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**A BRIEF ON THE ISSUES ARISING FROM
CONSIDERATION OF THE REQUIREMENTS FOR A
FUTURE SUBMARINE CAPABILITY FOR
AUSTRALIA**

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ATTACHMENTS

The attachments to this document are listed in the following table.

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1	Future Submarine Overview Mindmap	1

EXECUTIVE SUMMARY

1. TOP LEVEL CONCLUSIONS

To retain an effective undersea warfare capability planning needs to begin NOW on a future submarine (Collins lessons learnt).

To mitigate development risk, the Collins combat and ship control systems need to be evolved and migrated into the new SM.

The design, development and construction of the future submarine capability will be a uniquely Australian enterprise, with strong support from the USN.

2. IMMEDIATE ACTIONS REQUIRED

The future submarine capability project should be listed in the DCP in 2008.

There is an urgent need to shape the political environment to facilitate the initiation of the project.

Supporting studies, some R&D projects, not necessarily confined to DSTO, should be initiated in advance of DCP entry.

The industrial climate also needs to be prepared to support what will be a long-running, complex developmental project.

DISCUSSION OF THE ISSUES

3. INTRODUCTION

For the past 4 years the Submarine Institute of Australia (SIA) Project SM 2020 has been considering the requirements for a future submarine warfare capability for Australia. Deliberations have included 2 international conferences, the most recent in November 2006 and a number of workshops.

Members of the Institute recently completed a study for the Chief of Capability Development, Department of Defence, into the strategic setting; capability and roles required of a future submarine capability; lessons learnt from the Collins project; and the industrial and political aspects arising from a future submarine project.

This overview summarises the major findings and conclusions from these various considerations.

THE STRATEGIC SETTING, CAPABILITIES AND ROLES OF A FUTURE SUBMARINE

4. FORCES SHAPING THE FUTURE

Without attempting to predict the precise shape of Australia's strategic environment in the period 2020-2050, it is already clear that there are powerful forces at work that will determine both the strategic settings within which Australia will need to make its strategic choices and the boundaries within which Australia will seek to exercise its policy freedoms. Overall, the prospects for global peace and stability are gloomy: the convergence of ideological extremism driven by fundamentalist Islam and significant changes in global power balances indicate major strategic discontinuities. In the Asia-Pacific region, continuing adjustments in the great power balance, together with continuing political, social and economic dislocation in the Pacific Island countries indicate ongoing instability.

5. THE KEY DRIVERS

Radicalised Islam will continue to mount a fundamental and violent challenge to the value system of liberal democratic societies, and the threat of the use of asymmetric force – particularly terrorism – will continue to grow, sponsored by both radical non-state groups such as al-Qaida and by fundamentalist states such as Iran and Syria. Australia and western interests in South East Asia will continue to be targets for such acts of violence as is evidenced in the Philippines and Indonesia

China and India will emerge as major global and regional strategic players, exercising political, economic and strategic power in pursuit of their national objectives while at the same time constraining others in the pursuit of theirs. The centre of gravity of global economic power will continue in an easterly direction in the period of the strategic outlook so that by 2050 it sits largely on the Indo China border.

A fierce global competition for resources will become an increasingly important strategic factor; particularly energy (both hydrocarbon and nuclear), key strategic minerals and water. China and India will compete in this domain with the industrialised nations – the USA, Japan and the members of the European Union – as well as the emerging industrialised nations such as the members of ASEAN, key South American nations such as Argentina, Brazil and Mexico, the emerging powers of the Middle East (particularly Iran) and, of course, Russia.

The political, economic and strategic reach of the USA will, in relative terms, reduce. While it will remain the wealthiest nation in *per capita* GDP terms, the balance of power between the USA and its competitors will shift, and the USA will no longer enjoy the freedom of action that accompanied its status as the sole superpower. In view of the democratic and liberal values that both Australia and the USA share, the Australia – USA alliance will remain a core feature of our strategy.

Climate change is likely to impose major stresses on the region: a number of small Pacific states may disappear, the impact of changing sea levels is likely to be felt throughout the Indonesian and Philippine archipelagos, and the inundation of large low-lying areas such as the Ganges delta is likely to initiate major population pressures on the Indian subcontinent.

