REPORT TO
AUSTRALIAN INDUSTRY GROUP

DECEMBER 2013

NAVAL SHIPBUILDING &
THROUGH LIFE SUPPORT

ECONOMIC VALUE TO AUSTRALIA

MAINTAINING CAPABILITIES AND CAPACITY
RELIANCE AND DISCLAIMER

THE PROFESSIONAL ANALYSIS AND ADVICE IN THIS REPORT HAS BEEN PREPARED BY ACIL ALLEN CONSULTING FOR THE EXCLUSIVE USE OF THE PARTY OR PARTIES TO WHOM IT IS ADDRESSED (THE ADDRESSEE) AND FOR THE PURPOSES SPECIFIED IN IT. THIS REPORT IS SUPPLIED IN GOOD FAITH AND REFLECTS THE KNOWLEDGE, EXPERTISE AND EXPERIENCE OF THE CONSULTANTS INVOLVED. THE REPORT MUST NOT BE PUBLISHED, QUOTED OR DISSEMINATED TO ANY OTHER PARTY WITHOUT ACIL ALLEN CONSULTING’S PRIOR WRITTEN CONSENT. ACIL ALLEN CONSULTING ACCEPTS NO RESPONSIBILITY WHATSOEVER FOR ANY LOSS OCCASIONED BY ANY PERSON ACTING OR REFRAINING FROM ACTION AS A RESULT OF RELIANCE ON THE REPORT, OTHER THAN THE ADDRESSEE.

IN CONDUCTING THE ANALYSIS IN THIS REPORT ACIL ALLEN CONSULTING HAS ENDEAVOURED TO USE WHAT IT CONSIDERS IS THE BEST INFORMATION AVAILABLE AT THE DATE OF PUBLICATION, INCLUDING INFORMATION SUPPLIED BY THE ADDRESSEE. UNLESS STATED OTHERWISE, ACIL ALLEN CONSULTING DOES NOT WARRANT THE ACCURACY OF ANY FORECAST OR PROJECTION IN THE REPORT. ALTHOUGH ACIL ALLEN CONSULTING EXERCISES REASONABLE CARE WHEN MAKING FORECASTS OR PROJECTIONS, FACTORS IN THE PROCESS, SUCH AS FUTURE MARKET BEHAVIOUR, ARE INHERENTLY UNCERTAIN AND CANNOT BE FORECAST OR PROJECTED RELIABLY.

ACIL ALLEN CONSULTING SHALL NOT BE LIABLE IN RESPECT OF ANY CLAIM ARISING OUT OF THE FAILURE OF A CLIENT INVESTMENT TO PERFORM TO THE ADVANTAGE OF THE CLIENT OR TO THE ADVANTAGE OF THE CLIENT TO THE DEGREE SUGGESTED OR ASSUMED IN ANY ADVICE OR FORECAST GIVEN BY ACIL ALLEN CONSULTING.

© ACIL ALLEN CONSULTING 2013
Executive summary

Naval shipbuilding is an important contributor to the Australian economy. It directly employs some 6,000 people, and indirectly nearly 15,000 people. The industry makes a contribution to the Australian economy of between (conservatively) $1.5 billion up to around $2.3 billion (based on total multipliers) per annum.

Around 7,400 full time equivalent (FTE) jobs across Australia can be attributed to the production of naval vessels by the five largest prime contractors in the industry. In addition, up to 7,560 FTE jobs can be can be attributed to the activities associated with through life support of naval vessels. Thus, the total FTE jobs generated across Australia – and including direct employees, contractors and other flow-on jobs – is nearly 15,000. Because this is based on the sample of the five large contractors only it is a conservative estimate.

Of the potential $2.3 billion contribution from naval shipbuilding and through life support to the economy, the majority comes from the production side ($1.3 billion); however, the contribution from TLS is still highly significant ($975 million).

In addition to these direct dollar and employment effects, the naval shipbuilding industry has a number of other significant economic benefits:

- Technology transfer (for example, the development of Bisalloy steel)
- Transfer of expertise – firms involved in the naval shipbuilding supply chain gain skills that enable them to compete successfully in other projects and sectors
- Improved practices in areas such as quality assurance, business planning, sub-contracting and dealing with Defence in other fields.

A pattern of slowing down and then starting up again imposes large costs. The direct costs of re-opening a closed shipyard are relatively minor compared with the costs of retraining the workforce. If for example there were to be a 30 per cent loss of the workforce due to insufficient domestic demand, retraining costs could be from around $220m to $380m.

In addition, there are very large but unquantifiable costs resulting from the loss of the supply chain expertise gathered over many years. Some sources for this study suggested that the supply chain for a large and complex project could take up to 25 years to develop to maturity. Supply chains for naval shipbuilding are very complex, involving literally hundreds of different parties at different points in the chain. Loss of continuity means that crucial skills and expertise can be eroded, with large but unquantifiable costs to the economy.

Finally, maintaining domestic naval shipbuilding has other benefits in terms of the option value it creates for Australia. The complexity of modern systems and the need for integration of different aspects of platforms means that naval shipbuilding capability is directly relevant to the ability of industry to continue to provide through life support. An approach that maximises the value of these options would favour continuous build over a stop-start approach.
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive summary</td>
<td>ii</td>
</tr>
<tr>
<td><strong>1 Introduction</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1 Context</td>
<td>1</td>
</tr>
<tr>
<td>1.1.1 Purpose</td>
<td>1</td>
</tr>
<tr>
<td>1.1.2 Scope</td>
<td>1</td>
</tr>
<tr>
<td>1.2 The economics of naval capability</td>
<td>1</td>
</tr>
<tr>
<td>1.3 Approach</td>
<td>2</td>
</tr>
<tr>
<td>1.3.1 Analytical framework</td>
<td>2</td>
</tr>
<tr>
<td>1.3.2 Economic modelling</td>
<td>3</td>
</tr>
<tr>
<td>1.3.3 Data</td>
<td>4</td>
</tr>
<tr>
<td>1.4 Structure of the report</td>
<td>4</td>
</tr>
<tr>
<td><strong>2 Industry profile: current and future perspectives</strong></td>
<td>5</td>
</tr>
<tr>
<td>2.1 Profile of the current industry</td>
<td>5</td>
</tr>
<tr>
<td>2.1.1 Significant projects</td>
<td>5</td>
</tr>
<tr>
<td>2.1.2 Major infrastructure</td>
<td>6</td>
</tr>
<tr>
<td>2.1.3 Industry structure</td>
<td>7</td>
</tr>
<tr>
<td>2.1.4 Industry employment</td>
<td>9</td>
</tr>
<tr>
<td>2.1.5 Industry skills</td>
<td>9</td>
</tr>
<tr>
<td>2.1.6 Related industries</td>
<td>10</td>
</tr>
<tr>
<td>2.2 Future perspectives</td>
<td>12</td>
</tr>
<tr>
<td><strong>3 Economic contribution of naval shipbuilding</strong></td>
<td>14</td>
</tr>
<tr>
<td>3.1 Measures of macroeconomic impacts</td>
<td>14</td>
</tr>
<tr>
<td>3.2 Input-output analysis</td>
<td>15</td>
</tr>
<tr>
<td>3.2.1 Data provided</td>
<td>15</td>
</tr>
<tr>
<td>3.2.2 Employment</td>
<td>16</td>
</tr>
<tr>
<td>3.2.3 Income</td>
<td>17</td>
</tr>
<tr>
<td>3.2.4 Gross domestic product</td>
<td>18</td>
</tr>
<tr>
<td>3.2.5 Summary of economic impacts</td>
<td>19</td>
</tr>
<tr>
<td>3.3 Spillovers to other industries</td>
<td>20</td>
</tr>
<tr>
<td>3.3.1 Technology transfers</td>
<td>20</td>
</tr>
<tr>
<td>3.3.2 Transfers of expertise</td>
<td>24</td>
</tr>
<tr>
<td>3.3.3 Improved programs and practices</td>
<td>25</td>
</tr>
<tr>
<td>3.3.4 Improved capabilities and readiness</td>
<td>27</td>
</tr>
<tr>
<td>3.4 Avoided costs</td>
<td>29</td>
</tr>
</tbody>
</table>
3.4.1 Avoided infrastructure costs (shutdown and re-start costs) 29
3.4.2 Avoided supply chain costs 32
3.4.3 Avoided costs: summary and implications 33

4 Value to Government – real options analysis of naval shipbuilding 35

4.1 The value of capability 35
4.1.1 Choosing between capabilities and not just costs 35
4.1.2 Ensuring flexibility and adaptability 37
4.1.3 Real options approach 38
4.2 Weighing the options 39
4.3 Continuous build to exploit options 40

Appendix A Methodology A-1
Appendix B Summary of major naval projects B-1
Appendix C References C-1

List of boxes

Box 1 Product improvements breed success 22
Box 2 Australian vessels supplying the US Navy 23
Box 3 Case study: Favcote’s involvement in naval shipbuilding 23
Box 4 New practices open doors to new industries 26
Box 5 Helping suppliers negotiate complex Defence requirements 28
Box 6 Signed, steeled and delivered 28

List of figures

Figure 1 Defence-related shipbuilding: market and product/service segmentation ($2.8 billion) 8
Figure 2 Leading industry players for the total Australian shipbuilding and repairs services (by annual revenue generated) 8
Figure 3 Demand for Australian Submarines and Warships 13
Figure 4 Description of economic impacts 15

List of tables

Table 1 Framework for analysis 3
Table 2 Summary of significant defence shipbuilding projects since the late-1980s 6
Table 3  Major naval shipyards in Australia
Table 4  Employment in naval production and TLS for five largest prime contractors
Table 5  Breakdown of industry skills
Table 6  Local industry engagement for selected projects
Table 7  Suppliers for production and through life support (2013)
Table 8  Australian direct employment in naval production and TLS for five largest prime contractors in 2012-13
Table 9  Direct and indirect employment effects of naval shipbuilding and TLS (FTE employees)
Table 10  Direct and indirect income effects of naval shipbuilding and TLS (A$ million)
Table 11  Direct and indirect GDP effects of naval shipbuilding and TLS (A$ million)
Table 12  Simple and total effects of naval shipbuilding and TLS based on $100 million output
Table 13  Common technology transfers and impacts from ANZAC and Minehunter
Table 14  Common best practice adoption and impacts from ANZAC and Minehunter
Table 15  Example 1 – estimated shut-down/re-start costs
Table 16  Example 2 – estimated shut-down/re-start costs
Table B1  Collins Class Through Life Support project
Table B2  Future Submarines project
Table B3  AWD – SEA 4000 project
Table B4  Canberra Class LHD Project
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>AMC</td>
<td>Australian Maritime Complex</td>
</tr>
<tr>
<td>AWD</td>
<td>Air Warfare Destroyer</td>
</tr>
<tr>
<td>CIP</td>
<td>Coating Inspector Program</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial Off the Shelf</td>
</tr>
<tr>
<td>DSTO</td>
<td>Defence Science Technology Organisation</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GRP</td>
<td>Gross Regional Product</td>
</tr>
<tr>
<td>FTE</td>
<td>Full Time Equivalent (Staff)</td>
</tr>
<tr>
<td>HHA</td>
<td>High Hardness Armour</td>
</tr>
<tr>
<td>I-O</td>
<td>Input-Output (Modelling)</td>
</tr>
<tr>
<td>ICCPM</td>
<td>International Centre for Complex Project Management</td>
</tr>
<tr>
<td>JHSV</td>
<td>Joint High Speed Vessel</td>
</tr>
<tr>
<td>LHD</td>
<td>Landing Helicopter Dock</td>
</tr>
<tr>
<td>LCS</td>
<td>Littoral Combat Ship</td>
</tr>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>QLD</td>
<td>Queensland</td>
</tr>
<tr>
<td>RAN</td>
<td>Royal Australian Navy</td>
</tr>
<tr>
<td>RGNDI</td>
<td>Real Gross National Disposable Income</td>
</tr>
<tr>
<td>SA</td>
<td>South Australia</td>
</tr>
<tr>
<td>SAP</td>
<td>Supplier Audit Program (ASC)</td>
</tr>
<tr>
<td>SME</td>
<td>Small Medium Sized Enterprise</td>
</tr>
<tr>
<td>TLS</td>
<td>Through Life Support</td>
</tr>
<tr>
<td>US</td>
<td>United States (Navy)</td>
</tr>
<tr>
<td>VIC</td>
<td>Victoria</td>
</tr>
</tbody>
</table>
1 Introduction

1.1 Context

1.1.1 Purpose
The purpose of this report is to quantify the potential economic value of naval\(^1\) shipbuilding and through life support (TLS) to Australia. It covers only defence related shipbuilding. The report identifies the economic benefits generated by having a domestic industry capability in Australia to support the design, build and sustainment of a naval fleet that meets Australia’s strategic needs.

1.1.2 Scope
The analysis contained in this report is limited to the economic impacts of naval shipbuilding and TLS in Australia. It aims to provide a quantitative and qualitative estimate of the potential economic benefits to the Australian economy.

It is important to note that the economic impacts of civilian (or commercial shipbuilding) in Australia have not been modelled for this report. While such analysis was beyond the report’s scope, a qualitative assessment of civilian shipbuilding is provided in sections 2 and 3 in recognition of its importance to the sustainability of a defence shipbuilding and TLS industry.

It is also important to note that the values generated for Australia’s strategic and defence capability from the existence of a viable Australian defence shipbuilding industry are largely beyond the scope of this report. Such issues have been addressed in the past by the Department of Defence and the Royal Australian Navy (RAN) in other documents such as the Defence White Paper 2013 and the Defence Capability Plan 2012. These strategic issues are regularly reviewed and kept up to date within the department and the RAN.

1.2 The economics of naval capability
The naval shipbuilding industry operates within a competitive market that has a series of complex global connections and supply chains. Australian firms can benefit from being part of a nationally and internationally connected industry that provides opportunities to collaborate, design, and manufacture leading edge goods and services. In this sense naval shipbuilding is like any other industry in Australia, and its economic value should be seen in this way.

\(^1\) In this report the term “naval” shipbuilding and support refers to work for the Australian Defence Force, specifically the Royal Australian Navy (RAN), and other navies. There is some export of naval vessels from Australia, especially in the context of regional defence cooperation but also on a commercial basis. The analysis does not cover shipbuilding or through life support for civilian vessels, although we note that some of the companies consulted for this report do have a component of their business in the civil shipping sector.
However the nature of the capabilities required for supply of naval defence assets and related services is fundamentally different to many other industries. Maintenance of local technical capabilities to produce and deliver through-life support of civilian and defence naval platforms, equipment and systems, are important strategic decisions which impact on national security (CEDA 2012). For example, Australia may not wish to rely on naval capabilities that are dependent on highly uncertain, and/or highly risky, overseas supply chains or which can be affected by decisions taken by other sovereign governments. These strategic issues should be considered separately from the economic impact, but it is important to note that an Australian naval shipbuilding capability delivers benefits over and above the economic ones which are the main focus of this report.

Nevertheless from an economic perspective the unit of analysis is an important consideration in the assessment of net value. The key objective for the purchaser of naval Defence assets and related services, in this case the Australian government, is value for money. In this context we consider that best value for money relates not to the item of physical equipment (whether a ship or any other defence asset) but to the capability purchased. When considering value for money, it is crucial to consider not just differences in unit costs per item, but also relevant differences in the nature of the naval capability that is acquired and sustained over time, and the implications this has for Australia’s overall defence capability.

A capability consists not only of the asset and what it can do strategically (matters continually under consideration in the Department of Defence), but also the options that it creates. In Chapter 4 of this report we outline an approach to consideration of value for money in terms of ‘real options’, the portfolio of options for future value and management of risk represented by a particular investment decision. In value for money terms it is entirely possible that the value of the portfolio could be greater with fewer physical assets but with more options on how they can be deployed. That is, Australia may achieve better value for money from investment in local capabilities which support a smaller number of vessels through their entire life-cycle, rather than a larger number of vessels which require input from overseas (and potentially uncertain) supply chains.

