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# *Australia's future submarines programme*



an address to the Institute on 24 April 2012 by

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*Rowan Moffitt outlines the Australian Navy's future submarines programme which is intended to build at least 12 submarines in Australia over the next 40 years, with the first boat delivered around 2030. The submarines will need to be built at intervals longer than might be normal, to enable Navy to grow the people to crew them; and will probably need to be built in batches, to enable new technology to be inserted as it comes along over a very long construction programme.*

**Key words:** submarines; Australian Navy.

The media interest in submarines is intriguing. Much of the discussion centres on which sort of submarine we should acquire – small, off-the-shelf conventionals from Europe; or large nuclear submarines from the United States; seem to be the only options being discussed. And of course the Collins class gets the usual going over – we must never do THAT again!

This is the 'big boys' toy' question that I guess is inevitable, but I think it is a bit worrying that little of the discussion about Australia's future submarines focuses on the very much more important and difficult questions: Why Submarines? What does Australia want submarines for? What do we want them to do, where do we need to do that and for how long? Are they for peace time show or for serious war?

It is a little tricky for us to talk about the "why" of submarines, because what we actually do with them is a bit sensitive, so in this presentation I want to outline some of the inescapable truths I face with this programme.

Submarines, both present (Collins) and future, are not easily separable from one another. To get to the future, whatever that might be, we must start from the present. I am reminded of the Australian tourist in Ireland asking a farmer for directions to London. "Oh well then, if I was going to London I wouldn't start from here...." came the answer. We might say that too, but start from here we must. At this stage, we are charting the options for getting from here to the government's Defence policy objective – 12 future submarines. I will talk a little later about where we are now, but, as a navigator, I feel most comfortable starting with the destination. I know where we are, but where we are going needs to be clearly and comprehensively

identified before I can do a decent job of scoping the options for getting there.

## **Government Guidance**

The government's plan for 12 submarines more capable than the existing Collins class is well known, but in the detailed statements about the future submarine capability sought, in the Strategic Hedging section of the 2009 Defence White Paper<sup>2</sup>, paragraph 3.21 identifies circumstances that might justify acquiring more than twelve. Also, paragraph 9.9 of that document says: "The construction program for the Future Submarines will be designed to provide the government with the option to continue building additional submarines in the 2030s and beyond." This is a really important instruction to me as the programme manager, one with significant implications for the destination and the nature of the journey.

## **The Submarine Development Process**

Broadly speaking, the process for getting to the first of a new class of submarines, no matter what type they are, is a process that will have four fundamental blocks of activity over some years. First, we have to define the requirement; next, we have to design the submarine; then we can build it; and finally, once it is delivered, especially the first of the class, there must be a period of operational testing and evaluation.

## **Define**

The first step is to define the objective – what the key capabilities and performance characteristics are that we want, and why, and getting government

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<sup>2</sup>Department of Defence (2009). *Defending Australia in the Asia Pacific century: Force 2030 – Defence White Paper 2009* (Commonwealth of Australia: Canberra).

agreement on all that. The White Paper provides the vision, but that vision needs detailed elaboration before it can be turned into a submarine. Government agreement will be sought on the specifics as we identify them. This definition phase can take some years to do properly and in that time we have to develop a pretty good feel, not just for what we want, but also for what options, pathways, and capability trade-offs might exist and what the broad implications of each option would be, especially with respect to cost. After all, what we need must be contained within what we are prepared to pay.

Project management academics tell us that skimping on this part – the bit where we define clear objectives and properly complete the capability definition work – is a key reason why big programmes fail. In this phase, there is some focused cost-benefit analysis done by my team, but before that too. During the force structure review and development of the 2009 Defence White Paper much work was done examining the alternatives to submarines, the capability those alternatives might deliver, and their cost, risk and schedule profile – the detail of that work, however, was not published, being highly classified.

### ***Design***

Once government agrees what capability it wants and broadly how we will go about getting it, there will be some design work to be done – not all that much if we buy something off-the-shelf; quite a lot, over a longer period, if a new design is decided upon. A new submarine design might take 7 to 8 years of effort or, as the RAND Corporation has told us, between 8 and 12 million man-hours of design work.

### ***Build***

Once the design has reached a sufficient level of maturity and completion, construction can begin. Submarines typically take about 4 to 8 years to build. The next submarine Australia builds will be the first built in over a decade, so it is reasonable to expect that it will probably take us closer to 8 years to build it – regardless of the submarine we choose.

