shipbuilding would die in Victoria and be consolidated in South Australia and Western Australia, two States with a relatively thin labour market. It seems likely that the future capability of the industry would be subject to a substantial risk.

**Conclusions**

A major government objective in providing a defence workload to the naval shipbuilding industry in the future should be to build on the considerable investment made in capability since the 1980s. Capability is much more than just the physical infrastructure established at locations such as Williamstown, Osborne and Henderson. Most importantly, capability is embodied in the industry’s intangible infrastructure in the workforce and relationships with suppliers, as well as the ability to train and educate people with the requisite skills to sustain the industry out to 2020 and beyond.

The analysis of the international naval shipbuilding industry contained in this report gives rise to three major conclusions:

- Specialisation in shipyards appears to be an increasingly important means of reducing risks. There are no apparent benefits, in terms of economies of scale or scope, in co-locating submarine and surface warship construction.
- While rationalisation is a feature of the global industry, no country is contemplating closing down an existing successful shipyard and attempting to re-create the capability in a new facility elsewhere.
- The experience of the UK Government and BAE Systems suggests that rationalising the industry down to one effective supplier can bring about a dysfunctional and sub-optimal relationship between purchaser and provider.
Australia has two distinct centres of excellence in naval shipbuilding (with another one, in the Australian Marine Complex at Henderson, emerging strongly). Tenix’s shipyard at Williamstown has a record in significant surface warship construction that would be envied by many competitors around the world. At the same time, the ASC at Osborne has a capability in conventional submarine construction and support that is probably unrivalled outside Europe. The analysis provided in this report suggests that a sufficient workload exists in the future to build on the capability that has already been established in and around these centres of excellence.

The Government is now faced with a strategic choice that will determine the future structure and competitiveness of the naval shipbuilding industry in Australia. Provided its bid is competitive, a market-driven outcome would see Tenix winning the tender to consolidate the AWDs at Williamstown. Beyond the benefits of building on the established capability at Williamstown, however, this will be a national project with a workload that will need to take advantage of the skills and capabilities that exist all over Australia. A modular build program will be required, for example, with modules for the ships being constructed at least in South Australia and NSW. In particular, there could be a substantial workload for South Australia, not just in terms of building modules for the ships but undertaking high value work at the ‘smart end’ of systems. This would be in addition to the $3.5 billion contract for the through-life support of the Collins class submarines that has already been won by the ASC at Osborne.

If the Commonwealth chooses the alternative path, however, it would follow a government planning approach that would pick a new ‘winner’ and see all major naval shipbuilding located in South Australia. Writing off the investment in surface combatant capability that is well-established at Williamstown and trying to re-establish the capability elsewhere would require substantially higher capital costs. It would also constitute a major and quite unjustified risk because of the need to recruit a new skilled workforce in a relatively shallow labour market that already is required to supply skilled workers to ASC’s submarine operation. Other risks would occur as a result of inevitable disruptions to Tenix’s well-established supply chain for producing surface warships. The vast majority of participants in this supply chain are located in the Greater Melbourne area.

The first scenario is by far the most prospective in terms of sustaining a competitive and capable naval shipbuilding industry into the 2020s and beyond. Consolidating the industry in South Australia, on the other hand, would give rise to substantial risks to the industry’s future that cannot be justified in terms of any offsetting benefit.
Chapter 1

Introduction

This is the second of two reports by The Allen Consulting Group for the Government of Victoria on naval shipbuilding. The first report, Building the Air Warfare Destroyers: How does Williamstown Rate?, was published in February 2005. This report focuses on the longer-term issues and strategic choices now confronting policy makers as they approach decisions that will have a far-reaching effect on the future of naval shipbuilding in Australia. The potential impact of these choices is illustrated by the development of three scenarios.

1.1 Background

In the period since the arrival of the First Fleet, it is difficult to think of any nation to compare with Australia in terms of the strength of its reliance on the sea. Despite being defended by the ‘sure shield’ of the Royal Navy in the nineteenth century, individual Australian colonies were nevertheless aware of the importance of maritime links to the rest of the world and went to considerable lengths and expense to protect them. In the 1870s Victoria, for example, purchased a state-of-the-art iron battleship, HMVS Cerberus. In the years leading up to the First World War, Australia was one of the first nations in the world to acquire a dreadnought capital ship, the battleship HMAS Australia.

Since Federation, the Royal Australian Navy (RAN) has played a key role in the defence of Australia and the current strategic posture suggests it will continue to do so. Given our distance from potential suppliers and repairers of warships, an important element in the credibility of Australia’s defence posture is the ability of Australian industry to maintain military assets in a state of operational readiness. This strategic imperative has recently been articulated in terms of the defence policy objective of self-reliance.

Since the mid-1980s, there has been a renaissance in naval shipbuilding in Australia. Two projects — the ANZAC frigates and the Collins class submarines — have been worth over $12 billion at current prices over the last two decades. As a consequence, the naval shipbuilding industry is dominated by two companies. First, Tenix has developed a strong and internationally competitive position in building substantial and complex surface combatants at Williamstown and has been successful in the highly competitive export markets for warships. Secondly, the Australian Submarine Corporation (ASC) has delivered a sophisticated class of conventional submarines, for which the Royal Australian Navy (RAN) now has parent navy responsibilities.

Australian industry has also developed important capabilities in other areas of naval shipbuilding. The presence in Australia of a number of subsidiaries of global defence electronics players has helped to develop capability in defence systems. In parallel with similar successes in the automotive sector, Australian shipbuilders have demonstrated important creative skills in ship design and naval architecture. In addition, two successful players in the global fast ferry industry, Austal and Incat, have adopted innovative commercial designs to the requirements of the US Navy. They are now poised for success in what is not only the largest warship
market in the world but also one in which non-US players will only succeed if they can bring to the table a highly innovative product or service.

The development of Tenix and ASC in particular has been driven by major defence contracts dating back to the 1980s. The changed philosophy that led to this local procurement policy was not based on a naive desire to promote local industry and jobs. Instead it was directed towards developing Australian industry capability in pursuit of the defence objective of self-reliance. The logic was that if local procurement required the acceptance of only a small cost premium, this was worth paying if in return local industry developed the capability to maintain and repair the increasingly complex platforms and systems that comprise Australia’s naval assets.

Importantly, the philosophy was also implemented by a market driven approach, with non-government players bidding for major contracts in a highly competitive situation and the private sector accepting part of the substantial risks of these projects. Despite the problems with building the Collins class submarines, which are now being progressively rectified, the government’s approach must be judged a success. As far as can be judged, the local procurement programs have not resulted in substantial cost premiums. In return, the industry has developed a high level of capability and two players in particular, Tenix and Austal, have shown an ability to compete in global markets. Competition in the industry has generally produced good results: where the invisible hand of market forces has been free to direct the traffic, the result has generally been to deliver the performance sought by Defence.

Another way of looking at the situation is to suggest that the Australian community has made a major investment in capability development in sustaining both surface and sub-surface naval combatants in the last two decades. The result of that significant capital expenditure has been the development of an important defence capability asset. It is important to note that this capability is not readily transportable, but much of it resides in the workforce at a particular shipyard and the network of sub-contractors that have been developed over time to supply it.

1.2 Purpose of this report

Quo vadis is the major question for the industry at this time — how will this investment in Australian industry capability be sustained in the future? The major programs of the 1980s are coming to an end, with the Collins class submarine build program now complete and the last ANZAC frigate to be delivered in 2006. Although the value of the future workload may be slightly lower, however, Defence needs are set to remain a major driver of construction and repair activities in Australian shipyards. The 2004 Defence Capability Plan confirms a range of military platforms, systems and support services that will be required over the coming decade — at an estimated cost of around $50 billion. Contracts for enhanced and replacement naval capacity in this period are estimated at between $8 billion and $11 billion. As noted by Defence:

The majority of proposals are expected to include substantial Australian content during both the acquisition and through-life support stages of a proposal’s life cycle, in support of Australia’s self-reliance objectives.

The two major forthcoming programs are the three air warfare destroyers, worth up to $6 billion, and two Landing Ships, Helicopter Dock (LHD) with a likely cost of over $3 billion.

As it contemplates future naval programs, the naval shipbuilding industry is at a crossroads. Will government allow competitive forces to continue to determine the structure of the industry or will it succumb to a temptation to try to engineer a particular industry composition that it believes will best meet its needs? Will the government be able to separate its role as the purchaser of naval shipbuilding services from its position as the owner and soon-to-be seller of one of the competing shipbuilding firms? The government is in a difficult position in this respect. Indeed, one commentator suggests:

> A perceived conflict of interest exists between the government’s desire to get the best price for their ASC sale and awarding the SEA 4000 contract to the most capable contractor...


Australian States and Territories can be expected to compete vigorously to attract as much of this planned future defence work as possible. The mix of capabilities within each State, encompassing issues of industry structure, experience, infrastructure and skills, will be critical in deciding where to base significant construction projects like the AWDs and the LHD ships. Both of these projects involve significant acquisition risk. The AWDs will be not only double the displacement of the _ANZAC_ frigates but also by far the most complex warships ever built in Australia in terms of their weapons fit and systems. The LHD ships will be about four times as large as the AWDs in terms of displacement and, if a ‘ski-jump’ configuration is adopted, will resemble pocket aircraft carriers with a substantial force projection capability. If the contracts are awarded according to inappropriate criteria, the risks of a blow-out of costs or delivery schedules on these projects will be increased. A major objective for the Commonwealth must be the ability to minimise the acquisition risk in these projects.

The focus for this study is how the Australian shipbuilding industry is likely to emerge from the current situation after the two major contracts (AWDs and LHD ships) have been let. The key question here is whether it is possible to continue to build on the existing capability while giving rise to outcomes that are in the national interest rather than favouring particular States.

### 1.3 Report structure

In order to examine the Australian industry in an international framework, the characteristics and skill dimensions of naval shipbuilding globally are described in Chapter 2. Modern warships are extremely complex systems that require extensive subcontractor input and highly specialised skills. This discussion explores overseas experience in shipbuilding logistics and highlights potential implications for Australia’s AWD construction effort and other naval shipbuilding activities. The industry in many overseas countries has been subject to rationalisation in the last decade or so as a consequence of lower defence expenditures after the end of the Cold War. This has occurred in a period when the Australian industry was heading in the opposite direction, but nevertheless there are some useful lessons here for Australian policy makers.

The structure of the current naval shipbuilding industry in Australia is examined in Chapter 3, together with a brief history of the industry and the distribution and
capability set of Australia’s shipbuilders. The discussion focuses on Australian shipbuilders’ track record in naval construction and the infrastructure that is available to undertake the shipbuilding projects proposed over the coming decade under the Defence Capability Plan.

These issues are brought together in Chapter 4, in which the future of the Australian naval shipbuilding industry is discussed. Three key factors will have the major influence on the industry’s future development, namely DMO’s future capability requirements, whether or not a competitive tendering framework is retained and the identity of the winners of the AWD and LHD ships contracts.

Finally, the implications of this analysis are brought together in Chapter 5, which proposes three scenarios for the future development of the industry. Under the first scenario, the industry is able to build on its current capability and the outcome is that workload is shared on a national basis according to the capabilities of the industry in the various States. Under the other two scenarios, significant capability is written off in Victoria and NSW and the critical mass of the industry shifts to South Australia and Western Australia.
Chapter 2

Naval shipbuilding: global developments

Globally, the naval shipbuilding industry is characterised by a very high degree of government intervention and substantial barriers to international trade in warships. Governments commonly take ‘national interest’ issues into account when awarding naval shipbuilding contracts. For reasons such as national security, prestige, job creation, technology transfer and a desire to build and sustain specialised on-shore competencies, national governments can be prepared to pay a premium for local production of their warships. Australia is no different from many other nations in this regard.

Shipbuilding is a challenging exercise in design, engineering and logistics. This is particularly the case with ‘first of class’ ships, which can often present new and complex challenges and require the shipbuilder to ascend a steep (and frequently slippery) learning curve. As with research and development activity, the knowledge that a ship of a particular configuration has been built before can help reduce some of the perceived risk of a major construction project for a new builder. However, for a project such as the AWDs the challenges can be extensive — particularly as builders work to combine the systems and features specified by the Navy.

These challenges have led to a staged and highly specialised approach to ship construction — designed to minimise the risks and costs involved in moving from a set of specifications to a fully functional and effective warship. The pattern of warship production techniques that has emerged over time can provide insight to the arrangements that have been found most effective at ensuring successful and on-budget warship delivery.

2.1 Trends in warship construction

Warship production is a specialised activity and a limited number of nations have demonstrated a capacity to build complex front line vessels such as aircraft carriers, cruisers, destroyers and submarines which integrate elaborate communications, detection, defensive and attack systems. While leading naval shipbuilding companies can deliver across the full spectrum of warship design requirements, it is less common for individual shipyards to produce across a wide range of vessels. Different warships present different engineering challenges and, as their specifications become more ambitious, can be seen as increasingly distinct technologies.

Overseas experience suggests a significant specialisation in warship construction, and a likelihood that this trend will continue. Building complex warships is a high stakes game and risk management objectives have tended to see a growing consolidation of expertise and experience. Another factor leading to increased specialisation and rationalisation in the global naval shipbuilding industry has been the end of the Cold War and a significant reduction in expenditure on armaments.

The ability to stretch existing experience and skill sets, and the point at which the differences between ships on the drawing board become more important than their commonalities from a construction perspective, are key issues for the Australian Defence Department in assessing the relative capability of Australian contractors to
deliver the non-Aegis elements of the SEA 4000 AWD project. They are also relevant to longer term strategic considerations related to building and maintaining capacity to service Navy construction and repair needs into the future.

The following discussion focuses on shipbuilding in Europe and the US. Little information is available about naval shipbuilding in Asia.

**Europe**

Europe has a number of naval shipbuilders, spanning a broad capability set. As is common in the naval sector, many nations strive to maintain a domestic construction capability — exhibited in a strong overlap in capacity (and consequent problems of under-utilisation) in naval shipbuilding.

An overview of Europe’s naval shipbuilders is provided in Table 2.1.

**Table 2.1**

**EUROPEAN NAVAL SHIPBUILDERS AND CURRENT PROJECTS**

<table>
<thead>
<tr>
<th>Country</th>
<th>Major Company</th>
<th>Types of Warship</th>
</tr>
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<tbody>
<tr>
<td>Denmark</td>
<td>Danyard Aalborg</td>
<td>destroyers/ frigates; patrol vessels</td>
</tr>
<tr>
<td>France</td>
<td>DCN (11,000 employees)</td>
<td>aircraft carriers; nuclear submarines; conventional submarines; destroyers/ frigates</td>
</tr>
<tr>
<td>Germany</td>
<td>HDW (submarines: 3,435 employees); ThyssenKrupp (Blohm + Voss: frigates)</td>
<td>conventional submarines; destroyers/ frigates; patrol vessels</td>
</tr>
<tr>
<td>Greece</td>
<td>Hellenic Shipyards</td>
<td>destroyers/ frigates; patrol vessels</td>
</tr>
<tr>
<td>Italy</td>
<td>Fincantieri (10,000 employees)</td>
<td>aircraft carriers; destroyers/ frigates</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Damen Shipyards (Royal Schelde); RDM (submarines)</td>
<td>conventional submarines; destroyers/ frigates</td>
</tr>
<tr>
<td>Norway</td>
<td>Mjellem &amp; Karlsen</td>
<td>destroyers/ frigates</td>
</tr>
<tr>
<td>Portugal</td>
<td>ENVC</td>
<td>patrol vessels</td>
</tr>
<tr>
<td>Spain</td>
<td>IZAR</td>
<td>aircraft carriers; destroyers/ frigates</td>
</tr>
<tr>
<td>Sweden</td>
<td>Kockums (now part of ThyssenKrupp)</td>
<td>conventional submarines; patrol vessels</td>
</tr>
<tr>
<td>UK</td>
<td>BAE; Vosper Thornycroft</td>
<td>aircraft carriers; nuclear submarines; conventional submarines; destroyers/ frigates; patrol vessels</td>
</tr>
</tbody>
</table>

NB: ‘Patrol vessels’ includes corvettes and mine warfare vessels.


The information in this Table suggests some degree of excess capacity. According to the Centre for Defence Economics at the University of York:

Duplication is immediately apparent, with many countries and yards involved in the design and build of destroyers and frigates (9 countries), small warships (6 countries) and conventional submarines (5 countries). Elsewhere on large warships, there are four countries with an aircraft carrier capability, each requiring one to two units for their navies. Similarly,
Sustaining a wide range of naval shipbuilding skills has presented some significant challenges. In the UK, for example, naval shipyards are experiencing continuing pressures for rationalisation, as suppliers compete for a declining number of naval contracts. Shipyards operate in an environment where the Ministry of Defence seeks competitive bids for projects with the objective of minimising costs, but also has the objective of keeping a range of skill sets and capability alive in a market where supply outstrips demand, outputs are commonly valued in tens and hundreds of millions of dollars, and production can take several years, with a maintenance and upgrade requirement stretching over decades.

