

Implications of moving to a nuclear-powered capability for the RAN future submarine force

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Introduction

A programme with a current cost of over \$50bn which does not produce one operational submarine until at least 2036, by when the threat or technology may have changed dramatically, which is still planning to use superseded technology and which necessitates a significant capability gap, inevitably begs the question: is it worth it? Alternatively, is there a better, quicker, more cost effective way of achieving a similar or indeed superior capability?

This short article contends that a nuclear powered attack submarine (SSN), ruled out on many grounds in the past, is now the best solution to meet the very demanding RAN operational requirement. It explores some key issues that would be involved in any decision to 'go nuclear' and argues that they really are not the show stoppers often claimed. Further, given the very extended timescales and extraordinarily high and escalating costs of the *Attack* programme, the possibility of moving to an SSN force should now be seriously considered.

The requirement

The agreed requirement for 12 submarines to replace the *Collins* class is based around the need unilaterally to deter and defend the Australian homeland and the ADF from possible surface or subsurface attack by hostile naval forces. The submarines will carry out intelligence gathering, surveillance, targeting and reconnaissance operations, possibly many thousands of miles away from their base, in sea areas that are becoming more challenging and potentially more hostile. In wartime or periods of tension they would additionally be expected to provide area defence and sea denial, with long periods of lone covert submerged operations, alone or with allies. They will be required to undertake anti-submarine and anti-surface ship interdiction, requiring the latest in command, control, communications, sensor and weapon technology.

Even without a necessity for long range transits to the South China sea, simply to provide a continuous presence around the vast littoral of mainland Australia and in the various key sea lines of communication and choke points to the North, in itself requires a very considerable submarine force, hence the doubling of current numbers. Given the slow rate of build, the requirement to substantially increase the number of submariners and train them on new systems, the need for maintenance, defect rectification, personnel leave and balanced shore time, the actual number of available hulls, especially in the early years of transition from a life extended *Collins*, will inevitably mean that the Australian submarine force will be unable to meet the strategic and tactical requirement in such a vast sea area.

A key reason for this is that despite the doubling in numbers the new submarines will still be diesel powered, with lead acid batteries providing the electrical power. They will not be equipped with air-independent propulsion (AIP) and will necessarily have a slow speed of transit, with at best only half of a 70-day operation spent on patrol. With a regular need to snort to charge batteries, this will offer unwelcome counterforce detection opportunities.

Choice of propulsion

The decision to work solely with the French on a new design Short Fin Barracuda, with diesel

electric rather than nuclear propulsion, is the main factor that leads to the limitations noted above and contributes significantly to the enormous programme cost, risk and extended time schedule, all exacerbated by the lack of any initial competition in the procurement.

A nuclear power plant providing virtually unlimited electrical power, very high maximum and sustained dived transit speeds, endless capability to loiter at low speed, plus the ability to escape and evade and to move the area of operations expeditiously, all over very long transit distances from base, without any need to snort or surface, obviously gives an enormous major performance improvement over an SSK, as well as radically improving its survivability. Even more so given the *Attack* class has not been designed to use AIP or modern Lithium or Zinc based batteries. There is also the possibility that changing to an evolving design or 'son of' a current SSN such as the *Suffren* or *Astute* might not only more readily satisfy the very demanding requirement, but also lead to a similar or even a shorter procurement process.

The complicating factors would be around the political aspects of using nuclear power as well as the very substantial costs involved in providing the necessary personnel, the nuclear support infrastructure and training required to meet modern nuclear safety standards, as well as the increased unit cost of each submarine. Given that the current programme already looks unlikely to provide any new or enhanced submarine capability until the 2040s, then a decision to switch to a partial or full SSN fleet might not entail much, if any, significant further delay. There is already a requirement for an interim capability to include up to six life extended Collins (LOTE). Almost certainly a further six 'Son of Collins' would be required in order to maintain continuity of operations as well as to provide a cadre of fully trained submariners in requisite numbers to be able to crew the future SSNs.

