In the next few weeks, the government will make a decision about the future of the SEA 4000 (Air Warfare Destroyer) project. This ASPI Policy Analysis describes the macro-features of the decision for readers who wish to understand the broad issues.

The choice will be between two different designs. To a large degree it will also be between two different perspectives. One vessel appears to provide superior fighting capability now and into the future and the other promises to make for a lower risk project. It is the complementary nature of the merits of the competing designs that makes this decision an interesting litmus test of current government thinking on large defence procurements.

**The strategic rationale**

The 2000 Defence White Paper identified the vulnerability of a fleet without long-range air defence. Royal Australian Navy (RAN) fleet units would be more vulnerable to air attack, less capable of defending forces deployed off shore and less capable of contributing effectively to coalition operations. A decision was made to replace the fleet of guided missile frigates (FFGs) with at least three air-defence capable ships expected to be significantly larger and more capable than the FFGs.

While we will call them ‘Air Warfare Destroyers’ (AWDs) for consistency with everyone else, it is important to note that the proposed ships will actually be large multi-role surface combatants. (Indeed, the smaller competitor is not a destroyer at all. It is correctly termed a multi-purpose frigate.) As well as their principle anti-air role, they will be capable of performing anti-surface and anti-submarine warfare (ASW) roles. For the former they will have long range anti-ship missiles and a naval gun capable of firing extended range munitions. The gun will also be able to provide indirect fire support for land forces. For the ASW role they will carry modern sonar systems, decoys and surface-launched torpedoes.

The AWDs will embark multi-role helicopters that will undertake surveillance and response to support these key warfare areas. The ship design is intended to include hull and superstructure ‘real estate’ to allow for system growth over
the life of the ships, and to allow for the addition of new technologies as they become available. The design range is up to 6,000 nm, allowing these vessels to deploy for extended periods in regional waters, or further afield as part of a coalition operation.

Another role that has been mooted for these ships is as part of a ballistic missile defence system. That would require them to be fitted with the Standard Missile 3 (SM-3) and would give a limited capability against ballistic missiles. While potentially able to deal with theatre-range missiles in the ‘Scud’ class, defending with any certainty against missiles with an inter-continental capability is not possible. As well, an AWD cannot defend more than a radius of a few hundred kilometres. Thus the AWDs would have some ability to defend deployed forces against theatre-range missiles, but could not provide Australia with a national defence system.

The project

Previous decisions have approved in principle (‘first pass’ approval) the acquisition of three ships, the first of which is due to enter service by the end of 2013. In 2005 it was announced that the shipbuilder would be Adelaide-based ASC. Raytheon Australia will be the combat system systems integrator. An alliance consisting of ASC, Raytheon and the Defence Materiel Organisation (DMO) will manage the project.

Two competing designs will be considered when the project comes up for second pass approval by government in the second half of 2007. These are the already in-service Spanish F-100 designed by Navantia, which has been modified to meet Australian requirements, and a design evolved by Gibbs & Cox from the US Arleigh Burke class. Raytheon will integrate the Lockheed Martin Aegis combat system (to be supplied by the US Navy under a Foreign Military Sales arrangement) with other elements, such as sonar and communications equipment and the electronic warfare suite.

The publicly announced budget for the AWD Program is between $4.5 and $6 billion, though industry analysts have given estimates of between $7 billion and $8 billion.

The comparison

The two designs differ in some significant ways. The Gibbs & Cox design is appreciably larger at 8,100 tons compared to 5,800 for the F-100. As a consequence, it has more missile launch cells, a longer range and is built for two helicopters. While the F-100 can be modified to embark an additional helicopter, present examples carry one. As well, the ‘future proofing’ of the larger hull is probably superior. Of course, all of that comes at a cost.

The F-100 is reported to have a clear price advantage, as well as the benefit in risk management that comes with a design that is already in service. As well, it could be delivered into service faster, providing the RAN with a capability earlier. Conversely, the Gibbs & Cox design offers potential advantages in terms of Australian industry due to the fact that more work, including design activity, could be done here. That is why the Australian Industry & Defence Network has thrown its weight behind Gibbs and Cox.
The question is whether the additional capability of the Gibbs & Cox design outweighs the additional risk and cost. As ever it is hard to quantify the cost/benefit trade-off. One industry insider has been quoted as saying – ‘if we get to the point where we need 64 missile tubes then we will be fighting World War III’. However, that is not necessarily the case. An extended deployment in a zone of hostilities could see a ship run its magazine down, especially if it carries a range of missiles for different tasks, such as ballistic missile defence or land attack. With sea-skimming supersonic missiles fired from aircraft or submarines being deployed more widely, an extended missile load-out is likely to be important for mission effectiveness.

