Submission – The future of Australia's shipbuilding industry

Executive summary – Key points

The AMWU seeks to maximise the number of Australian jobs that will be created through the substantial naval defence procurement that Australia is embarking upon over the next 30 years. These jobs will be filled by highly skilled workers whose expertise will play a key role in the building, maintaining and sustaining Australia's submarines and surface vessels.

It is critical that the benefit from Australian industry participation and the subsequent spillover effects for the Australian economy are realised. To achieve this, it is vital that the government ensure that Australian industry involvement is included in the contracts with foreign primes.

Development of Contracts Relating to Naval Ship and Submarine Building

In relation to the Future Submarine Project, the contract that is signed with DCNS for the Shortfin Barracuda Block 1A must encourage and require where practical DCNS to open up and transfer its expertise and intellectual property into the supply chain of Australian firms. In addition, the government should develop a sovereign capability strategy that includes:

- Identifying the competencies that the government wishes to designate as required for sovereign capability;
- Identifying the Australian firms that will be required to hold these competencies;
- Ensuring the transfer of both know-why and know-how to these firms from foreign primes;
- Ensuring that this competence is both maintained and developed throughout the operational life of the Shortfin Barracuda Block 1A;
- Establishing suitable reporting requirements for DCNS in relation to sovereign capability building, local content, and spillovers into the Australian economy;
- Establishing appropriate measurements for the reporting of Australian content in the Shortfin Barracuda Block 1A by measuring local content as Australian value added plus input less any overseas input;
- Investing in making Australian firms "digital supply chain ready" and ensuring that local digital infrastructure does not become a barrier for these firms participating in the digital supply chain;
- Ensuring that all design and build activities are executed in Australia under Australian control grounded in reasons of national security, sovereign capability, and national economic benefit.

Introduction

The Australian government has a clear responsibility to participate in the planning and execution every part of its naval defence procurement. It is vital that a long-term view is adopted to ensure that the country gets the largest benefit from this spending. This begins with the structure of the contracts, continues with decisions around local content requirements in the design and build phase and includes the repair, maintenance and sustainment of the finished submarines and surface vessels. Taken together, the total spending on all of these activities over the next 30 years presents a huge opportunity to deliver significant security, economic and industrial advantages for Australia.

To get the best out of our defence procurement spending, Australia must maintain a higher degree of technical knowledge of how to how to manage build, maintain, repair and upgrade activities. We must also ensure that all the relevant skills are captured, maintained and built upon to deliver continuous improvement throughout the vessels' lifecycles.

Developing a sovereign capability for high tech systems (like submarines and surface vessels) requires changes to manning, employment, skill requirements, training, logistic support and management. Australia must acquire the ability to perform the full design, development, test and evaluation functions for both the construction phase and for the operational life of our vessels, some 40-50 years.

Having had a long history where we have not maintained a sovereign capability for all of our naval assets, it is imperative that the learning from the mistakes made in the Collins acquisition are not repeated in the Shortfin Barracuda Block 1A project.

If Australia's future submarines are built overseas with no little or no capability in Australia for through-life-support, the RAN will have to go back to the country of origin for any form of service, upgrade or modification, which may not always be possible.

Intellectual property should be managed both through Government to Government agreements and through commercial agreements. Protections and instructions for use must be made clear in the agreements, including end-user agreements. It is not necessary to own the IP, but to have unfettered use, to modify and develop it to improve our vessels through their operational lives.

With sensitive technologies, including those owned and controlled by Governments, a Government to Government agreement must be reached. In the case of sensitive technical data exchange, very strict rules for access need to be in place and an Australian owned Government Business Enterprise like ASC is ideally placed to protect this type of data.

The development of contracts relating to naval ship and submarine building

Three of the fundamental contractual requirements on France as a partner to Australia in the Shortfin Barracuda Block 1A project is that they must have a design office in Australia, transfer IP to Australia and have a substantial Australian industry participation plan. This plan will help build competitive Australian industry capability as well as sovereign capability.

These features must be built into the procurement process if the government wants to accomplish the defence objectives of self-reliance for our island continent, while also achieving the optimal balance between value for money and sovereign capability.

Without a local design capability, Australia will be increasingly reliant on military-off-the-shelf purchase for our military equipment. Moving down this route will, over time, dilute Australia's sovereign defence industrial capability. This will undermine the ability of industry as well as the capabilities of the defence force and reduce Australia's sovereign ability to adapt, integrate and improve equipment.

There is a frequently articulated, but erroneous, view that the advantage of off-the-shelf procurement lies in avoiding development costs. However, off-the-shelf products usually require compromises in performance, characteristics, cost of ownership and sovereignty. The advantages to the end-user are shortened delivery times, possible use of established training systems and other user operational support equipment. The downside is that desired modifications may not be possible or affordable, especially as reliance on off-the-shelf procurement will result in a declining Australian defence industry with the associated reduction in sovereign capability.

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 when all economic effects are taken into account. This in addition to the sovereign capability benefits.
- 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.

An over-reliance on off-the-shelf procurement will act as a disincentive for the Australian defence industry to invest and develop the next generation of products, as it is extremely difficult to sell defence equipment on the global market without the support of your own country.

The number of true off-the-shelf 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 off-the-shelf procurement solutions either require heavy modification, or simply fail to meet our requirements. It is also worth pointing out that it is quite common for off-the-shelf procurements to, through modification requirements, end up having a higher cost than that of a specifically developed solution.

