

Submission 51 - Submarine Institute of Australia

The Submarine Institute of Australia made submission 22 to the inquiry into the Future of Australia's naval shipbuilding industry in the 44th Parliament.

This document is intended as a supplementary submission to the original submission 22.

All submissions received in the 44th Parliament can be accessed via the following link:

http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Economics/Naval_shipbuilding/Submissions



Submission by the Submarine Institute of Australia to
The Senate Economics Reference Committee
Inquiry into the Future of Australia's naval shipbuilding
industry





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1. Introduction

1.1 The Strategic Direction for the Future Submarine Program - Deliver a Cutting Edge Sovereign Submarine Capability

In his statement at the signing of the Inter-Governmental Agreement with France on the Future Submarine on 20th December, Prime Minister Turnbull said "*The IGA is the last foundation stone needed to ensure Australia is able to develop a cutting edge sovereign submarine capability.*"

The Submarine Institute of Australia Inc commends the Prime Minister's statement that development of "cutting edge sovereign submarine capability" is the strategic direction for the Future Submarine Program.

1.2 The Submarine Institute of Australia Inc.

The SIA is pleased to make this submission in which lessons from the Collins Class submarine acquisition program and other experience provides a basis for several recommendations for the Commonwealth Government to consider in the Future Submarine Program. (Reference A)

The SIA strongly supports the Prime Minister's strategic direction for this program – that it should ensure that "Australia is able to develop a cutting-edge sovereign submarine capability". To achieve this objective its recommendations to the Senate Economics Reference Committee are enunciated in paragraph 5 of this submission.

2 Background

The Submarine Institute of Australia Inc. (SIA) was formed in 1999 with the following Objective:

To promote informed discussion and research in the fields of submarine operations, engineering, history and commercial sub-sea engineering – otherwise known as submarine matters.

2.1 Inquiry Terms of Reference

On 11th October 2016 the Senate referred the following matter to the Senate Economics Reference Committee for inquiry and report.

The future sustainability of Australia's strategically vital naval ship building industry, including:

- (a) the development of contracts relating to naval ship and submarine building;*
- (b) the design, management and implementation of naval shipbuilding and submarine defence procurement projects in Australia;*
- (c) the utilisation of local content and supply chains;*
- (d) the integration of offshore design work and supply chains in Australia;*





- (e) opportunities for flow on benefits to local jobs and the economy; and
- (f) any related matters.

2.2 Australia's Sovereign Submarine Capability

Submarines have been used to deliver maritime effect for Australia for 103 years. HMA Submarines AE1 and AE2 arrived from the UK in 1914.

2.2.1 1914 to 1967

The crew of AE1 were Australia's first casualties in World War 1 when the submarine was lost in the vicinity of Duke of York Island near Rabaul. The Australian submarine AE2 was the first Allied submarine to penetrate the Dardanelles. It did so on 25th April 1915 as the ANZACs were landing on the beaches on the other side of the peninsula.

Fremantle was the second largest submarine base in the World from 1942 to 1945 when it was home for 176 Allied submarines engaged in the war against Japan. Submarines based in Brisbane and Fremantle played a major (and largely unknown) role in the defence of Australia from 1942 to 1945. These submarines conducted the most effective submarine campaign in the history of submarine warfare with their efforts resulting in the complete destruction of the Japanese merchant naval fleet.

2.2.2 The RAN Oberons

The modern era of Australian submarine capability began with the acquisition and sustainment of the six Oberon-class submarines (commonly referred to as O-boats in the submarine community) starting with the arrival of HMAS OXLEY on 18th August 1967 at the purpose-built submarine base HMAS PLATYPUS in Neutral Bay in Sydney Harbour, from which Australian submarines operated until 1999. Refitting of the six O-boats was undertaken at Cockatoo Island Dockyard.¹

2.2.3 The Submarine Weapons Update Program (SWUP)

From 1975 to the early 1980's the submarines were modernised in the Submarine Weapons Upgrade Program [SWUP] developed with the support of the Submarine Warfare Systems Centre [SWSC] located in HMAS WATSON on South Head of Sydney Harbour.

