The Hon Tony Abbott MP
Prime Minister
PO Box 6022
House of Representatives
Parliament House
CANBERRA ACT 2600

Dear Prime Minister,

The South Australian Government is pleased that the Commonwealth is advanced in development of a new Defence White Paper to guide the future of Australia’s long term Defence capabilities. South Australia is also encouraged by the importance placed by your government on maintaining a globally competitive and sustainable defence industry – the critical fourth arm of Defence and a strategic enabler of the wealth and security of Australia. Returning Defence spending to two percent of GDP will provide industry with greater certainty and a clear future direction.

As you know, the Government of South Australia is a strong advocate for the growth of Defence and sustainable defence industries within this State and has backed this commitment with significant tangible support to the Commonwealth and our local industry.

The attached submission outlines the key issues that we believe should be addressed in the Defence White Paper 2015, to ensure that Australia’s defence industry is able to sustainably deliver on Defence’s operational requirements and to deliver improved self-reliance in military capabilities. Our submission is based on wide consultations with the State’s defence industry including a formal summit with over 100 community, industry and government leaders, and developed in close collaboration with the Defence SA Advisory Board.

Of particular interest to South Australia are plans for the future of naval shipbuilding and sustainment, including the SEA 1000 Future Submarines and SEA 5000 Future Frigate programs. It is our view that both programs should be built and sustained in Australia.

Our Government also urges the Commonwealth to optimize local industry participation in the build and sustainment of Army Combat Vehicles under the Land 400 program.
The success of the Defence White Paper 2015 and Defence Industry Policy Statement is reliant on the Commonwealth's ability to establish clear and dependable guidance and flow-on implementation for contested local industry involvement in upcoming major projects.

In the first instance, I seek your commitment to ensure this becomes a reality in all future acquisitions in the interests of our defence capability and the economic well-being of our people.

Yours sincerely

[Signature]

Jay Weatherill
PREMIER

17/10/14
Without a Defence Industry Capability Australia has no Defence Capability

October 2014
Key Recommendations

1. Recognise the critical partnership with states and territories in delivery of Defence objectives through training and skills infrastructure and industry programs.

2. Acknowledge that industry is the critical fourth arm of Defence.

3. Ensure that priority local industry capabilities for Defence’s strategic self-reliance are clearly defined, promulgated and genuinely supported.

4. Provide workflow continuity as a key strategy to reduce costs and increase innovation, productivity, global competitiveness and military capabilities.

5. Provide consistent strategy, policy and investment surety including a continuous build approach to underpin development of a robust indigenous naval shipbuilding and sustainment capability in Australia by committing to build surface ships and submarines in Australia over the next 30 years.

6. Make use of Australia’s extensive military and commercial automotive experience when defining local industry involvement plans to build Land 400 vehicles.

7. Apply a whole-of-lifecycle approach to procurement planning and management and involve industry in early capability discussions to ensure a more realistic assessment of what is achievable.

8. Establish a dependable and transparent ten year horizon to allow industry and State Governments to plan their forward investments with confidence.

9. Accept that local industry involvement in major defence supply chains is critical to capability development and other innovation gains.

10. Focus long term skills development in partnership with industry and the states and territories to lock in self-reliance.

11. Cluster geographic centres and enhance self-reliance and whole of life support by consolidating specialist workforces and infrastructure in one location.

12. Ensure that an advanced, whole-of-process defence technology agenda moves R&D up the technology readiness scale to fielded capabilities and products.

13. Mandate ‘made and supported’ in Australia solutions alongside international offerings, and adopt an early whole-of-lifecycle approach, to provide a thorough evidence-based comparative evaluation of any potential premium to source products locally.

14. Calculate the important contribution that the defence industry and defence projects make to the economy when making acquisition and sustainment decisions.
Introduction

Defence policy and capability decisions are rightly matters for the Commonwealth Government but State Governments play a key role in supporting the Commonwealth Government’s strategic defence policy, particularly in the areas of local industry participation, supporting infrastructure and skills development. In this regard, like other states, the Government of South Australia is heavily invested and committed to supporting the Commonwealth deliver its ambitious defence program.

The Commonwealth – South Australian defence partnership has successfully delivered significant Defence and industry infrastructure in South Australia in recent years, notably Techport Australia and the expanded Cultana Training Area. Together, we have brokered a win-win outcome for sensible co-existence within the Woomera Prohibited Area and successfully consolidated 1st Brigade (Adelaide) at RAAF Base Edinburgh.

The State continues to reserve strategic land adjacent the Techport Australia Common User Facility to support future naval shipbuilding programs, under a memorandum with the Commonwealth. Our undertaking to contribute to the establishment of a Submarine Land Base Test Site remains firmly in place. And of course, as the second largest investor in the Air Warfare Destroyer project, South Australia is strongly committed to supporting the Commonwealth and AWD Alliance in successful delivery of the AWDs to the Royal Australian Navy.

More recently, the Government of South Australia has made a high level commitment to provision of infrastructure support for Defence and industry with respect to Land 400. South Australia welcomes the opportunity to discuss potential co-investment with the Commonwealth to establish a world-class Land Combat Systems Precinct in South Australia, modelled on our successful Techport Australia partnership.

South Australia makes a major contribution to the national defence effort. Defence is a critical sector for South Australia’s economic prosperity and currently employs 27 000 workers (direct and indirect) and contributes around $2 billion to our economy annually.

We have a clear direction for the future – driving sustainable defence industry growth and attracting additional Defence activity to South Australia. In support of these strategies, the Government of South Australia will continue to collaboratively partner with the Commonwealth, industry, other states, the education, training, research and development sectors to meet Defence’s current and future requirements.

The forward challenges are significant. The partnership between governments and industry needs to be stronger than ever given Australia’s increasingly dynamic national security and defence environment and fiscal constraints. We need to work together and we need to work smarter in a true Team Australia approach, to best support the Australian Defence Force (ADF) to defend Australia’s national interests.
Defence Industry

A fundamental enabler to military operations and preparedness

South Australia welcomes the Commonwealth’s recognition of the importance of a globally competitive and sustainable Australian defence industry – the critical fourth arm of Defence and a strategic enabler of the wealth and security of Australia. A vibrant defence industry is vital to Australia’s self-reliance. In addition it creates highly skilled jobs, generates investment, fosters innovation and new technologies and makes a major contribution to Australia’s economic development and growth. Local industry is required to maintain equipment – involving parts, skills and design knowledge. The scale of some defence projects can elicit significant national pride and generate valuable economic benefit across the country, provided that a strategic whole-of-Australia view is adopted.

This is not to say that industry policy is or should be paramount in Defence acquisition and sustainment decision-making – South Australia readily accepts that Defence policy and capability considerations are fundamental and primary considerations. However, these things need not be mutually exclusive.

Australia’s defence industry is a fundamental enabler of military operations and preparedness. Yet it sits at a crossroad.

Consistent long term work is needed from the single customer, the Commonwealth, to ensure the industry’s ongoing competitiveness and sustainability in the face of increasing costs and complexity. Industry has long lacked clear guidance from Defence on exactly what capabilities will be procured, upgraded and exported from within country and is subject to unsustainable demands to deliver effective competition with separate sets of infrastructure and skills.

Years of reduced Defence spending, coupled with Defence’s traditional stop-start work programming, have been a challenge for an industry that is seeking to maintain effective use of capability and capacity in readiness for upcoming major projects.

The development of the Defence White Paper 2015 and subsequent Defence Industry Policy Statement is an opportunity to provide robust industry direction and to provide a clear, funded commitment to sustain the Australian industrial capability that supports, enhances and advances the ADF.

South Australia has long advocated for the fundamental reforms set out in this submission to enable Australian defence industry to sustainably deliver on Defence’s operational requirements.

The development of an updated Defence Industry Policy Statement was announced concurrently with the commissioning of the Defence White Paper 2015. The Government of South Australia would welcome the opportunity to assist this process. Similarly to the DWP Expert Panel, the Government of South Australia recommends the mandate of the expert team established to support development of the new Defence Industry Policy Statement be extended to secure meaningful industry involvement in the statement’s direction and proposed initiatives. This panel could also usefully assist in the validation of cost and schedule estimates.

Recommendation 2

Acknowledge that industry is the critical fourth arm of Defence.
Key industry capabilities

General

Priority and Strategic Industry Capabilities have caused much confusion within Australian industry.

Outlining clear integrated government plans to sustain priority local industry capabilities (including designated geographic centres of expertise, early guidance on sustainment requirements and alignment of cross-government procurement scheduling for similar capabilities) will provide the certainty and continuity of work needed by industry.

This clear direction will in turn allow companies and State Governments to make confident decisions on skills, R&D and infrastructure investments that will enhance ADF capability.

Shipbuilding

South Australia supports Commonwealth efforts towards smoothing the long-term cyclical demand for naval warships and providing a more predictable future for Navy and industry. This more stable future can only be achieved if the design, manufacturing, support and integration capacity within the industry is matched to that pattern of demand.

Australia needs a new shipbuilding model that can cost-effectively provide significant increases in capability and productivity at low rates of production. The UK model is worthy of consideration, providing mutual benefit to government and industry via a more collaborative approach to shipbuilding in a small domestic market.

Working in collaboration with the Commonwealth and module build and repair contractors in Victoria, Western Australia and NSW, specialised entities could be created to build surface ships and submarines at Techport Australia, providing shipbuilding infrastructure and a skilled workforce to effectively deliver and sustain naval capability at an affordable price to a predictable schedule. Commonwealth and State-owned capabilities could be sold into two newly established entities, one for surface combatants and the other for submarines, making a commercial return on the ongoing development, maintenance and operation of the precinct. In this scenario Government-owned waterfront facilities should be retained in government ownership and leased to these entities, to ensure control in the event of corporate non-performance.

The existing skilled workforce could be transferred into entities that would manage the workforce holistically to ensure that skills and experience are available when needed. Our Government is willing to partner with the Commonwealth, industry and universities and training organisations to ensure long-term shared commitment to skills and capability development including collaboration to create a centre of excellence in Naval Architecture and Combat Systems.

Coupled with a Commonwealth Government commitment to a continuous rolling build program, there would be sufficient work for both entities to

Recommendation 3
Ensure that priority local industry capabilities for Defence’s strategic self-reliance are clearly defined, promulgated and genuinely supported.

Recommendation 4
Provide workflow continuity as a key strategy to reduce costs and increase innovation, productivity, global competitiveness and military capabilities.

Recommendation 5
Provide consistent strategy, policy and investment surety including a continuous build approach to underpin development of a robust indigenous naval shipbuilding and sustainment capability in Australia by committing to build surface ships and submarines in Australia over the next 30 years.
maintain a sustainable and efficient capability with opportunities for continuous improvement. This would create the circumstances for competitive tension between the two entities as appropriate and potentially step-in by one entity if there is non-performance by the other entity over time.

For complex projects, an alliance (established through a selective competitive project definition studies process) can produce and develop a design and associated other requirements to a level of certainty suitable for an open competitive tender to prime contractors.

**Intelligence, Surveillance, Reconnaissance & Electronic Warfare (ISREW) and other technologies**

South Australia is home to the country’s most experienced ISREW capabilities – including the home base for the AP-3C Orions, unique electromagnetic environment in Woomera and related DSTO activity. Over 30 percent of the State’s specialist defence workforce is in electronics. This experience places the State and country well to support incoming unmanned aerial systems, and their sophisticated on-ground support requirements – a rapidly growing field of technology with military and commercial applications. Other important and future technologies include: laser airborne depth sounder technology, cyber and data analysis from ISR analytics, autonomous software and networking technologies.

A more incremental approach to the adoption of new technology could involve the Minors program, combined with DMO Project Managers to cultivate locally developed systems.

The State Government has long supported greater connectivity between research institutions and industry, particularly small to medium enterprises, to foster commercialisation of scientific research. This support has included development of a Secure Electronic Common User Facility and more recently, the Data to Decisions Cooperative Research Centre. These facilities underline the State’s commitment to enhance Australia’s ability to manage high volume surveillance data.

Greater emphasis could also be placed on overseas contenders to work collaboratively with Australian industry to enhance platforms/technology with locally developed solutions. This applies particularly to combat systems – in the past the US has made it difficult to access related data, hampering testing of indigenous enhancements. Local companies that are embracing emerging technologies should be supported.

**Military vehicles**

South Australia is working with local and global defence industry to secure the future Land Combat Vehicle Systems project, which is destined to be the Army’s largest and most complex project. Land 400 affords the opportunity to capitalise on the country’s extensive military vehicle industry experience and to utilise skills built up in Australia’s general automotive industry. The State Government is supporting automotive workers acquire new skills to make the transition to defence industry. South Australia is also prepared to invest in common user infrastructure to support successful delivery and maintenance of the next generation Army vehicles.

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**Recommendation 6**

Make use of Australia’s extensive military and commercial automotive experience when defining local industry involvement plans to build Land 400 vehicles.
Industry and State Governments need a well-structured, routinely implemented policy that defines the capabilities that Defence will need in Australia to build, support, repair and upgrade these vehicles in the future, especially in combat.

Land 400 should be executed in a way which provides the right capability for Army while creating industry infrastructure to sustain and upgrade the entire fleet in Australia.

**Developing an internationally competitive industry**

**Whole-of-lifecycle approach**

A whole-of-lifecycle approach is required when acquisitions are made to take into full account the long-term implications of procurement decisions, and thorough understanding and transparency of risk, costs and scheduling.

The value chain from acquisition to maintenance through to disposal must be fully understood and balanced to maximise the efficiency and effectiveness of defence spending, the skills base and key areas of self-reliance.

A whole-of-lifecycle approach to procurement planning and management will provide industry with a better understanding of the long-term through-life-support requirements of Defence’s platform and systems purchases and also ensure value for money for the Australian taxpayer.

The combined effects of outsourcing and organisational evolution mean that Defence does not have all of the knowledge or expertise that it needs to make informed decisions about its capability and ongoing support requirements.

