palgrave pivot

NAVAL MODERNISATION IN SOUTHEAST ASIA, PART TWO

Submarine Issues for Small and Medium Navies

Geoffrey Till
Collin Koh Swee Lean

Naval Modernisation in Southeast Asia, Part Two

Geoffrey Till · Collin Koh Swee Lean
Editors

Naval Modernisation in Southeast Asia, Part Two

Submarine Issues for Small and Medium Navies

palgrave
macmillan

Editors
Geoffrey Till
Defence Studies Department
King's College London
Swindon, UK

Collin Koh Swee Lean
Institute of Defence and Strategic Studies
S. Rajaratnam School of International Studies (RSIS)
Singapore, Singapore

ISBN 978-3-319-58390-7 ISBN 978-3-319-58391-4 (eBook)
DOI 10.1007/978-3-319-58391-4

Library of Congress Control Number: 2017947710

Cover illustration: © John Rawsterne/patternhead.com

Printed on acid-free paper

This Palgrave Macmillan imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

Abbreviations

AIP	Air Independent Propulsion (of submarines)
ASL	Archipelagic Sea Lanes
ASUW	Anti-surface Warfare
ASW	Anti-submarine Warfare
AUV	Autonomous Underwater Vehicle
C2	Command and Control
CEP	Competitive Evaluation Process
CIC	Combat Information Centre
CSG	Carrier Strike Group
CINCFLT	Commander-in-Chief Fleet
DD	Destroyer
DDG	Guided Missile Destroyer
DDH	Japanese Helicopter Carrying Destroyer
DSME	Daewoo Shipbuilding and Marine Engineering
EEZ	Exclusive Economic Zone
FC	Fuel Cell
FCS	Fire Control System
FF	Frigate
IJN	Imperial Japanese Navy
INCSEA	Incidents at Sea Agreement
INTERFET	International Force in East Timor
ISMERLO	International Submarine Escape and Rescue Liaison Office, Norfolk Virginia
ISR	Intelligence, Surveillance, Reconnaissance
JMSDF	Japanese Maritime Self-Defence Force
JSDF	Japanese Self-Defence Force

MCM	Mine Counter Measures
MEF	Indonesia's 'Minimum Essential Force'
MRO	Maintenance, Repair and Overhaul
NATO	North Atlantic Treaty Organisation
NDPO	Japanese National Defence Programme Outline
OOTW	Operations Other Than War
PLA(N)	Peoples' Liberation Army (Navy)
PMI	Prevention of Mutual Interference
PRMS	Pressurised Rescue Module System
RAN	Royal Australian Navy
RMAF	Royal Malaysian Air Force
RMN	Royal Malaysian Navy
RSN	Republic of Singapore Navy
RTN	Royal Thai navy
SAF	Singapore Armed Forces
SCS	South China Sea
SE	Stirling Engine
SITS	Ship Interface Template Set
SLOCS	Sea Lines of Communication
SPLN	Indonesia's Archipelagic Sea Defence strategy
SQDRN	Squadron
SRDRS	Submarine Rescue Diving and Recompression System
SSB	Conventionally propelled ballistic missile firing submarine
SSBN	Nuclear propelled ballistic missile firing submarine
SSK	Diesel propelled attack submarine
S-TASS	Submarine towed sonar array
TNI	Indonesia's National Defence Force
TNI-AL	Indonesian Navy
UAV	Unmanned Aerial Vehicle
UNCLOS	UN Convention on the Law of the Sea
USGW	Underwater to Surface Guided Weapon
UUV	Unmanned Underwater Vehicle
WSM	Water Space Management

About the Editors

Geoffrey Till is Emeritus Professor of Maritime Studies at King's College London and Chairman of the Corbett Centre for Maritime Policy Studies. Since 2009, he has also been a Visiting Professor and Senior Research Fellow at the Rajaratnam School of International Studies, Singapore. His *Understanding Victory: Naval Operations from Trafalgar to the Falklands* was published by ABC Clio in 2014, and he is currently working on a fourth edition of his *Seapower: A Guide for the Twenty-first Century*.