It is important to recognise that the structure and costs of Australia’s navy are not driven by peacetime demands, but rather by the combination of demand for a fleet that could help deter serious conflict and, should this fail, by demand for a fleet suited to delivering defence response capability. Viewed this way, the fleet is an investment in insurance for Australia and its allies against rare but potentially very damaging future scenarios. The acquisition of naval vessels is a massive investment by Australia that can only be sensibly judged across the life of the fleet. The on-shore capabilities and options that emerge from local build are part of what is acquired if local build is used. Importantly, like other expenditure on insurance, value for money cannot be assessed by modelling ‘normal’ operations.

These issues of value are at the centre of the real options facing the government in decisions on the naval shipbuilding industry. Further discussion about these options, and their economic value, is provided in Section 4 of this report.

1.3 Approach

1.3.1 Analytical framework

The analytical framework used to understand the economic contribution of naval shipbuilding is presented in Table 1. The framework was developed to assist ACIL Allen in undertaking both quantitative and qualitative economic analysis of a highly complex industry. It was also developed to align with a number of well-regarded studies of major
The economic analysis framework is well tested and reliable.

What matters is the total net change to the economy from a policy.

naval projects previously undertaken by ACIL Allen Consulting (or its forebears), and used extensively in the Senate’s Review of Australia’s naval shipbuilding industry (2006).

A more detailed description of the framework components is provided at relevant points in Sections 3 to 4 of this report. A more detailed description of the methodology used for this report is provided in Appendix A.

Table 1  Framework for analysis

<table>
<thead>
<tr>
<th>Framework theme</th>
<th>Framework components</th>
<th>Type of analysis (Quantitative / Qualitative)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall economic</td>
<td> Gross Domestic Product (GDP)</td>
<td>Quantitative</td>
</tr>
<tr>
<td>contribution</td>
<td> Employment</td>
<td></td>
</tr>
<tr>
<td></td>
<td> Wages and Salaries</td>
<td></td>
</tr>
<tr>
<td>Other economic contribution</td>
<td> Spillovers (including technology and knowhow transfers &amp; improved productivity</td>
<td>Mixture of quantitative &amp; qualitative</td>
</tr>
<tr>
<td></td>
<td>and capabilities)</td>
<td></td>
</tr>
<tr>
<td></td>
<td> Avoided costs</td>
<td></td>
</tr>
<tr>
<td>Value for government</td>
<td> Real options</td>
<td>Qualitative</td>
</tr>
</tbody>
</table>

Source: Adapted from previous work undertaken by ACIL Allen.

1.3.2  Economic modelling

The macroeconomic impacts of an industry, policy, project or other activity can be estimated using a variety of analytical methods. One frequently used method is input-output (I-O) multiplier analysis. Appendix A contains a brief discussion of input-output models.

By their nature, input-output multipliers focus on ‘market impacts’ across the economy (i.e. impacts on activities with observed market prices). Analysis of various non-market impacts or values, such as defence capability (discussed above), property right infringements, potential loss of biodiversity, changes in air quality, social justice implications, etc., may also be relevant in assessing value.

Fundamentally, although various aspects of a policy or project — such as the number of jobs or the size of the investment expenditure — are of relevance to certain stakeholders, the key aggregate measure of the macroeconomic impact or value is the extent to which the total income of the economy has changed as a result of the policy or project. Typically this is measured in terms of gross domestic product (GDP). For this project our estimates of economic value will focus on:

— Initial effect – To meet the demand for Defence ships, shipbuilders increase production and concurrently increase employment, wages paid and their use of capital.

— Production induced effect – To meet the new demand, shipbuilders increase purchases from their suppliers/subcontractors, who in turn increase purchases from their own suppliers/subcontractors, and so on. This cycle continues until all increases in demand are satisfied.

— Simple multiplier effect – Represents the sum of the initial and production induced effects.

— Consumption induced effect – Employees of the Defence shipbuilders, and the employees of suppliers and subcontractors, spend their income on goods and services and by doing so provide additional stimulus to the economy.

— Total multiplier effect – Represents the sum of the simple multiplier and the consumption induced effect.
1.3.3 Data

The data sources used in this report include:

— Operational data from the five leading naval shipbuilding contractors currently operating in Australia. These data were de-identified and aggregated for the purposes of the modelling.

— Consultations with each of the contractors to discuss the data and to identify possible case studies for Section 3. Follow-up consultations were also undertaken with a selection of private companies which feature in the case studies.

— Existing economic analysis and modelling previously commissioned for the naval shipbuilding industry, which included previous analysis by ACIL Allen, ACIL Tasman, Tasman Asia Pacific, Tasman Economics, and ACIL Economics.

— National sources, including industry data held by the Australian Bureau of Statistics.

— The 2006 Senate Inquiry into the future of Australia’s naval shipbuilding industry, including submissions to the Inquiry.

— Other publicly available information such as previous studies on naval shipbuilding commissioned by Defence, prime contractors and security analysts.

A full list of reference material and data used in this report is provided in Appendix C.

1.4 Structure of the report

The remainder of this report is structured as follows:

— Section 2 provides a profile of current naval shipbuilding industry in Australia. It also identifies some of the key changes anticipated to impact on the industry over the next five-to-ten years.

— Section 3 provides our analysis of the naval shipbuilding industry’s contribution to Australia’s economy. This section provides the results of modelling undertaken specifically for this report. It also provides an assessment of the other economic impacts arising from a naval shipbuilding industry.

— Section 4 discusses the value to Government of maintaining ‘real’ options for Australia’s naval shipbuilding industry.
2 Industry profile: current and future perspectives

2.1 Profile of the current industry

2.1.1 Significant projects

Australia’s naval shipbuilding, maintenance and repair industry is one of the oldest industries in Australia. Since the turn of the twentieth century it has delivered some of the largest defence construction projects such as the Collins Class (Collins) submarine project and the Air Warfare Destroyer (AWD) project, the two largest naval shipbuilding projects ever commissioned in Australia.

Today Australia’s naval shipbuilding industry stands as a highly capable industry supporting both production and TLS (or sustainment) of the RAN’s fleet.

Table 2 provides a high level summary of key naval shipbuilding and TLS projects since 1990. The table outlines the Prime Contractors of each project, the locations of projects (construction and TLS) and where ships are currently based. These projects are used as indicators or proxies for demonstrating the potential contribution of the industry to Australia’s economy.
### Table 2  Summary of significant defence shipbuilding projects since the late-1980s

<table>
<thead>
<tr>
<th>Program*</th>
<th>Prime contractor</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collins Class Submarines</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Commenced: 1987</em></td>
<td>ASC</td>
<td>Osborne, SA</td>
</tr>
<tr>
<td>Value: $5 billion (original value)</td>
<td></td>
<td>Osborne, SA</td>
</tr>
<tr>
<td>Future submarine²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. <em>Commenced: 2012</em></td>
<td>ASC</td>
<td>Osborne, SA</td>
</tr>
<tr>
<td>Value: $214 million (design)</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>AWD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2007 – current)</td>
<td>AWD Alliance (DMO, ASC &amp; Raytheon, Navantia)</td>
<td>Newcastle, NSW Williamstown, Vic Osbourne, SA</td>
</tr>
<tr>
<td>Value: $8 billion</td>
<td></td>
<td>Garden Island, NSW</td>
</tr>
<tr>
<td>ANZAC Class Frigate – including upgrade program</td>
<td>BAE Systems – previously Tenix ANZAC Alliance between BAE Systems, Saab and Department of Defence</td>
<td>Williamstown, Vic Newcastle, NSW New Zealand</td>
</tr>
<tr>
<td>3. <em>Commenced: ate 1990s</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value: $5.6 billion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Huon Class Minehunter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value: $1 billion</td>
<td></td>
<td>Garden Island, NSW</td>
</tr>
<tr>
<td>Landing Helicopter Dock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. <em>Commenced: 2006</em></td>
<td>BAE Systems</td>
<td>Williamstown, Vic</td>
</tr>
<tr>
<td>Value: $2 billion</td>
<td></td>
<td>Garden Island, NSW</td>
</tr>
<tr>
<td>Armidale Class Patrol Boat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Value: N/A</td>
<td></td>
<td>Cairns, QLD Darwin, NT</td>
</tr>
</tbody>
</table>

Note: *Dates and project values are indicative and only presented for illustrative purposes. Source: ACIL Allen Consulting.

### 2.1.2 Major infrastructure

The naval shipbuilding industry is capital intensive, and the infrastructure required to build and maintain the industry is expensive. A shipyard is a major industrial facility that occupies large tracts of land with access to water. It includes infrastructure such as docks, slipways, piers, cranes, large covered workshops as well as supporting administrative buildings and amenities (Senate 2006).

The shipyards relevant to this analysis are identified in Table 3.

---

² Noting that the government is currently engaged in detailed consideration of what this might entail
The ‘Shipbuilding and Repair Services’ sector generates $2.8 billion in annual revenue; defence-related markets generate 78 per cent of this revenue.
defence vessels. The remaining segment – commercial shipbuilding comprises 17 per cent of revenue (see Panel B) (IBIS World, 2013).

**Figure 1  Defence-related shipbuilding: market and product/service segmentation ($2.8 billion)**

![Defence-related shipbuilding: market and product/service segmentation](image)

*Source: IBISWorld 2013, Shipbuilding and Repair Services in Australia (C2391), October.*

The four largest industry players are prime contractors to Defence (ASC, BAE Systems, Thales Australia and Forgacs); they account for nearly 75 per cent of industry revenue (see Figure 2) (IBIS World 2013).

**Figure 2  Leading industry players for the total Australian shipbuilding and repairs services (by annual revenue generated)**

![Leading industry players for the total Australian shipbuilding and repairs services](image)

*Source: IBISWorld 2013, Shipbuilding and Repair Services in Australia (C2391), October.*

Four companies account for nearly 75 per cent of entire industry revenue; all are prime contractors to Defence.
Victoria, South Australia, Western Australia are the main jurisdictions involved in defence-related shipbuilding, as evidenced by the location of key shipbuilding yards and docks within these states (see Section 2.1.2).

2.1.4 Industry employment

Data obtained from the five largest defence shipbuilding prime contractors, as at 30 June 2013, suggest these prime contractors employed 3,107 people in naval ship production and 2,474 people in naval TLS. The same prime contractors had a further 627 contractors working on naval production and 505 contractors working in naval TLS. This provides a total of 6,713 people working as employees or contract workers in naval shipbuilding by the five largest prime contractors at the end of 2012-13.

With respect to where these workers were located, there were differences in the concentrations of production and TLS (see Table 4). South Australia has the highest proportion of production workers, with 39 per cent of employed workers and 65 per cent of contractors. It also has the highest proportion of TLS employees (39 per cent), whereas Western Australia had the higher proportion of TLS contracted workers (41 per cent).

For both production and TLS, the majority of employees were full time. Specifically 99 per cent of production employees and 97 per cent of TLS employees were full time.

Table 4  Employment in naval production and TLS for five largest prime contractors

<table>
<thead>
<tr>
<th></th>
<th>Full time employees</th>
<th>Part time employees</th>
<th>Casual Employees</th>
<th>Contract workers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>1,221</td>
<td>7</td>
<td>1</td>
<td>406</td>
</tr>
<tr>
<td>NSW</td>
<td>837</td>
<td>0</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Victoria</td>
<td>702</td>
<td>11</td>
<td>0</td>
<td>201</td>
</tr>
<tr>
<td>WA</td>
<td>322</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,082</td>
<td>18</td>
<td>7</td>
<td>627</td>
</tr>
<tr>
<td><strong>Through life support</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>951</td>
<td>24</td>
<td>2</td>
<td>134</td>
</tr>
<tr>
<td>WA</td>
<td>730</td>
<td>8</td>
<td>-</td>
<td>205</td>
</tr>
<tr>
<td>NSW</td>
<td>392</td>
<td>1</td>
<td>10</td>
<td>137</td>
</tr>
<tr>
<td>Victoria</td>
<td>338</td>
<td>17</td>
<td>-</td>
<td>29</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,411</td>
<td>51</td>
<td>12</td>
<td>505</td>
</tr>
<tr>
<td><strong>Total production and TLS</strong></td>
<td>5,493</td>
<td>69</td>
<td>19</td>
<td>1,132</td>
</tr>
</tbody>
</table>

Source: BAE Systems, Thales Australia, Forgacs Engineering, Austal, ASC.

2.1.5 Industry skills

The skills needed for the naval shipbuilding and TLS industry are highly technical and affected by constant technological change. While some of the activity involved in building ships is not directly relevant to supporting those ships in service, there is an overlap of some skills, particularly in platform design and systems development. The key link between design, build and sustainment is the transfer of engineering know-how and data in both directions (DMO 2012).
We understand from current data that the industry is dominated by highly skilled engineers and technicians who undertake application engineering to meet specific customer orders, and to develop new products and product features. These professionals are supported by trades workers who carry out engineering and technological processes, as well as skilled tradespeople such as welders, mechanical fitters and electricians (IBIS World 2013).

A skills breakdown for the broader Shipbuilding and Repairs Services sector is shown in Table 5 – which includes civilian and commercial shipbuilding and repairs. The table shows that a large proportion of workers (over 60 per cent) are professionals, technicians and trades people. We suggest that this proportion is highly representative of the naval industry due to the generally high-tech nature of shipbuilding and repairs.

Table 5  **Breakdown of industry skills**

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Proportion employed in occupation (%)</th>
<th>Major sub-occupations (proportion employed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>11.4</td>
<td>Specialist Managers (8.9%)</td>
</tr>
<tr>
<td>Professionals</td>
<td>19.5</td>
<td>Design, Engineering, Science and Transport Professionals (11.9%)</td>
</tr>
<tr>
<td>Technicians and Trades Workers</td>
<td>43.2</td>
<td>▪ Automotive, Engineering and Trades Workers (23.6%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Engineering, ICT and Science Technicians (6.4%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Electrotechnology and Telecommunications Trades Workers (4.6%)</td>
</tr>
<tr>
<td>Community and Personal Service Workers</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Clerical and Administrative Workers</td>
<td>12.0</td>
<td>Office Managers and Program Administrators (4.2%)</td>
</tr>
<tr>
<td>Sales Workers</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Machinery Operators and Drivers</td>
<td>4.8</td>
<td>Machinery and Stationary Plant Operators (2.3%)</td>
</tr>
<tr>
<td>Labourers</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Inadequately described/not stated</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0</strong></td>
<td></td>
</tr>
</tbody>
</table>


**2.1.6 Related industries**

**Civilian shipbuilding, repairs and maintenance industry**

Civilian (or commercial) shipbuilding in Australia is a $2.8 billion industry largely based around freight and water-based tourism, and there is an established export market for high-speed passenger catamarans. It includes the construction of commercial ships, such as barges, cargo ships, container boats, ferryboats, cruise liners, passenger ships, patrol boats and sailing ships (IBIS World 2013).

Figure 1 and Figure 2 (above) show the commercial shipbuilding industry comprises 22 per cent of the total market segmentation for shipbuilding and repairs. They also shows that commercial shipbuilding comprises 17 per cent of the industry’s revenue in terms of products and services, and 12 per cent of the industry’s revenue for the ship repair and maintenance segment.

While this segment of the industry has not been modelled or analysed in detail, its presence is recognised as important to the viability of a broader Australian shipbuilding and repair industry. For example, some shipbuilding and repair skills (such as fabrication, welding and
surface preparation) are shared between the defence and civilian industries. Furthermore, some component suppliers (see below) service both the defence and civilian industries. The linkages between these industries are identified (at a high level and where relevant) in the remaining sections of this report.

Component suppliers

The competition for defence-related shipbuilding contracts is usually restricted to the major companies, each with a reputation for providing sophisticated manufacturing, systems integration techniques and capabilities, product service reliability, as well as being able to respond to the changing needs of the customer. TLS contracts are largely dictated by Defence policy which reserves most TLS for Australian businesses (IBIS World, 2013).

Supporting the prime contractors for each major naval shipbuilding project is an extensive network of suppliers. Historically, the level of Australian industry involvement in naval shipbuilding has been high; approximately 70 per cent of the total contract value of the ANZAC, Minehunter and Collins programs was met by Australian industry. For the ANZAC and Minehunter projects there was also a high level of Small to Medium Sized Enterprise (SME) involvement (approximately 90 per cent in each instance). The amount of Australian industry engagement for these four construction projects is shown in Table 6.

