Under the Sea Air Gap: Australia’s Anti-Submarine Warfare Challenge

Brice Pacey
UNDER THE SEA AIR GAP

AUSTRALIA’S ANTI-SUBMARINE WARFARE CHALLENGE

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The Kokoda Foundation

www.kokodafoundation.org

Researching Australia’s Security Challenges
EXECUTIVE SUMMARY

This study attempts to identify issues surrounding Australia’s anti-submarine warfare (ASW) capabilities that will require greater scrutiny in the period leading up to the 2014 Defence White Paper, as part of a program of rigorous reviews of the mix and scale of Australia’s defence capabilities and their appropriateness to emerging threats to Australia’s national security.

The international market for submarines over the coming decade is projected to exceed one hundred vessels of all types, and more than half of these are destined for the Asia-Pacific region. Many will be delivered to navies that have not previously operated submarines.

Even more challenging will be the proliferation of submarines with significant offensive capabilities against targets both at sea and on land, and employing new propulsion technologies that will make them considerably harder to locate and track. New regional capabilities are developing at a rate and with a level of sophistication that would have seemed unlikely a decade ago.

In 2030, there will be more submarines, capable of stealthy and sustained operations, carrying more accurate and longer-range armaments, and operated by a larger number of regional navies. In some cases, these improved underwater capabilities will be deployed by states whose long-term intentions remain, at best, unclear.

In addition, there has been a series of revelations over the past two or three years about developments in Chinese military capabilities that raise questions about the strategic intentions of some in the People’s Liberation Army over the next few decades. There have even been incidents involving rogue states and criminal elements, such as the development of surprisingly capable submarines by drug cartels operating in the Americas that might yet come to affect Australia more directly.
In this environment, ASW is emerging as a national interest of the highest order. Australia’s strategic geography, while generally beneficial, exposes it disproportionately to any future undersea threat. Australia’s extended sea lines of communication and offshore resource industries, upon which so much of its wealth depends, are particularly vulnerable to any future underwater attack by either state or non-state actors. The consequences of such an attack on Australia, employing submarines or submersibles, could be catastrophic in strategic, economic and environmental terms.

Because of these changes in the undersea environment in Australia’s region, there is a strong case to be made for reviewing, and in some cases accelerating, the introduction of the new and enhanced ASW capabilities in Force 2030, the future Australian force described in the 2009 Defence White Paper. Some of the things that might be considered, include:

- **Reviewing the Naval Combat Helicopter Program and Accelerating Acquisition.** The planned increase in the number and capability of surface platforms, and the potential for operating naval combat helicopters from forward operating bases on land suggests a review of the planned numbers of naval combat helicopters. The review should proceed at a pace that recognises that the proposed Naval Combat Helicopter is an immediately available and effective force protection asset.

- **Additional Upgrades to the Collins Class Submarine.** It is likely that it will be necessary to extend the life of the Collins class submarine through more ambitious progressive upgrades and to use the Collins maintenance program to evaluate new technologies for the Future Submarine. One of the technologies that should be high on the priority list is air independent propulsion, part of the original plan for the Collins class that should be revisited.
• **Accelerating the Development of the Future Submarine.** There has been a significant loss of momentum in developing the capability requirement and selecting a builder and designer for the Future Submarine that needs to be fixed. Consideration should be given to designing the Future Submarine program to allow continuous batch building, eliminating the gaps in demand that increase the costs of Australian naval shipbuilding and lead to the problems of periodic block obsolescence. The Japanese approach to sustaining its submarine fleet may provide a model for Australia to consider.

• **An Enhanced Offshore Combatant Vessel.** The possibility of developing a modularised light ASW capability for the Offshore Combatant Vessel should be explored, as a means of supplementing other elements of the ASW capability that will already be severely stretched. The similar but larger US Littoral Combat Ship will have an ASW module, suggesting that there may be opportunities for a cooperative approach to systems development in close consultation with the US Navy.

• **Increasing the Strength of the Manned Portion of the Maritime Patrol Aircraft Fleet.** A detailed analysis of ASW in the lead up to the 2014 Defence White Paper is likely to reveal an increased requirement for the manned component of the Maritime Patrol Aircraft fleet to cope with the sophistication of the ASW threat and the size of Australia’s maritime jurisdiction and international obligations. Any studies will need to assess the limitations of available and planned unmanned aircraft in an ASW role.

• **Emphasising the Need for Interoperability.** ASW will expose the limits of defence self reliance in a demanding regional threat environment. There will be an increasing need for close cooperation with friends
and allies in developing a basic intelligence picture of the underwater environment in the region, and to collaborate in framing an appropriate ASW response. A high priority should be attached to interoperability which, in many cases might best be achieved by employing common platforms, sensors and data links.

A high priority should also be attached to revisiting some of the apparent assumptions in Australia’s capability development and procurement policies in the light of a rapidly evolving undersea environment. Some of the following questions need to be answered before Australians advance much further towards the development of the future ASW force:

• Does the possibility that regional powers might soon have a capacity to conduct extended sea denial operations mean that there is a need to be concerned about the strategic disconnection between Australia and its major sources of equipment in North America and Europe?

• If the technologies being developed in the region continue at the pace of recent developments, will Australia be able to obtain its materiel ASW needs from a functioning market, and will Australia have unrestricted access to the best technology available in that market?

• Does the growth in regional submarine capabilities mean that Australia’s strategic depth is of diminishing value, and should Australians be concerned about the concentration and lack of protection of key strategic industries, especially those relating to submarine support and maintenance?

• If there is a decision to invest in off the shelf solutions for any part of the ASW system, should they be based on equipment that none of Australia’s friends and allies in the Western Pacific operates, thereby reducing the opportunity to draw on common supply
chains and to share operational results and experience? Or should Australia commit to harmonising ASW procurement with friends and allies in the region?

The following issues need to be addressed before any sensible decisions can be made in relation to the more innovative aspects of the options indicated above:

- **Force 2030**, including the ASW force, needs to be subjected to a rigorous program of operational analysis, experimentation, and prototyping.

- There needs to be much more open analysis and discussion of investment on the scale anticipated in the 2009 Defence White Paper, especially if future circumstances require increased and accelerated ASW programs.

If Australia is to meet these new challenges, national security planners will need to assess the extent of the erosion over the past decade of the industry capabilities that will be needed to meet the ASW requirement. Maritime industries have been particularly hard hit by procurement reforms that have had short term financial benefits, but with long term consequences for Australia’s strategic independence and defence self reliance.

It is time for a more rigorous analysis of the strategic industry capabilities required to support an increased ASW effort, and a more economically literate assessment of how the expanded requirement can best be sustained. These priorities then need to be articulated in a genuinely strategic industry policy.
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He has taught at a variety of academic and vocational establishments including the United States Army Intelligence Centre and School. In addition, he has held representational roles in Australia and the region, including in Australia’s Embassy in the Philippines.

Following a 25-year military career, Brice spent several years in senior executive appointments and as a strategic and operational analyst in the private sector. He was a government adviser on military strategy and programs to the Howard Government.

Brice is a graduate of Macquarie University, the Australian National University, and the University of Arizona. He is also an honours graduate of the Armed Forces of the Philippines Command and General Staff College, and a distinction graduate of the Royal Australian Navy Staff College where he won the Admiral Griffiths prize.

He was a founding director of the Kokoda Foundation, and established the Menzies Research Seminar series on Australian Security in the 21st Century, which delivers an occasional series of seminars on vital national security issues in Parliament House. He has had papers published by the Strategic and Defence Studies Centre, the Menzies Research Centre and the Kokoda Foundation, and has had articles published in the Asia-Pacific Defence Reporter and the US Military Intelligence Journal. He has recently completed a history of the concept of national security for the National Security College.
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UNDER THE SEA AIR GAP:
AUSTRALIA’S ANTI-SUBMARINE WARFARE CHALLENGE

1. INTRODUCTION

The deployment of larger numbers of new and more capable submarines by navies in the Western Pacific and Indian Ocean demands serious discussion about the systems Australia requires to monitor submarine operations and, if necessary, to counter these.

Australia’s strategic geography, while generally beneficial, exposes it disproportionately to an undersea threat. Australia’s extended sea lines of communication and offshore resource industries, upon which so much of its wealth depends, are particularly vulnerable to any future underwater attack. And a large part of Australia’s population and industry is located in a thin coastal strip and clustered around the ports and harbours of Australia’s major cities.

The consequences of an attack on Australia by state or non-state actors, employing submarines or submersibles, could be catastrophic in strategic, economic and environmental terms. Thus, the secretive worlds of undersea and anti-submarine warfare (USW and ASW) are emerging as national interests of the highest order.

Yet, in marked contrast to the significant quantitative and qualitative developments in the submarine capabilities of regional states, by 2020 most of Australia’s ASW capabilities will be ageing. A large part of the relevant force elements will have been operating at a high tempo for two decades, with significant implications for wear and tear, although not necessarily in their ASW roles.

ASW assets have been diverted to perform other important tasks, with a substantial loss of experience and skills. There is growing concern about the proficiency of individual ASW capabilities and the effectiveness of combined ASW operations.
These weaknesses are recognised in the 2009 Defence White Paper, *Defending Australia in the Asia Pacific Century: Force 2030*.\(^1\) Foremost amongst the force structure changes announced for *Force 2030*, and certainly the most resource intensive and technically demanding, has been a renewed emphasis on ASW. This is a mission that received only indirect mention as recently as the 2000 Defence White Paper.\(^2\)

The renewed emphasis on ASW will remain a high priority if the levels of capability and availability required to preserve Australia’s maritime interests are to be assured in the coming decades. It will need to be accompanied by a healthy professional debate about how to optimise the ASW system within a rapidly changing domain, as a part of the Government’s expectation of ongoing strategic re-assessment.

Unfortunately, progress has been slow in implementing a program to deliver *Force 2030*. There are already concerns that the ASW capabilities that it describes, while substantial, remain insufficient. Furthermore, while some of the key ASW requirements for *Force 2030* are spelt out in the 2009 White Paper, there is a lack of clarity about many elements of the logic, strategy and resource allocation and timing. These have not been made any clearer by the publication of the Defence Capability Plan Update in December 2010.\(^3\)

The need to respond to the widespread deployment of more sophisticated submarines in the region has been made more urgent by continuing procurement failures. In a speech

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\(^3\) The Public Defence Capability Plan (DCP) provides an account of major capital equipment proposals that are currently planned for Australian Government consideration over the decade ahead. It provides information on resource allocation and schedule, as well as other information designed to assist industry planning.
in November 2009, Minister for Defence Personnel, Materiel and Science Greg Combet offered the abandoned Seasprite naval helicopter as a prominent example of the waste that erodes public confidence in Defence procurement. A plan to fast-track the procurement of a replacement with a greater ASW capability, a variant of the in-service Seahawk helicopter, has been shelved to allow competition with yet another developmental system.

ASW is also over-represented in the Government’s Programs of Concern Update released in December 2010. Three of the twelve programs identified as having problems with scheduling, cost, capability delivery or project management have consequences for Australia’s ASW capability. These programs are the Collins class Submarine Sustainment and Projects, the Lightweight torpedo replacements for the ANZAC and Adelaide Class Frigates, and the Electronic Support Measures upgrade for AP-3C Orion aircraft.

Furthermore, the investment in ASW planned for Force 2030 has been acknowledged as substantially appropriate in aggregate and the broad intent is generally supported. But the detail has been the subject of criticism, not the least on the basis of doubts about the affordability or cost-effectiveness of some of the proposals. Changes in the regional security environment seem to be moving quicker than the authors of the 2009 Defence White Paper may have appreciated.

Notwithstanding the long history of Australia’s involvement in undersea warfare, and the vital importance of ASW to

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5 Initially announced by a Joint Media Release by the Minister for Defence and Minister for Defence Materiel 36/10 dated 26 November 2010, a revised version was released in December.
6 Australia will commemorate 100 years of submarine operation during the drafting of the next Defence White Paper, planned for publication in 2014. Australian submarines first saw action in the waters around German New
Australian sovereignty and prosperity, Australian investments in submarines and their countermeasures have been neither sustained nor trouble free, and the problems seem set to continue.

Still, there have been positive developments. ASW is a subject that demonstrates the value of ongoing five-yearly strategic reassessments established by the Government in the 2009 Defence White Paper. If we look back some twenty years or so to the maritime environment of the South China Sea in 1990, just after the publication of the 1987 Defence White Paper, we can readily appreciate the challenge of predicting the regional security environment that Force 2030 ASW systems might operate in some twenty years into the future.

In 1990, the United States operated bases at Clark Air Base and Subic Bay in the Philippines, the Soviet Union had a strategic outpost at Cam Ranh Bay in Vietnam which hosted periodic deployments of Soviet Pacific Fleet submarines, and China operated patrol craft and conventional submarines from a modest base at Yulin Bay on Hainan Island.

Just two years later the Soviet Union had been dissolved and Russian forces had left Cam Ranh Bay. Damage caused by an eruption of Mount Pinatubo and the stalling of bases negotiations in the Philippine Senate had led the United States to leave Clark and Subic. And China’s slowly growing military presence in the South China Sea was being constrained by a third world economy and sanctions imposed by the United

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7 The 1947 Military Bases Agreement between the United States and the Philippines granted the United States a 99-year lease for 16 bases or military reservations including Subic Bay and Clark Air Base in Luzon. Subic Bay was the largest overseas US base in the Pacific at the height of the Vietnam War.

8 A 1979 agreement between the former Soviet Union and Vietnam granted a 25-year lease on the naval base at Cam Ranh Bay, at one time perhaps the largest Soviet naval base outside the Soviet Union.
States and European Union following the events in Tiananmen Square in 1989.9

Similarly, in 1990 the South China Sea littoral states of Vietnam, Malaysia and Singapore had no submarines in their naval inventories. The situation in 2011 is already markedly different, with a significant increase in the numbers of submarines operating and being deployed into the Western Pacific and Indian Oceans. Looking forward twenty years, Vietnam, Malaysia and Singapore are all likely to be operating well-developed fleets, along with China, Indonesia and Taiwan.

THE KOKODA STUDY

Importantly, the program of strategic reassessment that has been developed to cope with a changing security environment like that in the South China Sea also provides a framework for independent think tanks such as the Kokoda Foundation to engage the official strategic community and to contribute to the strategic debate in a meaningful way.

Over time, it is hoped that the approach will help overcome the doctrinal inflexibility that may have characterised the periods following some previous Defence White Papers, and to move beyond the partisan debates that have detracted from discussions of a rapidly evolving security environment.

It is within this context that the Kokoda Foundation has chosen to focus on Force 2030’s ASW provisions for meeting Australia’s future defence needs.

