

To Build or Not To Build

A '30-40% premium', '3 AWDs for the cost of 9', '500 more jobs in SA for future submarine sustainment', snapshots from recent Government media releases – the Government appears to be preparing the political ground for a decision to buy ships and submarine from overseas in lieu of building them in Australia.

I have recently written on the necessity and benefits of building Australia's Future Submarine's in Australia. However, the Minister of Defence's recent endorsement of the RAND Report ¹ on SEA 5000 caused me to review the several studies on warship building in Australia in the search for more appropriate yardsticks and to fill the gaps present in the RAND Report.

The Defence SA's paper on shipbuilding issued in December 2009 ² predates the current controversy and provides a useful discussion and explanation of the subject. I shall draw on it in this discussion.

There is nothing wrong with an alliance contract when properly structured and well led, however the AWD project has been in the news recently for all the wrong reasons – it seems a particularly inappropriate model to guide decision on SEA 5000. The AWD project involves some notable features and follies:

- A build of 3 specially adapted ships (the change of combat system is a major variation from the ships built in Spain), this means the AWD was never a 'build to print' project.
- The use of a MOTS ship's design (the design selected was against the strong and unusually public advice of the Chief of Navy of the day), compromised by the change of combat system resulted in a developmental design that was never optimised for ease of construction in Australia,
- A short production run of 3 ships with little chance to achieve significant productivity improvements.
- The failure to adopt a comprehensive, modern information management system to manage the technical, schedule and cost risks are all too evident; not even the purchase of a full suite of CAD/CAM drawings in lieu, a set of PDF documents.
- This has made the design changes necessary to accommodate the combat system and adapt the design for local production (across the language and significant ship building cultural differences) very time consuming and inefficient.
- The Alliance arrangement set up by DMO and Department of Finance places the DMO on both sides of the contract and diffuses responsibility – why would you be surprised by uncontrolled cost blowouts from such a system?

¹ Key Considerations for Managing Australia's SEA 5000

Future Frigate Program - Keeping Major Naval Ship Acquisitions on Course' prepared by the RAND Corporation (Santa Monica, California); http://www.rand.org/pubs/research_reports/RR767.html

² Naval Shipbuilding – Australia's \$250 billion Nation Building Opportunity, Defence SA Advisory Board, December 2009.

- Selection of a government owned company (ASC) that had never built a surface combatant, via a 'beauty parade', with no fixed price performance obligations.
- Selection of an overseas designer that had no experience of exporting/transferring its design and production technology.
- Failure to include the ship designer in the Alliance.
- Starting from a 'greenfield' shipbuilding site.
- For a bit of spice put two competitive industrial giants (Raytheon and Lockheed Martin) on either side of the contract— a new role for Raytheon; the USN and all other international Aegis installations uses Lockheed Martin in this role.
- No doubt the full impact of this decision is yet to be seen as the combat system fit out proceeds!

What were the DMO, Finance and the Program Manager AWD of the day thinking? No doubt there are many other critical points made in the yet to be released White/Winter Report.

I suggest that the man hours required to construct these ships is heavily distorted by these settings and no guide as to what could be achieved by an Australian workforce building SEA 5000 frigates. Comparing the productivity achieved on the first of class AWD with the 50th ship in the long running DDG 51 program as the RAND Study does, provides a dramatic but irrelevant comparison for the purposes of SEA 5000.

In short, the AWD project is a demonstration of how not to do SEA 5000!

The last Australian frigate program, the Anzac ship project provides a far more appropriate starting point for considering how to undertake SEA 5000. There are some useful studies I would like to draw from.

As the Defence SA Paper observes:

- The acquisition strategy for the ANZAC class frigates involved an open international competition for existing designs to be built in Australia by a predominantly Australian prime contractor.
- A strong basis on an existing design already in operational service was mandated to reduce capability risks and reduce the need for significant non-recurring engineering effort.
- The construction contract was a performance-based, fixed-price contract directly with the Australian prime contractor who then sub-contracted ship design, combat system and propulsion system design/supply and all other equipment procurement.
- The contract ran for 19 years and did allow for variations for certain labour and materials indices.
- This acquisition/contracting strategy successfully delivered the eight frigates for Australia and two for New Zealand with acceptance trials performance of the ships meeting all of the major Defence requirements specified.

- The sizable production program (10 ships) had benefits in amortising non-recurring costs and attracting significant learning curve efficiencies.
- Performance risks were generally well managed with a comprehensive land-based testing regime before installation of equipment in the ships.

The paper goes on to note a number of useful lessons learnt.

In terms of production learning curves, based on advice provided by DMO to the Senate ³ the Anzac Project achieved significant productivity improvements. Starting from ship #4 the program achieved 92% of the productivity achieved in the long running DDG 51 program.

- A good result for what was in effect a start-up shipyard, (Transfield Defence Systems, the builder of Anzac, had to close down the Naval Dockyard, setup a modern construction capability and engage a new workforce).
- The DMO advised that hull costs went from \$192.8M for the first ship to \$144.8M for the 10th ship, (despite the 10th ship including additional capabilities).