Winning government, public and allied support

This would not be a new debate. Some work has already been done and the SSN option would have been considered in any cost capability evaluation for the *Attack* programme. It can now be clearly argued with current factors considered that an SSN as opposed to a conventional submarine force is the optimum means to secure the safety and security of Australia and its people, trade and sea lines of communication in the long term, as well as that of its submariners going into harm's way. The implications must therefore be explored further.

As to gaining public 'buy in', much depends on honesty and fact. If the requirement and benefits are 'sold' strongly, the total costs are realistically shown (accepting the *Attack* programme is already the most expensive Australian defence programme ever), the nuclear safety issues are carefully explained (including long term disposal and other Green considerations), then the PR battle can be won, most especially if there is strong cross party political support. It could also form part of a wider debate as Australia moves from fossil fuels to alternative energy sources.

A testing area will be that of relationships with Australia's allies. The first discussion would be with the French and Naval Group, as shifting to a new SSN strategy would mean significantly modifying or possibly cancelling the *Attack* programme. Next, tentative discussions would need to be opened with both the US and Royal Navy, covering nuclear safety, support, training, technology transfer and the like, as well as, in the case of the UK, exploratory procurement talks, to investigate the feasibility of working with the RN over a new SSN design – possibly a joint design and build programme which would provide up to 12 hulls for Australia. The US will have a key part to play, especially over nuclear reactor IPR. Whilst previous informal discussions with both the USN and the RN over the possibility of Australia gaining an SSN capability have not been productive, it may well now be a more propitious time for such exploratory discussions, given the recent Type 26 project award and as the RN looks to replace the *Astutes* alongside the future

SSBN programme, and the United States reappraises its defence ambitions in the Indo Pacific region. This area could well benefit from a refreshed approach at both political and military levels to determine if attitudes are shifting and new partnerships possible, especially with the advent of novel, smaller nuclear reactors. Joint projects such as the F-35 can lead to significant reductions in unit production costs.

Nuclear certification, accreditation and safety

Australia already has a long-standing research reactor at Lucas Heights and manufactures radioisotopes for hospitals, industry and scientific research. There are consequently a good number of nuclear physicists and engineers and a comprehensive environmental and radiation-monitoring programme. The nuclear regulator, ARPANSA, is well regarded internationally and administers the latest nuclear safety and accident regulations and procedures. Many visits have taken place by nuclear powered warships and submarines, so certification and other nuclear issues are embraced in the naval and dockyard environments. Further work would be required to build on this framework, in order to cover the requirements of a new naval nuclear capability and, in particular, to initiate a major increase in nuclear safety and inspectorate personnel. Overall the lack of any home grown nuclear power industry should not in any way prevent a move from conventional to nuclear powered submarines, but significantly enhanced learning programmes would need to be introduced now, including new physics and technical courses both in Defence and in further and higher education establishments. This should lead to many new job opportunities, both within and outside Defence.

Manpower – training, numbers and transition

The submarine manpower and recruitment work already in place to meet the need to support 12 new SSKs provides a good basis and there is also much published high quality work on manning numbers, not just for the 12 Attacks but also looking to a possible transition to SSNs.¹ A critical area would be the complement of any new SSN, the ideal being around 60 as in the French SSN, rather than the 100 in Astute. This could lead to an initial requirement to quadruple the current submarine force to over 2,500. Over twenty years this is perfectly feasible. More complex is the training time and requirement to produce sufficient numbers of experienced, qualified nuclear engineers and executive branch officers, and maintaining a critical mass for the future. There would be a necessity to utilise other nations' facilities for much of this training initially.

The transition phase will be complex, as some personnel would be trained on current and new build SSKs and their systems, whilst an element would need to be moved on to lengthy nuclear training courses to prepare for the entry into service of the first SSN. In parallel will come the requirement to recruit, train and certify a significant number of civilian nuclear engineering, support and scientific personnel to work in the naval bases and headquarters.