The Kokoda Foundation hopes that this paper will assist in identifying the main issues, and presenting these in a way that will encourage informed commentary and debate. The purpose of this study has been to examine influences on and options for the shape and size of Australia’s future ASW force

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9 An arms embargo imposed by the Unites States and the European Union remains in effect, more than twenty years after the protests in Tiananmen in 1989.
in light of the capability priorities identified in the 2009 Defence White Paper.

**Kokoda Foundation Research Focus**

The primary issues to be addressed in this research paper are:

- The platforms, concepts and technologies employed in ASW.
- The nature of the maritime operational environment and growing regional submarine capabilities in the period 2020–2050.
- The maritime roles and ASW tasks likely to be required to balance these.
- The impact of technological change on ASW forces elements and their operations.
- The key drivers and options for Force 2030 ASW.
- The demands on and implications for the future of defence science and industry in Australia.

**The Kokoda Methodology**

The Kokoda Foundation’s approach is to:

- conduct background research on key issues and evaluate the available literature,
- establish close links with key government and non-government stakeholders, and
- organise closed workshops to discuss key issues in depth.

The workshops are undertaken under the Chatham House Rule with informed participants selected with the assistance of stakeholders. The participants are free to use the information received during workshops, but neither the identity nor the
affiliation of speakers, nor that of any other participant, may be revealed.

Participation varies between workshops to ensure that the Kokoda Foundation draws upon the full range of expertise available within each of the stakeholder groups. At each workshop, selected participants are invited to present a short working paper, followed by open discussion. This study does not draw upon official documentation other than that which is already in the public domain. No classified material was either sought or employed in the preparation of this paper.

**FORCE 2030 ANTI-SUBMARINE WARFARE**

The baseline capability to be considered in this paper is that laid down in the 2009 Defence White Paper, as part of the Force 2030 Australian Defence Force structure. The Government used the White Paper to announce its intention to acquire a new and more capable class of submarines, a future frigate optimised for ASW, upgrades to the ASW capabilities of the in-service ANZAC frigates, and a new generation of maritime patrol aircraft.

The Government also announced, as a matter of urgency, an intention to acquire a fleet of new naval combat helicopters with advanced ASW capabilities including dipping sonar and air-launched torpedoes. There will be a new prominence given to gaining information superiority in the undersea domain, and the Defence Science and Technology Organisation will be asked to increase its research into underwater sensors and networking to give greater emphasis to underwater situational awareness.

These programs are described in greater detail in Annex A.
2. SUBMARINES AND ANTI-SUBMARINE WARFARE

It is beyond the scope of this paper to examine the technology of submarines and ASW systems in any detail. Nevertheless, there are some general characteristics of the relevant systems that are useful for understanding submarine and ASW operations.

SUBMARINES

Submarines can increasingly be found at the heart of twenty-first century naval modernisation programs. They exploit the cover that can be provided by the sea to conduct a wide variety of covert operations ranging from intelligence collection to strategic strike. Submarines are capable of launching attacks on surface ships or land targets with little or no warning, closing ports with sea mines before slipping away unnoticed or inserting special forces as part of wider joint force operations.

Even the implied threat of a submarine’s presence can have a disproportionate effect on the operational behaviour of an adversary or an opposing commander’s allocation of resources to tasks. It can make sense for any littoral state with a modern economy to consider investing in submarines as part of their naval force.

Still, submarines cannot achieve their full potential acting alone, only as a very capable part of a strike reconnaissance network. A submarine operating independently has the potential to be disruptive, but submarines can only be decisive when operating as part of a coordinated network of command, control, communications and intelligence systems, and a full range of logistics support.

Submarines fall into four main categories according to their propulsion system and armament, although the distinctions are becoming blurred with the development of new technologies:

• Diesel Electric Submarines (SS and SSK),
• Nuclear Powered Attack Submarines (SSN),
• Cruise Missile Submarines (SSG and SSGN), and
• Ballistic Missile Submarines (SSBN).

PROPULSION

Diesel electric submarines have electric drive systems powered by batteries. The batteries are recharged, perhaps daily, by diesel generators drawing atmospheric oxygen through a snorkel. The electric propulsion system enables diesel electric submarines to be extremely quiet when submerged and operating on their stored battery power. But the requirement to regularly recharge batteries introduces a number of vulnerabilities that can be exploited by ASW forces, not the least caused by the machinery noise of the diesel generators.

Improving battery technologies such as those being developed for electric automobiles might reduce the amount of time a submarine spends near the surface charging its batteries as a proportion of its total time at sea, known as its indiscretion ratio. But there are problems to be overcome before the use of newer battery technologies becomes widespread.

In contrast to conventional submarines, nuclear submarines can generate power while submerged, and only need to operate near the surface for brief periods to allow high bandwidth communication or for the operation of some sensor types. This provides nuclear boats with their main advantage: their capacity to continue operating at high speed for effectively unlimited time while remaining submerged.

Nuclear propulsion comes at the cost of some radiated machinery noise, but the latest designs can be nearly as quiet as the best conventional boats. In contrast to conventional boats, nuclear boats also have the advantage of abundant electrical power to operate power hungry sensors and digital signal processing equipment.
The most recent generations of conventional submarines have gained some of the advantages of nuclear powered boats through the use of air-independent propulsion systems. These allow diesel electric submarines the potential to remain submerged for much longer periods of time, perhaps weeks rather than hours or days, and to operate at higher speeds for longer periods while submerged. This enables them to leave an area at a higher sustained speed following any indiscretion or ‘datum’, creating a wider area to be searched by responding ASW forces.

ARMAMENT

The combination of stealth with the ability to deploy its armaments with little or no warning makes the submarine an extremely effective platform. Submarines are fitted with armaments for one of two main roles: a tactical role that includes attacks on naval targets, or a theatre or strategic role involving the delivery of cruise or ballistic missiles.

For the tactical role, attack submarines have been traditionally fitted with torpedoes to allow them to neutralise or attack the naval forces of an opponent. In a blurring of what was once a clear distinction, attack submarines are increasingly able to launch cruise missiles for attacking targets on the surface of the sea and on land, contributing to broader theatre operations.

The strategic role of ballistic missile submarines derives from their ability to carry submarine-launched ballistic missiles, commonly nuclear armed. For those great powers with a variety of nuclear delivery systems, ballistic missile submarines form part of the reserve of nuclear forces to give an assured second-strike capability.

This is because their ability to hide increases the chance that they might survive an otherwise disarming first strike by an adversary, thereby increasing the range of available retaliatory options. In order to further increase the chance of surviving a first strike, ballistic missile submarines operate
deep in the open oceans, or in bastions which friendly forces attempt to deny to their adversaries during periods of tension or conflict.

The power, reach, and survivability of submarines, particularly those armed with cruise or ballistic missiles, make them an ineluctable factor in the calculation of the strategic weight and influence of states. They are the elephant in the room in contemporary diplomacy in the Indian Ocean and Western Pacific. They are also voracious consumers of resources, and can be difficult to operate successfully without a comprehensive understanding of their strengths and weaknesses; they are vulnerable to a skilled foe.

ANTI-SUBMARINE WARFARE

As the name suggests, ASW is the challenging task of preventing adversary submarines from carrying out their missions, roles and tasks. ASW involves the systematic use of surface ships, submarines, and aircraft and other sensors and platforms to detect, track, and destroy adversary submarines, to prevent them from reaching their intended operating areas, or to prevent them from interfering with friendly force operations in some other way.

SURFACE COMBATANTS

Surface combatants are given a prominent ASW role in Force 2030. However, although surface combatants have the overall characteristics of endurance and persistence, their use as ASW platforms can be problematic, because they are also a submarine’s primary target and susceptible to submarine attack.

Furthermore, surface combatants unavoidably generate noise, increasing the submarine’s relative noise advantage. This applies even when surface ships are built to similar standards to those employed in submarines themselves, with the extensive use of sound and vibration absorbing designs and materials, an approach used in some Royal Navy ASW
frigates. The relative noise deficit makes surface combatants more vulnerable to detection and attack, and degrades the performance of the surface combatant’s own ASW sensors and weapons.

These limitations can be partially overcome by the use of off-board sensors and fixed and rotary wing aircraft, operating at a distance from the parent surface vessel, as nodes in an ASW system. These also facilitate surveillance over large areas, contributing to cooperative tracking and improving situational awareness at the system level in a theatre context.

**SUBMARINES**

Submarines are widely considered to be the best ASW platforms, especially by submariners, as they are designed to operate quietly in the same underwater environment as their targets.

Conventional submarines can be highly effective when operating in a complex littoral environment, or in maritime choke points such as straits. Still, conventional submarines generally need to operate at slow speeds if they are to maintain their advantage of stealth over extended periods. And their slow transit speed greatly limits their effectiveness in blue water or for operations at long distances from their bases.

The submerged speed and endurance of nuclear boats offer significant advantages, particularly in blue water operations. While they are also stealthier when operated at slower speeds, sustained high speed operation does not require nuclear boats to regularly risk ascending to snorkel depth to recharge batteries.

**AIRCRAFT**

Aircraft offer advantages in range and speed over surface combatants and submarines, and may be the best options for sustained coverage of a maritime jurisdiction as large as Australia’s. They currently have the considerable advantage
of not being vulnerable to the weapons carried by submarines, although this advantage may be lost when submarines are fitted with surface-to-air missiles for air defence.

Naval combat helicopters operating from surface combatants provide a means whereby a naval force can attempt to establish a protective layer between the likely position of a submarine and surface vessels or naval task groups, by offering the ability to locate and destroy adversary submarines beyond the range of their primary weapons. They can also be based on land for operations in straits and narrows.

One of the major benefits of helicopters is their contribution to force protection, or the ability to prevent hostile actions against friendly forces, through their organic and persistent surveillance capabilities derived from the modern ASW helicopter’s suite of acoustic, electro-optic and radar sensors.

Maritime patrol aircraft generally operate from land bases to cover very large areas in a single mission, and to track, harass and destroy submarines while remaining outside the environment in which submarines weapons are effective.

There is scope for performing at least some of these missions, such as location and tracking, using high altitude and endurance unmanned aircraft, although an attack on a submarine by unmanned aircraft may not yet be feasible.

**SENSORS**

Each of these platforms has their own combinations of sensors incorporating a range of technologies, including:

- acoustic,
- radar,
- electro-optic, comprising infra-red, visual and low-light sensors, and
- magnetic.
In turn, each of these technologies can be deployed in several different ways. Acoustic technologies for example, can be permanently located on the seabed, mounted on the hulls of submarines or surface craft, lowered into the sea by helicopters, trailed behind various maritime platforms or dropped into the sea as buoys. Any of the subsurface, surface or aerial platforms could be either manned or unmanned and can be networked with other platforms and sensors or operate autonomously.

ASW helicopters lower sonar devices into the sea, dipping sonar, to locate and track their targets, or drop sonobuoys for this purpose. Maritime patrol aircraft drop sonobuoys into the sea to locate and track targets, supported by a range of alternative sensors tightly integrated into the broader ASW system.

**NETWORKING**

Communications between ships and aircraft are necessary, but not sufficient, to achieve the precision tracking which is a major objective of an ASW system. Dedicated data links and data obtained from advanced tracking are required to provide the precision to detect, locate, identify and engage submarines in the increasingly complex underwater environment that is developing as regional submarine fleets grow in size and sophistication. The emphasis must be on those specific aspects of network-centric warfare that are needed to enhance friendly ASW.

Considerable research is still required into ways of fully integrating submarines into the networks used by other elements of an ASW force. Enhanced communications between submarines and friendly ASW forces operating at speed and depth would reduce their vulnerability to detection and attack by adversary ASW forces.

A recent networked ASW task conducted by the Australian Defence Force’s Rapid Prototyping, Development and Evaluation program demonstrated that a submarine operated
at speed and depth could be successfully integrated into a naval task group network. Yet much more needs to be done.

Higher bandwidth radio and low probability of intercept satellite communications can complement low frequency (and low bandwidth) acoustic or radio communications, but require operation at periscope depth or the trailing of antennae just below the surface of the water.

**ASW WEAPONS**

The main weapons employed by surface ships, submarines and aircraft attacking submerged submarines are torpedos and mines. Mines can also be used offensively or defensively against submarines in the vicinity of its base, in likely transit areas, or in potential submarine patrol areas.

Notwithstanding the range of options available, the difficulties of detecting, tracking and destroying submarines remain great, and pre-emptive attacks on submarine bases, communications and maintenance facilities are likely to be part of an ASW plan during conventional conflict.
3. ASSESSING MARITIME ROLES AND TASKS

Australia is a maritime nation in a region comprising large expanses of open ocean to the east south and west, and a complex of archipelagic, island and littoral states to the north. The region to the north contains the greatest cluster of strategically significant maritime straits in the world.

The economic contribution of Australia’s maritime jurisdiction and the adjacent seas by way of trade and resource endowment underpins Australian prosperity and growing integration in the economic and cultural life of the broader Asia-Pacific region. Australia relies on sea transport for 99 per cent of exports by volume, while a substantial proportion of Australia’s domestic freight depends on coastal shipping. In 2009, a large proportion of Australian exports of coal and iron ore worth some $70 billion were shipped through the international straits to the north of Australia to markets in East Asia.

The extent of the economic contribution can be seen in a single offshore resource development. The Greater Gorgon Area gas fields located 130 kilometres off the north-west coast of Western Australia are the centre of the largest natural gas project in Australia’s history. During the first 30 years of the project Gorgon will provide a projected $64 billion boost to Australia’s Gross Domestic Product and support employment of around 10,000 people during the peak construction period. And there are many similar resource projects already in development or production.

This vital contribution of the sea to Australian prosperity and cultural identity is accompanied by significant challenges for maritime forces. Enforcing good order in Australian territorial waters is of considerable public interest and is a government priority of the first order.

The challenge is made more difficult by sharpened community expectations of the ability of maritime forces to be

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at all places on the surface of the ocean at all times, and to operate with an appropriate level of force or restraint as required under extremely demanding conditions. Yet few Australians have thought deeply about Australia’s key maritime roles and tasks.

**AUSTRALIA’S MARITIME JURISDICTION**


Maritime forces operate in an increasingly challenging jurisdictional environment as a consequence of changes to maritime law, in particular the 1982 United Nations Convention on the Law of the Sea.11

The conventions put in place limit the activities, but not the movement of maritime forces through the region to Australia’s north. They also impose considerable responsibilities within Australia’s maritime jurisdictional zones. No other nation confronts a larger or more complex combination of littoral and economic zones. Furthermore, the growing complexity of international law means that while old tasks seldom disappear, new ones keep developing.