The dilemma facing navy planners is how best to maintain access to skills and experience that they do not need now — but may wish to access in several years time. For naval shipbuilders, the challenge is to ensure sufficient business and cash flow to maintain operations and deal with the risks and uncertainties of lumpy and technically challenging projects, let periodically by a single purchaser with complete dominance in the local market. Shipyards in this situation with limited prospects for export orders — because of cost disadvantage or the local industry preferment policies of foreign defence purchasers — are essentially creatures of government, and rely on governments to plan for their maintenance, if the skills they embody are to be retained.

This tension is highlighted in an address to a recent UK shipbuilding conference by the Managing Director of BAE Systems’ naval shipbuilding arm:

> It is important to recognise that Industry's capacity and capability is not static. It only exists if it is being used. The ability to deliver naval programmes in the future depends on achieving continuity in the workload between now and then. It is probably too late to protect all of the existing UK capability and further rationalisation and downsizing seems inevitable in the coming months and years. But with today's much lower employment levels, short-term issues of critical mass come into play. Deciding what key skills it is right to retain and developing appropriate solutions is perhaps the most important consideration in the short term.

> ... Competition has played an important part in driving out waste and inefficiency. It forced the pace of rationalisation and reorganisation of the industry over the past 20 or so years. Indeed, what remains of UK industry is reasonably efficient - but it is now quite fragile and needs stability. Developing an industrial strategy gives us the opportunity to complement efficiency with effectiveness.


The challenge of achieving an appropriate balance between, on the one hand, the use of competition as a tool for driving innovation and cost minimisation and, on the other, a desire to share work among competitors in order to sustain and grow naval shipbuilding and repair capability, is an increasing policy theme in the UK. It has recently come to the fore in the context of tendering and work allocation arrangements for the new Type-45 destroyers (comparable in many respects to Australia’s AWD program).

For the Type-45 destroyers project, the UK Ministry of Defence (MoD) has explicitly sought to distribute construction work across shipyards. In July 2000 the MoD announced its plan to share construction of the destroyers across rival
suppliers, with BAE Systems Marine to build two Type-45s and Vosper Thornycroft to build one — with the potential for an additional nine Type-45s to be ordered in the future. While the range and complexity of the systems inherent in warship construction would generally see a significant degree of shipyard interaction and subcontractor involvement, the UK MoD involvement was notable for its prescriptive approach to work allocation. MoD also dismissed an unsolicited BAE Systems Marine tender to operate as prime contractor for all of the Type-45 construction program.

After a review of the economics and risks of this approach, however, it was subsequently decided to split the project on a modular basis, with the intention that both BAE Systems Marine and Vosper Thornycroft should be able to compete for production and assembly of future Type-45 modules, produced in a range of shipyards. According to consultancy advice from RAND delivered to MoD, the cost increase associated with splitting the project across shipyards on a ‘whole of ship’ basis would be in the range of 10 to 13 per cent, and about five per cent in the case of a modular split that allowed for greater learning and specialisation.

According to a UK Parliamentary report:

Informed by the RAND analysis, the MoD decided to allocate the Type-45’s six ‘blocks’ between the two shipyards, with the same blocks for each ship to be allocated to specific shipyards. Vosper Thornycroft will build virtually all the ship forward of the bridge (two blocks), as well as both masts, the funnel and the upper works. The BAE Systems Marine Barrow shipyard will build the engine rooms (two blocks) and, after Ship-One, will assemble the ships. And BAE Systems Marine's Clyde yard will make the stern and the operations room (each a separate block), as well as assembling Ship-One.

Select Committee on Defence - Fourth Report (2002), Warship Building Strategies, UK Parliament, para. 15

The increased costs in a modular build identified by Rand result from a loss of scale and learning economies. On the other hand, in a small economy like Australia’s these losses are likely to be more than offset by the benefits of being able to mobilise the resources of a number of shipyards. A modular approach makes it possible to build the ships to an accelerated schedule that would be impossible in a single Australian shipyard.

In the case of the Type-45, however, the modular build program and, indeed the option of single shipyard construction, needs to be viewed in the context of yard capacities available in the UK. The Barrow-in-Furness shipyard is one of the largest in the UK, employing 4,500 people on a 68-hectare site. At Barrow, BAE Systems operates a 24,300 tonne shiplift, a 270 metre x 100 metre super berth and a 142 metre dock hall. This is complemented by 2 large shipyards operated by BAE Systems in Glasgow (on the Clyde). Vosper Thornycroft’s operations are based in Portsmouth. They are moving to a 33-acre site in Portsmouth Naval Base, allowing construction of a new 130 metre ship assembly hall (to be extended to 200m in the future) and a 170 metre steelwork production hall. It is not clear whether this course of action has been chosen as a means of addressing the monopoly power of BAE Systems.

In addition, the UK naval construction sector is undergoing further reorganisation. In 2003, BAE Systems announced its plan to shift Type-45 destroyer work out of
its Barrow yard and focus it solely in its Clyde operations — as a means of optimising the development of its Astute class submarine and Type-45 destroyer projects, and downsizing its Barrow workforce. According to BAE Systems:

In view of the changes which have been necessary on the Astute programme, and to ensure the success of both Type 45 and Astute, the company has concluded that it must consolidate work on the Type 45 Destroyer build programme into the BAE SYSTEMS yards on the Clyde. … This move will ensure that the Astute and Type 45 programmes receive the appropriate intense focus. Both will benefit from having the build programme co-located with the principal design activity through the design teams in Barrow and on the Clyde, respectively, the latter being staffed jointly by BAE SYSTEMS and Vosper Thornycroft Marine.

… The consolidation of the Type-45 Destroyer build programme to the Clyde will help [the Barrow shipyard and Astute team in Farnborough] to focus all their efforts onto Astute and thereby de-risk that programme; and will similarly help to de-risk Type 45 and further ensure the success of this excellent programme.


This move by BAE Systems provides another significant piece of evidence in support of the view that there are virtually no synergistic benefits to be gained from co-locating the consolidation of major surface combatants and submarines. In fact, the available evidence suggests that those players large enough to operate more than one site see benefits in separating their submarine and surface ship operations.

Britain is also planning to build two large aircraft carriers of over 50,000 tonnes displacement, the largest ships ever built for the Royal Navy. The UK government’s reservations about the benefits of having one dominant supplier were shown by the announcement in January 2003 that the contract to build the two carriers will go to both BAE Systems and Thales, with BAE Systems the lead partner. BAE Systems will be the prime contractor with responsibility for project and shipbuilding management whilst Thales UK will provide the whole ship design. Since that announcement, however, the government has proposed that the US company Halliburton play a major role in overseeing the project.

**United States**

Naval shipbuilding in the USA is dominated by two major defence contractors — General Dynamics and Northrop Grumman. Between them, these companies operate the USA’s largest shipyards (known as the ‘big six’) and attract nearly all of the US Navy’s shipbuilding and conversion expenditure.

The ‘big six’ comprises the following shipyards.

**Newport News (Virginia – Northrop Grumman)**

This is one of the largest shipyards in the Western Hemisphere in terms of construction capacity. It occupies a 550-acre site and specialises in nuclear powered vessels, though it has the capability to build and service the full range of US naval requirements. It is the only yard capable of building nuclear aircraft carriers, and one of only two yards licensed to build nuclear submarines.2

**Electric Boat (Connecticut – General Dynamics)**

This yard has focused exclusively on submarine construction since the Second World War and holds a license to build nuclear submarines for the US navy. It

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2 Thompson, L.B. (1999), *US Shipbuilders: The Tide Begins to Turn*, The Lexington Institute, Washington DC.
currently employees around 7,500 people and is engaged in design and construction of the new attack submarine (NSSN), and delivery of the *Seawolf* attack submarine.

**Bath Iron Works (Maine – General Dynamics)**

Bath Iron Works is the lead designer and co-producer of the Aegis-equipped *Arleigh Burke* (DDG-51) class destroyers in the US, and has built more naval surface combatants than any other US shipyard. It also holds contracts to build the *San Antonio* class dock landing ships (LPD-17) for the US Navy and participates in development of the new DD(X) class destroyer, incorporating advanced stealth technologies.

**Ingalls Operations (Mississippi – Northrop Grumman)**

Ingalls is the sole builder of the *Wasp* class of large-deck multipurpose amphibious assault ships (LHD-1) for the US Navy and Marine Corps. Ingalls Operations also builds the *Arleigh Burke* guided missile destroyers and is lead design agent for the DD(X) multi-mission surface combatant. It also currently holds contracts in a far-ranging modernization of the United States Coast Guard's deepwater assets. It occupies a 650-acre site on the Pascagoula River, and is widely perceived as the most advanced conventional shipbuilding facility in the United States.

**Avondale Operations (Louisiana – Northrop Grumman)**

Avondale occupies 268 acres on the Mississippi River and employees more than 6000 personnel. Avondale is the prime contractor to design and build 12 *San Antonio* (LPD-17) class amphibious assault ships. The first LPD-17 ship is already under construction and the company has been awarded an advanced procurement contract for the fifth and sixth ships in the program, LPD-21 and 22. Avondale was the lead designer and builder of LSD-41 and LSD-CV amphibious assault ships, as well as minehunters, destroyer escort ships, and the *Charles F. Adams* (DDG-18) class guided missile destroyers. It also maintains a significant commercial shipbuilding orientation, producing a range of vessels from tugboats to oil tankers chiefly for the domestic market.

**National Steel and Shipbuilding Company (NASSCO, California – General Dynamics)**

NASSCO specialises in the design and construction of auxiliary and support ships for the US Navy and oil tankers and dry cargo carriers for the commercial shipping market. Located in San Diego, it is the largest shipyard on the United States west coast, employing over 4000 people.

The configuration and workload of the major US shipyards has suggested a trend of increasing specialisation. Both the two main players, General Dynamics and Northrop Grumman, have separated their submarine operations from surface warship construction, and have had the objective of reducing the number of different kinds of vessel produced in their shipyards. An indication of the benefits of specialisation is provided in Figure 2.1 below. As the product mix in the Ingalls yard has been reduced since the early 1990s, productivity has clearly increased.

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Figure 2.1

**PRODUCTIVITY VS PRODUCT MIX COMPLEXITY AT INGALLS SHIPBUILDING**

![Graph showing productivity vs product mix complexity at Ingalls Shipbuilding.](image)


The main lesson from the US industry, however, is the very large role that economies of scale play in shipbuilding, and the significant resource and experience requirements typically required to design and construct a complex modern warship.

### 2.2 Trends in system and skills specialisation

Trends in warship construction exhibit a steady increase in the cost and level of complexity of modern vessels. Advances in defence technology are ongoing, and a small improvement in weapons, sensor or defensive systems can confer a decisive advantage in a warfighting situation. Also, economic factors have tended to result in a scale down in shipbuilding facilities (in all but the largest navies) resulting in the need to share work associated with very large and infrequent projects.

The UK’s experience in planning to build the Type-45 destroyers and two new aircraft carriers in domestic shipyards is instructive:

… there will still be challenges for building a 50,000 tonne carrier in the UK for the first time in half a century. Shipyard capacity is such now that the Future Carrier cannot be built at one location. The Type-45 programme, however, is providing a model for its construction. Shipyards will have to cooperate to build modules in different locations and then assemble them elsewhere. RAND highlighted how the ‘hook-up’ of the blocks will be a greater challenge with the Future Carrier than with the Type-45, and in that light CDP [the Chief of Defence Procurement] saw the experience with the Type-45 and the Alternative Landing Ship Logistic (ALSL) as particularly valuable. The ALSL is being constructed on the Clyde to a Swan Hunter design, and that requires co-operation between two yards ‘who do not instinctively cooperate—this is practising at it’. Sir Robert saw in these developments the beginning of a ‘network’ of shipyards that could co-operate to build ships.

Analysis from the US also highlights the significant costs involved in developing new ships. Even for production of a single class of vessel, lead times are such that new technologies are specified prior to completion or construction and input costs might change.

As highlighted by naval engineers Laverghetta and Brown:

Navy ships are bought in small quantities, have very long development cycles, and are extremely costly… precluding the ‘fly before you buy’ approaches required for purchase of other weapon systems. The typical duration for combatant ship design can exceed 12 years and official DOD timelines (satisfying all program requirements) can exceed 22 years (Ryan and Jons, 1991). Over such an extended period, it is difficult to assess how a specific process improvement will respond to fluctuating funding, political and organizational transitions, and changing military threats. Thus, the lessons learned from process improvements within programs such as DD-21, NSSN or LPD-17 may be neither fully recognized for years nor transferable to future programs due to long term changes in the socio-political environment.


Learning economies are widely recognised within the shipbuilding industry, but these also interplay with factors that put upward pressure on costs within the shipyard, such as changes in specification, reliability of supply, and labour issues. These elements can be particular sources of risk to budgets and timetables when a new and complex construction project is being undertaken. Even for experienced US shipyards, some of the US Navy build requirements can be daunting. Thompson (1999) points out that the Virginia class New Attack Submarine (NSSN) — the first of which was commissioned in October 2004, five years after the keel laying ceremony — has nine time as many individual parts as a Boeing 777 wide bodied airliner and requires over 14 times the digital disk space (145
gigabytes) to store its design. These factors are evident in the cost trend for a range of US warships (see Figure 2.2).

Recent US Navy purchase reforms are aimed at reducing pressure on costs through an emphasis on outsourcing, simplified specification and a more holistic approach to ship design requirements and management. A set of Acquisition Reform Initiatives was announced in 2000 by the Secretary of the Navy as a cornerstone for future naval ship projects:

- general performance statements that replace or streamline the highly detailed Military Specifications (‘MILSPECs’) of the past.
- Commercial-Off-The-Shelf (‘COTS’) technologies and systems that replace service-unique equipment.
- ‘Total Ship Engineering’ approaches that address the design, engineering, and construction of new ships as an integrated ‘system-of-systems’ facilitated by advanced modular construction techniques.
- introduction of ‘Full-Service Contracting’ that promises far-reaching changes in program management structures, organizations, processes, and relationships.
- ‘Total Ownership Costs’ and ‘Best Business Practices’ that shape research and development, acquisition, and life cycle strategies, plans, and programs.

This is particularly the case for combatants. Even when it is feasible for a single shipyard to handle the modular construction and assembly of a warship, a large component of the total cost of the ship is absorbed by materials and systems. The UK MoD has estimated that purchase of materials and systems could typically represent 50 to 70 per cent of unit production costs for a warship (see Figure 2.3).

Figure 2.3

ESTIMATED CONSTRUCTION COST SHARES: TYPE 23 FRIGATE


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6 Thompson L.B. op. cit., p.3.
Given the rapid change in military technology, the share of system costs could be expected to have escalated further in the last decade. Systems integration also requires close liaison between contractors and suppliers in ship construction. In addition to the wide range of outsourced components that need to be assembled in constructing the ship, the technological requirements of warships are such that specialised ‘system integrators’ are also a key requirement of a significant construction project.

Australia’s AWDs are likely to have more complex systems than a British Type-23 frigate, where, as shown in Figure 2.3, the combat system accounts for 40 per cent of the total cost. The myriad of complex systems that need to be integrated into a US Arleigh Burke class destroyer is illustrated in Box 2.1. These systems must not only be installed and operate within the envelope of the ship, but must also be made interoperable — effectively communicating with and reacting to new information and situation priorities.

Box 2.1

**UNIFIED SYSTEMS OF THE US ARLEIGH BURKE (DDG-51) CLASS DESTROYER**

The Arleigh Burke (DDG-51) class of multi-mission, guided missile, and battle force capable destroyers form the core of the Navy’s surface combatant force for the 1990s and beyond. These ships are designed for forward presence and are capable of precision engagement of targets ashore and full-dimensional protection of joint and allied forces operating at sea and in the littorals. Planned upgrades to the AEGIS Weapon System and Standard Missile will give DDG-51 a ballistic missile defence capability. DDG-51’s armament includes a mix of 90 missiles to support its missions, housed in two MK-41 vertical launch systems. The ship uses a computer controlled machinery control system and an up-rated LM 2500 gas turbine propulsion system to provide a maximum speed of at least 30 knots.

The AEGIS Weapon System (AWS), which includes the SPY-1D radar and vertically launched SM-2 surface-to-air missiles, provides DDG-51’s area defence anti-air warfare capability. For ASW, DDG-51 uses the SQQ-89 surface ASW combat system, the LAMPS MK III ASW helicopter, over-the-side torpedoes, and vertically launched ASW standoff weapons. DDG-51 also employs TOMAHAWK and HARPOON missiles, and has a five-inch gun for anti-surface and strike warfare missions. The Phalanx close-in weapons system, along with the SM-2 missiles and gun, provides self-defence against anti-ship missiles. The DDG-51 AEGIS Combat System is the integration of the AWS, the SQQ-89, and the ship’s anti-surface, strike warfare and self-defence systems.

