

Cutting Edge: The Collins experience

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by Patrick Walters

The \$5 billion Collins Class submarine project has been by far the most ambitious and controversial defence project ever undertaken in Australia. No major defence procurement project in Australian history has generated such an extraordinary saga of strategic, commercial and bureaucratic rivalries, technical snags, cultural

misunderstandings, political interference and genuine national achievement as the building of the Collins Class vessels.

Branded by the media as ‘dud subs’ in the late 1990s, the Collins Class project also came under sustained government criticism during the 2001 election year—in



Nuship Collins under preparation prior to Official Rollout at ASC Facility in South Australia. © Department of Defence

a politically-driven assault unprecedented for a major Australian defence industry endeavour. The project also exposed serious deficiencies in the Defence Department's procurement processes and contract management practices. The result has been that it has taken years for the Collins Class to overcome the negative public perceptions generated after the design and performance problems associated with the early boats became apparent.

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The only other defence procurement project that can compare with the Collins boats in terms of public controversy is the purchase of F-111 fighter-bombers initiated by the Menzies Government more than forty years ago. Both procurements were technologically way ahead of their time and represented a big leap of faith for the governments of the day. Both became objects of political controversy. But while the F-111's were eventually purchased off-the-shelf from the US, the decision to build all the Collins boats in Australia was a major political and commercial risk for the Hawke Government.

Twenty-five years after the idea of an Australian-built submarine was first broached and twelve years after the launch of the first boat, Navy finally has six operational submarines. The Collins boats are very quiet

and have performed exceptionally well on long deployment and in regular exercises with the US Navy. One of Australia's most vital front-line defence assets they are now widely regarded as the finest conventional submarines in the world. The Collins project also delivered a massive shot-in-the arm to Australia's defence industry and it is only now, after the completion of the project, that the industry benefits can begin to be assessed.

This **Strategic Insight** provides an overview of the Collins Class project. It examines the industry, capability and strategic impact of what is still the most complex defence project ever undertaken in Australia. It concludes that the Commonwealth's \$5 billion investment has not only provided Australia with a key strategic asset but also greatly boosted the skill base of our naval construction industry—a national asset that will be sustained and further enhanced over the next decade by the recently approved \$6 billion Air Warfare Destroyer (AWD) project.

The strategic importance of this local industry capacity is underlined by the fact that no future off-the-shelf submarine is likely to come close to Australia's unique requirements. Decisions will need to be taken within the next two to three years on the funding of feasibility studies if Navy is to have a new class of Australian-built vessels in service from 2026 when the Collins Class begin to retire. But as yet no provision has been made for funding studies in the latest Defence Capability Plan (DCP).

Collins Class submarines

Each Collins Class submarine has over 3,800,000 parts, 75 km of cable, 200,000 on-board connections, 23.5km of pipe, 14,000 pipe welds, and 34.5 km of hull welding.

(Source: ASC)



Collins Class submarine HMAS Waller during a helicopter transfer operation. © Department of Defence

The build

Planning for the Collins Class began in 1978—a full fifteen years before the launch of the first boat, HMAS *Collins*, in 1993. Navy wanted to acquire a new class of modern submarines to replace its six UK built Oberon Class boats. By the early 1980s the Navy's new submarine project team had determined that it should build a unique submarine that matched Australia's special requirements rather than buying off-the-shelf from an overseas supplier. Navy wanted a larger, long-range, higher speed conventional submarine capable of long transits and long endurance compared with European boats traditionally built for shorter distances and endurance.

Central to Navy's argument for an all-Australian build was technology transfer and the desire to build the necessary capacity to sustain a long-term submarine capability in Australia. The new submarine project team argued that building all six boats in Australia was essential to achieving the strategic industry goal of being able to fully support the new capability in-country. Navy's Oberon Class boats had been heavily dependent on overseas supply and technical support notwithstanding the considerable experience gained in the highly successful Australian-managed upgrade of the Oberon Class boat's weapons system.

In May 1985, the Hawke Labor Government accepted Navy's advice that all six of the new class of submarine should be built in Australia. It was a courageous decision remarkable for its boldness even when viewed from the perspective of hindsight two decades later.

From the special high-tensile steel required for the hull, the advanced software demanded for the combat system, to the management of the actual contract, the risks were formidable. Virtually every aspect of the project involved technical challenges and a level of innovation unprecedented in Australian naval or industry experience.

The decision to build all six boats in Australia was founded on an intensive dialogue between the new submarine project team and Australian industry. That in turn helped bolster the government's judgement that a local build should be attempted. At that time, the Royal Australian Navy (RAN) had not built the close working relationship with the US Navy that has since enabled many of the teething problems associated with the Collins Class to be sorted out.