Finally, it is entirely possible that Australia’s future strike capability will include land attack cruise missiles. The Gibbs & Cox design would more easily accommodate such missiles. For all of these reasons, it is not hard to see why Navy would prefer the larger competitor.

On the other hand, those who have to deliver a project on time and on budget will understandably take the view that the risk profile of the project should be a significant consideration. As well, the earlier delivery of the Navantia design means that the Navy would improve the capability of its surface fleet sooner and for less cost. And, not unreasonably, the DMO would argue that a lower-risk option that meets all of the specified requirements is the sensible choice.

The table below summarises the comparison between the competitors.

**Table.** Relative advantages of the competing AWD designs.

<table>
<thead>
<tr>
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<th>Gibbs &amp; Cox</th>
<th>Navantia</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Capability</td>
<td>√</td>
<td></td>
<td>The Gibbs &amp; Cox design accommodates 16 more missile tubes, is designed for two helicopters and has more hull ‘real estate’, allowing more easily for future system upgrades.</td>
</tr>
<tr>
<td>Price</td>
<td></td>
<td>√</td>
<td>While the advantage to Navantia on cost is unconfirmed in public documents, industry sources suggest a differential of around half a billion dollars.</td>
</tr>
<tr>
<td>Design certainty</td>
<td></td>
<td>√</td>
<td>A clear advantage to the established Spanish design.</td>
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<tr>
<td>Project risk</td>
<td></td>
<td>√</td>
<td>A corollary of the previous point. Greater certainty of the design translates into a lower project risk profile.</td>
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<tr>
<td>Delivery timeframe</td>
<td></td>
<td></td>
<td>The Navy could have an AWD capability at sea earlier with this design due to reductions in the design and planning times required.</td>
</tr>
<tr>
<td>Australian Industry opportunity</td>
<td></td>
<td>√</td>
<td>The as yet unbuilt nature of the Gibbs &amp; Cox competitor means that there are, at least, additional opportunities for design and work prior to construction commencing.</td>
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Risks

Some of the technical risks that would normally face a project such as this have been mitigated by the selection of proven systems and designers. However, the construction of a major warship is a complex task, and cost, schedule and capability issues will undoubtedly arise at various stages of the project. However, Australia’s record in shipbuilding projects is actually very good, as historical data shows.

Major defence projects rarely run according to plan. While not (quite) an immutable law of nature, cost and schedule overruns are common. US defence writer Norman Augustine analysed data on US procurement programs and discovered that, on average, projects take one-third as much time again as the original plan. To see how Australia’s projects fare, the graph below shows the actual time for Defence to achieve a capability, plotted against the originally planned time.


Apart from the predictable reaffirmation of Augustine’s Law within this data set, it is worth noticing where the shipbuilding projects sit. The Armidale Class Patrol Boats were exactly to plan, though they have suffered some fuel system problems after being taken into service. The Anzac frigates and Collins class
submarine are much closer to parity than many other projects. The worst performing shipbuilding project is the Huon Class Minehunters and, with a three year slippage, they were still better than average.

Even with all of the caveats that should be applied to a small data set, the precedents in this figure provide some cause for optimism. The Anzac and Collins projects, while being based at least in part on existing designs (the German MEKO frigate and Kockums submarine designs respectively), both involved substantial design and integration work. Both projects ultimately delivered very capable platforms. After some well-publicised noise and vibration issues were sorted out, the biggest problem with the Collins was the combat system (only recently rectified).

The *Aegis* system to be fitted to the AWD is well-established, thus avoiding the single largest risk. However, there are many other sub-systems to be integrated, so there is potential for problems—and hence slippages—to arise. A possible yardstick is provided by foreign projects. As well as the US, four other countries have built AWDs with the *Aegis* system. There are examples that mirror both choices for the Australian ships. Japan and South Korea have built ships of over 7,000 tons displacement based on the *Arleigh Burke* class. Navantia built the F-100 class for Spain. Norway then partnered with Navantia to build 5,000 ton ships. All of these projects have delivered successful outcomes in terms of schedule and designed capability.

