Chapter 6

What submarine capability does Australia need?

Recommendation 5

The committee recommends that Defence and the government start immediately to:

- **strengthen and build a more collaborative relationship with Australia's Defence industry and engender a co-operative environment in which industry is encouraged to marshal its resources in support of Australia acquiring and building a highly capable fleet of submarines;**
- **listen to the technical community's concerns about risk—the technical community, supplemented by outside expertise from industry and allied technology partners, understand the state of technology and the degree to which a new design extends that technology;**
- **consult with retired naval engineers and submariners, especially those who have been involved in reviews of the Collins class submarines and subsequent reforms, and include the most knowledgeable and experienced in a first pass gate review;**
- **work with Australian and Australian-based businesses, from prime contractors to small and medium businesses, to ensure that the contribution that can be made by Australian industry is identified and integrated as much as possible into the project plan;**
- **ensure that opportunities to improve skills and upgrade facilities, particularly those that have multiple uses are identified so that investment in the human and physical capital required for this project is maximised;**
- **risks associated with the transfer of technology are anticipated, identified brought promptly to the government's attention and managed effectively—such risks go beyond securing the rights to IP and also take account of potential or real political and cultural incompatibilities; and**
- **experienced and senior people in key management positions are involved in the project—this requires a strategy to grow people so they are experienced in various disciplines.**

6.1 The current fleet of Australian submarines comprises six Collins class boats. Both the 2009 and 2013 Defence white papers recognised the importance of Australia's submarine capability and of the need to replace its ageing Collins class submarines. In this chapter, the committee considers the strategic importance of acquiring submarines that would give Australia the leading-edge capability it was seeking to achieve.

Determining requirements

6.2 The requirement phase in the capability development life cycle of a major naval acquisition is critical. Decisions made during this stage are central to a project's success and to delivering the best capability that Australia can afford. Vice Admiral Barrett explained that, as the Chief of Navy, he sets the capability requirement for naval vessels. Although he will not define the specific submarine that will eventually be chosen, he will specify requirements in terms of range and endurance and operational needs when on site. He explained that it is capability development and then the actual project that will determine how those requirements would best be met. He explained:

> It is then a consideration with the DMO to confirm that we are in a position to afford the requirements that I have set, not just for the build but to sustain it through its life with the numbers that have been modelled as being necessary to be able to produce that effect.[1]

6.3 According to the Chief of Navy, 'all parts of the system are trying to achieve the best result for Australia based on those capability requirements'.[2]

Critical importance of right decision

6.4 A number of witnesses highlighted the central role that submarines have in protecting Australia's interests. Commander Owen, SIA, noted that over the past 100 years, submarines have demonstrated their importance to Australia's defence and foreign policy. He argued that they 'are no longer an optional extra in the Australian order of battle': they are 'critical to the pursuit of an independent foreign policy and are part of the Australian armoury for the foreseeable future and for at least the next 100 years'.[3] The SIA stated further that submarines are 'the only means available to allow the government to exert consistent influence along the full length of our sea lines of communication'.[4] Commander Owen highlighted the numerous areas in which Australia's submarines have a critical role. He was not suggesting that submarines were the only means of protecting Australia's sea lines of communication, but they

1 *Committee Hansard*, 30 September 2014, p. 52.

2 *Committee Hansard*, 30 September 2014, p. 52.

3 *Committee Hansard*, 30 September 2014, p. 3.

4 *Committee Hansard*, 30 September 2014, p. 1.

would be the only means when access to the sea surface and the air above it was denied. He stated:

> Australia relies on trade for its prosperity, most of which is carried by ships, and thus our maritime security is of vital importance. Long-range submarines, capable of stealthy operations over the length and breadth of our trading routes, are Australia's primary maritime deterrent. Their ability to operate covertly in sea areas denied to other Australian forces deter others from military action and guards against the disruption to our economy that would result from conflicts on and around our trade routes. Australia can and does deploy other forces in support of its maritime security…
>
> In peace time, government has the option to exert quite subtle influence through its use of submarines…
>
> Execution of that influence and support of government policy through the full spectrum of contingencies can be achieved by a single submarine through a six-week patrol. It can observe and report without being detected and it can deploy its weapons, should that be required. A capable submarine force is a vital contributor to Australia's prosperity in the 21st century.[5]