To deliver a thorough understanding and transparency of risk, costs and scheduling, a high level commitment by Defence to better integrate industry into initial capability discussions and throughout the capability definition and acquisition phases will result in a more realistic assessment of what is achievable.

**Workflow continuity**

The ability of Australia’s defence industry to efficiently and sustainably deliver military capability is inherently dependent on workflow continuity. Improvements to defence procurement processes and scheduling are critical to ensure workflow continuity for local industry, as is a strengthened Commonwealth commitment to defence exporting.

Developing long-term workflow plans will significantly assist to maintain an efficient and effective industry and the skills base necessary to support capabilities requiring high degrees of self-reliance.

Project life cycles across military capabilities must be managed, consolidated and scheduled to provide relatively consistent workflow in what is essentially a finite and limited market in Australia. Defence should also involve industry in developing workflow plans that satisfy capability, capacity and industry planning requirements.
Defence acquisition cannot continue to be implemented on a project-by-project basis as this has led to a costly stop-start cycle which stifles innovation, productivity and global competitiveness.

The significant and unfortunate consequences of this now historic approach are clearly evident today in Australia’s naval shipbuilding sector, which is at risk of losing much if not all of the specialist skills and experience built up over the past few years of the AWD, LHD, ANZAC, Minehunter and FFG projects. Job losses are already occurring across Australia’s shipyards.

The massive $250 billion investment required over the next 30 years to build and sustain Navy’s future fleet provides a unique and nation building opportunity for Australia to develop a strategic and enduring naval shipbuilding capability. Indeed it is essential if as much of this work as possible is to be undertaken in Australia.

Commonwealth strategy, policy and investment surety (and continuous build approach) will underpin development of a robust indigenous naval shipbuilding capability in Australia, to build and sustain Navy’s future fleet. Workflow continuity will drive innovation, productivity, efficiencies and improved capability.

**Dependable Defence plans**

The Government of South Australia supports the intent to issue a ten-year Defence Capability Plan that gives effect to Defence White Paper 2015. Dependability and transparency of these time horizons will allow industry and State Governments to plan their forward investments with confidence. The Government of South Australia’s $300 million investment in Techport Australia involved ten years of planning and development to bring to fruition. Provided classified and commercially-sensitive information is duly protected, underpinning estimates should also be made public to build confidence in the reality of the plans.

**Supply chain development**

Global competitiveness and innovation are important for company resilience and critical to retain the ADF’s strategic edge. Defence companies seeking to enter global defence markets, including supply chains, are reliant on the backing of the Commonwealth Government, including for products that are not in service with the ADF.

Australia’s purchases of major platforms from overseas should also be further leveraged to open doors for local companies seeking to enter those markets. Conversely, ADF testing and use of local products is critical to local company success overseas.

Australia’s defence industry is not homogenous and demonstrates structural imbalance, with most of Defence’s procurement and sustainment in-country spend flowing to a small number of largely foreign owned primes. In addition, the implementation of bilateral agreements to increase interoperability have in the past unintentionally blocked local novel developments. For example the Deutch-Ayers agreement for submarine technology developments could be better reinterpreted to accomodate local industry.

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**Recommendation 8**

Establish a dependable and transparent ten year horizon to allow industry and State Governments to plan their forward investments with confidence.

**Recommendation 9**

Accept that local industry involvement in major defence supply chains is critical to capability development and other innovation gains.
Growing the capability of medium-sized firms and retaining SME interest in defence is critical to capability development and other innovation gains, as well as security of subcomponent supply. This could be achieved through greater emphasis on local supply chain development.

**Industry Participation Policy**

In 2013, the Government of South Australia commissioned Deloitte Access Economics to prepare a report to quantify the economic contribution made through State Government procurement. The findings of the report formed the basis for wide ranging changes to the State’s Industry Participation Policy.

Advanced procurement requires open and competitive tendering and fosters collaborative contracts arrangements, strengthened procurement and tendering capability and improved demand management. There is a significant body of evidence from overseas that demonstrates the use of industry participation policies for defence and other complex projects drives successful commercialisation of innovative solutions into other sectors of their economies, in turn increasing long-run domestic growth and increasing firm competitiveness.

**Geographic centres of expertise**

Consolidation of resources in one geographic location reduces major overhead costs and increases efficiency by allowing multiple usages of common infrastructure and skill sets. Where self-reliance, whole-of-lifecycle support and value for money are critical requirements, geographic centres of expertise should be considered, including complex naval shipbuilding and sustainment at Techport Australia.

A strategic geographic approach provides further confidence to industry and State Governments to make long-term investments in skills and infrastructure and allows long-term planning cycles involving skills development, construction and community understanding.

Consolidation of expert skills and infrastructure also supports competition as it provides the opportunity for skilled workers to move from prime to prime, subcontractor to subcontractor and project to project in the one location as the market demands. The likelihood of ongoing challenging work will further enhance specialist skills retention.

Geographic centres of expertise provide a competitive solution for continuity of work for specialist contractors and suppliers in multiple or contiguous programs. Consolidation of skills in a geographic area also engenders a sense of ownership and support for programs and their people within the wider community, all of which enhances the social and financial value for money proposition.

It is in the national interest to foster existing clusters of capability rather than create duplication. This is vital as it allows the building of critical mass, including in technologies which allow Australian firms to compete globally in niche markets while meeting Defence’s needs.

Complex defence projects can draw on skills and infrastructure across multiple geographic centres of expertise. Complex surface ship construction centred at
Techport Australia, with module production occurring around the country, would allow the shipbuilder(s) to concentrate on the high-end value of bringing various building blocks together. Modern modular construction techniques allow for the distribution of work across the country, either subcontracted to other shipyards or steel fabricators.

The collocation benefits available through a geographic centre of expertise underpins South Australia’s proposal to partner with the Commonwealth to establish a world-class Land Combat Systems Precinct in South Australia, modelled on our successful Techport Australia partnership. The precinct would support collocation and integration of the industrial and Defence elements of the Land Combat Systems capabilities throughout the life of the vehicles and its systems. The concept was launched at the recent Land Forces 2014 event, to strong Defence and industry interest.

Design and skills development

Australia has not cogently embraced intellectual infrastructure in its universities and vocational education systems during earlier defence acquisition projects.

Given the specialist nature of the work in this industry, the Defence White Paper must reflect skills development as a priority issue. Concrete initiatives also need to be reflected within the Defence Industry Policy Statement.

Addressing the skill needs of the future requires a long-term commitment to policy intervention across the education spectrum, from primary to doctoral level, to increase capability and capacity. Defence has established a number of programs to support industry skills initiatives. Further long-term investment in these successful programs, including the Advanced Technology Industry School Pathways Program and Skilling Australia’s Defence Industry, is essential.

A more focused effort is required to develop and maintain a pipeline of trained trades and professionals to suit the specific medium and longer-term needs of Defence and industry. This will require an even closer partnership with State Governments on curriculum, teacher training, careers promotion and interaction with defence industry. Promotion of science and maths at primary and secondary education levels is critical to the future of a number of key industries in Australia, particularly defence, resources and construction. This also suggests the need for training and careers promotion on a regional basis to support localised centres of expertise.

The State Government has strongly supported the development of defence industry skills in South Australia. Through the Defence Teaming Centre, a specific Defence Industry Workforce Strategy is in place for South Australia. The State Government is also investing $0.370 million to assist The Heights School to become a Defence High School, following recent successful establishment of Le Fevre High School as a Maritime High School.

The defence industry has also been a priority sector under the State’s Skills for All industry programs, with a total of $0.970 million of funding allocated to local defence firms under the 2013–14 funding round. This is in addition to the workforce development commitments valued at around $20 million being...
delivered to support the Air Warfare Destroyer project requirements, including an on-site Maritime Skills Centre at Techport Australia.

The State’s universities have also been proactive in working with Defence and related industry to establish graduate and research programs in much needed maritime, systems integration and software engineering.

Advanced defence technology agenda

Past Defence White Papers have recognised that technology is changing military doctrine. The 2015 iteration should comprehensively commit Australia to advancing the defence technology agenda. Opportunities to access parent company technology and Australia’s involvement in international development programs are not being leveraged to the full benefit of Australia’s industrial base. Defence needs to drive and facilitate greater transparency and easier access to these opportunities for local industry.

Defence should also define a clear set of critical technologies in which it will readily support further development to deliver on its own operational requirements and to increase interoperability with key allies.

Significant intellectual capital resides in South Australia, as a result of the Defence Science and Technology Organisation and additional academic research conducted in our local universities. South Australia strongly supports this important work; however, it is not resulting in enough commercialised products and services.

A further Defence commitment, including a more integrated whole-of-process funding approach beyond the Capability Technology Development program, to move research and development up the technology readiness scale and which provides greater certainty of end use of capabilities or products is required. The Rapid Prototyping, Development and Evaluation program should also be reviewed to ensure a continued focus on filling technology gaps. Innovation investment programs should fund multiple contenders for a given research area to provide competitive tension and encourage new development, with IP ownership in the early stages remaining with the developer and government having non-exclusive rights to use.

This also means that Defence needs to ensure that its future technology requirements are fully aligned and built into the national innovation and relevant industry agendas. In this extended period of fiscal constraint, Australia needs more significant outcomes from its defence research investments and must build new and enduring defence capabilities within the university sector.

Defence Economics

Evidence-based comparatives

South Australia accepts that domestic supply of Australia’s military capability cannot come at any cost, but the full flow-on economic benefits of defence spending within Australia including tax and other revenues back to
Commonwealth and State Governments must form part of the business case for every acquisition.

Clear Australian industry content policy is required to ensure that the Commonwealth can undertake a thorough evidence-based comparative evaluation of any potential premium to source products locally. This must include mandated ‘manufactured and supported in Australia’ in addition to ‘best value’ proposals for all tenders, particularly those where an international off-the-shelf solution is sought.

Where there is no express national security requirement for a local industry capability, there should still be a preference for local content. This does not necessarily mean a price premium, but any competitive analysis should make a thorough evaluation of all the factors involved, including through life costs.

Where phased capability is required, the tender should include (where practicable) fixed price offers for subsequent requirements. Whole-of-lifecycle considerations must be factored in at acquisition, including via concurrent tender of through-life-support requirements where possible. Understanding through life maintenance, training, spare parts, upgrades and other support costs is essential to making the right financial choice in equipment acquisition. Given the exponentially higher cost of in-service support, it is critical to understand early the total costs of ownership in order to avoid serious budget spikes when equipment and systems enter service.

Application of these rules of engagement at the imminent first pass for Land 400 would encourage – indeed commercially drive – overseas bidders to give full and early consideration to local production and sustainment. Importantly, it would allow the Commonwealth to make an informed purchase decision, including whether it is prepared to pay a premium for domestic supply – if indeed there is a premium when whole-of-lifecycle costs are taken into account, together with defence, national security, operational advantages and spillover value to other sectors of the economy.

Experience from the ANZAC Frigates Project demonstrates that if the overseas designer/builder is required to engineer the project for Australian build and sustainment from the very start of the tendering/procurement process, at least to provide a competitive comparison to overseas supply, the costs of Australian procurement, construction and sustainment can be dramatically reduced. Arguably, the ANZAC Frigates were built at no greater cost in Australia, with around 80 percent local content and with significantly lower whole-of-lifecycle costs as a result.

A straightforward low cost way to validate cost and schedule estimates is to, while maintaining genuinely confidential information, consult broadly and transparently with the industry that will ultimately deliver the equipment. The results will be rough order of magnitude estimates against high-level descriptions of the capability requirements.

**Economic Imperative**

The Australian economy is at a cross road, and the situation is particularly critical in South Australia. There is structural change underway in the resources and manufacturing sector, and the recent growth in the household sector will not underpin a long-term dynamic economy. Defence projects,
delivered in country at a competitive price create economic complexity and will provide long and stable activity in advanced manufacturing and engineering, a stated policy goal of all Australian governments. Procurement from local suppliers would also maximise the extent of local labour and capital, and therefore result in greater economic benefit to immediate regions and the nation.

The South Australian Economic Development Board recently commissioned analysis from the National Institute of Economic and Industry Research to assess the economic impact of the Future Submarine program on the Australian economy. The research found that there would be no difference in the price for the submarines regardless of build location. Further, depending upon currency fluctuations, Australian GDP will lose out by $20 billion or more if the next generation of submarines is built overseas. A copy of the report is attached as Enclosure 1.

Conclusion

The ADF is a highly sophisticated and advanced military with a critically important role to play in defending Australia’s national and regional security interests and in supporting global security. Local defence industry capability is essential to support independent Australian military operations – it is indeed the critical fourth arm of Defence.

Defence industry policy has historically been produced as an adjunct to core policies about strategic threats and military response options, without serious industry consultation. Good policy is important to provide State Governments and industry with clear and certain direction to invest reliably in infrastructure to support workforce and industry development. It is the State’s view that without a healthy and viable defence industry a country lacks a healthy and viable defence capability.

The timing of the Defence White Paper 2015 is exceptionally important to the Australian Defence Force and the nation more generally. Through collaboration between the Commonwealth and state governments, a resilient and responsive defence industry can be fostered to provide critical support to the ADF, achieve asymmetric capability in the region, and to the economic benefit to the nation.

We request that the Commonwealth adopt our recommendations when finalising the Defence White Paper 2015.

Government of South Australia
October 2014

Attachment:
EDB Economic Analysis of Australia’s Future Submarine Program
Economic analysis of Australia’s future submarine program

Introduction
Following media reports that the Federal Government was considering purchasing Japanese Sōryū class submarines to replace Australia’s existing Collins class vessels, the South Australian Economic Development Board (EDB) commissioned an analysis from the National Institute of Economic and Industry Research (NIEIR) to assess the economic impacts of this proposal on the Australian economy. The instructions were to make the analysis very conservative.

Having discussed the suitability of existing vessels with submarine experts domestically and internationally, it is clear that no submarine currently exists anywhere in the world with the ability to operate in Australia’s unique environment and has the capabilities required for the defence task of the Australian Navy. This means that whatever Australia ends up operating will in effect be a new submarine class.