DDG-51s are being constructed in flights to incorporate technological advancements during construction. Flight II, authorized in FY92 with the first ship delivered in 1997, incorporates improvements to the SPY radar and communications systems and adds automatic electronic countermeasures. Flight IIA, authorized in FY94 with the first ship to be delivered in 2000, adds hangar facilities to accommodate two helicopters, deletes HARPOON, and replaces Phalanx with the Evolved Sea Sparrow Missile. FOT&E of a Flight IIA ship will occur in FY00-FY02.

The SPY-1D radar system is the multi-function, phased array, three-dimensional (range, altitude, and bearing) radar which conducts search, automatic detection, and tracking of air and surface targets. The SPY-1D also provides mid-course guidance for the SM-2 missile. SPY-1D is a variant of the SPY-1B radar system on later TICONDEROGA (CG-47) class cruisers, tailored for a destroyer-sized ship. The AN/SPY-1D(V), under development for installation in later Flight IIA ships, is an improved system with better performance against targets in clutter, additional moving target indicator wave forms, and greater ability to counter deceptive electronic attack measures.


Overseas experience suggests a high and growing degree of interdependence between participants in the naval shipbuilding industry. The technological
challenges require access to an increasing range of specialised skills and suppliers. This point has been emphasised by the Senior Vice President of General Dynamics in recent testimony to the Seapower subcommittee of the US Senate:

... we cannot overlook the fact that, despite the best efforts of industry and the Navy, the risks of construction cost growth and schedule delays are an inherent part of building complex warships in a constrained budget environment. Repercussions from one mis-step are felt by all. If a problem evolves with any one program, all members on this panel share the burden of recovery. The staunch ‘stand alone’ mentality that had driven the industry since World War II has evolved to a business environment of shared resources and innovation. Further, the ‘winner take all’ approach has given way to teaming and alliances which integrate the strengths of all of us at the table. One success story on this front is the National Shipbuilding Research Program, NSRP, formerly known as Maritech. NSRP provides a key forum for members of our community, both public and private, to share manufacturing and technology advances. Improvements have a direct impact on the capability, affordability and producibility of naval platforms. Benefits from this program are already being realized by several member shipyards.

John K. Welch, Testimony to the Seapower Subcommittee of Senate Armed Services Committee, April 4, 2001

Welch goes on to emphasise the critical difficulties General Dynamics faces in ensuring it sustains its surface combatant skill set in the face of declining government orders for new destroyers:

Non-DDG-51 shipbuilding work, such as the LPD-17 program, can help from an overall shipyard volume and employment perspective, but sustained surface combatant construction and related engineering work is the only way to ensure that the surface combatant industrial base is adequately maintained and future combatants are affordable.... An industrial base erosion and subsequent reconstitution will increase the costs of remaining DDG-51 ships and add to the costs and risks to the start up of the DD-21 construction program.

While the DD-21 program has now been absorbed by the new DD(X) program aimed at development of a next generation stealth technology destroyer, the issues remain relevant to government consideration of shipyard workload and contract placement. The US model suggests that high-risk projects are increasingly encouraging cooperation among defence contractors and the formation of alliances between shipbuilders and systems integrators. Under the DD(X) contract, for example, Ingalls (Northrop Grumman) was selected as lead design agent with Raytheon Systems Company as systems integrator. But the Ingalls proposal also includes Bath Iron Works as a subcontractor for design and test activities. Other major subcontractors include Lockheed Martin, United Defense Limited Partnership (UDLP) and Boeing.

2.3 Implications for Australian industry

These issues, developments and approaches from overseas are worthy of consideration in the context of forthcoming decisions on Australia’s naval shipbuilding program, and their ramifications for future budgets and sourcing capabilities. The main lessons from recent international experience are;

- Modern warships are extremely complex weapons systems. Acquisition of warships therefore involves increasingly high risks and governments need to adopt strategies to minimise these risks.

http://www.naval-technology.com/projects/dd21/
• One strategy to reduce risks is to purchase tried and tested systems where possible and to avoid the temptation to customise platforms with a ‘mix and match’ of different weapons and systems.

• Specialisation in shipyards appears to be an increasingly important means of reducing risks. There seem to be no benefits, in terms of economies of scale or scope, in co-locating submarine and surface warship construction.

• While rationalisation is a feature of the global industry, no country is contemplating closing down an existing successful shipyard and attempting to re-create the capability in a new facility elsewhere.

• The experience of the UK Government and BAE Systems suggests that rationalising the industry down to one effective supplier can bring about a dysfunctional and sub-optimal relationship between purchaser and provider.
Chapter 3

Australia’s naval shipbuilding industry

3.1 Australia’s warship building industry post World War II

While significant naval shipbuilding began only after the Second World War, Australian shipyards have had the capacity to maintain ships since the early colonial days. Government-owned shipyards at Cockatoo Island in Sydney and Williamstown in Melbourne were particularly active in ship repair in the Second World War, with many US naval units operating out of Australia and the British Pacific Fleet based in Sydney in 1944-45. The construction of substantial warships in Australia, however, did not commence until after 1945.

In the immediate post-war period, there was a significant policy change and the Navy’s warships, at least, up to the destroyer/frigate size, were mainly built in Australian yards. However, as the Australian Strategic Policy Institute (ASPI) notes, Australia’s experience in the construction of complex warships was not without its problems:

In the 1950s and 1960s a total of nine destroyers in two classes—the Daring and River classes—were built in the government-owned Williamstown and Cockatoo Island dockyards. The results were mediocre to put it mildly. The Daring class ships were delivered years late, and cost twice as much as the same class of ships built in Britain. The River class suffered three-fold cost escalation during the project. …. In between the DDGs and FFGs, during the early 1970’s, there was an unsuccessful attempt to design and build a light destroyer in Australia. It was abandoned in the planning stage because Defence proved unable to settle on specifications, which kept on expanding, and because costs estimates escalated alarmingly.


In the 1960s and ‘70s there were further changes of policy. First, the Menzies government commenced a move away from Australia’s traditional approach of acquiring defence equipment of British design. While six conventional Oberon class submarines were acquired from the UK (since the 1950s the USA has only produced nuclear submarines), Australian eyes turned increasingly to the United States as a source for military hardware. An associated change was that the government became disillusioned with local procurement because of the experience of significant cost and delivery penalties. Three Charles F. Adams guided missile destroyers were acquired ‘off-the-shelf’ from the US in the 1960s, followed by four Oliver Hazard Perry class guided missile frigates (FFGs) in the 1970s. Remarkably, in view of more recent approaches, the ADF required very little modification to the original designs for these ships.

This hiatus in the local procurement of warships, however, was relatively short lived. In the early 1980s it was decided to acquire two more FFGs but to build them in the government-owned shipyard at Williamstown. It soon became apparent that there had been, at best, no improvement in efficiency in the shipyard since the Daring class ships had been built. Industrial relations at Williamstown were very poor, characterised by defensive management, overmanning, rank absenteeism and appalling labour productivity. Until the shipyard was privatised, progress on the FFG project proceeded at a snail’s pace.
### Figure 3.1
DEFENCE SHIP CONSTRUCTION FOR AUSTRALIA SINCE WORLD WAR II

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**Source:** Australian Strategic Policy Institute (2002), Setting a Course for Australia’s Naval Shipbuilding and Repair Industry, ASPI, p.17

**Note:**
- Dates denote years from laid down to delivery to the Commonwealth. Timing of future build programs is based on Defence Capability Plan 2009-2019.
- "CV" class carriers were built in the US and transfered to Australia as for the "F." Pacific patrol boats were built by Pacific Island Nations.

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**Legend:**
- Built in Australia
- Built overseas
- Built locations not specified
This failure, together with the likelihood of two major new acquisition programs for the RAN, prompted another major change in warship procurement policy. This is described in the following section of the report.

The mix of domestic and foreign built naval vessels commissioned by Australia since the Second World War is shown in Figure 3.1.

3.2 Current policy framework: self-reliance and local construction

Local procurement of significant warships will generally cost more than acquiring an equivalent ship ‘off the shelf’ from an overseas supplier. Overseas shipyards often have a scale advantage over Australian producers and, where the parent navy is acquiring a substantial number of ships of the same class, will benefit from significant learning/experience advantages too. Nevertheless, Australian governments are generally keen to promote local procurement where feasible in order to enhance the capability of Australia’s defence industry.

Currently, the relationship between the ADF and the local defence industry is dominated by the concept of ‘self-reliance’. In philosophical terms, this has probably been a key strategic concept since the fall of Singapore in 1942, but only recently has its meaning been articulated in any detail. Self-reliance, of course, does not mean self-sufficiency: no nation, not even the United States, can produce everything it needs purely from its own resources. There has never been any view that Australia, for example, should build all the missiles and military systems that it requires. But while assets such as missiles and other hardware can be stockpiled so as to be able to meet defence needs in any emergency, in other areas there is a need for significant in-country industrial capability to maintain defence assets in a state of operational readiness.

One major objective of self-reliance is to allow battle damage to defence platforms such as warships, aircraft and tanks, to be repaired in Australia in a war situation and returned to front line service as expeditiously as possible. The Government’s aim is to have:

… a sustainable and competitive defence industry base, with efficient, innovative and durable industries, able to support a technologically advanced ADF.

Defence 2000: Our Future Defence Force, (page xv)

The Defence Matériel Organisation (DMO) has proposed several reasons in favour of the policy of local procurement of warships, where feasible:

a. Local construction significantly enhances the ability to tailor overseas designs to meet any unique requirements of the ADF and to maximise commonality of systems and equipment across classes.

b. As argued in recent economic evaluation, the potential to deliver significant economic benefit to the nation as a whole.

c. Having built the platforms in Australia, the shipbuilder and sub-contractors have a first hand knowledge of the vessel’s design and assembly which facilitates cost-effective whole-of-life support and access to required intellectual property (IP).

d. Enhancement of the repair and maintenance skill-sets base, as a result of the transfer of people and skills from the build phase to the whole-of-life support phase.
e. Technology transfer resulting from local construction has substantially upgraded the nation’s technological base and provided significant advantage beyond shipbuilding and Defence related production.

f. It promotes the establishment of an in-country production design, re-design and upgrade capability, leading to the assumption of “parent navy” responsibilities.

g. It provides protection against the disruption of overseas supply. In-country construction leads to the establishment of local supply chains which are more responsive to Navy’s urgent requirements.

h. A capable and cost-effective construction capability provides a sound base for promoting the export of similar products, especially within the near region. It may thus strengthen Defence cooperation with Australia’s regional neighbours.

i. It assists our balance of payments and retains investment within Australia.


Some of these reasons would raise the eyebrows of an economist. For example, no government in a modern economy would build warships for ‘balance of payments’ reasons; such a rationale should be consigned to the North Koreas of this world. The economic benefits of major domestic defence projects costing more than overseas acquisition are also doubtful and often greatly exaggerated, including in some consultants’ reports, where heroic modelling assumptions are used to give rise to huge net employment gains from local procurement. These dubious economic benefits need to be put to one side. The fundamental rationale for local procurement remains capability building. While capability is valuable for defence reasons, however, the value of this benefit is not infinite. It must be balanced against any additional costs arising from producing defence assets in Australia.

Conceptually, the ability to build warships is not necessarily a prerequisite for having the capability to repair and maintain them (including repairing battle damage). Nevertheless, in practical terms investors are unlikely to commit funds to maintaining shipyards that have only a repair and maintenance function. Not only is the workload from Navy unlikely to be sufficient to justify such an investment, but the prospect of seeking to create a more substantial workload by competing in the global steel shipbuilding industry would not be appealing. With low throughput and high labour costs, Australian industry is not competitive in this market (as opposed to the aluminium shipbuilding sector).

DMO also suggests there is an important link between ship construction and maintenance:

> Whilst a distinction is made between ship construction and repair and maintenance, a strong relationship exists between the two. Success as a shipbuilder undoubtedly provides a competitive advantage in the repair and maintenance activities associated with the whole-of-life support required for that class of vessel. Specifically, building a ship based on a whole-of-life philosophy establishes an effective configuration management and integrated logistic support regime from the outset. It also establishes capabilities that are essential for effective support in the sub-contractors responsible for ship sub-systems through the pre-existence of supplier networks and working arrangements.

3.3 Current and recent projects

In the mid-1980s, two major acquisitions for the Navy were being developed. First, a replacement for the ageing Oberon class submarines was required. Secondly, a program to replace the UK-designed Leander class frigates in both the Australian and New Zealand navies was being developed. A decision was taken to build these ships locally provided that a significant portion of the construction risk could be transferred to the private sector.

The objective of developing Australian industry capability provided the main rationale for local procurement of these ships.

Collins class submarine

In the mid-1980s a decision needed to be taken on the replacement for the Navy’s Oberon class submarines, which would reach the end of their useful lives in the 1990s. The requirement was for a large conventional boat, about 50 per cent larger in displacement than the British Upholder class that had been designed to replace the Royal Navy’s Oberons, and capable of sustaining a long-range, blue water role. None of the main builders of submarines in ‘western’ countries built such a large boat, but Kockums of Sweden won the design contest with a considerably expanded version of a submarine in service with the Swedish navy (Figure 3.2). The specifications of the Collins class submarines are shown in Table 3.1.

![Figure 3.2](image)

Source: Kockums AB

One condition of building the submarines in Australia was that a commercial enterprise would undertake the construction. A new consortium, consisting of

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9 Following a defence review, the British took their Upholder class submarines out of service at an early stage in their lives. Eventually Canada bought the four boats to replace their Oberon class submarines.
Kockums, the government-owned AIDC, Wormald and Chicago Bridge and Iron, won the contract at a greenfield site at Osborne in Adelaide. Not only had Australia never built a submarine before, but a new company with a new workforce was contracted to undertake the task in a State with no history of naval shipbuilding. In addition, the Collins design was essentially a new one and so from the word go the RAN recognised that it would have ‘parent navy’ responsibilities for the new class. This issue and the associated risk was compounded by the fact that Navy was not happy with any existing combat system for the boats and contracted with Rockwell to design and install a new and supposedly state-of-the-art system. Clearly, this was always going to be a high-risk project.

Table 3.1

<table>
<thead>
<tr>
<th>Construction features</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>3050 tons (surfaced)</td>
</tr>
<tr>
<td>Length</td>
<td>78 m</td>
</tr>
<tr>
<td>Beam</td>
<td>8 m</td>
</tr>
<tr>
<td>Draught</td>
<td>7 m</td>
</tr>
<tr>
<td>Complement</td>
<td>42 (including 6 officers)</td>
</tr>
<tr>
<td>Propulsion</td>
<td>3 x Hedemora/garden island type V18B/14 diesel engines, 1475 kw each</td>
</tr>
<tr>
<td></td>
<td>3 x Jeumont Schneider 440 v generators, 1400 kw each</td>
</tr>
<tr>
<td></td>
<td>1 x main motor, 5250 kW</td>
</tr>
<tr>
<td>Armament</td>
<td>Surface-to-surface missile sub Harpoon</td>
</tr>
<tr>
<td></td>
<td>Torpedoes: 6 x 533 mm tubes for Harpoon and Gould mk 48 torpedoes - total of 22 carried</td>
</tr>
<tr>
<td></td>
<td>Mines: up to 44 mines in place of torpedoes</td>
</tr>
<tr>
<td></td>
<td>Combat data system: Rockwell Australia combat system, being replaced with Raytheon ccs Mk 2</td>
</tr>
</tbody>
</table>

Source: www.naval-technology.com/projects/collins/specs.htm

In some respects the new company, the Australian Submarine Corporation, performed well. The quality of the welding on the pressure hull, for example, was at least as good as on the sections that were constructed in Sweden on the early boats. The project also had a number of problems, however, some of them quite severe, and the boats were not delivered on time and on budget. Many of the problems related to the combat system and a new one, based on an existing system being employed on the US Navy’s Virginia class SSN, is now being retro-fitted to the boats by Raytheon.

Beyond these difficulties, many of which were design issues that could not all be laid at ASC’s door, there were a number of other significant faults with the boats, including faulty seals, excessive noise and cavitation and engine problems. There was also a difficult relationship between ASC and its client, Defence, and an unwillingness to act in an assertive role as prime contractor in its dealings with the combat systems integrator. For these reasons, ASC was criticised extensively in the report commissioned by the then Minister for Defence, John Moore, from Malcolm McIntosh and John Prescott in 199910:

In looking at ASC’s conduct … there appears to be an underlying atmosphere of confrontation and contempt for their customer’s wishes. (Lloyd’s Register, quoted on page 18.)

… ASC is interpreting its contractual obligations as narrowly as possible in this area and this is symptomatic of issues between Navy and ASC in other areas. The fact remains that the submarines have not complied with the contract … (Page 9.)