Data obtained from the five largest naval shipbuilders in Australia for this study demonstrates the supplier network of major naval shipbuilding projects. In terms of production of naval vessels, there are 4,861 suppliers supporting the five major shipbuilders, with a total value of goods and services in excess of $490 million. There are a further 2,711 suppliers supporting the five major shipbuilders with TLS for naval vessels, with a total value of goods and services in excess of $325 million. This results in a total of 7,572 suppliers for naval shipbuilding, with a total value of goods and services in excess of $815 million. With respect to the distribution of these suppliers:

— Production:
  — By volume, more than one third of suppliers (39.7 per cent) of suppliers are located in New South Wales, followed by South Australia (21.1 per cent) and Western Australia (19.5 per cent).
  — By value, more than one third (35.5 per cent) of the value of goods and services is from suppliers located in New South Wales, followed by South Australia (25.8 per cent) and Victoria (23.9 per cent).
— Through Life Support (TLS):
  — By volume, nearly three quarters (30.7 per cent) of suppliers are located in New South Wales, followed by South Australia (28.7 per cent) and Victoria (18.4 per cent).
  — By value, nearly half (43.7 per cent) of the value of goods and services is from suppliers located in New South Wales, followed by South Australia (27.7 per cent) and Western Australia (14.9 per cent).

The geographic breakdown of suppliers by volume and value of goods and services provided is shown in Table 7 for 2013.

<table>
<thead>
<tr>
<th>Suppliers for production and through life support (2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
</tr>
<tr>
<td>Number of suppliers</td>
</tr>
<tr>
<td>New South Wales</td>
</tr>
<tr>
<td>Victoria</td>
</tr>
<tr>
<td>Queensland</td>
</tr>
<tr>
<td>South Australia</td>
</tr>
<tr>
<td>Western Australia</td>
</tr>
<tr>
<td>Northern Territory</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
</tr>
<tr>
<td>Tasmania</td>
</tr>
<tr>
<td><strong>Total Australia</strong></td>
</tr>
</tbody>
</table>

Source: ASC, BAE Systems, Thales, Forgacs, Austal data.

Defence-related contracts are crucial for the viability of some businesses; defence-related contracts ‘enhance’ the viability of many more.

Naval shipbuilding is soon expected to work far below its operational capacity; this will force job losses.

Suppliers vary in their reliance on Defence contracts; some suppliers find Defence-related work crucial to their viability, others do not. Some find it enhances their business. For example, just under 30 per cent of businesses involved with Minehunter considered defence-related contracts ‘crucial’ to their business, as did only 13 per cent of businesses involved with ANZAC. Approximately 50 per cent of suppliers to both projects considered that defence related contracts ‘enhanced’ their business’s viability (Tasman Economics 2002).

### 2.2 Future perspectives

There are a number of anticipated developments which will have significant impacts on the profile of the naval shipbuilding industry. The most significant of these is the anticipated time between major projects where Australia’s naval shipbuilding industry is expected to have to work far below its current operational capacity. It is anticipated that this expected gap between major naval projects will force a significant contraction across the shipbuilding and TLS industries (in the form of job losses) so that companies can avoid making substantial operational losses (IBIS World 2013). This predicted scenario is often referred to as the ‘Valley of Death’ amongst major industry participants (Raytheon 2013, The Australian 2013, NewsCorp 2013).

Figure 3 depicts the estimated demand for Australian submarines and major warships out to 2100, as well as the timeframes for the design, build and TLS of major submarines and warships.
Figure 3  Demand for Australian Submarines and Warships


With the AWD and helicopter landing dock (LHD) top platform (not depicted in the above figure) construction programs winding up in 2014-15, and the build of the future submarine project not anticipated to commence until 2018-19, the industry is anticipating a four to five year period of very low demand.

This gap between projects may force every major Australian naval shipbuilding company, with the exception of ASC, to ‘start ramping down production’ and consider job losses. Industry representatives have raised concern that the loss of skills, talent and industrial capability developed during the 1990s and 2000s will be lost to the industry (ABC 2013, The Australian 2013, News Corp 2013).

In some extreme instances the period of low demand may force the closure of infrastructure and facilities supporting the industry. These facilities will generate additional costs to close and, if demand increases again, re-open. Indicative estimates of the anticipated costs of shutting down and re-opening existing facilities is discussed in Section 3.4.1.

Indeed this process has already started; in November 2013 BAE Systems made 30 welders and boilermakers at the Williamstown shipyard redundant citing the lack of upcoming work (The Age, 7 November 2013). Furthermore, it could be expected that the consequences will flow on to other parts of industry that supply prime contractors on major projects such as AWD and LHD as these construction programs are scheduled for winding up in 2014-15.

It is acknowledged by the industry that some of these losses will be offset if delays to the completion of AWD and LHD eventuate. However, there is considerable uncertainty about these delays and the impact of delays on future demand has not been assessed (quantified) for this report.

Prime contractors have already started retrenching workers; BAE Systems made 30 trades works redundant in November 2013.

4 See also ATSE (2006) and Senate (2006) for the estimated growth in highly skilled labour necessary to support these programs. These estimates provide an indication of the size of the problem facing companies highly dependent on these projects.
3 Economic contribution of naval shipbuilding

3.1 Measures of macroeconomic impacts

To estimate the current contribution of the naval shipbuilding and through life support industry, ACIL Allen has used the input-output (I-O) multiplier method. I-O multipliers are summary measures generated from I-O tables that can be used for predicting the total impact on all industries in the economy resulting from changes in demand by a particular industry or consumer. The I-O tables that are at the heart of multiplier analysis provide a comprehensive picture of the supply and consumption of all commodities within the economy. They are essentially the bottom-up accounting framework that underlies the calculation of aggregate GDP. Unlike the GDP account however, I-O tables retain all intermediate consumption and therefore provide a detailed picture of the structure and interrelationships of industries.

For this analysis, ACIL Allen has utilised a national I-O table and associated I-O multipliers for Australia for the 2010-11 financial year. The 2010-11 table and multipliers were created by ACIL Allen from the ABS 2008-09 I-O table and utilised available industry and macroeconomic data for the 2010-11 financial year.

In usual practice, I-O multipliers can be derived in two ways to capture:

1. only the initial impacts that apply to the producer plus the upstream production-induced impacts arising from purchases made by the producer as well as subsequent flow-on effects, or
2. these same initial and production-induced impacts plus the impacts arising from the spending by wages and salary earners (this later effect being referred to as the consumption-induced effect).

The first type of multiplier is commonly referred to as a Simple or Type 1 multiplier, while the second type is referred to as the Total or Type 2 multiplier. The differences between these two approaches are illustrated in Figure 4.

In the analysis below, the results from using both types of multipliers are presented. Due to the simplifying assumptions that underpin the derivation of I-O multipliers, it is often considered that there is the potential to overestimate economic impacts with the inclusion of consumption-induced effects. Therefore, it is reasonable to consider the economic impacts derived from the use of simple multipliers as a lower bound on the actual impacts, with the results derived from the total multipliers providing an upper bound to the actual impacts.

For the I-O analysis undertaken here, ACIL Allen has focussed on the impacts on income (wages and salaries), employment (expressed as full-time equivalent [FTE] employment and GDP).

For additional discussion of I-O multipliers, including their limitations see Appendix A.
Initial effect - To meet the demand for defence ships, the defence shipbuilders increase production and concurrently increase employment, wages paid and their use of capital.

Production induced effect – To meet the new demand, defence shipbuilders increase purchases from their suppliers/subcontractors, who in turn increase purchases from their own suppliers/subcontractors, and so on. This cycle continues until all increases in demand are satisfied.

Simple multiplier effect – Represents the sum of the initial and production induced effects.

Consumption induced effect – employees of the defence shipbuilders, and the employees of suppliers and subcontractors, spend their income on goods and services and by doing so provide additional stimulus to the economy.

Total multiplier effect – Represents the sum of the simple multiplier and the consumption induced effect.

Source: ACIL Allen.

3.2 Input-output analysis

3.2.1 Data provided

To ensure the analysis captured key industry interactions, ACIL Allen received data from each of the five major prime contractors covering their most significant domestic purchases, employment, labour costs and key elements of their cash flows. Utilising these data in conjunction with the national I-O table and multipliers, the analysis for each prime contractor participant was completed.

These results have been summed to preserve the confidentiality of the data provided and are presented in the following sections.
3.2.2 Employment

Across Australia, the five largest prime contractors employed over 5,500 staff, with an additional 1,100 contractors employed on various projects, as shown in Table 4 (in Section 2.1.4) and summarised in Table 8. Production of naval vessels directly generated 3,082 full-time jobs in 2012-13, with an additional 25 people employed on a part-time or casual basis. The employment of contractors was also significant, with 627 contractors employed in the production of naval vessels in 2012-13. Activities associated with TLS generated 2,411 full-time jobs, with an additional 63 people employed on a part-time or casual basis. There were an additional 505 people employed on a contract basis.

Table 8 Australian direct employment in naval production and TLS for five largest prime contractors in 2012-13

<table>
<thead>
<tr>
<th></th>
<th>Full time employees</th>
<th>Part time employees</th>
<th>Casual employees</th>
<th>Contract workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>3,082</td>
<td>18</td>
<td>7</td>
<td>627</td>
</tr>
<tr>
<td>Through life support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,449</td>
<td>51</td>
<td>12</td>
<td>505</td>
</tr>
<tr>
<td>Total production and TLS</td>
<td>5,493</td>
<td>69</td>
<td>19</td>
<td>1,132</td>
</tr>
</tbody>
</table>

Source: BAE Systems, Thales Australia, Forgacs Engineering, Austal, ASC.

While Table 8 shows the direct employment impacts associated with naval shipbuilding and TLS, to capture the flow-on benefits to the economy requires the application of the I-O multipliers, as shown in Table 9. These multipliers indicate that:

--- In addition to the direct employment of 3,082 production FTEs (i.e. the initial effect):
  - 1,832 additional people are employed as a result of the production-induced effect (see Figure 4), therefore
  - 4,930 people in total are employed by the prime contractors and by the suppliers/subcontractors throughout the economy whose production increased to meet the demands of the prime contractors (i.e. the simple multiplier effect).
  - 2,543 people are employed in the wider economy as a result of the additional consumer spending on goods and services generated (directly and indirectly) as a result of the production activities of the prime contractors (i.e. the consumption induced effect), therefore
  - A total of up to 7,437 people (FTEs) are employed directly and indirectly as a result of naval ship production (i.e. the total multiplier effect) from the five major prime subcontractors. This should be considered as a lower limit because it only considers data from the five major prime contractors.

--- In addition to the direct employment of 2,449 TLS FTEs (i.e. the initial effect):
  - 2,513 additional people are employed as a result of the production-induced effect (see Figure 4), therefore
  - 4,962 people in total are employed by the prime contractors and by the suppliers/subcontractors throughout the economy whose TLS activities increased to meet the demands of the prime contractors (i.e. the simple multiplier effect).
  - 2,598 people are employed in the wider economy as a result of the additional consumer spending on goods and services generated (directly and indirectly) as a result of the TLS activities of the prime contractors (i.e. the consumption induced effect), therefore
A total of 7,560 people (FTEs) are employed directly and indirectly as a result of naval ship TLS (i.e. the total multiplier effect) from the five major prime subcontractors.

Table 9  **Direct and indirect employment effects of naval shipbuilding and TLS (FTE employees)**

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>TLS</th>
<th>Total production and TLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct*</td>
<td>3,098</td>
<td>2,449</td>
<td>5,547</td>
</tr>
<tr>
<td>Production-induced</td>
<td>1,832</td>
<td>2,513</td>
<td>4,345</td>
</tr>
<tr>
<td>Simple multiplier</td>
<td>4,930</td>
<td>4,962</td>
<td>9,892</td>
</tr>
<tr>
<td>Consumption-induced</td>
<td>2,543</td>
<td>2,598</td>
<td>5,141</td>
</tr>
<tr>
<td>Total multiplier</td>
<td>7,437</td>
<td>7,560</td>
<td>14,997</td>
</tr>
</tbody>
</table>

Note: *FTE direct employment excludes contractors and assumes that part-time employees work as 0.5 of an FTE.

Source: ACIL Allen calculations.

The results in Table 9 show that up to 7,437 FTE jobs across Australia can be attributed to the production of naval vessels by the five largest prime contractors. In addition, up to 7,560 FTE jobs can be can be attributed to the activities associated with TLS. Thus, the total FTE jobs generated across Australia – and including direct employees, contractors and other flow-on jobs – could reach nearly 15,000.

### 3.2.3 Income

Income, which here refers to wages and salaries income, also benefits from the naval shipbuilding and TLS industries in Australia. The flow-on benefits to the economy using I-O multipliers is captured in Table 9. These multipliers show that:

— In addition to the $287 million in wages and salaries paid to employees involved in naval ship production (i.e. the initial effect):
  
  — $108 million of income is generated as a result of the production-induced effect (see Figure 4), therefore
  
  — $395 million of income by the prime contractors and by the suppliers/subcontractors throughout the economy whose production increased to meet the demands of the prime contractors (i.e. the simple multiplier effect).

  — $173 million of income is generated in the wider economy as a result of the additional consumer spending on goods and services generated (directly and indirectly) as a result of the production activities of the prime contractors (i.e. the consumption induced effect), therefore
  
  — A total of $568 million of income is directly and indirectly generated as a result of naval ship production (i.e. the total multiplier effect) from the five major prime subcontractors.

— In addition to the $225 million in wages and salaries paid to employees involved in naval ship TLS (i.e. the initial effect):

  — $159 million of income is generated as a result of the production-induced effect (see Figure 4), therefore
  
  — $384 million of income by the prime contractors and by the suppliers/subcontractors throughout the economy whose TLS activities increased to meet the demands of the prime contractors (i.e. the simple multiplier effect).
$177 million of income is generated in the wider economy as a result of the additional consumer spending on goods and services generated (directly and indirectly) as a result of the TLS activities of the prime contractors (i.e. the consumption induced effect), therefore

A total of $561 million of income is directly and indirectly generated as a result of naval ship TLS (i.e. the total multiplier effect) from the five major prime subcontractors.

Table 10  Direct and indirect income effects of naval shipbuilding and TLS (A$ million)

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>TLS</th>
<th>Total production and TLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>287</td>
<td>225</td>
<td>513</td>
</tr>
<tr>
<td>Production-induced</td>
<td>108</td>
<td>159</td>
<td>266</td>
</tr>
<tr>
<td>Simple multiplier</td>
<td>395</td>
<td>384</td>
<td>779</td>
</tr>
<tr>
<td>Consumption-induced</td>
<td>173</td>
<td>177</td>
<td>350</td>
</tr>
<tr>
<td>Total multiplier</td>
<td>568</td>
<td>561</td>
<td>1,129</td>
</tr>
</tbody>
</table>

Source: ACIL Allen calculations.

Table 10 demonstrates that nationally, production of naval vessels by the five largest prime contractors generates (directly and through flow-on effects) up to $568 million. TLS is only slightly less significant with an impact of up to $561 million. Combining both phases shows an Australia wide benefit of up to $1.129 billion.

3.2.4 Gross domestic product

The size of the Australian economy, and of most other economies across the world, are measured in terms of GDP. GDP is the measure of the value of final goods and services produced by a nation. The contribution of naval shipbuilding and TLS to Australia’s GDP in 2012-13 is presented in Table 11. These multipliers show that:

— In addition to the $743 million in GDP generated as a result of naval ship production (i.e. the initial effect):
  
  — $184 million of GDP is generated as a result of the production-induced effect (see Figure 4), therefore
  
  — $927 million of GDP by the prime contractors and by the suppliers/subcontractors throughout the economy whose production increased to meet the demands of the prime contractors (i.e. the simple multiplier effect).
  
  — $396 million of GDP is generated in the wider economy as a result of the additional consumer spending on goods and services generated (directly and indirectly) as a result of the production activities of the prime contractors (i.e. the consumption induced effect), therefore
  
  — A total of $1.3 billion of GDP is directly and indirectly generated as a result of naval ship production (i.e. the total multiplier effect) from the five major prime subcontractors.