6.5 Rear Admiral Briggs, whose naval career spanned 40 years with over half involved in submarines in various roles at sea and on shore, endorsed the comments that emphasised the critical importance of the submarine fleet to Australia's national security. He wanted to underline the uniqueness of submarines, indicating that no other platform in the ADF provided Australia with the reach that 'gives the same punch, the same bite and is useful in situations where you do not own the surface of the sea or the air above it'. He added:

> They are high pay-off. They are one of the few offensive assets if need be. If we need to throw it, they are the tip of the spear. You better make sure it is a sharp spear and an effective one. They are equally effective in peace time scenarios and, in periods of tension, they are absolutely critical to understanding what is going on and to giving you some lead time as to what people on the other side of the problem are thinking about.[6]

6.6 There can be no doubt of the integral role that Australian submarines have in Defence capability and in securing Australia's strategic interests. To fulfil this function, Australian submarines cannot be second best. The 2009 and 2013 white papers clearly indicated the government's intention to acquire world class submarines designed to meet Australia's unique strategic needs. Evidence supported this objective. For example, Commodore Greenfield, a qualified weapons and electrical engineer,

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5 *Committee Hansard*, 30 September 2014, p. 2.

6 *Committee Hansard*, 30 September 2014, p. 9.

stated that Australia's Future Submarines should be 'the most capable vessels possible within a reasonable and affordable price'.[7]

Royal Australian Navy Collins Class submarines exercising off the West Australian coast. HMAS Waller and HMAS Dechaineux were involved in the extensive training exercise which tested both the crew and machine.

(Image courtesy of the Department of Defence)

6.7 In this regard, Mr King explained that DMO wanted the ADF 'to have a technological edge'.[8]

Special requirements

Range and endurance

6.8 Australia's geography imposes certain demands on its submarines, which means they require special features to be an effective force. Many witnesses argued that Australian submarines need endurance, range and reasonable mobility to be able to get into and operate in the areas of strategic importance to Australia. Most notably, Australian submarines operate under extremely demanding circumstances especially

7 *Submission 18*, p. 1. Commodore Greenfield is a qualified weapons and electrical engineer with career in operations, maintenance and acquisition programs of ships and submarines with a focus on trials and major contracting and procurement programs.

8 *Committee Hansard*, 30 September 2014, p. 50.

their very long transit times and routes.[9] Rear Admiral Briggs referred to the huge distances that Australian submarines traverse:

> We are the only submarine navy in the world that steams a submarine halfway around the world and then expects it to go on patrol and, when it is finished, to come back. It is a huge driver. The transit requirements will determine the size of the submarine. The ability to cover 3,000 miles of open ocean, some of it under other people's surveillance, to do it quickly with good mobility and to arrive in a patrol area without having been spotted and to do your job is absolutely critical to the success of the submarine and no-one else has the geography or the problems that we are dealing with.[10]

6.9 Likewise, Commodore Greenfield referred to the long distances to be travelled at speed, which determines the large size of Australia's submarines:

> It requires more generating capacity…it requires more fuel, more crew with good habitability to mitigate against fatigue, more food, more weapons and, importantly, extra-large water tanks to ensure a balanced trim and to compensate for changes in buoyancy due to water temperature and salinity, the use of fuel and consumables and weapons et cetera.[11]

6.10 Importantly, the long transit and time spent undetected in the patrol zone defines the Australian submarine's mission and is the main driver of the boat's design. According to Commodore Greenfield, the submarine's mission is 'like no other country's defining mission'. He recalled the observations of a retired submarine engineer officer who said:

> Australia has the only navy in the world which flogs its diesel-electric submarines, dived across thousands of miles across the ocean and then sends them on patrol.[12]

6.11 Commodore Greenfield explained further that the word 'flog' is naval jargon referring to the very heavy punishment received by the machinery during the transit phase. He stated:

> The rapid and partial charging and discharging of the battery severely reduces its performance. Remember, we have 400 tonnes of lead acid battery. It is not like the lead acid battery in your car. The reliability of the diesels is affected due to heavy fluctuations in the load, the suction and back pressures, and the masts suffer reliability problems due to high usage rates and vibration.[13]

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9 *Committee Hansard*, 30 September 2014, p. 38.