To our surprise, deficiencies have occurred in items that should have been relatively straightforward had testing, even along the lines of that routinely applied to merchant ships, been undertaken. (Page 7.)

The cavitation and flow characteristics problems reflect inadequate testing on the hull. In fact, it seems this was less than that carried out for many merchant vessels. (Page 9.)

On the other side of the ledger, however, is a view that when the problems with the Collins class have been fixed, the boats will be highly effective submarines. As the Australian Strategic Policy Institute (ASPI) puts it:

But even now, with substantial funds committed to a new combat system, the total cost increase for the Collins can hardly be compared with the cost blow-outs of the Daring and River class projects of the 1950s and 1960s. And there is no reason to assume that the project would not have faced similar problems if we had contracted to build the same submarines overseas.

ASPI [2002], Setting a course for Australia’s naval shipbuilding and repair industry, page 19.

ASC is now wholly-owned by the Commonwealth government and is likely to be privatised in the near-term.

**The ANZAC frigate program**

The ANZAC ship program was developed in the mid-‘80s as a replacement for the RAN’s River class frigates (Figure 3.3).

The ANZAC class were conceived of as Tier Two ships at the time, namely relatively lightly armed vessels that were capable of performing a large number of tasks for Navy but would have less impressive survivability qualities if exposed to a conflict involving more sophisticated vessels. Within Defence, however, it was always considered that eventually the weapons systems on the ships would be upgraded. The specifications of the class are shown in Table 2.2, noting that the more sophisticated weapons fit involving Harpoon and the Evolved Sea Sparrow missiles is being retro-fitted to the frigates and reflects decisions taken more than a decade after the inception of the program.

The eponymous first ship of the class was delivered on time and on budget in March 1996. This, together with the fact that HMAS ANZAC had a fully operating combat system at the time, constitutes ‘an unchallenged world first’, according to Tenix. Subsequent ships have also been delivered within the budget, with some of the frigates being ahead of schedule.

The Government selected the Blohm+Voss MEKO 200 design as the basis for these ships and decided to build them locally, but not in a government-owned shipyard. In the mid-1980s the government-owned Williamstown shipyard was sold to Transfield (later it became Tenix Defence) with the contract to complete the two locally-built FFGs. In 1989, the company won the contract, in the face of strong competition, to build up to twelve ANZAC class frigates, eight for the RAN and four (later reduced to two) for New Zealand. It was believed that the cost premium involved in building the ships locally would be small, assisted by the substantial
number of vessels to be constructed, which gave rise to significant scale and experience economies, and the relative lack of complexity of their systems. The specifications of the ANZAC class are shown in Table 3.2.

Figure 3.3

HMAS ANZAC

Source: Tenix Defence (Copyright)

One issue where Tenix took the lead was in making substantial advances in the modular build concept in what was the first surface combatant to be constructed in this way in Australia. Not only were modules for the ships’ hulls and superstructure built in other parts of Australia, but some were also constructed in New Zealand in a shipyard established by Tenix. This sharing of the work allowed ten ships to be delivered in a much shorter period of time than otherwise would have been the case; at one stage of the project ships were being completed almost every year.

Tenix’s other major initial decision, namely to ensure that the combat system was fully effective and tested at an onshore facility before installation on the ships, paid off handsomely. The cooperation between Tenix and SAAB in designing and installing the combat system has been one of the keys to success in this project. Subsequently the ‘ANZAC Ships Alliance’, comprising Tenix, SAAB and the DMO has also seen the weapons systems upgrades, which make these much more capable and sophisticated ships, delivered on time and on budget.
Table 3.2

<table>
<thead>
<tr>
<th>Construction features</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>3600 tons (fully loaded)</td>
</tr>
<tr>
<td>Length</td>
<td>118 m</td>
</tr>
<tr>
<td>Beam</td>
<td>14.8 m</td>
</tr>
<tr>
<td>Draught</td>
<td>4.35 m</td>
</tr>
<tr>
<td>Crew</td>
<td>163 (including 22 officers)</td>
</tr>
</tbody>
</table>
| Propulsion system     | 1 x GE LM 2500 gas turbine, 22.5MW  
2 x MTU 12V 1163 TB83 diesels, 6.5MW |
| Armaments             | **Surface-to-air missile**: 1 x 8-cell Mk 41 VLS for Sea Sparrow missile, 8 missiles carried, Evolved Sea Sparrow in last four ships of class (154-157), 32 missiles  
**Surface-to-surface missile**: Harpoon (to be fitted)  
**Guns**: 1 x 127mm (5-inch) Mk 45 Mod 2 gun  
**Torpedoes**: 6 x 324mm torpedo tubes, Mk 46 Mod 5 torpedoes  
**Helicopters**: 1 x S-70B Seahawk then SH-2G SeaSprite with anti-submarine torpedoes and Penguin anti-ship missiles.  
**Combat data system**: SaabTech 9LV 453  
**Weapons control**: SaabTech 9LV 453 optronic director, Raytheon CW Mk 73 for Sea Sparrow missile, CEA SSCW for ESSM |

Source: www.naval-technology.com/projects/anzac/specs.htm

Tenix’s achievements in delivering the ANZAC ships on time and on budget are sometimes downplayed on the basis that the ships are relatively ‘simple’. This view is mistaken, since considerable complexities were involved both in building the ANZAC platforms and latterly in upgrading them. First, the design drawings for the MEKO 200s were produced in a form required by a German shipyard with a long tradition of building ships and were lacking in the level of detail provided by the Americans for the FFGs. Substantial work was required to make them suitable for use in Australia. Also, Tenix (together with Blohm+Voss through Australian Maritime Technologies) had to undertake some significant design engineering tasks to deliver the modifications required by Defence to the original MEKO 200 design.

Secondly, the upgrades to the ANZAC ships are converting them into sophisticated warfighting ships, with a capability way beyond the original design concept. Integrating onto these platforms systems that were never designed for them, such as Harpoon, Evolved Sea Sparrow Missile (ESSM), Nulka, Eurotorp and the advanced Petrel mine avoidance system, is an immensely complex task. Not only do these very substantial upgrades impose significant challenges to the ships’ combat system, but they also bring with them a major increase in weight and a need to find new stability and sea keeping solutions. Tenix, as the leading player in the ANZAC Alliance, has shown its ability to meet these very significant challenges and deliver the upgrades on time and on budget. It may need to meet even more complex requirements in the future if Defence goes ahead and seeks to install a close-in-weapons-system (to supplement ESSM) and a second channel of fire.

Tenix’s performance in successfully developing an internationally competitive major warship business is extremely rare in the world of naval shipbuilding. Industry consultations suggest that early in the ANZAC project representatives of Blohm+Voss had considerable doubts that a company with virtually no experience of warship construction would be able to deliver their MEKO 200 design to the
standards they were accustomed to in Germany. They had particular doubts as to whether Tenix could meet the demanding delivery schedules with a ship that satisfied testing quality standards with the low level of faults seen in their German yard. As the project progressed, these doubts were overcome and there has been nothing but praise for Tenix’s performance.

**Smaller warships: the Huon and Armidale classes**

Some smaller warships have also been built in Australian yards in recent years, of which the *Huon* and *Armidale* classes are the most significant.

Construction of the *Huon* class of minehunters began in Newcastle in 1994 (see Figure 3.4 and Table 3.3). Australian Defence Industries won the contract for the construction and support of the six vessels. The design is based on an existing Italian platform, the *Gaeta/Lerici* class, and the hulls are constructed in a composite fibreglass material.

Figure 3.4

**HMAS HUON**

Source: http://www.adi-limited.com/

Although built on a fairly simple platform, the *Huon* class are equipped with some of the most modern mine detection and underwater mine warfare systems in the world. The ships are operated out of the HMAS *Waterhen* base in Sydney. By all accounts the *Huon* class vessels are considered to be highly successful in their specified role. According to ASPI:

> The *Huon* is a complex project, involving advanced Italian-designed composite material hulls and a very advanced sensor suite which has not been fitted to this hull before. The project is on schedule, within budget and has all critical systems above, at or close to their specifications.

Table 3.3

**HUON CLASS MINEHUNTER SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Construction features</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>720 tons (fully loaded)</td>
</tr>
<tr>
<td>Length</td>
<td>52.5m</td>
</tr>
<tr>
<td>Beam</td>
<td>9.9 m</td>
</tr>
<tr>
<td>Draught</td>
<td>3 m</td>
</tr>
<tr>
<td>Crew</td>
<td>36</td>
</tr>
<tr>
<td>Propulsion system</td>
<td>1 x 1460 kw Fincantieri GMT diesel driving one shaft controllable pitch propeller</td>
</tr>
<tr>
<td></td>
<td>3 x 124 kw electro-hydraulic motors driving Riva Calzoni retractable auxiliary propulsion units</td>
</tr>
<tr>
<td>Armaments</td>
<td><strong>Gun:</strong> 1 x MSI 30 mm DS30B</td>
</tr>
<tr>
<td></td>
<td><strong>Tactical data system:</strong> BAe systems nautis iim</td>
</tr>
<tr>
<td></td>
<td><strong>Mine disposal vehicles:</strong> 2 x Bofors Sutec double eagle Mk2 mine disposal vehicles equipped with NDI Damdic mine disposal charges</td>
</tr>
</tbody>
</table>

Source: www.naval-technology.com/projects/huon/specs.htm

The Defence White Paper of 2000 recognised that the *Fremantle* class patrol boats were nearing the end of their service life. The report identified the crucial role that this type of vessel plays in coastal surveillance and enforcement. In December 2003, the government signed a contract with Defence Maritime Services (led by Austal Ships) to build and support 12 *Armidale* class patrol boats (see Figure 3.5)

**Figure 3.5**

**ARMIDALE CLASS PATROL BOAT**

Source: Defence Matériel Organisation

An innovative procurement process was employed for the Armidale class acquisition, with a strong reliance on market forces. According to the DMO:
The selection process involved an innovative strategy linking through-life support to the materiel purchase. Also it used a two-stage request for tender process; Defence first examined private financing and direct purchase as potential ways of acquiring the replacement patrol boat capability. Following Government’s decision in June 2002 to proceed with direct purchase, Defence then requested detailed proposals from the three shortlisted tenderers.

Defence described its requirements in functional performance terms. Instead of stating a need for a given number of boats of particular length, weight and construction, it asked for a patrol boat capability to provide 3,000 days of annual operational availability of specified performance. Performance requirements included, for example, the ability to conduct surveillance and response boarding operations at top of sea state 4 (wave heights of 2.5 m) and surveillance at top of sea state 5 (wave heights of 4 m). Other requirements included a range of 3000 nautical miles, being able to conduct a 42-day mission without re-supply, able to accommodate two sea-boats for boarding operations, and being equipped with a 25mm gun. Tenderers had to provide support solutions that mean the boats will be available to the Navy for 3000 patrol days per year, with up to 600 days surge per annum at 48 hours notice to meet operational contingencies over 15 years.

The contractor assumes full responsibility for providing the RAN with patrol boats available for operations, in return for the support fees, for 15 years for each patrol boat. Combining the construction and through life support activities in a single contract with one prime contractor means the contractor must consider the long term sustainability and supportability of the boats. The intense competition for this contract throughout the tender process, and particularly over the second stage, highlighted the competitiveness of Australia’s small vessel shipbuilding industry.


Austal had a major design input to the project, proposing an aluminium hull for the boats, which offered, *inter alia*, considerable fuel savings. The Western Australian firm’s success in this tender was not widely expected in the industry, where it was believed that one of the incumbent naval shipbuilders, such as ADI or Tenix, would win the job. In many ways, Austal’s success is based on the same factors that underpin the company’s value proposition in the global commercial shipbuilding industry, namely a strong capability in design and a willingness to explore innovative solutions.

The first of the *Armidale* class boats was launched in January 2005 and, providing the ship successfully completes it sea trial, it should enter service on schedule in May 2005. Two further boats were ordered in January 2005, making a total of fourteen for the class.

### Table 3.4
**ARMIDALE CLASS SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Construction features</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Displacement</td>
<td>270 tonnes</td>
</tr>
<tr>
<td>Length</td>
<td>56.8 m</td>
</tr>
<tr>
<td>Crew</td>
<td>21</td>
</tr>
<tr>
<td>Propulsion system</td>
<td>2 x MTU 16V M70 2320 kW diesels driving twin screws through ZF transmissions.</td>
</tr>
<tr>
<td>Armaments</td>
<td>Guns: 1 x Rafael Typhoon 25mm stabilised deck gun 2 x 12.7mm Machine Guns</td>
</tr>
<tr>
<td></td>
<td>Support Craft: 2x Zodiac 7.2m waterjet sea boats</td>
</tr>
<tr>
<td></td>
<td>Surveillance System: low light optical, communication direction finding and radar</td>
</tr>
</tbody>
</table>

Source: www.naval-technology.com/projects/
3.4 Capability of Australian shipbuilders

What does ‘capability’ mean?

The word ‘capability’ can be used rather loosely in discussing the capacity of Australia’s various shipyards and naval shipbuilders. Tenix and Austal, for example, are both ‘highly capable’ shipbuilders, but their capabilities are very different. Tenix specialises in large steel warships while Austal works with aluminium to build patrol boats or high-speed naval vessels. Neither shipbuilder would consider its high level of capability in its own field would make it a major contender in the other player’s particular market, nor would either of them believe, for example, that they could demonstrate the capability required to build a submarine.

Box 3.1

COMPLEXITY AND CAPABILITY

A major thrust of the ASC’s bid to build the AWDs is based on the argument that the Collins class submarines are the most complex warships built in Australia to date and therefore their builder is best equipped to build the highly complex destroyers. As one defence journal puts it, ‘ASC claim that the submarines are twice as complex as the [ANZAC] frigates, making them better suited to building the equally complex AWD’. (Defence Today, April 2005, page 37.)

While this argument may have some superficial appeal to the public, it does not resonate with anybody who knows anything about naval shipbuilding. As discussed in Chapter 2, building submarines is completely different from building surface warships and, where they have the capacity to do so, shipbuilders who construct both types separate their submarine operations from their warship building activities because of the benefits of specialisation. Submarine builders need to focus on ensuring the integrity of a pressure hull at depths of up to 300 metres and on the efficiency of direct current electric motors, while installing a suite of sensors that are almost entirely based on sound waves (sonar). Their main offensive weapon is the long range, heavyweight torpedo, although the Collins class also deploys the Harpoon anti-ship missile.

The capability of a surface warship is built around its missile systems and gun, directed by a complex suite of radar sensors. Their engines are usually gas turbines and their electrics are based on alternating current. These factors mean that building a surface combatant is different from building a submarine and requires a different skill set. Indeed, if complexity, alone and undefined, were the measure of ability to build the AWDs, we should be seeking bids from companies such as Boeing, IBM and Microsoft.

Even if we were to accept the complexity argument, ill-founded as it is, the claim that ASC’s task on the submarines was more complex than Tenix’s task on the ANZAC frigates is questionable. First, ASC did not assume responsibility for the combat system on the Collins class, perhaps the most complex part of the boats. Tenix, on the other hand, has been deeply involved with SAAB in the ANZAC combat system throughout the program. This involvement includes the upgrade program for the frigates, which requires the integration of a number of highly complex weapons systems including Harpoon, Evolved Sea Sparrow, Nulka, the European lightweight torpedo and a the Petrel mine detection system. The original design of the frigates did not envisage the installation of these systems.

It is not at all clear, therefore, that the upgraded ANZACs are less complex ships than the Collins submarines. What is clear, however, is that they are complex in a completely different way, and in a manner that is highly relevant to the challenge that will be offered by the AWDs. Most of the complex systems that Tenix has installed on the upgraded ANZACs will also be part of the weapons fit of the AWDs.
The issue of capability is critical in determining which shipyard in which location is best equipped to build the AWDs. One question revolves around the relevance of complexity, with some observers claiming that ASC’s record in building complex naval platforms, irrespective of the fact that they were submarine platforms, makes it best suited to build the complex AWDs. This argument is specious (see Box 3.1).

Another issue is whether capability is embodied in a particular site or location or whether it can readily be transported or re-created somewhere else. The puzzling issue regarding the AWD acquisition is the fact that a number of observers appear to believe that the capability already established at Williamstown can readily be written off and re-established at Osborne in South Australia at no cost. This is not the case. Williamstown’s capability in building surface combatants is, in large part, embodied in that particular location.

First, the most obvious issue is that the capital cost of providing the necessary infrastructure to build the AWDs would be around twice as great in Osborne as in Williamstown. Some in Defence suggest that this would not matter because the funds would be provided by a State government rather than the Commonwealth. This, of course, is a false argument since the additional capital cost would be met by public funds provided by the Australian community.