It also has to be remembered that procuring off-the-shelf actually means buying from someone else's shelf which can lead to problems:

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, or the supplier may no longer be around.
2. Monopoly provider, out of stock: The supplier may have to priorities its own domestic defence customer and has no spare capacity to serve us.
3. Monopoly provider, change of mind: For strategic, diplomatic or legal reasons, suppliers may no longer be willing or able to sell products, parts or services for our material which would severely limit our operational capability.
4. They don't make them like they used to: This can cause unforeseen compatibility problems in interfacing complex systems and hence limiting operational efficiency and effectiveness

The learning from the mistakes in other submarine projects, as well as other relevant programs, should be incorporated in the way the Shortfin Barracuda Block 1A project is executed[1].

As the types of naval defence procurement projects being considered by the government vary, so should the contracts that underpin them. The dimensions that impact the optimal contract type are:

- Uncertainty around the product (this is high for the Shortfin Barracuda Block 1A and low for small calibre ammunition): The risk here is that the product as designed does not meet the client's needs or that it is unknown how the product will perform once built
- Uncertainty around the process (this is high for the Shortfin Barracuda Block 1A and low for small calibre ammunition): The risk here is that the process does not deliver the product as designed.
- Situational and Contextual Complexity (this is high for the Shortfin Barracuda Block 1A and low for small calibre ammunition): The risk here is that the client's needs change from what was originally envisaged, or there are multiple stakeholders with different or unclear needs or that the context is highly dynamic and will likely change over time.
- Ability of customer to contribute (this is low-medium for the Shortfin Barracuda Block 1A and high for small calibre ammunition): The fundamental risks here is that the client is unable to contribute and hence have provided the wrong specification that is only discovered too late in the project.

The conclusion from the literature is that the contract form chosen must be relevant for the product uncertainty, process uncertainty, complexity and customer contribution situation.

The design, management and implementation of naval shipbuilding and submarine defence procurement projects in Australia

Australia must have 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 is known as "Sovereign capability". 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.

---

[1] see e.g. Commonwealth of Australia, 1992; Hall & Markowski, 1996; Commonwealth of Australia, 1997; 1999; McIntosh et al., 1999; Hartley, 2001; Woolner, 2001a; 2001b; Thomson & Harrington, 2002; Arena et al., 2005a; 2005b; 2005c; Birkler et al., 205a; 2005b; Bush, 2005; Kelton, 2005; Mitchell, 2005; Schank et al., 2005a; 2005b; Gregory, 2006; Markowski et al., 2008; Mortimer, 2008; Skinner, 2008; Yule & Woolner, 2008; Australian National Audit Office, 2009; Wylie & Markowski, 2009; Woolner, 2009; Birkler, 2011; Birkler et al., 2011a; 2011b; 2011c; Briggs, 2011; Bushell, 2011; Coles, 2011; Davies & Thomson, 2011; Rizzo, 2011; Schank et al., 2011a; 2011b; 2011c; Coles et al., 2012; Morris, 2012; Birkler et al., 2013; Byers & Webb, 2013; Hughes, 2013; Stewart & Ablong, 2013; Australian National Audit Office, 2014; Coles et al., 2014; Senate Economics References Committee, 2014; Birkler et al., 2015; Hause & Hallett, 2016; Ritchie; 2016

As an island nation, Australia's submarine systems are one of, if not the most important advanced complex defence system. One of the fundamental requirements on France as a partner to Australia in the Shortfin Barracuda Block 1A 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 must be built into the procurement process and be reflected in the final contract if the government wants to accomplish its defence objective of self-reliance for an island continent, while achieving the optimal balance between value for money and sovereign capability.

The requirements on France in the Shortfin Barracuda Block 1A project is that France work to ensure that Australia develops the sovereign capability to design, engineer, build and maintain the people, platform and infrastructure required for the Shortfin Barracuda Block 1A. This is the only way to ensure self-reliance and protection of the nation's fighting forces.

In order to build the industrial capability necessary for maintain sovereign capability Australia must:

1. Map out the existing supply chain where the product is produced overseas (for example, for the Scorpène-class and the Barracuda-class submarines in France).
2. Once the supply chain is mapped out, for each firm designate it as belonging to one of three categories:
    a. Category A: firms providing input that falls within the domains designated as sovereign capability critical for Australia. For each of these firms a corresponding Australian firm must be identified and designated as the recipient of the relevant IP (both the "know-how" but even more importantly the "know-why" which necessitates the participation in the relevant project from day 1).
    b. Category B: firms that provide non-critical input that is available from multiple suppliers. Here a normal tendering process can be used to select the Australian supply chain participants .
    c. Category C: firms to provide critical complex system, sub-system or component input that will never be manufactured in Australia. For these firms a security of supply agreement will have to be reached requiring them (or not as the case may be) to establish themselves in Australia with the capability to contribute to the sustainment throughout the operational life of the vessels.

3. Establish suitable reporting requirements for sovereign capability building (by supplier auditing), local content (this needs to be done in a way that avoids the Australian shell company approach so common in the mining industry and also in the Collins project) and spillovers into the Australian economy (a best practice example of this latter reporting is the one required by the Swedish Defence Procurement Agency (FMV) of SAAB in the Swedish JAS Gripen project)
4. Establish and implement an ongoing strategy for securing sovereign capability as relates to naval defence procurement throughout the operational life of the vessels. This will necessitate:

a. A contractual structure between the provider of the IP and the recipient of the IP that allows the recipient to provide input on a higher and further developed capability level than it received originally – for example, during mid-life upgrades.
b. Budgeting for study and prototype projects that can be commissioned by the government from any critical sovereign capability holding firm so that its capacity and capability is maintained in temporary periods of low utilisation.