As a consequence it is clear that our unique requirements mean significant efficiencies in the R&D program will be gained from the ability to test new developments ‘on-site’. This benefit has not been included in the model used.

Detailed cost data on building (1) overseas or (2) locally, has been gathered and checked with numerous Australian and overseas experts. The clear conclusion is that it will cost no more to build locally. This is partly because Australia requires a tailor made vessel, and partly because there are only four potential international partners to build the submarines with (Germany, France, Japan and Sweden) and they are all high-cost countries.

The analysis modelled two scenarios:
- Scenario 1: Build all 12 submarines overseas, with Australia retaining only the light maintenance
- Scenario 2: Build all 12 submarines in Australia with both heavy and light maintenance being undertaken locally over the 40 year life of the project.

In the discussion below, and in the model, the following assumptions were made:
- All $ figures are 2014 AUD unless otherwise stated.
- AUD exchange rates of $0.92USD have been used in the calculations. Assuming that the AUD is currently overvalued, the benefits of local production will be increased if this exchange rate normalises to purchasing power parity. Conversely, at a more competitive exchange rate of $0.74 cents per $US, the impact of an overseas build could be in the regional of 30 per cent worse.
- The total cost of construction in Australia is assumed to be the same as that of overseas construction, namely, $20bn.
- The figures in the report are based on the assumption of fixed public sector deficit targets requiring cuts in government expenditure domestically to fund the purchase of the submarines.
- The average rate of corporate income tax paid in Australia will remain at 28%. The effects on the economy are modelled with and without tax revenue recoupment.
• Construction is undertaken at Techport in Adelaide, South Australia and all the heavy 
  maintenance at Henderson in Perth, Western Australia, but goods and services are drawn 
  from many Australian and overseas regions.
• The loss of automotive construction in Australia generates enough surplus capacity in the 
  Australian labour market to ensure that the Australian economy does not hit any capacity 
  constraints from undertaking local construction of submarines. This is verified since there is 
  a clearly identified transformation path from the automotive sector into the defence ship 
  building sector. The model includes an estimate that Scenario 2 (build in Australia) would 
  utilise only 11.4% of the surplus capacity created by auto sector closures.
• A slowdown in mining-related construction in WA would also generate enough surplus 
  capacity for the Henderson program.
• Because virtually no capacity constraints are anticipated in the labour market, the program 
  is not expected to stimulate additional wage increases. For this reason, the Australian 567-
  local government region input-output model has been used, rather than a computable 
  general equilibrium model.
• In these types of complex projects there is normally a “knowledge spillover” effect from the 
  increased range of competencies of local firms that result from domestic construction. For 
  example, Professor Gunnar Eliasson\(^1\) has estimated that the JAS 39 Gripen multi-role combat 
  aircraft project in Sweden generated a spillover multiplier of 2.6 on the development 
  component alone. For the purposes of this report, a conservative multiplier of 0.7 has been 
  applied to the local R&D and materials spend. This means that $7 billion spent on Australian 
  R&D and materials will increase GDP by $5bn.

Using total local expenditure on the submarines as the base, this result is consistent with a 
spillover multiplier of 0.4 for Scenario 2 over the 40 year life of the project. There are 
numerous cases from the Collins program, of Australian companies developing new 
technologies and new capabilities that indicate that this $5bn number underestimates the 
spillover effects.

Key results
Under any scenario, the cost of a new fleet of submarines will be borne by Australians and there are 
two separate components to this cost. The first is the impact on the Commonwealth Government 
(see Table 1) and the second is the impact on the economy (see Tables 2 and 3).

Table 1 indicates two significant benefits to the Government from building in Australia:
• First, an estimated $5.5 billion of tax is recouped by the Government. Under the “no change 
  to budget” assumption in this model, this reduces by $5.5 billion, the need to cut other 
  Government programs to cover the cost of the submarines.
• Second, there is a $7.3 billion reduction in counter party risk and exchange risk carried (or 
  hedged at large cost) by the Government if the AUD mean-reverts to a purchasing-power 
  parity of $0.74 US cents (compared with the $0.92 US cent rate used elsewhere in the 
  model).

\(^1\) Eliasson, G. (2010) *Advanced Public Procurement: The Aircraft Industry as Technical University*, Springer
Table 1

<table>
<thead>
<tr>
<th>Total Cost to Commonwealth Government</th>
<th>Australia ($m) @0.92 USD</th>
<th>Australia ($m) @0.74 USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash cost: build overseas</td>
<td>21,114</td>
<td>28,344</td>
</tr>
<tr>
<td>Tax recoupment from building overseas</td>
<td>624</td>
<td>624</td>
</tr>
<tr>
<td>Net cost to Commonwealth Government</td>
<td>20,490</td>
<td>27,720</td>
</tr>
<tr>
<td>Cash cost: build in Australia</td>
<td>20,957</td>
<td>21,960</td>
</tr>
<tr>
<td>Tax recoupment from building in Australia</td>
<td>6,011</td>
<td>6,011</td>
</tr>
<tr>
<td>Net cost to Commonwealth Government</td>
<td>14,946</td>
<td>15,949</td>
</tr>
<tr>
<td>Saving in net cost to Commonwealth Government if built in Australia</td>
<td>5,545</td>
<td>11,771</td>
</tr>
</tbody>
</table>

Table 2 summarises the more favourable economic impact on the Gross Domestic Product (GDP) of Australia and on the Gross Regional Product (GRP) of the States and Territories from building in Australia. The table indicates that Australia is “better off” by around $21 billion and that every State and Territory benefits.

<table>
<thead>
<tr>
<th>Table 2: Total Impact on GDP/GRP</th>
<th>Australia $m</th>
<th>South Australia $m</th>
<th>Western Australia $m</th>
<th>Other States $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1 – build overseas</td>
<td>- 29,344</td>
<td>- 2,193</td>
<td>- 786</td>
<td>- 26,366</td>
</tr>
<tr>
<td>Scenario 2 – build in Australia</td>
<td>- 8,207</td>
<td>11,081</td>
<td>2,046</td>
<td>- 21,333</td>
</tr>
<tr>
<td>Amount by which Scenario 2 is better than Scenario 1 for the economy</td>
<td>21,137</td>
<td>13,274</td>
<td>2,832</td>
<td>5,032</td>
</tr>
</tbody>
</table>

Table 3 summarises the difference in impacts between the two scenarios as relates to average jobs over the life of the program. The table indicates that Australia is “better off” by more than 3,000 jobs per year for 40 years and that every State and Territory benefits.
### Table 3: Total Impact on Jobs

<table>
<thead>
<tr>
<th></th>
<th>Australia average number of jobs each year for 40 years</th>
<th>South Australia average number of jobs each year for 40 years</th>
<th>Western Australia average number of jobs each year for 40 years</th>
<th>Other States average number of jobs each year for 40 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional direct employment: Scenario 2</td>
<td>797</td>
<td>378</td>
<td>345</td>
<td>74</td>
</tr>
<tr>
<td>Total economy-wide change: Scenario 1</td>
<td>-6,691</td>
<td>-559</td>
<td>-350</td>
<td>-5,782</td>
</tr>
<tr>
<td>Total economy-wide change: Scenario 2</td>
<td>-2,886</td>
<td>1,856</td>
<td>218</td>
<td>-4,961</td>
</tr>
<tr>
<td>Net economy-wide impact: How many annual jobs Scenario 2 is better than Scenario 1 by</td>
<td>3,805</td>
<td>2,416</td>
<td>568</td>
<td>821</td>
</tr>
</tbody>
</table>

The estimated regional impacts can be seen in Table 4 below:

### Table 4: Estimated regional impacts by council region and Federal electorate

<table>
<thead>
<tr>
<th>Main Commonwealth Electorate</th>
<th>Build in Australia less build overseas</th>
<th>South Australia</th>
<th>Addition to GRP $ million</th>
<th>Additional total man-years over the 40 year period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>South Australia</td>
<td>Addition to GRP $ million</td>
<td>Additional total man-years over the 40 year period</td>
</tr>
<tr>
<td>Adelaide</td>
<td>Adelaide (C)</td>
<td>2,837</td>
<td>1,583</td>
<td></td>
</tr>
<tr>
<td>Port Adelaide</td>
<td>Port Adelaide Enfield (C)</td>
<td>5,183</td>
<td>14,753</td>
<td></td>
</tr>
<tr>
<td>Mayo</td>
<td>Onkaparinga (C)</td>
<td>265</td>
<td>8,588</td>
<td></td>
</tr>
<tr>
<td>Makin</td>
<td>Tea Tree Gully (C)</td>
<td>244</td>
<td>8,503</td>
<td></td>
</tr>
<tr>
<td>Hindmarsh</td>
<td>West Torrens (C)</td>
<td>388</td>
<td>4,256</td>
<td></td>
</tr>
<tr>
<td>Pt Adelaide, Makin</td>
<td>Salisbury (C)</td>
<td>432</td>
<td>10,935</td>
<td></td>
</tr>
<tr>
<td>Hindmarsh</td>
<td>Charles Sturt (C)</td>
<td>541</td>
<td>10,303</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total of these regions</td>
<td>9,890</td>
<td>58,920</td>
<td></td>
</tr>
<tr>
<td>Total SA</td>
<td></td>
<td>13,274</td>
<td>96,621</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Western Australia</th>
<th>Addition to GRP $ million</th>
<th>Additional total man-years over the 40 year period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fremantle</td>
<td>75</td>
<td>4,160</td>
</tr>
<tr>
<td>Brand</td>
<td>1,975</td>
<td>2,190</td>
</tr>
<tr>
<td>Brand, Canning</td>
<td>33</td>
<td>2,385</td>
</tr>
<tr>
<td>Brand</td>
<td>72</td>
<td>2,683</td>
</tr>
<tr>
<td>Brand</td>
<td>101</td>
<td>7,063</td>
</tr>
<tr>
<td></td>
<td>Total of these regions</td>
<td>2,256</td>
</tr>
<tr>
<td>Total WA</td>
<td>2,832</td>
<td>22,734</td>
</tr>
</tbody>
</table>
In summary, the key results of the analysis indicate the following:

- **Under Scenario 1 (build overseas):**
  There would be a negative impact of $29 billion on Australian GDP over the 40 year life of the project. This is the equivalent of $725 million every year for 40 years.

  Australian workers could expect to lose 6,600 jobs every year for 40 years.

- **Under Scenario 2 (build in Australia):**
  The negative impact on Australian GDP if the submarines are built here is estimated to be $8.2 billion over the 40 year life of the project – approximately $21 billion dollars less than the Scenario 1. In other words Australia would be around $525 million a year better off in Scenario 2 than in Scenario 1.

  In addition, at least 3,000 more Australian jobs would be saved every year over the 40-year life of the project if built in Australia.

### Modelling method

The modelling has been based on extensive investigation of current technologies and their costs (built on publicly available contract data) in five submarine-building nations including France (including French submarines built in India and Brazil), Sweden, Germany (and the German submarines built in Greece, Turkey and Korea), Japan and Australia.

Under Scenario 2 (build locally), an assumption has been made that construction would be undertaken at Techport in Adelaide, South Australia and all the heavy maintenance at Henderson in Perth, Western Australia, with goods and services being drawn from many Australian and overseas regions.

The Australian 567-local government region input-output model has been used rather than a computable general equilibrium model. This approach is based on knowledge that the loss of the automotive sector in Australia will, in the relevant parts of the Australian economy, generate 8 or 9 times the surplus capacity required for local construction of submarines.

The Submarine program would span 40 years and has been split into four sub-programs:

- **R&D (Years 1 – 4):** This includes development costs for a submarine that fulfils Australian requirements inclusive of manuals, development of training & maintenance documentation and production support. This is estimated to be 6 million man-hours, equalling $0.9bn (NPV discount rate 0%)

- **Construction (Years 3 – 29):** This includes building 12 submarines (5 years build time + 1 - 2 years sea trials) with a new submarine started every 2.5 years. For each submarine, domestic material cost is estimated at $0.5bn, imported material cost estimated at $0.25bn and man-hour costs estimated at $0.375bn dropping to $0.27bn for the twelfth submarine due to experience curve effects.

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3 Any cumulative numbers in this text only are discounted at 0.0 per cent to achieve the NPV whereas in the model an appropriate discount rate is used.
• Sustainment [light maintenance (Years 10 – 40) and heavy maintenance (Years 20 – 40)] includes:
  o Light maintenance including capability upgrade (level 1 annually, level 2 after 2 years of operations, level 3 after 5 years of operations)
  o Heavy maintenance including capability upgrade after 10 years of operation.

In Scenario 1 there is no heavy maintenance and only low level light maintenance.
In Scenario 2 all building takes place in Adelaide (including first in class) and all sustainment in Perth.
In summary, light maintenance (worth $2.4 billion) is undertaken in Australia under both scenarios whereas heavy maintenance (worth $4.2 billion), including upgrading as new technology becomes available, is undertaken in Australia only if the submarines are built here, thereby creating the required technical capability to undertake the heavy maintenance.

Macro-economic impact

Advanced system integrators operating in the defence sphere with their associated supplier ecosystems is one of the back-bones of all advanced manufacturing economies i.e. those economies with high economic complexity that generate high productivity growth, highly paid jobs and large export earnings. The economic benefits from advanced and complex defence systems routinely exceed the development costs of these systems because:

• The realisation of a major industrial project such as a complex defence system requires a large number of technical problems to be solved. These projects therefore become broad-based technology drivers that generate a flow of technology spillovers. The result is a situation of dual production since there are two outcomes: (1) the defence system and (2) the spillovers that surround the development project. These spillovers predominantly originate during the product development phase which means that if the procurement is military off-the-shelf there will be minimal or no economic benefits.