### ***Operational testing and evaluation***

Operational testing and evaluation will be done once the submarine is handed over to the Navy, to make sure the users know exactly what capability has been delivered and to work out how best to use it. We cannot consider that we have an operational capability before this work is done and it should be expected to take some years.

### ***Process duration***

So, for a submarine of a completely new design, the longest to execute of all the options, it would take around 20 years from starting the definition process to

having the first one of the new class ready for operational use. This estimate is consistent with the experience of overseas submarine builders and assumes that one is starting with a ready work force.

Follow-on submarines should take somewhat less time to build than the first, as the builders climb the learning curve. But that does not necessarily translate to a quicker or increasing delivery rate. In Australia's case, the delivery rate for follow-on submarines must take into account how quickly the government wants the force size to grow to 12 and a couple of other important factors as well.

Firstly, we are required eventually to double the size of the submarine force, so the Navy has to grow more crews for this larger fleet, starting from today's lower than optimum start point. There is no point in delivering submarines if the crews for them do not exist and growing those people takes time. For example, to grow just one new commanding officer you need to start with eight people off the street and work on them for about 15 years. This suggests that we might need to deliver the new submarines more slowly than we have seen in past naval programmes.

Secondly, if we deliver the new submarines at say 2-year intervals, the build programme would take 24 years. New technology would emerge in that time that we would want to incorporate into the submarines as we built them. For example, we are on the threshold now of a major advance in submarine battery technology – from lead-acid batteries to more exotic materials like lithium. This new technology promises considerable operational performance improvements, but will also demand potentially significant design changes. There are likely to be other advances in technology over the course of a long build programme such as we face. Even now, we can see quite a few promising technologies emerging. So, if we do not refresh the design periodically to incorporate new technology as we go, the risk is that the later of the 12 submarines will be obsolete when we deliver them. This suggests a need to build in batches with some design activity being devoted to each batch.

### ***Batch construction***

For the sake of illustration, let us assume we decide to build the 12 submarines in three batches each of four submarines<sup>3</sup>. In Batch 1, we would define and design the submarine, and then build and test four submarines, with some overlap between them, and starting each around 2 years apart. We would commence the design of the Batch 2 submarines before the design of the Batch 1 submarines was complete, with a view to their construction

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<sup>3</sup>We might not do that of course – it is an illustration only – the rate of maturity of new technology would determine the number of submarines in each batch.

commencing while the Batch 1 submarines were still under construction. Similarly, the design, construction and testing of the Batch 3 submarines would begin concurrent with the later stages of the Batch 2 submarines so as to achieve a more-or-less continuous design, build and test process to deliver 12 submarines at about 2-year intervals once the initial definition and design had been agreed. The overall life of the programme would be some 36 to 42 years. And, based on our current model of a 30-year life-of-type, as we deliver submarine number 12, submarine number 1 would be approaching retirement age, so we will have to start building a replacement – and so on *ad infinitum*.

### Continuous Sustainment

Having built and commissioned the submarines, they will need to be maintained. For about the first time in our acquisition history, we will have to move into the major maintenance and upkeep phase well before the build phase is finished. So we will need not only to be evolving and building new submarines, but maintaining the older ones and the newer ones concurrently.

Experienced advice tells us that building and sustainment are activities that demand some skills sets that differ significantly, especially in planning, schedule optimisation and management. We must therefore make sure that we structure the programme in a way that acknowledges that fact.

So then, once it starts, the future submarines programme will run for a very long time and perhaps not finish. Regardless of that, it will demand the successful establishment and management of three quite different functional activities concurrently, each one very challenging in its own right: the design of submarines; the building of new submarines; and the upkeep of the submarines that are in service.

In short, what we face with the future submarines programme is not just about building 12 submarines – it requires that Australia assemble the elements of capability needed to sustain a complex and demanding, high-technology enterprise. That enterprise must exist regardless of which submarines we acquire and regardless of which elements we decide should be in Commonwealth ownership, available commercially in Australia or done on our behalf overseas.

### The Future Submarines Programme

For these reasons, and others, the future submarines programme is unlike any other major Defence equipment capital acquisition programme we have seen. If you look at all of the other modern Australian Defence Force acquisitions, we start the programme, deliver the equipment, close the programme and then move into the sustainment

phase. We buy things, often from overseas production lines, they are delivered and we move on to something else. The future submarines programme cannot be like that. This suggests to me that we have to think differently about it, regardless of the submarine we choose.