Within this complex body of law and convention, there are provisions that apply specifically to submarines that are relevant to ASW operations in the archipelagic region to Australia’s north:

- **Innocent Passage.** Submarines exercising innocent passage through territorial seas are required to travel

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11 The Third United Nations Convention on the Law of the Sea (UNCLOS) is the international agreement that resulted from the third United Nations Conference on the Law of the Sea, which took place from 1973 through 1982. The Law of the Sea Convention defined the rights and responsibilities of nations in their use of the world’s oceans, establishing guidelines for economic activities, the environment, and the management of marine natural resources.
on the surface and to show their flag. Without prior approval, the collection of intelligence, the conduct of survey activities, or any exercise of practise with weapons of any kind would be considered to be prejudicial to the good order or security of the coastal state.\textsuperscript{12}

- **Transit Passage.** In international straits, all ships have the right of passage in their normal mode, including the right of submarines to travel submerged, although they must proceed without delay and refrain from any threat or use of force.\textsuperscript{13}

So a submarine passing through the straits that lead to Australia’s maritime zones would be quite within the conventions to do so submerged, and would only be required to surface within twelve miles of the Australia baseline, essentially the coast.

**AUSTRALIA’S MARITIME ROLES AND TASKS**

This paper employs the terminology in common usage in Western naval literature, in which the basic tasks of middle power navies are described as being to conduct sea control, sea denial and power projection missions:

- **Sea Control.** Sea control is the ability to use the air and sea for friendly purposes, and to deny that use to an adversary. It is generally limited in time and space, often in terms of a specific operation or campaign.

- **Sea Denial.** Sea denial is a related but more restricted concept in which an adversary is denied the ability to use an area of the sea for his own purposes for a period of time. But it does not imply the unrestricted use of the sea for friendly forces, and it does not ensure the safe conduct of trade and other economic activities.

\textsuperscript{13} Ibid., Articles 38 and 39.
• **Power Projection.** The ability to deliver force *from the sea* is called power projection, and it represents a particular objective of sea control. The level of power can be implied or threatened, as well as asserted. Used skilfully, power projection can be a major source of persuasion against littoral states.

Maritime forces are highly versatile elements within the total force that have a unique range of applications over a wide span of operations, commonly falling into three roles.

• **Diplomacy.** Diplomatic tasks derive in large degree from the instrumental value of naval forces. Navies can exercise freedom of navigation to achieve a presence denied armies and air forces in situations short of war. They can be used for strategic objectives ranging from coalition building to coercion in ways denied to land power other than in the case of contiguous states. Naval vessels are also emblematic of the wealth and technological achievement of their flag nations.

• **Constabulary Operations.** Constabulary operations are those that operate within a framework provided by Australian domestic and international law. They encompass defence force aid to the civil power and community, border protection, environmental and resource management and protection, anti-piracy operations, disaster relief fisheries protection and quarantine operations and search and rescue.

• **Warfighting.** As is clear from *Force 2030*, high-end warfighting continues to be seen as the core task for the Navy, and surface combatants will continue to be central to Australia’s maritime capability. It is the capacity for operations at the more demanding end of the conflict spectrum, both real and perceived, that underpin a navy’s effectiveness in less demanding diplomatic and constabulary tasks.
DEFENCE WHITE PAPER ROLES AND TASKS

The 2009 Defence White Paper is unambiguous in stating that the primary obligation of Force 2030 is to deter and defeat attacks on Australia, with deterrence a fundamental idea behind the range of capabilities specified in the proposed surface combatant fleet and the task groups that they form with other force elements including amphibious ships and submarines. The grand strategy is described as ‘a fundamentally maritime strategy, for which Australia requires forces that can operate with decisive effect throughout the northern maritime and littoral approaches to Australia, and the Australian Defence Force’s primary operational environment more generally.’\(^{14}\)

The strategy is described as ‘a proactive one in which we seek to control the dynamics of a conflict, principally by way of sea control and air superiority, and also by defeating hostile forces in their bases, in staging areas, or in transit.’\(^{15}\) Where necessary, Australia will use power projection in the form of strategic strike and land operations along the maritime approaches in support of that strategy.

Beyond this high-end requirement, the 2009 Defence White Paper also requires forces appropriate to the full range of constabulary and diplomatic functions, including domestic security and emergency response efforts. Some of these roles will involve the provision of support to other services and agencies. Maritime forces may be required to support stability and security operations in the South Pacific and East Timor, in which the predominant Australian Defence Force contribution might be land forces. Other roles will exploit the unique responsiveness of maritime forces for contributions to military contingencies in the wider Asia-Pacific region and in support of global security.


\(^{15}\) Ibid.
For these roles and tasks, Force 2030 is required to provide ‘major surface combatants (destroyers and frigates), submarines and other naval capabilities, supported by air combat (for air superiority and maritime strike) and maritime surveillance and response assets’ ‘to establish sea control, and to project force in our maritime environment (including for the purposes of maintaining freedom of navigation, protecting our shipping, and lifting and supporting land forces).’

The four principal tasks identified for Force 2030 will be to:

- deter and defeat attacks on Australia by conducting independent military operations without relying on the combat or combat support forces of other countries,
- contribute to the stability and security in the South Pacific and East Timor by conducting military operations in coalitions with other countries,
- contribute to military contingencies in the Asia-Pacific region by assisting Southeast Asian partners to meet external challenges and meeting Australia’s alliance obligations to the United States, and
- contribute to military contingencies in the rest of the world in support of global security and a rules based international order.

The utility of ASW systems in the maritime security environment of 2025–2050 derives in large measure from the roles and tasks that they can perform at the high end of the capability spectrum in support of Australia’s national interests during war. Submarines and ASW are central to the first and third of the Australian Defence Force’s prescribed tasks.

But the ASW system also includes a range of versatile platforms that have the ability to contribute to a wide range of constabulary and diplomatic functions. Should the increasing

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use of submersibles and submarines by criminal elements in the Eastern Pacific and Americas be adopted in the Western Pacific, there might be a requirement for the ASW elements of Force 2030 to assist in the second of these tasks.
4. THE MARITIME ENVIRONMENT 2025–2050

Large changes have taken place in the regional security environment over the past two decades, but they are likely to be dwarfed by the changes anticipated in the two decades to come.

Before the publication of the 2009 Defence White Paper, it was possible to write a cautiously optimistic view of the potential for maritime security cooperation in the Western Pacific, while cautioning that some of the regional actors had taken steps that were unhelpful.

There have been several important developments in the regional security environment since then that could dampen that optimism:

• the completion of an elaborate naval base on Hainan Island in the South China Sea and the apparent willingness of China to use one of the world’s busiest waterways as a bastion for its reserve of strategic nuclear forces;

• the emergence of a possible “disconnect”17 between the actions of the People’s Liberation Army and the intentions of its civilian leadership, suggested by the flight test of a new generation aircraft during Secretary Gates visit to Beijing in January 2011;

• the increasing assertiveness of Chinese claims to waters in the South China Sea represents, at best, different interpretations of the conventions of the law of the sea;

• the sinking of a South Korean naval vessel by a North Korean submarine in the Northwest Pacific and disclosures of unexpected progress in the development of the North’s nuclear capabilities; and

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• the proliferation of sophisticated submarine technology in the Western Pacific, the Indian Ocean, and the archipelagic region to Australia’s north.

The use of increasingly sophisticated underwater vehicles by criminal syndicates in the Eastern Pacific might be added to the list, although there is little recent evidence of comparable developments in Australia’s region. Thai Police did find a small submarine apparently being built for the Liberation Tigers of Tamil Elam in Phuket in 2000,18 and there were reports of the Moro Liberation Front seeking to acquire mini submarines form North Korea in 2003.19 The implications of these developments are discussed later in this paper.

In spite of these challenges, the best prospects for peace and security in the region in the Western Pacific will flow from cooperation rather than competition with regional states and China. Notwithstanding a recent moderation of Chinese behaviour, there is there is some way to go before China and the region reach a shared understanding of how peace and prosperity might be maintained in the Western Pacific. Moreover, what some commentators have seen as clumsy politico-military diplomacy by Australia during the 2009 White Paper process may not have helped.

Following the end of the Vietnam War, Australia adopted a range of comfortable assumptions that informed national security planning. These included the advantages derived from Australia’s strategic geography, the powerful US military presence in the Western Pacific region, the preoccupation of the middle powers in Southeast Asia with internal security, and the margin of maritime capability possessed by the alliance system centred on Washington.

Some, or all, of these assumptions are now under threat. Australians must comprehend the possibility that the maritime predominance of the United States and its allies will be challenged, at least in the Western Pacific, and that the margin of conventional superiority possessed by Australia will be eroded by new asymmetrical threats, with submarines perhaps the most technically difficult of these to defend against.

While the threat of invasion remains remote, Australia’s trade routes and offshore economic activities might soon be more vulnerable to harassment or interdiction by submarines than at any time since the Battle of Midway in 1942.\(^20\)

**GEOGRAPHY**

Australia is a maritime nation in a region comprising large expanses of open ocean to the east, south and west, and a complex of archipelagic, island and littoral states to the north. The region to the north contains the greatest cluster of strategically significant maritime straits in the world.

When the 1972 Australian Defence Review stated that ‘geography has been a compelling influence on Australian security’, it did so with the assurance that ‘dominant sea and air power was possessed by friendly powers.’\(^21\) It is likely that this will continue to be the case, but it is no longer certain with the rise of new powers and the deployment of new capabilities such as the new generations of nuclear and conventionally powered submarines. Even if a margin is retained, the numerical and technical advantage is likely to be reduced.

While the 2009 Defence White Paper confirms a maritime strategy as an enduring feature of Australia’s strategic outlook and a sensible response to Australia’s strategic geography, the maritime strategy that it embraces is much broader than its

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20 In June 1942, the United States Navy defeated the Imperial Japanese Navy in a large fleet engagement, considered a turning point in the Pacific War.

predecessors. No longer limited to the geographic determinism and the sea denial strategy of a previous generation, subject to an effective ASW capability, the surface combatant component of Force 2030 seeks to establish sea control at a distance from Australia when deployed on joint and combined task group operations, tasks which necessarily involve control of the undersea environment.

Most analyses of the future regional security environment suggest that in some respects it will be similar to the current environment. Still, there are uncertainties in the emerging strategic landscape which might have large consequences:

- the fragility of favourable trends in South and Southeast Asia;
- continuing instability in the South West Pacific;
- the possibility of the erosion of US maritime predominance, at least in the Western Pacific;
- ambivalence about the rise of China and its implications;
- the deployment of destabilising weapons systems into the region;
- growth in offensive capabilities and strategic strike; and
- new generations of quiet submarines with longer endurance and improved sensors and strike weapons.

Furthermore, there are technological and force structure changes in prospect in regional navies that will be the subject of further discussion in the following chapters.

**SOUTHEAST ASIA**

There are many positive signs in Australia’s relationship with Southeast Asia, and it is difficult to see a direct threat to Australian sovereignty arising from within this region in the period covered by this paper. On the other hand, some of the
lesser contingencies that could arise could nonetheless be quite demanding.

One of the most striking features of the region is a common interest in stability, and a desire to cooperate in dealing with contingencies at the lower end of the conflict spectrum. This is reflected in the high level of engagement being sought by regional navies with the Australian Defence Force.

Security cooperation between Australia and Indonesia is becoming much more broadly based, with increasing cooperation across a range of humanitarian assistance, resource, and border protection activities. The relationship has been enhanced by the Lombok Treaty\textsuperscript{22}, which provides a unique treaty-level framework for addressing traditional and non-traditional security challenges.

On the other hand, there may still be weaknesses in Australia’s understanding of strategic cultures in the broader region. Australia’s diplomatic presence in the region could be strengthened, and there may be a case for the Australian Defence Organisation to develop a more refined engagement strategy more closely coordinated with the Department of Foreign Affairs and Trade.

**SUBMARINE PROGRAMS IN THE NEAR REGION**

There has been growing interest in submarines in the region, although many of the purchases have been of small off-the-shelf designs with limited capabilities, range and endurance.

\textsuperscript{22} The Agreement between Australia and the Republic of Indonesia on the Framework for Security Cooperation (Lombok Treaty) was signed by Foreign Ministers in Lombok on 13 November 2006. Australian Foreign Minister Stephen Smith and Indonesian Foreign Minister Dr Hassan Wirajuda exchanged notes on 7 February 2008, bringing the Treaty into force. The Treaty provides a legal framework for dialogue on a wide range of issues relating to defence, law enforcement, counter-terrorism, intelligence, maritime and aviation security, the proliferation of weapons of mass destruction, and emergency management and response.
Nevertheless, as can be seen from Table 1 and Table 2 (page 31), the large increase in absolute numbers will complicate Australia’s own planning, as the task of identification of friends and foes becomes more difficult.

More positively, the acquisition of submarines by friendly states can also be helpful in strengthening regional resilience and providing opportunities for new areas of cooperation over the longer term. In the time-frame under consideration, new generations of submarines will be operated by Vietnam, Singapore, Malaysia and Indonesia.

- Vietnam. Vietnam has entered into a contract to buy six Kilo class submarines from the Admiralty

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<thead>
<tr>
<th></th>
<th>2010</th>
<th>2025</th>
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<tbody>
<tr>
<td><strong>Australia</strong></td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td><strong>Malaysia</strong></td>
<td>2</td>
<td>2</td>
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<tr>
<td><strong>Singapore</strong></td>
<td>4</td>
<td>4</td>
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<tr>
<td><strong>Taiwan</strong></td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td><strong>Vietnam</strong></td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>

**Table 1. Submarine Operators in Oceania and South East Asian Region**

Shipyards in St Petersburg. Ironically, the likely strategic intent is to offset superior Chinese surface forces, in much the same way that China is developing asymmetrical capabilities to neutralise the power projection capabilities of US carrier battle groups in the Western Pacific. This view is supported by the refurbishment of Cam Ranh Bay naval base and the suggestion that it might be made available for use by the China’s strategic competitors in the Western Pacific, including Russia and the United States.

- **Singapore.** Singapore has signed an agreement with the Swedish firm Kockums for the supply of two Archer Class submarines to replace two of the four much older Challenger Class submarines which entered service with Singapore in the mid-1990s. The Archer Class have been modernised with improved sensors and adapted for tropical use, and will be the first operational submarines in Southeast Asia to be fitted with an air-independent propulsion system.

- **Malaysia.** The Malaysian Navy has recently taken delivery of two modern and very quiet Scorpene Class submarines from the Franco/Spanish DCNS/Navantia consortium.