10 *Committee Hansard*, 30 September 2014, p. 9.

11 *Committee Hansard*, 30 September 2014, pp. 21–22.

12 *Committee Hansard*, 30 September 2014, p. 21.

13 *Committee Hansard*, 30 September 2014, p. 21.

6.12 Such extreme demands on a submarine create a raft of engineering requirements and challenges.[14]

Stealth

6.13 Commodore Greenfield noted the need to have stealth as a priority for the future submarines.[15] Having transited to the main area of operation, a submarine must remain undetected. Commodore Greenfield emphasised the importance of maintaining stealth during the long, speedy transit, which, he argued, created a unique challenge for Australian submarines. In his view, Australian industry understands this need for stealth and was constantly developing new ideas and concepts to improve it.[16] He underscored the fact that Australian submarines are sent in harm's way. Based on firsthand experience, he told the committee that the crews 'need blind faith and confidence that systems will work as advertised in emergencies—whether it be fire, flood, battle damage or some other emergency'. He reiterated:

> …in these situations, our crews need absolute confidence in the supporting contractors, suppliers and maintainers. And later, of course, they will need quick access to remedial action—and they will only get that from Australia.[17]

6.14 The SIA also referred to stealth in submarine operations and the all-pervading need for the highest levels of security throughout the life of the submarine, in order to protect that capacity for stealth. Commander Owen explained further that once a submarine has a low signature or what is called a low indiscretion rate—not exposing the boat's masts and making noise—in regions far removed from its base, it has to operate in an area where there are now several nations that have acquired submarines. He underscored the importance of stealth:[18]

> So, once you are in that area, you then need to be able to preserve your stealth when you are operating slowly and quietly to perhaps not be put in a situation where you are counter-detected first and the reaction of that less-experienced submarine is to classify you with a weapon. So you need better sensors, better capability and therefore better stealth in order to achieve that.[19]

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14 *Committee Hansard*, 30 September 2014, p. 21.

15 *Submission 18*, p. 5.

16 *Committee Hansard*, 30 September 2014, p. 21.

17 *Committee Hansard*, 30 September 2014, p. 24.

18 *Committee Hansard*, 30 September 2014, p. 5.

19 *Committee Hansard*, 30 September 2014, p. 5.

6.15 Clearly, stealth is essential for the safety of the submarine crews and their operations and for the effectiveness of government policy. According to Commander Owen, stealth is a fundamental characteristic of successful submarine operations.[20] He noted that stealth in the operational area depends on technology, construction and sustainment; the competence of the operators; and stringent security.[21]

Crewing arrangements

6.16 Commander Owen spoke of a submarine that, having made the long transit, may need to remain in a patrol area undetected for several weeks or months with 50, 60 or 70 people working in close confines and operating completely independently, perhaps without the benefit of communication back home. He noted that in order to sustain that capability with the onboard technical skills, the crew needs to be able to remedy defects that might occur and to have the logistics support, which requires 'the habitability that really only a larger submarine can possess'.[22]

ANZAC Frigate HMAS Stuart tracks Collins class submarine HMAS Sheean as she sails past Christmas Island on return to her home port of HMAS Stirling, Freemantle, Western Australia.

(Image courtesy of the Department of Defence)

20 *Committee Hansard*, 30 September 2014, p. 1.

21 *Committee Hansard*, 30 September 2014, pp. 1–2.

22 *Committee Hansard*, 30 September 2014, p. 5.

Physical environment

6.17 Earlier, when comparing the Soryu and Collins submarines, the committee referred to the very demanding sea conditions in which Australian submarines operate.[23] Commodore Greenfield cited these very different operating surrounds of Australian submarines as another factor when considering the specific requirements for the future boats. He noted that unlike all Northern Hemisphere submarines, Australian submarines have to deal with tropical, highly saline waters. According to Commodore Greenfield, this environment promotes higher rates of corrosion and biological growth. He referred to 'high machinery and main storage battery operating temperatures—40 degrees, rather than the Mediterranean 25 degrees—and the need for much higher capacity cooling systems'. In his view, these conditions have 'a consequential effect on energy and fuel usage, hence range and endurance'. The designer has to take all these factors into account.[24] Mr Pacey, a private sector consultant with wide-ranging experience in defence and national security, also noted that Australia's areas of operations are primarily in warm waters that are characterised by high levels of salinity.[25]