Secondly, apart from the physical infrastructure, the capability at Williamstown is embodied in management and the workforce. The literature suggests that learning and experience play a major part in reducing the costs of warship construction. On the ANZAC program, for example, the labour hours needed to produce one frigate fell by around one-third between the early ships and the later ones. These enormous savings result from the ability of the workforce to learn smarter ways of working. This goes to a great deal of detail about how to build a ship, such as issues like the most efficient ordering of pipes and cables in the cavity behind the deckhead. While some of these learning benefits are specific to the class of ship, because there are numerous similarities between surface combatants, many of them are also transferable to a new class of warship.

If Defence decided, for no obvious reason, to re-locate surface shipbuilding to South Australia, some of these benefits would be retained if Tenix won the contract in Adelaide. Many would be lost, however, because most of the workforce would not move from Victoria and management can only codify some of the relevant experience. If ASC won, however, most of the learning benefits would need to be re-created. In South Australia’s shallower labour market, it may also be more difficult to recruit workers with the required skills.

Thirdly, the supply chain is a critical element that is, in some degree, tied to a particular shipyard. The information presented in our first report suggested that propinquity plays a large part in the selection of supplier industries. A close relationship between the prime and the sub-contractors is extremely valuable in terms of the timely delivery of key components and such a relationship takes time to develop. It is harder to develop a close relationship over a longer distance. Melbourne’s role as the heart of manufacturing in Australia gives it a significant advantage in the supply chain.

In terms of capability, the re-location of surface warship building to South Australia would involve some significant additional costs and risks.
Four main players

The projects described in Section 3.3 have provided an impetus to skill and capability building within Australian shipyards. A significant infrastructure, both physical and intangible, has been developed in response to the demands of Navy for new Australian built ships and the capacity to maintain and repair them locally.

At present, this demand focuses on four key Australian shipbuilders — particularly for larger construction and upgrade projects:

- Tenix Defence Marine Division (Tenix);
- Australian Submarine Corporation (ASC);
- Australian Defence Industries (ADI); and
- Forgacs.

Table 3.5
CURRENT MAJOR NAVAL SHIPBUILDING CAPABILITY

<table>
<thead>
<tr>
<th>Naval shipbuilding experience</th>
<th>Existing facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Australian Submarine Corporation</strong>: the prime contractor for the six Collins class submarines, built at Osborne, South Australia. With the completion of the construction program, ASC will transition from a builder to maintainer and repairer. Routine maintenance work will be undertaken in Western Australia while major refits and upgrades are planned for Osborne.</td>
<td>Osborne (SA): 5000 tonne shiplift, length 80 metres, width 20 metres. Significant facility development required for participation in major surface ship module construction or ship assembly. Adjacent land is available for significant expansion.</td>
</tr>
<tr>
<td><strong>Tenix</strong>: (formerly Transfield Defence Systems [Victoria] and Transfield Shipbuilding WA), which built the last two FFGs and Pacific class patrol boats and is presently the prime contractor to the ANZAC Frigate Project. The frigates are built at its Williamstown yard in Victoria. Also, some paramilitary and commercial vessels are built at Henderson, Western Australia.</td>
<td>Williamstown (Vic): Two 6000 tonne building slipways. Graving dock effective length 145 metres. Could construct large ship modules, but infrastructure changes would be necessary for consolidation of large ships.</td>
</tr>
<tr>
<td><strong>ADI</strong>: (a 50–50 joint venture between Transfield and Thales) is the prime contractor for the six Huon class minehunters which were built at its Newcastle facility. It is also a builder of other minor naval and commercial vessels. ADI operates the major naval repair facility at Garden Island in Sydney under lease from the Commonwealth. ADI is also a major maintainer/repairer of commercial vessels.</td>
<td>Newcastle (NSW): Not suitable for large ship assembly. Could construct ship modules. Sydney (NSW): Key capabilities relate to repair sector. Could construct large ship modules. Technically, Captain Cook Dock could be used to assemble modules but this would disrupt repair and maintenance dockings.</td>
</tr>
<tr>
<td><strong>Forgacs</strong>: substantially modified Manoora and Kanimbla at its Newcastle facility. Also provides ship repair for the commercial coastal fleet and has undertaken some limited work on warships and large auxiliaries.</td>
<td>Newcastle (NSW): Major facility is 15 000 tonne capacity floating dock. Length 180 metres, width 33 metres. Associated facilities in Newcastle area would allow construction of large ship modules. Cairncross (Brisbane, Qld): Large 85 000 tonne capacity drydock and associated ship repair facilities. This facility is not appropriate for ship construction. Caims (Qld): Facilities geared to small- to medium-sized ships. Significant facility development necessary to construct large ship modules.</td>
</tr>
<tr>
<td><strong>NQEA</strong>: built Fremantle class patrol boats and hydrographic ships. Also builder of commercial vessels including fast ferries.</td>
<td></td>
</tr>
</tbody>
</table>

A profile of these four companies, and a summary of their current capabilities, is provided in Table 3.5. NQEA, a Cairns-based engineering and shipbuilding company is also listed. NQEA tends to specialise in smaller vessels and, in addition to building the Fremantle class patrol boats, light landing craft and hydrographic vessels for the Australian navy, has a strong commercial orientation — building a range of craft including fast aluminium ferries, barges and motor yachts. Austal is excluded from the Table largely because its impact on the industry has been relatively recent.

Apart from ASC, which is currently government-owned but is likely to be privatised in the near term, all of these companies are in the private sector. Most of their work is focussed on defence contracts. As such, they represent a substantial investment in capability that has been made by private sector players in response to signals provided by government through the Defence department. Defence, in its turn, has made its own significant contribution to this investment in capability by its willingness to trade off some additional acquisition costs against the ‘self-reliance’ benefits of local procurement.

A broad experience profile of these companies, and their respective facilities, is set out in Table 3.6, reproduced from DMO’s strategic plan for the industry published in 2002. It shows the different capacity demonstrated by each shipyard to discharge various shipbuilding tasks (ranging from repair and maintenance to final assembly), and the relatively limited crossover of submarine and surface warship engineering activity — particularly for more complex construction and assembly activities.

### Table 3.6

**CAPABILITY IN SURFACE SHIPS AND SUBMARINES AT DIFFERENT LOCATIONS**

<table>
<thead>
<tr>
<th>Company/ facility</th>
<th>Major Surface Ships</th>
<th>Submarines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Consolidation/ Final Assembly</td>
<td>Modular Fabrication</td>
</tr>
<tr>
<td>Tenix, Williamstown, VIC</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Tenix, Henderson, WA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASC, Osborne, SA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADI, Garden Island, NSW</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Forgacs, Newcastle operations, NSW</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Forgacs, Cairncross, QLD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


11 It seems likely that if ASPI were preparing this Table today, Austal Ships would be included. In the last three years, Austal has made a significant impression on the naval shipbuilding industry in Australia.
Taking the information presented in these tables together with an analysis of the companies’ performance allows some conclusions to be drawn about each player’s capabilities.

Of particular interest is the fact that DMO acknowledged in 2002 that ASC is a specialist submarine builder and repairer. ASC is the only company of the four shown in the Table that is accorded no capability at all in the construction, upgrade or repair of surface ships. Nevertheless, ASC is the only Australian player capable of building and upgrading submarines. While the Collins class program had its difficulties, the finished product is a powerful weapons system which, if supplemented with cruise missiles, is capable of significant force projection. Among the ADF’s other major assets, only the F-111 shares this potential. ASC now embodies the nation’s investment in submarine capability and, since the RAN has parent navy responsibility for the Collins class, this capability will be required in-country for many years to come even if ASC builds no more submarines. (It is still possible that two more submarines will be required to augment the Australian fleet.) In support of DMO’s summary of ASC’s capabilities shown in Table 3.5, the company has no record of building surface combatants at Osborne, nor has it competed in the export market. In this context, ASC’s credentials for building the AWDs are questionable. ASC now has a guaranteed workload until the late 2020s under a $3.5 billion contract for through-life support of the Collins class submarines.

Tenix is the only player with the current capability to consolidate major naval platforms such as destroyers and frigates and with capabilities across the whole of the range of surface shipbuilding functions. The main reason why Tenix’s repair and maintenance facilities are located in Henderson is that it is adjacent to Fleet Base West (FBW) and Navy requires that repair and maintenance be undertaken at or in close proximity to one of the two fleet bases. Tenix is also capable of undertaking repairs and maintenance of submarines in Western Australia. Tenix’s performance in delivering the ANZAC frigate program on time and on budget is widely acknowledged. Despite their common depiction as ‘simple’ ships, the combat system on the lead vessel worked from Day One and the latter ships, which employ much more complex systems and weapons, are sophisticated combatants. Tenix, in cooperation with SAAB, has also delivered these upgrades efficiently. In addition, Tenix has also been a successful player in highly competitive warship export markets and won a major contract with New Zealand, Project Protector, in competition with over twenty shipyards from around the world.

Australian Defence Industries (ADI) was created in 1989 as the result of privatisation of a business in the government’s Office of Defence Production. ADI is jointly owned by Transfield and Thales, a major French defence hardware and systems company, and covers a broad spectrum of defence industry capabilities spanning armaments, aerospace, electronics and systems integration. It is the prime contractor for the FFG frigate upgrade, and also produced the Huon class minehunter and 6 amphibious watercraft (LPAs) to operate in conjunction with the current naval amphibious support ships, HMAS Kanimbla and Manoora. The high quality of ADI’s work on the Huon class has been widely recognised. Nevertheless, while the Thales connection is very valuable in terms of technology transfer, it is no secret that the French ownership can create some difficulties where leading-edge American equipment is being acquired. More importantly, the FFG upgrade program has been subject to significant problems and delays, and Defence has
cancelled the upgrade for two of the six ships. According to a recent report, ‘reflecting low confidence in ADI, Senator Hill recently said that Tenix had been awarded the $60 million contract to reconfigure the Korean-built oiler Delos for the RAN, despite a reportedly lower bid from ADI’. ADI has never built a large steel ship but is expected to be a major contender for the LHD ship project, where the choice lies between French and Spanish designs. ADI has not bid for the AWD consolidation but may build modules for the ships.

Forgacs is an older established shipbuilding company with a recent record in steel ship repair and upgrade. Forgacs was prime contractor on the project to refurbish the two amphibious command ships acquired from the United States, now HMAS Manoora and Kanimbla. The condition of these ships on acquisition was not as good as expected but the quality of Forgacs’ work was acknowledged to be good. The two ships now play key roles in the ADF force structure. Forgacs has the capacity to build modules for the AWDs and could participate in a consortium to bid for the LHD ships contract.

Two aluminium shipbuilders

Apart from the builders discussed above, two commercial shipbuilders, Austal and Incat, are also active in the market and have been proving increasingly competitive in the supply of vessels for naval support, fast deployment and coastal patrol work. These companies are Australian-owned and are global players in commercial shipbuilding, having built significant niche positions in designing and building aluminium fast ferries. When this market suffered a severe downturn in the late 1990s, Austal in particular diversified into the naval market. These producers are also building a reputation for innovation in design and construction that adds significantly to Australia’s shipbuilding skill set, and could be increasingly important to alliances and synergies in the future.

Austral’s Australian operations are based in Henderson, Western Australia. It, like Tenix’s WA facility, is located within the newly formed Australian Marine Complex — a facility-sharing arrangement promoted by the WA government. The Gallop government has committed to provide a $65 million floating dock at the Complex. This would allow the construction of large vessels such as the proposed LHD ships.

Austal is a world leader in aluminium ship design and construction and is a major global player in fast aluminium ferries. In recent years it has established a shipyard in Mobile, Alabama, partly as a means of addressing the Jones Act, with its restrictions on acquiring ships from non-US sources for the American market. Austal has a significant ship design and construction capability at its Henderson site, and plans for future expansion. Austal has also been invited to participate in the US Littoral Combat Ship (LCS) project, in partnership with General Dynamics. Design work for the project is largely based in Australia, with construction to take place in Austal’s US facility. The company has also announced its intention to compete for Australia’s LHD ships project and has teamed with Raytheon, which also has an operation within the Australian Marine Complex at Henderson.

In recent years it has also demonstrated a capacity to service naval requirements — completing an order for 10 coastal patrol boats for the Republic of Yemen (see

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Figure 3.6) and winning the Royal Australian Navy contract for the new Armidale class patrol boat.

Winning the Armidale project, now extended to 14 patrol boats, was a major achievement for Austal. The project was widely expected to be won by a traditional steel ship supplier such as ADI or Tenix. Yet Austal made a considerable design input (the company has a large and innovative design and naval architecture department) and clearly has the capability required for the task.

Incat is based in Tasmania and is a world leader in the design of aluminium hull wave piercing catamarans. Like Austal, Incat has also demonstrated strong export performance in the supply of fast passenger and vehicle ferries — and has recently begun to develop a presence in the market for fast naval vessels. It has chartered vessels to the Australian and US navies, and has established operations in the USA in order to supply Theatre Support Vessels to US defence forces.

In 1999 the RAN chartered the HMAS Jervis Bay, an Incat 86-metre vessel, for use during the East Timor intervention. The ship won the attention of the worldwide military, enabling them to witness the potential of High Speed Craft to perform various military roles. In 2001 and in response to the considerable interest from US forces in high-speed craft, Incat formed a strategic alliance with Bollinger Shipyards of Louisiana, which has extensive experience with supplying patrol craft to the Military and Coast Guard. Later in 2001, joint forces from the US Military awarded Bollinger/Incat USA the contract for a High Speed Craft to be used as an evaluation platform for various trials and demonstrations for the different forces involved. This was the 96-metre Wave Piercing Catamaran, HSV-X1 Joint Venture.
In November 2002, the US Army took delivery of its first Theatre Support Vessel, TSV-1X Spearhead. The craft is part of the Advanced Concept Technology Demonstrator program, a joint effort by the acquisition and operational (war fighter) communities within the Department of Defence. A third vessel, HSV Swift was delivered to the US Navy in August 2003 (see Figure 3.7). This vessel will serve operationally as an interim Mine Warfare Command and Support Ship, and will also support Navy experimentation associated with the LCS program.

Figure 3.7
THE HSV SWIFT — BUILT BY BOLLINGER/INCAT USA


3.5 Other industry sectors

The focus above has been on the consolidation of platforms, which in many ways is the key sector of the industry. Fundamentally, the location of a shipyard is essentially fixed while the other activities required to produce a finished warship will, to a greater or lesser extent, cluster around the shipyard. These other parts of the industry, however, are also important. Three activities are considered below:

- ship design;
- systems engineering and integration; and
- component suppliers.

Ship design

Design constitutes a major part of any naval ship construction project. While significant Australian naval ships are always based on overseas designs, considerable work is required to adapt the designs to detailed requirements of the shipyard. In the case of the Collins class, the Australian boats were almost totally different from the platform on which they were based and Kockums took most of
the responsibility for the re-design. The ANZAC frigates were also extensively modified versions of the MEKO 200 design and Tenix in liaison with Blohm+Voss played a very important role in producing detailed designs. The air warfare destroyers will be subject to substantial detailed design work in Australia.

Currently ASC has retained a design team with a strong expertise in submarines. Tenix has a smaller design capability than at the commencement of the ANZAC frigate project, but it still has a significant capacity that could be built up if the AWD project goes to Williamstown. Shipbuilders such as Tenix do not succeed in export markets without expertise in design, and Project Protector for the New Zealand Navy requires a major design capability.

In shipbuilding, as in other manufacturing industries such as motor vehicles, Australian expertise is being increasingly recognised at the creative, high end of the value chain. The two Australian shipbuilders that have had significant commercial success globally, Austal and Incat, place a great deal of emphasis on design, which is an important feature of their value propositions. Austal, for example, maintains a design team of around 200 at its Henderson facility, including a large number of naval architects.

The bottom line is that Australia has significant skills in the areas of ship design and naval architecture. Clearly this activity is footloose to a degree and certainly more so than an established shipyard. While the ability to undertake detailed design exercises is obviously a criterion for winning a contract such as the AWDs, the availability of such skills in Australia suggests that the successful shipbuilder would be able to build up a skilled design team reasonably rapidly after winning the contract.

**Systems engineering and integration**

As stated in our first report, systems nowadays account for the greatest share of a warship’s overall cost (see Figure 3.8). The ability to maintain, upgrade and repair naval systems is an integral element in sustaining self-reliance. In some respects this is becoming more difficult these days as naval systems become ever more complex, although the adoption of open architecture systems also increases accessibility.

Key companies with a major systems capability are:

- **ADI** has developed a systems integrator capability within its Electronics and Aerospace Division. ADI command and control systems currently operate on the HMAS Manoora and Kanimbla and ADI is prime contractor for the systems upgrade on the FFGs. ADI has its headquarters in Sydney.

- **BAE Systems Australia** specialises in electronic and software engineering applications, with a strong background in serving defence needs. It employs around 2,600 people across Australia and is based in Adelaide.