Australia's capacity to mobilise a high tech workforce capability is one of the lessons we should draw for SEA 5000 from this example.

The RAND Report is ambivalent about the economic benefits:

“ it is unrealistic to expect that shipbuilders will produce significant favorable spin-offs and spillovers”. ⁴

A Tasman Asia Pacific Study ⁵ into the Anzac Ship project on the other hand, found significant favourable impacts:

- The \$5.6B (1999 dollars) ANZAC Ship contract with it high level of Australian content (72% achieved) generated between \$200-500M in additional GDP per annum.
- Over the 15 year construction phase this means GDP grew by at least \$3B as a result of this project.
- Generating between \$147-300M additional consumption and 7,850 full time equivalent jobs.
- The high levels of Australian industry involvement led to savings in sustainment in the order of \$520M net present value.

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http://www.apf.gov.au/Parliamentary_Business/Committees/Senate/Economics/Naval_shipbuilding/Additional_Documents

⁴ Ibid summary page xxxviii.

⁵ IMPACT OF MAJOR DEFENCE PROJECTS: A CASE STUDY OF THE ANZAC SHIP PROJECT Final report by Denise Ironfield, February 2000, Tasman Asia Pacific Pty Ltd

- A 3.0 - 3.5% premium, ⁶ more than offset by the economic (not to mention the strategic) benefits flowing from the project. The latter are discussed in greater detail below.

On the non economic spin offs this Study observed that the 780 Australian suppliers involved:

- Became more innovative through their own R&D and access to foreign technology.
- Improved business practices.
- Increased export opportunities.
- Acquired new defence capabilities.

The Study was used as one of the inputs to the 2006 Senate review into Australian shipbuilding. ⁷ The comprehensive Senate Report makes interesting reading, not least as it records the ambitions for the AWD Project now laid bare by the snippets we are seeing of the White/Winter Review.

This Senate Report noted the difficulty in calculating the economic benefit of a shipbuilding project on the wider economy and was critical of Defence's failure to consider the long term benefits of local construction in tender evaluations. ⁸ None the less, the Committee was in no doubt as to the overall economic and strategic benefits of local construction:

"... it is in Australia's national interest to maintain a viable naval shipbuilding and repair industry. This requires a commitment by the Government to have Australian naval vessels constructed in Australia." ⁹

Overall the Senate Report recommendations are strongly supportive of Australia's naval shipbuilding and repair industry, include recommendations intended to improve Defence's performance in this area and to provide greater transparency and support for local shipbuilding. Sadly it would seem little has changed for the better in these areas over the past decade.

In December 2013 ACIL-Allen undertook a study to quantify the potential economic value measured in terms of GDP of naval shipbuilding and through life support to Australia. ¹⁰ Of note:

- The study considers value for money; not just the acquisition cost but more broadly as represented by the total life costs versus the capability and options it delivers against the worst-case scenario of a defence contingency.

⁶ Allen Consulting Group, Future of Naval Shipbuilding in Australia: Choices and Strategies, May 2005, p45.

⁷ Blue Water Ships – Consolidating Past Achievements, 7 December 2006.

⁸ Ibid, p 249.

⁹ Ibid, Main Findings para 6 & 7, page xvi.

¹⁰ ACIL-Allen 20131201 Shipbuilding report to AIG, NAVAL SHIPBUILDING & THROUGH LIFE SUPPORT ECONOMIC VALUE TO AUSTRALIA MAINTAINING CAPABILITIES AND CAPACITY. Dec 2013

- Operational data from the five leading naval shipbuilding contractors currently operating in Australia and a range of other sources was considered.
- The benefits generated for Australia's strategic and defence capability from the existence of a viable Australian defence shipbuilding industry were not considered.
- Whilst recognising that 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.

Based on an input-output analysis, the direct and indirect impacts of having naval ship production and through life support carried out in Australia are:

- 15,000 full time employees
- \$1.13 billion of income
- \$2.3 billion of GDP.

These impacts could be considered lower limits given the data used to inform these results came from the five largest prime contractors only. The above impacts relate to the actual naval ship production and through life support activity in the 2012-13 financial year.

The Study concluded that:

- A \$100 million increase in naval shipbuilding would increase GDP by \$73 - 104 million,
- While \$100 million in through life support increases GDP by between \$80 - 136 million.

Of course \$100M spent building ships overseas foregoes the \$73-104M pay back opportunity!

The December 2013 ACIL-Allen Study provides examples of the spillovers (such as technology transfers), the cost of starting up/shutting down a shipbuilding site, additional cost from an overseas supply chain and the advantages flowing from a continuous build strategy.

The financial benefits of building in Australia are reinforced by analysis commissioned by the Economic Development Board of South Australia.¹¹ This analysis found that Australia would be between \$20 and \$30bn better off building submarines in Australia as compared to overseas.