• There will be no new products better and more sophisticated than those demanded by sophisticated and competent customers. That means that without a competent customer who understands what is possible, knows how to put what is possible to use and are willing to pay to get what they want, these types of products will not be developed. When it comes to complex and sophisticated products such as military systems, the customer often contributes user knowledge. Advanced and demanding customers therefore raise the quality of the technological spillover flow and represent a competitive advantage for a national economy. In other words, the economic benefit realised from advanced and complex defence systems, is directly proportional to how competent and demanding the customer is.

Long-term competitive sustainability of any industry requires local presence of one or more technology-leading firms at its helm for the rest of the industry to learn from. The defence industry develops and manufactures extremely complex products, developing and using leading edge industrial technology. The defence industry today already uses many of the technologies that will be used in the broader engineering industry tomorrow. It operates as, and compares well in terms of performance with, a really good technical university, both in generating and proving new technologies and in supplying well-educated and experienced workers and engineers to industry at

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large. In fact, while some advanced knowledge may be taught in principle in a university environment, many critical industrial competencies, such as systems integration in which defence industries excel, can only be acquired through direct experience from production. In other words, the presence of a sophisticated defence industry accelerates the dissemination of productivity enhancing knowledge and practice to the broader industrial base. Since the engineering industry, as a subset of the more general manufacturing industry, will continue to serve as the industrial backbone and wealth generator of advanced economies, the continued role of the defence industry as a technical university for engineering industry and hence for manufacturing in general should not be underestimated. As the servitization of manufacturing continues, this role extends also to the sophisticated part of the service industry.

The benefits that can be realised from these projects through entrepreneurial activities require an economy with high complexity (i.e. a broad and deep industrial commons) to create, identify, and commercialize successful projects. This complexity, together with well-established and well-functioning institutions, enable the developed IP (and other intangible assets) to be tradeable and hence end up with agents that have the highest opportunity to create economic benefit. The level of economic benefits that can be realised from spillovers is proportional to the complexity of the ecosystem that is required for that industry to function, or in other words, proportional to the economic complexity of the industry.

Spillovers become available to industry at large in proportion to the local entrepreneurial capacity to identify and realise opportunities for commercialisation. They can then be converted to economic benefits to the nation in proportion to the relative economic complexity of the economy. Property rights to intangible assets play a role both in stimulating the development of spillover-rich products and services and in commercializing spillovers. Hence social value creation is supported by policies directed at enhancing both the entrepreneurial capacity and the economic complexity of the national economy as well as the tradability of intangible assets.

For “public goods and services” such as national defence (the services of which cannot be purchased individually in the market), Government is the representative customer of its citizens. Government is also the main beneficiary of the social value created by the spillovers, so we have a case of double customer benefit. Therefore, advanced public procurement can be seen as a component of effective industrial policy. Today, and in the wake of a massive privatization of previously public production of private goods that has taken place over the last 20 years or so, defence is one of the few remaining industries where such public double benefit of considerable magnitude can be effectively achieved. Advanced public procurement is one of the most effective forms of industrial policy and can be used as a vehicle to overcome the considerable underinvestment in private R&D among industrial economies. The efficiency benefits (disregarding the spillovers) of competitive bidding rest squarely on the assumptions of the neoclassical economic model, which is based on a sharp dichotomy between supply (the producer) and demand (the customer). When the producer and the customer cooperate over a long period to improve upon the product, and arrange to share both risks and gains through an incentive contract, the standard conclusions on competitive bidding no longer hold. Mechanical competitive bidding, furthermore, tends to favour low-cost outcomes at the expense of non-contractable quality\(^5\), and there is no readymade alternative set of rules to guide the purchasing process other than to stay away from stereotyped competitive bidding. A practical proof of this on a smaller scale can be seen in the enduring success of the US SBIR program.

The social value created around advanced production is potentially very large. The spillover multiplier is defined by Gunnar Eliasson as the ratio between the estimated social value created (net of opportunity costs) and the development investment that has created them. As an example, the JAS 39 Gripen development program has generated (in the Swedish economy) over and above the opportunity costs, an additional social return to society (a spillover multiplier) in the order of magnitude of at least 2.6 times the original development investment during the period from 1982 through 2007. This means that an average investment per year of 0.17% of the Swedish GNP, in the Gripen case, has generated a return to society of 0.43% of GNP annually. To judge from studies on the difference between social and private rates of return (an alternative indirect method to calculate the spillover multiplier), notably on North American data, this Swedish number appears to be on the low side. These studies would support a spillover multiplier of at least 2–4 (and sometimes even larger) for the US economy, being more entrepreneurial than the Swedish economy but with similar levels of economic complexity. While the Gripen is a unique and highly sophisticated development project, the econometric estimates are based on much broader aggregate categories with significantly smaller spillover intensity. The cautious low-end estimate is sufficient to make development programs of the JAS 39 Gripen combat aircraft type worthwhile and socially very profitable. Swedish society, in effect, paid nothing for the development of the aircraft and still received significant benefits in return. Given that the submarine development is a project of even higher complexity than military aircraft development, the return on such a project would be even higher. In the Swedish economy it is estimated it would result in a multiplier of above 3.

Meso-economic impact

Advanced complex defence systems projects have a very large industrial, economic and employment impact and none is more advanced than building a submarine (the only system more complex than a submarine is a space re-entry vehicle). This can be illustrated by some examples:

- The Collins Class through Life Support (TLS) project, signed in 2012, contributes around $150 million and 1400 jobs to Australia’s economy every year. Converted it would be equal to 112,000 FTE man years over a 40 year period for 12 submarines.
- The UK Astute class nuclear submarine class construction draws on around 1200 firms, of which 400 are project specific and 150 are tier one suppliers. This equals an estimated FTE range of between 15,000 and 25,000 depending on how many of the low-end service providers you include. Converted to a non-nuclear submarine build of 12 submarines over a 40 year period this would equal approximately 2/3*12*15,000-25,000 = 120,000-200,000 FTE man years. Assuming that the same work force does the build and the sustainment and staying with the lower numbers, the number of FTE man years is estimated to be around 115,000 which aligns with the results from the model.

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6 Allen Consulting, using a different methodology and not taking into account the technological spillover effects, estimates a multiple of between 1.53 and 2.4 for naval shipbuilding in Australia
Case Studies

The economic benefits generated by building the replacement submarines in Australia can be illustrated by two examples:

- Around nine in every ten of the Australian suppliers sub-contracted for the Navy’s Minehunter and ANZAC projects were SMEs. The skills acquired during those projects have had positive, long-term impacts on their ability to enter new industrial domains and offer technologically advanced, innovative goods and services to other industries.

- Secondly, the Australian company Bisalloy Steel supplied the Collins program and Australia’s Bushmaster armoured vehicle program with a steel product that was superior to anything available at the time. This world-leading product was developed through collaboration between the firm, the customer and the Defence Science and Technology Organisation. Bisalloy’s steel is now used in the US, India, the Middle East and Asia and export sales have grown significantly.
Supplementary Submission to the Senate Economics References Committee:
Inquiry into the future of Australia’s naval shipbuilding industry – future submarine program

Supplementary Submission to the Joint Standing Committee on Foreign Affairs, Defence and Trade:
Inquiry into Government support for Australian defence industry exports

The submarine procurement decision has repercussions for both our national security and the future of our economy. We risk antagonising China, Australia’s largest future trading partner, and investing heavily in another nation’s defence industry at the expense of our own. With so much at stake, you expect the Australian Commonwealth Government to follow due process. What I have been able to deduce from open sources is the following key steps in the process:

- In 2009 Defence released a request of information (RFI) to overseas designers to be able to gauge what they had to offer. I don’t know what was in the responses but I would expect that it would have included information on what they termed Military-Off-The-Shelf designs as well as information on what they had to offer to meet the 2009 Defence White Paper requirements.

- The 2009 Defence White Paper indicated a desire by the then Government for 12 submarines much more capable than Collins. I am aware that there were responses to Defence’s RFI from the Swedes, the Germans, the French and the Spanish. Since then, the Spanish designer has admitted to a fundamental weight error which has not helped their credibility and they would therefore likely have been discounted.

- The information sought in the 2009 RFI was about modifying or adapting the smaller European submarines, not about adapting submarines of a size as large as Collins. As a result of this, I know that work on so-called European MOTS designs modified to meet Australian legislative requirements “Option One) and European MOTS designs modified to include the US/Australian AN/BYG-1 combat system and the US/Australian Mk 48 torpedos "Option Two) have been shelved for the time being, because they do not meet Australian requirements. That left work to be done assessing Option Three "Evolved Collins) and Option Four "New Design).

- As far as I can tell, Option Three – Evolved Collins – is the only work adapting a European design of the Collins size - and it was doomed from the start, because the pressure hull diameter was constrained to the current 7.8 metres. This constraint required the hull to be stretched and this would limit a future growth path because you can only stretch a submarine so far before it becomes hydro-dynamically inefficient.

- It is not clear that any of this work was aimed at an Australian build program, although in 2009 there was some Request for Information work aimed at companies in Australia regarding an Australian build. I understand that the information requested included such things as workforce capacity and capability including ramp-up rates, infrastructure, overseas collaboration, program risks, schedule, cost estimates and overall project timings, and contracting strategies for construction. Much of this information would have been based on actual numbers, not theoretical numbers and so as a result, Defence should have a pretty good basis for understanding what can be practically achieved based on real results.

- The lack of progress since 2009 tells me that either the information was not understood, or it was ignored. Why else would there be speculation that Australia will be buying from Japan.

- The interesting thing is that a submarine program of say $20bn sail away cost for 12 vessels is a hugely significant job in terms of national effort. If we purchase from Japan, Australia would have to pay for Japan to somehow insert our program into a national effort of its own, which would already be run efficiently with no allowance for additions such as ours.
If Australia procures the existing Sōryū-class submarine, this means that the Japanese would have to build a new facility for building the submarines and recruit and train a new workforce to do the building work – all paid for by Australia.

If Australian procures the Sōryū-class replacement submarine, currently around 5 years into its design phase, this would mean that the Japanese would either compromise their own optimised design to be able to fulfil Australian requirement – which is unlikely, or that they would divide into two design streams: the continuation of the Japanese Sōryū-class replacement submarine design for a further 5 years to reach the production stage; and re-starting the design of an export design for Australia. This means going back to scratch, taking up to 10 years to come up with an appropriate design, and only if there are competent manhours for submarine design available. Otherwise, there is a need to train an appropriate and competent submarine design workforce which can take up to 10 years – lengthening the time to production to at least 15 years - again all paid for by Australia.

Some quotes from media may be used to illustrate this point: Prof. Kazuhsa Ogawa, a former government defence adviser and one of Japan’s top military analysts, said if construction happened in Japan it would be bad for Australian jobs, but good for the Japanese economy. "If the issue of military secrets can be resolved then Japanese business will be happy it will bring jobs and growth”

- I’m certain that there would have been a lot of information gained out of the Option Three work – all based on Collins – what works well, what doesn’t – and this would form a good basis from which to move forward.

- On the other hand, I now hear (including from evidence given by Defence at the 30th September Senate Economics References Committee hearing) that Defence is working on a “limited tender” to Japan to purchase our next submarine fleet, and I hear that they will be designed and built overseas because an Australian build program would cost twice as much. This latter is erroneous. It would cost no more to build in Australia than it would cost to build an Japan, Sweden, Germany or France given:
  o That they are all high cost countries with very low differences in labour cost “the labour cost component of a submarine makes up about one third of the total build cost whilst material makes up two thirds)
  o That one third of the material cost is made up of specialised input sourced from a sole supplier, or from a group of very few alternative suppliers and hence there would be no real cost difference depending on build location.
  o That two thirds of the material cost is made up of domestic input where there might be some benefits of scale depending on the size of the submarine project, but since most submarine projects are low volume and the Australian would be in this group a high volume this is likely to generate a lower cost in Australia.

If anything it can be seen that it might actually end up cheaper building in Australia.

- Whilst there is no clear evidence of a decision to build overseas, the media has been given some good leads for some time, and they look to the slow progress of the first of class Air Warfare Destroyer project without understanding that it is the first step along a learning curve, and which all shipbuilding programs follow – one would expect the first of class to be between 5% and 10% more expensive than the 3rd or 4th of class – and the cost overrun on the AWD – large as they sound in dollar terms is only around 6% and hence sits well within the norm.

- There has not been any recent work since the 2009 RFI tendered to Australian companies asking for build costs, or if it has, it has not been made public. So to my knowledge there has been no recent RFI requesting build time, cost and risk information from an Australian based builder. Remember that all Government contracts are made public.

Of course, a builder would have to know what the design was, but in parametric terms, in round figures, a very rough sail-away cost estimate could be determined if the size were known. In fact, several overseas designers have already made it clear that they could build, in Australia, 12 submarines of about 4,000 tonnes to a sail-away estimate of $20bn. Australian Financial Review’s take on this is summarised in figure one below.

![Submarine wars]

This flies in the face of the ASPI estimate of $36bn, although that is an overall project budget, which would include design, infrastructure, jigs, tooling, and defence costs. The actual cost for modern submarines is actually very stable in terms of cost per tonne as can be seen from figure 2. This is the only truly empirical and peer reviewed paper that both has an acceptable methodology and has been verified by substantial expertise as outlined in the beginning of the

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2 See AFR 11th and 12th September 2014
source paper. It is easy to see how the mistakes in pricing from ASPI was made if you select a sample including data points from the older generations and then execute a simple line fit. This would give you a curve sloping upwards and indicate a higher price than the actual one as seen from the difference between the $36bn and the price indicated by the actual building contenders.

- If the procured submarine system is to fulfill the stated Australian requirements (e.g. on range, speed, stealth, indiscretion ratio, etc), there is consensus that there is no such thing as an ‘off-the-shelf’ submarine. This means that the costs of maintenance, sustainment and replacement must be taken into account, alongside the need to transfer IP and allow Australia access to the designs. Recently, senior Japanese Defence personnel ruled out the possibility of transferring IP, advising Australia not to buy the submarines from Japan. They warned, in an interview with the ABC, that the submarines would cost much more than $20 billion, unless all construction took place in Japan. That is an outcome that Australia cannot agree to, unless it is prepared to surrender all control over the asset, with repercussions for sovereign capability and national security.