— In addition to the $287 million in GDP generated as a result of naval ship TLS (i.e. the initial effect):
  
  — $289 million of GDP is generated as a result of the production-induced effect (see Figure 4), therefore
- $576 million of GDP by the prime contractors and by the suppliers/subcontractors throughout the economy whose TLS activities increased to meet the demands of the prime contractors (i.e. the simple multiplier effect).
- $399 million of GDP is generated in the wider economy as a result of the additional consumer spending on goods and services generated (directly and indirectly) as a result of the TLS activities of the prime contractors (i.e. the consumption induced effect), therefore
- A total of $975 million of GDP is directly and indirectly generated as a result of naval ship TLS (i.e. the total multiplier effect) from the five major prime subcontractors.

Table 11  Direct and indirect GDP effects of naval shipbuilding and TLS (A$ million)

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>TLS</th>
<th>Total production and TLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct</td>
<td>743</td>
<td>287</td>
<td>1,030</td>
</tr>
<tr>
<td>Production-induced</td>
<td>184</td>
<td>289</td>
<td>473</td>
</tr>
<tr>
<td>Simple multiplier</td>
<td>927</td>
<td>576</td>
<td>1,503</td>
</tr>
<tr>
<td>Consumption-induced</td>
<td>396</td>
<td>399</td>
<td>795</td>
</tr>
<tr>
<td>Total multiplier</td>
<td>1,323</td>
<td>975</td>
<td>2,298</td>
</tr>
</tbody>
</table>

Source: ACIL Allen calculations.

From Table 11 we see that production and TLS contribute up to $2.3 billion towards the Australian economy. Most of this contribution is from the production side ($1.3 billion); however, the contribution from TLS is still highly significant ($975 million).

According to the latest ABS figures, Australia’s 2012-13 GDP was $1,521.5 billion; therefore, naval shipbuilding production and TLS represented (directly and indirectly) 0.15 per cent of the Australian economy in 2012-13.

3.2.5 Summary of economic impacts

Based out our I-O analysis, the direct and indirect impacts of having naval ship production and TLS carried out in Australia are:
- 15,000 full time employees
- $1.13 billion of income
- $2.3 billion of GDP.

Note: these impacts could be considered lower limits given the data used to inform these results came from the five largest prime contractors only. Modelling of data provided by all industry participants could deliver results which show a higher economic contribution.

The above impacts relate to the actual naval ship production and TLS activity in the 2012-13 financial year. Table 12 demonstrates the impacts of a hypothetical $100 million spend on naval ship production and on TLS.

Table 12 shows that the direct and indirect impacts on employment from a $100 million increase in naval shipbuilding range from 386 FTE jobs (estimated with the simple multiplier) to 585 FTE jobs (estimated with the total multiplier). These jobs would occur in one year if the $100 million increase in output occurred in one year. If the spending is spread evenly over several years, then the annual jobs impact is estimated by dividing by the number of years over which the spending occurs.

On a similar basis, an increase in TLS output of $100 million increases FTE employment by between 694 and 1,057 jobs.
Table 12  **Simple and total effects of naval shipbuilding and TLS based on $100 million output**

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>TLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Simple multipliers</strong> (impacts per $100m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment*</td>
<td>386 FTE jobs</td>
<td>694 FTE jobs</td>
</tr>
<tr>
<td>Income</td>
<td>$31 million</td>
<td>$54 million</td>
</tr>
<tr>
<td>GDP</td>
<td>$73 million</td>
<td>$80 million</td>
</tr>
<tr>
<td><strong>Total multipliers</strong> (impacts per $100m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment*</td>
<td>585 FTE jobs</td>
<td>1,057 FTE jobs</td>
</tr>
<tr>
<td>Income</td>
<td>$44 million</td>
<td>$78 million</td>
</tr>
<tr>
<td>GDP</td>
<td>$104 million</td>
<td>$136 million</td>
</tr>
</tbody>
</table>

Note: * The employment impacts of $100 of output are spread over the duration of the spending. So if spread evenly over 10 years the annual employment impact would be one tenth of the value shown.
Source: ACIL Allen calculations.

Table 12 also shows that a $100 million increase in naval shipbuilding increases income by between $31 million and $44 million, while $100 million in TLS increases income by between $54 million and $78 million.

Finally, Table 12 shows that a $100 million increase in naval shipbuilding increases GDP by between $73 million and $104 million, while $100 million in TLS increases GDP by between $80 million and $136 million.

As noted previously, the total multiplier is likely to be an over-estimate of the effect.

In addition, if we were to assume that workers in shipbuilding could quickly and easily move into other industries should they lose their jobs, then a reduction in shipbuilding would have a lower impact on the economy than an extrapolation from the total multiplier number above may suggest. Alternatively however it could be argued that at present employment opportunities in advanced manufacturing in Australia are contracting (for example in automotive industries), which may make any reduction in shipbuilding a greater loss to the economy.

### 3.3 Spillovers to other industries

Complex projects which involve high technology and tight quality specifications can create unexpected spillovers, such as technology transfers, improvements to internal programs and practices, and improved capability. If experienced, these transfers can have a positive impact on a business in a range of ways.

#### 3.3.1 Technology transfers

A technology transfer is the transfer of intellectual property, such as skills, knowledge, technologies, methods of manufacturing and samples, between developers (such as research organisations or Defence prime contractors) and the users (such as the suppliers of inputs to Defence vessels).

Around one quarter of businesses involved in production of the ANZACs (22 per cent) and Minehunters (25 per cent) experienced a technology transfer. A technology transfer can be sourced through a range of channels and can lead to positive impacts for the business; the main technology transfers and impacts experienced by businesses involved in ANZAC and Minehunter are shown in Table 13.
Table 13  Common technology transfers and impacts from ANZAC and Minehunter

<table>
<thead>
<tr>
<th>Technology transfers</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing published material</td>
<td>Increase Defence related sales</td>
</tr>
<tr>
<td>Staff training</td>
<td>Extended product range</td>
</tr>
<tr>
<td>Original R&amp;D</td>
<td>Increased market share</td>
</tr>
<tr>
<td>Purchasing/licencing technology</td>
<td>Improved quality</td>
</tr>
<tr>
<td>Strategic partnerships</td>
<td>Improve flexibility</td>
</tr>
<tr>
<td></td>
<td>Improved productivity</td>
</tr>
</tbody>
</table>

*Note:* Transfers and impacts are listed in no particular order. Transfers and impacts in the same row do not necessarily correspond.

Source: ACIL Allen Consulting.

The example of Bisalloy (see Box 1) demonstrates a technology transfer that stemmed from naval shipbuilding. Bisalloy worked with BHP and the Defence Science Technology Organisation (DSTO) to develop steel plates for four FFG 7 frigates. Throughout the 1980s and 1990s, Bisalloy supplied the Collins program as well as the Bushmaster armoured vehicle programs, on both occasions teaming up with DSTO to create a superior steel product. Bisalloy’s steel is now qualified by militaries in the US, India, the Middle East and Asia and export sales have grown significantly.
Bisalloy Steels Pty Ltd, a company of less than 100 people located at Unanderra near Wollongong, is Australia’s sole supplier of high hardness steel products for military application. Bisalloy’s internationally recognized capability began in 1988 with an order for hull plates to be used in the local construction of two FFG 7 guided missile frigates. In cooperation with BHP Port Kembla and the Defence Science and Technology Organisation (DSTO), Bisalloy produced HY 80 steel plates, to a US specification, that significantly outperformed the equivalent US manufactured steel plate. After five blasts with 15kg of Pentolite high explosive, the Bisalloy HY 80 plate was stretched to the point where its thickness had reduced by 29.9 per cent without fracturing. The specification called for only 16 per cent deformation without fracture. Australia’s four US built FFG 7 frigates were subsequently retrofitted with the Bisalloy HY 80 plate. Bisalloy produced approximately 1000 tonnes of steel for the FFG program.

At the end of the 1980s Bisalloy was contracted to supply hardened steel plate for the Collins class submarines. Working again with BHP Port Kembla and the DSTO, Bisalloy successfully produced the BIS 812EMA plate; a weldable, micro-alloyed, high yield stress steel with excellent low temperature impact properties that had, up until then, been an experimental Swedish product in its embryonic developmental stage. Bisalloy went on to supply more than 8,000 tonnes of steel over 15 years for the submarine program.

During the late 1990s, the development of a new breed of protected infantry mobility vehicle under Project Bushranger, led to the design of the Bushmaster IMV. The vehicle had to be capable of withstanding mine blasts of up to 10kg of TNT and side impact from high velocity small arms ammunition. For the Bushmaster vehicle, Bisalloy, in cooperation with DSTO, created new high hardness armour (HHA) plate from specially produced BlueScope steel. The ‘green feed’ product from BlueScope Steel is subsequently quenched and tempered to produce a grade of armour plate rated to the highest levels of performance. Since 1993, Bisalloy has produced over 3,500 tonnes of steel for the Bushranger program.

The science, technology and manufacturing processes developed for the production of these low sulphur, micro alloyed steels has flowed on to the production of all Bisalloy steel products, including for commercial purposes. Bisalloy’s Quality Assurance system meets the requirements of ISO 9001, with stringent quality controls developed in order to qualify the performance of materials being used in commercial or military critical products.

In 2008 the company’s defence business in armour plate accounted for 14 per cent of all steels produced, or about 6,000 tonnes. The majority of this output was for export to the USA, Middle East and Asia. Bisalloy has established two joint ventures; one in Indonesia and the other in Thailand, to assist with the sale of commercial and military grade steel into Asian markets. Another joint venture agreement in China is being considered. Foreign governments in the USA, India, the Middle East and Asia have qualified Bisalloy’s armour plate for use by their militaries and exports now far exceed domestic orders. Bisalloy is also an invitee on international working groups and panels defining standards for the next generation of Ultra High Hardness steel for armour applications.

Bisalloy is in a position to design, develop and manufacture a wide range of high-hardness steels for Australia’s armour plate needs. For 25 years the Bisalloy story has been one of working in tandem with Australian steel producers, defence scientists, international organisations and manufacturers of military ships and vehicles, to produce some of the best armour plate products in the world.

Source: ACIL Tasman 2009, ‘The economic impacts of the BUSHRANGER Project: The economic contribution of the BUSHRANGER Protected Mobility Vehicle Project to Australia, Victoria and Bendigo’.

Austal is another example of a technology transfer obtained in naval shipbuilding. Austal has penetrated the prestigious US naval shipbuilding with its Littoral Combat Ship (LCS) and Joint High Speed Vessel (JHSV). Designed and initially project managed from WA, Austal now supplies components and provides the technical expertise to the US Navy in the operation of these components (see Box 5).
Box 2  **Australian vessels supplying the US Navy**

The ‘Jones Act’ in the United States stipulates that vessels operated on a domestic service (between US ports) must be built in the US. The US Navy also stipulates compliance with the  *Code of Federal Regulations, Buy America Requirements* in their acquisition contracts. When the US announced a tender for a novel high speed vessel design to transport personnel and modular mission packages, Austal was presented with an opportunity to provide naval solutions for this significant naval customer. Austal was awarded contracts for the LCS and for JHSV in 2005 and 2008 respectively. Twelve LCS and ten JHSV platforms are currently being manufactured at Austal’s shipyard in Mobile, Alabama.

Austal initiated both these projects in Western Australia; the vessel’s initial designs were both undertaken in Australia. Aluminium construction expertise was also provided from Australia and seconded to the US to train US workers in the specific construction techniques required to build aluminium vessels in Alabama.

Despite being manufactured in the US, Austal in Australia continues to support these programs. Long time Austal subcontractor, Veem provides the cast appendages which form part of the Austal ride control system used by the LCS and JHSV platforms. Austal also manufactures the switchboards and the integrated monitoring and control system for the JHSV which are sent to the US for installation. Around $10 million worth of equipment is provided to both programs each year. Intellectual property for the vessel is shared between the US and Australia.

Austal also provides ongoing skills support to the projects. When the ride control systems and the power distribution switchboards (both of which are designed and manufactured in Australia) are sent over for installation, they are accompanied by around four Austal technicians who train US Navy operators how to use the technologies. With two ships commissioned each year, this training (which lasts one to two months) is occurring every six months.

To date two JHSV and two LCS are in operation and there is the potential for further international TLS involvement by Austal. The US Navy has declared that two vessels will be deployed to South East Asia, possibly stationed in Darwin. If this plan comes to fruition, there is the potential (although not a guarantee) for Austal to be involved in future TLS of the vessels.

**Source:** Austal.

Favcote provides another example of how a technology initiated for naval shipbuilding has been developed and applied in another industry. Since the 1990s, most of Favcotes work in the application of protective coatings has been for the Australian navy. Favcote has expanded the application of a US-based surface preparation technology to Collins submarines and the construction industry.

Box 3  **Case study: Favcote’s involvement in naval shipbuilding**

Favcote is an Australian owned SME specialising in preparation for and application of protective coatings. It has capabilities in the marine, commercial and industrial sectors.

Favcote has seen considerable business growth by continuity of work in the ship repair industry. Since the mid 90’s, the majority of its blasting and preservation work has been applied to various Royal Australian Naval vessels dealing directly with the Australian Department of Defence and Prime contractors such as Thales, BAE systems, United Group Infrastructure and Forgacs Engineering in Garden Island, Sydney and Newcastle.

Sustained involvement in naval shipbuilding has allowed Favcote to significantly expand the domestic application of US-based surface preparation technology, called sponge jet blasting. Sponge jet blasting provides an alternative surface preparation technique that generates low waste and requires less encapsulation of working areas compared to traditional forms of grit abrasive blasting. The use of sponge jet blasting also means that surface preparation and cleaning can take place without major disruption to other repairs and maintenance.

Favcote’s use of sponge jet blasting has delivered benefits to the shipbuilding and other industries. These benefits are summarised below.

- The successful use of sponge jet blasting by Favcote on a range of projects at Garden Island was a significant catalyst for ACS’s adoption of the technology for its Collins Class Through Life Project and AWD Project.
The successful use of sponge jet blasting by Favcote on a range of naval projects has seen considerable growth in interest from the construction industry in the technology. Consultation with Favcote has identified that major national construction contractors are now using sponge jet blasting to undertake refurbishment of major ports in an environmentally sustainable and cost effective way. It has further identified that the oil and gas industry are using it to remove paint from large gas pipelines prior to undertaking testing of welds.

- Growth in demand for sponge jet blasting from the construction industry has also provided opportunities for Favcote to fund internal training and skill-up employees who will increasingly have opportunities to work across sectors and industries. For example, Favcote currently has three NACE Coating Inspectors (Level 1) and one NACE Level 2 trained inspectors who ensure that all of the projects undertaken are delivered to the strictest of standards and specifications.5

Source: http://www.favcote.com/index.php/sectors

### 3.3.2 Transfers of expertise

Long term Australian naval shipbuilding and TLS programs generate significant human capital that can benefit other industries and sectors. High human capital value programs (such as submarines) provide the demand for large numbers of highly trained workers with skills and experiences at all career levels.

For example, since the ANZAC and Collins design and build programs, a number of Australian companies have been developing their workforce through focused training programs and real life opportunities to implement the training. High value naval programs can act as technical universities in that they facilitate the transfer of knowhow from the most proficient and experienced personnel to other personnel within the industry. Naval programs can be a way of up-skilling a workforce of technical professionals, trades and paraprofessionals to pursue levels of competencies not supported by mainstream education institutions.

Used in concert with formal education and learning programs these programs can also deliver critical skills that also benefit other industries. Technical skills and disciplines such as project scheduling, risk management, asset management, supply chain management, systems integration, systems engineering, and logistics and specialised trades, are important to civilian industries including the marine, construction, mining and aeronautical industries (ASC 2013).

Being the home of the Techport facility, the South Australian government is working closely with industry to develop and maintain a specialised maritime skills base, including secondary, tertiary and trades training. While often specific to maritime, this training and development can be applied to other defence industries as well as civilian industries.