Collin Koh Swee Lean is a Research Fellow at the Maritime Security Programme, part of the Institute of Defence and Strategic Studies which is a constituent unit of the S. Rajaratnam School of International Studies (RSIS). He is especially interested in researching on naval affairs in the Indo-Pacific, focusing on Southeast Asia in particular, and generally issues related to naval technologies, naval modernisation, naval arms control and the offence–defence theory. Collin also taught at the Military Studies Programme and taught various professional military education and training courses with the Singapore Armed Forces Training Institute. Prior to join the Maritime Security Programme, Collin worked at the Military Studies Programme (2010–2014) and the Centre for Non-Traditional Security Studies (2008–2010), also at RSIS.

List of Figures

List of Tables

CHAPTER 1

Submarines and Their Acquisition: A General Introduction

Geoffrey Till

Abstract This chapter sets the scene for the whole book by identifying submarine acquisition as a particularly crucial and a particularly difficult aspect of naval modernisation for small and medium navies. It explores the historic role and performance of the submarine in naval warfare and reviews the strategic impact they may have in Southeast Asia in an era of dispute over the South China sea and rising competition between China and the USA.

Keywords Naval modernisation · Southeast Asia · Submarines in naval warfare · South China sea · China and the USA · Strategic competition

Ever since the weird little *H.L. Hunly* sank the USS *Housatonic* in Charleston harbour in July 1864, the submarine has been seen as a weapon of the weak, a 'force-multiplier' against a stronger adversary. In the eighteenth and nineteenth centuries, a skein of early inventors, Bushnel, Fulton, Nordenfelt and Holland all justified their efforts on this

G. Till (✉)
Defence Studies Department, King's College London,
Swindon, Wiltshire, UK
e-mail: geofftill45@gmail.com

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_1

basis, very often with an over-mighty Royal Navy in mind. The stealth advantages of the submarine, they argued, would narrow the military-technical dominance the great navies derived from the capacity of their great ships to control the sea, to blockade the shipping of weaker countries, to seize their oversea possessions, to support land operations and even to threaten invasion. In the words of the French delegate to the 1922 Washington Treaty, 'the submarine is the only arm that allows a country without a large navy to defend itself at sea'.[1]

The experience of the First World War seemed to confirm all this. German U-boat operations seriously constrained the sea-control operations of the British Grand Fleet in the North Sea and its maritime power projection capabilities in the Mediterranean. Worse still from the perspective of the great navies, submarine operations seemed likely to transform the nature of maritime strategy itself by outflanking the classical emphasis on securing sea control as a precondition for all operational activity at sea. Instead, weaker navies equipped with submarines could achieve decisive strategic effect through a direct assault on the commercial shipping of the maritime powers. This moreover had major international repercussions, not least for its impact on US strategic thinking.[2] It was the same story in the Second World War, when Churchill rightly regarded the struggle against the submarines as the decisive battle at sea, at least in the Atlantic war.[3]

At this stage, submarine technology was still mostly fairly primitive 'and [submarines] could be described as torpedo boats capable of short periods of submerged operation'.[4] However, the advent of more sophisticated types like the German Type XXI pointed to numerous possible futures for the submarine. Indeed, when the US Navy initiated a major study of the possible functions of the submarine in the late 1940s, no less than 13 different roles that could be developed were identified.

In the Cold War, the military–technical pendulum seemed to swing even further in favour of the submarine and the significance of the undersea campaign, first because many so believed in the improving tactical advantage that stealthy long-endurance submarines had over apparently vulnerable surface ships that they simply divided fleets into 2 categories—submarines and 'targets'. This was exemplified by the tremendous efforts the Royal Navy (one of the most skilled ASW operators in the world at the time) had to make in order to prosecute a couple of decrepit or malfunctioning and largely absent Argentine diesel submarines in the Falklands operation of 1982. Likewise, HMS *Conqueror*

effectively checkmated the entire Argentine navy, after the sinking of the *General Belgrano*.

Second, submarines came into their own in two other ways as well. The deadly games played between the Russian and NATO submarines in Europe's northern waters confirmed that they had become agents not just of sea denial, but of sea control, apparently usurping many of the functions of the old battle fleet. In the Second World War, British submarines sank 17 enemy submarines, and the Americans 24, but these were nearly all on the surface. At that time, the limitations in submarine sensors meant that submarine versus submarine operations under the surface were not yet a practicable proposition. Despite the scepticism of those who thought the submarine should stay focussed on fleet support, and in particular on guarding the carriers, technological improvements led to their assuming a central role in the general ASW battle.[5] In the post-war era, the submarine *versus* submarine battle became an essential—and indeed many thought *the* essential—dimension of the struggle for sea control. In this the nuclear propelled submarine had tremendous advantages over their diesel-driven equivalents in speed, range and endurance.