The utilisation of local content and supply chains;

The intent must be to maximise local content in the supply chain. This must be real local content that engage local workers and provides them with skills and experience to perform at a high level. In previous projects, local content requirements were met by defining Australian Industry contents as work performed by an Australian company or business that was incorporated in Australia. This allowed for work undertaken overseas was classed as local content where the supplier operated through an incorporated Australian company.

This outcome can be avoided by measuring local content as Australian value added plus domestic input minus any overseas input.

The Australian supply chain must also be made project ready which means a substantial upskilling of the potentially participating firms plus providing them access to suitable capital equipment.

This approach should be included in the implementation of the 2016 Defence Industry Policy Statement. In this document it states "the existing Priority and Strategic Industry Capability policy will be replaced by a Sovereign Industrial Capability Assessment Framework to improve the identification and management of the sovereign industrial capabilities that develop and support our ADF capabilities." We look forward to seeing the operationalisation of this framework in a way that maximises the opportunities for Australian Industry, while ensuring good value for money when the value of sovereign capability and economic spillovers are taken into account.

The integration of offshore design work and supply chains in Australia;

All the design and build work relating to submarines and surface vessels should ideally have to be executed in Australia because:

- It would enable Australia to control and manage the security of the design and performance data of its submarines and surface vessels which is crucial for our national security.
- Only if the design for these projects is executed in Australia and under Australian control will Australia get access to sensitive US military or industrial information
- In order to gain insight into the "Know-Why" it is imperative that all key suppliers participate in the design phase of the these critical projects. This will also make the development of sovereign capability both easier and cheaper.
- In relation to the Future Submarine project, Australia requires a regionally superior submarine which means that as much of the technology in the submarine as possible needs to be developed (or further developed if it is already in existence) domestically or if deemed necessary in cooperation with other key partners in the submarine domain.

These requirements are based on key lessons that the industry has learned from the Collins project and they must be taken into account. Having Australian industry participation in the supply chain from the beginning of the design phase and a clear strategy for handing over both know-why and know-how capability to both Australian Industry and the RAN are key steps in managing the cost and risk of the project in both the short- and long-term.

Opportunities for flow-on benefits to local jobs and the economy

Several studies outline the economic spillover effects of large and complex defence projects for the host country. If these projects are well executed, the economic benefits from advanced and complex defence systems routinely exceed the development costs of these systems because:

- The realisation of such projects 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. These spillovers predominantly originate during the product development phase. That is one of the major benefits from avoiding military off-the-shelf purchasing, as this provides little or no economic benefits. Similarly, if all development work is done overseas there will be little or no opportunity for innovation and entrepreneurial endeavor.
- There will be no new products better and more sophisticated than those demanded by sophisticated and competent customers. Without competent customers who understand what is possible, and the know how to put what is possible to use and the willingingness 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, customers often contribute user knowledge. Defence Science and Technology Group's ability to provide relevant scientific advice and innovative technological solutions is also clearly important here.

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.

Property rights to intangible assets (such as intellectual property) play a role both in stimulating the development of spillover-rich products and services and in commercialising those spillovers. Hence broader economic value created can be supported by policies directed at enhancing the entrepreneurial capacity in this sector of the economy.

The benefits that can be realised from these projects through entrepreneurial activities require a strong advanced manufacturing sector with the capacity to create, identify, and commercialise successful projects.

For public goods and services such as national defence, government is the representative customer of the underlying private demand of its citizens for defence services. Correctly done, the government gets a double benefit, because it is also the main beneficiary of the social value created by the spillovers. The use of public procurement can act as industrial policy, without compromising quality or cost, if it is done effectively.

The spillover effect created by advanced manufacturing is potentially very large. As an example, the JAS 39 Gripen combat jet development program has generated (in the Swedish economy) over and above the opportunity costs, an additional spillover multiplier in the order 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. Swedish society has, in effect, paid nothing for the development of the aircraft and still received significant benefits in return.

Publicly available data identifies a considerable underinvestment in private R&D. This suggests there is a unique opportunity to drive growth in the economy through advanced public procurement of spillover-intensive projects, reinforcing the fundamental importance of projects such as the development and production of advanced and complex defence systems.

Public procurement is directed at acquiring public goods and services that are privately demanded but would otherwise not be supplied. The economic complexity of advanced defence systems is much higher than Australia's average economic complexity and hence would contribute to raising Australia's economic complexity with the associated increase in the ability to generate economic benefits and increased national prosperity.

The idea that government spending creates a multiplier effect for economy benefit was based on the economic theory of John Maynard Keynes. Economic multipliers can be calculated for three distinct areas of the shipbuilding industry's overall economic impact:

1. Direct impacts: employment and activity in the sector itself.
2. Indirect impacts: employment and activity supported down the supply chain, as a result of a sector's companies purchasing goods and services from suppliers.
3. Induced impacts: employment and activity derived from spending made possible by the direct and indirect impacts.