In addition, some universities (for example the University of South Australia, Adelaide University and Flinders University – there may be others) offer courses relevant to the defence shipbuilding industry, however application of the training gained in non-defence industries is also noted. Some examples of the courses offered and their cross industry application include:

- Bachelor of Engineering (Naval architecture) – design, construction and maintenance of maritime vessels such as ships, submarines, yachts and high-speed vessels.

---

5 The NACE (The International Corrosion Society) Coating Inspector Program (CIP) is the world’s most recognised protective coating inspector certification program. CIP is the first international certification program designed to improve the overall quality of inspections performed, and it continues to provide the most complete training curriculum, producing top-notch inspectors for the industry. Building on the momentum of the last 30 years and over 26,000 certified inspectors, NACE has recently enhanced the CIP learning experience with more hands-on time with new inspection methods and equipment, better graphics and video presentation as well as additional emphasis on international standards (see http://www.nace.org/ctfm/Education/Program.aspx?id=dc77f0f6-8b16-b611-953c-001435090c9a#hash=59e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3d143828af7246e5abf9d55bbdf396859e20e0d3
— Master of Marine Engineering – advanced technical and management roles in marine engineering.
— Master of Engineering (Military Systems Integration) – creation of complex defence systems to meet the capability needs of the Australian Defence Force.
— Bachelor of Engineering (Maritime Electronics) – application of electronics in the maritime naval, commercial or recreational industry.

Specialist technical skills are also offered through the Maritime Skills Centre. The Maritime Skills Centre in Adelaide delivers trade and technical skills required for the AWD project. It is a specialist facility for the up-skilling of personnel in the naval industry. The Centre is designed to become a centre of excellence in skill development for shipbuilding and related industries. It facilitates trade and technical training programs throughout the life of the AWD build, and potentially the ongoing repair, maintenance and upgrade lifecycle of the fleet.

### 3.3.3 Improved programs and practices

Involvement in Defence shipbuilding projects can result in a business adopting a range of programs and practices which might be considered as best practice. Adopting best practice business and management techniques can go on to improve business performance, for example through export growth and the ability to adopt and manage new technology. The high standards required of Defence shipbuilding projects often flow from the prime contractor down to the lower tier suppliers.

For example, more than 80 per cent of businesses involved in the ANZAC and Minehunter projects implemented at least one program or practice commonly associated with best practice. Similar to the technology transfers, implementing programs and practices can have strong positive impacts on businesses implementing them. For these two vessels, the most common program/practices implemented and related impacts are shown in Table 14.

<table>
<thead>
<tr>
<th>Program/practice implemented</th>
<th>Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality assurance</td>
<td>Greater client satisfaction</td>
</tr>
<tr>
<td>Budget forecasting</td>
<td>Culture of continuous improvement</td>
</tr>
<tr>
<td>Formal business planning</td>
<td>Improved product quality</td>
</tr>
<tr>
<td>Regular assessment of employee training needs</td>
<td>Improved productivity</td>
</tr>
<tr>
<td>Employee performance appraisal programs</td>
<td>Increased sales</td>
</tr>
<tr>
<td>Outsourcing/subcontracting</td>
<td>Opportunities for new business</td>
</tr>
<tr>
<td>Formal networking</td>
<td></td>
</tr>
</tbody>
</table>

Note: Programs, practices and impacts are listed in no particular order. Programs, practices and impacts in the same row do not necessarily correspond.
Source: ACIL Allen Consulting.

As demonstrated in Section 2.1.6, a large proportion of businesses supplying prime contractors on naval shipbuilding projects are SMEs. It is often the case that these businesses do not have the necessary skills to fulfil the requirements of complex Defence projects. If businesses do not have the necessary practices in place, it is often the case that they are thoroughly assessed by the prime to minimise risk or to understand potential risks, possibly trained in the necessary skills or receive greater oversight by the prime contractor to ensure the quality of the outputs. If they have the necessary skills, suppliers are less reliant on the prime contractor and more capable of acting autonomously, thus reducing the burden on the resources of the prime contractor.
For example, H.I. Fraser is one company that has developed as a result of being involved with naval shipbuilding projects (see Box 4). In 1996 H.I. Fraser had a turnover of $2 million; today it has a turnover of $35 million, largely the result of its development of programs and processes to supply to large complex projects. The quality programs, project management, risk mitigation, project planning and other documentation it developed in the course of the Collins project have helped the business to supply similarly large and complex oil and gas projects.

Box 4 **New practices open doors to new industries**

H.I. Fraser has been involved in all major Australian naval shipbuilding projects in the past 20 years. Specifically H.I. Fraser designs, manufactures and services critical gas, fluid and waste systems. Naval shipbuilding and maintenance accounts for 60 per cent of the company's revenue and it was the involvement in the Collins program that transformed the H.I. Fraser from a small boutique manufacturer with a turnover of $2 million in 1996, into a company that has 75 employees and $35 million in sales including export sales of critical fluid systems.

Prior to involvement in Collins, H.I. Fraser had no sophisticated processes for participating in large scale defence projects. It was the foresight of Collins project managers to provide the opportunity to H.I. Fraser that enabled H.I. Fraser to develop its skills in areas such as quality programs, project management, risk mitigation, project planning and other documentation, all of which now form the basis of the current business.

H.I. Fraser has spent significant time developing systems and certification to meet the requirements of prime contractors to Defence. This includes ISO9001 requirements, as well as participating in the primes’ supplier induction process. H.I Fraser has found that time spent on working through multi-national defence prime supplier requirements was not wasted and there are a number of similarities to multi-national oil and gas supplier requirements.

H.I. Fraser has found that once internal processes are at a high level, it was easier to adapt the requirements of Defence contracts to other industries. Manufacturing components and supplying systems for naval ship build programs such as Collins, Minehunter and AWD have allowed H.I. Fraser to refine quality systems and complete work for other markets demanding high quality workmanship. Using the processes it has developed through naval shipbuilding projects, the company has been able to successfully enter the oil and gas industry, which now accounts for 30 per cent of the its revenue. Recent export examples include Industrial gas fittings to South Korea and Chemical Injection skids to South Africa.

H.I. Fraser recognises that without the skills it developed by participating in naval shipbuilding projects, entry into the oil and gas industry would have been much more difficult. H.I. Fraser would have been “going in blind”, and without the experience and processes to resolve large and complex issues. H.I. Fraser knows that it would have learnt the hard way and that errors could have been very costly and potentially at the expense of future contracts.

Over time, H.I. Fraser has also worked to ensure it remains relevant in today’s competitive production climate, which is often driven by low cost components. H.I. Fraser has adjusted its focus away from commodities and into niches. It now takes innovative approaches to sourcing and assembling equipment utilising a cost benefit process to assess what is sourced overseas, and what is manufactured in Australia.

Source: H.I. Fraser

There can be synergies between improved programs and practices and the ability for a supplier to be more ‘Defence capable’ (itself a spillover which is discussed in Section 3.3.4). For example, ASC’s Supplier Audit Program (SAP) provides assurance that supplied goods and services will meet requirements and hence mitigate risk to support ASC in meeting its contractual requirements. SAP consists of a series of audits and activities to verify that subcontractors and/or suppliers have appropriate processes and systems in place to supply products and services that meets contracted requirements. Suppliers are required to participate in these audits and demonstrate the current state of systems and processes for controlling work. The audits can also be contract specific.
The SAP helps suppliers who have not supplied to a defence contract before deal with the steep learning curve of requirements and specifications they tend to experience. It enables ASC to guide suppliers through this learning curve, as well identify opportunities for continual improvement to their business. This places businesses in a prime position to bid for work on complex contracts in Defence or in the civilian market place.

ASC supported its supplier Ferrocut through the SAP. The many lessons learnt at different levels during this process as well as the subsequent improvements made to the business enabled Ferrocut to manufacture goods from international designs and specifications. More details about Ferrocut’s story are provided in Box 6.

3.3.4 Improved capabilities and readiness

A naval shipbuilding project represents a major opportunity for Australian industry to support Defence’s war fighting capability and, at the same time, to improve its defence capability. 49 per cent of businesses involved in the ANZACs and 80 per cent of businesses involved in Minelayers improved their ability to supply Defence. The main areas of improvement were:

— Knowledge to supply Defence
— Capacity to supply Defence
— Resources to supply Defence
— Can work with new defence technology
— Can provide better quality
— Can assist program through-life-support.

Becoming ‘Defence capable’ is not necessarily an easy process but once achieved it enables businesses to expand range of projects they can deliver on time and within allocated budgets. This capability is especially important for defence projects that are typically complex in nature and prone to cost and schedule overruns.

Research by Love et al (2009) on complex construction and engineering projects has found that errors account for approximately 38 per cent of the total rework costs experienced on major projects, and that errors drive schedule overruns. This research (and other research) has also suggested that maturity in project management has the ability to mitigate the impact of errors in complex projects and that organisations with high or ‘optimised’ levels of project management maturity are between 40 per cent and 50 per cent less likely to experience significant delays in major projects. This research also suggests that organisations with high or ‘optimised’ levels of project management maturity are between 50 per cent and 60 per cent less likely to experience significant cost overruns in major projects (Prado et al 2013).

The presence of a viable naval shipbuilding capability in Australia, gained through projects such as AWD and Collins, provides the preconditions to achieve widespread maturity in the type of project management that can deliver complex integrated infrastructure. Such capabilities can be extended to attract and successfully execute other Defence contracts including international contracts. They can also be applied to other major construction and engineering projects – including major off-shore liquid natural gas and petroleum project – however, independent evidence to support this argument has been difficult to assemble for this report.

The Austal case study (below) provides an example of how maturity in all parts of the supply chain can benefit project outcomes. Austal actively educates suppliers on how to respond to Defence contract requirements places them in a better position to both respond more
efficiently to Australian Defence contract requirements as well as international defence requirements (see Box 5).

Box 5  **Helping suppliers negotiate complex Defence requirements**

Fourteen Armidale Class patrol vessels were procured by the Royal Australian Navy in 2003 under a commercial contracting arrangement from the Australian commercial and naval shipbuilder Austal. Since the original Armidale contract a number of international navies have expressed interest in procuring boats based on Austal’s original Armidale platform. Most naval customers prefer to reduce program risk and cost by using a proven parent design with some level of customisation and the installation of Commercial Off The Shelf (COTS) components. Currently the majority of the communications and navigation equipment integrated into the Armidale variants are COTS.

It is typical for a Defence project to require all components to be accompanied by detailed information and data on maintainability and supportability for the life of that component. While including COTS components ensures a much larger pool of suppliers, it also means that many of the suppliers are unfamiliar with the Defence data requirements that must accompany the supply of a COTS component for a naval ship. This is particularly the case for suppliers who have only had experience in commercial shipbuilding.

In some cases the suppliers may not know how to respond to the detailed information request, while in others cases the data may not even exist. To ensure that all support documentation and data for COTS components are delivered to Defence, Austal works closely with its suppliers and educates them in developing the necessary data to accompany COTS components. Austal notes that Defence understands the value of working with COTS suppliers to reduce project risk and cost and absorbs any costs associated with teaching suppliers how to comply with Defence requirements.

Skills are developed by suppliers over time as more data requests are completed and the suppliers become more competent at responding without support. Suppliers are then able to provide this data to Defence and are in a better position to participate in other international defence contracts.

Source: Austal.

Adelaide company Ferrocut provides another example of a business is using a major naval shipbuilding project as a springboard into other Defence contracts (see Box 6). AWD was Ferrocut’s first ‘prime contractor’ Defence project, having been a second or third tier supplier in the past. By moving a $15 million, purpose built facility in Techport as Osborne, Ferrocut is planning to be in a strategic position to supply other Defence projects, such as the LAND 121 protected and unprotected mobility vehicles program.

Box 6  **Signed, steeled and delivered**

Signed, steeled and delivered: South Australian company Ferrocut has found itself at the cutting edge of the Air Warfare Destroyer project

Ferrocut’s through-life contract for work on the $8 billion AWD project is a first for the Adelaide-based company.

While the steel-place-processing business has worked indirectly on Defence Industry projects for the past eight years, the AWD contract is the first it has signed as a prime contractor.

Ferrocut Director Geoff Ellens says the contract is an important and prestigious win for the company, which has its sights set on boosting its involvement in South Australia’s Defence sector.

“This is our first major first-tier contract,” he says. “In April, we were awarded the plate-cutting contract for the AWD modules that will be built in SA and, while we have worked as a second-tier and third-tier contractor in the past, this is a milestone for us.”

Ferrocut’s intention to build on its Defence work is proven by its recent move into a $15 million, purpose-build, state-of-the-art, plate-processing centre in Techport at Osborne.

The company was the first to build premises in the hi-tech naval hub and is situated across the road from the Australian Submarine Corporation.

Its premises house 49 employees – everyone from computer programmers and welders to NCN machine operators and crane operators. Ferrocut’s expansion plans included its most recent acquisition – a Bystronic, 6kW laser-cutting machine with a table size of 6.5m x 2.5m, which is among
Ferrocut’s increased capability is expected to generate further interest from the Defence Industry, as precision is crucial in Defence work. The company plans to capitalise on this process, providing the industry with quality precision components and reducing the need to value-add with a machining process.

Ferrocut’s move to Techport was important for the company’s long-term involvement in the Defence Industry.

“Part of the plan was to be industry-ready for future Defence work, and the AWD will be used as a springboard into other Defence areas,” Mr Ellens said.

“The White Paper highlights the need to expand Australia’s naval capacity in the future and, with the proposed 12 new submarines in the design phase and the possibility of future shipbuilding of frigates, Ferrocut’s move to Techport places it in a strategic position to provide a crucial capability to keep the Defence work in South Australia.”

Mr Ellens says maritime work is not the only area of Defence business on Ferrocut’s radar.

“We are also seeking other Defence work, such as work on the future LAND 121 Phase 4 vehicles, where we hope certain components of the project are made in South Australia, by SA companies, because Ferrocut is well-placed to complement them with our capability.

The Techport site offers a logistic advantage for most cutting disciplines of steel, stainless-steel and aluminium-place-processing, including oxy cutting, high-definition plasma and laser cutting that can meet the needs of all Techport precinct users.

As well as the Defence Industry, Mr Ellens says Ferrocut also services mining, agricultural, automotive, general engineering and toolmaking industries... “basically anybody who uses steel plates, profiles and components”.

The Defence Industry’s growing momentum in South Australia, together with future interest from other Defence suppliers in Techport, means Ferrocut has a long-term future at Techport and a long-term future in defence he says.


3.4 Avoided costs

There are a number of significant long term costs that can be avoided through the development of a sustainable naval shipbuilding industry in Australia. ACIL Allen has analysed two categories of avoided costs. These categories have been identified from discussions with companies that have participated in this project.

The first category includes the costs that can be avoided from having to shut down facilities due to low or insufficient demand and then re-open when demand increases. The second category includes the costs that can be avoided by using on-shore as opposed to off-shore supply chains (providers) during design, build and sustainment phases of significant projects.

3.4.1 Avoided infrastructure costs (shutdown and re-start costs)

For the purposes of this project, ACIL Allen asked five leading naval ship builders to estimate the costs of shutting/mothballing down a shipyard completely (due to the completion of their current major contracts/projects) and then subsequently re-opening the facility within five-to-ten years (when new contracts/projects are initiated). It is important to note that the costs identified here are for illustrative purposes only. These costs are intended to highlight some of the additional financial and economic impacts that the expected low levels of demand will have on the industry. As such the costs described below should be seen as indicative only. The costs do not reflect the absolute costs of a shut-down/re-start given that such an event may have wide reaching implications.

Avoided costs

There are a number of significant long term costs that can be avoided through the development of a sustainable naval shipbuilding industry in Australia. ACIL Allen has analysed two categories of avoided costs. These categories have been identified from discussions with companies that have participated in this project.

The first category includes the costs that can be avoided from having to shut down facilities due to low or insufficient demand and then re-open when demand increases. The second category includes the costs that can be avoided by using on-shore as opposed to off-shore supply chains (providers) during design, build and sustainment phases of significant projects.