This marked a very significant shift toward a fully sovereign submarine capability. In particular, three strategic changes took place:

- The submarine combat system was changed from analogue to digital (the first ships in the RAN to take up a digital combat system).
- The new weapons were sourced from the US and included a submarine launched anti-ship missile (submarine launched Harpoon missile).

¹ With the exception of the last two refits which were undertaken at Garden Island Dockyard.





- The system integration, test and evaluation and acceptance into operational service was conducted by Australians in the SWSC.

The capability enhancement for the submarines was very significant. (From an anti-ship torpedo with a range of 5,000 metres to a multi-purpose torpedo with a range of about 40km and a missile of about 65km.)

The success of the SWUP gave the submarine community the confidence to believe that the Collins program could be undertaken by Australians in Australia.

2.2.4 The Collins Class Submarines

The Oberon-class submarines were replaced by the Australian built Collins class submarines during the 1990s. As with most new classes of submarines entering service, the complexity of the submarine design created several initial issues in operational performance.

2.2.4.1 RAN as a Parent Navy

The Collins Class meets special design criteria that meet the requirements of the unique environment in which Australian submarines operate. As a consequence the submarines are the first vessels in the RAN to be uniquely designed for Australia.

Management of the complexity of this very large project and the introduction of the submarines into operation service was not fully understood at the outset, and appreciation that the Royal Australian Navy must exercise the role of parent navy was only slowly reached. As a consequence, many of the teething problems attracted a lot of public attention.²

2.2.4.2 The Coles Reviews - Collins Sustainment

It was not until Government adopted the recommendations of the Reviews by John Coles that the full capability of the Collins Class was realised.

Today Collins sustainment is a national benchmark. Very high levels of operational availability at lesser cost per nautical mile steamed are being achieved.

2.2.4.3 The Submarine Enterprise

Coles also recommended the adoption of an "enterprise" model to achieve better sustainment of the capability. In this model all of the submarine elements in Defence and industry (i.e. ASC, Raytheon, Thales, Sonartech Atlas, BAE Systems, Pacific Marine Battery, JFD) see themselves as critical elements in the "Submarine Enterprise" - each with specific responsibilities for the delivery of a fully effective submarine capability.

2.2.5 Security

Submarines rely on silence and stealth for their effect.

On patrol they must not be detected. When they are not on patrol they must conduct themselves in a manner that does not increase the risk if their detection while on operations.

This means:

²The significance of the role of parent navy was not fully appreciated at the time, but became clear in the Collins program. This included attention to the design authority role as discussed later in this submission.





- a. The highest levels of professionalism from their crews and the industry supporting the submarines (an "Enterprise" approach).
- b. That the majority of matters about submarines, their crews, their technology and their sustainment should not be discussed in public.
- c. That the submarines should have access to and use the most advanced technology.

2.2.5.1 Sensitive Technology

The most sensitive technology is developed in Australia for its own use, or purchased from its closest allies. Access to this technology is very jealously guarded, and there are situations where the Australian Government, or an Australian company may have access to technology that cannot be released to an overseas company (other than one which is the same nationality as the technology).

2.2.5.2 Impact on Contracting

In the case of the Collins Program, the US Government required Australia to protect the Combat System technology from the Swedish submarine platform designer. In this case the Commonwealth elected to contract the combat system house directly.

3 Discussion

The following discussion addresses the general sequence of the terms of reference followed by additional matters considered relevant by the SIA.

3.1 Development of Contracts Relating to Naval Ship and Submarine Building

Submarine construction contracts are largely long term contracts. Contracts not only specify the technical or capability outcome(s) they are expected to deliver, they also (either intentionally or unintentionally) establish and significantly impact on the behaviour between the parties.