For a start, while it will certainly cost a lot of money, that funding will be spread over decades – a relatively small amount on an annual basis compared with the total programme cost. It will be much more of a cash-flow management matter that requires new thinking about budgeting, than it is a question of total cost. Indeed, the whole notion of total cost has less practical meaning. How many people have a clue how much we have spent to have a destroyer and frigate force of about 11 or 12 ships over the last 40 or 50 years?

The future submarines programme is also one that gives us the opportunity to consider new paradigms. For example, I mentioned 30-year life-of-type earlier. That is what we have done historically with ships. With the pace of technology improvements these days, that is a very long time. Historically, at some stage during that life, sometime several times, we have given them a major upgrade to insert new technology and capability. These upgrades have been more-or-less successful, but they have always been expensive and have always taken ships out of service for long periods.

Major upgrades in submarines are necessarily harder to do because it is harder to get at things, so the whole activity is inherently more difficult, costly, risky and long. An alternative might be to design the submarines for a shorter life-of-type in the first place and not do major mid-life upgrades at all. Initial rough estimates by my team around a submarine service life of 20 years suggest this approach might cost in the order of 5 to 8 per cent less through life, which is not to be ignored.

Other benefits might accrue from such a model. The lower average age of the fleet could reduce upkeep costs and as we know only too well, old ships



HMAS *Onslow*, an Oberon-class submarine, c.1998  
[Photo: Department of Defence]

are proportionately much more unreliable and expensive to maintain than young ones. Submarines are no different. There would no longer be a need to have submarines out of service for long periods in upgrade – upgrades would be delivered in successive batches of new submarines, with the number of submarines in each batch varied to suit the pace of technology development.

Regardless of whether we take this approach or some other though, the very different nature of the future submarines programme compared with other Defence acquisitions, and the opportunity, if not necessity, for doing things differently, should prompt us to think carefully about the approach we take to what the government clearly sees as a vital strategic military capability for Australia's future security.

### **Australia's Naval Shipbuilding Industry**

There seems little doubt that one challenge we will face stems from the fact that, in a fully mature state, the future submarine capability enterprise will require Australia's Navy and naval shipbuilding industry, and the other elements of the national machinery we decide to own ourselves to support them, to be bigger than they are today. But the workforce analyses I have seen show they need not be dramatically bigger. We are talking thousands of people in total, not tens of thousands. In this context, I was very heartened late last year talking with the chairman of Skills Australia, a man who knows a great deal about Australia's industry skills base, to find him confident in Australia's ability and capacity to build the future submarine programme.

Another key difference will be that the size of the submarine force will be such that, for the first time in any part of the Navy's capability, we will have the chance to provide the steady, reliable and predictable work flow needed to sustain the shipbuilding industry over the long term – and to do that without the need for exporting, which would be very problematic.

Undoubtedly though, all these attractions aside, we will face challenges and it will not be easy. We must decide carefully what makes the most sense for us to own and control, and what we can safely, reliably and cost-effectively have done by others – and the risks associated therewith. It goes without saying of course that no matter where those elements are, one way or another Australia will pay for them.

When we had the Oberon class, we became acknowledged as competent submarine operators and maintainers. It generally worked well for us back then, in part because we could draw on the expertise of not only the Oberon designers, builders, original equipment manufacturers and those organisations performing maintenance work on them overseas, but the parent operating Navy as well. All those elements are critical to having a successful capability outcome.

When the Royal Navy stopped using Oberons, the United Kingdom stopped fulfilling its parent-nation role for the submarines and it quickly became much harder for us, because we had to rely on ourselves much more.

With the Collins class, there was no other nation using our submarine, no one else performing maintenance work, no one researching solutions to problems that arose in service and no one who understood how we used the submarines and why. Until Collins, Australia had no real experience of just how significant and extensive these parental obligations are for a nation, or how critical to keeping the capability effective it was to ensure the parental obligations were met. There are few complex Australian Defence Force capabilities, if any, that put us in this situation.

Australia built the Collins-class submarines to world-class standards of quality and, according to Skills Australia's chairman, we can do that again. But if we are going to have a real submarine capability that we can rely on in the future, then we must make sure that the various parental responsibilities are properly met – be they design-, build-, maintain- or operate-related; or be they met by us or someone else – and we must structure the enterprise knowing how all the responsibilities will be met, by whom, and at what cost. In short, we must mature from being a Navy operating a fleet, to a nation owning a Navy.