Nuclear option

6.18 Recent Defence white papers have ruled out the option of a nuclear submarine. Evidence to the committee was consistent with this view. Vice Admiral Jones, Chief, Capability Development Group, informed the committee that both sides of politics have decided that they would not pursue a nuclear option.[26] Mr King also noted that as a matter of policy Australia was a conventional boat operator.[27] Furthermore, he acknowledged the practical obstacles that would currently make a nuclear choice unworkable for Australia:

> With such a decision [to have nuclear-powered submarines] comes an enormous overhead. First of all, you have to change people's attitude towards nuclear power and then, beyond that, the industry behind it to sustain that capability and the cost of operating it. It is an interesting comparison that Japan, which has a nuclear industry and has a substantial nuclear base, chooses to operate conventional submarines.[28]

23 See paragraph s 5.57–5. 58.

24 *Committee Hansard*, 30 September 2014, p. 21.

25 *Committee Hansard*, 30 September 2014, p. 29.

26 *Committee Hansard*, 30 September 2014, p. 62.

27 *Committee Hansard*, 30 September 2014, p. 38.

28 *Committee Hansard*, 30 September 2014, p. 62.

Potential suppliers

6.19 The committee has heard evidence that there are a number of different non-MOTS options open to Australia that would enable it to acquire a fleet of world class conventionally-powered submarines suited to the nation's requirements.

Changing technology and the global market

6.20 Changing technology and the increasing costs associated with the design and development of state-of-the-art communication and combat systems for naval vessels means that few countries or companies in their own right can produce sophisticated, highly complex and expensive systems. Recent decades have witnessed an increasing trend toward globally integrated production systems. Countries that seek to remain at the cutting edge of technology quite sensibly explore promising technologies developed elsewhere in the world. Some engage in collaborative developments—alliances or joint ventures, teaming and licensing arrangements—which offer them the opportunities to share research and development costs and combine technical capabilities to produce a more innovative product than might not otherwise have been possible.

Need for partnerships

6.21 Based on the evidence before the committee and the numerous reports dealing with shipbuilding, it is widely accepted that Australia cannot undertake the future submarine project without overseas assistance. For example, the expert industry panel involved in the future submarine industry skills plan was unanimous in its view that:

> …Australia had a good range of skills that could contribute to the design of a complex warship like a destroyer or submarine, with such a project requiring the partnership of an established, overseas designer.[29]

6.22 Witnesses to the inquiry observed that Australia would need a design partner for the submarines and that there would have to be technology transfer.[30] They agreed that there were limited contenders for designing and building conventionally powered submarines. Commodore Greenfield noted that all the submarines that are in production at the moment, the so-called MOTS submarines, are either European or Japanese.[31]

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29 Department of Defence, *Future Submarine Industry Skills Plan*, 2013, p. 57.

30 See for example, Mr Hamilton-Smith, Minister for Defence Industries, South Australian Government, *Committee Hansard*, 14 October 2014, p. 6.

31 *Committee Hansard*, 30 September 2014, p. 25.

6.23 Rear Admiral Briggs said that there were four valid starting points for the future submarines—the French, Swedish, German or Japanese boat.[32] Likewise, Professor Roos agreed that Australia needed a partner in the design phase with only France, Germany, Sweden and Japan as likely partners.[33]

6.24 According to Mr King, Defence had been in discussions with Japan, Germany, France, Sweden, the UK and the USA. Evidence suggested that some of the European designers and builders had flagged their interest in tendering for the future submarines. For example, Mr Jackman, Chief Executive, Defence SA, indicated that TKMS, builder of the German submarine, was pressing its case to be included in the process. He was also aware that the Swedish, with the Saab organisation, were also keen to do exactly the same. He stated:

> Both those organisations have put their hands up to meet with the minister and the Premier to discuss what support they would want from this state to build those submarines in this country.[34]

6.25 Also, according to Mr King, Defence had paid for some work to be done on submarines by France and Germany and by Sweden to look at the evolved design. He stated further:

> We have paid them money to do work for us. We paid them on the MOTS options. So, yes, we have been engaged with them and, yes, we have paid some of their costs.[35]