- **Indonesia.** Indonesia currently operates two HDW Type 209 submarines which have been progressively upgraded. There have been expressions of interest in building up to 12 submarines by 2024. Jakarta has indicated that the fleet will be built at a rate the economy can sustain, which has been suggested might mean an order of three, four or five boats in the shorter term. Both Russian and Korean designs are under consideration, without any firm commitment.

- **Thailand.** Thailand does not currently operate submarines, but has expressed interest in acquiring a submarine capability in response to regional developments.
The relatively modest number of smaller submarines being acquired by the ASEAN states over the shorter term will not be sufficient for sustained power projection. They will, however, be useful to their parent navies for intelligence collection, limited maritime strike, and sea denial operations of a short duration within the confines of the archipelagic region, albeit with some considerable imposition on their overall resources.

They will also provide their operating navies with opportunities to train with submarines and to develop doctrine and operating procedures and to gain experience in ASW. Even in small numbers, they could greatly complicate the planning of any potential aggressor, and greatly increase the cost of aggression.

But they will also add to the complexity of the undersea environment in the region, placing higher demands not simply to detect, but also to identify submarines, with significant implications for Force 2030 ASW.
SUBMARINE PROGRAMS IN THE WIDER REGION

<table>
<thead>
<tr>
<th></th>
<th>China</th>
<th>Japan</th>
<th>North Korea</th>
<th>South Korea</th>
<th>India</th>
<th>Russia</th>
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</thead>
<tbody>
<tr>
<td><strong>Submarine, Nuclear</strong></td>
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<tr>
<td>Ballistic Missile</td>
<td>3</td>
<td></td>
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<td>4</td>
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<tr>
<td>Attack</td>
<td>6</td>
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<td>1</td>
<td>11</td>
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<tr>
<td><strong>Submarine, Diesel</strong></td>
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<tr>
<td>Coastal</td>
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<td>21</td>
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<tr>
<td>Inshore</td>
<td></td>
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<td>2</td>
<td></td>
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<tr>
<td>Other</td>
<td>2</td>
<td></td>
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<td></td>
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<tr>
<td><strong>ASW Capability</strong></td>
<td>54</td>
<td>16</td>
<td>22</td>
<td>11</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total 2010</strong></td>
<td>65</td>
<td>16</td>
<td>43</td>
<td>13</td>
<td>17</td>
<td>24</td>
</tr>
<tr>
<td><strong>Projected 2025</strong></td>
<td>78</td>
<td>20</td>
<td>26</td>
<td>24</td>
<td>14</td>
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</tr>
</tbody>
</table>

Table 2. Submarine Forces of the Major Asian Powers

Developments in the wider region are more challenging again.

CHINA

The rhetoric in the recently released Chinese White Paper conveys a seemingly genuine willingness to collaborate and to develop confidence building measures in the region. There are indeed a great many common interests in the security of the sea lines of communication. The free flow of trade between Australia and China is a shared interest that suggests an opportunity for constructive engagement.

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Furthermore, prospects for the peaceful resolution of unresolved sovereignty claims in the region remain strong, if not as strong as they appeared a year ago. And there is a general regional hope that China will move to engage constructively in cooperative security arrangements.

But there are also deep concerns about Chinese strategy and:

- the increasing likelihood that Beijing will make more muscular use of its growing military power;
- the destabilising effect of the deployment of new Chinese asymmetrical sea-denial capabilities in the East and South China Seas;
- the possibility that Beijing plans to use the South China sea as a haven or bastion for its reserve of strategic nuclear forces – its growing fleet of ballistic missile submarines;
- a rate of growth in Chinese naval capability that would appear to exceed the requirement for coastal defence or the maintenance of pressure on Taiwan;
- the risk of the proliferation of these emerging technologies if the Chinese economy falters, which is no longer unthinkable; and
- the risk of miscalculation that might flow from China’s lack of naval experience, differing interpretations of maritime law, and an incomplete appreciation of the reasons for the durability of western naval predominance.

Indeed, Chinese technological and naval developments are already threatening to undermine Chinese diplomatic efforts aimed at presenting a peaceful and non-threatening image to the region and to the world.

China has the largest submarine fleet in Asia, currently consisting of more than 60 attack submarines of which six are nuclear. The most recent developments relate to:
• the replacement of older noisier and generally less capable submarines with growing numbers of very quiet modern diesel electric submarines of the Yuan, Song and Kilo Classes;

• the deployment of new nuclear attack boats of the Shang Class and ballistic missiles of the Jin Class; and

• the equipping of Chinese submarines with advanced torpedoes and advanced long-range anti-ship cruise missiles, providing a potent surface warfare capability.

There has been some discussion that a combination of Russian technology transfers and advances in Chinese submarine design capabilities will allow the development of submarines approaching the capable Russian Akula class in terms of quieting, performance, range and weapons.  

In addition, China now has fully developed the new supporting infrastructure on Hainan Island in the South China Sea, close to the vital sea lines of communications which supply a large part of China’s needs for energy and raw materials.

EAST ASIA

Japan and Korea both operate fleets of modern conventional submarines, and have well developed plans for future growth. There are strong incentives for Australia to deepen naval and industrial ties with Japan and Korea, and to explore options for increasing technical and intelligence exchanges.

• Japan. Japan operates a modern submarine fleet of 16 boats, the most recent of which are fitted with an air-independent propulsion system. There has been some discussion that this fleet might be increased to

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20. Japanese submarines are built in Japan to indigenous designs, and are well supported by industry policies that recognise that the submarine force is a strategic asset of national importance. The Japanese build program sustains a viable industrial base and enables continuous development to maintain a technological edge.

- **South Korea.** South Korea has a fleet of 11 modern conventional submarines, with plans to increase its fleet to 26 over the coming decade.

- **Taiwan.** Taiwan has a fleet of two submarines, and has explored options for expanding its fleet to eight diesel electric submarines.

**SOUTH ASIA**

There seem to be real prospects for a deepening relationship with India, a potential balancer to the strategic ambitions of East Asian powers. This is substantiated by the growing support for the new Indian Ocean Naval Symposium, modelled on the similar grouping that has been operating in the Western Pacific for some two decades. These Symposia provide a mechanism for regional chiefs of navy or other maritime agencies to consult on matters relating to maritime security with a view to arriving at agreed courses of action.

- **India.** India is also increasing its submarine fleet of both nuclear attack and ballistic missile submarines, but at a lower rate than China. On the other hand, India has progressed much further in developing carrier borne aviation, perhaps reflecting its easier blue water access and more relaxed relationship with the United States.

India’s geostrategic and geo-economic strengths make it important for Australia to consolidate what has been an occasionally prickly and often undervalued relationship.
THE UNITED STATES

There can be a tendency for some commentators to write the United States prematurely out of the Western Pacific. Pessimistic assessments of US naval capabilities in the region often underestimate three things:

- the long-standing naval tradition and deep understanding of maritime affairs that will inform research, development and capital investment by the United States in maritime capabilities;
- the presence of major US allies in the region, notably Japan, Korea and Australia, all of which already have advanced naval capabilities of their own and are investing heavily in submarine and ASW capabilities; and
- economic, demographic and geographic constraints on any prospective peer or regional competitor in the first half of the 21st century.

Furthermore, the United States has clearly reaffirmed its commitment to regional engagement. While US economic leadership may arguably be under some threat over the longer term, the United States retains much broader ideological and cultural appeal than any prospective competitor. For the most part, regional states are comfortable with US security guarantees and Washington’s well practised leadership, and are relaxed about allowing the US Navy access to their ports and harbours.

Most accept that, for the foreseeable future, it will be US and allied naval power which secures the sea lines of communication to vital energy and raw material supplies in the Middle East, Africa, South America and Australia.

Nevertheless, there is concern in the United States about the size and age of its submarine fleet and a relative decline in its ASW capabilities. Unless there is a change in US policy, the number of US submarines and ASW capabilities available
for operations in the Western Pacific might decline over the next twenty years.

Still, the reduction in numbers will be offset by a shift from ‘platform intensive’ to ‘sensor rich’ and networked ASW operations, a change that Australia will follow with interest.

**Growth in Regional Submarine Fleets.** The above figures illustrate the general trend in the growth of regional submarine fleets. There will be some new operators, and
some greatly expanded capabilities amongst existing operators. The figures are drawn from Tables 1 and 2, but should be regarded as indicative only. Given the Years of Decision in the Defence Capability Plan, it is unlikely that Australia, for example, will be able to deploy 12 submarines before 2040. The figures for other operators are also likely to change in response to geo-economics as much as geostrategic and geopolitical factors.

**IMPLICATIONS**

Notwithstanding a range of benign trends in the regional security environment, one of the more important judgements that appears to have been be made in framing the White Paper is that conventional war will continue to be the most important role and force structure determinant for the Australian Defence Force.

An equally important inference is that national security planning will have to confront continuing and possibly growing uncertainty in the strategic environment.

It is difficult to imagine major maritime operations at the upper end of the threat spectrum that will not be conducted within the framework of the alliance with the United States. There will also be a large number of challenges short of conventional war that Australia will face either independently or in regional coalitions, possibly in a leadership role. These will require increasingly effective maritime domain awareness and the ASW capabilities required to respond.

Uncertainties about Chinese intentions have led to a consensus amongst Australian strategic planners that the South China Sea will be a bellwether in helping to judge how China will use its emerging sea power and how regional states will react.

In this regard, the build up of forces on Hainan Island and their apparent intended use is disturbing. This would represent an unprecedented deployment of ballistic missile submarines in Australia’s near region, in one of the world’s busiest
waterways, through which the bulk of Australia’s maritime trade passes. The Straits of Malacca also carries some 80 per cent of China’s oil imports, approaching one half of China’s total oil needs.27

A consequence of the growing uncertainty is a pressing need for deeper engagement between Australia, the United States, China and other Western Pacific naval powers. Any disruption to maritime trade or resource extraction in the region would have large political and economic costs, possibly leading to a crisis of domestic consensus in any state in which the leadership derived its legitimacy from continuing economic success.

In particular, there would be value in dissuading the deployment of destabilising weapons systems in the South and East China Seas and encouraging more cooperative ways to secure the maritime approaches to East Asia, thereby enabling continuing access to markets and raw materials, the drivers of the region’s economic development.

Equally pressing will be the need to engage India as its bilateral trade with Australia and naval influence over the Indian Ocean increases. Both countries have a deep interest in securing the sea lines of communication to the Middle East, and to assure East Asian powers that they do not need to project power into the Indian Ocean to be confident of their own access to energy supplies.

5. THE THREAT ENVIRONMENT

The international market for submarines over the coming decade is projected to exceed one hundred vessels of all types, and more than half of these are destined for the Asia-Pacific region. Many will be delivered to navies that have not previously operated submarines.

Even more important will be the proliferation of submarines with significant offensive capabilities against targets both at sea and on land, and employing new propulsion technologies that will make them considerably harder to locate and track.

The environment in which the ASW elements of Force 2030 operate will be transformed by these developments. These have received little attention in the public discussion in Australia, although they have caused some apprehension amongst friends and allies in the region.

Much of the maritime modernisation underway in Australia’s region is welcome. Improved regional surveillance and naval combatants are offering greater scope for effective constabulary operations, restricting the scale of criminal activities ranging from people smuggling to piracy.

There is a growing level of cooperative constabulary activity, including the joint patrols by Australia and Indonesia in the resource zones which lie between the two countries, and joint operations by Thailand, Malaysia, Singapore and Indonesia in the Straits of Malacca which have reduced attacks to a quarter of the more than 200 recorded in the year 2000.

Unfortunately, there has also been a series of slow revelations over the past two or three years about developments in Chinese military capabilities that raise questions about the strategic intentions of some in the People’s Liberation Army over the next few decades. And there have been incidents involving rogue states and criminal elements that might yet come to affect Australia more directly.
While there have been some promising signs in Chinese military diplomacy, until an apparent disconnection between Chinese declaratory strategy and its developing force structure is fully explained, it is prudent to contemplate some as yet improbable, but still highly consequential futures.

While Chinese concerns about the security of the sea lines of communication and its maritime approaches may be legitimate, the way that China is moving to secure these may prove to be unhelpful and may progressively increase the risk of future misadventure or inadvertent and uncontrolled escalation.

Some of these regional developments might have significant implications for the composition and disposition of the planned Force 2030 ASW capabilities. There may even be a question as to the future viability of large scale forces operating on the surface of the sea, raising questions about the large investment in a Future Frigate optimised for ASW. In this environment, Australia’s Future Submarine might prove to be of growing importance as a way of maintaining a naval presence in a region crucial to Australia’s economic interests and providing a level of assurance to friends in the region.

**Sea Control and Power Projection**

Since the 50th anniversary of the People’s Liberation Army Navy, China has been considering the development of a true power projection capability and the ability to conduct precision strike beyond the first island chain that bounds the maritime approaches to China, shown in the map on page xx. This strategy would rely on the conventional measures of maritime strength including large surface combatants and carrier borne aviation.

Towards this end, the People’s Liberation Army Navy is beginning experiments with a former Soviet carrier currently deployed with the northern fleet, and increasing its modern experience of distant deployments with a welcome contribution to anti-piracy operations off the coast of Somalia.
But it will be a generation before Beijing can rely on the conventional instruments of sea power to stare down Washington and the Western alliance system if that is the objective. This reality is acknowledged by those Chinese scholars who argue that the development of a conventional power projection capability under current circumstances would divert investment away from more cost-effective asymmetrical technologies.

Furthermore, the Chinese economy may not yet be in a position to support the sustained investment that would be required for a blue-water fleet without diverting much needed resources away from the problems confronting civil society and more pressing domestic security concerns or peaceful programs designed to enhance Chinese prestige such as the Chinese lunar exploration program.

SEA DENIAL

At its current state of development, China has demonstrated the economic and technological strengths required to develop a potentially effective if destabilising strategy of sea denial in the East and South China Seas by employing a range of asymmetric technologies and tactics, including:

- Anti-Ship Ballistic Missiles,
- Anti-Ship Cruise Missiles, and
- Modern Submarines and Undersea Warfare.

This approach may fit more closely with a national security strategy dominated by the People’s Liberation Army. Historically a continental power, China could be expected to want to insulate its land power from the maritime strengths of its strategic competitors on both sides of the Pacific, while maintaining a capability to project sufficient force to support its policy of coercive diplomacy towards Taiwan.

In addition, an efficient sea denial capability might be seen as helpful in reminding countries with overlapping territorial
claims in the South China Sea of China’s strategic potential. Vietnam, Malaysia, Indonesia and the Philippines might be encouraged to settle any residual claims on terms favourable to China before an asymmetric capability complemented by modest naval patrols and the investment in ports and facilities on Hainan Island undermined the reassurance provided by a Western naval presence.