Cold War sensitivities made the US wary of discussing any aspect of submarine technology other than weapons systems with its close ally. Australia may have been building a new submarine capability of significant strategic value to the US but, at the time, it had to go it alone.

The six Collins Class submarines

- HMAS *Collins* launched 28 August 1993, commissioned July 1996
- HMAS *Farncomb* launched 15 December 1995, commissioned January 1998
- HMAS *Waller* launched 14 March 1997, commissioned February 2001
- HMAS *Dechaineux* launched 12 March 1998, commissioned February 2001
- HMAS *Sheean* launched 1 May 1999, commissioned November 2000
- HMAS *Rankin* launched 7 November 2001, commissioned March 2003.

(Source: Royal Australian Navy)

In May 1987, the Hawke Government announced that the Swedish firm Kockums had won the contest to build the new class of diesel-electric submarines over the German submarine builder Howaldswerke-Deutsche Werft (HDW) following a government-funded project definition study. The \$4.7 billion (1987 dollars) fixed price contract called for the delivery of a wholly new platform based on a Swedish design with a new generation US-supplied combat system. It was a complicated acquisition strategy that proved to be more problematic than defence planners envisaged at the time.

A new single project company, Australian Submarine Corporation (now known as ASC), was established in Adelaide with Kockums together with Australian and US companies as shareholders—an arrangement that later generated considerable tensions between the designer/builder and the customer. After HDW merged with Kockums in 1999, the Howard Government exercised its pre-emptive rights in November 2000 and acquired 100% of ASC. The company remains in full government ownership.

The government sought a minimum of 70% Australian industry content for the new platforms—an ambitious target given that Australia had never before attempted to build a submarine. Achieving and eventually exceeding that target involved extremely close cooperation between state and federal governments and Australian industry.

The boats were assembled at a greenfields site at Adelaide's Outer Harbour with a skilled workforce that signed up to wholly new industrial relations contracts. In the end, the construction of the Collins Class involved seventy major subcontractors in Australia and overseas. At least two thousand new jobs were created and more than one hundred Australian companies achieved the ISO 9000 quality assurance standard directly as a result of the project.

Basic specifications

Length: 78 metres

Diameter: 8 metres

Displacement: 3,000 tonnes

Diving depth: 180+ metres

Speed submerged: 20+ knots

Speed surfaced: 10+ knots

Propulsion: Diesel-Electric

Crew: 45

Weapons: Mark 48 heavyweight torpedoes, Harpoon missiles.

(Source: Royal Australian Navy)

ASC ended up managing more than 1,600 individual sub-contractors for the construction of the Collins Class submarines of which three hundred and forty-six were from overseas. The project achieved 73.5% Australian industry content for the platform and 45% local industry content for the combat system.

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Australian industry performed extremely well. The deficiencies in the build phase related more to design and contractual problems, including with overseas suppliers, than to any manifest shortcomings on the part of local industry. The project spawned a number of small companies that have produced

leading-edge technology ranging from pumps to towed arrays and anechoic tiles. The only problems with the hull construction turned out to be associated with the welding in Sweden on two sections of the first boat in the class—the *Collins*. In comparison, the US Navy's Seawolf submarine program saw the first two hulls scrapped because of welding problems.

The problems

Every country that has built a new class of submarine based on an *ab initio* design has experienced development problems and significant cost overruns with the first of type. Navy's desire to proceed with a unique design to meet Australia's special requirements guaranteed a range of developmental problems. It would be surprising if there had not been problems with the Collins project; ASC estimates that complexity of building the three thousand tonne Collins Class boats at ten times that of the ANZAC frigates.

The June 1999 McIntosh-Prescott report¹ on the Collins project chronicled a range of deficiencies in the new submarines, three of which had been delivered to the Navy by that time.

'The Collins Class submarines constitute, on the one hand, probably Australia's most important strategic asset for the decades starting in 2000 and on the other, Australia's most ambitious and technically advanced defence industrial project ever,' McIntosh and Prescott concluded. *'Australia sought, for good reason, to undertake a project well beyond its previously established capacity in defence, but despite a great deal of success in some aspects, has not so far established the total organisational and systems capabilities nor some of the individual competencies required,'* they said.

While the Collins Class had been well designed for Australia's special requirements and was generally soundly built, the report found that the submarine project had been subject to *'leaks and public vilification on an unprecedented scale.'* This adverse publicity hampered recruitment for the submarine arm—always a difficult issue for the Navy.