- **CEA Technologies** is an Australian company specialising in advanced radar and communications systems. The CEA-FAR Active Phased Array Radar is currently being trialed on an ANZAC class frigate. Successful trials may lead to a contract with the Royal Australian Navy to supply CEA-FAR as part of the SEA 1448 Anti-Ship Missile Defence (ASMD) program. Additionally, the company has sold systems to navies around the world, including the US Navy.
With 200 employees, CEA Technologies has its headquarters in Canberra and offices in Melbourne, Adelaide and San Diego.

- **Honeywell** has an extensive background in electronics in automated systems. It deals across a wide range of defence activities and has a particularly strong presence in aerospace. Honeywell’s Australian arm is based in Sydney.

- **Lockheed Martin** is the project leader on both the Aegis combat system and the F-35 Joint Strike Fighter and has extensive experience in advanced electronics and systems integration, including radar. It is currently based in Canberra with operations in Melbourne, Adelaide and Sydney.

- **Raytheon Australia** is a mission systems integrator providing solutions for sea, land, air and office environments. The company employs over 900 people.
across Australia. Raytheon currently supports a range of weapons, radar and communication systems for the Australian Defence Forces and provides components for the Aegis combat system, which has already been selected as the core of the new air warfare destroyer. The company is based in Canberra.

- **SAAB Systems’** core business is advanced operational software intensive systems. It provides development, integration, production and support for defence and professional applications. SAAB provided the combat system for the **ANZAC** frigates, and the integrated, control, management and monitoring system for the **Collins** class submarine. SAAB Systems has offices in Canberra and Rockhampton, and is headquartered in Adelaide.

- In addition to its shipbuilding capabilities, **Tenix** operates an Electronic Systems Division which specialises in systems engineering and integration. The Division was formed in 1999 and employs 310 professional staff across 5 Australian sites, and is headquartered in Adelaide.

The ability of these firms to build and maintain effective company networks and attract skilled personnel will be factor in the success of the forward program of naval procurement. This issue will need to be fully considered in the context of risk management and capacity building under the defence capability plan, and its ambitious shipbuilding program.

Different States have different pros and cons as a location for systems companies. South Australia has an advantage because the systems research areas of the Defence Science and Technology Organisation (DSTO) are located in that State. On the other hand, States such as Victoria and NSW have strong advantages because of the depth and skills in their labour forces and hence the availability of suitably trained people. One international systems company reported that it has similar sized facilities in both Victoria and South Australia and it finds it considerably easier to recruit skilled staff in Melbourne than in Adelaide.

The systems engineering task also has a significant element of the footloose about it. International companies will first win a significant contract and then establish an operation to undertake the work at the most appropriate location. Raytheon, for example, was awarded the contract to install the new combat system in the **Collins** class submarines and established an operation at Henderson, adjacent to FBW where the boats are home ported. If BAE Systems or SAAB win the integration work for the AWDs, they would probably undertake much of the work at their South Australian operations but, if the hulls are consolidated in Williamstown, the companies would need to have some staff available at that location as well.

**Supply chain**

As with all manufacturing industries supplying an advanced finished product, naval shipbuilding sits at the end of an extensive supply chain. Most of the companies in the supply chain are not exclusively engaged in the naval shipbuilding industry. Many of them will supply products, such as pipes, valves and cables, which are the same as or derived from the goods they regularly supply to other commercial activities. Nevertheless, the existence of a chain of reliable and efficient suppliers is a critical element in ultimately determining a shipbuilder’s capability.

While ASC cites over 1600 individual contractors and suppliers in its project management, and 73.5 per cent local content, further details of the supply chain for
the Collins project are not available.\textsuperscript{13} In the case of the ANZAC ships, a very extensive supply chain was also developed. According to a recent report, ‘the ANZAC ship project is estimated to have involved over 1300 companies (over 90 per cent of which were SMEs) in Australia and New Zealand. Companies in Victoria, where the ships were assembled, received over 75 per cent of the value of Australian sub-contracts.’\textsuperscript{14} When Tasman Asia Pacific undertook a study of the project in 2000, three quarters of the sub-contractors that responded to the consultant’s survey were engaged in manufacturing while nearly half had fewer than 20 employees.\textsuperscript{15}

The strength of the Victorian supply chain and the importance of proximity are further illustrated by more recent data on the main Australian suppliers to Tenix, not just for the ANZAC ships but for all the company’s activities at Williamstown. It is heavily oriented towards Victoria. Of the 416 suppliers included in the register, 383 are based in Greater Melbourne and many of those are in close proximity to Williamstown. Only ten suppliers (2.4 per cent of the total) were based in South Australia.

Given that proximity appears to be an important factor in managing an effective supply chain, a shipyard located in Victoria in particular or in New South Wales would appear to have some advantages in this regard. A State’s ‘critical mass’ in manufacturing is important in terms of being able to provide the myriad of products required by naval shipbuilders. Evidence in support of Victoria’s pre-eminence in this respect is provided by the relative size of its manufacturing sector and by the very high proportion of suppliers to the ANZAC ship project that were located in Victoria. Another important factor is the availability of skills and, as was demonstrated in this Group’s first report, more people with the required skill sets emerge from universities and TAFE in Victoria than in any other State.\textsuperscript{16}

3.6 Overall assessment

The modern Australian naval shipbuilding industry has developed in a relatively short period of time while sister industries overseas were facing a reduced workload and significant pressure for rationalisation. The industry has a number of strengths and according to one observer:

The Australian [naval shipbuilding] industry is lean, produces ships of exceptional quality and is progressively being seen as a world leader in innovation. It is almost as though the conservative approach of European and US governments has driven the industry to abandon its traditional reticence and explore what is possible using contemporary technology. It is this approach that has seen Austal export aluminium patrol boats to the Middle East and both Austal and Incat lease high speed aluminium ships into the United States.


Perhaps two companies, one a builder of traditional warships and the other a relatively new entrant at the innovative end of the industry, best exemplify the strengths of Australian shipbuilding.

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\textsuperscript{14} ACIL Tasman, A Profile of the Australian Defence Industry, November 2004, page 31.
\textsuperscript{15} Tasman Asia Pacific, Impact of Major Defence Projects: A Case Study of the ANZAC Ships Project, Canberra, 2000, page 63.
Tenix is a relatively recent competitor in the global naval shipbuilding industry. Over the last two decades it has completed two FFGs and is in the final stages of the successful program to construct ten ANZAC class frigates in Australia. Tenix’s record in delivering these ships on time and on budget, with all systems fully operational, is an excellent one even by global standards. The company has also made a significant impact in highly competitive export markets, with its recent success in winning Project Protector for New Zealand being of particular note. Nevertheless, Tenix’s naval shipbuilding business is small by world standards, reducing its ability to benefit from the significant scale economies available in the industry. This will become more of an issue as the ten-ship ANZAC program comes to an end. In the future Tenix will need to rely more on innovation and flexibility to maintain its competitiveness internationally.

Austal is a very different company that was ‘born global’ with, until recently, an almost total orientation towards exports. Its value proposition has been the ability to design and deliver to world markets highly innovative, fast aluminium ferries, a niche market in which Australian shipbuilders have developed a substantial competitive position. With the downturn in the fast ferry market in the late-1990s, Austal entered the warship business and has built a number of patrol boats for export as well as winning the recent tender to build twelve and then 14 Armidale class boats for the RAN. Its major future opportunity in the global defence industry, however, lies in its membership of the General Dynamics-led consortium that is strongly placed to win a contract to build 60 Littoral Combat Ships for the US Navy to what is fundamentally an Austal design.

Austal is also different from most naval shipbuilders in the sense that commercial shipbuilding remains its core business. Its entry into the naval sector was essentially opportunistic when its main market entered a downturn. Austal can therefore play a valuable role with Defence in that while it is not dependent on a naval workload, it is available to provide competition in bidding for defence contracts.

Apart from these two companies, Australia also has developed a strong capability in conventional submarines, probably unmatched outside Europe. With the possibility of the Australian Submarine Corporation being purchased by an overseas shipbuilder when it is privatised, the company has the potential to develop the presence in global markets that has, to date, eluded it.

The industry has some gaps and weaknesses in terms of capability. Power plants and propulsion systems are fully imported, but there are only a few companies in the world making gas turbines and marine diesel engines and Australian engineering skills are quite sufficient to enable the engines to be maintained in-country. Secondly, the local industry is not competitive in building large steel hulls. This is largely because a relatively low throughput means that investing in some of the global state-of-the-art techniques, such as robotic welding, cannot be justified. This weakness is covered to some degree by the use of sophisticated modular techniques to build significant warships.

The major difficulty for the industry is that it operates in a global market that is highly distorted through government intervention and is likely to remain so in the foreseeable future. Another significant challenge lies in the fact that Australia is unlikely to see again major programs involving high numbers of significant warships like the Collins (six boats) and ANZAC (ten ships) programs. Through no fault of the industry, an inability to exploit scale and experience benefits in future
programs means it may be increasingly difficult to justify local procurement. On the other hand, if the shipbuilding industry develops in the same way as the automotive sector, increased flexibility in manufacturing systems may significantly offset this disadvantage.

Overall, therefore, the Australian shipbuilding industry is in a relatively healthy state. Key decisions on future acquisitions will have a major impact on the industry, however, and will determine its future structure and location. These strategic choices for the future are examined in Chapter 4 of this report.
Chapter 4

Future prospects for the Australian industry

Australia’s naval shipbuilding industry has developed in the last twenty years from a marginal, uncompetitive activity to one with a successful record of performance and the demonstrated ability to compete internationally. The key question for this report is how the industry is likely to develop in the future and what are the prospects for the current players in the industry and the State economies that play host to them.

While some of the participants in the industry have demonstrated an ability to supplement their local defence workload with exports, demand from the ADF is likely to continue to be the major driver of the industry in the future. The current industry structure has developed largely on the back of two major naval projects, the Collins class submarines and the ANZAC frigates. Delivering these two projects has required a major investment in a sophisticated level of capability that has not existed before. That capability represents the critical element in delivering self-reliance in naval shipbuilding and repair.

A key question is how that capability may be sustained and developed in the future at a cost that is acceptable in relation to the benefits provided. Three important issues will influence the future development of the industry:

• the future trade-off between sustaining capability and the relative cost of local procurement;
• whether or not Defence maintains the principle of competitive tendering; and
• the identity of the successful tenderers for the AWDs and the LHD ships.

Other factors, such as future ownership of ASC are also important but these three issues are the most significant. They are considered in detail below.

4.1 Self-reliance, capability and local procurement

Defence requirements

We have discussed above Defence’s broad capability requirements so as to meet their objective of self-reliance. In terms of skill sets needed in the naval shipbuilding and repair sector, DMO’s requirements are set out in Box 4.1. While some shipbuilding skills are relatively reproducible and in good supply in the wider economy, others are highly specialised and strategically important to maintain. These skills are vested in the people that work for these companies and can often be reflected in a particular workforce rather than a few key personnel. As suggested above, they can often be difficult to transplant or reproduce within a short timeframe.

The definition of a strategically important skill set, as applied by DMO (2002) is one which:

a. if not available in-country, would prevent the delivery and/or conduct of ADF capability and operations, in accordance with Australia’s defence self-reliance posture; and
b. if denied, could not be obtained in-country within the time-frame required by Defence to meet operational requirements and/or at a cost acceptable to Government.

Box 4.1

**SKILL SETS NECESSARY TO MEET NAVAL SHIPBUILDING AND REPAIR REQUIREMENTS**

Consultation with key industry stakeholders produced the following list of skill requirements considered necessary to satisfy ongoing naval demands for construction, maintenance and repairs:

1. program/project management;
2. detailed and production design;
3. system engineering;
4. general engineering;
5. class and configuration management;
6. integrated logistics support;
7. whole of ship/platform integration;
8. quality assurance/control;
9. strategic procurement/equipment and services procurement;
10. estimating, planning and detailed costing;
11. sub-contractor management;
12. hull/mechanical construction and repair;
13. outfitting and equipment installation;
14. tests, trials and evaluation; and
15. training.

Source: DMO (2002), op cit. p.66

Priority skill sets in that category were identified as those relating to the design, construction, modification and whole-of-life support of Navy’s major surface ships and submarines – with a particular emphasis on the need to maintain a range of capabilities centred around the *Collins* class submarine. The emphasis on the *Collins* submarines reflects the RAN’s parent navy responsibilities for the class and the fact that competencies in submarine maintenance and support are limited in Australia.

**Current capability**

As stated above, Defence and private sector interests (such as Tenix) have made a major investment in developing capability in the naval shipbuilding sector. In terms of self-reliance, this would appear to have paid off. If self reliance can be interpreted as the ability to repair battle damage and restore the damaged assets to a state of combat readiness, then Australian industry would be able to achieve this (in most circumstances) for the *ANZAC* ships and the *Collins* class submarines. Not only could damage to the hulls be repaired, but most potential problems affecting the ships’ systems could also be remediated. The same conclusion applies to the FFGs, the *Huon* minehunters, patrol boats and the amphibious command ships, *Manoora* and *Kanimbla*.

The ships’ systems represent a very important consideration here since it does not require high technology skills to repair holes in a steel hull or damage to a diesel
engine. The systems in these ships have been subject to significant engineering in Australia and most problems with them could probably be repaired by local industry. This proposition includes the combat system in the upgraded ANZAC ships with their complex and advanced weapons fit.

On the other hand, the Collins class combat system could probably only be repaired for battle damage because Raytheon has an operation in Australia retrofitting a new system in the submarines. This combat system, however, is derived from the one deployed on the US Navy’s latest hunter killer nuclear submarines. In many ways it is analogous to the Aegis system in that it would be highly unlikely that all the details of the system, including the source codes, would be revealed to non-US interests. In another sense this is academic, however, in that it is difficult to conceive of an operational scenario in which a submarine would incur significant damage to its combat system and yet the boat would not be lost.

Nevertheless, the point behind this discussion is that in undertaking local build of both the Collins and ANZAC classes Australia put itself in the position whereby it has significant parent navy responsibilities for both classes of ships and has achieved a high level of self-reliance in maintaining them. This came at some cost in that it would probably (and we cannot be sure) have been cheaper to acquire both classes of ships overseas. It is almost impossible to estimate a cost premium for the Collins class because the submarines are unique; we cannot guess what problems an overseas shipbuilder would have encountered in building them to the original specification, particularly for the combat system. The cost premium for the ANZACs most frequently quoted is of the order of 3 to 3.5 per cent. While this is relatively low, it needs to be remembered that it is equivalent to over $200 million on a $7 billion acquisition and that projects of this nature absorb scarce, highly skilled labour resources that could otherwise be employed on commercial, internationally competitive projects.

A major point, however, is that the cost premium for each of these classes was low for particular reasons that may not apply to the acquisitions currently in the pipeline. This is because a significant number of both the Collins and ANZAC classes were produced in Australia, even by world standards. While a production run of six submarines may be considered paltry by US Navy standards, the US does not build conventional submarines. In the rest of the world, six large submarines represents a respectable production run. The same is true of the ANZAC project in that a production run of ten frigates is quite substantial by global standards. In an industry where the availability of significant scale and learning economies are important factors in determining unit costs, the length of the production runs for both these classes of ship would have allowed significant benefits to be derived from scale and experience economies.

In the case of the Collins and ANZAC classes, therefore, there was a beneficent coincidence of minimum local production costs, because of the availability of scale and learning economies, and maximum benefits in terms of self-reliance, because of the use of domestically engineered and integrated systems. The pay-off to Defence from the investment in local capability was almost certainly positive.

Maintaining self-reliant capability with future acquisitions

In terms of future acquisitions, the picture is less rosy. The two major acquisitions on Navy’s horizon, the AWDs and the LHD ships, will be built in production runs
of three and two respectively. In the case of the AWDs, for example, if we select a design based on the DDG-51 Arleigh Burke class, Australian yards would be building three ships compared with production runs in some US shipyards of over twenty copies of this class. The cost premium of a local build could be high because of the inability to benefit significantly from scale or experience economies. (This premium would be even higher if the ships were built in a new location with a new workforce and supply chain.) This point applies to a lesser degree to the European-based LHD ships, since a low production run of the vessels can also be expected in France or Spain.

On the other hand, what are the benefits, in terms of capability and self-reliance, to be derived from a local build of these ships? Clearly there would be some benefits in that the hulls and many of the systems could readily be repaired in country. It seems likely that there would be a major capability to maintain and repair battle damage to the LHD ships. On the other hand, the heart of the AWDs is the Aegis combat system. This will be delivered by the US Navy more or less as a ‘blackbox’ in a government-to-government transaction. Unless Australian industry has the capacity to repair Aegis, the benefits of a local build of the AWDs in terms of providing the capability to sustain self-reliance must be questionable.

This suggests that two conditions need to be met to make a local build of the AWDs attractive:

- a US systems company (probably Lockheed Martin), with US Government agreement, needs to guarantee the sustenance of a local operation capable of maintaining and repairing Aegis in the future; and
- the cost premium for the three ships needs to be not excessive.