**SUBMARINES AND UNDERSEA WARFARE**

China is developing by far the largest and most capable submarine force in the region, arguably exceeding the numbers and sophistication required simply for defence, or even their practice of coercive diplomacy in the immediate waters of the East and South China Seas.

The Chinese fleet is the largest in the Western Pacific with more than 60 submarines, including five that are nuclear powered, ten improved Kilo class diesel-electric boats, and some increasingly sophisticated nuclear and conventionally powered domestic designs. Sufficient progress may have been made in submarine design and operations to enable one of China’s submarines recently to surface undetected in the middle of a US carrier battle group, although an attempt to penetrate Japanese territorial waters was detected and tracked, leading to a Chinese apology.

Certainly, Beijing is not alone in acquiring modern and highly capable conventional submarines. But the modest developmental programs in other Southeast Asian states suggest that the motivation is largely defensive and may, at least in part, be seen as hedging investments against growing Chinese power. The Japanese fleet of sixteen boats and the South Korean fleet of eleven are highly capable designs, but once again the relatively small numbers are consistent with a defensive strategy in a region complicated by the resident rogue state of North Korea.
ANTI-SHIP CRUISE MISSILES

Anti-ship cruise missiles built on mature technologies have been widely deployed on aircraft, surface ships and submarines already deployed in the region. Some new technology anti-ship cruise missiles possess very low signatures and attack at supersonic speeds making their interception and destruction by ship-based defences exceptionally difficult.

China now has a dozen stealthy and capable Kilo class submarines armed with the SS-N-27 Sizzler anti-ship missiles, representing a very high risk to surface force ASW elements.

ANTI-SHIP BALLISTIC MISSILES

One of the more remarkable recent Chinese developments is the testing and planned fielding of anti-ship ballistic missiles. Much of the information available in the public domain was published in the 2009 Annual Report to US Congress on the Military Power of the People’s Republic of China. This added to evidence of capabilities implied by congressional testimony during 2008 and considerable speculation in open source literature including the prestigious journal of the US Naval Institute, Proceedings.

The main focus has been on the development of a maritime strike version of the CSS-5/DF-21 Intermediate Range Ballistic Missile. The DF-21 variant in question is a truck mounted solid fuel rocket with a range approaching 2000 km. Various reports suggest it may be equipped with control surfaces for mid-course and terminal manoeuvring, and a form of terminal guidance and target recognition.

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The possibility that China has made progress in developing an effective anti-shipping capability should not be underestimated. Institutions associated with the Second Artillery Group have published articles that suggest confidence in the concept, and significant progress towards its realisation.

The People’s Liberation Army Navy literature, on the other hand, tends to recognise the difficulties of locating and tracking a carrier battle group in the open ocean when it talks of deterrence, demonstration and mission kill rather than platform kill when armed with a conventional warhead.\(^{29}\)

There may not have been sufficient evidence of the existence, let alone the strengths and weaknesses, of the anti-ship ballistic missile concept to change the surface combatant force in *Force 2030*, but there is clearly sufficient evidence to justify deep reflection on the implications of a successfully demonstrated and deployed system in the lead up to the 2014 Defence White Paper. Progress may have been sufficient to raise questions about the balance of investment between surface force ASW platforms and other ASW force structure elements in *Force 2030*.

But even if the anti-ship ballistic missile capability is imminent, the submarine capability is extant, and might be much less vulnerable to pre-emption, disruption and interdiction.

**COMPLEMENTARY CAPABILITIES**

Force protection will continue to be an issue in the archipelagic region where extremist groups can easily obtain explosives and fast vessels or aircraft for suicide attacks, and some straits in the region are sufficiently narrow that even infantry weapons can pose a threat to surface shipping and combatants.

\(^{29}\) Mission kill might be achieved by no more than damaging aircraft on carrier decks, sensors, communications, launching gear and control towers. A mission kill does not require destruction of the platform itself.
There is a growing possibility that small low technology and low cost submarines suited for coastal operations and the littoral environment in the archipelagic region might be used in an anti-surface warfare role, for laying mines in choke points, for attacking offshore facilities such as gas or oil rigs, or for a variety of terrorist or criminal activities.

The sinking of the South Korean corvette *Cheonan* by a North Korean midget submarine in March 2010 presented a new dimension to the ASW problem, and indicates how even relatively primitive submarine capabilities can have a military and strategic impact out of all proportion to their cost.\(^{30}\) This would be of immediate concern if the Australian Defence Force were to undertake naval operations as part of a UN led coalition during a crisis on the Korean Peninsula for example.

But there is a wider concern if the technologies proliferate in the region. The mere suggestion that submarines are present would require airborne and seaborne ASW capabilities to be deployed for force protection before surface combatants could be put at risk in a regional contingency.

In a further twist to the ASW problem, police in Ecuador recently seized a thirty-metre submarine being built by a drug cartel. The craft was designed to carry a crew of six and up to ten tonnes of cocaine. Unlike the submersibles previously operated by drug cartels, the latest vessel seized was estimated to be capable of diving to a depth of twenty metres. With a speed of up to eight knots, the submarine was likely to have been capable of missions of up to ten days duration with a range approaching 2,000 nautical miles. These are

\(^{30}\) In March 2010, an explosion was reported on board the South Korea corvette *Cheonan* causing the vessel to break apart and sink a short time later. An international team formed to investigate the incident, including members from Australia, Britain, Canada and Sweden, found the likely cause of the explosion to have been a North Korea torpedo attack. The report’s findings have been challenged by others, including a Russian investigating team that found that the explosion was more likely to have been caused by a mine. A copy of “Joint Investigation Report: On The Attack Against ROK Ship Cheonan” can be found at http://www.nautilus.org/publications/essays/napsnet/reports/Cheonan.pdf.
specifications that might be of use even in a maritime jurisdiction as large as Australia’s.

**IMPLICATIONS**

As a consequence of these developments, there are some concerns about the future survivability of surface combatants in the Western Pacific and South China Sea, raising questions about the wisdom of investing such a large part of the Force 2030 ASW capability in surface combatants that are, in any case, needed for other roles. Within a few years, Australian maritime planners might face difficult choices:

- Abandoning traditional missions,
- Accepting very high levels of risk and relying on shipborne defensive systems, or
- Conducting preliminary operations to reduce or eliminate the immediate threat (pre-emption).

The number and sophistication of submarines being deployed in the region have implications for future ASW operations and rules of engagement, which are likely to be restrictive in congested bodies of water such as the archipelagic sea lanes and the South China Sea. It may not be possible to determine the location and identity of a submerged submarine in this environment, let alone determine whether it is being operated with hostile intent.

Allied naval experience suggests that submarines can exploit similar circumstances to penetrate traditional ASW screens, demonstrated dramatically by the Taiwan Straits incident and the sinking of the South Korean frigate *Cheonan*. The repeated success of Collins class submarines in penetrating the perimeters of allied task groups during exercises is also suggestive of the submarine’s potential, recognising the limitations of exercise as indicators of performance in real situations because they are contrived to guarantee interaction for training benefit.
This may well mean that there is a need to develop an operational concept that places the emphasis on the protection of surface ships, minimising the need for them to be in the same water space as an unlocated submarine, and maximising the range of structures, assets, techniques and procedures to defeat the submarine’s mission and intent.

The combined military, criminal and terrorist threat from submersibles and submarines will require a persistent ASW capability that can conduct extensive search operations for boats ranging from the relatively primitive and expedient through to the most sophisticated naval vessels ever constructed. The combined quantity of rotary and fixed wing aircraft required to undertake this task is far greater than forecast in Force 2030.
Sea-Denial Capabilities. The People’s Liberation Army’s conventional forces are currently capable of striking targets well beyond China’s immediate periphery. Not included are ranges for naval surface- and sub-surface-based weapons, whose employment at distances from China would be determined by doctrine and the scenario in which they were employed. After the Report to the US Congress on the Military Power of the People’s Republic of China, 2009.
6. ASW OPTIONS

Before turning to an analysis of the Force 2030 options, there are a number of gaps in concepts, doctrine, and logic as well as weaknesses in the capability process that will need to be addressed. This section will introduce some of the issues before looking at relevant aspects of equipment and force balance.

As the challenges facing future maritime forces operating on the surface of the ocean increase, there will be growing interest in alternative ways of projecting power. Some of the weapons and technologies that will make the surface of the ocean a difficult place to operate will have similar consequences for land-based facilities such as airfields, ports and harbours, and forward operating bases, especially in northern Australia and the Southeast Asian archipelago.

The costs of and difficulties of operating nuclear powered aircraft carrier fleet are beyond all but the most robust and advanced economies. The uncertainties of carrier operations in the Western Pacific are sufficient to deter all but the most ambitious emerging powers from attempting to match the US carrier fleet for some decades yet.

So submarines would appear to offer a way of achieving a more limited capability at a greatly reduced cost, although not without a range of technical and doctrinal hurdles. Although submarines have to rely on a relatively small number of vulnerable and highly specialised facilities for support, repair and maintenance, these can be hardened like China’s, or in Australia’s case, located in great strategic depth.

Conventional submarines are constrained by their transit and patrol speeds, payloads, sensors and communications, even before they compromise their positions by taking offensive action. But the increasing adoption of air-independent propulsion will reduce the impact of several of these limitations. And the larger powers like China have demonstrated a strong commitment to growing their nuclear fleets and improving their characteristics.
Still, any attempt by submarines to penetrate the Southeast Asian archipelago beyond 2030 will confront a Force 2030 ASW system, backed up by a substantial intelligence effort, so it is important to get these right. Force 2030 ASW is planned to include eight Future Frigates optimised for ASW, three Air Warfare Destroyers with a capable sonar, their associated naval combat helicopters, 12 Future Submarines, along with eight Maritime Patrol Aircraft and up to seven high altitude and long endurance unmanned surveillance aircraft. However, this force structure is contested and needs much more careful analysis in the lead up to the 2014 Defence White Paper, and ongoing analysis beyond that.

Any attempt to bypass the straits would increase the risk of encountering Western naval forces operating in open seas where the asymmetric threat posed by ballistic missiles and conventional submarines is somewhat reduced, although nuclear boats could remain a potent threat because of their greater speed and endurance. The growth in fleets of nuclear submarines will also need ongoing study and analysis.

**THE GAP IN ASW CAPABILITY AND PROFICIENCY**

Given the rapid qualitative and quantitative growth in regional submarine capabilities, and the prospects that this growth is likely to continue, a major concern has to be the impact of the long period of time until the new ASW capabilities achieve initial operational capability with the Australian Defence Force. On current planning, the Future Frigates and Future Submarines both *begin* to enter service in the mid to late 2020s, and any procurement delays will only increase the gap in capability. Given the history of recent procurement failures and the over-representation of ASW in the Government’s projects of concern, there can be little confidence that Defence procurement can deliver these capabilities before 2030.

The current Defence Capability Plan suggests that a design for the Future Submarine might not be selected until as
late as 2020, making it highly unlikely that an Initial Operational Capability for the first boat can be achieved by 2025, and perhaps not by 2030.

There is also a risk that an under-resourced program to maintain the in-service Collins class submarines will mean a progressive reduction in that capability, already falling behind some regional fleets in important new technologies such as air independent propulsion.

Notwithstanding the urgency implied by the emerging threat environment, Force 2030 is beginning to look more like Force 2040.

By the time these new platforms enter service, Chinese submarine capabilities will have become more formidable with the introduction of large numbers of new and more capable vessels. Furthermore, the submarine capabilities of the smaller navies in the region are likely to have matured.

Australians must now consider the possibility that in order to simply keep up with regional submarine and undersea warfare developments, there will be a requirement to accelerate the introduction of new ASW capabilities. The alternative might be to allow a worrying gap and serious vulnerability to emerge between regional submarine capabilities and Australian ASW capabilities and proficiency.

The gap will not be overcome by the hasty procurement of smaller, less capable military off-the-shelf submarines. None of the available European designs have the endurance or payload capacity required by the 2009 Defence White Paper. Neither do they possess the engineering margins required to adapt or modify the submarine in response to a constantly evolving threat environment. The adaptation of an existing design would also involve substantial technical, cost and schedule risks, and would involve difficult negotiations over intellectual property and future design authority.31

31 A more complete discussion of the implications for Royal Australian Navy of adopting an off-the-shelf solution can be found in Admiral Peter Briggs'
Furthermore, an off-the-shelf solution is unlikely to be affordable given that larger numbers and new facilities that would be required to achieve the level of capability of a larger submarine designed at the outset to meet the Australian requirement. The reduced range or endurance of the available off-the-shelf designs would require the development of more vulnerable facilities to support the submarines in Australia’s north, where there are few realistic fleet base options.

Compounding the problem is a lack of practical experience in the Australian Defence Force in coordinating the operations of friendly submarines, maritime patrol aircraft and surface combatants in a joint environment. This is in large measure a consequence of the high operational tempo required by border protection tasks, deployments into the Middle East Area of Operations, and stability and disaster relief operations in the region.

The ASW capability gap will severely undermine Australia’s capacity to monitor and if necessary deter the aggressive use of submersibles and submarines in the maritime approaches to Australia, within Australia’s resource zones and along the critical sea lines of communication to the critical markets in South and East Asia.

THE GAP IN ASW CONCEPTS AND DOCTRINE

An additional problem is the concern that the focus of ASW remains at a blue-water tactical level with a conventional doctrine and mission set that has remained largely unaltered since World War II despite dramatically changed circumstances. In part a legacy of 20th century wars, it is based on attrition and unlimited state on state conflict.

Australian Naval Journal article “Future Submarine, A Growth in Australia’s Navy Capability”, March 2011. Admiral Biggs concludes that Collins is the closest starting point to the White Paper requirement, and an evolution of the Collins design would benefit from the substantial operating experience gained in the regional environment.
The Navy has made significant gains over the past decade in producing the impressive doctrinal basis to be found in the Australian Maritime Doctrine series. The recently updated *RAN Maritime Doctrine* 1 is a high-level guide to understanding the service’s contribution to Australia’s national security. This complements *RAN Doctrine* 2, which describes the Navy’s contribution to Australian Maritime Operations.

That said, current doctrine may not yet fully comprehend the shift in emphasis from deep water to littoral operations and restrictive rules of engagement, or the growing sophistication of submarines and their tighter integration into combined and joint force operations. There is a pressing need for a new Australian Defence Force ASW operational concept that clearly draws on evolving strategic guidance to develop strategic, operational and tactical doctrine that reflects what could be the messy reality of ASW in the modern era.

A future ASW concept needs to comprehend that ASW operations are conducted within a theatre level context, to enable a joint force to achieve an operational objective. An unlocated submarine operating in a space in which sea control is necessary for the accomplishment of a task or mission might increase the risk to a level that is simply unacceptable.