- With value for money in doubt, Commonwealth rules on competition are also in question. There is increasing evidence that alternative options, including an Australian-built submarine or the adaptation of a European design, have not been adequately explored. If it had, we would have reliable figures regarding the competitive bids against Australia’s technical specifications; a decision could be made based on quantitative data rather than rumour and hearsay. As things stand, the Australian public has not been adequately informed about the relative merits and drawbacks of the various options: the data has been piecemeal, the debate has become politicised.

The above reasoning as well as the behaviour of the European contenders indicates that an Australian-built submarine or the adaptation of a European design has not been adequately explored which is surprising given that the Commonwealth Procurement Rules are clear. They

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Figure 2: Updated version of figure on page 50 in Pacey, B. ‘January 2012). Sub Judice: Australia’s Future Submarine. Kokoda Paper No.17

uphold value for money, encourage competition and are committed to transparency throughout the procurement process. The rules are there to ensure Australia secures the best outcome for the best price, and that all options are given due consideration. As Australia continues to debate the provenance of a crucial defence asset, those rules matter – they provide a framework and a guarantee that Australia will make the right choice.

If the Government were to make it known that it was sole-sourcing a contract e.g. through indicating a “limited tender” which indicates a unilateral sole-source approach to one submarine designer only, then it would place that Government in a negotiating position where it would be difficult, if not impossible, to get a good deal on both price and terms and conditions. This would de facto expose Australia to an unacceptable level of risk in the national security domain; the political domain; the operating domain; and as previously stated the commercial domain. All this would also take place at an unusually early phase in what is a complex evaluation and procurement process.

It will be impossible if the best option was chosen unless at least one other option was pursued in parallel – also as a back-up in case the Japanese option for some reason is taken off the table by the Japanese themselves for political, performance, commercial or national security reasons. This seems unacceptable given that the submarine project is likely to be Australia’s largest defence program for at least the coming 40 years.

The Future Submarine Industry Skills Plan indicated that “For reasons of national security, nations usually keep their best technology for their own use and export less capable designs or submarines “complete or systems)”[4] (p. 36) which is correct. All countries guard their most sensitive secrets and submarine secrets are the most closely guarded. Any exports will be a second tier of technology which has already been surpassed by the country’s science and technology programs and engineering development. Anyone who thinks they will be buying the most up-to-date stealthy submarine from another country is naive. Developed countries have three tiers of technology – one for their own use and guarded very closely, a second ‘export’ version with older, superseded technology to countries which are termed ‘friends and allies’ and a third version even older still – a ‘vanilla’ version if you like. It is essential that Australia gets access to a submarine design where the “older” embedded technology is not very old and is in fact the best in the world with the exception of the supplying countries own submarine system. I could speculate that this outcome is more likely if the partner chosen was Sweden since the geopolitical military overlap with Australia is nil and the technological exchange with US is on the highest possible level and the risk of them coming into any form of military conflict with PRC is nil. The Swedish government have also indicated a willingness to enter into a very close reciprocal military technology agreement with Australia.

In this global environment, the only way that Australian submarines can develop and maintain a capability edge is if the submarines are built in Australia and fitted with high-end, secret technology through Australian Eyes Only programs which are continuously funded through the service life of the fleet. These technologies would be targeted towards specific areas – stealth techniques, signal processing, and commanding officer’s tactical aids – anything that gives our submarines an edge. We have done this before with ultra-quiet pumps, acoustic tiles, special sonars, and so on. Failure to do this will mean Government embarrassment in the least and a tragic loss at the worst. Would you want the safety of your son or daughter to depend on an export version of someone else’s design?

In their submission, Mr Briggs and Mr Roach stated that the experiences with the Collins class submarine demonstrated that “the required transfer of technology can only be gained through the construction of the first submarine in an Australian shipyard and that the associated risks could be successfully managed” (paragraph 35). This assertion is correct since the only way to ensure the

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domestic presence of design knowledge, technology knowledge and the associated competencies and skills is through partaking in the design and being involved in the construction of the first of class. This secures the necessary capability that can later be deployed for modifications and upgrades and remedying difficult faults.

This occurred with the Oberon class with the support of the Royal Navy and Vickers (designer/builders) who established the Australian submarine squadron and Vickers Cockatoo Dockyard to support the submarines. VCD conducted continuous dockings and refits of Royal Navy submarines from WWII onwards.

Australian industry obtained the depth of knowledge for the Collins class with Kockums, the designer, training Australian engineers in Sweden, and then accompanying them back to Australia where Kockums supervised the design work inside ASC, and sat alongside the production staff. The other European designers (TKMS and DCNS) recently advocated the same method at the ASPI conference.

From a purely engineering view, without the knowledge and know-how of construction in Australia, including the certification, design assurance and testing, and the vast amount of information collected at build for assurance, a maintainer is working blind. This can lead to errors, time delays and high costs. We are not talking about Oberon submarines for which the Royal Navy was the Parent Navy, or about aircraft built elsewhere and exported by the hundreds, and for which many user groups exist all of whom apply pressure on the designer/builder to remedy faults. We are talking about conventional submarines designed specifically to meet Australian requirements for long ocean transits and patrols, which no other navy does. The submarines must be maintained here because it is simply too far from Europe or even Japan to be held on a long, thin thread of supply chain and maintenance work. The lack of the right knowledge can lead to errors with tragic consequences. While the SUBSAFE program helps to mitigate this, there are many items of equipment, failures of which can prevent the submarines from achieving the availability performance required. The Coles Review is testament to this.

A future submarine program would of course commence with Australian engineers being seconded to the overseas designer before being repatriated, with the overseas design team, to Australia to complete the detail and production design. This has been suggested by TKMS at the recent ASPI (Australian Strategic Policy Institute) conference, but very few people know that this was the method used for Collins. The result was that the Collins build did not suffer from the inability of the production workers to interpret the design – the design was managed at the build yard. In addition, constructing the lead submarine here means that all the calculations, the standards, specifications, test results, build information including objective quality evidence, design certification and assurance will happen here and will be learnt by Australian engineers from the very beginning. All organisations connected to the build process will benefit from this, not just the builder. As each boat is built, the work teams, the engineers and the organisations involved move along a learning curve, with increasing productivity. Each stage of learning will be reached much faster if the lead boat is built here, and if not, then the first boat built here, which might be number two or number three etc., will need to commence the learning process at greater cost and potential for delays.

Remember that the construction of a complex thing like a submarine is a connection of many organisations and parts. If the lead boat is not built here, our Australian industry will not have instant access to the thousands of build records required to be able to make certification that following maintenance, the boats are safe to operate and will be free from major defects until the next maintenance period, which could be several months away. Worse, the DMO and Navy will be unaware of this vast library of data and the need to keep it updated for safe, efficient and effective learning and certification.
maintenance and design certification. If the lead boat is not built here, we will never catch up to the level of knowledge needed.

The only way out of the present conundrum is a transparent process. This process would look something like this:

<table>
<thead>
<tr>
<th>Key Activity</th>
<th>Estimated Time in months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulate the necessary Top Level Requirements with related engineering and logistic Statement of Requirements</td>
<td>2</td>
</tr>
<tr>
<td>Preliminary evaluation of the four contenders (TKMS 216AU [Germany]; Sōryū-class [Japan]; Sōryū-class successor [Japan]; SMX Ocean Class [France]; Collins Class Evolution [Sweden]; Modified NGU [Sweden]) against the above requirements</td>
<td>3</td>
</tr>
<tr>
<td>Short-listing of two options</td>
<td>3</td>
</tr>
<tr>
<td>Develop and award project definition study contract to short-listed parties</td>
<td>2</td>
</tr>
<tr>
<td>Execution of project definition study</td>
<td>9-12</td>
</tr>
<tr>
<td>Evaluation of project definition study deliverables</td>
<td>3</td>
</tr>
<tr>
<td>Contract team formation and encouragement of consortia formation</td>
<td></td>
</tr>
<tr>
<td>Release of formal Request for Tender</td>
<td></td>
</tr>
<tr>
<td>Request for Tender response preparation and submission</td>
<td>3</td>
</tr>
<tr>
<td>Final evaluation of project definition study deliverables and response to request for tender</td>
<td>3</td>
</tr>
<tr>
<td>Government-to-government agreement and contract award</td>
<td>3</td>
</tr>
<tr>
<td>Building commences</td>
<td></td>
</tr>
</tbody>
</table>

This process would enable a proper evaluation of the alternatives that ensures maximum value for money, essential when billions of dollars of taxpayers’ funds are at stake, given the fulfilment of Australia’s unique requirements. This process would also provide an opportunity for the contenders to make clear what additional “sweeteners” they would be willing to offer and hence make the value for the Australian tax payer even higher.

Given the way this approach differs from how DMO normally approaches these processes I would recommend establishing a separate authority to manage this process. This suggestion is also made since we have seen the effect of the run-down of engineering in Defence and Navy over the years as a result of a series of efficiency reviews, going right back to Malcolm McIntosh’s Defence Efficiency Review. How bad it became, and how to remedy the situations for the amphibious ships and the Collins became the subject of the Rizzo and Coles Reviews. The Coles Review specifically made the recommendation “R22” to develop and implement a plan to resolve loss of Naval Engineering Skills in the submarine domain. Defence has established an organisation in Adelaide, called the SEA1000 Integrated Project Team or IPT which was to undertake work on the Future Submarine Option Four New Design; however, it appears likely that the IPT may well be called upon to work on engineering aspects in whatever direction the project takes. The IPT is comprised of some 60 staff mostly seconded from industry with some defence people. If Defence selects the right people, with the right experience, it could handle a process as outlined above.
There is a major problem with Defence making decisions. Since the first round of RFIs in 2009, there has been virtually no progress. We are back to the start. As I said before there is a lack of submarine domain knowledge at the top which hampers decision making processes because it is difficult to separate the things that really matter from the ones that don’t. It also means that incorrect assumptions can be made and the real issues are buried underneath other issues of less importance. How else could we have got to the point where the Government is considering sole selection of a submarine that won’t meet Australian requirements (the Sōryū or Sōryū-successor).

Before the Coles Review I would have said that it was doubtful if the Defence organisation have the deep knowledge required to be an intelligent and smart customer when it comes to acquiring the submarines. However, the Coles Review Progress Report released in March 2014 indicates a massive turnaround beginning with the Navy setting the lead and the goals. The DMO and ASC were able to follow. Clearly a lot of the problem rested with the leadership. The Collins sustainment has been sorted out to a large extent, but the SEA 1000 project is a completely new issue and it doesn’t appear to be handled in the same way.

In projects of this nature it is essential that Defence have a rigorous test and evaluation regime that enables it to understand fully the maturity of the capability it intends to acquire. I do not know what they do have but I would expect the Navy to have a test organisation in WA for post-overhaul and operational trials. For SEA 1000, I would expect the project office itself to develop a specific test organisation, perhaps augmented by others such as shipbuilder and combat system suppliers, which was the case for Collins. There might also be DSTO staff and some defence civilian engineers. The first task is to develop a test concept document which would specify broadly how each of the major operational requirements would be tested. I would expect that this would have been done by now. After all, they have been at it for over five years. For a MOTS design, such as the Japanese Sōryū or even its successor, the task would probably have to be passed to the project’s IPT – Integrated Project Team – in Adelaide. As the IPT was originally developed to manage the Option Four New Design, they should be capable of understanding what was being put to them.

An important question is if Defence have personnel with requisite qualifications and design/certification experience to understand, assess and challenge information presented to them as relates to a new submarine design. This is a difficult question to answer. If Defence staff had the right qualifications and experience to understand what was being present we might not have needed the Coles Review. But that was for Collins sustainment. The SEA 1000 project office has established an Integrated Project Team in Adelaide of some 60 staff, mostly seconded from industry, and all of whom should have the requisite qualifications and experience. The real issue is whether the information together with the implications of particular decisions they pass upwards through the hierarchy is understood at the very senior levels in Defence and Government. Again, Coles commented on “submarine domain knowledge thinly spread” at the top level. If submarine domain knowledge was available at the highest levels we would not have the speculation in the press about buying Japanese submarines that are not designed to suit the Australian requirements. Further, I would not have expected our past history of Collins to be ignored in terms of submarine design, shipyard construction and mobilisation from scratch, submarine assembly (for that is what it was), and the relatively short duration from contract award in 1987 to delivery in 1996, including more than 18 months of contractor sea trials. Including two years of funded definition studies, the whole thing took 11 years.

There are some clear challenges confronting builders and Defence when modifying a design to suit Australian requirements. Firstly, all the designers that Defence is looking at are also builders. In that respect the domestic build strategies are often very different to the methods employed in Australia, which must be to strict legislative requirements for WHS and in particular for work considered high risk. That is, working with high voltages, heights above the ground, heavy weights, and so on. Also, builders have to interpret the design and in continuous build the designers and builders normally
settle down to a comfortable relationship whereby the production workforce does much more interpreting than we would in Australia. The outcome is that each successive ship or submarine is not necessarily built the same way. The differences cause problems later on during the test phase and operations and maintenance. Secondly, the designers would have to understand the implications of the Australian conditions and the engineering challenges that they bring – such as the long, ocean transits and keeping the diesels reliable and quiet despite the punishing duty cycles and harsh treatment of the ocean environment, the high sea-water temperatures and the effect on the machinery and batteries, speed of corrosion and bio-fouling, and the high salinity which affects buoyancy. There would also have to be an understanding of what is important to prevent crew fatigue in terms of habitability and conveniences. Some countries do not treat their ship’s companies the way Australia does – remember our people are all volunteers. Countries and designers that do not send their submarines on long patrols do not understand the implications, nor are they motivated to look at the solutions. It is up to us. This cannot be implied, inferred or directed by a contract. It requires in-depth understanding.