3.4.1 Avoided infrastructure costs (shutdown and re-start costs)

For the purposes of this project, ACIL Allen asked five leading naval ship builders to estimate the costs of shutting/mothballing down a shipyard completely (due to the completion of their current major contracts/projects) and then subsequently re-opening the facility within five-to-ten years (when new contracts/projects are initiated). It is important to note that the costs identified here are for illustrative purposes only. These costs are intended to highlight some of the additional financial and economic impacts that the expected low levels of demand will have on the industry. As such the costs described below should be seen as indicative only. The costs do not reflect the absolute costs of a shut-down/re-start given that such an event may have wide reaching implications.
The direct and indirect costs associated with closing shipyards for periods of time and then re-opening them could be significant and long term.

The estimates of shut-down/re-start costs for two naval shipbuilders are provided in Table 15 and Table 16 below along with additional detail about other related costs. The estimates were assembled using financial year 2012-13 dollar estimates. The names of facilities and companies have been withheld to protect the confidentiality of participants.

Additional detail about these and other costs is outlined below.

Example 1

Example 1 is a facility with capabilities for the design, manufacture and TLS of vessels. The primary infrastructure on this site includes:

— A shipbuilding facility with a production line where the cutting or raw materials through to the final assembly of ships takes place. This facility has machinery and equipment that support production and TLS, in particular, the fabrication and welding of high quality metals.

— A vessel launch and retrieval system specifically designed to ensure the safe launch and retrieval of vessels from the water.

Table 15 provides an estimate of the costs for this company associated with the hypothetical scenario of shutting down and re-opening the shipyard. It suggests that the direct capital and staffing costs (in the form of redundancy payments) could reach $40 million.

A large proportion of these costs would be generated from having to re-tool due to obsolete machinery and equipment or to cease operations if the shipyard was mothballed. For example:

— A large proportion of the shipyard’s fabrication machinery and equipment is highly dependent on propriety software that requires constant maintenance to minimise obsolescence. This machinery would need to be completely updated to meet the platforms and requirements of future software.

— Without sufficient maintenance of the shipyard’s vessel launch and retrieval systems (both of which are permanent steel structures in the water), corrosion would be inevitable. If the shipyard is closed, left unmaintained for five-to-ten years and then re-opened, these systems would have to be completely replaced.

<table>
<thead>
<tr>
<th>Table 15</th>
<th>Example 1 – estimated shut-down/re-start costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated cost of shutdown</td>
</tr>
<tr>
<td>Type of infrastructure</td>
<td>Capital</td>
</tr>
<tr>
<td>Shipbuilding Facility</td>
<td>$5m</td>
</tr>
<tr>
<td>Shipbuilding Machinery &amp; equipment</td>
<td>$3m</td>
</tr>
<tr>
<td>Vessel Launch and Retrieval system</td>
<td>$0m</td>
</tr>
<tr>
<td>Sub totals</td>
<td>$8m</td>
</tr>
<tr>
<td>Total estimated cost</td>
<td>$39.7m</td>
</tr>
</tbody>
</table>

Source: Based on estimates provided to ACIL Allen.

Consultations with this shipyard’s managers have identified a range of other costs that could be associated with a shutdown/re-start scenario. While they could not be quantified for this project they can include:

— The loss of existing non-defence contracts.
Estimated to be in the order of $220 million for one company. These contracts have taken many years to secure and if the shipyard was forced to close, there would be no guarantee that similar contracts could be secured in the future.

The loss of a specialised workforce.

One shipyard currently employs between 150 and 200 specialist welders. These welders require at least one year of on the job training before they can meet the technical requirements of large vessels. Welders from other professions, i.e. the mining and construction industries, do not usually have the required skills to work within this segment of shipbuilding without specialised training. Similarly, it is not necessarily the case that welders, for example, can simply transfer their skills to other naval vessels.

The loss of on-site working vehicles and cranes.

The shipyard has a fleet of vehicles and specialised cranes that would need to be replaced if left unused for a period of time. The sheer size of some vehicles/cranes could make replacement a very costly exercise.

Ongoing safety, security and other costs of an unused facility.

If left unused and unsecured a shipyard represents an unsafe area to the community and costs will need to be incurred to ensure it is safely mothballed.

If left unused the facility would also generate rates, land taxes and utilities charges that would need to be funded by the shipyard’s owners.

Complex range of socio-economic costs due to increased local unemployment and business closure in the area.

Example 2

Example 2 is an example of a major national facility servicing both the naval and civilian shipbuilding and repairs industries. The site’s primary infrastructure includes:

A dockyard with substantial trade workshops. These workshops comprise machinery and equipment to undertake all types of ship repairs and maintenance which include fabrication of steel components.

Weapons and combat systems workshops where the inspection, testing and refurbishment of a wide range of systems occur. This is the location where high technology activities take place on the site.

A graving dock for lifting vessels in and out of the water. This facility is one of the largest and most complex in the southern hemisphere.

Reticulated services which include a reserve power generation plant for emergency situations.

Table 16 provides an estimate of the costs to this company associated with this hypothetical scenario. It suggests that the direct capital and staffing costs could reach $122 million.

A large proportion of costs would be generated from having to re-tool due to obsolete machinery and equipment if the shipyard was mothballed. For example, the largest proportion of costs would be associated with the restart of trade workshops weapons and combat system workshops.
Consultations with this shipyard’s managers have identified a range of additional costs that could be associated with a shut-down and re-start of facilities. While they could not be quantified for this project they can include:

- The loss of commercial contracts.
- This shipyard currently holds TLS contracts that exceed an annual value of $200 million. If the facilities are mothballed there is no guarantee that similar contracts would be secured in the future.
- The loss of staff capable of providing repairs and maintenance for high tech systems.
- Many of these staff are required to undergo multi-year training and development programs in order to meet the high technological requirements of modern systems. It is estimated that the training and development costs for these staff exceed $500,000 per staff member.

The implications of these costs, which are well beyond those identified here, are described in more detail at the end of this section.

### 3.4.2 Avoided supply chain costs

ACIL Allen also asked participating companies to consider the additional costs that may be avoided from having to source goods, services, materials and expertise from suppliers in overseas locations. According to industry sources these costs are highest overseas suppliers are used for customised vessels (such as the Collins Class Submarines, AWD and LHD).

One participant in this study estimated that the use of off-shore suppliers in Asia led to a 100 per cent increase in the travel and accommodation costs associated with sending staff to offshore locations (or flying contractors in to rectify problems), or by providing off-ship accommodation for a crew while the ship is being repaired/maintained in a foreign country. For example, this participant estimated the cost of maintaining a ship’s technical staff (of at least 30 people) while an overseas-based refit was taking place would exceed $1.4m for a six month period.

While others consulted for this project could not estimate the additional costs of using overseas suppliers, an effective domestic shipbuilding and sustainment capability would help to avoid the:

---

**Table 16**  Example 2 – estimated shut-down/re-start costs

<table>
<thead>
<tr>
<th>Type of infrastructure</th>
<th>Estimated cost of shutdown</th>
<th>Estimated cost of re-start</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Capital cost</td>
<td>Labour cost</td>
</tr>
<tr>
<td></td>
<td>$m</td>
<td>$m</td>
</tr>
<tr>
<td>Dockyard/Trade Workshops</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Weapons/Combat Systems Workshops</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Graving Dock</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Reticulated Services</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td><strong>Sub totals</strong></td>
<td><strong>33</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

**Total estimated cost** $122.4m

*Note:* *Estimated labour costs are for shutdown are a result of redundancies. **Other costs such as training, loss of production efficiency were identified for Example 1 but not costed.

Source: Based on estimates provided to ACIL Allen

---
— General loss in supply chain efficiencies borne from sustainable volumes or levels of work in Australia. This is particularly pronounced if there is considerable uncertainty in overseas supply chains.

— Loss of rapid rectification of emergent warranty issues. This loss of response time can lead to additional repair costs if critical faults or engineering issues are not dealt with in a timely way.

— Increased corporate general and administration costs through the need to manage contracts with overseas suppliers. These contracts often carry additional financial costs (such as currency hedging) and legal costs (such as the engagement of overseas legal teams) that can materially impact projects that have a long shelf-life.

— Increased insurance costs. Insurance companies generally charge a premium on projects which are substantially dependent on overseas providers/suppliers.

— Loss of IP and continuity of corporate knowledge in Australia with respect to ship sustainment and repair.

Avoided ‘generational’ losses to supply chains

It has been suggested during this project that the domestic supply chains supporting complex naval shipbuilding and TLS projects take many years to mature, and a generation to rebuild if they are substantially broken or diminished.

Consultation with the International Centre for Complex Project Management (ICCPM) identified that the disruption of a supply chains for complex projects (such as destroyer and submarine projects) could take as long as 25 years to repair. This is because the minimum capabilities to deal with the complex integration requirements of ‘next generation’ defence projects require decades to mature and evolve, and often leave an industry if demand is insufficient to support such capabilities.

The case study on Bisalloy (see Box 1) provides an example of how a supplier has matured over decades having serviced major Defence projects. For Bisalloy the learnings and product developments gained through an initial Defence contract spilt over into other major contract opportunities, and eventually into the global defence market

ICCPM are currently preparing a proposal for Government to examine the impact of major defence projects on Australian supply chains. If successful this proposal will assist in delivering quantitative evidence to support ICCPM’s observations.

3.4.3 Avoided costs: summary and implications

It is acknowledged that the closure of a single shipyard will generate local area costs that are significant, but these costs do not in themselves provide an economic rationale for industry support. Infrastructure, machinery and equipment can always be replaced (through local or off-shore suppliers) when demand for naval shipbuilding increases. It may also be replaced at levels which are cost effective and in keeping with the technological requirements of individual projects and vessels.

However, one element that cannot be easily or cost effectively replaced is the human and intellectual capital which is fundamental to the successful design, build and sustainment of naval ships that meet the strategic needs of Australia. Consultation for this project with five major shipbuilders has revealed the considerable time and resources that are necessary to ensure a naval shipbuilding capable workforce is available to deliver project outcomes against RAN’s strategic and technical specifications.
For example, consultation for this report, has highlighted that the average staff training and development budget for shipbuilding and repairs is between 1.5 per cent and 2.5 per cent of a staff member’s initial salary (depending on the level of complexity in a staff member’s job).

Using the data provided to ACIL Allen for this project we can calculate the possible cost of retraining workers some shipyards close and cause a loss in skills to the industry, but the industry was to require to re-start a short time afterwards.

If we assume an average salary level of a shipbuilder or contractor is approximately $92,000 per annum (figure includes costs such as superannuation), and we estimate there are approximately 5,500 staff directly employed in naval shipbuilding in Australia (see Table 9) the total training costs for the industry could be between $759 billion and $1.26 billion. If several shipyards in Australia were to close due to insufficient demand and 30 per cent of the workforce retrenched, the cost of retraining these staff could range from $227 million to $379 million for the industry.

ACIL Allen suggest that costs such as these would only represent a small proportion of the total costs experienced by the industry if it were to significantly ramp-up and then ramp-down within a five-to-ten year period. These costs would be in addition to the direct costs (outlined in Table 15 and Table 16), but would be exclusive of any other costs associated with the productive capacity of staff while undertaking training and development. They also exclude any costs associated with the disruption of the supply chain, which are suggested could be just as large.

For these reasons, the avoided cost of maintaining domestic naval shipbuilding capabilities impacts are likely to be cumulative or non-linear in nature. These costs are likely to grow in an exponential way they are realised on individual projects through all aspects of the supply chain. Also the anticipated complexity of future shipbuilding projects (i.e. Future Submarines project) will require a sophisticated and mature local capacity that cannot be built over night, but must be developed over a longer period of time.
4 Value to Government – real options analysis of naval shipbuilding

4.1 The value of capability

The discussion in previous chapters of this report has been concerned largely with the financial costs and direct economic impacts of designing, building and sustaining a fleet over its life, based on ‘normal operations’. It highlights hidden, but real, financial costs that are likely to arise if a decision is taken to source ships from overseas, or between different approaches to Australian design, build and sustainment. These costs are important, and need to be factored into any balanced weighing of alternative approaches to meeting demands for Australian naval capability.

However, as was flagged in Section 3 these financial costs fall well short of telling the full story and are only part of the story of whether it is worth maintaining a naval shipbuilding capability in Australia. If we are looking at value for money, it is crucial to consider not just differences in costs, but also relevant differences in the nature of the naval capability that is acquired and sustained over time, and of the implications this has for Australia’s overall defence capability.

4.1.1 Choosing between capabilities and not just costs

Any decisions about whether to design, build and sustain vessels from local or overseas sources inevitably involves a choice about what capabilities will be developed in Australia. Reasons for this include:

— The fact that local design and build brings with it infrastructure, skills and expertise that is unique to Australia’s needs
— These are real assets and capabilities, over and above the ships themselves, that flow from local build and that underscore a range of options for enhancing and sustaining fleet capability over time and across plausible future scenarios that could depart from tasking requirements envisaged at the time the ships were built. This delivers a different type of capability to overseas models.
— The value of this difference is heightened by the limited scale and scope of local non-naval shipbuilding capabilities
— Options for extracting value from the greater local on-shore design, build and sustainment capability include scope for higher priority and faster access to repair and support facilities, potential for rapid ramp up at times when concerns about major conflicts are rising, and ‘surge capacity’ to deal with the greatly heightened demands for vessel repair and modification that could emerge from conflict, especially conflict within Australia’s region
— Naval vessel build always involves some design adaptation during the build phase – as lessons are learnt, new technologies emerge or the likely tasking needs evolve.
— Local build provides much greater scope for ongoing Naval involvement with the build and adaptation process, with this likely to lead to different adaptations being made to the physical features of the vessels
- The build stage benefits from insights from Australian naval personnel, and from more diverse and deeper understanding of the vessels, their requirements and their capabilities.

- This understanding and the associated skills that are developed have an obvious application to sustainment over the life of the vessel, and would not be realised without onshore building. These again point to options that arise from local design, build and sustainment that are likely to flow through to different vessels and wider capabilities.

- Local build typically faces some disadvantage as a result of relatively poor access to large size economies. While these disadvantages can be partially offset by the opportunity costs discussed in Section 3, they also tend to favour careful consideration of the merits of continuous versus batch building of vessels as a cost effective way of sustaining capability.

- However, continuous build may also open up potential for sustaining greater and more valuable capability of the Naval fleet over time:
  - Relative to batch building that effectively cycles each class of vessels between very modern and decidedly dated vintages, it can support a much smoother profile of capability, in which there are always several ships that have been built very recently, with leading edge capability—while older vessels are still perfectly capable of many tasking requirements where the vintage of the vessel is much less significant.
  - While recognising the value in a high level of commonality across a vessel class, this same feature does open up possibilities for more cost effectively responding to the very different capability demands that can apply across diverse tasking requirements.

Acquiring classes of vessels in batches, built in quick succession and then operated over several decades, does create a cycle in the capabilities of each class of vessels.

Soon after the batch arrives, the vessels are likely to reflect near state-of-the-art design and vessel capability. However, over the next 20 to 30 years, this changes, even with periodic upgrades to the vessels. While their technical tasking capabilities may well be sustained, or even enhanced, across their lives, they are aging vessels built to an aging design that imposes increasing constraints on supporting state-of-the-art capabilities. While they may be as technically capable as they ever were, the chances that that capability is becoming less competitive, against state-of-the-art developments in other fleets, including fleets with which these vessels might come into conflict, is very high.

Similar considerations can apply with vessels supplied to Australian defence partners as part of regional cooperation. For example, cycling of patrol boats between use in other countries and refit and rebuild in Australia would maintain a higher level of regional capability than a one-off build and transfer. One possible option would be to lease patrol boats for a specified period to another country (say two to three years), then replace that boat with a more recently built model. The old vessel could then be refitted with state of the art technology and refurbished to bring it up to a comparable standard.

---

6 There are also point-in-time differences in costs between overseas and onshore building that arise from exchange rate effects. These effects should be excluded from the analysis. Exchange rate movements are unpredictable and over the lifetime of a naval asset could be either favourable or unfavourable to the relative cost comparison. It would be unwise, for example, to conclude that recent high exchange rates that reflect mineral export prices will continue over the life of a future shipbuilding project.
Competitiveness of fleet capability is not just a reflection of systems bolted onto these vessels, but can be built into the design. For example, new designs with improved logistics within the vessels, and in relation to resupply at sea capabilities, can radically alter the capability of vessels in conflict settings. New designs can be optimised to absorb recent technology advances in ways less likely to imply compromise of other vessel tasking capabilities.