6.26 For Rear Admiral Briggs, it was simply a matter of the starting point, the baseline and the chosen partner 'to go forward on the journey to do the design'. He suggested that those factors come together to build a risk. He said:

> Every solution will have a different level of risk and a different range of factors in it. Picking the right starting point, picking the right design to do the job is the key question in front of Australia at this point.[36]

6.27 Dr John White said that the MOTS option—submarines currently in production—had no chance of any success as it was 'well known that no existing submarine design would meet Australia's requirements'. To his thinking, however, a MOTS design, which allowed for modifications to meet minimal essential RAN requirements, held the most promise because:

> …it recognised the advantage of evolving a proven MOTS design from a prominent submarine company to include specified RAN requirements.[37]

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32 *Committee Hansard*, 30 September 2014, p. 9.

33 *Committee Hansard*, 8 October 2014, pp. 17–18.

34 *Committee Hansard*, 14 October 2014, p. 8. See also Mr Hamilton-Smith, Minister for Defence Industries, South Australian Government, *Committee Hansard*, 14 October 2014, p. 1.

35 Senate Foreign Affairs, Defence and Trade Legislation Committee, Estimates *Committee Hansard*, 22 October 2014, p. 100.

36 *Committee Hansard*, 30 September 2014, p. 9.

6.28 Ultimately, Dr White formed the view that there were three plausible overseas contenders. They were:

- the German TKMS design based on the current 214AU and the conceptual design 216AU for Australia;
- the French SMX OCEAN class conceptual design based on a barracuda hull; and
- an updated Japanese Soryu class submarine.

6.29 Witnesses generally referred to four possible bidders, including an evolved Collins. Most of the evidence taken by the committee, however, related to the Collins class and Japanese submarines as the potential basis for future work.

French

6.30 Commander Owen observed that the French both design and build very good submarines and have experience in exporting that technology. He indicated that they were currently exporting a mix of diesel and nuclear submarines to Brazil.[38]

6.31 Dr White noted that the French SMX OCEAN class conceptual design was the next generation SSN of the French Navy fitted not with a nuclear propulsion system but a conventional propulsion system, SSK, with air-independent propulsion, or AIP, technology. He informed the committee that this development in France seeks an endurance of 14,000 nautical miles and a continuous transit speed of 14 knots for one week utilising its AIP system and fitted with two fuel cells. This concept was to be released at the end of October 2014 in France.[39]

German

6.32 Commander Owen considered that the Germans, who have vast experience in building and exporting submarines and supporting their export arrangements around the world, build very good submarines. In his view, the fact that countries keep going back to the German submarines would suggest that they build and design good boats. Commodore Greenfield observed, however, that we often hear stories that German submarines can do so many days dived but, when you really do the calculations, it is probably at four knots. He surmised that they are talking about the patrol area but not the transit route. Dr White thought that the German TKMS should be an option open for further consideration offering a MOTS evolution solution.[40]

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37 *Committee Hansard*, 13 October 2014, p. 26.

38 *Committee Hansard*, 30 September 2014, p. 7.

39 *Committee Hansard*, 13 October 2014, pp. 26–27.

40 *Committee Hansard*, 13 October 2014, pp. 26–27.

6.33 As noted earlier in this chapter, Australian submarines need to transit great distances—3½ thousand miles away. To do so, they have to travel that long distance and come back again. In Commander Owen's assessment, none of the other submarines were designed to be able to do that.[41]

Collins

6.34 The Australian Submarine Corporation (later ASC) was established in 1985 through a joint venture between Kockums, the Australian Industry Development Corporation, Wormalds International and Chicago Bridge and Australia Iron. It was chosen in 1987 as the prime contractor for the design, manufacture, upgrade and delivery of the Collins class submarines.[42] This project was one of the most ambitious and highest profile naval shipbuilding projects in Australia.

6.35 The May 1987 decision to award the Collins class contract to ASC established a highly capable prime contractor.[43] The decision reflected Navy's view that considerable benefits would accrue from having one organisation build and maintain the vessels. An Australian build with close access to the building yard promised reduced operating and maintenance costs and increased length of service between refits. In addition, it was argued that building the vessels in-country would economise on the high initial capital outlay on the integrated logistics support needed to bring the submarines into military service. As a result of the Collins class project, ASC was the likely choice for the 25-year, A$5 billion contract for the through-life support of the submarines, announced in 2003.