Defence and industry have to the developmental nature of the future submarine project. Even a small modification of a so-called MOTS design will require several iterations of design work to achieve a fully balanced design. This is developmental work and cannot be short cut. The developmental design must be given sufficient time to accommodate the design iterations and must be fully funded with contingencies to match. My evidence of this is the Air Warfare Destroyer project which was heralded as a MOTS design for which there would be no design changes. However, the nature of the Australian combat system (instead of the Spanish one) has meant a huge volume of design changes for which the project was not prepared. Even the designer has been held at arm’s length from the shipbuilder when it is common sense that the two should be in a very close relationship. A simple example: the extra power required for the Australian combat system needed installation of larger diameter power cables (a consequential design change). The larger bend radius of the new cables larger diameter caused real problems when they would not bend properly, as per the designed cable trays, to connect to the switchboards. Insufficient understanding of the developmental nature of a project will result in insufficient funds and contingencies to be applied, which means that there will be big trouble in the later stages of the project – Collins was just such a case where Defence provided less than 5% contingency for a developmental project which should have had some 15-20% contingency applied. “It is often forgotten, in the rush to apportion blame for the things that went wrong, that the vast majority of things went right and that Kockums as the designer and ASC as the contractor – with the guidance of the project team – were responsible for these.”

Before settling on a final choice of design, a good amount of test and evaluation, sometimes by modelling and simulation techniques if no other method is available (because the vessel has not been built yet) is necessary to avoid down-stream problems, unnecessary costs and delays. McIntosh and Prescott, in their Report on the Collins submarine and related matters in 1999, noted that insufficient hydrodynamic testing and analysis had been done on the Collins design after there had been late changes. What seemed obvious after the event was not obvious earlier in the project. Where there is no model existing, then computer modelling must suffice.

The idea is to remove as much risk as possible, as early as possible. That allows the design to be settled early, and early cementing of project plans, the budget and the expectations of the

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customer, and for targets to be met with confidence. One of the lessons from Collins is the need to allow an adequate time for First of Class (FOC) trials to identify areas of shortcomings, design and implement a fix in sufficient time for them to be incorporated in follow on submarines. The normal allowance for FOC trials in a European design is 2 years, far more than allowed for Collins; I suggest increasing this to 3 for FSM given the challenging operating environment and stretch entailed for all designers.

**Capability of the Japanese Sōryū-class submarine**

There is no existing off-the-shelf diesel-electric submarine class in operation or in the process of being designed with customer commitment to buy, that fulfils Australian requirements. There are some existing concepts but none as yet have any customers.

I would be very surprised if Defence, including the Navy, Capability Development Group, and the DMO, are not aware of the short-comings of the Sōryū-class submarine when compared to the Collins class. However, there are very few people in Defence at the top of the senior ranks who understand the implications of selecting the wrong design. The Coles Review noted that “submarine domain knowledge was thinly spread” and this played a role in the Collins submarine’s poor availability performance.

The Minister himself speaks about Soryu being the biggest and best in the world, but as was made clear on the 30th September, he has been quoting the dived displacement. The number that really counts - the surfaced displacement, which is an indicator of capability - is actually slightly less than that of the Collins class (see the table below).

In an article Rex Patrick states that Japan is well into the design phase of a successor to Soryu. Perhaps Defence hopes that an adaption to the successor to Soryu could be made, which would meet Australia’s requirements. However, that adaption would have to include extra diesel generators, extra fuel tanks, and probably a larger main storage battery as a bare minimum to meet the Collins performance. These would be fundamental to the whole design and would mean going back to the start of the design process. The changes could not be injected half way through the design. No time will be saved as a consequence and other issues will surface as outlined above.

There are those in Defence who understand these things but I wonder if they are being heard.

This is because all submarine systems are optimised for a given requirement and Australia is the only submarine user with exceptional long transits to patrol areas and the only one that have to cover the complete range from arctic to tropical waters.

This is a domain where more capable individuals than I can talk with greater expertise but already from public sources you are able to conclude the following:

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Sōryū-class</th>
<th>Collins-class</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Displacement (tonnes)</td>
<td>2950</td>
<td>3100</td>
<td>Sōryū has less “and even substantially less with AIP) usable volume than Collins</td>
</tr>
<tr>
<td>Ballast water weight when submerged</td>
<td>1300</td>
<td>300</td>
<td>Sōryū drags around 4 times more water than Collins limiting manoeuvrability e.g. acceleration, and increasing energy use when submerged limiting submerged range</td>
</tr>
</tbody>
</table>

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9 Coles Review, November 2012, page A5-1
10 Australian Pacific Defence Reporter, December 2012
Estimated theoretical range at 10 knots (nautical miles) submerged

<table>
<thead>
<tr>
<th>Estimated Theoretical Range at 10 Knots (Nautical Miles) Submerged</th>
<th>3000</th>
<th>9000</th>
<th>Sōryū cannot operate with the long transits required by Australia</th>
</tr>
</thead>
</table>

Diesel generator capacity

<table>
<thead>
<tr>
<th>Diesel Generator Capacity</th>
<th>2 x 1400 kW</th>
<th>3 x 1400 kW</th>
<th>Sōryū has higher indiscretion ratio</th>
</tr>
</thead>
</table>

Propulsion system power per submerged tonne

<table>
<thead>
<tr>
<th>Propulsion System Power Per Submerged Tonne</th>
<th>1.40 kW/tonne</th>
<th>1.58 kW/tonne</th>
<th>Sōryū has less power resources</th>
</tr>
</thead>
</table>

Armament issues

<table>
<thead>
<tr>
<th>Armament Issues</th>
<th>Cannot in its current configuration carry the heavy version of the MK 48 Torpedo</th>
<th>Can in its current configuration carry the heavy version of the MK 48 Torpedo</th>
<th>Sōryū unsuitable for Australian requirements</th>
</tr>
</thead>
</table>

Habitability

<table>
<thead>
<tr>
<th>Habitability</th>
<th>65 crew</th>
<th>58 crew</th>
<th>Sōryū crew habitability and effectiveness much worse than Collins. Estimated 20-30% [the higher number is with AIP] less space per crew member.</th>
</tr>
</thead>
</table>

Operational Life

<table>
<thead>
<tr>
<th>Operational Life</th>
<th>16-20 years</th>
<th>28-30 years</th>
<th>Sōryū and Japan needs to change its design philosophy or Australia needs to change its operational and sustainment philosophy to ensure compatibility</th>
</tr>
</thead>
</table>

Table 1: Open source based comparison of Collins class with Sōryū class

Advantages and Disadvantages of an Evolved Collins as a Solution

Mr Pacey argued that a Future Submarine based on an evolution of the Collins design would be the best way to benefit from the experience of operating a modern submarine fleet in Australia’s maritime domain. The main disadvantages of such an approach would be that the pressure hull diameter can act against you – it will not save you any design time or cost. Defence has made it known that it is assessing an evolved Collins as Option Three. Defence chose to do this to try to limit the time, cost and risk to complete an evolved design when compared with a new design and therefore to avoid a capability gap. Defence was attempting to do this by constraining the pressure hull diameter to the current Collins 7.8 metres in the hope that this would minimise the number of drawing changes. However, the amount of stretching that can be done to the hull will be limited, as Collins is already at a L:D ratio of 10:1 (78m: 7.8m). It is already a good balance between a hydrodynamic ideal and good manoeuvrability. Too much stretch will increase directional stability and reduce the manoeuvrability. If there was freedom on the hull diameter this disadvantage would be removed. The entire back end of the existing Collins Class will have to be re-designed to accommodate new, modern diesel engines, a modern electric propulsion motor and the accompanying switchboards. The amount of work involved in this alone will mean that it is effectively a new design and no time or costs will be saved when compared with designing a new submarine. The largest drawback is the ill-informed media campaign against the Collins class since its inception and this must be stopped through the provision of facts.

There are some very substantial advantages to evolving from Collins however. And this is particularly so if the restriction on the pressure hull diameter is removed to allow a future growth.

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path if a stretch is wanted. Re-use of the Collins design will reduce risks to the build program, and in meeting the Navy’s requirement. This is because of the familiarity of the build yard (assuming ASC), the DMO and the Navy with Collins. Familiarity means a job gets done easier and with less problems. I would include re-use of the design philosophy, the systems philosophies and characteristics, standards, specifications, calculations, working parameters, and importantly the build strategy. There are huge benefits to be gained in re-using the design, even though it is modified. Collins used a less expensive ‘modular construction’ technique compared to the old ‘Olympic’ method where everything was passed through hatches in the pressure hull after it was built and the tradesman who was first got the straightest pipe or electric cable run. Re-use of the design has a flow-on effect which cascades down through the engineers and production workers in the build yard. It also includes the supply chain, quality assurances, design certification, testing techniques, operator and maintainer training and so on and the Navy’s standard operating and emergency procedures. Despite what you hear, there is a significant amount of Collins build experience still in the industry. If the boats are built in Australia, an evolution of Collins would carry less risk due to the familiarity of the production organisation, the workers, and the Navy. There is benefit in building on what you know – you can re-use the good parts – and there are many, and design out the known bad parts. It means that the Collins infrastructure would be available (perhaps with some slight modification) and a new yard would not have to be built. ASC would probably want to move some maintenance to WA but that is good for WA and the Navy, as the boats are home-ported there.

Going down this route means making a long term partnership with the original designers – now owned by Saab – a huge Swedish based multinational. But I don’t see any downside here either as it would have Swedish government backing. This is because the export of Swedish submarine intellectual property is controlled by the Swedish government and I understand from the press that the Swedish government would back Saab in such an approach.

Other Lessons from the Collins Class
Mr Simon Cowan argues with reference to the Collins class that “However, from a support and sustainment perspective it appears to have been largely a failure—its ongoing costs are far too high and it is taking longer and longer to complete maintenance activities ‘for example, Full Cycle Docking12 on the Collins Class takes a “long time even by modern nuclear submarine standards”13, 14. I understand from Commodore Retd Paul Greenfield, the officer charged with the task at the time, that this is due to the Navy, who managed the support programs ‘pre-DMO) deciding not to follow the very clear transition plan and in-service support management plan developed by the Project Office. This plan was aimed at making Navy understand how to best look after the new asset. The Project Office also developed draft support contracts, statements of work and an acquisition strategy to be applied to those contracts which were ignored as well. From this you can infer that Defence at the time did not understand fully the proper methods of sustainment. Had they done so, the Coles Review would not have been necessary. In essence I do not think that the Navy understood what being a parent Navy for a new class of submarines entailed as evidenced by the RAND report: LEARNING FROM EXPERIENCE - Lessons from Australia’s Collins Submarine

12 Also known as major depot maintenance—a complete overhaul and refurbishment of a submarine typically takes several years to finish).
The consequences of these decisions can be seen from the quote “Retro-fitting the necessary logistical arrangements and sustaining them will be more challenging than getting them right at the outset”. The Coles Review was quite explicit in its criticism of the Navy’s failure to set the overall objectives, the DMO’s failure in establishing a strategy to match the Navy’s objectives, and the lack of a bottom-up, zero-based budget for maintenance, and update. The follow-up Coles progress review reported that the three organisations have recognised the shortfalls and are following the implementation of a plan to ensure that Collins achieves international availability benchmarks by 2018.

The same problems can occur again, with ANY design, no matter the source, if the fundamentals pointed out by Coles are forgotten. It is up to the Navy to provide the leadership as it is now doing, and DMO and the industry to meet the Navy’s requirements as best they can, while concentrating on their own jobs and not those of others. The lack of clear objectives provided by Navy led to a dilution of responsibility, authority and gaps and overlaps in the support of the Collins.

An integrated design process such as the Integrated product process design (IPPD) used by the USN should be used. IPPD uses a seamless process and avoids the traditional step by step design process with a period between each phase whilst decisions on proceeding were taken; often leading to delays, design changes and cost escalation:

- Life cycle costs are considered at every stage of development.
- IPPD has resulted in designs being completed much more rapidly than the traditional process.
- Individuals with knowledge of the construction process are involved throughout, minimizing the requirement/costs for re-work.
- The companies responsible for through life support and maintenance are also involved and provide contracted prices for delivering these services.
- This results in an accurate cost of ownership and a contractually enforceable regime for delivering it.

This is not very dissimilar from the process actually used for Collins.

As a parent Navy you have greater responsibilities then if you procure from someone else in ensuring the operational standard of the class. You also have a clear responsibility to participate in the planning of as well as the execution of the transition from production through to sustainment – which is commenced before the commencement of build and continued until the first of class is accepted after two years of sea trials. This means that you have to maintain a higher than normal technical knowledge of managing submarine maintenance, repair and upgrades as well as ensuring that all experience is captured, maintained and built upon for continuous improvements. You are also responsible for the continuous performance improvements of the class. In other words the parent navy role is closely tied in to the concept of sovereign capability. Being a parent Navy of high tech systems requires changes to manning, employment, skill requirements, training, logistic support and management. In summary the parent navy role entails the full design, development, test and evaluation effort, including e.g. weapons certification, for both the construction phase of the class and for the class’ operational life, some 40-50 years all in all.

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The Oberon class submarines operated and maintained by the Royal Australian Navy were built in the UK, where specialist teams of Navy officers and civilian engineers stood by on site as part of the customer teams. Submarine officers did their general and specialist training in the UK and some even spent time as crew members in RN submarines or at shore postings in the UK. This method transferred the knowledge and skills to both Navy officers and to civilian engineers. The operations procedures, tactical methods, emergency procedures and maintenance management was all set up by this method. The Australian submarine force was deep-rooted in the UK. There was continual dialogue back and forwards for design tasks and for enquiries regarding wear, corrosion, materials selection and spare parts.

Even the submarine base in Neutral Bay, Sydney, was a copy of a RN submarine base and the organisational arrangements were copied from the RN. So too, was Cockatoo Dockyard, which was a copy of UK shipyards, and run by Vickers of Barrow.

At the time of the transition to Collins, Naval engineering had been hollowed out following a series of efficiency reviews. The connection with the UK had been severed over the years and Australia took on the full responsibility of all that it had previously learnt from the UK. However, the full implications of that responsibility were neither acknowledged, nor realised.