These are all key considerations in the current debate on building submarines and frigates in Australia.

The number of man-hours to build a ship is highly dependent on the design chosen as RAND points out in Table B.10 of its Report, with figures ranging from 1.8M to 7m. Comparing man-hours between ships designs requires great care to ensure you are including all the same components to achieve a like with like comparison. I am

¹¹ Economic Analysis of Australia's future submarine program, Economic Development Board SA, October 2014

assuming we are including all ship yard man-hours to fabricate and deliver the ships working to a selected design and that the designers man-hours are not included.

Selection of a nominal figure of 5.5M man-hours for the first of class and 5M for the remainder raises doubts in my mind that this the US experience is a valid model for the future frigate.

I am not alone, as the Senate Committee heard from Dr Donald Winter, the then US Secretary of Navy during a fact-finding visit to the USA:

“We need a new shipbuilding model that can cost-effectively provide significant increases in capability at low rates of production.”¹²

Dr Winter’s reservations were borne out by a study of major US shipyards:

“the U.S. is yet to embrace fully this modern state-of-the-art shipbuilding technology. It found that, with a few exceptions, the extent of module construction in U.S. yards was 'disappointingly low’.”¹³

Some recent European frigate programs appear to hold more positive lessons. Odense Maritime Technology A/S, the shipbuilder for the three ship 6,650 tonne Iver Huitfeldt class of frigates¹⁴ for the Royal Danish Navy advises that:

- Each ship was constructed for 0.7M man-hours, albeit using a shipyard familiar with the design, which was also optimized for ease of construction.
- The ships employ the Stanflex modular mission payload system enabling the ship to be quickly re-configured to better match the mission.¹⁵
- Based on a Danish Ministry of Defence document, the ships were delivered for a cost of ~ \$343M USD (2014) each.

Of note, the 52 months keel to commissioning time given by RAND Report in table S.5 for the Iver Huitfeldt is misleading; the delivery of the ships was slowed down at the request of the customer.

- The shipbuilder advises that the platform took 21 months to assemble and 9 months to fit out, a total of 30 months.
- On a par with the 32 months for the DDG51 given in the RAND Report.

I wonder how many other examples in the table are similarly affected by similar external factors?

I am advised that the first of class Anzac required less than 2.5M ship yard man-hours to produce and the 10th ship less than 1.7M man-hours.

So the picture emerging from the studies I have cited is of construction premiums, significantly less than 30-40% quoted for the AWD, being offset by the economic

¹² Ibid, p12.

¹³ First Marine International findings for the global shipbuilding industrial base benchmarking study, Part 1: Major shipyards, August 2005, p. 24.

¹⁴ <http://nozebra.ipapercms.dk/valcon/OMT1/DanishFrigateProgram/>

¹⁵ en.wikipedia.org/wiki/Iver_Huitfeldt-class_frigate

boost to GDP, technology spin offs and increased strategic benefits from a local supply chain to increase availability - this is all a rather different picture to that painted by the RAND Report!

I think it is reasonable to conclude that:

- There have been enough studies (some better directed than the recent RAND Report), upon which to base the policy for building Australia's future submarine and the frigates.
- We should be looking to the most efficient ship builders (including European and South Korean) for assistance in setting up and undertaking the SEA 5000 project.

The move to build future submarines and frigates overseas stands to wipe out the hard earned IP, knowledge and skills built up via the Collins, Anzac and dare I say it, AWD projects. Australia currently has significant ship and submarine building and production design skills, a hard earned body of knowledge that we appear ready to junk, with the resultant loss of sovereignty for future builds and sustainment of these maritime capabilities.

I would have to agree with the RAND Report's recommendations for urgent Government action to ameliorate the impact of the 'valley of death'.

Are we seriously considering handing these benefits of skills and funding for future submarines and frigates to overseas builders at the expense of Australian Industry?

Economists may argue over the economic spin off of investing in the order of \$20B to acquire future submarines, say a further \$10B for frigates (spread over the 28-30 year life of the acquisition) and initiate a continuous build program for both (as recommended by RAND for the frigates). To a non-economist, the complete loss of any spin offs from an overseas build is striking.

Investment in Australian skills and industry sounds exactly what the Governor of the Reserve bank had in mind when he recently urged the Government to invest in big projects, create a positive dynamic of confidence and enhance workforce skills, innovation and investment.

From a strategic perspective, looking to the uncertain times ahead there are more fundamental issues at stake for a maritime nation, such as Australia, dependent on the sea for prosperity.

For self reliance, minimizing the cost of ownership and ensuring access to all the information and skills necessary to achieve high availability from modern, capable ships and submarines there are strong benefits if we build the frigates and the submarines in Australia – the Government should direct this as the starting point for both projects.

Peter Briggs is a retired submarine specialist and a past President of the Submarine Institute of Australia. In March 2015 he visited DCNS's submarine design, construction and in service support facilities at their expense. He remains an independent commentator, without commitment to support any of the contenders for the future submarine or frigate programs.