6.36 The Australian-built Collins class submarine illustrates some of the complexities faced by a modern naval shipbuilder:

> Aboard the Collins, we have 108 systems integrated into a pressure hull, one of which we are required to safety certify. It is a safety-critical piece of equipment. That alone makes it an engineering and technical challenge. The shipbuilder, or the submarine builder, in that case, is responsible for integrating those systems into the vessel. The combat system constitutes a system and there are the communications system and other systems. Even by the time we are done with everything that can be construed as a related part of the combat and C3I system, we still have 100 systems that are integrated which work to keep the platform in motion, keep the crew safe at deep-dive depth and a lot of other things.[44]

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41 *Committee Hansard*, 30 September 2014, p. 25.

42 ASC *Annual Report 2005*, p. 2.

43 The Australian Submarine Corporation (later ASC) was formed in August 1985 with Kockums holding a 49 per cent shareholder of ASC when ASC was selected as the prime contractor for the submarines in May 1987.

44 Mr Gregory Tunny, Managing Director and Chief Executive Officer, ASC Pty Ltd, Foreign Affairs Defence and Trade Committee, Inquiry into Australia's Naval Shipbuilding Industry, *Committee Hansard*, 4 September 2006, p. 12.

6.37 The Collins class submarine is well known to Australians both for its well-publicised problems but also for its achievements. In his 2012 paper, *Sub Judice: Australia's Future Submarine*, Mr Pacey suggested that the Collins was 'the only available conventional submarine approaching the range and endurance to meet the capability requirement for the Future Submarine'.[45]

Problems

6.38 Witnesses did not deny that the Collins class submarine had experienced problems throughout its construction and service life.[46] In his submission, Commodore Greenfield noted that while the Collins program was far from perfect it was 'much better than the press would have you believe'. He suggested that Australia was in a much stronger position now than at the time of the last submarine acquisition and, if lessons from the past were learnt,[47] could build on this to good effect.[48] In his view the 'least risky pathway was to re-design the Collins—we know what works well and what doesn't'.[49]

6.39 Mr Chris Burns told the committee that many mistakes were made in negotiating and establishing the Collins submarine contract. He then stated:

> …but Australian industrial tenacity and innovation turned the project around to the point where we now operate among the most capable conventional submarines in the world.[50]

6.40 The Collins class project proved and improved the capacity and productivity of the Australian industrial base to build from scratch, complex warships to a high quality. Indeed, a number of witnesses referred to the enormous challenge confronting Australia's defence industry in building the Collins. Mr Whiley, who joined ASC in 1989, noted that the project started in Osborne as a greenfield site with no production staff, no tools, no infrastructure and no capacity. ASC was completely different from the current hive of activity.[51] He then observed:

> Throughout the world's submarine community, the Collins class submarines are considered a world-class conventional submarine with unparalleled capabilities, a sentiment that extends to the team of personnel who built and now maintain them.[52]

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45 Kokoda Paper No. 17, *Sub Judice: Australia's Future Submarine*, January 2012, p. 63.

46 See for example, Rear Admiral Brigg who acknowledged that there were design deficiencies in individual equipment. *Committee Hansard*, 30 September 2014, pp. 17–18.

47 *Submission 18*, p. 2.

48 *Committee Hansard*, 30 September 2014, p. 24.

49 *Submission 18*, p. 3.

50 *Committee Hansard*, 14 October 2014, p. 15.

51 *Committee Hansard*, 14 October 2014, p. 21.

52 *Committee Hansard*, 14 October 2014, p. 21.