The Collins class was a different matter entirely because the design was much more complicated than the Oberon, was a technological jump of at least 25 years, and was completely unfamiliar to those who had to operate, maintain and modify it.

The lack of understanding the challenges of being a Parent Navy led to the falling availability in the Collins submarine fleet, the unreliability, the high costs and the lack of crews which became the subject of the Coles Review.

One example is that the Coles Review reported that HMAS Waller was taken out of service three months early because of a main storage battery that was thought to be un-recoverable. When the battery manufacturer received it, the cell tops had not been kept clean and dry. This simple maintenance procedure had been forgotten by the Parent Navy and three months of submarine availability was lost. There was a need to establish a local design capability to manage upgrades, update and upkeep. Even for maintenance, design certification is necessary to determine if certain levels of corrosion or wear, or fatigue are satisfactory for the next period of operations.

During the service life of a submarine it will need to be upgraded at some point, due to obsolete equipment or because the threat has increased. An upgrade requires the original designer to be involved for anything more than a minor modification. This is because there are margins designed into the submarines for weight and stability, power and cooling. A change to one system will affect nearly all others and the result is that the submarine becomes unbalanced, or the new equipment won’t fit in the space, or the batteries and generators can’t handle the new loads. The design then requires several iterations to refine it before it can be accepted. This is not a simple task.

A Parent Navy must understand that it is the end of the line – it must understand the issues, set the aims and objectives, pay for the changes, and ensure that design certification is assured, and that the design intent is preserved. Failure to do that will result in the mess that brought about the Coles Review.

**Economic Impact**

An economic analysis was commissioned by the Economic Development Board of South Australia from National Institute of Economic and Industry Research (NIEIR). The analysis builds on the following assumptions:
• All $ figures are 2014 AUD unless otherwise stated.
• The figures in the report are based on the assumption of fixed public sector deficit targets requiring cuts in government expenditure domestically to fund the overseas purchase of the submarines.
• Light maintenance is undertaken in Australia under both scenarios.
• Heavy maintenance, including upgrading as new technology becomes available, is undertaken in Australia only if the submarines are built here, creating the required technical capability.
• A 40-year program life is assumed in both scenarios. It is necessary to model the full program life to pick up the full impact of creating the domestic capability to undertake heavy maintenance.
• The total cost of construction and maintenance in Australia is assumed to be the same as that of overseas construction, namely, $20bn.
• AUD exchange rates of 0.92USD have been used in the calculations. Assuming that the AUD is currently overvalued, the benefits of local production will be increased if this exchange rate normalises to purchasing power parity. Conversely, at a more competitive exchange rate of 70 cents per $US, the impact of an overseas build could be up to 30 per cent worse.
• Under the build in Australia Scenario, for every one percent increase over the budgeted cost, the net benefits are reduced by one percent. This means it would have to cost twice as much to build in Australia compared to building overseas before it would be equally beneficial to build overseas.
• Construction is undertaken at Techport in Adelaide, South Australia and all the heavy maintenance at Henderson in Western Australia, but goods and services are drawn from many Australian and overseas regions.
• The loss of automotive construction in Australia generates enough surplus capacity in the Australian labour market economy to ensure that the Australian economy does not hit any capacity constraints from undertaking local construction of submarines.
• A slowdown in mining-related construction in WA also generates enough surplus capacity for the Henderson program. The model includes an estimate that the build in Australia Scenario would utilise only 11.4% of the surplus capacity created by auto sector closures.
• Because virtually no capacity constraints are anticipated in the labour market, the program is not expected to stimulate additional wage increases. For this reason, the Australian 567-local government region input-output model has been used, rather than a computable general equilibrium model.
• There is a “knowledge spillover” effect from the increased range of competencies of local firms that result from domestic construction. For example, Professor Gunnar Eliasson\(^\text{18}\) has estimated that the JAS 39 Gripen multi-role combat aircraft project in Sweden generated a spillover multiplier of 2.6 on the development component alone. For the purposes of this report, a conservative multiplier of 0.7 has been applied to the local R&D and material spend. This means that $7 billion spent on Australian R&D and materials will increase GDP by $5bn. Using total local expenditure on the submarines as the base, this result is consistent with a spillover multiplier of 0.4. There are numerous cases, from the Collins program of Australian companies developing new technologies and new capabilities that indicate that this $5bn number underestimates the spillover effects.

The program characteristics are assumed as per the following table:

| Development cost for a submarine that fulfill Australian requirements inclusive of Manuals, Training & Maintenance documentation development and Production support | 6 million manhours equalling $0.9bn |
| Building of 12 submarines (5 years build time + 1 - 2 years sea trials) new submarine started every 2.5 years | Domestic material cost estimated at $0.5bn imported material cost estimated at $0.25bn Manhour costs estimated at $0.375bn dropping to $0.27bn for the twelfth submarine due to experience curve effects. |
| Sustainment: DCM Including capability Upgrade after 10 years of operation ICM Including capability Upgrade (level 1 annually, Level 2 after 2 years of operations, Level 3 after 5 years of operations) | DCM: Manhours $135m, domestic material $90m, international material $45m ICM: Annual: Manhours $1.5m, domestic material $1m, international material $0.5m ICM: After 2 years of operations: Manhours $12m, domestic material $8m, international material $4m ICM: After 5 years of operations: Manhours $24m, domestic material $16m, international material $8m |
| If Japanese solution no DCM and only low level ICM but instead new submarine after 16 years | |
| If build in Australia solution all build in Adelaide (including first in class) and all sustainment in Sterling | |
| Program Duration | 40 years total |

Based on the above a comparison between the following two scenarios is made:

- **Scenario 1:** Build all 12 submarines overseas, with Australia retaining only the light maintenance over the 40 year life of the project.
- **Scenario 2:** Build all 12 submarines in Australia with both heavy and light maintenance being undertaken locally over the 40 year life of the project.

The key findings for:

- **Scenario 1:** Build overseas are:
  - A $29 billion negative impact on Australian GDP over the 40 year life of the project (≈$730 million annually).
  - Government debt would have to increase by at least $20bn to pay for the overseas submarines with minimal return to the local economy. These funds could otherwise have been used for domestic projects.
  - Adding to job losses in the auto industry, importing submarines is likely to result in 260,000 man years lost to Australian workers over the 40 year project.

- **Scenario 2:** Build locally are:
  - Building locally will still have a negative impact on the Australian economy because the direct import content of the submarines is about one third of the total material cost, compared to negligible imports for current government expenditure. However, the size of that negative impact is estimated at $8.2 billion on Australian GDP over the 40 year life of the project (≈$200 million annually).
  - Adding to job losses in the auto industry, building submarines locally is likely to result in only 140,000 man years lost to Australian workers over the 40 years of the project.
Detailed cost data on building overseas and locally has been gathered and checked with numerous Australian and overseas experts. The overwhelming conclusion is that it will cost no more to build locally. This is partly because Australia has a unique set of operating environments and requirements - there is no off-the-shelf solution available, and partly because there are only four potential international partners to build the submarines (Germany, France, Japan and Sweden) and they are all high cost countries.

The conclusions on these very conservative assumptions is that Australia as a country is at least $21bn better off to build in Australia than to purchase overseas in addition to creating 120,000 man years of additional jobs in the economy over the life of the project as compared to building overseas.

**Effect of Differing Design Philosophy**

Every complex system and submarines are as complex as it gets, have to be designed using a well defined design philosophy. The initial design phase of a submarine includes both the system definition and the preliminary design activities. In this initial phase (frequently known as the conceptual design phase) the design team work to understand and specify the context in which the system will be put to use, the environment in which it will be used, the mission that it is to execute and the tasks that any operator will have to conduct as well as physical, technical, cost, time and human information processing factors. In this phase the design philosophy is developed and locked in, and once locked in it is not possible to change. The design philosophy is fundamental for the continued work and has far reaching consequences for the way the system will be operated and can be operated during its life since this design philosophy provides the rationale for any given design element and provide the basis for any specific requirement e.g. “Hand gripping surfaces that minimize abrasion to the EVA glove material shall be provided on handles of tools” (NASA, 1995).

The design philosophy provides the “regulatory framework” that all elements will have to adhere to e.g. if the design philosophy for the pilot display in a fighter plane is to provide situational awareness information in a status-at-a-glance format to minimize pilot head-down time, a display sub-system that provide precision control information by which the pilot is expected to control the aircraft would be rejected as it violates the underlying design philosophy and thereby the intended usage. This is why, in the design process, each design decision has to adhere to and align with the underlying design philosophy.

As the project moves into the design implementation phase, prototypes (real or simulated) are developed, evaluated, and refined based on empirical and/or simulated data and constantly verified in terms of adhering to the design philosophy. This design phase often is collaborative with subject matter experts from many domains working together toward a final design. It is often characterized by group brain-storming sessions and often decisions are revisited iteratively as new data are available to support or refute these decisions, whilst maintaining unchanged the underlying design philosophy.

The next phase is the Design Evaluation and Transfer phase which includes design verification and validation as well as the transfer of design information for a variety of purposes including the development of training or instructional materials, procedures for operational use, system manufacturing, or design modification. Design verification refers to the process of confirming that the system has been designed as specified and that the design output meets the design input guidelines and adheres to the design philosophy, whereas validation refers to the process of checking that the design output addresses the users’ needs and intended uses. In essence, design verification and validation serve as the checkpoints for a good design. In order to accomplish design verification and validation, one needs access to the rationale behind the design process. Often a design can only be evaluated via the design trace. For example, two designs may seem comparable; however, they may differ with respect to the design process used. One may have undergone a more
thorough design and evaluation process and the decisions may be based on a more solid empirical foundation, which would otherwise be invisible to those removed from the design process.

One of the fundamental differences in design philosophy between the Japanese option and the other options on the table lies in the approach to operational life-cycle and sustainment. Whereas the other options are designed for life extension and continuous upgrades the Japanese option follow a build-use-scrap design logic which does not require any sustainment outside the type of operational maintenance executed by the Navy at sea or in port (including battery change). This means that the Japanese hull e.g. is designed for a fatigue life time of approximately 20 years that cannot be extended, whereas the other options are designed for a fatigue life time of twice that with extension and sustainment. This also means that there is no sustainment needed for the Japanese options and a new submarine will have to be procured after 16 years or so to ensure that there is a maintained “boat-in-the water” for 40 years, i.e. two new Japanese submarines equals one life extended submarine based on the normal western approach with differing cost calculation over the 40 year cycle.

The conclusion is that with the Japanese option there will be no work in the Australian sustainment shipyards and they will have to be closed down.

**Economic Complexity Effect**

The industrial commons is normally defined as the embedded knowledge, technology capabilities, specialised equipment and specific co-specialised assets that enhance the efficiency, effectiveness and productivity of the proprietary capital and labour that use it. This industrial commons does not reside in one organisation but is spread out over a large group of organisations and individuals but normally within a limited geographic domain. A broad base of industrial commons with different domain expertise and located in different geographies across the country provides a basis for a high level of economic complexity. Hence, the complexity of an economy is related to the multiplicity of useful knowledge embedded in it. This emphasises the fact that modern societies are able not only to amass but also to utilise effectively large amounts of productive knowledge, because of it being distributed in modules amongst members of society.

Economic complexity is therefore expressed in the composition of a country’s productive output and reflects the structures that emerge to hold and combine knowledge. To be fully utilised, different knowledge need to come together in diverse combinations in teams, organisations and markets. It is these various teams, organisations and markets that allow the diffusion and use of this knowledge across society and globally, and that provide on the one hand the networks that allow increasing degrees of specialisation, whilst on the other hand ensuring that the outputs of this specialisation can be absorbed and used.

Increased economic complexity is necessary for a society to be able to hold and use a larger amount of productive knowledge vested in many individuals and networks). That means that to be utilised fully, knowledge needs to be organised through a social process into organisations, markets and institutions as modules. This complexity then consists of:

- Increasing levels of specialisation and technical sophistication and organisation of knowledge into modules, and
- Their complex combining and coming together in institutions, enterprises, markets and organisations.

This productive knowledge is not only formal but also tacit, and hence hard to acquire. It is not tradable, nor can it be priced in the normal sense. It is clustered around and embedded within organisations, markets, institutions and their networks and referred to as the “industrial commons” when limiting it to manufacturing only. For those countries and regions that do acquire and hold it, it becomes a basis for competitive advantage distinct from standard price-based competition. It is therefore evident in those high cost manufacturing economies that succeed regardless of low cost
competition, and is of vital importance to all countries and specifically to countries like Australia, that have become high cost economies and are in clear danger of losing significant manufacturing capabilities, unless they undertake accelerated transition to advanced manufacturing activities.

The higher the economic complexity, the easier to transition into advanced manufacturing since this requires the interaction and combination of the knowledge of specialists e.g. designers, marketers, finance specialists, engineers, technology experts from various disciplines, human resource managers, legal experts, environmental scientists, specialists from the social sciences, etc.). Where these inputs are missing, it is not possible to make products of the same complexity. Making advanced products involves interdependencies requiring cooperation amongst and between individual actors.

The more these interdependences can be located within a nation or region, the more that nation or region’s economy has the potential to capture the benefits of the activity or sector in locally based complex value chains. Building these networks embodying key capabilities, including leveraging demand along high growth value chains is a central task for policy.

In order to achieve a high Economic Complexity Index an economy has to have a high presence of product groups or communities requiring or generating high complexity.

Manufacturing is critical for a country’s ability to achieve high levels of economically-useful embedded knowledge and hence for its ability to capture value from economic activities and to grow both employment and GDP over time. An economy with a high economic complexity has a higher probability of benefiting from a random entrepreneurial event than one with low economic complexity. In the latter economy, the entrepreneurial event will engage lead customers and access specialist suppliers in places with high economic complexity and this will over time lead to the entrepreneurial start-up firm migrating to the economy with the higher economic complexity and larger economic scale.