It is a mistake to think in terms of fleet capability purely in terms of the technical ability to undertake tasks that were scripted at the time the concept for these vessels was first developed – possibly 30 or more years earlier. Across the planned lives of naval vessels, tasking requirements typically evolve dramatically, in response to changes in the nature of threats and Australia’s relationship with allies, changing technologies and changing geopolitical realities.

4.1.2 Ensuring flexibility and adaptability

Flexibility and adaptability are key features of the value of any Australian investment in such costly, long-lived assets.

Over and above these trends over the life of a vessel class, in the event of serious hostilities erupting, the demands of the fleet can be expected to change dramatically – along with demands for on-shore support to deal with changes such as:

— Much more intensive utilisation of the fleet, with direct implications for maintenance and associated demands for facilities and skilled support people
— Potential demands for rapid repair of damage caused by conflict – and, in the case of local regional conflict, for local, priority repair that maximises availability
— Potential demands for rapid adaptation of vessels to meet specific new tasking needs shaped by the specific nature of the conflict
— Possibly the need for rapid gearing up of a vessel replacement strategy, in the event that vessels are lost or badly damaged

Of course, these demands can, fortunately, be viewed as low likelihood in the foreseeable future. However, it should be recognised that the size and structure of Australia’s naval fleet, and Australian willingness to incur the high costs of acquisition and support, is based on demand for preparedness to deal with just such low probability but potential very damaging events. Without these low probability, but potentially highly damaging risks, the optimal size and structure of the Australian naval fleet would be very different, and the cost would be much lower.

The structure and costs of the fleet are not driven by peacetime demands, but by the combination of demand for a fleet that could help deter serious conflict and, should this fail, by demand for a fleet suited to delivering defence response capability.

Viewed this way, the fleet is an investment in insurance for Australia and its allies – against conflict occurring, through deterrence, and against excessive damage to Australia in the event of conflict as a result of the capability of the fleet to mount and sustain effective defence operations of a suitable type and scale. This view of fleet requirements as insurance, against rare but potentially very damaging future scenarios, is broadly analogous to the justification for investment in local facilities and skills capable of responding to major disease outbreaks in people, animals or plants. The Australian Animal Health Laboratory is hardly optimised for dealing with routine animal health threats in Australia – much of its costs are tied into specialised facilities that exist to deal with low risk but potentially very damaging events, such as an outbreak of foot and mouth disease where the benefits from very early detection and response are significant.
The acquisition of naval vessels is a massive investment by Australia that can only be sensibly judged across the life of the fleet. The on-shore capabilities and options that emerge from local build are part of what is acquired if local build is used. Importantly, like other expenditure on insurance, value for money cannot be assessed by modelling 'normal' operations.

4.1.3 Real options approach

The most useful paradigm for weighing the value of investment that includes substantial insurance against rare but catastrophic threats is that of real options. Real options emerged formally in the late 1970s as an approach to investment analysis that could address the serious biases recognised on the more conventional benefit-cost and Net Present Value (NPV) tools. The real options approach is an extension of these methods that addresses the biases that arise when there is a combination of two features in the investment strategy:

— High levels of uncertainty regarding future conditions that will impact on the investment, on how it is used and on its value, and
— Substantial flexibility to adapt the investment in response to the way these uncertainties play out over time.

These two features lie at the heart of the case for investment in naval capability – inclusive of on-shore support capability. The fleet is designed to provide a broad range of options for deterring and responding to possible future threats. Response to any major conflict or imminent threat of conflict will involve departure from normal operating patterns, increased support demands and, under some circumstances, increased demands for repair and adaptation. The value of these naval defence options is linked fundamentally to the flexibility embedded in these options, to adapt to changing threats and associated needs. The naval fleet that emerges out of local build embeds quite different options for such adaptation relative to a fleet sourced overseas. Overseas sourcing that can meet ‘normal’ tasking demands needs to be assessed in terms of how it would cope with major departures from normal conditions – and especially departures that pose special threats to Australia.

When this is done, quite different ‘opportunity costs’ enter into consideration:

— Constraints on surge capacity in repairs and maintenance, flowing from the much more intensive operations and real risks of serious damage to vessels
  — Increase risks of serious problems at sea, in a conflict zone, if maintenance needs to be deferred
    › Implications for reduced capability, just when capability has maximum value
— Costs that could arise were it necessary for any vessels to return to repair facilities located remotely, in the country where the vessels were constructed
  — Reduced availability, just when availability has maximum value
— Costs, if repair is to be done by another country, if Australia’s needs are not accorded maximum priority – which is a plausible development in the event of a conflict involving multiple countries
  — Again reflected in reduced availability, or continued operation of an impaired vessel in a conflict zone while waiting for a repair ‘slot’
— The costs that could arise in the event of conflict towards the end of the life of a batch of vessels, when the capability of the class is at a low point in its competitiveness against plausible threats
  — Continuous build would support the presence in the fleet of some quite recent vessels reflecting latest design and capability thinking
The costs that could arise during a protracted period of serious conflict, should Australia see the need to gear up to build new and replacement vessels to maintain its naval capability.

- Presence of the infrastructure and skilled teams that would flow from ongoing naval shipbuilding provides the foundations for much more rapid ramp up to meet these needs, with the potential to limit or avoid the emergence of a serious, and costly, gap in Australia’s naval defence capability – just when such a gap is most costly in terms of risks to Australia.

### 4.2 Weighing the options

The above discussion recognises that different approaches to acquisition imply qualitative differences in fleet characteristics, including capability to deal with rare but potentially highly damaging events, and different options for dealing with future threats. Even economic modelling, based around a normal, peacetime ‘business as usual’ scenarios has its limitations in that it will not pick up the potential economic costs for Australia of different states of preparedness to deal with low probability but high potential damage scenarios.

If local or overseas shipbuilding were to offer identical fleet capabilities, inclusive of identical capabilities to respond to potential threats and to sustain the response for an appropriate time, then simple cost comparisons would provide a good guide for choosing. But for the reasons set out above, that is not the case here. Local build brings with it options for Australia that do not arise in the case of overseas build – options whose value lies most in capability that will have most value should Australia enter a period of significant conflict or risk of major conflict.

We see this concept of the value of capability, rather than just capability in a technical sense, as critically important to sound choice of approaches to acquisition and support. There is a strong case for viewing local build – with the implied enhanced infrastructure and skill base – as creating capability for support that may have low value under normal circumstances, but that has the potentially to switch rapidly to very high value under plausible changes in the nature of the threats faced by the vessels, and Australia.

Local build also opens up scope for considering Australia moving more strongly towards a continuous build approach to vessel acquisition. This approach may serve to lower some of the costs of local batch build, especially those linked to periodic ramp up and then ramp down in capability – and this in itself could lower any apparent cost advantage in overseas sourcing. However, it could also fundamentally reshape the structure of the fleet and the onshore build and support capabilities, delivering different capability value under some threat scenarios.

Any value difference attributable to the differences in the nature of the fleet and the onshore support capabilities will depend strongly on the nature and likelihood of plausible forward threats. We are not in a position to undertake this assessment within the scope of the current work – it would certainly require active engagement with the Navy and its capability planners. While the real options approach could be viewed as a logical extension of a more traditional approach of developing a capability specification, stress testing it across plausible scenarios and then seeking to source at least cost under base case (normal, peacetime operations) assumptions, it does in fact entail quite fundamental differences and can be expected to favour different strategy. Instead of focusing on least cost sourcing of minimum necessary capability, it would focus on sourcing to deliver highest expected value, assessed across the major uncertainties – thus bringing explicitly into the planning the value of any capability in excess of minimum requirements.
4.3 Continuous build to exploit options

Continuous build has been around as a concept for many years – primarily motivated by recognition that this approach could improve the throughput economies of local build and, in particular, could eliminate the substantial ramp up/ramp down costs associated with local batch building. If shipbuilding in Australia is to rely on periodic batch builds for a small number of vessels with long planned lives, Australian build will necessarily face cost hurdles relative to overseas sourcing from shipyards with much bigger throughputs.

These arguments are valid and highly relevant here. The costs of ramp up/ramp down were discussed above in Section 3.4.1. Important also here is the fact that volatile demands for shipbuilding can work against the capacity of Australia to sustain the full range of SMEs that might be commercially viable, and competitive, under a continuous build model that supports greater confidence in continuing demand for key services. In turn, this SME capability can translate into part of the on-shore capability, insurance and capability value recognised above – additional options for sustaining and adapting capability in a conflict situation, through locally supplied services. Real options planning, of the form envisaged in Section 4.2 above, would need to factor in these components of capability value under a local build model.

However, it is also important to consider, as was flagged above, whether a move to continuous build would sensibly lead to a shift in what capability is being acquired continuously. Suppose there were a move from a batch to a continuous build approach to surface combatant vessels. Batch build would imply agreeing the vessel class specifications and proceeding to acquire a fleet of such vessels over a relatively short period. All vessels in the class would be virtually identical. At the end of the build, all the vessels would be recent, modern and competitive for their planned tasking requirements.

Twenty five years later, despite some major upgrades, the fleet will have aged in several respects:

— The fundamental infrastructure will be 25 to 35 years old, implying:
  - Growing concerns with reliability, with associated more intensive support requirements, and escalating annual costs of maintenance
  - Basic vessel architecture that does not incorporate advances in thinking that have occurred in the past 25 years, potentially constraining its performance in a range of areas
  - A legacy of compromises that have occurred as system upgrades and additions have been introduced into the vessels, including trade-offs between the added capabilities of some new systems and the constraints that fitting them in may have placed on the performance and value of older systems

— All vessels will be almost identical, even though a diverse range of tasking requirements will have evolved over the twenty five years – requirements that might be met better or more cost effectively through greater diversity across the fleet
  - Normal border protection activities might well be adequately met using vessels little changed from their original design
  - Deployment into war zones, against threats undreamt of twenty five years earlier, and with coordination required with allied vessels that may have been built in the last few years, may well require very different capabilities and justify significant new investment

— The range of threat scenarios around which capability planning will be being done will have evolved dramatically – possibly to a sufficient extent to challenge the appropriate
classes of vessel, and numbers within classes, best suited to responding to these threats

- The batch build model will have delivered a high level of inflexibility in adapting to this evolution prior to the delivery of the next batch – a major, very high cost process

Continuous build, not just of a class but of an interleaved range of classes, potentially offers much greater flexibility to evolve the capabilities of some vessels in the fleet, even including changes in key aspects of architecture, without the need to replace an entire class of vessels. Remaining older vessels may well still be very cost effective in some forms of deployment, but new vessels with an evolved design could be brought in to deliver specific new capabilities earlier, and more cost effectively, than might be done through batch replacement.

Of course there is value in commonality across a class of vessels – as there is in many systems across the entire fleet. But there are trade-offs involved, and the flexibility to adapt the design of the next vessel to be built, without embedding those design changes in an entire new batch, does potentially offer great flexibility for responding to evolving threats, technologies and alliances. Viewed as delivering options (noting that there is no need for the design to evolve unless it emerges as a cost effective thing to do), this flexibility could well have high value.

Were continuous build to be used, interleaving vessel classes and, as appropriate, exercising options to evolve the design of the new vessels within classes and even to substitute between classes in term of numbers of vessels, then it is at least plausible that this could deliver substantially greater fleet capability and capability value across the lives of the vessels. It is even possible that this increased value could be sufficient to allow reassessment of whether the same number of vessels need to be maintained in each class – for example, if the use of evolving design has resulted in reduced risk of a vessel being lost in conflict. Such possibilities could certainly feed positively into the economics of local shipbuilding, alongside the avoidance of ramp down/ramp up costs and associated capacity to support a range of onshore build (and support) capabilities.

Another possibility that emerges from these considerations is that of moving to a shorter vessel life, in at least some cases. Cost of vessel support and maintenance typically grows strongly as vessels age beyond 20 years or so. More intensive maintenance is required, vessel availability becomes harder to sustain and there can be increasing demands for costly upgrades that will only have a limited life if vessels are to be replaced within a few years. A number of assessments, by Navy and others (including one by ACIL Tasman) have pointed to the fact that keeping vessels operational for 30 to 35 years delivers little if any cost saving relative to more frequent replacement at around 20-25 years. If these long lives also bring with them greater loss of capability value – including the competitiveness of the capability and its suitability to evolving needs – it could well be that the real economics, appropriately assessed, of these long vessel lives are misguided.

If for example, there were a move to building surface combatant vessels on a continuous basis, with a new vessel being delivered every 20 months or so, this would allow that fleet to evolve towards a replacement cycle closer to 24 years – with enhanced fleet capability and the possibility that costs would be contained. The right cost calculations relate not to a vessel across its life, but to the rolling annual cost of maintaining an evolving fleet into the future. That indicative rate of build could support a viable, sustainable shipyard and construction teams – with the associated option value in the event of conflict or otherwise escalated maintenance and repair capabilities. The same long term build profile could create stronger incentives for the emergence of more capable local SMEs.
It is at least arguable, that this approach could deliver a more valuable fleet, better suited to dealing with evolving demands into the longer term – and to do so cost effectively.

Doing justice to this sort of possibility again needs the use of a sound options framework – it is crucial that the evaluations consider much more than project costs, bring in the value of capability and insurance, the value of flexibility supported by this approach and, of course, value when it is most needed – where risk of conflict is imminent or already realised.

Of course, any decision to move to such a model will require careful assessment and will take considerable time. However, again it could be risky to pull back from current naval Australian shipbuilding activity in advance of these possibilities being seriously considered and weighed.
Appendix A

Methodology

A.1 Input-output modelling

Input-output tables provide a snapshot of an economy at a particular time. The tables used in this analysis were for the 2010-11 financial year.

The 2010-11 input-output tables provide a picture of the region’s economy in the 2010-11 financial year. Input-output tables can be used to derive input-output multipliers. These multipliers show how changes to a given part of an economy impact on the economy as a whole. A full set of input-output multipliers for each region were estimated for the purpose of this analysis.

The input-output multipliers allow rigorous and credible economic impact analysis to be performed for the region of interest. Input-output multipliers are suitable tools for analysing the impact of the following types of economic change:

1. construction projects
2. changes in exports
3. changes in private or government consumption
4. sporting or cultural events
5. changes in visitor expenditure.

The common factor in each of these cases is that local production is stimulated as a result of an increase in final demand for the region’s goods and services. Final demand includes private consumption, government consumption, investment and exports (including sales to tourists/visitors). Increases in final demand provide a stimulus to the economy of a region that filters through the entire economy due to the linkages between local industries. Input-output multipliers capture these linkages and this is what makes them such a useful tool for economic impact analysis.

A.1.1 Multiplier types

Input-output multipliers estimate the economic impact on a region’s economy from a one dollar change in the final demand for the output of one of the region’s industries. Generally, four types of multipliers are used:

1. Output – measures the impact on the output of all industries in the economy
2. Income – measures the effect on the wages and salaries paid to workers within the economy
3. Employment – measures the jobs creation impact, and
4. Value-added – measures the impact on wages and salaries, profits and indirect taxes.

The sum of wages and salaries, profits and indirect taxes for a given industry provides a measure of its contribution to the size of the local economy – its contribution to gross regional product (GRP). The value added multiplier can therefore also be considered to be the GRP multiplier.

Input-output multipliers are a flexible tool for economic analysis. Their flexibility stems from the different forms of each multiplier type. For each region, multipliers were estimated in the following forms:

— initial effects
— first round effects
— industrial support effects
— production induced effects
— consumption induced effects
— simple multipliers
— total multipliers
— type 1A multipliers
— type 1B multipliers
— type 2A multipliers
— type 2B multipliers.

The above multiplier types are defined in full in Johnson (2004) for output, income, employment and value-added multipliers; however, a brief overview of the different types of output multipliers is presented below.

A.1.2 Multiplier effects

When additional sales to final demand are made, for example through increased exports or sales to the public, production increases to meet the increased demand, and this is the initial effect. Since production increases to exactly match the increased final demand, the increase is always equal to one (remember that the multipliers are defined in terms of a one dollar increase in final demand).