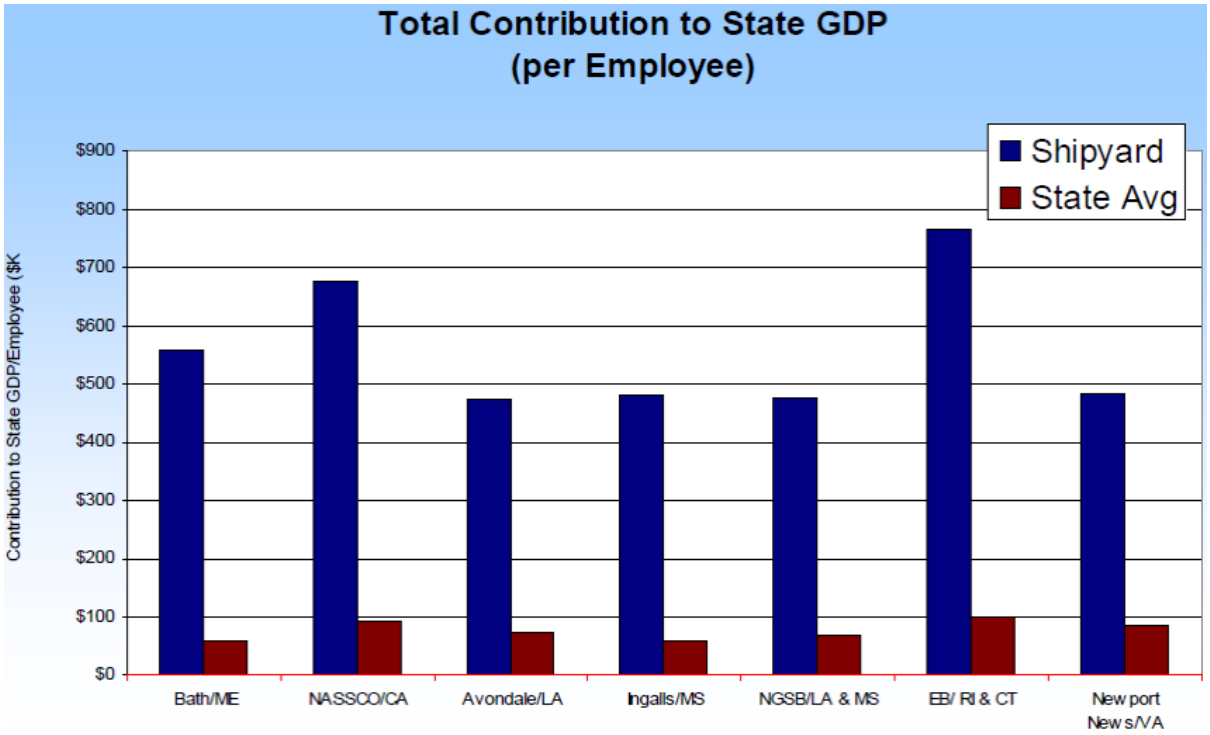
Diverse studies for the whole aerospace and defence sector evaluate the employment multiplier effect (of items 1 and 2 above) to between 2.2 and 2.4 (Duran et al., 2012). Estimations from the USA suggest an average employment multiplier of 2.36 for the US defence industry as a whole, where this multiplier effect is slightly higher (2.96) for the manufacturing of Military Land vehicles (Deloitte, 2012).

Based on US data Meyers (2010) estimates the direct economic impact of an additional $100 Million Output from different sector as:

Sector	Purchases made by the sector in order to produce its final output (M$)	Value Added (M$)	Indirect effects (M$)	Type 1 multiplier	**Induced impact** (employment and activity supported by the consumer spending of those employed in the sector or in its supply chain) **(M$)**	**Type 2 multiplier** (based on an average everything included tax rate of 35% and an average marginal propensity to save of 7%, resulting in a marginal propensity to consume of 93%)
Automobile manufacturing	74	26	97	**2.7**	71 – 242	**3.4 – 5.1**
Aircraft manufacturing	65	35	69	**2.3**	34 - 168	**2.7 – 4.0**
Armored vehicles & tank parts manufacturing	60	40	60	**2.2**	20 - 140	**2.4 – 3.6**
Shipbuilding and repairing	57	43	52	**2.1**	9 - 118	**2.2 – 3.3**
Offices of physicians, dentists, health care practitioners	35	65	25	**1.6**	0 - 20	**1.6 – 1.8**

After carrying out a literature review, the RAND report (Birkler et al., 2015) determined that the economic multiplier effect is around 1.7 in Shipbuilding which, as can be seen, is lower than the values of Meyers (2010).

This multiplier effect is underpinned by US data that indicates that a shipbuilding worker contribute more to GDP than an average worker (Wright & Fields, 2009).



Meyer also looked at the employment multiplier in shipbuilding is 1.45 and 1670 employees needed to generate $100 million of output. This aligns with the findings of Australian studies:

Program	Prime employment (Approx.)	Subcontractor employment	Employment multiplier	Multiplier for total employment effect in the economy	Source
ANZAC	1225	1335	1.52	2.85	Ironfield (2000); NIEIR (1989)
The Mine Hunter Coastal project	1800				Commonwealth of Australia. (2013)
AWD	1800	1200	1.4		Commonwealth of Australia. (2013)

To this needs to be added that the spillover from R&D activities is substantially higher than the spillover from construction and maintenance activities. Building on Eliassons's numbers for the Swedish Fighter project an economic multiplier of 3.6 can be conservatively assumed for the design phase of the fighter plane and since the design phase of a submarine is more complex a higher multiplier can be expected. Similarly, a lower multiplier can be expected for the design phase of a surface vessel. These claims are also supported by the study by ACIL Allen Consulting (2015).