6. INCREASED IMPORTANCE OF THE MARITIME ENVIRONMENT

Because of the uncertain future strategic outlook, the maritime environment will become even more significant in both economic and strategic terms. Sea Lines of Communication (SLOCs) will become more heavily populated and the threat to commercial shipping will increase.

7. ASSERTION OF MARITIME SOVEREIGNTY

The maritime environment will also become more demanding: nations will assert their maritime sovereignty rights, including in the undersea environment, and will develop the capabilities necessary to enforce their rights. Surface and sub-surface passage will be subject to legal and quasi-legal interference and constraint. In short, more countries will seek to practise undersea denial.

8. REGIONAL INVESTMENT IN SUBMARINE CAPABILITY

Significant investment is underway by regional nations to acquire or improve their submarine capability. Modern, Western European technologies are being fielded in many of these capabilities. Both India and China are also acquiring European and Russian submarine technology of considerable sophistication. The emergence of regional powers armed with nuclear powered submarines and submarines with a strategic strike capability are likely.

9. AUSTRALIA'S SUBMARINE FORCE

Turning to Australia's submarine force, the submarine's stealth, long range and endurance allow it access in key areas denied to other platforms. The correct investment strategy in a future submarine force will confer a significant strategic deterrent capability for Australia, not only measured in Defence Terms but also contributing to the security of energy supply. This capability will result in consolidating existing roles and an expanded range of strategic effects that could be achieved by the submarine force. The latter category includes:

a. Surveillance and Intelligence Gathering.

The ability to gain access to areas denied to other units, combined with its ability to observe activities underwater, on the surface, in the air and over the electromagnetic spectrum are particular strengths. Combined with the ability to interpret the observations and react to maximise the opportunities for further collection and understanding the activities makes a submarine a unique platform for this role.

b. Land strike.

The submarine's ability to position within launch range, without alerting the adversary, launch on instruction and withdraw without provoking a further engagement is unique.

c. Battle space preparation.

The submarines' ability to covertly gain access to the denied areas, assess the environment and deployment of opposing forces and relay this back to allow future task force operations in the area, make it a preferred option for effective battle space preparation. With suitable capabilities embarked, the submarine is able to neutralise threats prior to the task force into in the area. Once the Task Force operation is underway, the submarine is able to provide direct support-

d. A Network Contributor With Unique Abilities.

The submarines ability to gain access to critical, denied areas allows it to make it a unique contribution to the network.

e. An expanded range of Special Forces operations.

Given they strategic setting and trend for asymmetrical conflict, this is likely to be a growth area for the future submarine capability.

f. Offensive, declared mining using sophisticated, precision mobile mines to deny access to selected areas or ports.

These can be laid and activated on command, if necessary, by the submarine in areas inaccessible to other units.

Consequently, a submarine capability will remain a core defence requirement for Australia beyond 2020. By virtue of the historical circumstances that have allowed Australia to develop a unique submarine capability, Australia's regional pre-eminence as a designer, builder and operator of submarines will need to be maintained as a matter of strategic priority.

These new or modified strategic effects expand the roles required of the future submarine, beyond those currently expected of the Collins force.

10. A UNIQUE REQUIREMENT

Because of Australia's location and interests, the design and operational characteristics of the submarine capability will represent a unique combination of factors. Consequently, no "off the shelf" solution is likely:

- a. Long transits, combined with the likelihood of short-notice contingencies will demand high levels of mobility and endurance.
- b. The nature of the littoral operating areas will demand both high agility and prolonged covert operations in operating areas.
- c. And, as a result of the changes to the maritime operating environment noted above, Australia's submarine force will require low signature in all spectrums and at high speed, thereby imposing new demands on submarine design.