The industry producing the additional output makes purchases to enable itself to increase production, these new purchases are met by production increases in other industries and these constitute the first round effect. These first round production increases cause other industries to also increase their purchases, and these purchases cause other industries to increase their production, and so on. These “flow-on” effects eventually diminish, but when added together constitute the industrial support effect.

The industrial support effect added to the first round effect is known as the production induced effect. So far this chain of events has ignored one important factor, the effect on labour and its consumption. When output increases, employment increases, and increased employment translates to increased earnings and consumption by workers, and this translates to increased output to meet the increased consumption. This is the consumption effect.

A.1.3 Multipliers

The simple and total multipliers are derived by summing the effects. The simple multiplier is the sum of the initial and production induced effects. The total multiplier is larger, because it also adds in the consumption effect. So far all the effects and multipliers listed have had one thing in common, they all measure the impact on the economy of the initial increase in final demand.

The remaining multipliers take a different point of view, they are ratios of the above multiplier types to the initial effect. The type 1A multiplier is calculated as the ratio of the initial and first round effects to the initial effect, while the type 1B multiplier is the ratio of the simple multiplier to the initial effect. The type 2A multiplier is the ratio of the total multiplier to the initial effect.

7 Johnson, Peter (ACIL Tasman) (2004), An Input-Output Table for the Gascoyne Region of Western Australia. Gascoyne Development Commission.
initial effect, while the type 2B multiplier is the ratio of the total multiplier less the initial effect to the initial effect.

Given the large number of multiplier types to choose from, output, income, employment and value added multipliers, and each with numerous variations (simple, total, type 2A, etc) it is important that the analysis uses the most appropriate multipliers. Usually, the multipliers that include consumption effects (i.e. the added impact that comes from wage and salaries earners spending their income) are used. These are the total and type 2A multipliers. The total and type 2A multipliers will generally provide the biggest projected impact. Simple or type 1B (which omit the consumption effect) may be used to provide a more conservative result.

A.1.4 Limitations of input-output analysis

Input-output analysis is not without its limitations. Input-output tables are a snapshot of an economy in a given period, the multipliers derived from these tables are therefore based on the structure of the economy at that time, a structure that it is assumed remains fixed over time. When multipliers are applied, the following is assumed:

— prices remain constant;
— technology is fixed in all industries;
— import shares are fixed.

Therefore, the changes predicted by input-output multipliers proceed along a path consistent with the structure of the economy described by the input-output table. This precludes economies of scale. That is, no efficiency is gained by industries getting larger – rather they continue to consume resources (including labour and capital) at the rate described by the input-output table. Thus, if output doubles, the use of all inputs doubles as well.

One other assumption underpinning input-output analysis which is worth considering is that there are assumed to be unlimited supplies of all resources, including labour and capital. With input-output analysis, resource constraints are not a factor. It is thus assumed that no matter how large a development, all required resources are available, and that there is no competition between industries for these resources.

It is important to understand the limitations of input-output analysis, and to remember that the analysis provides an estimate of economic contribution, not a measurement of economic impact.

A.2 Data collection methodology

The data used to inform this study was collected from the five prime contractors partnering with this study – BAE Systems, Thales Australia, ASC, Forgacs Engineering and Austal. Detailed information requests were sent on Monday 18 November 2013 and data received until Thursday 28 November.

A.2.1 Input-Output data

To inform the Input-Output (I-O) modelling, the data was collected for each prime contractor’s defence shipbuilding activities in 2012-13. It was requested that separate data be provided for production and TLS. Prime contractors were asked to provide:

— Revenue, selected expenses and profit in the 2012-13 financial year from Naval Shipbuilding and Through Life Support/Sustainment, including:
Revenue items
  › Domestic sales
  › Export sales
  › Other income
Expense items
  › Wages and salaries and superannuation paid to employees residing in Australia
  › Payments made to contracted labour working in Australia
  › Purchased goods and services
  › Payroll tax
  › Company tax
  › Fringe benefits tax
  › GST paid
  › Rates
  › Depreciation
Profit/loss before tax
Full time equivalent employees as at 30 June 2013
  › Full time, part time and casual only, not contractors
Break down for the number of at each town/city/base
  › Full time, part time, casual and contract workers
Total number of suppliers from each state/territory
Total value of goods and services from suppliers in each state/territory
Top 7 cost items
  › Item description
  › Value
  › Proportion produced in Australia

If needed, ACIL Allen contacted the prime via phone or email to clarify data provided.

A.2.2 Shutdown/start-up and spillover analysis

To inform the shutdown/start-up and spillover analyses, an information request for quantitative and qualitative data (2012-13) and material was also sent to the five prime contract partners. Prime contractors were asked to provide:

— As assessment of current infrastructure
  — Shutdown and re-start costs of major infrastructure
    › Type of infrastructure
    › Estimated capital cost ($m)
    › Estimated labour cost ($m)
    › Other costs ($m)
  — Onshore and offshore sustainment
    › Category of cost ($m)
    › Estimated value of cost (assuming onshore supply) ($m)
    › + / - of offshore supply (%)
    › Reason for difference in cost
Transfers of spillovers

› Description of activity or investment
› Type of transfer or spillover generated
› Who benefited from the transfer or spillover and how did they benefit?
› Estimated value of transfer or spillover to Australian companies (if known) ($m)
› Case study subjects to showcase these spillovers

If needed, ACIL Allen contacted the prime via phone or email to clarify data/information provided.
Appendix B  Summary of major naval projects

This appendix provides high level summaries of major projects currently in their design, build or sustainment phases

B.1  Submarines

B.1.1  Collins Class Submarines Through Life Support

Table B1  Collins Class Through Life Support project

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Multi-billion dollar contract</td>
</tr>
<tr>
<td>Key partners</td>
<td>- ASC Pty Ltd</td>
</tr>
<tr>
<td></td>
<td>- Defence Materiel Organisation</td>
</tr>
<tr>
<td></td>
<td>- Royal Australian Navy</td>
</tr>
<tr>
<td>Project overview</td>
<td>The Collins Class fleet was constructed at ASC’s Osborne facility between 1990 and 2003. The facility now provides ongoing design enhancements, maintenance and through-life support for the fleet. In 2012, ASC signed a new In Service Support contract for maintenance of the Collins fleet going forward. This project contributes around $150 million and 1400 jobs to the state’s economy per year. The Collins Class submarine is 78 metres long, 8 metres in diameter and has a displacement of 3,000 tonnes.</td>
</tr>
<tr>
<td></td>
<td>The submarines rotate through an extensive maintenance and upgrade refit program known as a full-cycle docking. This massive undertaking of some 1.25 million hours of labour and 7,500 tasks requires ASC to deliver:</td>
</tr>
<tr>
<td></td>
<td>- a replacement Combat System</td>
</tr>
<tr>
<td></td>
<td>- a heavyweight Torpedo</td>
</tr>
<tr>
<td></td>
<td>- sewage automation</td>
</tr>
<tr>
<td></td>
<td>- Halon fire suppression</td>
</tr>
<tr>
<td></td>
<td>- numerous other modifications and enhancements</td>
</tr>
<tr>
<td>Project milestones</td>
<td>- March 2003: HMAS Rankin is delivered to the Navy, the final submarine of the Collins Class fleet</td>
</tr>
<tr>
<td></td>
<td>- March 2003: Through-life-support contract issued to ASC Pty Ltd</td>
</tr>
<tr>
<td></td>
<td>- August 2004: ASC completes first Collins Class full-cycle docking on HMAS Farncomb</td>
</tr>
<tr>
<td></td>
<td>- March 2007: Completion of HMAS Waller’s full-cycle docking, including first time implementation of the replacement combat system and heavyweight torpedo upgrades</td>
</tr>
<tr>
<td></td>
<td>- May 2010: Completion of HMAS Dechaineux full-cycle docking</td>
</tr>
<tr>
<td></td>
<td>- July 2012: ASC signs new In Service Support Contract for the maintenance of the Collins submarines</td>
</tr>
</tbody>
</table>

Source: [http://www.techportaustralia.com/about/naval-contracts/collins-class-submarines](http://www.techportaustralia.com/about/naval-contracts/collins-class-submarines)
B.1.2 Future Submarines – SEA 1000

Table B2 Future Submarines project

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>N/A</td>
</tr>
<tr>
<td>Key partners</td>
<td>Defence Materiel</td>
</tr>
<tr>
<td></td>
<td>Raytheon Australia</td>
</tr>
<tr>
<td></td>
<td>Royal Australian Navy</td>
</tr>
</tbody>
</table>

Project overview

The Future Submarine project is the largest and most complex defence project ever undertaken in Australia, delivering a new, more potent defence capability to replace the existing Collins class submarine fleet.

The Commonwealth’s commitment to assemble the 12 future submarines in South Australia will provide jobs for thousands of South Australians for decades to come.

The 2013 Defence White Paper (released in May), reinforced the Commonwealth’s commitment to assembling 12 future submarines in Adelaide, and effectively narrowed procurement options to either an evolved Collins submarine or a new design (eliminating an off-the-shelf solution). This approach provides the greatest opportunities for South Australia, and the nation as a whole.

South Australia has successfully captured early opportunities from this project - namely securing the Future Submarine Systems Centre and the Submarine Land Based Test Site for South Australia.

The decisions reaffirm Techport Australia as the uncontested home of the Future Submarine Project, and indeed the centre of naval shipbuilding in Australia. A Defence and Industry Integrated Project Team has been established in Adelaide to work on the new design concept - drawing in expertise from around the world.

Project milestones

- May 2009: Commonwealth commits to building 12 future submarines in South Australia to replace the current Collins fleet
- May 2012: Commonwealth provide $214 million for the next stage of the Future Submarine Project
- September 2012: Commonwealth announces the Future Submarine Systems Centre will be based in Adelaide
- December 2012: Commonwealth announces Future Submarine Land Base Test Site will be based in Adelaide
- May 2013: Commonwealth narrows procurement options

Source: [http://www.techportaustralia.com/about/naval-contracts/future-submarines](http://www.techportaustralia.com/about/naval-contracts/future-submarines)
B.2 Destroyers

B.2.1 Air Warfare Destroyers – Project SEA 4000

Table B3 AWD – SEA 4000 project

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>$8 billion</td>
</tr>
<tr>
<td>Key partners</td>
<td>Air Warfare Destroyer Alliance:</td>
</tr>
<tr>
<td></td>
<td>- Defence Materiel Organisation</td>
</tr>
<tr>
<td></td>
<td>- ASC AWD Shipbuilder Pty Ltd</td>
</tr>
<tr>
<td></td>
<td>- Raytheon Australia Pty Ltd</td>
</tr>
<tr>
<td></td>
<td>Royal Australian Navy</td>
</tr>
<tr>
<td></td>
<td>United States Navy</td>
</tr>
<tr>
<td></td>
<td>Navantia</td>
</tr>
<tr>
<td></td>
<td>Lockheed Martin Corporation</td>
</tr>
<tr>
<td></td>
<td>Government of South Australia</td>
</tr>
</tbody>
</table>

Project overview

The $8 b AWD project is the largest defence contract in Australia and one of the most significant shipbuilding projects in Australia’s history. The AWD Alliance is responsible for delivering three HOBART Class Air Warfare Destroyers to the Royal Australian Navy between 2016 and 2019. The Alliance is working with Navantia as the chosen Platform System Designer, and alongside the United States Navy and Lockheed Martin Corporation to deliver the Aegis Combat System for the ships.

The AWDs will provide air defence against attacking missiles and aircraft. With a range of 5,000+ nautical miles, they protect land forces and infrastructure in near-coastal areas as well as other ships.

The project is progressing, with consolidation of the first destroyer Hobart well advanced. Work has also begun on two thirds of the blocks for the second ship, HMAS Brisbane. The Air Warfare Destroyer project will spend about $2.3 billion in South Australia including work at the ASC shipyard and the AWD Systems Centre, which is the headquarters of the Air Warfare Destroyer Alliance, as well as the many companies involved in supplying steel fabrication items like pipe work and ventilation trunking, combat system equipment and a whole range of services to the project.

There are currently more than 1600 people directly working on the Air Warfare Destroyer project in South Australia.

B.3 Frigates

B.3.1 Canberra Class Landing Helicopter Dock Project

Table B4 Canberra Class LHD Project

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key partners</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Navantia</td>
</tr>
<tr>
<td></td>
<td>BAE Systems</td>
</tr>
<tr>
<td></td>
<td>RAN</td>
</tr>
</tbody>
</table>

Project overview

The Canberra class is a ship class of two Landing Helicopter Dock (LHD) ships being built for the Royal Australian Navy (RAN). Planning to upgrade the navy’s amphibious fleet began in 2000, based on Australian experiences leading the International Force for East Timor peacekeeping operation. In 2004, French company Direction des Constructions Navales (DCN) and Spanish company Navantia were invited to tender proposals, with the companies offering the Mistral class amphibious assault ship and the “Buque de Proyección Estratégica” design (later commissioned as Juan Carlos I) respectively. The Spanish design was selected in 2007, with Navantia responsible for construction of the ships from the keel to the flight deck, and BAE Systems Australia handling the fabrication of the superstructure and fitting out. Construction of the first ship, HMAS Canberra, commenced in late 2008, and the hull was launched in early 2011. Work on the second vessel, HMAS Adelaide, started in early 2010. The ships are expected to enter service between 2014 and 2016. The construction of the first ship, HMAS Canberra, began in late 2008. Her keel was laid in September 2009 and the ship was launched in February 2011.

Project milestones

- The first steel was cut for the second ship, HMAS Adelaide, in February 2010.
- HMAS Adelaide was launched in July 2012.


B.4 Milestones

- April 2005: Raytheon Australia Pty Ltd selected as the Combat System - Systems Engineer
- May 2005: ASC AWD shipbuilder Pty Ltd selected as Shipbuilder
- November 2005: Adelaide selected as the location for the AWD Program headquarters
- June 2007: Navantia-designed F100 selected as basis for Australia’s future Hobart Class AWDs
- August 2007: State Government commenced construction on the Common User Facility at Techport Australia in support of the AWD program
- October 2007: AWD Program enters build phase
- August 2008: Ultra Electronics selected to supply Undersea Warfare Sonar System
- June 2009: FORGACS and BAE Systems Australia Defence signed contracts for the construction of hull blocks
- January 2010: AWD project passed critical design review and entered production phase
- January 2010: Official opening of the ASC Shipyard
- March 2010: Official opening of the Common User Facility at Techport Australia
- April 2010: Construction of the AWD blocks underway in South Australia, Victoria and New South Wales
- April 2010: ITT-EDO Reconnaissance and Surveillance Systems Inc selected as the preferred supplier for the electronic warfare system
- May 2010: Thales Australia Limited selected as the preferred supplier for satellite communications equipment
- December 2010: Official opening of the AWD Systems Centre at Techport
- August 2011: First keel block arrives at the ASC Shipyard
- September 2011: Two more keel blocks delivered to ASC Shipyard
- January 2102: Vertical Launch System for AWDs arrive in Adelaide
- April 2012: First of three state of the art horizon-search radars for the AWDs delivered to Adelaide
- July 2012: $3.25 million contract awarded to MG Engineering for the AWD masts
- January 2013: First block for the second AWD arrived in Adelaide
- April 2013: Twenty-Two metre-high mast for first AWD delivered
- June 2013: Last block for first AWD delivery

Source: [http://www.techportaustralia.com/about/Naval-contracts/air-warfare-destroyers](http://www.techportaustralia.com/about/Naval-contracts/air-warfare-destroyers)
Appendix C

References


ACIL Tasman 2009, ‘The economic impacts of the BUSHRANGER Project: The economic contribution of the BUSHRANGER Protected Mobility Vehicle Project to Australia, Victoria and Bendigo’.


ATSE (Australian Academy of Technological Sciences and Engineering) 2006, ‘Submission to the Senate Inquiry’, ATSE.


IBISWorld, October 2013, ‘Shipbuilding and Repair Services in Australia (C2391)’.


Yule, Peter and Derek Woolner, 2008, ‘Collins Class Submarine Story: Steel, Spies and Spin’.