**What price an AWD?**

Building AWDs in Australia rather than buying them from overseas comes at a cost premium. That is because we are building only three ships and therefore cannot achieve the economies of scale required to drive costs down. If we could buy the ships and submarines we wanted ‘off the shelf’ from overseas builders, we would generally pay less.

Of course, there are also benefits that accrue from building ships in Australia. It is not just a naive question of ‘dollars for Australian jobs’. (And, while that may seem attractive in an election year, just where the skilled labour will come from in the existing economic conditions remains to be seen.) More importantly, building ships and submarines here also generates expertise and the industrial base for supporting those vessels and their systems throughout their lives. As well as providing ongoing economic benefits for Australian industry, we also achieve a measure of self-reliance—though needing to source all the ordnance required for combat effectiveness from overseas limits the validity of that argument.

As a previous ASPI paper *Setting a Course for Australia’s Naval Shipbuilding and Repair Industry* argued, it makes sense to build warships in Australia if the premium is not too high, because there are economic benefits and some advantages in developing the skills for repair and maintenance. The question is—how big is the premium, and where is the break even point?
We can look at a couple of overseas programs to get a feel for the going cost of an AWD. South Korea has just launched the first of three 7,600 ton Aegis equipped destroyers. Costs are cited as being around $1.25 billion per unit. Looking at the larger US-built Arleigh Burke class (9200 tons full-load for late build ships), the costs are a little under $1.5 billion per unit. The per-ton comparison of the US and Korean ships shows that their production costs are remarkably similar, at around $160,000 per ton. (All costs are in 2007 Australian dollars.)

Let us be charitable. If we assume that the Australian AWDs can be brought in at the upper DCP figure of $6 billion, then that means a unit cost of $2 billion, or superficially a premium of 33% for Australian construction. The per-ton costs are even further elevated, at over $250,000 per ton. A little care is required here. Steel and air are cheap, while spaces packed with sophisticated equipment are expensive, so it is not strictly an apples versus apples comparison. However, the cost still appears to be significantly higher than overseas examples.

If, as is widely-rumoured, the price comes in somewhat higher, the premiums estimated above will rise accordingly. Ultimately it is a matter for judgement as to what premium is acceptable. However, it is always best to at least understand what we are actually paying for the industry and self-sufficiency benefits so that the opportunity costs can be appreciated.

Conclusions

At the time of writing, media reports suggest that the Navantia F-100 has been selected within Defence as the preferred option. Reportedly, Navy would prefer the larger Gibbs & Cox design.

We have seen in a number of recent decisions that the government is quite capable of making up its own mind despite advice from Defence. In this case, it will provide an interesting read-out of current thinking on large Defence procurements. If the government endorses the rumoured Navantia choice, it will be opting for the greater certainty and lower project risk profile that comes with an established design. The trade-off will be a capability that is lower now and that, perhaps more importantly, has less growth room in future. As well, there will be a reduced opportunity for Australian industry participation—perhaps less critical now than in times of lower employment.

We are not privy to all of the information that decision makers will have in front of them when considering this project. On the basis of arguments that have been made public, it appears to be a case of weighing risk against capability. It is unlikely to be that simple. If the Navantia option did not meet the specified requirements, it would almost certainly be rejected within Defence. On the other hand, it is unlikely that all of the project risk sits with the Gibbs & Cox design. Some rework of the F-100 to meet Australian requirements is almost bound to be required—the fitting out with another helicopter comes to mind.
The case for the Gibbs and Cox design looks strong, but the government will have much information that is not publicly available. The issues they will undoubtedly want to concentrate on when deliberating are:

- (If, as is rumoured, Navy prefers the Gibbs & Cox design.) What extra capability do Navy see it providing, and in what combat situations could that capability prove decisive?
- The degree of risk in each option—both in terms of capability and project delivery.
- The quantitative results of modelling of the number of missiles of various types required for credible contingencies.
- The future growth margins of both vessels, especially if land attack missiles and/or ballistic missile defences are to be seriously considered.

About the Author

Dr Andrew Davies is ASPI’s Operations and Capability Program Director.

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