11. THE KEY DESIGN DRIVERS

The key design drivers are identified in priority order are:

- a. Stealth.
- b. Mobility.
- c. Range and Endurance.
- d. Payload including weapons and Unmanned Underwater Vehicles (UUVs).
- e. Sensors and connectivity.
- f. Manning.
- g. Handling characteristics

12. R&D ACTIVITIES

Noting the unique features of Australia's requirements, difficulty of accessing submarine Intellectual Property (IP) and the timescales, combined with the gaps in conventional submarine IP available from a US capability partner, there are a number of areas where Australian industry has the capability for but requires the incentives to develop an indigenous R&D capability in a number of key submarine technologies. **Given the lead times for such activities, this is now an urgent requirement.**

13. CONCURRENCY AND ATTRITION

The issue of concurrent roles and allowance for attrition of own submarines employed on offensive operations are additional factors to the traditional calculation of the force structure required to achieve the strategic effects. In considering the strategic setting it is likely that the capability will be expected to concurrently maintain submarines in the critical surveillance intelligence gathering, indications and warning (I&W) role and in the event of a contingency, concurrently provide submarines in support of Task Force operations or for special force missions.

14. CONCLUSIONS ON THE STRATEGIC SETTING, CAPABILITY & ROLES

- a. The likelihood of significant strategic discontinuities and major shifts in global power balance over the next four decades create a compelling case for the acquisition of a new undersea warfare capability as Collins class starts to reach end of life from 2025.
- b. The strategic environment 2020 – 2050 demands a high-end capability, centred on a long-range, sophisticated submarine.
- c. The future submarine capability will be required to operate in a more demanding environment, at greater range and to achieve an expanded number of strategic effects.
- d. The new submarine will be required to undertake expanded roles, carry a wider range of weapons and payloads and operate with a crew similar to that Collins 45 - 55.
- e. The submarine capability will be a critical and unique asset in the nation's Defence capability and a likely increasing contribution to the US alliance obligations.
- f. The strategic effects, consequent roles, the need for concurrency and an allowance for attrition indicate a need for more than six submarines.

COLLINS LESSONS LEARNT IN THE CONTEXT OF THE FUTURE SUBMARINE CAPABILITY

15. OUTCOME

The principal aim of the COLLINS program was to acquire a new class of submarines suitable for operations in the mid-1990s and beyond. Compared to a 'build to print' program (eg, construction of, say, UPHOLDER Class submarines based on 1970s technology), the COLLINS program involved a number of innovations and acceptance of risk to ensure the capability sought was appropriate to the future strategic environment. It is now clear, despite its complexity and controversy, the aim was achieved and Australia acquired a world-class conventional submarine capability augmented by a strong industrial support base. In doing so the foundation necessary for the future submarine capability program has also been established.

16. AUSTRALIAN CAPABILITY TO MANAGE A COMPLEX PROJECT

The COLLINS program demonstrated that Australia has the capacity for and capability to manage a complex submarine construction program as well or better than a European or US supplier. Deficiencies in the build phase related more to design and contractual problems, including with overseas suppliers, than to shortcomings on the part of Australian industry. While a future program will also involve a number of innovations and acceptance of risk, there will also be initiatives based on COLLINS experience that will mitigate risk. These include migration of some equipment/systems evolved in the COLLINS class, access to US submarine technology, adoption of more appropriate contract terms and conditions and improved transition planning. For example:

- a. More emphasis in the prime contract should be on acceptance and apportionment of risk (cost, schedule and performance).
- b. Construction contracts should include provisions governing payments and disbursements of revenue to ensure adequate retention of contractors' contingencies and profits and until conclusion of sea-trials, rectification of design deficiencies and delivery and acceptance.
- c. Emphasis should be given to reducing the overall development, construction and delivery schedule including, in particular, a reduction in the time taken to rectify design defects associated with sea trials. Incentives should be included in future construction contracts to enable this objective.

-
- d. In hindsight, the COLLINS combat system requirement was very ambitious, developmental, risky and required a different management and contracting approach. The combat system for Future Submarine should be based on the future development of the USN sourced RCS planned for Collins submarines.
 - e. Personnel and Capability Transition planning is a critical activity and requires adequate funding. This is a Navy wide priority.
 - f. Noting there was no involvement of the USN in the COLLINS program, access to US SM design and weapons technology is a key issue in reducing risks for COLLINS upgrades and future submarine capability.
 - g. The responsibilities of a parent navy should not be underestimated in terms of Through Life Support (TLS), upgrades and cost of ownership and should be measured against the level of capability required as dictated by Australia's geo-strategic environment.