In this part of the submission the SIA identifies the relevant lessons from the Collins program, and recommends how those lessons might be applied in the case of the FSM.

3.1.1 Experience from the Collins Submarine Program

3.1.1.1 Sovereignty

The submarine capability can only be a sovereign capability. The SIA is not aware if there is an agreed definition of sovereignty, but in this context the ownership of the Prime Contractor responsible for delivery of the capability is a critical element.





In the Collins program the Commonwealth has always maintained that the Prime Contractor should be an Australian company.

3.1.1.2 Ownership of the Australian Submarine Corporation Pty Ltd (now ASC)

The Collins contract specified ownership arrangements considered necessary to ensure that Australia was establishing a "sovereign" capability. NPB 1114 (which became the Collins program) required that the Australian Submarine Corporation Pty Ltd (now ASC) be 51% (or more) Australian owned.

The initial shareholding in the Submarine Corporation was four companies:

- a. Kockums AB (a Swedish company) with 29%,
- b. Chicago Bridge & Iron (CBI) (a US Company) with 20%,
- c. Wormald (an Australian company) with 25.5%, and
- d. Australian Industry Development Corporation (an Australian merchant Bank) with 25.5%.³

Kockums chaired the Australian Submarine Corporation Board.

The world economic conditions from 1987 to 1991 caused significant changes in the ownership of ASC.

CBI quickly became dissatisfied with Kockums' approach to project management, and offered to buy the Kockums shares. The Commonwealth maintained its view that the submarine designer must be a shareholder and have influence (chair) in the company, and as a consequence CBI exited the ASC.

In the same period, the Malaysian business man, Lee Ming Tee, acquired Wormald. This was not a successful venture and Wormald also sold its shareholding in the ASC .

The resulting shareholding in the ASC was:

- a. Kockums 49%
- b. AIDC 48.5%, and
- c. RCI (a subsidiary of James Hardie Industries) 2.5%.

Kockums continued in the role of chairman of the ASC until it was nationalized in 2001.

This arrangement continued until the late 1990s, when Kockums advised that it wished to sell its shares in the Submarine Corporation to Howaldtswerke-Deutsche Werft (HDW), the German submarine builder. The Commonwealth, through AIDC, chose to exercise its pre-emptive right to buy Kockums shares, and as a result became the 100% owner of the Australian Submarine Corporation.

When AIDC was dissolved, ownership of the ASC was initially exercised by the Commonwealth department responsible for Industry and later the Department of Finance. The Government of the day envisaged that the Australian Submarine Corporation might be sold to the private

³ A Commonwealth statutory corporation established by the *Australian Industry Development Corporation Act 1970* (Cwth) – the AIDC Act.





sector, and in the AIDC Sale Act 1997 directs in relation to the Australian Submarine Corporation, that the owner of the asset (ASC): "... must not subsequently sell or transfer those interests to a foreign person (within the meaning of the Foreign Acquisitions and Takeovers Act 1975) ...⁴".

The Commonwealth saw the Australian Submarine Corporation as a critical element in the Australian submarine capability and wished to retain it as a sovereign Australian asset.

3.1.2 The Submarine Designer as a Shareholder in the Prime Contracting Entity

Defence (and Kockums) argued that it was important that the submarine designer should have a corporate stake in the enterprise. Kockums was the submarine designer, and while the Kockums members of the Australian Submarine Corporation board operated at arm's length from the design office, a potential conflict of interest existed. Kockum's directors might not wish to apply pressure on the Kockums AB (KAB) design house.⁵

This conflict became more serious in two areas, namely:

- a. Commonwealth access to important Intellectual Property, which continues to be problematic.
- b. Attempts by the other shareholders in the ASC to grow the business were frustrated by Kockums who saw the ASC as competition to the business development by the parent company KAB in Malmo.