Interestingly, McIntosh and Prescott also noted in 1999 that there had been no significant increase on the real contract price. Their report detailed the most serious technical defects yet to be remedied in the boats. They included problems with the diesel engines, noise propagation, and the performance of propellers, periscopes, masts and the combat system. McIntosh and Prescott judged that Australia's strategic circumstances would have had to had been extremely serious to risk the submarines being 'sent into danger' given their operational state at the time.

Most of these issues have since been addressed with the vital help of Australia's Defence Science and Technology Organisation (DSTO) and the US Navy with the combat system still the key outstanding issue. In retrospect, the Collins build stands up well by comparison with other new submarine projects notably the British Vickers 2400 and the US Seawolf Class.

High-level technology support from the US Navy and the American firm Electric Boat has been absolutely critical to remedying the design flaws in the Collins Class boats particularly the cavitation noise problems and the integration of the combat system.

Not surprisingly, the biggest impediment to achieving full operational performance for the Collins Class proved to be the combat system. The original combat system supplier Rockwell

¹ M.K. McIntosh, J.B. Prescott: *Report to the Minister for Defence on the Collins Class Submarine and Related Matters*, June 1999, p.5

(later Boeing) and Navy underestimated the sheer complexity of building a new system from scratch. The system delivered never worked properly and, after a series of interim fixes, is planned to be progressively replaced at a cost of \$500 million. HMAS *Waller* is scheduled to be the first Collins Class boat to be upgraded sometime this year.

The original 2000 tender evaluation by the Defence Materiel Organisation (DMO) concluded that a German combat system developed by STN Atlas Elektronik represented the lowest risk and best value for money solution. However, acting on advice from Navy, the Howard Government rejected the recommendation citing the strategic importance of increased cooperation and interoperability on submarine matters with the US.

In September 2001, Canberra and Washington entered into a long-term partnership on submarine technology. This resulted in Raytheon being selected to equip the Collins Class with the AN/BYG-1 Combat Control System (CCS) Mk2 system which is also being

fitted to the US Navy's SSN-744 Virginia Class boats and retrofitted to the US Seawolf Class. A joint project office has been established to develop, manage and support the new combat system for both navies.

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Navy's original specification proved to be too ambitious for the 1980s technology that was locked into the design. Nearly two decades later the irony is that the major setbacks in the combat system development that occurred in the 1990s will now result in an even more advanced system being progressively fitted into the Collins Class boats by 2010. In the meantime, interim measures allowed Navy to finally accept 'operational release', or acceptance into naval service, of the six Collins Class boats in March 2004.



Rollout of HMAS *Collins* at ASC's Osborne facility. Photo courtesy ASC

Just as important have been the steps taken to consolidate the local capability. Here there has also been steady progress. In early 2004, ASC signed a \$3.5 billion contract with Defence for the maintenance and upgrade of the boats through their thirty year operational life. In that same year a long-running series of legal disputes between Kockums and ASC over ownership of intellectual property and other matters were eventually settled. Finally ASC became the design authority for the Collins Class in December 2004—a clear sign that Australia’s submarine industry base had come of age.

Nevertheless, not all the original industry goals for the Collins Class were achieved. Strategic, political and commercial considerations have meant that this unique marriage of European, US and Australian technologies has not produced an export version of the Collins as envisaged by government and industry in the 1990s.

The capability

The Collins Class submarines are now performing at a high level of capability in a range of operations including the regular exercising of their traditional anti-surface



Oberon Class submarine—HMAS *Otama*. Photo courtesy Royal Australian Navy

and anti-submarine warfare roles. In war games with the US Navy they have regularly penetrated the protective screen guarding US carrier battle groups. The boats have long endurance, good manoeuvrability and excel in littoral waters. Clandestine operations include surveillance and intelligence gathering, and the boats also have some capacity to insert Special Forces troops for reconnaissance missions—a capacity that may be enhanced in future upgrades.

Last September HMAS *Sheean* completed a fifty-five day deployment to North and Southeast Asia—the longest deployment yet by a Collins Class submarine. The all-round performance of the boats will be enhanced under a continuous improvement program covering both the propulsion and combat systems.

Further enhancements are possible. Technically, the role of Collins Class boats could be expanded to include land strike by fitting the submarines with long-range cruise missiles. With the retirement of the F-111 strike force from 2010 this bears examination, although the potentially destabilising impact of being the first country to introduce such a capability into the region would need to be weighed carefully.