This means that using costs of recent and planned US naval construction projects with the Shortfin Barracuda Block 1A project added (US$) the following table can be constructed

Program	R&D expenditure (including the design phase) ($US bn)	Average unit production cost ($US bn)	Economic spillover from R&D (multiplier 2 for surface vessels and 4 for submarine)	Economic Spillover from Build (mutilpier 1.7) per unit	Number of units to be built	Total value to the economy of spillover less actual or estimated costs given everything produced in country ($US bn)
DDG 1000 Destroyer	7	3.3	14	5.61	3	14
CVN 21 Aircraft Carrier	4.6	10	9.2	17	3	26
Virginia Submarine	7	2.5	28	4.25	48	105
Littoral Combat Ship	2.1	0.65	4.2	1.11	40	21
Shortfin Barracuda Block 1A	0.7 (est)	1.3 (est)	2.8	2.2	12	13

The value to the Australian economy of the spillover effects is a function of the share of the input and value added done in Australia. If all the work is done in Australia, the total spillover effect would be $US13 billion (or $16.85bn in Australian dollars).

If proportion of work is reduced, then the spillover effect is similarly smaller. For example, if 20% of the construction work is done in Australia and the design and R&D is done in France this estimated value of $US13bn will be reduced around $US 1.6 bn. This emphasises the importance of ensuring Australian content, not only from a sovereign capability perspective, but also from an economic perspective.

Sources and further reading

ACIL ALLEN CONSULTING. (2015). Economic Impact Case Studies; Establishing The Broad Economic Value of the Defence Science & Technology Program. Report to Defence Science and Technology Group.

Anderberg, B. & Roos, G. (2004, April). Recommendations for an Effective Research and Technology Management System within the BMVL. Report for the Austrian Ministry of Defence.

Andersson, J. J. (2015). Submarine Capabilities and Conventional Deterrence in Southeast Asia. Contemporary Security Policy, 36(3), 473-497.

Arena, M. V., Birkler, J., Schank, J. F., Riposo, J. & Grammich, C. A. (2005c). Monitoring the Progress of Shipbuilding Programmes: How Can the Defence Procurement Agency More Accurately Monitor Progress? Santa Monica, Calif.: RAND Corporation, MG-235-MOD.

Arena, M. V., Pung, H., Cook, C. R., Marquis, J. P., Riposo, J. & Lee. G. T. (2005a). The United Kingdom's Naval Shipbuilding Industrial Base: The Next Fifteen Years. RAND Corporation. Santa Monica. CA.

Arena, M. V., Pung, H., Cook, C. R., Marquis, J. P., Riposo, J. & Lee. G. T. (2005b). Can the United Kingdom Rebuild Its Naval Fleet? Challenges and Opportunities for the UK Shipbuilding Industrial Base, 2005-2020. RAND Corporation. Santa Monica. CA.

Australian Manufacturing Workers' Union. (2013). Australian Naval Shipbuilding. AMWU Paper On Australian Naval Shipbuilding.

Australian National Audit Office. (2009). Audit Report No. 23 2008-09, Management of the Collins-class Operations Sustainment. Canberra, ACT: Commonwealth of Australia.

Australian National Audit Office. (2014). Audit Report No.22 2013–14, Air Warfare Destroyer Program. Canberra, ACT: Commonwealth of Australia.

Barrett, T. (2015). Australia's submarine capability. Australian Defence Force Journal, (196), 5-9

Birkler, J. (2011). Industry and Infrastructure for Future Submarines: An International Perspective. RAND Corporation. Santa Monica. CA.

Birkler, J., Rushworth, D., Chiesa, J., Pung, H., Arena, M. V. & Schank. J. F. (2005a). Diversifying the Customer Base for Shipbuilding in the United Kingdom. RAND Corporation. Santa Monica. CA.

Birkler, J., Rushworth, D., Chiesa, J., Pung, H., Arena, M. V. & Schank, J. F. (2005b). Differences Between Military and Commercial Shipbuilding: Implications for the United Kingdom's Ministry of Defence. RAND Corporation. Santa Monica. CA.

Birkler, J., Schank, J. F., Arena, M. V., Keating, E. G., Predd, J. B., Black, J., Danescu, I., Jenkins, D., Kallimani, J. G., Lee, G. T., Lough, R., Murphy, R., Nicholls, D., Paoli, G. P., Peetz, D., Perkinson, B., Sollinger, J. M., Tierney, S. & Younossi, O. (2015). Australia's Naval Shipbuilding Enterprise. Rand Corporation.

Birkler, J., Schank, J. F., Arena, M. V., Riposo, J., & Lee, G. T. (2013). Strengthening the Shipbuilding Industry. Proceedings Magazine, 139(12/1,330), 41-46.

Birkler, J., Schank, J. F., Riposo, J., Arena, M. V., Button, R. W., DeLuca, P., Dullea, J., Kallimani, J.G., Leadmon, J. & Lee, G. T. (2011a). Australia's Submarine Design Capabilities and Capacities: Challenges and Options for the Future Submarine. National Security Research Div. RAND Corp. Arlington. VA.

Birkler, J., Schank, J. F., Riposo, J., Arena, M. V., Button, R. W., DeLuca, P., Dullea, J., Kallimani, J.G., Leadmon, J., Lee, G. T., McInnis, B., Murphy, R., Predd, J. B. & Williams, R. H.