The benefits (if any) of including the submarine designer as a shareholder in the Prime Contractor need to be balanced with the risks that if the designer is in fact the Prime Contractor, the designer is in effect "marking its own homework".

3.1.3 Contracting the Combat System House

For the security reasons described above (para 2.2.5) a separate contract was placed with Rockwell for the Collins Combat System.

The Commonwealth has followed this practice in the Future Submarine by placing a separate contract with Lockheed Martin. This means that all deliverables from Lockheed Martin Australia (LMA) are to the Commonwealth and then become government furnished information [GFI] and equipment [GFE] to the prime contractor.

Experience from overseas programs emphasise the stringent need to manage GFI and GFE effectively and in a timely manner. In addition to a not inconsequential project management role, it places a significant product acceptance responsibility on the Commonwealth. The Commonwealth must ensure that the items it receives from the Combat System House are acceptable before delivering them to the submarine builder. This can have particular challenges if the GFI and GFE are supplied under Foreign Military Sales (FMS) rather than a commercial contract.

⁴ AIDC Sale Act 1997 Clause 33KA sub clause 3.

⁵This situation was predictable and may arise again with DCNS for the Future Submarine program [FSP] if a similar arrangement is applied.





This appears to be contrary to the First Principles Review which encourages Defence to be a "Smart Buyer", to focus on governance and the outcome that it requires while requiring project management to be undertaken by industry.. This still requires the skills and knowledge to be a "Smart Buyer" which requires relevant professional and technical skills.

If the Commonwealth was to appoint an Australian Prime Contractor it could require the Combat System House to be a sub-contractor to the Prime.

3.2 Design, Management and Implementation of Naval Shipbuilding and Submarine Defence Procurement Projects in Australia

3.2.1 The Role of the Design Authority

The Design Authority (DA) in the Submarine Capability is a critical role. In the construction phase, the submarine designer is the platform DA while the Combat System (CS) House will be the CS DA.

In the operational phase of the submarine's life (the sustainment phase) those arrangements might change.

The former Managing Director of ASC, Dr Hans Ohff, described his view of the arrangements in the Collins class as follows:

ASC controlled the physical and knowledge-based intellectual property, i.e. the IPR that resided in the heads, minds and bodies of the people who designed and built the Collins, and, after a lot of hackling with FMV - to a lesser extent with KAB - the Commonwealth became the legal owner of the fore and background IPR for the Type 471 (Collins class) design.⁶

Under this scenario, ASC would remain the appropriate design authority (DA) for the submarine platform. Items such as the torpedo-discharge-pump, which the CoA requisitioned directly from the USA, as well as other proprietary items were excluded from the IP transfer.

The Commonwealth's instruction in 2001/02 for ASC to sever the design contract, including the responsibilities of the DA with KAB was a costly exercise (in money and submarine availability terms). To release KAB from all design and fabrication responsibilities, waiving the warranty and latent defects clauses and making a multimillion dollar severance payment to KAB was imprudent. ASC was ill-equipped to take on the responsibilities of the DA in 2002/03. KAB's involvement during the transition period was essential.

Therefore, excluding the submarine designer, in this instance DCNS, from the role of DA after completion of the submarine design and building contracts, is, in my view, not in the best interest of the end-user (RAN). It excludes the CoA from routinely exchanging knowledge on augmented and new submarine systems.

⁶ FMV or Försvaretsmaterielverk is the Swedish Defence Materiel Administration, the equivalent of the previous Australian Defence Materiel Organisation (DMO), the present Capability and Sustainment Group (CASG).





The primary reason for being the owner of back and foreground IPR must be to undertake unimpeded modifications to the submarines or... develop an evolved or new FSP. It cannot be to become an exporter of the RAN's most valued asset.

For the Commonwealth to be the DA of the FS brings with it considerable responsibilities, it requires a high standard of continued submarine design capabilities. I prefer for the submarine design house to maintain equity (between 25 and 49%) in the DA.