The theatre level ASW campaign must deny an adversary the effective use of its submarines by a range of measures including deterrence, coercion, deception, prevention, disruption, or destruction of its submarine operations. This will involve not simply tactical operations against the submarine, but will also require acting to undermine the political and operational will of the adversary, together with its command and control infrastructure and operational support. The effort may need to be directed at deterring it from sailing or stopping it from deploying.

**The Gaps in Force 2030 Logic**

Australians must now consider the possibility that the new capabilities being deployed in Australia’s region fundamentally
alter the basis on which Australia’s maritime forces are planned. A response to these changes could require significant changes in the force elements in Force 2030.

In explaining Australia’s military strategy, the 2009 Defence White Paper notes that Force 2030 should be prepared to ‘undertake proactive combat operations against an adversary’s military bases and staging areas, and against its forces in transit, as far from Australia as possible’.32

While this approach may have considerable military strategic merit, it is not without grand strategic risk. It raises significant questions about whether the investment of a large part of Australia’s ASW capability in the surface force described in Force 2030 is the best option.

The new regional capabilities, including anti-ship ballistic missiles, supersonic anti-ship cruise missiles, newer generation torpedoes and maritime strike aircraft pose a significant challenge for naval surface ASW, particularly when surface ships have been give the additional task of land attack.

There will be considerable value in looking at alternative ASW force structures in detail in the lead up to the 2014 and subsequent Defence White Papers. That is prudent planning, and may reveal options that have yet to be fully appreciated.

The need to address a range of ASW options is of fundamental importance because it is Australia’s self-evident capacity for high-end warfighting, in which ASW is central, that underpins its politico-military diplomacy and attempts to shape the security environment in ways that are favourable to Australia and friendly states in the region.

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Figure 1 shows the time available for key decisions, and the way intelligence indicators may identify a need to adapt Force 2030 to more or less desirable maritime security environments.

Figure 1 represents an attempt to map the decision space and show how a mature Force 2030 will be preceded by three, and possibly four, Defence White Papers.

Importantly, there will be two Defence White Papers, in 2014 and 2019, before government confers first pass approval on what is likely to be the largest and most capital-intensive ASW component of Force 2030, the Future Frigate and Future Submarine program.

The 2009 Defence White Paper provides some high level guidance about the Future Frigate and Future Submarine. Yet a great deal of work is required to confirm the detailed capability requirements and functional specifications of these vessels, and little progress is currently being made.
THE NATURE OF MARITIME FORCES

In looking at platform issues, it is important to bear in mind that the strategic centre of gravity for maritime forces will be the fleet, not particular platforms. Survivability will be an integral part of the design, starting with integration into a layered and networked defence system. It is unlikely that major components of Force 2030 will be required to operate independently in more demanding conflicts.

Still, the role of the network in modern warfare does not diminish the role of individual platforms as nodes within that system. It is likely that the real estate and electrical power provided by surface combatants will ensure them a continuing place as important nodes within that system, especially when deployed to forward theatres. Surface ships will continue to be useful for basing ASW helicopters, for the carriage of stores, and for towing towed arrays for multi-static radar operations.

In order to achieve a fully effective and networked ASW system, however, there will also have to be comprehensive study, and extensive research and development, into the links between the nodes within the system, as high-speed communications with submarines and sensors continue to present great challenges. There is promising work being undertaken by Australian companies in the use of carefully managed acoustic communications that could form part of a properly structured strategic industry capability.

Much of the research is predicated on studies that have demonstrated that submarines do not need to be constantly connected to networks. This can even be counter-productive. Information must be exchanged rapidly and securely when connected as circumstances allow or dictate. The driving factor is the rate of change of information, which can vary according to various tactical, operational and theatre level factors.
ASW FORCE OPTIONS 2030

It is difficult to imagine the circumstances in which task groups, such as those that might be formed to support operations by the Canberra Class Amphibious Ships, could operate in a serious threat environment without a theatre level approach to ASW. At any time the Amphibious Ships might have embarked a substantial proportion of Australia’s combat ready land forces and associated hardware, so the defence of an expeditionary task group will be a national security interest of the highest order.33

However, a future ASW concept must not be limited to the ASW escort and protection of high value units, and the prosecution of submarines by ASW escorts and their supporting systems. The maritime environment, the ASW roles and tasks to be performed in that environment, and the design factors affecting new generations of ASW systems, all have implications for the shape and size of the future ASW component of Force 2030.

Australia has only just begun the detailed analysis of highly complex capability requirements, but the task can better be understood by considering three categories of options:

- the capabilities expected of individual ASW sensors and platforms,
- the balance between the components of the proposed ASW force, and
- the balance between ASW and competing capability requirements.

In all probability, successive White Papers are likely to adjust all three in order to optimise the ASW capabilities of maritime forces designed to operate together in joint and combined operations.

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33 The Canberra Class Amphibious Ship project will provide the Australian Defence Force with the ability to land a force of over 2,000 personnel by helicopter and water craft, along with all their weapons, ammunition, vehicles and stores.
In the interests of simplicity, the numbers of vessels proposed in the 2009 Defence White Paper have been retained, although the White Paper does not reveal the logic underlying these numbers. While the numbers require further analysis and justification, they should have been derived in part from the composition of future task groups and the range of independent operations that might be required.

Ideally, these judgements will have been based on extensive experimentation and war gaming. Instead, the Force 2030 Force Structure appears short on analysis, at least in part due to the short time allowed for drafting.

Based on the analysis below, it will become clear that the numbers in the 2009 Defence White Paper may not take full account of the size of Australia’s maritime jurisdiction. It is difficult enough to maintain surveillance of the surface of the ocean in Australia’s maritime approaches, let alone what lies beneath the surface.

**Capabilities of Individual ASW Platforms and Systems**

There are significant methodological problems confronting any attempt to either cost or specify the Australian Defence Force’s planned future ASW system in any detail at this time. Few of the major components have been through the Government’s First Pass Approval process. In the case of the Future Frigate, First Pass approval may not occur until 2019, at which point approval will be given to the capability requirement, but not specific capability options. The detailed consideration of options will then proceed until Second Pass, at which point the scope is defined and a budget allocated. So solicitation through a tender process may not begin until beyond 2020, with design to be completed sometime after that.

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This is too far into the future to make useful cost and capability predictions, and there is little value in looking at existing designs for the Future Frigate or Future Submarine in detail.

The estimation of cost is particularly problematic given the lack of clarity around the capability requirement, itself a consequence of a rapidly changing regional security and threat environment, and the lack of information in the Defence Capability Plan.

There have been some recent attempts to simply extrapolate the cost of major equipments and projects based on historical data. However, attempts by some commentators to forecast the cost of the Future Submarine have been deeply flawed, and have done little to inform the public debate while being prejudicial to timely decision making.

AIR WARFARE DESTROYER

The primary role of the Air Warfare Destroyer is air defence. Unfortunately, there is now little scope for major change in the design.

All round air defence of a single task group will require two of the three ships currently approved, meaning that it is unlikely that any will be available for other tasks or for a contribution to a broader air or ballistic missile defence.

While it is planned to fit the Air Warfare Destroyer with a capable ASW system, the system remains developmental and the propulsion system and standard machinery fit-out have not been optimised for very quiet anti-submarine operations.

There are other reasons for concern about the Navantia design adopted for the Air Warfare Destroyer. The Navantia ships, with only 48 vertical launch tubes and a single embarked helicopter, might be less able to handle simultaneous attacks from multiple sources than the Navy’s preferred Gibbs and Cox design, which was to be equipped with 64 vertical launch tubes. The addition of land attack to the
Destroyer's missions, as required by the 2009 Defence White Paper will only compound the problem.

The ability of the Gibbs and Cox design to embark two helicopters would have considerably expanded a future task group's ASW options. The loss of the ability to embark a second helicopter for the ASW role might prove to be a false economy if properly assessed at the system rather than the platform level. Any increase to the numbers of naval combat helicopters required for a future task group may require additional ships, not simply helicopters, with implications for the cost, size and layout of the Future Frigate and the number of ships that need to be allocated to task groups according to mission.

The selected Navantia design will offer a baseline capability in its primary role, but it may also represent a lost opportunity for a cost-effective increase in the ASW capabilities of future task groups. A detailed study of the influences on the Air Warfare Destroyer decision might provide important lessons for future investment decisions, among them the importance of carefully weighing professional naval opinion and long-term value ahead of price and schedule.

**FUTURE FRIGATE**

The Future Frigate program will not receive the final go ahead from the Government for a decade. Although a great deal of analysis is still required, there remains substantial scope for changes in the capability requirement and functional specification. At least four major questions need to be addressed:

- Should the Future Frigate be optimised for ASW or be changed to a multi-mission frigate with a bent towards air warfare?
- What ASW systems are likely to be required or specified?
Can the ASW and air-defence roles coexist on a single platform? What are the ramifications if this is to occur?

What proportion of the sensors and systems should be placed on the ship, and how much should be placed off board on autonomous and remotely operated vehicles?

The growth in regional submarine fleets would seem at first glance to favour the focus on ASW. However, there are real questions as to whether a surface combatant is a good way to counter the submarine threat, and the supersonic cruise missiles with which a small but growing proportion of submarines are armed.

In order to achieve a level of noise reduction required to hunt submarines, some modern ASW frigates employ construction techniques commonly used in submarines themselves, including extensive shock mounting and noise dampening.

These quieting measures can be expensive, and there is some doubt about whether they can be entirely effective on the surface of the sea. With further study, it might be found that the margin of investment required for this would be better spent on specialist ASW submarine helicopters capable of operating from a variety of less specialised surface platforms, and remotely operated vehicles and systems.

Any conclusions to these questions can only follow a comprehensive net assessment of force structure alternatives across a range of plausible scenarios to determine whether it is better to build specialist ASW frigates or to build general-purpose frigates accompanied by a shift in the

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35 Net Assessment seeks to provide a comparative analysis of the military capabilities of potential strategic competitors. For a more complete description of its application to Australian security planning see Brice Pacey, "The Potential Role of Net Assessment in Australian Defence Planning", Strategic and Defence Studies Centre, Working Paper No. 148, Australian National University, 1988.
balance of ASW responsibilities toward other elements of *Force 2030*.

With regard to the distribution of sensors and systems, it is possible that a future surface combatant might superficially resemble a light fleet carrier, but optimised for the deployment and recovery of unmanned aerial vehicles and other off board sensors and systems. The Japanese Maritime Self Defence Force ASW frigate Hyuga, a photograph of which is enclosed at Annex C, is a current example of this system design philosophy.

This is because, by the time that *Force 2030* is deployed, unmanned craft might predominate in certain types of maritime operations with surface combatants functioning as nodes and operating bases within a network enabled force. There would be value in looking at a design of this kind, should the decision be made to retain the ASW focus of the Future Frigate.

Looking towards their broader roles and tasks, either a general-purpose frigate or a frigate with a focus on ASW will be able to perform a wide range of diplomatic, constabulary and warfighting roles. The number of available vessels, together with their range, endurance and sea keeping, are likely to make these vessels the mainstay of constabulary operations in remote and demanding seas.

Their warfighting roles are likely to include participating in task groups formed for power projection missions, and they will have a major, although not necessarily a lead role in anti-submarine operations as part of measures to prevail against any prospective adversary’s sea-denial and power projection capabilities.

**OFFSHORE COMBATANT VESSEL**

As nominally the least capable vessel in the surface combatant fleet, the Offshore Combatant Vessel may at first glance seem to involve the simplest choices. But the range of options may raise some difficult questions regarding investment priorities.
The 2009 Defence White Paper calls for the Navy’s patrol boat, mine counter-measures, hydrographic and oceanographic forces to be combined into a future single modular multirole class of around 20 Offshore Combatant Vessels. In addition, the vessels might be required to undertake offshore and littoral warfighting roles, border protection tasks, long-range counter-terrorism and counter-piracy operations, support to Special Forces, and missions in support of security and stability in the immediate neighbourhood.

They may be required to embark helicopters or unmanned aerial vehicles, allowing a surge in surveillance and response capabilities without the need to deploy additional ships, but there are currently no plans to acquire enough naval combat helicopter to do this. It is certainly worth studying the possibility of developing additional modules to support ASW operations and to enable the embarkation of ASW helicopters or unmanned vehicles.

However, this potential needs to be balanced against the already broad range of roles for the Offshore Combatant Vessel, including other aspects of undersea warfare like hydrography and mine counter-measures. The versatility of these ships means that they will be in high demand for competing tasks.

There may be grounds for adopting a multi role vessel based on an advanced Australian hull form, such as those used in high speed ferry designs. These are potentially larger and more stable than the existing minor warfare vessels and patrol boats, and possibly able to perform a wider range of tasks.

Yet, there would need to be an extensive study to assess the warfighting potential of these vessels against the high level requirement for the Offshore Combatant Vessel, an assessment of their high fuel usage and an evaluation of their suitability for operating at the low speeds required by many constabulary and other tasks.
The level of capability currently specified for the Offshore Combatant Vessel is approximately that of a modern corvette, some of which can accommodate a small or medium ASW helicopter. However, their warfighting capabilities might prove to be illusory in an increasingly demanding undersea threat environment, and studies by the Australian Department of Defence in the mid 1980s found that a much larger vessel would be required for sustained naval operations in the sea states encountered in Australia’s maritime jurisdiction.

**MARITIME PATROL AIRCRAFT**

Where surface vessels have the important ASW characteristics of persistence, range and payload to house a broad range of naval capabilities, Maritime Patrol Aircraft have the advantages of speed, range, versatility and the security of operating above the water, reducing the submarine threat to the aircraft.

Maritime Patrol Aircraft play a valuable role in task group operations since they are able to range many miles ahead of the task group for hours at a time conducting ASW operations to detect any submarine threat or to disrupt their operations through deterrent operations. These preparatory operations may need to be conducted for days or weeks in advance of the task group’s main operations. The networked nature of the sensors fitted to Maritime Patrol Aircraft enhance a task groups overall ASW awareness and may also be used by friendly submarines to assist in their targeting.

The current fleet of 19 AP-3C Orion Maritime Patrol Aircraft is planned to be withdrawn from service in 2019 with many aircraft having been in service for over forty years. The 2009 Defence White Paper states that the current capability of the AP-3C is to be replaced by a combination of eight manned and seven unmanned aircraft.

The manned aircraft will be capable of conducting the full range of airborne ASW with a full suite of ASW sensors
including radar, advanced acoustics and air-launched torpedoes and anti-surface weapons.