(2011b). Australia's Domestic Submarine Design Capabilities: Options for the Future Submarine. RAND Corporation. Santa Monica. CA.
Birkler, J., Schank, J.F., Riposo, J., Arena, M.V., Button, R.W., DeLuca, P., Dullea, J., Kallimani, J.G., Leadmon, J. & Lee, G.T. (2011c). Australia's Submarine Design Capabilities and Capacities: Challenges and Options for the Future Submarine. RAND Corp National Security Research Div. Arlington VA.
Briggs, P. & Roach, T. (2014). Submission to the Economics Reference Committee: Naval Shipbuilding Inquiry – Future Submarine Project. Future of Australia's Naval Shipbuilding Industry. Senate Submission 17. Parliament of Australia.
Briggs, P. (2011). Future Submarine-a Growth in Australia's Navy's Capability. Some Implications for the RAN. Headmark, (139), 4.
Buckley, S. R. (2015). A High-Value-Best-Value approach to public shipyard human capital management to improve ship availability. Doctoral dissertation. Naval Postgraduate School. Monterey. CA.
Bush, C. R. (2005). The Victoria-class Submarine Program. Canadian Naval Review, 1(2). 4-8
Bushell, E. (2011). An Analysis of Defence Materiel Organisation Major Projects Management and What Needs to be Fixed. Air Power Australia Analyses, 8(2), 1.
Bushell, E. (2011). Australia's Failing Defence Structure and Management Methodology. Air Power Australia Analyses, 8(4), 1.
Bushell, E. (2011). Review of Defence Materiel Organisation Major Projects Report. 2009-10.
Byers, M., & Webb, S. (2013). That Sinking Feeling: Canada's Submarine Program Springs a Leak. Canadian Centre for Policy Alternatives. Ottawa.
Byrne, T., & Mo, J. P. (2015). Critical factors for design of successful performance-based contracting environment. International Journal of Agile Systems and Management, 8(3-4), 305-331.
Coles, J. (2011). Collins Class Sustainment Review. Department of Defence, November.
Coles, J., Greenfield, P., & Fisher, A. (2012). Study into the business of sustaining Australia's strategic Collins class submarine capability. Ministerial and Executive Coordination and Communication Division, Defence, Commonwealth of Australia, November, 176.
Coles, J., Greenfield, P., Fisher, A. & Davies, S. (2014). Study into the business of sustaining Australia's strategic Collins class submarine capability. Progress review – March 2014. Ministerial and Executive Coordination and Communication Division. Defence. Commonwealth of Australia.
Commonwealth of Australia 1992, Audit Report No. 22, 1992-93, New Submarine Project, AGPS.
Commonwealth of Australia 1997, Audit Report No. 34, 1997-8, New Submarine Project, AGPS.
Commonwealth of Australia 1999, The Joint Committee of Public Accounts and Audit, Review of Audito
Commonwealth of Australia. (2002). Agreement Between the Government of Australia and the Government of the United States of America Concerning Security Measures for the Reciprocal Protection of Classified Information. Parliament of Australia. Canberra.
Davies, A., & Thomson, M. (2011). The Once and Future Submarine: Raising and Sustaining Australia's Underwater Capability. Australian Strategic Policy Institute.
Davies, A., Ergas, H. & Thomson, M. (2012). Should Australia build warships? An economic and strategic analysis. ASPI Discussion paper

Defence Material Organisation. (2013). Future Submarine Industry Skills Plan - A Plan for The Naval Shipbuilding Industry. Defence Material Organisation. Department of Defence. Commonwealth of Australia.
Deloitte (2012). The Aerospace and Defense Industry in the U.S. A financial and economic impact study.
Deloitte Access Economics. (2014). The Economic Impact of Major Defence Projects.
Department of Defence. (2016). Defence Industry Policy Statement. Commonwealth of Australia
Do, Q., Cook, S., Fossnes, T., & Haskins, C. (2014, July). 9.3. 2 The Use of Models across the Contractual Boundary: Past, Present and Future. In INCOSE International Symposium (Vol. 24, No. 1, pp. 973-989).
Duran, J., Isusi, I. & Corral, A. (2012). Study on the Perspectives of the European Land Armament Sector. Final Report (ref. E3779 v_03). IndustryAll & ikei. Donostia-San Sebastián.
Eliasson, G. (2010). Advanced public procurement as industrial policy: The Aircraft Industry as a Technical University (Vol. 34). Springer.
Eliasson, G. (2011). Advanced purchasing, spillovers and innovative discovery. Journal of evolutionary economics, 21 (1), 121-139.
Eliasson, G. (2013). Automotive dynamics in the Stockholm and southern German regional economies1–a comparison. Innovation and Finance, 115.
Ergas, H. (2012). Australia's defence: A review of the 'reviews'. Agenda: A Journal of Policy Analysis and Reform, 63-71.
Frye, M. C. (2010). Applying set based methodology in submarine concept design. Massachusetts Inst of Technology. Cambridge. MASS.
Goldsmith, S. (2015). SEA 1000, Design Options for the Royal Australian Navy's Future Submarine
Goldsmith, S. (2016). Naval Shipbuilding. Australia's Underlying Insurance Policy. http://navalinstitute.com.au/wp-content/uploads/Naval-Shipbuilding-1.pdf
Gregory, G. (2006). The Future of Australian Naval Shipbuilding. Maritime Studies, 2006(147), 1-11.
Haider, M. Z. (2014). Future Australian Submarine Force-Ambitions and Reality. Defence Journal, 17(10), 31.
Hall, P., & Markowski, S. (1996). Some lessons from the Australian defense offsets experience. Defense Analysis, 12(3), 289-314.
Hartley, K., 2001. The UK submarine industrial base: an economic perspective. In: Edmonds, M. (Ed.), One Hundred Years of the Trade: Royal Navy Submarines: Past, Present and the Future. CDISS, University of Lancaster, Lancaster
Hause, M., & Hallett, J. (2016, July). MB-PLE to Plan and Track Submarine Configurations. In INCOSE International Symposium (Vol. 26, No. 1, pp. 2195-2210).
Hughes, D. (2013). Managing Complex Projects – A VICTORIA Class Extended Docking Work Period (EDWP) Naval Perspective. Ottawa: The 2013 Ottawa Marine Technical Symposium.
Kahn, R. F. (1931). The relation of home investment to unemployment. The Economic Journal, 41(162), 173-198.
Keating, E. G., Danescu, I., Jenkins, D., Black, J., Murphy, R., Peetz, D. & Bana, S. H. (2015). The Economic Consequences of Investing in Shipbuilding: Case Studies in the United States and Sweden. RAND Corporation. Santa Monica. CA.
Kelton, M. (2005). New Depths in Australia-US Relations: The Collins Class Submarine Project (No. 162). Strategic and Defence Studies Centre.