The personnel and training area is the potential Achilles heel and requires extensive, accurate modelling, leading to a major targeted and sustained recruitment drive, backed by very high quality incentives to attract and retain the significant numbers required for the new RAN submarine arm. This area has recently proved extremely challenging for the Royal Navy, especially in the areas of nuclear watch-keepers and junior executive and engineering branch officers.

Nuclear infrastructure

¹ The extensive published work undertaken by Rear Admiral Peter Briggs AO RAN (Retd) is very informative, for example <https://www.aspistrategist.org.au/nuclear-propulsion-australias-submarines/>

A major civil engineering construction programme would be required to provide the necessary dockyard facilities required to berth, maintain and repair a fleet of perhaps ten to 12 SSNs. This would include dry docking facilities as well as nuclear certified cranes. There could also be a requirement to refuel. Whilst much of the cost of developing a nuclear submarine capability falls in the infrastructure area, the regulations and requirements are well documented and the civil engineering is straightforward – and does provide significant local employment opportunities.

Construction and partnership considerations

Given the lack of any naval nuclear infrastructure or construction experience, this is not an area that Australia can readily develop without support or partnership from others. Two countries could support an SSN programme through concept, design, build and sea trials, namely France (Naval Group) and the UK (BAE Systems). Given political will, either country would also be able to assist in providing training and advice on infrastructure, nuclear safety and other associated areas.

Costs

A nuclear submarine force can cost around four times a conventional capability. Indeed a large SSN itself could cost \$3BN whilst an SSK \$700M. However experience of the *Attack* class programme indicates that extreme caution should be exercised over projected costs at this stage. Equally an early move from the *Attack* programme to an SSN variant could minimise sunk costs and hopefully reduce any financial penalties. Any feasibility study will need to scrutinise this whole area, noting that as well as the increased costs inherent in nuclear procurement, safety, training and infrastructure, there is another simple delta caused by a possible fourfold increase in the overall size of the submarine arm (also needed to crew the *Attacks*). This capability does not come cheaply but a cost benefit analysis, against the operational requirement, especially in comparison with the 12 boat *Attack* in service dates and total programme cost will be very illuminating.

The way forward and timescales

It is difficult to foresee having a fully operational 12 SSK force until the 2050's, and there is already debate over how capable the *Attack* will be in 30 years time. By then a 'son of *Collins*', if the process began now, could well have addressed the capability gap and provided a link to a new SSN force. A transition could involve a twenty year lead time, when procurement, design, construction, training, recruitment, technical, safety, infrastructure, logistic support, sea trials, and acceptance into the fleet are all taken into consideration. If, following a review, a final decision to 'go nuclear' were made within the next few years and personnel planning and recruitment were embarked upon immediately, then it is certainly feasible for new SSNs to start entering service in the mid to late 2040's.

Conclusion

The impediments mentioned are major but not insurmountable. Procuring an SSN capability either through a major renegotiation of the current SF Barracuda programme or through a joint design and build programme with another ally is certainly feasible. The gains of such a revised strategy now seem to outweigh the potential difficulties and would give Australia a far superior operational capability, possibly in a similar timescale. It would also give Australia a much enhanced strategic position as a major regional power in the Indo Pacific. This of course could well be very important if the USA contemplates a more disengaged future strategy.

In any event, it would appear clear that the current SEA 1000 Programme needs a reappraisal to

ensure that it meets the real operational and strategic need into the late 21st Century and provides full value for money, as well as a submarine that can safely operate in what is fast becoming a very challenging operational environment. A nuclear submarine strategy could now well be a better, more capable, resilient and safer option.

Recommendations

1. Commission a study into the implications of procuring nuclear submarines and the consequent effect on the *Attack* class programme and the anticipated capability gap.
2. Negotiate a Feasibility Study with Naval Group for a *Suffren* successor SSN.
3. Commence discussions with other nuclear capable allies, to explore possible joint SSN design and build collaboration.

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