While the unmanned aircraft will be able to operate at great range for many hours or even days, their ASW capability will be limited. So although the proposed Maritime Unmanned Aerial System will assist greatly in developing overall maritime situational awareness through radar and electronic support measures, it will contribute little to the Australian Defence Force’s ASW capability. While projects in the future may develop an unmanned aircraft for ASW operations, there is no known such project underway.

All 19 of the in-service fleet of AP-3C maritime patrol aircraft are capable of conducting the full range of ASW operations—to search, detect, localise, track and attack submarines. In contrast, the unmanned portion of the Force 2030 fleet will not have any ASW capability. So while the mix of unmanned and manned aircraft may be assessed as an optimum mix for broad area surveillance operations against surface targets, there will be a reduction in the ASW capability of the maritime patrol fleet.

Furthermore, there will be a significant reduction in the ability to sustain concurrent ASW operations. A minimum of four maritime patrol aircraft would be required to conduct continuous 24 hour operations over a given operating area at a modest range, and then only for days rather than weeks at a time.

At the greater ranges required in a maritime jurisdiction as large as Australia’s and along sea lines of communication as extended as Australia’s the required number of aircraft increases significantly. The entire planned fleet of eight aircraft would be severely challenged to sustain concurrent ASW operations in just two operating areas, or no more than one on each of the east or west coasts.

The present submarine to maritime patrol aircraft ratio is about 1:3 (six Collins class and 19 AP-3C), whereas the 2009 Defence White Paper mix is 3:2 (12 new submarines, 8 new
maritime patrol aircraft). There is no apparent explanation of this fundamental shift in the balance of the force.

If the strategy is to defeat an adversary in transit and presumably at range, additional Maritime Patrol Aircraft would be essential to have a realistic chance of achieving the required coverage, taking advantage of their versatility, range and speed. With the proliferation of advanced submarines throughout Australia’s region, more, not less Maritime Patrol Aircraft will be necessary.

These inconsistencies suggest a flaw in Australia’s planning methodology, in which the balance in the total force may not be adequately tested, as part of a process of net assessment or optimisation at the system and theatre level.

**BALANCE WITHIN THE TOTAL FORCE**

Finally, there is scope to look at the room for adjustments in the ASW force not only at the individual sensor or platform level, but at the level of the total force, leading to additional options for responding to an increasingly demanding threat environment.

**ALTERNATIVE ASW FORCE STRUCTURE**

The case for a more robust ASW capability will follow asymmetric developments within (or leading to) a deteriorating threat environment resulting in a decision to shift the balance in the total force towards a variety of force structure options including increased naval combat helicopters, submarines and maritime patrol aircraft. In this environment, it may be found that even if a defence against new generation cruise and ballistic missiles is feasible, large surface combatants may no longer be a cost effective means of conducting ASW operations.

Should the defensive measures prove insufficient it may be necessary to make more substantial adjustments to *Force 2030*, perhaps by reducing the ASW role of surface
combatants in the seas to Australia’s north, while retaining a sufficient large surface combatant force to operate in the open ocean areas to the east, south and west. The elements of this alternative future force might include a greater reliance on:

- an expanded fleet of maritime patrol aircraft,
- an increase to the size and capability of the submarine fleet,
- unmanned vehicles in the air, and on or beneath the surface, or
- an enhanced and higher technology Offshore Combatant Vessel.

The numbers contained in the table are purely illustrative.

<table>
<thead>
<tr>
<th>Offshore Combatant/ Mine Warfare</th>
<th>Future Frigate</th>
<th>Air Warfare Destroyer</th>
<th>Submarines/ Maritime Patrol and Unmanned Aircraft</th>
<th>ASW Helicopter</th>
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Table 3. Alternative to Force 2030, in which the threat to surface combatant has led to a shift in the total force structure towards air and sub-surface operations, and a fundamental change in the roles and composition of the surface force.
7. KEY ISSUES FOR FURTHER STUDY

Having evaluated the range of issues involved in developing the future ASW for Force 2030, this study will now turn to identifying issues that require greater scrutiny in the period leading up to the 2014 Defence White Paper.

It is not simply a sovereign risk to Australian territory that is at stake, but also Australia’s broader economic interests and perceptions of Australia’s diplomatic weight in the region. It is now possible to envisage hostile actions involving submarines and submersibles, taken against Australia and its friends and allies in the region that would have catastrophic human, economic and environmental consequences.

The Australian Defence Force needs to closely monitor regional submarine developments in the years ahead, and may have to revise its assessment of regional capabilities before options are developed for the 2014 Defence White Paper. Not all of the developments are a cause for concern, indeed some of the developments in regional states should provide opportunities for closer naval engagement and cooperation across a range of submarine and ASW related activities, such as submarine search and rescue.

Still, the emergence of some of these capabilities has the potential to threaten future Australian Defence Force operations. At the upper end of the spectrum, the Australian Defence Force may now have to contemplate deeper cooperation with friends and allies to counter the very sophisticated capabilities of major states during periods of heightened tension or during hostilities.

The new regional capabilities are developing at a rate and with a level of sophistication that would have seemed unlikely a decade ago. Certainly recent developments do not appear to have been fully appreciated by the authors of the 2009 Defence White Paper, and were not anticipated at all by the authors of the 2000 Defence White Paper.

In 2030, there will be more submarines, capable of stealthier and more sustained operations, carrying more
accurate and longer range armaments, and operated by a larger number of regional navies. In some cases, these improved underwater capabilities will be deployed by states whose long-term intentions remain, at best, unclear.

For a variety of reasons, there has been a decrease in ASW training and doctrinal development over recent years as key Australian Defence Force assets were redeployed to deal with more pressing short term problems leading to a decline in skills and experience.

With a renewed focus on ASW, these are matters that might be remediated over time as long as the Australian Defence Force responds to the emerging challenges of a changed environment, and does not simply remake a capability built upon past assumptions and experience. Australians should not underestmate the time necessary to develop the level of capability that will be required in response to a more demanding maritime environment.

However, the poor state of procurement in ASW programs will continue to be a drag on the Australian Defence Force as it seeks to rebuild its capabilities. Failed programs, programs of concern, and ongoing maintenance problems need to be fixed, and fixed quickly.

It is becoming clear that some of the more process intensive and time-consuming reforms to the procurement organisation have slowed the deployment of critical new ASW capabilities to a degree that can no longer match the pace of change in the capability requirement.

Among the first things to be addressed, a new ASW operational concept must be developed to fulfil a number of requirements. It should derive a set of representative missions from strategic guidance in order to provide a framework for an ASW concept of operations.

The concept should be subjected to rigorous operational analyses, war gaming, and net assessment together with deep consultation with friends and allies with similar problems but
greater experience. Recent discussions with a view to revitalising the strategic relationship between Australia and the United Kingdom will be useful in this regard, as will Australia’s close cooperation with the United States in maritime matters. However, it would be valuable to deepen cooperation with other friendly states resident in the Western Pacific, notably Japan and South Korea.

Because of the changes in the undersea environment in Australia’s region, there is a strong case to be made for reviewing, and in some cases accelerating, the introduction of the new and enhanced ASW capabilities in Force 2030, the future Australian force described in the 2009 Defence White Paper. Some of the things that might be considered, include:

- **Reviewing the Naval Combat Helicopter Program and Accelerating Acquisition.** The planned increase in the number and capability of surface platforms, and the potential for operating naval combat helicopters from forward operating bases on land suggests a review of the numbers of naval combat helicopters to be acquired. The review should proceed at a pace that recognises that the proposed Naval Combat Helicopter is an effective force protection asset that Australia can acquire quickly, which is important given the lengthy task of recapitalising the surface fleet.

- **Additional Upgrades to the Collins Class Submarine.** It is likely that it will be necessary to extend the life of the Collins class submarine through more ambitious progressive upgrades and to use the Collins maintenance program to evaluate new technologies for the Future Submarine. One of the technologies that should be high on the priority list is air independent propulsion, ironically part of the original planning for the Collins class.

- **Accelerating the Development of the Future Submarine.** There has been a significant loss of
momentum in developing the capability requirement and selecting a builder and designer for the Future Submarine that needs to be fixed. Defence should consider designing the Future Submarine program to allow continuous batch building, eliminating the gaps in demand that increase the costs of Australian naval shipbuilding and lead to the problems of periodic block obsolescence like that confronting ASW in the build-up to Force 2030. The Japanese approach to sustaining its submarine fleet may provide a model for Australia to consider.

• **Considering An Enhanced Offshore Combatant Vessel.** Defence should explore the possibility of developing a modularised light ASW capability for the Offshore Combatant Vessel to supplement other elements of the ASW capability that will already be severely stretched. Australian companies are playing a significant role in the conceptually similar but larger US Littoral Combat Ship, which will have an ASW module, designed by US companies currently operating in Australia. Some of the candidate Australian designs for the Offshore Combatant Vessel will allow for the operation of a helicopter and are able to be fitted with similar modules to their US counterparts. This suggests that there may be opportunities for a cooperative approach to systems development in close consultation with the US Navy.

• **Increasing the Strength of the Manned Portion of the Maritime Patrol Aircraft Fleet.** It is likely that a detailed analysis of the requirement in the lead up to the 2014 Defence White Paper will reveal an increased requirement for the manned component of the Maritime Patrol Aircraft fleet to cope with the sophistication of the ASW threat and the size of Australia’s maritime jurisdiction and international obligations. This might be achieved by a shift in the balance between manned and unmanned aircraft
while maintaining the existing overall fleet size, but it is more likely that the required number of manned Maritime Patrol Aircraft will only be achieved by increasing the size of the total fleet. Any further studies will need to fully comprehend the limitations of currently available unmanned aircraft in an ASW role.

- **Emphasising the Need for Interoperability.** ASW will expose the limits of defence self-reliance in a demanding regional threat environment. There will be an increasing need for close cooperation with friends and allies in developing a basic intelligence picture of the underwater environment in the region, and for collaboration in framing an appropriate ASW response. A high priority should be attached to interoperability. In many cases this might best be achieved by employing common platforms, sensors and data links.

There is a need to gain a better appreciation of the advantages and prospective limitations of any military off the shelf solutions to Australian capability requirements. Any proper analysis of off-the-shelf designs to replace the Collins class, for example, would need to take full account that greater numbers that would be required to achieve the military effects specified in the 2009 Defence White Paper, although these effects themselves might require further analysis.

There would also be a need to factor in the considerable cost and risk of relying on forward basing, necessary to overcome likely limitations in the speed and endurance of an off-the-shelf design. In Australia’s case, the problem would be compounded by the relatively small number of basing options in northern Australia, and the risk that these might fall into the range of theatre ballistic weapons already deployed in the region.

Perhaps the greatest problem would be the risk of investing in equipment that was neither designed for nor tested in the Australian maritime environment, and would be
challenging to integrate with the systems of Australia’s allies in the region.

While some commentators have canvassed nuclear propulsion as a means of providing the speed and endurance required for Australia’s Future Submarine, a nuclear option is unlikely to be an effective allocation of resources given competing priorities in the ASW system and Force 2030 as a whole.

While the cost premium for nuclear propulsion is growing smaller for countries with well developed nuclear industries, Australia would face high establishment costs.

There may be options for the successful acquisition of nuclear submarines involving private sector project management and deep collaboration with allied navies, but on the basis of its recent performance, there would not be a high level of confidence that the Defence Materiel Organisation could manage a nuclear program.

Regardless of their technical difficulties, quiet conventional submarines with air-independent propulsion have some advantages for ASW operations in the littoral region to Australia’s north. They would provide a useful complement to the nuclear powered fleet of Australia’s principal ally, the United States.

An original design to meet an Australian requirement would not be without risk. But in a speech to the Australian New Zealand School of Government the then Minister for Defence observed that ‘cutting edge technology is more sophisticated and more complex than ever before, and the speed of change is accelerating. If the Australian Defence Force is to maintain a warfighting edge, it needs to take some risks, and then manage those risks professionally and

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36 In testimony before the US House of Representatives Committee on Armed Services, US Naval War College Professor Thomas Mahnken expressed support for the lease or purchase of Virginia Class nuclear-powered attack submarines floated in “Australia’s Strategic Edge in 2030”, a 2011 Kokoda Paper by Ross Babbage.
This philosophy will be critical if Australia is to ensure the future effectiveness of an ASW system in a rapidly changing maritime security and technology environment.

Not all of the solutions to the ASW problem are hardware related, and some do not fall neatly into the responsibilities of the Australian Defence Organisation.

There is a pressing need for continuing engagement between Australia, China and other Western Pacific naval powers, because of the economic and political crises that would follow any disruption to maritime trade or resource extraction in the region. In particular, there would value in dissuading East Asian states from deploying destabilising weapons systems in the South and East China Seas before entering into more cooperative ways to secure their maritime approaches and access to markets and raw materials.

This study has highlighted some very positive developments in the newly adopted White Paper process including:

- the adoption of a more systematic approach to formulating strategic policy;
- a growing recognition of the dynamics of the regional security environment; and
- a strong commitment to improving the underlying logic of the next Defence White Paper, and communicating the rationale for defence investment.

On the other hand, the study reaffirms the need to recognise that:

- The strategic planning task is difficult, and that the Australian Defence Organisation will not always get investment decisions right. These decisions should therefore be open to greater public debate.

37 A speech by the Minister for Defence, Senator John Faulkner to the Australia and New Zealand School of Government, Sydney, 13 August 2009.
• There may be a gap between the strategic priorities of the capability managers and the financial priorities of the procurement staff.

• There may be a need to refocus the Defence Materiel Organisation on delivering capability, not defining it, and to seriously consider accessing the sophisticated commercial project management market to improve procurement performance.

A high priority should therefore be attached to revisiting some of the apparent assumptions in Australia’s capability development and procurement policies in the light of a rapidly evolving regional security environment. Some of the following questions need to be answered before we advance much further towards the development of the future ASW force:

• Are Australia’s strategic planning and procurement processes robust, flexible and nimble enough to develop capability requirements and deploy capability at the speed that will be required in a rapidly changing maritime security environment?

• Does Australia need to accelerate the introduction into service of the next generation ASW platforms and systems?

• Does the possibility that regional powers might soon have a capacity to conduct extended sea denial operations mean that there is a need to be concerned about the strategic disconnection between Australia and its major sources of equipment in North America and Europe?

• If the technologies being developed in the region continue at the pace of recent developments, will Australia be able to obtain its materiel ASW needs from a functioning market, and will Australia have unrestricted access to the best technology available in that market?
• Does the growth in regional submarine capabilities mean that Australia’s strategic depth is of diminishing value, and should Australians be concerned about the concentration and lack of protection of key strategic industries, especially those relating to submarine support and maintenance?