17. CONCLUSIONS ON COLLINS LESSONS LEARNT

The Collins project, despite its complexity and controversy delivered an excellent strategic capability for Australia. A future submarine project will have a much stronger starting point as a result. The Government and Defence should have strong confidence in Australia's capacity to manage and deliver the capability.

INDUSTRY CAPABILITY

18. GLOBAL MARKET PLACE

The global marketplace for submarine construction has undergone considerable consolidation in recent years particularly in the UK, Germany and US. While a number of countries construct submarines under licence, only Germany, Russia and France are active in the export market.

19. AUSTRALIAN SHIPBUILDING SKILL BASE

Commonwealth investment in the COLLINS Class has greatly boosted the skill base of naval shipbuilding in Australia. The base will be further enhanced by the selection of ASC to construct the Air Warfare Destroyer (AWD).

20. GOVERNMENT RECOGNITION IMPORTANT

Recognition and commitment by government of the strategic importance of the naval shipbuilding industry and relevant industry at large would give the industry confidence in its future and encourage investment in its workforce, facilities and innovation.

21. ACCESS TO INTELLECTUAL PROPERTY (IP)

Access to and control over IP is a key determinant of shipbuilding and repair capacity particularly in relation to vessel design and combat systems and their ongoing development and upgrades.

22. COMPETITIVE TEAMING FOR EFFICIENCY

In addition to the design support provided by EB and Kockums, competitive teaming through commercial alliances between overseas shipbuilders/designers and local industry for the supply of systems and components offers the best prospect of ensuring efficient Australian construction.

23. SUBMARINE SKILLS

The availability of submariners to support the role of Defence as an 'informed buyer' with the skills and abilities to manage the future submarine capability program will be a significant issue. The transition from COLLINS to future submarine capability will also pose significant personnel challenges.

24. FUTURE SUBMARINE CAPABILITY PROTOTYPING IN COLLINS

COLLINS Class technology refresh/spiral development programs could serve to de-risk design development work and prototype testing associated with the future submarine capability.

25. CONCLUSIONS ON INDUSTRY CAPABILITY

- a. The global market for conventional submarine design and construction has shrunk considerably since Collins was designed.
- b. Australia's industry base has grown significantly during the same period.
- c. The limited Defence and Navy capacity to oversee the project is a significant factor in developing the acquisition strategy.
- d. Collins through life development can assist in reducing technical and schedule risks for a future submarine project.

DEVELOPMENT OF THE ACQUISITION STRATEGY

26. NO OFF THE SHELF SOLUTION

Having regard to Australia's geo-strategic environment in the mid-2020s and beyond, the anticipated roles and missions for future submarine capability, the Top Level Capability and resulting submarine major design characteristics, there is currently no off the shelf conventional design (nor is there one expected) that will meet the ADF requirements for future submarine capability - a situation similar to that impacting the design development of COLLINS in the mid-1980s. Thus the design of future submarine capability will also be unique if it is to fulfil its intended roles.

27. A HIGH END CAPABILITY IS REQUIRED

Noting the proliferation of submarines in our region of interest, it will be important that the future submarine capability maintains an underwater warfare technological edge throughout its service life.

28. MIGRATE THE COMBAT SYSTEM AND SHIP CONTROL SYSTEMS

There are compelling reasons to base the selection of the combat system for future submarine capability on the USN Combat System AN/BYG-1 and to migrate that system from COLLINS to future submarine capability at an appropriate time during the design development process. Similar benefits would accrue in migrating as far as practicable the USN SSN C4I capability and weapon/payload and equipment fit to the future submarine capability. The ship control system is another highly complex, software based system with significant development risk. This risk can be ameliorated by maintaining and evolving the system in Collins, with an intention that it be migrated to the future submarine.

29. DESIGN OPTIONS

Each of the design options for the future submarine capability should be studied to determine capability and equipment levels/constraints, broad acquisition costs and other constraints (eg, security implications) that may preclude their further consideration.