Some of the work we have done so far helps us understand exactly where we currently stand on the pathway to that maturity. The RAND report entitled *Designing Australia's Future Submarine*<sup>4</sup> paints us a fairly clear picture in respect of designing a submarine in Australia. I want to stress here that RAND assessed our capability and capacity to design the future submarine, not to build it. The RAND report makes it clear that we will have a heavy reliance on skills and technology transfer from overseas to close the gap between Australia's capability and capacity today and what is needed to execute successfully the future submarines programme. We will need to do more than just develop acquisition options. We must also select the best partners to help deliver the total capability and capacity we need to do the whole job.

We have learned a lot from the Collins experience in combat systems, weapons, signature management, logistics, maintenance, engineering and so on – and by 2020 we will have learned still more. What we will need are partners able and willing to help us go to the next level – to the level of parent nation, so that we can produce the outcome the government wants – a

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<sup>4</sup>Birkler, John, *et al.* (2011). *Australia's submarine design capabilities and capacities: challenges and options for the future submarine* (RAND Corporation: Australia) available at <http://www.rand.org/pubs/monographs/MG1033.html>

sufficiently capable submarine force that is available, reliable, cost effective and affordable.

Expressed another way, industry players need to understand that, to win the right to profit by being a part of Australia's future submarines programme, they must not just supply designs or products or expertise, they need to be willing to transfer their skills, technology, intellectual property and perhaps even workforce for a time, to Australia. Companies with the most relevant capabilities and sufficient capacity, who are also willing to share with others, some of whom might conceivably be natural competitors, in a tightly-controlled intellectual property environment, will be the ones most likely to profit. These are some of the lessons from our experience of the Collins submarine programme and they influence the advice I give to government.



A Collins-class submarine [Photo: Department of Defence]

### The Collins-class Submarine

I will end by discussing the Collins-class submarine, because that is where we are today and from where we must begin our journey to the future submarines, despite our severe dose of national pessimism based on the media's understanding of that programme – which sadly is flawed.

I think it is worth remembering a few things. Firstly, Australian tradesmen and tradeswomen built the Collins-class submarines and they did so very well – just as we have built complex naval ships well in Australia for almost a century. There is no problem with Collins that was caused by poor Australian workmanship. The problems were all either a product of our inexperienced decisions early in the programme or they were imported from overseas. The thousands of Australians who built the Collins submarines richly deserve great credit for what they did so well. We can do that again.

Secondly, Australian submariners are acknowledged as having achieved remarkable things over almost a century and are still doing so today, in the Collins class. Australia's submariners also do not get the credit they deserve for what they achieve with what they have.

And finally, as I said, we have learned a huge amount from the Collins experience. We have learned for example that:

- it was perhaps not such a great idea to build six unique, state-of-the-art submarines that were a developmental platform, with a developmental combat system, a developmental main motor and developmental diesel generators;
- in a city with no contemporary naval shipbuilding pedigree or Navy presence or expertise of any consequence;
- which was also distant from the existing national centre of submarine expertise and activity, as well as also being distant from the proposed new home of the submarines;
- in a programme that guaranteed that the industry established for the building task would not have ongoing business through which to survive after the building programme was finished;
- while, at the same time, relocating the Navy's small and highly specialised submarine capability work force to the other side of the country;
- where we could predict with confidence that we would face a major struggle, not only to recruit submariners, but also to establish a viable submarine sustainment activity.

### Conclusion

The future submarines programme poses a great challenge, for not only Australia's Navy and naval shipbuilding industry, but for the nation as a whole – a challenge not dissimilar to that posed by the Snowy Mountains Hydroelectric Scheme half-a-century ago. Given the capabilities and capacities we already possess and the lessons learned from the Collins programme, I am confident that we can successfully meet this challenge.

**The Author:** Rear Admiral Rowan Moffitt has been Head of Australia's Future Submarine Programme since February 2009. Born and schooled in Sydney, Admiral Moffitt graduated from the Royal Australian Naval College, Jervis Bay, in 1975. A surface warfare officer and specialist navigator, he has had diverse sea and shore postings in a 38-year naval career, including command of the frigate HMAS *Newcastle*, the destroyer HMAS *Brisbane*, the Australian Defence Force Warfare Centre at RAAF Base Williamstown and the Australian Fleet. He has served as the Deputy Chief of Navy and Deputy Chief of Joint Operations. In recognition of this service, he was appointed a Member of the Military Division of the Order of Australia in 2004 and an Officer of the Order in 2008. [Photo of Admiral Moffitt: Department of Defence]