Kulkarni, P. R. (2015). Review of Global Naval Shipbuilding Trends and Lessons for Indian Shipbuilding Industry. Maritime Affairs: Journal of the National Maritime Foundation of India, 11(1), 116-132.
Markowski, S., Wylie, R., & Hall, P. (2008). Australian naval procurement cycles: Lessons for other small countries. 5th Annual Acquisition Research Symposium of the Naval Postgraduate School: Acquisition Research: Creating Synergy for Informed Change. May 14-15.
McIntosh, Malcolm & Prescott (1999). Report to the Minister for Defence on Collins Class Submarine and Related Matters. Commonwealth of Australia
Meyers, N. A. (2010). An economic analysis of investment in the United States shipbuilding industry. Doctoral dissertation. Naval Postgraduate School. Monterey. CA.
Mitchell, A. (2005). Lessons Learnt from the Oberon-Class Procurement. Journal of Australian Naval History, The, 2(1), 31.
Moore, N. A. (2015). The US Government's Role in the Ship Repair Industry. Naval Engineers Journal, 127(4), 59-65.
Morris, P. (2012). A Joint Government & Industry Approach to Submarine Support Management: Maximising Availability with Reducing Budgets. Undersea Defence Technology Conference, Spain, 2012.
Mortimer, D. 2008, Going to the Next Level: The Report of the Defence Procurement and Sustainment Review, Defence Materiel Organisation, Canberra.
Office of the Under Secretary of Defense for Acquisition Technology and Logistics (DPAP). (September 2002). Contract Pricing Reference Guides, volume 1 Price Analysis and volume 2 Establishing and Monitoring Contract Type. USA
Oxford Economics, (2009). The Economic Case for Investing in the UK Defence Industry. Report prepared for the Defence Industries Council (DIC)
Oxford Economics. (2010). The BAE Systems Contribution to the UK in 2009.
Oxford Economics. (2011). The Economic Case for Investing in the UK Defence Industry. Report prepared for the Defence Industries Council (DIC).
Pacey, B. (2012). Sub Judice: Australia's Future Submarine. Kokoda Paper No 17. The Kokoda Foundation.
Pung, H., Smallman, L., Arena, M. V., Kallimani, J. G., Lee, G. T., Puri, S. & Schank, J. F. (2008). Sustaining Key Skills in the UK Naval Industry. RAND Corporation. Santa Monica. CA.
Riposo, J., Alkire, B., Schank, J. F., Arena, M. V., Kallimani, J. G., Blickstein, I., Curry Hall, K. & Grammich, C. A. (2008). US Navy Shipyards. An Evaluation of Workload-and Workforce-Management Practices. RAND Corp. Santa Monica. CA.
Ritchie, N. (2016). Feeding the 'monster': Escalating Capital Costs for the Trident Successor Programme. British American Security Information Council (BASIC).
Rizzo, P. J. 2011, Plan to Reform Support Ship Repair and Management Practices, Department of Defence, July.
Roos, G. (2005). National Innovation Systems and Strategies and their Relationship to Defence and Security Research. in Sünkel, H. and A. Vogel (Hrsg.), "Wissenschaft Forschung Landesverteidigung, 10 Jahre ÖAW-BMLV/LVAK", Kommission für die Wissenschaftliche Zusammenarbeit mit Dienststellen des Bundesministeriums für Landesverteidigung, Projektbericht 7, Verlag der Österreichischen Akademie der Wissenschaften, Wien. pp 112-123
Roos, G. (2014). Defence funding – an investment, not a cost. Connections. Issue 197. November