30. COMPARISON OF ACQUISITION COSTS

Noting that future submarine capability will be a unique design, it will be essential to develop and manage an acceptable acquisition budget and one that will allow comparison to costs of other submarine design solutions at or within the lower and higher capability bands.

31. RAN PARENT NAVY IMPLICATIONS

As has occurred with COLLINS, the unique capability requirement for the future submarine capability will have implications for the RAN as a parent navy. The responsibility for design management and the associated safety case, maintenance management and integrated logistics support arrangements will lie with Australia. These implications can to some extent be ameliorated by selection of common systems, sensors, weapons derived from or in service with the US and UK Navies.

The shortage of qualified and experienced submariners and submarine experienced defence civilians will in practice limit the options open to Defence in terms of acquisition strategy and the level of competition that can be managed and supported.

32. CONTRACTUAL IMPLICATIONS

It will be important that the Commonwealth has 'freedom of action' with respect to IP and not be tied to specific companies and/or design solutions because of IP constraints.

Noting the limited competition likely to be available for the design and construction of the future submarine capability, major challenges lie with ensuring value for money and the use of novel contracting principles with associated terms and conditions to provide appropriate visibility and assurance regarding costs, progress, payments, and profit margins.

The development of an undersea warfare capability for the 2020s and beyond will be a significant challenge involving new technologies and elements of risk. It will therefore be necessary to develop appropriate contractual mechanisms to ensure a successful acquisition outcome.

33. TIMESCALES

Using an estimate of some three years for first of class contractors' and operational sea trials and accepting that Collins will be decommissioned in 2025, then an aggregation of the trials period and design and construction period suggests that initial design work should begin around 2011 and DCP entry should be at the next available opportunity after 2007, ie, DCP 2008-18.

34. LONG LEAD ACTIVITIES

Some key technology studies and engineering activities need to begin early because of the long lead-time required to determine outcomes. These include:

- a. Hull forms and materials
 - b. Battery technology, performance and storage
 - c. Air independent propulsion
-

- d. Propulsion technology and systems
- e. Unmanned underwater, surface and above water vehicles and their interfaces.

35.

CONCLUSIONS ON THE DEVELOPMENT OF AN ACQUISITION STRATEGY

- a. There is no military off-the-shelf option that satisfies the requirements justified by the strategic circumstances outlined above, a developmental project with the RAN as the parent navy is required (similar to that of COLLINS).
- b. Each of the design options for the future submarine capability should be studied to determine capability and equipment levels/constraints, broad acquisition costs and other constraints (eg, security implications) that may preclude their further consideration.
- c. The combat system and integrated ship control, monitoring and management system, evolved and updated, should be migrated from Collins to the future submarine capability.
- d. Obtaining value from money in the sole source paradigm requires new approaches to managing the investment.
- e. A whole of government approach will be required to provide the necessary support, including the key areas of fiscal appropriation, commitment and management, technological encouragement, and industrial encouragement and incentives.

Future Submarine - Overview

- = Now critical
- = Caution, heading for critical
- = progressing

Near term Actions

Severe shortage of Submarine personnel, only 3/5 SMs manned and dropping!

1 Establish Submarine Expertise in Canberra to manage the project

1 Understand Implications of a Developmental Project

1 Agree Top Level Capability

1 Agree Acquisition Strategy

1 Agree Timelines

1 Agree Acquisition Strategy

ASC Design, evolved from Collins design philosophy

1 Ensure Requirements Factored into Sale of ASC

2 Identify areas for R&D - start recruiting the talents

2 Identify Knowledge Gaps & set about filling them

2 Initiate Supporting Studies

2 Shape Industrial Climate

2 New Aus/US SM Cooperation Agreement to cover FSM concluded 2009??

2 Brief to Industry ACTU

2

Time scales difficult to definitively set out until Acquisition Strategy decided - but First Pass 2011 = there is no time to waste