Of course, another factor that needs to be accounted for is the cost of not sustaining the capability to maintain and provide through life support for the Collins and ANZAC classes. If the AWDs and LHD ships were not built in Australia, this capability could be compromised.

In deciding whether or not to build the new ships in Australia, the Government needs to take all these factors into account. The fact that the Northrop Grumman option, for constructing the AWDs in part in the United States, remains on the table suggests that the Government is considering the various trade-offs involved in a local build. Having invested heavily in the capability required to sustain self-reliance in large surface warships and submarines, however, any decision to acquire the new generation warships entirely from overseas would be a courageous one.

Finally, in assessing the location of shipbuilding in the context of future labour requirements, Defence needs to take account of the distribution of workload among naval suppliers with an explicit aim of retaining sufficient depth in the available skill set. Skill shortages are emerging as a significant issue across Australia, and are also affecting the defence industries — particularly for tradespeople and professionals (see Table 4.1). It is unlikely that the industry’s skill requirements will be met if activity is concentrated in a few locations, particularly in States with less depth in their labour markets. The analysis presented in our first report suggests that the skill creation rate in the States of Victoria, in particular, and New South Wales is critical to maintaining industry capability. The industry needs to be able to draw on labour markets on a national basis if it is to be able to satisfy its significant skill requirements.
Table 4.1

SEVERITY OF SKILL SHORTAGE IN DEFENCE INDUSTRY FIRMS

<table>
<thead>
<tr>
<th>Occupational group</th>
<th>Total responses</th>
<th>Critical</th>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
<th>Nil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior manager</td>
<td>62</td>
<td>2</td>
<td>9</td>
<td>14</td>
<td>9</td>
<td>28</td>
</tr>
<tr>
<td>Professional</td>
<td>72</td>
<td>3</td>
<td>12</td>
<td>27</td>
<td>11</td>
<td>19</td>
</tr>
<tr>
<td>Associate professional</td>
<td>62</td>
<td>1</td>
<td>6</td>
<td>23</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>Trades people</td>
<td>69</td>
<td>16</td>
<td>13</td>
<td>17</td>
<td>4</td>
<td>19</td>
</tr>
</tbody>
</table>

Source: ACIL Tasman (2004), A Profile of the Australian Defence Industry, ACIL Tasman Pty Ltd, Canberra, p.18

4.2 Competition versus monopoly

Views differ in the industry and in Defence regarding the forces that should shape the future structure of the naval shipbuilding industry. On the one hand, it is argued that the future workload is insufficient to sustain the current investments in capability and that government should adopt a *dirigiste* approach and identify and sustain a preferred single supplier. The alternative view is that there is sufficient workload to sustain a healthy industry into the future and that, in any case, the market should be allowed to determine the industry’s structure and configuration. The following discussion of these issues is based on the application of economic principles.

**Dirigisme and monopoly**

In 2002, as the two major acquisition programs of the 1980s and 1990s, the *Collins* submarines and the *ANZAC* frigates, were winding down, the Defence Matériel Organisation turned its attention to the future of the naval shipbuilding and repair (NSR) sector. DMO had two concerns. First, they considered that the traditional procurement process of competitive tendering for each and every project was counter-productive in terms of sustaining the deep investment in capability required by Defence:

> The NSR [Naval Shipbuilding and Repair] Sector, more than any other Defence industry sector, exemplifies the problems associated with Defence’s project-by-project approach to acquisition and the ineffective application of Defence’s industry policy framework. Over the past 15 years, Navy’s six major projects have been awarded to five different companies at five different locations. Consequently, the key capabilities and skill sets created within these companies, which are critical to the effective whole-of-life support of Navy’s ships and submarines, are not being sustained once the projects come to an end.


It is certainly the case that some contracts have been awarded to players outside the traditional naval shipbuilding industry (for example, Austal Ships winning the *Armidale* class patrol boat contract). There is a tension here between sustaining capability in the traditional naval shipbuilding sector and reaping the benefits of competition by selecting the best design at the best price.

But it is also possible to observe a tendency for greater risks to budgets and timetables to be associated with more complex shipbuilding projects, and for end of
Future of Naval Shipbuilding in Australia: Choices and Strategies

Project costs to differ greatly from the original bid. Overseas experience shows that the cost of ‘first of class’ warships can be notoriously difficult to estimate accurately. Even after the learning curve has been ascended, unforeseen problems and costs can still be encountered. 

It is entirely feasible for a more experienced shipbuilder to bid a higher price for construction of a warship and to be simultaneously efficient, pragmatically accurate and unsuccessful in a competitive process that did not engage sufficient expert advice and experience in the selection. The successful tenderer may then find they have significantly underestimated costs of undertaking the project. As a consequence, the Australian taxpayer may wind up paying considerably more for the warship than originally promised. In a thin market like naval shipbuilding this might also mean the loss of valuable skills and capability (see Box 4.2).

Box 4.2

DMO PERSPECTIVES ON NAVAL SHIPBUILDING PROCUREMENT

Over the past decade it has become evident that the procurement strategy normally used by Defence has not always delivered the best value for money. In each project, a prime contractor has usually been selected through an open tendering process, and awarded a fixed-price contract to supply the capability.

This has encouraged tenderers to under-bid, downplay risk and offer optimistic schedules that in reality are difficult to achieve. Profit margins then tend to be recovered as detailed production specifications emerge as contract variations. This procurement strategy also tends to produce an adversarial relationship, rather than a close partnership between Defence and its contractors.

This carries through to variations that arise during the life of the contracts, reflecting changing Defence needs or new technologies. The result is a contract structure with strong penalties against the exercise of innovation and flexibility during the life of the contract - even though such flexibility is central to effective defence capability. It may also discriminate against bids that in fact offer greater through-life value.


DMO’s second major concern was that future workload would be insufficient to sustain the industry in its current form:

… Defence’s new construction demand for the next 15 years is projected to be about half that of the preceding 15 years.” Accordingly, Defence’s future naval shipbuilding and repair requirements will not sustain the current capacity in Australia’s naval shipbuilding industry. Specifically, there will be insufficient Defence business to sustain the current specialised waterfront facilities for the construction and upgrade of major surface combatants and submarines. Maintaining excess supply within each of Australia’s shipbuilding facilities has the potential to increase costs, lead to fragmentation of core naval shipbuilding and repair skills, and is non-viable for industry. Given the disconnect between current industry capacity and Defence’s demand, industry has confirmed that consolidation in the Australian NSR sector is inevitable.

DMO’s solution to these issues focussed on the idea that Defence needed to foster alliance relationships with key suppliers, which would have a preferred position when it came to bidding for those future projects where they had a clear advantage in terms of existing capability. For shipyards capable of building large naval steel ships and submarines, DMO’s plan proposed that the sector be rationalised so that only one major supplier remained. DMO never specified the identity of that single supplier, but according to ASPI:

Although it was never spelt out, the outcome was clear: a new mega-shipyard would be built next to the Collins submarine construction site in South Australia which would consolidate ship modules built at existing yards in other States.


**Problems with the monopolistic model**

The DMO proposal has been widely criticised and its NSR strategic plan has not been accepted by the Government.

There are few obvious benefits in the proposal to create one monopoly supplier of major surface ships and submarines. While some may consider that this would create savings through exploiting synergies or economies of scale and scope, in fact, there are few synergies between submarine and surface warship production because of the fundamental differences between these vessels and the systems they employ. As shown in Chapter 2, large and efficient overseas shipbuilders such as General Dynamics and ThyssenKrupp Marine Systems (TKMS) build surface ships and submarines in separate yards. Where builders such as Kockums (now part of TKMS) have consolidated their submarine and surface ship operations in one yard this has been as a consequence of a reduced order book and the need to consolidate a commercial entity’s operations at one site. There would be negligible benefits from co-locating different commercial entities building the two kinds of warship, while moving one highly capable player to a new location would lead to a substantial cost bill as well as putting additional pressure on the local labour market.

At the same time, consolidation into one monopoly supplier clearly creates a number of potential problems:

- **Risk of excessive [monopoly] pricing.** This issue is complex. In principle the creation of a monopoly in naval shipbuilding would lead to higher prices. This would be true unless the monopoly were regulated. The DMO argued that the reduced demand created a situation in the NSR sector where a natural monopoly would emerge, that is, a situation where a competitive model would be less economic. The theory of natural monopoly is well known to Australian policy makers and regulatory systems have been developed so that natural monopolies such as gas pipelines charge tariffs that mimic a competitive outcome. The difficulty with regulating an entity such as a shipyard is that they may accommodate rate of return regulation by not investing in improvements or state-of-the-art techniques and adopting a lazy, ‘satisficing’ approach that would lead to Defence paying higher prices than necessary.

- **No pressure to modernise.** Linked to the last point, a monopoly position would mean there was no pressure on the entity concerned to invest in leading edge
techniques and processes. Since technological change is an important success factor in this industry, this could be a major issue of concern.

• **Significant write-off of capability.** Consolidation of naval suppliers would mean that either the current investment in submarine capability or surface ship capability would need to be written off and re-created elsewhere.

• **Reduced industry capacity.** Consolidation in one entity may mean that other companies scale down their operations. This could mean in the future that there is a much reduced capacity to build ship modules around the country, leading to slower construction schedules for major warships in the future.

• **Little incentive to compete in export markets.** With a level of demand that was virtually guaranteed, there would be no significant incentive for the selected entity to engage in globally competitive markets.

Overseas experience suggests that creating a monopolist is by no means a necessary condition for enhancing capability or for establishing a productive and non-adversarial relationship between government and industry. Indeed, Britain’s defence industry has become highly concentrated since the end of the cold war and this appears to have created a more adversarial relationship between government and BAE Systems, the dominant player. As shown in Chapter 2, a desire for competition led the UK government to request the French company Thales to bid to build two proposed new aircraft carriers in competition with BAE Systems and subsequently to award the contract to both companies. This concern also led the government to contract Vosper Thornycroft to take a significant role alongside BAE Systems in building the Type-45 destroyers. A number of recent reports have provided considerable anecdotal evidence of a lack of trust between the British government and its major defence contractor.

Turning to the possible objective of consolidating the industry in South Australia, this would be a major issue of concern because:

• **It would mean writing off a significant investment in capability.** Defence, on behalf of the Australian community, has invested heavily in developing capability at Williamstown in major surface ship construction, repair and upgrades. This capability is embodied not just in the shipyard, but in its highly skilled and experienced workforce and in its supply chain, which is overwhelmingly located in the Melbourne area. Re-creating such a capability in South Australia would involve additional costs and significant risks. The capital expenditure required to create a facility capable of consolidating the AWDs would be twice as great in Osborne as in Williamstown.

• **It would involve punishing success.** The ANZAC ship project at Williamstown has been one of the world’s more successful naval shipbuilding projects in the last two decades. The ships have been delivered on time and on budget with fully effective systems and latterly the systems have been relatively complex. By contrast, the Collins project delivered in South Australia, which as a State has no history of naval shipbuilding, was plagued by significant problems and overruns.

• **South Australia may lack the necessary critical mass.** As discussed in our first report, Victoria’s labour market has a much greater depth than South Australia’s, while the Victorian economy in general is substantially better.
equipped in terms of soft and hard infrastructure to provide the critical mass necessary to underpin advanced manufacturing.

- **It would significantly increase the costs and risks in the AWD acquisition.**
  This would occur as a consequence of the above three issues.

**Market driven, competitive model**

While DMO’s problems with competitive tendering are acknowledged, this does not provide a sufficient case for dispensing with an approach fundamentally based on competition. The Australian Strategic Policy Institute (2002) observed that:

> The competitive tender process itself allows the costs of building in new facilities with inexperienced workforces to be compared with those of building in established ones. If there really are major cost advantages in using established companies with developed facilities and skill bases, that should be reflected in lower prices. All things being equal the established companies should win the contracts if their costs are lower.

ASPI (2002), *Setting a Course for Australia’s Naval Shipbuilding and Repair Industry*, page 28

The problems identified by DMO in Box 4.1 above suggest not that the principle of competition is deficient in the case of defence contracts but that Defence may have applied it in an inadequate or inappropriate way. While it is a reasonable objective to sustain capability in individual companies, those players that have already invested in that capability should have an advantage in bidding for contracts that require it. There are several possible reasons why an incumbent player with significant sunk costs in capability may not win a tender, for example:

- its price is uncompetitive because it is seeking to exploit a perceived monopoly position;
- its performance on other contracts for Defence has been sub-standard; or
- a new rival may offer a more innovative and cost-effective solution.

One or all of these factors may have applied, for example, in the decision to award the *Armidale* patrol boat contract to Austal Ships when it was widely expected to go to one of the mainstream players in the naval shipbuilding industry. If so, it would be difficult to argue that that particular decision was ill-conceived in light of the fact that Austal offered an innovative design, a competitive price and a proven track record in building aluminium ships. It certainly fails to substantiate a case in favour of creating a monopoly supplier and feeding it with a guaranteed workload.

In some cases, however, an efficient incumbent may lose a contract because a new competitor has misjudged the extent or complexity of the work and has under-priced. In such a case, Defence would have to bear some responsibility for awarding the contract to a company that cannot deliver the required outcomes at the quoted price. There are various approaches that DMO could adopt to address this issue, for example:

- before issuing an RFT, determine which companies have the capability and performance record to undertake the work and then restrict the bidding to those players;
- do not always award the contract to the lowest price tenderer, but take account of capability and a record of performance;
in the case of substantial contracts, try to ensure one overseas bidder tenders for the work in order to provide a benchmark price as well as another viable procurement option;

• scrutinise the costing of the various tenders in detail;

• ensure that tenderers understand that they will bear most of the risks of under-quoting;

• develop protocols with companies on how changes or extensions to a contract should be addressed over the period of the contract.

The first point was made strongly in the independent report on the problems then being experienced with the Collins class (our italics):

Defence should ensure that the prime contractor and the subcontractors have the technical, financial and managerial expertise to carry out the project and to respond to likely risks... What is required are terms which compel the contractor to demonstrate his capacity to deliver in advance of the contract itself. This might variously be through an established track record of building the same thing for similar applications (if not, something similar or a derivative for a different application), or a series of tests and trials.


If DMO let and administered contracts in this way, it would also reduce the adversarial nature of the relationship with contractors. Other measures can be taken to address this issue, including the adoption of a more arms length approach to monitoring performance and developing a spirit of cooperation in relation to unforeseen developments that occur over the course of any major defence contract.

It may be suggested that competition will be ineffectual if, for example, only one contender has a strong capability in surface combatants and bids for a project such as the AWDs. This is not the case, however, since other companies can form alliances with overseas groups, for example, and we have seen how commercial global players such as Austal have the capacity to enter the naval market almost on an opportunistic basis and put forward innovative and competitive proposals. Also, in future DMO will abide by the recommendation in the 2003 Kinnaird report on defence procurement, which proposed that every tender process for the acquisition of a significant defence asset should contain at least one overseas option. This approach would serve the purpose of ‘keeping the locals honest’ while also providing information to assist DMO in assessing whether or not the increase in local capability consequent on a domestic acquisition can be justified in terms of the cost premium that would be incurred.

In terms of the need to rationalise the naval shipbuilding industry in the face of a declining workload, it should first be noted that the future naval workload has increased by over 20 per cent since the DMO’s NSR sector plan was published in 2002. Nevertheless, it may well be that the size of the industry will decline over time. If so, there seems little merit in Defence prescribing the future industry structure and determining which players will survive and which will die. Defence bureaucrats have no more credibility in ‘picking the winners’ than other government officials and this kind of prescriptive approach to industry policy has long been discarded in Australia in favour of a market-driven model.

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In our view, the appropriate role of government is to determine the level and nature of the defence industry capability it requires and then to allow market forces to prevail by allowing industry to bid for the resulting contracts. In letting these contracts it is to be expected that government will select the most competitive and least risky bids. It should not try to overlay the tender process with any other objectives, such as to further any *dirigiste* objectives of defence officials or to favour one State over another or support a publicly-owned player over private sector competitors.

This approach appears to have been endorsed by the Government. Two years after DMO released its NSR sector strategic plan, the Minister for Defence and the Minister for Finance stated that:

> Given the significant increase in NSR sector expenditure resulting from the Defence Capability Review, a competitive model is the preferred approach in the NSR sector with intervention by Government only in exceptional circumstances.


Overall, a competitive approach to defence procurement can certainly give rise to some problems. But it is difficult to come up with a better approach. Indeed, to paraphrase Churchill on democracy as a form of government, 'competition is the worst system except all those other systems that have been tried from time to time'.

### 4.3 Two major projects

Under the latest Defence Capability Plan, a major component of new work worth over $8 billion is expected to flow to Australian shipyards over the next decade (see Figure 4.1).