6.41 Mr Derek Woolner detailed some of the positive results achieved by the Collins class submarine:

- All six vessels, with the exception of the bow of the lead boat, were constructed in Australia to a high standard of workmanship. In terms of poor construction work, the main fault was with welding done in Sweden on the bow of the first ship.[53]
- The Collins class project achieved 73.5 per cent Australian industry content for the new platforms, exceeding the government's minimum target of 70 per cent.[54] In so doing, the project promoted the establishment and development of many second and third tier Australian companies.
- The Collins class project greatly enhanced the skill base of the naval construction and design industry. Institutions such as the defence science facility and the local TAFE at Port Adelaide were important in the training process. The project has provided the design and engineering skills that will assist in ASC's development of the three AWDs and will be crucial should Australia commit to a new generation of submarines.
- The project indicated that ASC was more productive than its overseas counterparts. It produced one submarine per year, a faster rate of vessel construction than in Dutch and British yards.[55]

Lessons learned from the Collins-class

6.42 Mr Pacey acknowledged the criticisms directed at the Collins, including 'some straight talking from John Coles himself'. He suggested that:

> Few of us would disagree with those criticisms, but what has been overlooked is that the phase 1 report by John Coles stated: 'The scale of the achievement to acquire and build these highly capable submarines is recognised internationally. These achievements give us every confidence that Australia can and will achieve success in owning and operating at a reasonable cost a fleet of sophisticated and capable submarines, fully capable of protecting our maritime interests'.[56]

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53 Mr Patrick Walters, 'The Cutting Edge: The Collins experience', Strategic Insights, Australian Strategic Policy Institute, February 2006, p. 6.

54 Mr Patrick Walters, 'The Cutting Edge: The Collins experience', Strategic Insights, Australian Strategic Policy Institute, February 2006, p. 5. Derek Woolner noted that the project was 'revolutionary in that it required those companies bidding for the RFT [Request for Tender] to provide detailed information on their plans to involve Australian industry'. Mr Derek Woolner, Procuring change: How Kockums was selected for the Collins class submarine, Research Paper No. 4, 2001–02, Parliamentary Library, p. 11.

55 Mr Derek Woolner, Getting in early: Lessons of the Collins Submarine Program for Improved Oversight of Defence Procurement, Research Paper No. 3, 2001–02, Parliamentary Library, p. 14.

56 *Committee Hansard*, 30 September 2014, p. 29.

6.43 A study produced by the Kokoda Foundation and authored by Mr Pacey reached the same conclusions. In summary, the study found that Australia had a unique capability requirement that could only be met by an ab initio design or an evolution of an existing design. It found:

> Of the options that were available three years ago, an evolved Collins emerged as the lowest risk because it was the only available conventional submarine that came close to meeting Australia's capability requirement in terms of range, endurance and payload. The lessons learned from operating Collins were too valuable to throw away. Any new option will need a comparable level of analysis.[57]

6.44 Mr Pacey informed the committee that, whereas a few years ago he was pessimistic about a successful outcome, during the course of the future submarine study he became increasingly confident that the Collins could be returned to a reasonable level of availability at an affordable cost. He also came to understand that the future submarine program could deliver a boat suited to Australia's unique strategic circumstances at a cost significantly lower than some figures that had gained traction at the time. 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.[58]

6.45 A number of other witnesses referred to the substantial body of knowledge, skills and experience that had been built up over the years through work on the Collins. Commander Owen described Australia’s submarine capability as an insurance policy for uncertain times. In his view, the low risk path was to build on Australia's 21 years' experience with Collins. He formed the view that the Collins would provide 'a very much better place to step off from than leaping into the unknown, where we do not have any understanding of the many aspects of building a submarine'.[59] Commander Owen argued that while Australia's 'regional colleagues smile uncomfortably at the Australian press criticism of the Collins-class submarines, their own experience has told them that the assertions have little substance'. In his opinion:

> Australian submarines and the Australian submarine capability are the regional benchmark in the safe conduct of operations and in matters of submarine escape and rescue.[60]

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57 *Committee Hansard*, 30 September 2014, p. 29.

58 Kokoda Paper No. 17, *Sub Judice: Australia's Future Submarine,* January 2012, p. 62.

59 *Committee Hansard*, 30 September 2014, p. 6.

60 *Committee Hansard*, 30 September 2014, p. 2.