Political preparation

Defence project Team

Early Political Decisions

1 Agree the Top Level capability - bipartisan political understanding and acceptance

2 Agree Acquisition Strategy - no off the shelf RAN Parent Navy

3 Migrate Combat System, C4I and Ship Control System from Collins

3 Value for Money & managing risks a challenge

3 Impact on Sale of ASC

Ownership structure

Timing of sale

3

This will limit level and nature of European involvement

Should be taken into account at the outset

Access to USN technology is critical

1 US Alliance/strategic partnership is a major factor

Review Models used by USA, UK, Fr, Ger, Sw

Relationship contract

3

Timings

Operational 2025

First of Class Sea Trials, rectification 2022 - 24

Build 2016 - 2022

Detailed Design 2014 - 2020

Select Technologies for Design **Second Pass 2016**

System Design 2011 - 2015

Technologies for Development? **First Pass 2011**

R&D Targets? Project Mobilisation & Concept Development 2008 - 2010

Build rate V Capability Requirement an issue

Part 3 - Industry Issues

Global conventional SM designers/builders have shrunk Australian Industry base significantly advanced from Collins.

USN is particularly sensitive to exposing its SM IP to third parties

Accessing SM IP is a critical/limiting factor

Electric boat I&V+design support

European conventional SM Design Support Consultancy

Value for \$s fm sole source requires suitable arrangements - USA, UK, Fr, Sweden and Germany all manage it!

ASC the clear choice to design & build

Limited Defence/Navy ability to oversee FSM significant factor

Collins development can assist in risk reduction

Part 1 - Strategic Setting

- Compelling Argument for FSM
- Highly Capable SM
- Expanded Strategic Effects -> Additional Roles
- Roles + Concurrence+Attrition = > 6

Able to operate in Areas where we do NOT have Sea or Air control

Australia's Strategic Sting

Why Submarines? (The Key Strategic Questions) - Does Australia:

- Need to have visibility and understanding of the developing maritime capabilities in our region, with a view to being able to understand future intentions?
- Wish to be able to deter, and if necessary retaliate against someone interfering with our maritime trade?
- Need to be able to threaten and if necessary, launch precise attacks on selected maritime and land targets without exposing our intentions, the deployment of the launch platform or laying the launch platform open to immediate retaliation?
- Need to maintain a presence in maritime areas in our region, eg the archipelago to our north, in circumstances where we do not control the air or sea surface or when an overt presence may be unwelcome or inflammatory?
- Need to have a comprehensive understanding of the underwater warfare environment?
- Wish to be able to exploit the following military strategies:
 - Uncertainty of our force dispositions and intentions for the potential opponent?
 - Unacceptable risk for the potential opponent by moving against us?
 - Constraint on freedom of action for the potential opponent - arising from this situation?
 - An inability to predict where our forces are?
- What platform is uniquely able to covertly provide an intelligence, surveillance, reconnaissance and strike capability, deploy at long range (eg 3,500 nautical miles) and remain for several weeks on task?

UUV contribution to all roles

SM Roles

- Surveillance
- Remote Sensors
- Intelligence Gathering
- Deterrence
- ASW
- Prep UW Battlespace
- SAF support
- Sea Control contribution
- Sea Denial
- Land Strike
- Training

- Indications & Warning of intentions
- Combine visual, acoustic and electronic observations - react to maximise collection opportunities
- Direct Support
- Forward Deployed
- Rapid Environmental Assessment
- Support for CD MCM/Rece Landing Sites
- Swimmer Delivery Vehicle (SDV)
- Submerged Exit/Re-entry
- C2 support for SAF
- Precise land Attack in support

Top Level Requirement

- Able to maintain at least 2 SM on patrol @ at least 3,500 Nm? (cf Collins 2 @ 2,500 nm)
- Able to maintain 2 on task @ 2,500 Nm for the balance of these roles
- Concurrency & attrition & need to train own forces need to be factored in to the numbers calculation

Part 2 - Collins Lessons In FSM Context

- Achieved a world class submarine capability
- Much stronger Australian starting point
- Lessons Learnt Process to defend against 'here we go again' claim
- Should have strong confidence in Aus ability to deliver
- Limitations on CW Capacity to manage the project should be factored in
- The difficulty for European designers to adapt to the Australian Geographical context should not be underestimated