3.2.2 Design, Construction and Acceptance into Naval Service

The design, construction, acceptance into naval service [AINS] and sustainment of naval ships and submarines is a time-honoured process that is adapted to the specific requirements of the individual program.

In addition to any broader national outcomes desired by Government such as 'to use the Defence dollar to drive a high technology, advanced manufacturing future' the most important reason to undertake the building of ships and submarines in Australia is to sustain the capability – the full capability not just the asset.⁷

This requires a clear understanding of all nine Fundamental Inputs to Capability [FIC] and the role they play in underpinning any ADF capability.

Understanding the design intent and ensuring full access to all relevant intellectual property rights [IPR] and the material (tangible form) in which they are represented, along with establishment of local supply chains, is necessary to upgrade and enhance the capability to ensure we maintain a regionally superior capability across the full life cycle of the asset class.

The critical role of submarine design authority arrangements apply to the full service life of all submarines in the class, and must be addressed in the contracting arrangements. In the case of the Future Submarine program, DCNS is expected to be the DA for the life of the platform.

3.3 Utilisation of Local Content and Supply Chains

Local content is generally considered desirable for national economic well-being, and to enhance the local industrial expertise required for sustainment of the ship or submarine through the approved service life. This capability has come to be termed the "sovereign capability" to acquire and sustain the submarine capability over the life of the assets.

3.3.1 Determination of Service Life of Defence Assets

The service life is determined based on a variety of formal means of verification and validation of safety, efficiency and sustainability. However, it should be understood that the remaining service life of any asset, including defence assets, is subject to periodic survey and assessment of remaining cost of ownership including enhancement and modernisation, versus replacement costs. The know-how and know why behind a submarine capability means that local industry will be able to provide enduring support to such a complex asset over its life of type. This is

⁷Minister for Defence Industry, SIA Conference 16 Nov 16.





particularly relevant in the case of both the Collins and Future Submarine as the RAN is the parent Navy for these two classes.

3.4 Integration of Offshore Design Work and Supply Chains in Australia

Australia has never acquired the full capability nor the deep expertise for ab initio design and construction oversight of complex naval submarines. Australia therefore is obliged to partner with an overseas organisation possessing such expertise for the design and oversight of construction. At the same time, the transfer of design insight and competence is encouraged from the partner to the local workforce with consequential growth in sovereign design capability needed for through-life sustainment.

This partnership therefore requires effective coordination, review and approval of work conducted overseas in the partner's offices with complementary work performed in Australia. With the advent of modern information and communications technologies [ICT] this is now more readily accomplished, while still requiring close oversight, knowledge transfer and effective governance. The broad term encompassing this approach is a digital shipyard, a system of systems that can create, share and track numerous elements of the design and build programs.

3.4.1 Importance of Data Sharing Across Multiple Sites and Agencies

It is important to ensure proper data flow between stakeholders and configuration management/data management is conducted efficiently and effectively. The growing use of digital shipyard technology, which cross international and national boundaries, are increasingly important in this space. These ship design and construction enterprises, in common with other complex engineering domains, employ a comprehensive ICT architecture and environment for the creation, sharing, review, construction, integration, verification and sustainment of engineering structures and dynamic systems.

This is especially powerful when some of the resources are located overseas, when there may be issues of access and application of national security information, commercial intellectual property and export restrictions. Different languages and cultures may also apply.

3.5 Opportunities for Flow on Benefits to Local Jobs and the Economy

The participation of local design, construction and sustainment industry has several benefits in achieving cost-effective, sovereign design and sustainment capability. Finding opportunities for this to occur is important. There have been a number of socio-economic studies over the years that address this topic. The SIA does not offer any new perspectives on the subject.

3.6 Any Related Matters

3.6.1 The Role of ASC, Formerly the Australian Submarine Corporation

The SIA strongly supports the Prime Minister's statement of 20th December 2016 that the purpose of SEA 1000 and the Future Submarine program is

"to develop a cutting-edge sovereign submarine capability".