The countries with the highest Economic Complexity Index are in order Japan (2.3), Germany (2.0), Switzerland (1.9), Sweden (1.9), Austria (1.8), Finland (1.7), Singapore (1.6), Czech Republic (1.6), United Kingdom (1.6), Slovenia (1.5) and Korea (1.5). These are then followed by e.g. the US (1.4) in the next group, whereas Australia is ranked as number 79 with an Economic Complexity Index of -0.3.

Example of product groups with high economic complexity are: Machinery (2.54) and Electronics (2.25). Defence systems that are made up of more than one product group hence the term system) will have an even higher economic complexity with the highest being space re-entry vehicle systems followed by submarine systems both well over 3, and lower down on the list fighter planes with a complexity level of around 2 in economic complexity terms.

The impact of building the submarines overseas will be a decline in Australia’s economic complexity and hence in its future value creating potential. The size of this reduction is estimated to around 3%.

**Employment**

“According to research from the University of Oxford, technology will replace close to half of all low knowledge-intensity jobs over the next 20 years.”

“Countries that do not support the growth of technology-based industries will increasingly find that their economy is dominated by low value, low knowledge-intensity jobs that service high value industries in other countries.”

In order to generate employment in new industries with higher productivity which the productivity commission is so fond of claiming is a natural occurrence) a number of things must happen:
• Productivity enhancing skills and technologies must be disseminated across industry – The procurement of advanced complex defence systems with a domestic system integrator does this.

• The economic complexity of the nation must be high enough and the depth of the relevant industrial commons must be deep enough to enable the commercialisation of identified productivity enhancing opportunities in either start-ups or existing businesses. The procurement of advanced complex defence systems with a domestic system integrator does this and in shipbuilding generally and submarine building and sustainment specifically Australia have a deep enough industrial commons.

• In addition, the procurement of advanced complex defence systems with a domestic system integrator contributes to the following productivity drivers: R&D capital formation; higher-quality general labour and capital inputs; increased capabilities relating to key enabling technologies; increased managerial competence and capability together with managerial practices; improved innovation volume and success rate; demand for sophisticated solutions.

All of the above will generate employment in emerging advanced firms with high productivity. On the one hand this can potentially decrease employment in firms operating in mature industries, on the other hand it creates the option for these firms to enter new industrial domains resulting in increased employment.

This can be illustrated by two examples:

• Around nine in every ten of the Australian suppliers sub-contracted for the Navy’s Minehunter and ANZAC projects were SMEs – the skills acquired during those projects have had positive, long-term impacts on their ability to offer technologically advanced, innovative goods and services to other industries for years to come.

• Secondly, the Australian company Bisalloy Steel supplied the Collins program and Australia’s Bushmaster armoured vehicle programs by creating a superior steel product. This world-leading product was achieved through a collaboration between the firm, the customer and the Defence Science and Technology Organisation. Bisalloy’s steel is now used in the US, India, the Middle East and Asia and export sales have grown significantly.

We have some employment data of relevance to the Future Submarine Project:

• The Collins Class through Life Support (TLS) project, signed in 2012, contributes around $150 million and 1400 jobs to Australia’s economy every year. Or converted it would equal to 112,000 FTE man years over a 40 year period for 12 submarines.

• The UK Astute class nuclear submarine class construction draws on around 1200 firms of which 400 are project specific and 150 are tier one suppliers. This equals a FTE range of between 15,000 and 25,000 depending on how many of the low-end service providers you include. Converted to a non-nuclear submarine build of 12 submarines over a 40 year period this would equal approximately 2/3*12*15,000-25,000 = 120,000-200,000 FTE man years.

Assuming that the same work force does the build and the sustainment and staying with the lower numbers we would estimate the number of FTE man years to around 115,000 which fits the economic models estimate of 120,000.

**Coordination Costs**

Working with partners costs money due to the need to coordinate work across organisational, standards, linguistic and cultural barriers. This has already been experienced in the Navantia AWD case where it can be measured in the hundreds of million dollars, and this in an environment where both sides had experience of this type of cooperation and the distances on the different dimensions between the parties was medium and reasonably well understood. In the case with Japan where the
distances on all the identified dimensions are very large and where at least one party have no experience in working with partners this is expected to result in a cost overrun in the billions.

These problems were alluded to by the Japanese Ambassador in his recent commentary\(^\text{19}\) on the potential Sōryū-Class procurement by Australia.

A suitable mitigation strategy will have to be developed to manage the coordination cost risk.

**Currency Risk**

Procuring from overseas with an Australian dollar that is technically overvalued by around 30% is a high risk proposition unless hedging is done. Hedging poses the problem of both a high hedge cost and at the volume discussed i.e. $20bn and the time period of 20 years, a substantial counter party risk. This provides a very real cost that the Japanese cost initially understood to be around $20bn may actually be substantially larger taking into account the hedging cost and the monetary volume and the counterparty risk means that a hedge may not even be possible exposing the purchase to a real risk of at least a 30% cost increase if the Australian dollar achieves a more normal level against the US$.

**Project Commencement Risk**

It can probably be safe to say that the decision to buy from Japan will not be taken in Canberra but instead in Tokyo and not only by the Japanese political system (since 1994 Japan has had 12 prime ministers) including getting the Japanese Navy and the Japanese Ministry of Defense to support a decision, but also by the Japanese industry who may decide that they do not want to share their most sensitive secrets with Australia if they perceive that there is a risk that they may leak to the US and/or to PRC. This means that any deal is far from made even if Canberra decides to proceed. This means that the Australian Commonwealth Government will have to pursue more than one alternative to avoid a capability gap.

**Sovereign Capability**

‘Sovereign capability’ here means the ability to ensure, under full national control and without reliance on any direct foreign assistance, the execution and sustainment of national security operations. This will require:

- Sufficient numbers of highly capable and competent staff
- Defence systems with the required capabilities and operational availability
- Domestic capabilities to support and sustain these defence systems

The extent to which industry is critical to sovereign capability is frequently not realised in the public debate. Without local industry expertise, it is impossible to sustain operations.

For Australia, being an island nation with 6 marine choke points, submarine systems are one of, if not the most important advanced complex defence system. Hence one of the fundamental requirements on a partner to Australia in any submarine project is that they must have a design office in Australia, they must transfer IP to Australia and have a substantial Australian industry participation plan. This requires that competitive tension between contending builders is created to transfer technology and help build competitive Australian industry capability. This can, and must, be built into the procurement process if you want to accomplish the defence objectives of self-reliance for an island continent, and achieve the optimal balance between value for money and sovereign capability.

The requirements in any submarine project must then be that when you partner with Australia in this major defence submarine project it is necessary to ensure that you work to ensure that Australia develops the sovereign capability to develop, engineer, build and maintain the people, platform and

\(^{19}\) As reported in The Australian on 29 Sep 2014
infrastructure required for the submarines of the future. And you do it in the most cost effective way possible. This is the only way to ensure self-reliance and protection of the nation’s fighting forces.

If the submarines are built overseas with no capability in Australia for through-life-support then they will have to go back to the country of origin for any form of service, upgrade or modification which may not be possible in a scenario where China has an interest in neutralising Australian submarine capability.

IP is managed through Government to Government agreements and through commercial agreements. Protections and instructions for use are made clear in the agreements, including end-user agreements where the end-user promises how the IP will be treated and protected. It is not necessary to own the IP, but to have unfettered use of it, providing it is not passed to competitors of the originator. This is normal business.

With sensitive technologies, those owned and controlled by Governments, a Government to Government agreement must be reached. This was the case for Collins during the original build (Aus/Sweden and Aus/US) and for later combat system upgrades (Aus/US).

Submarine technical data is generally at the top of the list for protection and prevention of leakage to third parties, especially foreign countries and those who might use the technology in their own designs for export. In the case of US sensitive technical data exchange, there are very strict rules for access, including on the submarines, the build site, the maintenance site and in test facilities where those technologies are in use.

The US (and this will be the same for any country offering sensitive technology to Australia) will not permit companies not of Australian origin or ownership to have access to its technical data in accordance with the Government-to-Government agreement. The Australian Government will be required to uphold this protection and report any breaches.

Being a fully Australian owned Government Business Enterprise (GBE), ASC has the right set-up to hold, use and protect data, where-ever the source country. This is not the case for shipyards not Australian owned and special arrangements will need to be sought from the source of the technical data. Whether or not it is allowed is a matter for the source country, however, there have been difficulties with this in the past: Replacement Combat System for Collins in 2000 – when Krupp Atlas won this tender, the project was terminated by the Government due to “strategic reasons” and it became front page news.

One of the fundamental requirements on a partner to Australia in any submarine project is that they must have a design office in Australia, they must transfer IP to Australia and have a substantial Australian industry participation plan. This requires that competitive tension between contending builders is created to transfer technology and help build competitive Australian industry capability. This can, and must, be built into the procurement process if you want to accomplish the defence objectives of self-reliance for an island continent, and achieve the optimal balance between value for money and sovereign capability. You can then further strengthen this through different government-to-government agreements.

**Procuring Off-the-shelf**

DMO is tasked with securing the equipment-related aspects of Australia’s sovereign capability and this includes managing the four different procurement situations differently.
Australia’s sovereign defence industrial capability will diminish over time if off-the-shelf (OTS or MOTS) procurement leads to an increase in the number of solutions being supplied and supported from overseas (this is likely to start being seen in the aircraft domain relatively soon). OTS or MOTS procurement of advanced and complex defence systems will not necessarily attract competition, especially not if they are FMS procurements. With a reduction in defence spending flowing through to domestic industry, there is a high probability that a significant number of future solutions will be supplied from overseas e.g. the supply vessels from Korea. This prospect will, over time, dilute Australia’s sovereign defence industrial capability and diminish the levels of investment, development of future Australian technologies, and the ownership of intellectual property and design authority. This will undermine the ability of industry as well as the capabilities of the defence force and reduce our sovereign ability to adapt, integrate and improve equipment.

There is a frequently articulated but erroneous view that the advantage of OTS or MOTS procurement lies in avoiding development costs, except where modifications have to be included for legal and mandatory reasons. However, MOTS/OTS usually requires compromises in performance, characteristics, cost of ownership and sovereignty. The advantages to the end-user are shortened delivery timescales, possible use of established training systems and other user operational support equipment. The downside is that desired modifications may not be possible or affordable. Finally, the dialogue throughout Australian industry will not largely be available except through consultants. There will be little incentive for Australian defence contractors to invest large sums of money to develop the next generation of off-the-shelf equipment – in the hope that someone will buy it – you cannot sell defence equipment on the global market unless your own forces use it.

There are three types of procurement:

1. **New Builds or Highly Modified Builds** (e.g. Future Submarine)
2. **Modified) Military Off the Shelf** (e.g. UAVs, LAND 400, JSF)
3. **Off the Shelf** (e.g. Small calibre ammunition)
4. **Customised One-Off Designs** (e.g. New bespoke computer system)

The number of true OTS or MOTS procurements that can be made decreases dramatically with the increase in system complexity, technological complexity and uniqueness of requirements. This leads very quickly to a situation where many so-called OTS or MOTS procurement situations (i.e. situation ③ above) become in effect, situations with procurement from one monopoly supplier (e.g. JSF) or very few suppliers with often intertwined supply chains (e.g. LAND 400) leading to a requirement for a different approach to procurement. It is also worth pointing out that it is quite common for OTS or MOTS procurements to, through modification requirements, end up having a higher cost than that of a specifically developed solution i.e. procurement situation ② can become cheaper than situation ④ but both are more expensive than a situation ③ with many alternative suppliers, but
situation ③ rarely occurs in complex advanced defence systems due to the monopoly situation that may make them more expensive than situation ②.

Two examples from the UK can be used to exemplify the above:

- The ASTUTE class submarine, despite its delays and cost over-runs, is estimated to be cheaper than an off-the-shelf acquisition of a similar submarine from the USA.
- The Nimrod R replacement and REAPER, have systems that will be controlled fully by FMS and ITAR regulations. Neither provides value to UK industry, nor do they stimulate investment in research.

Finally procuring OTS or MOTS actually means buying from someone else’s shelf which leads to four problems:

- Problem Number 1 – None on the shelf: The supplier is out of stock, no longer produces the product, has been taken over by some else with different priorities for the use of the equipment required to produce the good, or the supplier may no longer be around.
- Problem Number 2 – You can only buy them from us but we don’t have any, sorry: The supplier may have to priorities its own domestic defence customer and has no spare capacity to serve us leaving us on a waiting list with unknown waiting time.
- Problem Number 3 – You can only buy them from us but we will not sell them to you since we do not agree with what you are using the equipment for, sorry: severely limiting our operational capability.
- Problem Number 4 – Your MOTS is not the same as our MOTS: This can cause unforeseen compatibility problems in interfacing complex systems and hence limiting operational efficiency and effectiveness

**Strategic Relationship Issues**

Purchasing from Japan will contribute to an increasingly complex relationship with PRC. Even acknowledging the role and interest of the US in this we must understand the consequences for Australia on the geopolitical stage. What will the impact be on the free trade agreement negotiations and other economic relationships between Australia and China?

**Additional economic arguments for developing and building in the future submarine together with a foreign partner in Australia:**

1. Military off the shelf procurement of advanced complex defence systems generates minimal or no economic benefits.
2. The economic benefit realised from the development and production of advanced and complex defence systems is directly proportional to how competent and demanding the customer of these systems is.
3. The presence of a sophisticated defence industry accelerates the dissemination of productivity enhancing knowledge and practice to the broader industrial base.
4. The higher the domestic entrepreneurial capacity, the higher the realised economic benefit of the development and production of advanced and complex defence systems.
5. The higher the economic complexity of the nation and the deeper the industrial commons of the relevant industrial domain, the higher the realised economic benefit of the development and production of advanced defence systems.
6. Smart public procurement practice is a basis for the realisation of economic benefit of the development and production of advanced defence systems.
7. The economic benefits of the development and production of advanced defence systems to the country far exceeds the cost.