The two largest naval projects in this plan are:

- **SEA 4000**, involving construction of three air warfare destroyers for the Royal Australian Navy, with delivery scheduled from 2013; and
• JP 2048, which involves replacement of the two amphibious transport ships HMAS Kanimbla and Manoora, and the landing ship HMAS Tobruk, with two large ‘flat-topped’ amphibious transport ships (LHDs) between 2010 and 2016.

These projects come on top of already programmed construction and repair work. But only a part of this will flow to the shipyards. Much of this budget will go toward the purchase and integration of shipboard systems developed by other contractors and installed on existing platforms. Overall, the decisions to be taken in the next twelve months on the AWDs and the LHD ships will have a very far-reaching influence on the structure of Australia’s naval shipbuilding industry in the medium to long term.

**SEA 4000: the air warfare destroyers**

The Allen Consulting Group’s first report on naval shipbuilding focussed on the $6 billion AWD program. The report concluded that, provided the Government takes the decision to build the ships in Australia and assuming its bid was competitive, Tenix has by far the strongest credentials to take the lead role on this project and consolidate the destroyers at its shipyard at Williamstown. Our analysis suggested that under all the criteria we examined (except systems integration, where a Tenix operation at Osborne was ranked equal), the Tenix operation at Williamstown offers a superior capability for building the AWDs (Table 4.2).

<table>
<thead>
<tr>
<th></th>
<th>Tenix at Williamstown</th>
<th>Tenix at Osborne</th>
<th>ASC at Osborne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capability and competitiveness</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Skilled workforce</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Network of capable suppliers</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Securing the site (CAPEX)</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Consolidating naval platforms</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Integrating surface ship systems</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>


To build the AWDs at Osborne in South Australia would involve significantly higher costs in terms of capital expenditure and considerably higher risks. Nevertheless, a considerable momentum has built up in favour of writing off surface combatant capability in Williamstown and re-investing in this capability in Osborne. The arguments in favour of this proposition range from a concern over Williamstown’s supposed gentrification to a view that consolidation in submarines and surface combatant capability in South Australia would somehow be more efficient. In our earlier report, these arguments were all found to be flawed.

The Group’s first report has been widely circulated and reported upon. Its fundamental argument has not been refuted.
The government has decided to acquire two large naval vessels known as Landing Ships, Helicopter Dock (LHD). These ships will replace the amphibious command ships Manoora, Kanimbla and Tobruk and will be able to carry a significant number of helicopters on a flight deck and in a hangar below. They will also carry landing craft in a floodable dock and be able to transport and land Australia’s new Abrams tanks. Overall, the ships will provide a major boost to the ADF’s sealift capability and offer a considerable increase in Australia’s force projection capacity.

United States versions of such ships do not offer the broad range of capabilities required by the RAN and instead two European designs are being considered:

- IZAR of Spain’s 27,000 tonne strategic protection ship, which has a ‘ski-jump’ flight deck and thus a capacity to deploy STOVL fixed wing aircraft such as the Harrier and the F-35B; and
- Armaris of France’s 21,300 tonne Mistral class force projection and command vessel, together with a larger version based on the original extended design.

These are large ships, being around 200 metres long with a displacement greater than Australia’s last aircraft carrier, HMAS Melbourne, and around three or four times that of the AWDs. Their systems are less complex than those of major combatants and they would rely on other warships such as the AWDs to provide protection in any combat situation. They essentially represent large steel hulls capable of transporting and deploying valuable assets such as the ADF’s new troop lift helicopters and tanks.

It is not clear what cost penalty the government is prepared to accept on these vessels in order to undertake a local build. Australian industry is not competitive in building a small number of large steel ships, while the ability to repair damage to their hulls does not depend on having built them in Australia in the first place. The government may decide to build them in Australia using modular techniques or contract for the hulls to be built overseas and then fitted out in Australia. An interesting feature of Tenix’s successful bid for the New Zealand Project Protector was that the hull for the only large ship to be constructed in the program is to be built in the Netherlands and then floated out to Australia for fitting out. In addition, where large steel hulls are required, recent Defence practice has been to acquire second-hand ships overseas and fit them out in Australia (for example, Manoora, Kanimbla and the Westralia replacement). This approach is obviously not available for the LHD ships.

Assuming the ships are built in Australia, there will be several contenders for the work:

- A consortium involving Austal Ships and Raytheon at the Australian Marine Complex at Henderson, Western Australia. This group does not include a specialist steel shipbuilder but could be expanded to include Tenix (which has an adjacent facility) or ADI. However, there are also a number of steel fabricators in WA with specialist skills in building offshore oil and gas platforms. In terms of infrastructure, the Gallop government has committed to building a $65 million floating dock at the Complex, which would be suitable for building these ships. (This consortium would be particularly strongly

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21 Short take-off, vertical landing.
placed if the hulls were constructed overseas and the ships fitted out in Australia.)

- Tenix, which may find these ships too large to build at their Williamstown facility but could certainly build modules there for final fitting out in their Henderson facility. However, if Tenix wins the AWD contract they might not expect to win this work, at least as a single lead shipbuilder.

- While Forgacs at Newcastle has no recent experience in building large steel naval ships, it is capable of module construction and has successfully upgraded the *Manoora* and *Kanimbla*.

- The acquisition would seem a good fit for ADI’s capabilities (particularly since it is a European design) for construction at Newcastle, but ADI has never built a large steel ship and the significant delays being experienced on the FFG upgrade project may be a problem.

If the hulls for these ships were to be built in Australia, a modular approach would provide significant work for shipyards in New South Wales, Western Australia and either Victoria or South Australia, depending on the location of the AWD consolidation.

**Other naval programs**

Construction and modification work over the next decade also includes the replacement of the Navy’s replenishment ship HMAS *Westralia* (a second hand vessel has been purchased for naval modification by Tenix at Henderson, and is in turn scheduled for replacement in 2018), and the support vessel, HMAS *Success*.

Other major programs are the continuation of the upgrades of the FFGs (ADI as lead contractor) and the *ANZAC* frigates (*ANZAC* Ship Alliance, comprising Tenix, SAAB and DMO). These will provide workload, but not enough to satisfy the requirements of these companies’ naval divisions.

The $3.5 billion contract for through life support of the *Collins* class submarines, already awarded to ASC, represents a major program over the next two decades. Nevertheless, there is a concern that this workload is insufficient to sustain ASC which, given the parent navy responsibilities for the *Collins* class, is seen as essential. But according to ASPI:

> The financial concern is a little surprising because at first glance the work of supporting the six submarines would appear to be a pretty big business. An indicative rule of thumb for annual maintenance costs of something of the complexity of a submarine is about 5 per cent of the capital value of an asset. For the six *Collins* boats, that would work out at around $250 million per year. This is larger than the turnover of all but the largest Australian defence companies.

ASPI (2002), page 25.
Chapter 5
Future industry structure: the strategic choice

5.1 Three scenarios for future industry development

As discussed above, it is difficult to predict how the naval shipbuilding will develop over the longer term. The future composition of Australia’s naval shipbuilding industry depends on a number of unknowns, which, if they were all included in the mix, would give rise to a large number of scenarios. In order to provide a digestible number of feasible alternatives, three scenarios are presented here.

The major unknown, of course, is which shipyard will win the contract for consolidating the AWDs and the LHD ships. In assessing the relative competitive strengths of the three options (excluding Northrop Grumman) for the AWDs, we believe that Tenix at Williamstown is clearly superior. Provided its bid is competitive in price, it will only fail if the Government:

- accepts the Northrop Grumman proposal; or
- decides to incur higher costs and risks by building the ships in South Australia essentially for non-economic reasons.

The issue of the LHD ships is less clear-cut. There is a capability to build large steel ships in NSW, principally at Newcastle, although none have been built for the RAN recently. The difficulty here is that the delays in the FFG upgrade may have raised some question marks over ADI’s performance, while Forgacs may be unlikely to meet all the criteria for a prime contractor role. Although the Austal/Raytheon consortium has no obvious expertise in steel ships, the Chairman of Austal has suggested that another participant could join the team.22 This might be a steel shipbuilder, with Tenix operating a facility adjacent to Austal’s at the Australian Marine Complex in Western Australia.

On the other hand, Defence may decide that the best trade-off between cost and sustaining local industry capability lies in having the hull constructed offshore with the fitting out occurring in Western Australia. Both Austal and Raytheon appear to have met DMO’s performance standards in recent years, while the State government is prepared to commit $65 million to providing the required infrastructure to build or fit out the ships at Henderson. On balance, it seems likely that the advantage lies with the Western Australian bid for the LHD ships.

In terms of the combat systems integrator, having been selected as combat system engineer, Raytheon would seem to have an advantage in the three-way contest.

The three scenarios are based on the alternative options for consolidating the AWDs (excluding Northrop Grumman). In each of the scenarios it is assumed that Austal/Raytheon wins the LHD ships contract, with the hulls being constructed overseas. It is also assumed that Raytheon wins the systems integration work. The first scenario is loosely designated as a competitive outcome, while the second and third scenarios reflect more of a dirigeiste or ‘industry engineering’ approach.

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Scenario 1: a competitive outcome and a national industry

Under this scenario:

- Tenix wins the AWD consolidation project at Williamstown;
- Raytheon wins the combat system integration task; and
- A consortium of Austal and Raytheon wins the LHD ship contract at Henderson in Western Australia, with the hull being fabricated overseas.

The implications of this for the industry in various States is as follows:

- **Victoria.** The State government funds a substantial upgrade of the infrastructure at the Williamstown shipyard. Tenix at Williamstown has a major workload out to at least 2018 consolidating the AWDs. Lockheed Martin and Raytheon establish operations in Melbourne to deliver the systems to the AWDs, but much of the systems integration task occurs in NSW and South Australia.

- **South Australia.** The State government funds a limited upgrade of the facilities at Osborne and ASC wins significant work building modules for the AWDs. Defence provides increased funding for the through life support of the Collins class submarines. An overseas shipbuilder purchases ASC and integrates its operations into its global business. A major part of the systems integration work for the AWDs occurs in South Australia.

- **New South Wales.** Forgacs wins work to build modules for the AWDs. ADI scales back its marine division and focuses on maintenance work at Fleet Base East. Raytheon undertakes significant systems work in NSW.

- **Western Australia.** Austal and Raytheon have a major workload in WA with the LHD ships. Austal completes the Armidale patrol boat project and then the consortium of which it is a member wins the contract to build 60 Littoral Combat Ships for the US Navy. Continuing work for Tenix on maintaining warships and submarines based at Fleet Base West (FBW).

- **Queensland.** No change.

- **Tasmania.** The consortium of which Incat is a member wins a major, longer-term workload to build high-speed transports for the US Navy.

- **Australian Capital Territory.** Significant work for Canberra-based electronics companies, including Lockheed Martin, Raytheon and the Australian-owned CEA Technologies.

Overall, this outcome is benign for all existing players and every State. There is a sufficient naval workload to maintain existing players, which can also compete for future work and for export orders. Victoria consolidates its position in major naval surface platforms and South Australia in submarines and naval systems. An important new entrant takes over ASC and injects additional expertise into the industry. The division of workload between the States minimises potential skill shortages and maintains capability in the areas where significant investments have already been made.
Importantly, these outcomes minimise the risks and costs involved in the procurement of the AWDs in particular. The two Australian players that appear to be most competitive internationally, Tenix and Austal, benefit from this outcome.

**Scenario 2: concentration and dislocation**

Under this scenario:

- Tenix wins the AWD consolidation project at Osborne; and
- a consortium of Austal and Raytheon wins the LHD ship contract at Henderson in Western Australia, with the hull being fabricated overseas.

The implications of this for the industry in various States is as follows:

- **Victoria.** Some modules for the AWDs are built in Williamstown in order to phase down the shipyard’s operations gradually. After this shipbuilding ceases at Williamstown as Tenix, not needing three facilities in Australia, consolidates its operations at Osborne and Henderson.

- **South Australia.** With the submarine through-life-support program and 70 per cent of the AWDs being undertaken in the State, naval shipbuilding has effectively moved to South Australia. In addition, most of the systems integration tasks now occur in South Australia. Significant skill shortages have an impact on the AWD project and no significant benefits are realised through synergies between submarines and surface ships.

- **New South Wales.** Forgacs wins work to build modules for the AWDs. ADI scales back its marine division and focuses on maintenance work at Fleet Base East. Raytheon undertakes significant systems work in NSW.

- **Western Australia.** Austal and Raytheon have a major workload fitting out the LHD ships. Austal completes the Armidale patrol boat project and then the consortium of which it is a member wins the contract to build 60 Littoral Combat Ships for the US Navy. Tenix and Raytheon gain ongoing maintenance work at FBW.

- **Queensland.** No additional workload.

- **Tasmania.** The consortium of which Incat is a member wins a major, longer-term workload to build high-speed transports for the US Navy.

- **Australian Capital Territory.** Significant work for Canberra-based electronics companies, including Lockheed Martin, Raytheon and the Australian-owned CEA Technologies.

This outcome sees a radical change in the structure of the naval shipbuilding industry. The successful investment in surface ship capability at Williamstown is written off as significant naval shipbuilding ceases in Victoria and is greatly reduced in NSW as well. The big winners are South Australia and Western Australia, which also win much of the systems workload too. This causes significant problems with skill shortages in the industry and with a much longer supply chain.

**Scenario 3: high risks and write-offs**

Under this scenario:
• ASC wins the AWD consolidation project at Osborne; and
• a consortium of Austal and Raytheon wins the LHD ship contract at Henderson in Western Australia, with the hull being fabricated overseas.

The implications of this for the industry in various States is as follows:

• **Victoria.** Tenix buys ASC so as to protect its position in major warship platforms. Some modules for the AWDs are built in Williamstown but after this shipbuilding ceases at Williamstown as Tenix consolidates its operations at Osborne and Henderson. Naval shipbuilding and most associated activities cease in Victoria.

• **South Australia.** With ASC owned by Tenix and all significant naval shipbuilding moved to Osborne, the original DMO proposal for consolidation with one supplier is achieved. In addition, most of the systems integration tasks now occur in South Australia. Significant skill shortages have an impact on the AWD project and no significant benefits are realised through synergies between submarines and surface ships.

• **New South Wales.** Forgacs wins work to build modules for the AWDs. ADI scales back its marine division and focuses on maintenance work at Fleet Base East. Raytheon undertakes significant systems work in NSW.

• **Western Australia.** Austal completes the *Armidale* patrol boat project and then the consortium of which it is a member wins the contract to build 60 Littoral Combat Ships for the US Navy. Tenix and Raytheon gain ongoing maintenance work at FBW.

• **Queensland.** No additional workload.

• **Tasmania.** The consortium of which Incat is a member wins a major, longer-term workload to build high-speed transports for the US Navy.

• **Australian Capital Territory.** Significant work for Canberra-based electronics companies, including Lockheed Martin, Raytheon and the Australian-owned CEA Technologies.

This outcome also brings about a radical change in the structure of the naval shipbuilding industry. The successful investment in surface ship capability at Williamstown is written off as significant naval shipbuilding ceases in Victoria and is greatly reduced in NSW as well. The big winners are South Australia and Western Australia, which also win much of the systems workload. This causes significant problems with skill shortages in the industry and with a much longer supply chain.

**5.2 Implications of the scenarios**

These three scenarios demonstrate the extent to which the future of Australia’s naval shipbuilding industry depends on the current strategic choice confronting the government in regard to the AWD consolidation.

Logically, a market driven outcome would see the AWDs consolidated at Williamstown in line with the first scenario. This is the only scenario that provides a balanced workload for the industry into the future on a national basis while sustaining existing capability and maintaining a competitive industry structure.
There would be a substantial program of work for the next two decades in Victoria, South Australia and Western Australia, with modules to be built and maintenance to be carried out in NSW. Importantly, it builds most effectively on the significant investment in capability that has been made to date and the strengths that have become apparent in different States and locations. By building on the success of the two players, Tenix and Austal, that have demonstrated a high level of international competitiveness in the naval shipbuilding industry, this approach would also demonstrate government backing for existing winners, a commitment to market-driven outcomes and an appreciation of the need to minimise risks.

The alternative, government planning approach, would almost certainly result in the end of naval shipbuilding at Williamstown, with its excellent record in building the ANZAC frigates and established capability in surface warship construction. As stated before, the case for building on a well-established capability and a record of success by consolidating the AWDs at Williamstown is extremely difficult to refute. If there is a strong argument for rationalising the ‘large warship’ sector of the industry to a single location in South Australia, it has yet to be persuasively articulated. There are negligible synergies to be derived between surface warship and submarine shipbuilding, while the risks and costs of attempting to re-build capability in a location with a relatively shallow labour market and limited supply chain are not to be underestimated. There is also sufficient workload over the next two decades to dispense with any idea that government needs to engineer a rationalisation of the industry. From a national perspective, there would be no obvious benefits from this approach while both the costs and the risks would be substantially higher.