This is a long-term program that will continue for many years.

With these principles in mind the SIA submits there are important issues to be considered in the ongoing evolution of the corporate structure of ASC.

Australia has invested significant resources over the past 30 years to develop an Australian submarine manufacturing and sustainment capability in ASC and its sub-contractors. The need now is for an Australian company with the submarine construction knowledge and commercial substance to prime and lead the program. ASC is well qualified to step up to this role.

ASC's potential role with DCNS in the build program of the FSM has yet to be clarified, noting that ASC has by far the greatest experience in construction and final assembly of submarines within Australia. Any departure from the build strategy in which ASC is not fully engaged has the potential for new sources of risk and incur an opportunity cost for the new investments necessary to gain the experience already existing in ASC.

3.6.2 Transition to Sustainment Role

An important question is how to sustain the Australian submarine capability and ensure that it delivers the capability effect required by Government. This will require significant effort to establish the production program for the Future Submarine, while at the same time ensuring Collins availability is maintained at current levels.

This program is likely to stretch the availability of suitably qualified and experienced people. To exclude the capability that exists in ASC workforce and business processes from full and significant participation in all aspects of the ongoing development of Australia's sovereign submarine capability will introduce unnecessary risk. If ASC is responsible for sustainment, then there is a compelling argument for it to be closely involved in the build also.

3.6.3 Timeline for the Program as it Affects the Shipbuilding industry and Defence Force Structure

A further aspect of naval submarine building is the pace of the building activity as discussed in Reference C (Davies 2016). This examines the tension between the strategic need to build up the submarine force numbers compared with the industry desire for continuity of workload over an extended period.

The conceptual model is also affected by the achievable life-of-type and the service life for individual units, including any extension of life that is judged cost-effective. A further factor is the possibility of export but this then raises issues of sovereignty with regard to the intellectual property and the protection of critical performance data and other national security issues and information.

3.6.4 The Most Critical Factor – the People Involved in the Program

The critical factor is the people who will be building the future submarines and many of these people will come from ASC. Even with the help of DCNS people, the task to train a new





workforce inexperienced in submarine building to be able to build a submarine safely and successfully within schedule and budget will be challenging.

With Collins and AWD lessons learned about production quality from subcontractors, even with professed experience in shipbuilding, the most sensible solution is to use as many experienced people from ASC as is practically possible to receive some 'train the trainer' experience knowledge which can then be applied to train newcomers.

We should acknowledge the importance of not 'stealing' from Collins maintenance. The critical factor is the people who will be building the future submarines and many of these people will come from ASC. Even with the help of DCNS people, the task to train a new workforce inexperienced in submarine building to be able to build a submarine safely and successfully within schedule and budget will be challenging.

In addition there should not be a one-way street between the old and the new submarines. There needs to be a healthy exchange of personnel, both civilian and military during the transition.

Finally, naval ship and submarine building in Australia is vitally affected by the available skilled workforce which takes several years to develop, maintain and expand.⁸ The recent announcement of the closure of Australia's only school of naval architecture at UNSW augurs poorly for the expansion envisaged in various planning vision statements.

4 Conclusion

The SIA has approached this opportunity to make a submission to The Senate Economics Reference Committee Inquiry into the Future of Australia's naval shipbuilding industry through the lens of sustaining and developing Australia's submarine capability, and ensuring that Australia's submarines are able to deliver the strategic effect required by Government.

To that end, it strongly supports the goal stated by the Prime Minister that SEA 1000 ensure that *"Australia is able to develop a cutting-edge sovereign submarine capability"*.

Australia has made significant investments to achieve its current submarine capability. Lessons derived therefrom include the following:

1. There should be a single Australian Prime Contractor. The experience of the Collins program shows that complex prime contracting arrangements require very significant effort from the companies and the Commonwealth to be made to work, and increase the risk of cost and schedule overruns.
2. The platform designer and combat system supplier should be sub-contractors to the Prime Contractor. If they are not, the Commonwealth is drawn into the project management of the activity, and distracted from its governance and acceptance roles. It also opens the possibility for the prime Contractor to diffuse responsibility.