Roos, G. (2014). Submarines: reader response. The Strategist, 18 November
Roos, G. (2014). Supplementary Submission to the Senate Economics References Committee: Inquiry into the future of Australia's naval shipbuilding industry – future submarine program. 13 October.
Roos, G. (2015). Economic complexity drives national prosperity. FOCUS, No. 192. p. 3-5
Roos, G. (2015). Economic complexity is the answer to Pyne's innovation problem. The Conversation. 12 October.
Roos, G. (2015). How Australia could leverage a local submarine build. The Conversation. 16 October.
Roos, G. (2015). RAN's Future Submarine: the case for an on-shore build. The Strategist. 24 August.
Roos, G. (2016). How to make sure Australia's submarines pay for themselves. The Conversation. 26 April.
Roos, G. (2016). Why it is imperative that we have a national build of the future submarine. https://www.linkedin.com/pulse/why-imperative-we-have-national-build-future-submarine-goran-roos
Schank, J. F., Arena, M. V., DeLuca, P., Riposo, J., Hall, K. C., Weeks, T. & Chiesa, J. (2007). Sustaining US Nuclear Submarine Design Capabilities (Vol. 608). Rand Corporation.
Schank, J. F., Arena, M. V., Kamarck, K. N., Lee, G. T., Birkler, J., Murphy, R. E. & Lough, R. (2014). Keeping Major Naval Ship Acquisitions on Course. Rand Corporation.
Schank, J. F., Cook, C. R., Murphy, R., Chiesa, J., Pung, H., & Birkler, J. (2005b). The United Kingdom's Nuclear Submarine Industrial Base, Volume 2: Ministry of Defence Roles and Required Technical Resources. Santa Monica, CA: RAND Corporation
Schank, J. F., Ip, C., Kamarck, K. N., Murphy, R. E., Arena, M. V., Lacroix, F. W., & Lee, G. T. (2011a). Learning from Experience, Volume IV: Lessons from Australia's Collins Submarine Program. RAND National Defense Research Institute. Santa Monica. CA.
Schank, J. F., Ip, C., Lacroix, F. W., Murphy, R. E., Arena, M. V., Kamarck, K. N., & Lee, G. T. (2011b). Learning from Experience, Volume II: Lessons from the US Navy's Ohio, Seawolf, and Virginia Submarine Programs. RAND National Defense Research Institute. Santa Monica. CA.
Schank, J. F., Ip, C., Lacroix, F. W., Murphy, R. E., Ip, C. C., Arena, M. V. & Lee., G. T. (2011c). Learning from Experience: Volume III: Lessons from the United Kingdom's Astute Submarine Program. RAND Corporation. Santa Monica. CA.
Schank, J. F., Kallimani, J. G., Chandler, J., Arena, M. V., Price, C. C., & Grammich, C. A. (2011). Changing Aircraft Carrier Procurement Schedules: Effects that a Five-Year Procurement Cycle would have on Cost, Availability, and Shipyard Manpower and Workload. RAND National Defense Research Institute. Santa Monica. CA.
Schank, J. F., Lacroix, F. W., Murphy, R. E., Arena, M. V., & Lee, G. T. (2011). Learning from Experience, Volume I: Lessons from the Submarine Programs of the United States, United Kingdom, and Australia. RAND National Defense Research Institute. Santa Monica. CA.
Schank, J. F., Pung, H., Lee, G. T., Arena, M. V. & Birkler, J. (2005). Outsourcing and Outfitting Practices: Implications for the Ministry of Defence Shipbuilding Programmes. RAND Corporation. Santa Monica. CA.
Schank, J. F., Pung, H., Lee, G. T., Arena, M. V. & Birkler. J. (2005). Commercial Shipbuilding Techniques: Can They Be Applied to Warship Production in the United Kingdom? RAND Corporation. Santa Monica. CA.

Schank, J. F., Riposo, J., Birkler, J., & Chiesa, J. (2005). The United Kingdom's Nuclear Submarine Industrial Base, Volume 1: Sustaining Design and Production Resources. RAND Corporation. Santa Monica. CA.
Senate Economics References Committee. (November 2014). Part II, Future of Australia's naval shipbuilding industry, Future submarines. Canberra: Senate Printing Unit
Skinner, C. J. (2008). NCSM: The Collins Class Submarine: National Benefits and Costs. Journal of the Australian Naval Institute, Issue 129. 28-34
Smallman, L., Tang, H., Schank, J. F. & Pezard. S. (2011). Shared Modular Build of Warships: How a Shared Build Can Support Future Shipbuilding. RAND Corporation. Santa Monica. CA.
Stewart, J., & Ablong, T. (2013). When Australian defence procurement goes wrong: Improving outcomes in a troubled contractual environment. The Economic and Labour Relations Review, 1035304613482653.
The Auditor-General. (2014). Air Warfare Destroyer Program. Audit Report No.22 2013–14. Performance Audit. Australian National Audit Office. Commonwealth of Australia
Thomson, M. J., & Harrington, C. S. H. (2002). Setting a Course for Australia's Naval Shipbuilding and Repair Industry. An Australian Strategic Policy Institute (ASPI) Policy Report. Budget and Management Programme. August
Turner, J. R. (2000). Managing scope – configuration and work methods. in Turner, J. R. & Simister, S. J. (eds.). The Gower Handbook of Project Management, 3rd edition. Gower. Aldershot.
Turner, J. R., & Simister, S. J. (2001). Project contract management and a theory of organization. International journal of project management, 19(8), 457-464.
Turner, J. R., Anbari, F., & Bredillet, C. (2013). Perspectives on research in project management: the nine schools. Global Business Perspectives, 1(1), 3-28.
Vlahopoulos, N., & Hart, C. G. (2010). A Multidisciplinary design optimization approach to relating affordability and performance in a conceptual submarine design. Journal of Ship Production and Design, 26(4), 273-289.
Woolner, D. (2001a). Getting in early: Lessons of the collins submarine program for improved oversight of defence procurement. Research Paper No. 3, 2001-02. Canberra: Parliamentary Library.
Woolner, D. (2001b). Procuring Change: How Kockums was Selected for the Collins Class Submarine. Department of the Parliamentary Library. Research Paper, No. 4, 2001-02. Canberra: Parliamentary Library.
Woolner, D. (2009). Taking the Past to the Future: The Collins Submarine Project and Sea 1000. Security Challenges, 5(3), 47-71.
Wright & Fields, (2009). NAVSEA 05C Portfolio Assessment Team Economic Impact Study.
Wylie, R., & Markowski, S. (2009). 6 The Australian defence value-adding chain. Defence Procurement and Industry Policy: A Small Country Perspective, 187.
Yule, P., & Woolner, D. (2008). The collins class submarine story: steel, spies and spin. Cambridge University Press.