From the end of the Second World War, it also became increasingly clear that it was feasible for nuclear reactors to be installed in large submarines equipped to fire solid fuel ballistic rockets against the land. This all came to fruition in the USA with the cruise of the first SSN, the USS *Nautilus* in 1955, the commissioning of the USS *George Washington*, the first SSBN at the end of 1959 and the first firing of a guided Regulus I missile from the USS *Halibut* in the following year.[6] As the Soviet Navy's Admiral Gorshkov repeatedly pointed out to sceptical colleagues in the Politburo, Army and Air forces, submarines were the ideal platform for the operation of the strategic nuclear deterrent and so seemed likely to make navies more strategically decisive than ever they had been before. The development of this mission inspired other roles for submarines too, in both the location and attack and defence of the SSBN 'boomers'.

All these attributes of a well-handled submarine fleet seemed to mean that the development of a submarine capability could offer the navies of the Asia–Pacific region five different, but complementary kinds of potentially decisive strategic effect:

- *Sea Denial & Control*. Most obviously, their stealth and expanding offensive power, and their emerging role in ASW operations, made submarines a key element in battles for *sea control* between equal

fleets and very possibly for the *sea denial* operations of a weaker fleet against a stronger one. The sinking of the ROKS *Cheonan* apparently by a mini-submarine of the North Korean navy suggests that even such unorthodox craft as these may have significant sea-denial potential, at least in some circumstances. This is important since such outcomes would effectively determine the shape of the subsequent conflict at sea, or even its likelihood in the first place. Given the current level of interest in anti-access/area denial (A2/AD) operations in the congested and contested littoral, all this would seem of particular interest to the navies of East Asia and the Western Pacific.

For such war-fighting functions, the air-independent propulsion (AIP) systems gradually arriving in the region appears to offer major tactical and operational advantage since they allow the need to surface in order to recharge batteries to be reduced from perhaps once every 3–4 days to once every 2–3 weeks depending on how the submarine is used. Whether AIP proves to be one of those technologies that change everything remains to be seen, as does the particular form it might take and the relative attractiveness of the alternate route of going for improved Lithium-ion batteries instead.

- *(Nuclear) deterrence*. For some navies, submarines could become the principal and safest agents for the delivery, attack and protection of a country's nuclear *deterren*t capability. For the moment at least, this would seem only of direct interest to a few of the larger navies of the region, but indirectly it could affect many others. The dynamics of the wider South China sea, for example, would be changed, for instance, should the Chinese seek to use it as a 'bastion' for their nuclear propelled ballistic missile- firing submarines (SSBNs) operations. It would increase still further the strategic significance of the area and China's sensitivity to US naval activity there perhaps to plot the bottom, and to seed sonar buoys and other such listening devices. Likewise, North Korea's determination to build up a substantial sea-based deterrent capability as evidenced by its recent missile firings, development of the Gorae (Sinpo) class of conventionally powered ballistic missile-firing submarines (SSBs) and the building of two large concrete submarine pens close to the Mayang-do naval base, has major implications, especially for the navies of South Korea and Japan.

Neither should the potential attractiveness of non-nuclear deterrent effect potentially delivered by submarines be forgotten. Vietnam's *Kilo* submarines, for example, are being upgraded in order to operate the *Klub* missile system which can be used against land targets. In some situations, this capability could add significant strategic effect to the general level of deterrence provided by well-resourced naval forces. Arguably, the mere acquisition of a submarine (however effective it may be) signals a country's determination to defend its interests, shows that its waters are a contested zone and so helps deter unwelcome acts.