⁸ Experience relating to welding on the Collins program is just one example.





3. The Commonwealth must ensure unrestricted access to all relevant IP and related technical data, at least by way of full licensing if not full ownership

The SIA concludes that the issues raised by Dr Davies (Reference C) are significant but must not result in delays to the decision-making process. There is always a tension between customer demand and optimum operation of a production line.

The life-of type is a complex function involving changing threat, technology, and cost of ownership including modernisation and cost and lead time for replacement. This needs to be kept under review for the program and at a more granular level, for each asset individually.

ASC (and its sub-contractors) represent a significant long term investment in Australia's sovereign submarine capability, which should have a major role in the detailed design and construction phases of the Future Submarine. This capability should ultimately sustain the FSM through its life.

The nature of information management architecture and environment will be absolutely critical.

5 Recommendations

It is recommended to ensure that "Australia ... develop(s) a cutting-edge sovereign submarine capability that is sustainable over the long term:

1. There should be a single entity who is the Prime Contractor for the Future Submarine Program.
2. The Prime Contractor for the Future Submarine Program should be an Australian company and remain so. Protections additional to those within the meaning of the Foreign Acquisitions and Takeovers Act 1975 may be required.
3. The platform designer of the Future Submarine should be a subcontractor to the Prime Contractor, and not be a substantial shareholder in or have other significant interests in or obligations to the Prime Contracting entity.
4. The combat system supplier for the Future Submarine should be a subcontractor to the Prime Contractor, and not be a substantial shareholder in the Prime Contracting entity.
5. The Commonwealth recognise the potential for delays and cost overruns if the prime contractor is impeded by late or deficient combat systems elements for which the Commonwealth is ultimately responsible as GFI/GFE.
6. The significant capability of ASC to maintaining Australia's sovereign submarine capability is recognised, valued and sustained.
7. The Commonwealth acknowledge that availability of suitably skilled and experienced people will be a major constraint on the program requiring special attention to meet all criteria for education and immigration.





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Annex A. - Glossary of Terms Used

Abbreviation	Full description	Comment
ADF	Australian Defence Force	
AIDC	Australian Industry Development Corporation	
AINS	Acceptance into naval service	
ASC	(Former) Australian Submarine Corporation	
AWD	Air Warfare Destroyer	Three ships built by ASC
CBI	Chicago Bridge and Iron Corporation	
CCSM	Collins Class Submarine	
DA	Design Authority	
DCNS	Formerly Directions des Construction Navales	A French company
DSMR	Directorate of Submarine Maintenance & Repair	
ERC	(The Senate) Economics Review Committee	
FIC	Fundamental input to capability	
FMS	Foreign Military Sales	
FMV	Försvarsmaterielverk	Swedish government agency
FOC	First of class	
FPR	First Principles Review	
FSP	Future Submarine Program	
GBE	Government business enterprise	
GFI/GFE	Government furnished information/equipment	
HDW	Howaldtswerke-Deutsche Werft	
HMAS	Her Majesty's Australian Ship	
ICT	Information & communications technology	
IGA	Inter-Government Agreement	
IP	Intellectual property (rights)	
IPDE	Integrated Product Development Environment	
KAB	Kockums AB, a Swedish company	
LMA	Lockheed Martin Australia	
NPB	Naval Project Brief	
O-boats	Oberon class submarines of the RAN	
RAN	Royal Australian Navy	
RDT&E	Research, development, test & evaluation	
SIA	Submarine Institute of Australia	
SWSC	Submarine Warfare Systems Centre	Within HMAS WATSON
SWUP	Submarine Weapons Upgrade Program	
UUV	Unmanned underwater vehicle	