Navy's submarine arm will arguably become even more crucial in the next ten to fifteen years in the face of rapidly evolving regional military capabilities. Their contribution to effective maritime security in concert with the US, Japan and Southeast Asian partners will only grow as naval competition between big regional players including China and India develops. As a contribution to US coalition operations they fill a unique niche given that the US does not have any conventional submarines.

The lessons

As has been detailed above, a huge amount has been learned from the Collins experience—not just by Australian industry but by the Defence Department and other government agencies. The creation of the DMO was in part a response to the problems thrown up by the submarine project.

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Defence's relative lack of experience in managing the multiple risks in such a major enterprise as the Collins project is now being addressed in the major overhaul of procurement procedures that has accompanied the establishment of the DMO. The requirement for clear performance milestones in contracts, better cost assessments, and improved risk management by experienced procurement professionals have now been brought into sharper focus.

The 1999 McIntosh-Prescott report was the first step in ensuring the DMO would be structured on the most professional basis possible and provided the basis for many of the Kinnaird Reforms that exist today. These include the practice of bringing in experienced professionals to head up the DMO and remunerating them appropriately as well as the two-pass procurement process. More importantly, the 2003 Kinnaird Defence Procurement Review also recommended to government that at least one off-the-shelf option must be included in the initial business case for defence procurements. Under this proposal any option that proposes the 'Australianisation' of capability now needs to

fully outline the rationale and associated costs and risks. Serious consideration of this reform will be vital to ensure that the mistakes of the Collins are not repeated in the AWD project.

The early lessons from the Collins experience were also a major factor in the arrangements put into place by the government for managing the RAAF's airborne early warning system (Project Wedgetail). These included introducing the practice of extended funded design activities, appointing a single person to be responsible for bringing the capability into service, continuous review of the project, performance incentives as well as utilising integrated team approaches to the system's development.

Another lesson learnt relates to management of the potential gap between retiring a platform or capability and its replacement. Australia almost lost its operational submarine capability because the decision to retire the Oberon Class was made without on-going reference to when the Collins Class might actually become fully operational. With the benefit of experience that practice is unlikely to be repeated but will be worth remembering when dealing with the retirement of the F-111 and F/A-18 aircraft and the entry into service of the Joint Strike Fighter (JSF).

The next generation

Australia's defence planners are already turning their minds to the next generation submarine. The key question is whether, now that Australia possesses indigenous submarine design and construction skills, we should plan on building the next generation submarine?

Another issue to be considered is the future of the government-owned ASC. The government has already foreshadowed the sale of ASC to the private sector. Continuation of full government ownership of ASC would greatly

complicate any decision on an Australian build. The transfer of ASC to the private sector is necessary to ensure that it remains commercially competitive for the long-term. ASC's submarine design and engineering skills will have to be carefully fostered if Australia is to attempt the construction of a next generation submarine. Fortunately, the future of ASC appears to be sound with the company chosen to be the shipbuilder for the AWD project—a task that promises to be as complex as the Collins project. If ASC had not won the AWD contest, the engineering and design skills needed for the next submarine build would probably have dissipated despite the on-going maintenance and upgrade work on the Collins boats.

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The government will have to make a decision early next decade whether to go ahead with an Australian build of a new generation submarine. Advanced design work would have to commence by 2014–15 for an in-service date of 2026. This requires a commitment of funds in the ten year long DCP within the next two to three years. With little prospect of an off-the-shelf foreign built submarine meeting Australia's needs, it makes sense to get as early a start as possible.

While some of Australia's submarine fraternity favour nuclear propulsion for the next generation boats, this is an unlikely prospect. Australia simply does not possess the nuclear industry that would be required to properly support such a capability. However, with the recent resurgence of interest in nuclear power due to global warming concerns and the suggestion that Australia

develop a large scale nuclear fuel industry for the international market, the possibility should not be dismissed out of hand.

The more probable outcome is a conventional submarine evolved from the Collins design. The new class would be equipped with a second generation Air Independent Propulsion (AIP) system, state of the art battery systems and far superior communications systems. It would almost certainly include an unmanned underwater vehicle capability.

A successful transition from the Collins Class to the next generation of Australian-built submarines will require another bold commitment from government as well as intense collaboration by Defence and DSTO with local industry. The close naval partnership that has developed with the US will also be vital for success. An alliance with a US submarine builder will be essential as will sound relationships with European technology suppliers. The all-round experience gained from the Collins Class augurs well for the future.

The crucial test for ASC and Australian industry will be the AWD project which is scheduled to deliver its first warship in 2013. Successfully meeting this challenge and lifting Australia's industry skills base should give future governments the confidence to progress the construction of Australia's next generation submarine.

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