- *Economic Effect.* In some circumstances, submarines could inflict decisive *economic* and/or *political* effect through the disruption or destruction of commercial shipping. Here, the possible role of the submarine in exploiting President Hu's 'Malacca Dilemma' through a policy of 'offshore control' has occured to quite a number of US and Chinese analysts.[7] Alternatively, other analysts have discussed the notion of China inflicting a submarine/mining sea denial campaign against Taiwan or the Ryukus or Okinawa—how long could such places hold out if the flow of basic foodstuffs, petroleum products and so forth were heavily disrupted. How, in any case, could the USA respond to this?[8]
- *Cognitive Effect.* From earliest times, the *psychological and moral* effect of submarines has often been much greater than their actual operational effect. Hence, the wariness of the Royal Australian Navy about the threat of a couple of Indonesian submarines during the East Timor operation of 2000. In having so great an effect on the cognitive dimension of naval operations, submarines seem to offer a uniquely cost-effective capability, given the advantage the offensive has over the defensive in submarine operations. Thus, in January 1942, the correlation of defensive/offensive force was 173 ASW craft and 268 aircraft against 19 U-boats; by December this had risen to 403 ASW craft and 686 aircraft against 50 U-boats.[9] This may be especially of interest to smaller navies, because of the effect of this adverse balance of resource on the will of an adversary rather than simply on his physical means.
- *Enabling missions.* In addition, to all this, the modern submarine has also picked up a variety of newer roles such as covert surveillance, support for operations against maritime crime, and the insertion of special forces that will be of interest to small and great navies

alike. If anything the submarine's capacity to deliver these additional enabling functions appears to be increasing. More and more countries are interested, for example, in submarines as a means of getting the small groups of special forces ashore to raid or gather information. Swimmer delivery vehicles and mini-submarines have increased the submarine's capacity to do this as in the case of the Swedish A26, the acquisition of which is now being widely considered in the region.[10]

Covert surveillance was a feature of the operations of both sides during the Cold War as, for example, in the *Ivy Bells* exercise of sometime in the 1960s or early 1970s, when US subs tapped into the Soviet Navy's telephone system in the Sea of Okhotsk.[11] The Russians are suspected of still engaging in such undersea eavesdropping operations.[12] Submarine sonars offer an effective means of monitoring all maritime traffic while electronic signal measures systems can monitor radio traffic and radar transmissions ashore and afloat. This function may well be further extended by the use of remotely operated vehicles. The arrival of optronic masts with television cameras, image intensifiers and thermal imaging systems have also greatly increased the submarine's capacity for visual surveillance.

Much of this then would seem to apply particularly well to the diverse navies of the Asia–Pacific region, with some, as will be shown later, attracted to some of the possible attributes of a submarine capability and others to others. And yet, none of these aspirations are risk and cost-free, especially for smaller navies seeking to recover a submarine capability or to develop one for the first time. Lack of familiarity with the *genre* and economy of scale problems make this particularly difficult for them—but indeed all navies face considerable challenges in developing effective submarine forces. Six such challenges stand out:

Firstly, for the submarine, stealthiness is a relative rather than an absolute operational advantage. All though the Cold War, pundits spoke of military-technical ways of rendering the oceans transparent, or at least much less opaque. Now some warn of the tremendous advances in the rapid collection, processing and dissemination of 'Big Data' which could, for example, make low-frequency sonar much more effective as a means of detecting submarines. It could, for example, deal with the distortions caused to weak signals by the thermal layer complications to be found in

the sea. Were this to eventuate at least some of the operational advantages that derive from a submarine's stealthiness would disappear.[13] Of course, this is speculative and such developments in 'finding' might well be countered by the kind of 'topographical acoustics' suggested by some researchers in Singapore as a means of enhanced 'hiding.' The point is that stealthiness, the essential strategic advantage of the submarine, is a dependent variable and the fewer resources a country devotes to develop it, the less likely it is to be successful.

Secondly, this shows that technological innovation in the submarine and anti-submarine world (as illustrated by improved sensors, more effective propulsion systems, the deployment of unmanned vehicles and so forth) is far from over. From the time that Bushnell developed his barrel like submersible in the eighteenth century, submarines have constantly evolved in their hulls, propulsion systems,[14] weaponry and sensors and are still doing so. To the extent that states have the resources to invest in and profit from this continuing campaign, their submarines are likely to be markedly superior to those of states that do not—hence the apparently increasing need to invest in potentially game-changing technologies in both submarine and anti-submarine capacities.[15] This must cast at least some doubt on the ability of an inferior fleet with second rate submarines to prevail in a sea denial campaign over an adversary with first rate subsurface capabilities, other things being equal. Great navies, in other words, may still hold the upper hand in the undersea world.