• If there is a decision to invest in off-the-shelf solutions for any part of the ASW system, should they be based on equipment that none of Australia’s friends and allies in the Western Pacific operate, thereby reducing the opportunity to draw on common supply chains and to share operational results and experience? Or should Australia commit to harmonising ASW procurement with friends and allies in the region?

The following issues need to be addressed before any sensible decisions can be made in relation to the more innovative aspects of the options indicated above:

• **Force 2030**, including the ASW force, needs to be subjected to a rigorous program of operational analysis, experimentation, and prototyping, skills that need to be revitalized in the Australian Defence Organisation.

• There needs to be much more open analysis and discussion of the need for investment on the scale anticipated in the 2009 Defence White Paper, especially if future circumstances require an increase and acceleration in ASW programs.

**STRATEGIC INDUSTRY CAPABILITY**

If Australia is to meet these new challenges, national security planners will need to assess the extent of the erosion over the past decade of the industry capabilities that will be needed to meet the ASW requirement. Maritime industries have been particularly hard hit by procurement reforms that have had short term financial benefits, but with long term
consequences for Australia’s strategic independence and defence self reliance.

It is time for a more rigorous analysis of the strategic industry capabilities required to support an increased ASW effort, and a more economically literate assessment of how the expanded requirement can best be sustained. These priorities then need to be articulated into a strategic industry policy so that:

• the number of assumptions made about the nature of future conflict are kept to a minimum, and continuously tested as the strategic environment evolves, there should be no repeat of the narrow ‘Defence of Australia’ orthodoxy that dominated official thinking in the 1980s and 1990s, and led to a serious decline in the adaptability and flexibility of the Australian Defence Force;

• there is a better prospect for the development of strategic industry capabilities at a reasonable cost in terms of the country’s total strategic investments;

• there can be greater confidence that key national security capabilities can be sustained during demanding and possibly extended periods of conflict;

• there can be confidence that Australia’s critical infrastructure will remain secure and operational and that major defence equipment is secure when undergoing repair or maintenance in commercial facilities; and

• if, as is increasingly likely, Australia cannot be assured of secure lines of communication, the country has stockpiles and a domestic industry capability sufficient to satisfy crisis requirements.

In short, strategic industries are an essential part of national security, seldom recognised for the contribution they make. Too often in the past, broader strategic industry policy has suffered from benign neglect by governments even as
defence industry was subject to repeated though sometimes shallow reviews. A possible range of methodologies for identifying strategic industries is suggested at Annex B.

Finally, Australia should not allow a repetition of past policy mistakes where Australia lost world class leadership in areas such as slim line towed arrays, and torpedo delivery systems.38

Australia needs to invest much more in customer funded research and development, currently low by the standards of advanced industrial economies. Where possible, Australia should exploit its world-leading expertise in:

- acoustic through water communications; and
- some aspects of acoustic signal processing, including signature processing.

In addition, there is a need to monitor closely developments in:

- off board systems;
- multi-static detection systems;
- deployable, covert, persistent, autonomous surveillance systems;
- non-acoustic detection mechanisms;
- networking of platforms and sensors, including the potential of network and process at the data level;
- advances in platform stealth, including quietening techniques; and
- modular weapons systems including ASW modules.

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38 The Ikara missile was an Australian ship-launched anti-submarine missile that launched an acoustic torpedo to a range of 10 nautical miles (19 km), allowing fast-reaction attacks against submarines at ranges that would otherwise require the launching ship to close for attack, placing itself at risk.
Annex A.

FORCE 2030 ASW PROGRAMS AND INITIATIVES

In order to gain a fuller picture of the ASW structure of Force 2030, it is necessary to look beyond the 2009 Defence White Paper to the Defence Capability Plan updates and other recent official publications.

PLATFORMS

The components identified in Force 2030 include submarines, frigates, maritime patrol aircraft, naval helicopters and upgrades to existing platforms.

FUTURE SUBMARINE

The Government intends to double the size of the submarine force from six to twelve boats to be larger and more capable than the existing Collins class submarines. The new submarines are to be fitted with secure real-time communications and will be able to carry different mission payloads such as uninhabited underwater vehicles.

The Future Submarine will be capable of a range of tasks such as strategic strike, for which it will be equipped with land-attack cruise missiles, as well as anti-ship and ASW, strategic strike, mine detection and mine-laying operations, intelligence collection, supporting special forces, and gathering battle space data in support of operations.

The current Defence Capability Plan is particularly vague on the timing for key decisions, but it is suggested that a design might not be selected until as late as 2019, making a planned initial operational capability in 2025 ambitious.

There are several modestly funded programs designed to maintain the capability of the in-service Collins class submarines.
FUTURE FRIGATE

The Government has also committed to acquire a fleet of eight new Future Frigates optimised for ASW operations. These frigates will be larger than the 3,600 tonne ANZAC class ships that they replace.

The proposed frigate design will include an integrated sonar suite, part of which will be long-range active towed-array sonar, and it will be required to embark both helicopters and unmanned aerial vehicles.

NAVAL COMBAT HELICOPTERS

The 2009 Defence White Paper provides for the acquisition of a fleet of 24 naval helicopters to be fitted with advanced ASW capabilities including dipping sonar, lightweight torpedoes, and an ability to fire air to surface torpedoes.

While it was originally intended to provide a mid-life upgrade and life extension to the existing Seahawk fleet, the Defence Capability Plan indicates that a reduced program will now focus on maximising the number of aircraft available for operations by undertaking a lower risk program that addresses obsolescence without additional capability enhancement.

MARITIME PATROL AIRCRAFT

In order to meet the challenge of the size of Australia’s maritime environment, the Government will acquire eight maritime patrol aircraft, although there is some pressure on numbers. These are intended to provide a highly advanced ASW capability. These will be supplemented by up to seven high-altitude, long-endurance unmanned aerial vehicles to improve persistent coverage in both the land and maritime domains.

In the interim, the Defence Capability Plan has a program to update and sustain the AP-3C Orion Maritime Patrol Aircraft until they are withdrawn from service in 2019, although the
cost of this program would seem to indicate that it will be less comprehensive than a similar program currently underway for the New Zealand P3 Fleet.

**ENHANCED ASW ON SURFACE FLEET**

There will be ASW upgrades to the ANZAC Frigates, and an Undersea Warfare Capability for the Offshore Combatant Vessels.

**ASW SYSTEM**

While Force 2030 describes the characteristics of the individual platforms, these are also the components of an ASW system, although there is much work to be done to assess how the ASW system might work in the complex security environment to Australia’s north. There are also force structure elements that might be expected in a fully developed system, that do not appear to have been forecast or funded, although the research and development program gives hints as to where future investment might be made.

On the other hand, there are plans to take advantage of advances in the areas of sensor and acoustic signal processing to provide improved detection, tracking, and classification of submarines and torpedoes.

One planned program will enable the ANZAC Class Frigate to employ a towed array to enable the detection and tracking of submarines and torpedoes at tactically useful ranges. Another will complete the provision of torpedo self-defence systems across the surface combatant fleet.

**RESEARCH AND DEVELOPMENT**

The Defence Science and Technology Organisation will enhance its research into underwater sensors and networking to give greater emphasis to underwater situational awareness.
The most recent round of the Capability Technology Demonstrator program approved projects for the development of a fibre optic array to improve sonar data collection in the maritime environment, an adaptive exhaust silencer for submarines, and a system to help Navy measure the acoustic susceptibility of its submarines and surface ships:

- **Fibre Optic Towed Array.** – Thales Australia. The aim of the Thales project is to demonstrate an ASW capability that can be obtained using a thin, lightweight fibre optic towed array system that might be fitted to a range of surface vessels including the Offshore Combatant Vessels and Future Frigate.

- **Adaptive Exhaust Silencer.** – University of Adelaide. The aim of this project is to develop a silencer that will tune itself automatically to quieten the noise generated by the exhaust system of a diesel generator such as might be found in a future submarine.

- **Acoustic Susceptibility Assessment.** – L3 Nautronix. The aim of this project is to provide a system that will process the acoustic signatures of the Navy’s surface ships and submarines using threat capabilities and environmental information to assess their acoustic susceptibility.

**Priority Industry Capabilities**

The Priority Industry Capability Program established by the Howard Government, was endorsed by the 2009 Defence White Paper as a means of ensuring that certain strategically important industry capabilities continue to be available within the Australian domestic economy. The following have been identified as Priority Industry Capabilities:

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• **Signature Management.** Described as the industrial capabilities required for coatings used for signature management in submarines, naval vessels, and other platforms. The approaches include noise reduction, radar and infrared absorbent materials, and stealth technologies that might not be available from overseas suppliers.

• **Support for the Collins Combat System.** Acknowledging the knowledge and experience that has been developed in Australia.

• **Acoustic Technologies and Systems.** The development and support of underwater acoustic systems.

**STRATEGIC INDUSTRY CAPABILITIES**

Surprisingly, given their great importance, there are no ASW programs or capabilities identified as the more broadly defined strategic industry capabilities, although naval shipbuilding and repair is identified and includes submarine design and construction as one of its aims.
ANNEX B.

A METHODOLOGY FOR IDENTIFYING STRATEGIC INDUSTRIES

It is time to expose the assumptions underpinning procurement policy to serious scrutiny, and to consider strategic industry policy in the context of all of the complexities of Australian national security in the 21st century, and not to focus simplistically on price and schedule.

The current approach to the development of priority and strategic industry capabilities seems to be bureaucratically intensive, but lacking in analytical rigour. Problems with the current approach relate to clarity and purpose. It is not clear how Australia defines strategic industry capabilities, nor is it clear how the Australian Defence Organisation identifies and prioritise them. There is no easy answer to this problem.

One approach might be to reverse engineer a definition. Using this approach, a strategic industrial capability could be defined as one that Australians are prepared to pay a premium to maintain. Historically, the munitions industry has fallen into this category. There were two principal components of payment under original agreement for the supply of ammunition post privatisation. The first was a capability payment, designed to meet the cost of maintaining a production capability in excess of normal peacetime requirements. The second component was the delivery of munitions themselves, at the marginal cost of production. Unfortunately, while this approach can be used to define a strategic industry, it does not help to identify one.

Alternatively, Australia could attempt to identify disruptive technologies that might, in the future, lead to fundamental changes in the future battlespace. The current sea denial capabilities being deployed into the East and South China Seas might be highly relevant examples of these. This approach appears to be favoured by the Defence Science and Technology Organisation. Unfortunately, it can be very
difficult to identify disruptive technologies during their developmental phase, certainly not with the precision that might be required to provide focus for a research and development budget that is small by international standards. While the United States might be in a position to explore the military potential of emerging technologies across a broad range of possible military applications; Australia would need to be more discriminating.

Another approach might be built upon the geographical determinism of the old ‘Defence of Australia’ construct. Under this approach it might be argued that the enduring physical and geographical characteristics of Australia’s strategic environment allow the identification of niche industrial capabilities focussed on special needs. Shallow-water ASW might fall into this category. An unintended by product of this approach could be to inhibit the development of an internationally competitive defence industry, as Australian industry would, by definition, develop products that would only be attractive to states with similar geography or a similar operating environment. Ironically, a potential aggressor might fall into this category.

A military strategic approach might use strategic logistics to prioritise industrial capabilities on the basis of assurance of supply. This approach might recognise that Australia is remote from the sources of supply for major capabilities in North America and Europe. Furthermore, the lines of communication are long and vulnerable, and hence subject to interdiction. It might also recognise that there are capacity constraints that might prevent allies, pressed by contingencies in other theatres, from giving Australia the level of support that might easily be obtained during peace or periods of localised conflict.

A domestic production capability is not the only response to this class of problems, and alternatives might include the strategic stockpiling of key armaments. But stockpiling has problems of its own. The cost of maintaining strategic
reserves can itself be considerable, and runs the risk of block obsolescence during periods of rapid technological change.

It might be possible to identify areas of competitive advantage in the Australian economy that could assist in the development of advanced military capabilities. The commissioning of the Australian built and modified commercial ferry by the Navy as HMAS Jervis Bay, and its effective use supporting the Australian commitment to East Timor, might be an example. A world-class Australian industry and experienced naval dockyard was able to adapt a capability at short notice to meet a pressing operational requirement, albeit at a relatively low level of complexity.

Similarly, Australia could explore in detail the competitive advantage conferred on industry by close association with the Australian Defence Force. The Australian Defence Force has shown itself to be capable, at times, of developing capability requirements that are in advance of allied requirements and the international market. The Bushmaster vehicle provides an excellent example of the benefits that can be obtained through a close collaboration between the Australian Defence Force and Australian industry.

In reality, a useful list of strategic industries might be informed by any or all of these approaches, as long as the Government remains clear about the motive behind the commitment of public funds to sustaining capabilities which cannot be justified on a purely economic basis. That clarity is currently lacking.
ANNEX C.

TRENDS IN ASW CAPABILITIES

The following examples are provided for illustration purposes.

The Japanese Hyuga class helicopter carrier may represent a future design trend for ASW surface combatants. The ship is shown here with eight Seahawk ASW aircraft.

At 14,000 tons, the Hyuga is comparable in size to modern small aircraft carriers operated by Italy and Spain, but is substantially smaller than Australia’s Canberra Class Amphibious Ships, which will have a displacement of 27,500 tons.
About the Kokoda Foundation

Purpose

The Kokoda Foundation has been established as an independent, not-for-profit think tank to research, and foster innovative thinking on, Australia’s future security challenges. The foundation’s priorities are:

• To conduct quality research on security issues commissioned by public and private sector organisations.

• To foster innovative thinking on Australia’s future security challenges.

• To publish quality papers (*The Kokoda Papers*) on issues relevant to Australia’s security challenges.

• To develop Security Challenges as the leading refereed journal in the field.

• To encourage and, where appropriate, mentor a new generation of advanced strategic thinkers.

• Encourage research contributions by current and retired senior officials, business people and others with relevant expertise.

Membership

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In the rapidly changing regional security environment, Anti Submarine Warfare is emerging as a national interest of the highest order. Australia’s strategic geography, while generally beneficial, exposes it disproportionately to any future undersea threat. Extended sea lines of communication and offshore resource industries, upon which so much of Australia’s wealth depends, are particularly vulnerable to any future underwater attack by either state or non-state actors. The consequences of such an attack on Australia, employing submarines or submersibles, could be catastrophic in strategic, economic and environmental terms.

This study attempts to identify issues surrounding Australia’s Anti Submarine Warfare capabilities that will require greater scrutiny in the period leading up to the 2014 Defence White Paper. The context is provided by the Australian Government’s commitment to a program of ongoing rigorous and periodic reviews of the mix and scale of Australia’s defence capabilities and their appropriateness to emerging challenges in Australia’s strategic outlook.