6.46 Rear Admiral Briggs and Commodore Roach were of the view that the Collins provided a 'sound starting point for the future submarines'.[61] Indeed, the Collins class experience has produced valuable lessons for the procurement of Australia's future submarines. Commodore Greenfield suggested that 'the least risky pathway was to re-design the Collins—'we know what works well and what doesn't'.[62]

6.47 Commodore Greenfield argued that the Navy, the DMO and Australian industry now understand the Australian requirements. In his opinion, Australian industry could provide engineering solutions as it did for Collins and was still doing.[63]

6.48 Rear Admiral Briggs agreed with this assessment. He suggested that 'more went right with Collins than went wrong'. In his view, there was a bit of a national naivety that 'we could start with a patch of sand on the Adelaide River and build this bigger, modern submarine and not have any problems'. He explained that the problems were handled and at the end of the fixed program 'we had two modified, fast-tracked submarines, as they were called, with fixes, hardware in the systems and in the combat system that were able to be sent to sea and sent into harm's way'.[64]

6.49 According to Rear Admiral Briggs, Defence was over ambitious in its specification. He also referred to the contract, which was a black-letter law contract:

> 'This is what it will do'—when in fact what we were setting off to do was to develop a combat system and we should have had a lot more interaction with the contractors and be prepared to move the requirement as we understood more about the technology. We did not do that; we stood there with lawyers rather than with engineers.[65]

6.50 Commander Owen, SIA, cited the key lessons he wanted to be learnt from the Collins class experience:

- it took time to learn that we were the parent Navy of our submarines;
- we cannot give the responsibility for our sovereignty to another country—to protect our most sensitive secrets, then we must take ownership of them;
- we need ongoing and respectful relationships with suitable suppliers;
- a dedicated program of maintenance and investment is absolutely essential to ensure that Australia's submarine fleet is fully operable, capable and available; and

61 *Submission 17,* p. 11.

62 *Submission 18*, p. 3

63 *Committee Hansard*, 30 September 2014, p. 22.

64 *Committee Hansard*, 30 September 2014, p. 16.

65 *Committee Hansard*, 30 September 2014, pp. 16–17.

- more than six submarines are required to provide an effective deterrent. While various numbers have been discussed, we calculate that at least 12 submarines are required.[66]

6.51 The SIA underscored the importance of ensuring that Defence has continued access to the submarine technology that is most relevant to the nation's strategic environment. It argued that the government must guarantee that Australia can sustain, maintain and upgrade its submarine capability throughout the next 100 years.

6.52 Acknowledging that the diesels in the Collins were a major source of unreliability, Rear Admiral Briggs explained that Defence adapted a diesel because we needed one of that size and there was not an off-the-shelf one. In his view, Defence and industry learnt a very, very hard lesson—'There is no way in the world that anyone now would do anything except go and buy an accepted, off-the-shelf diesel, and they are there'.[67]

6.53 Despite the valuable lessons to be learnt from the Collins, a number of witnesses were of the view that an evolved Collins was not a preferred course of action. Mr Whiley observed that Collins was almost 30 years old and the design has been moved on. Based on his understanding of the requirements, he thought that the design would have to be changed significantly for the current sets of requirements. Even so, he was of the view that there were many lessons from Collins that 'could be used in the future submarine design and build process'.[68] Professor Roos also thought that an evolved Collins, was doomed from the start, because the pressure hull diameter was constrained to the current 7.8 metres. He explained that 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'.[69]

6.54 As noted earlier, Dr White was of the view that the separate designation of the Collins upgrade as option 3 in 2012 was inappropriate, given that the design was approaching its 30th birthday without evolution.[70]

66 *Committee Hansard*, 30 September 2014, pp. 2–3.

67 *Committee Hansard*, 30 September 2014, p. 17.

68 *Committee Hansard*, 14 October 2014, p. 30.

69 *Submission 25*, p. 1.

70 *Committee Hansard*, 13 October 2014, p. 27.

Conclusion

6.55 Australian submarines are an integral part of Australia's Defence capability and central to promoting the nation's strategic interests. They are, however, highly complex machines that operate in demanding and unique environments that require special features.

6.56 There is no existing submarine that Australia can purchase off-the-shelf that would satisfy Australia's requirements.

6.57 The government should rule out a military-off-the-shelf option for Australia's future submarine fleet.

6.58 As the committee has heard, the government has a number of options to consider for the future submarine project.

6.59 As recommended, the government should test these options through a competitive tender process so that the Australian public has confidence that the government is purchasing the best, most capable submarine, at a competitive price for the taxpayer.

Senator Sam Dastyari
Chair