This is a particularly important point, given the emphasis on the sea denial capabilities so often identified as the principal reason for acquiring submarines. Such claims are usually based on the assumed advantage of the submarine over the surface ship. But this superiority may not hold against the superior *submarine* of a great power. To a large extent, the first task of the modern nuclear propelled attack submarine SSN is actually ASW—indicated by the fact that for the first 20 years, US Navy SSNs did not have a dedicated anti-ship missile. Operating against diesel-propelled submarines (SSKs), the SSNs of the great navies could seed SSK operating areas with CAPTOR and other intelligent mines programmed, for example, to attack particular submarines like the *Kilo* which are not fast and would find outrunning such attacks difficult.

Thirdly, in the past, even quite sophisticated submarines for their time have quite often proved unequal to defensive off-shore tasks because of their poor position-keeping, low horizon of visibility, communication limitations, relatively slow speed and surprisingly common problems with

their torpedoes.[16] The allied submarine force assembled to protect the Dutch East Indies in 1941–1942 from Japanese attack, achieved very little; neither did the Japanese submarine fleet prove to be a decisive check against the American westward advance across the Pacific.[17] It is not clear that simpler, cheaper submarines have entirely overcome these disadvantages.

Fourthly, participating in a submarine race that is qualitative as well as quantitative will be especially demanding for a navy capable only of deploying only a few submarines because of the economy of scale problems mentioned earlier. This makes submarines produced in low numbers relatively much more expensive than ones in larger scale serial production. The same goes for maintaining, operating and crewing relatively small numbers of submarines, as even the Australian and Canadian navies have discovered in recent years, especially if they are doing so for the very first time with little in the way of the hard-won experience. Having just a few submarines makes it difficult to guarantee the *permanent* operational capability needed for secure planning. The iron law of refits (improving though it might be) means it is quite possible that the required submarine capability a country needs in an emergency is simply not available when needed most, and so cannot be relied upon.

As even long-term submarine operators such as the British and Swedes have demonstrated, it is excessively difficult to maintain an independent submarine building capacity especially when comparatively low fleet numbers are involved. Early problems in the delivery of the Royal Navy's *Astute* SSN programme were the consequence of the long gap in submarine manufacturing that had taken place before the programme started. The byzantine story of the Swedish government's disposal and subsequent reclamation of an independent submarine manufacturing capacity in Kockums illustrates both the costs and also the apparent desirability of such an aspiration. In Sweden's case, this aspiration may be rendered more feasible by a determined export drive for submarines designed or made in the country for foreign customers; this of course is another way of developing economies of scale for the producer. This offers such significant commercial advantage even to well-established diesel submarine producers such as the Japanese, Swedes, French and Germans that submarine acquisition policy in Southeast Asia may be distorted by too much producer-push rather than consumer-pull.[18]

The fact that most medium to small countries will find it especially difficult to start up relevant indigenous industrial capacity can only

increase their dependency on others. In terms of design and delivery skills, submarine production is extremely demanding and it will be a very long time, if ever, that such an enterprise would make commercial sense. If this is so, then smaller customers for submarines are likely to be strategically beholden to producers, at least to some degree for the foreseeable future. On the other hand, the experience of the Japanese navy seems to suggest that a settled long-term submarine acquisition plan can go a long way in resolving these difficulties.

Fifthly, the history of the submarine shows that both their technological development and operational deployments are inherently dangerous, and mistakes and deficiencies are generally more catastrophic in their consequence than they are for equivalent surface combatants. Too many submarine entrepreneurs went down with their inventions and never came up; not for nothing were submarines often referred to as 'peripatetic coffins' in the nineteenth century. In wartime operations, the German *Kriegsmarine*, for example, delivered arguably the most operationally proficient submarine fleet of the twentieth century but even so 72% of its total personnel died at sea.[19] Pre-war and post-war submarine operators, even experienced ones, have suffered numerous tragic accidents even in times of peace.[20] The list is a long one, including the American *Thresher* and in 1968 *Scorpion*, Israel's *Dakar*, France's *Minerve* (both also in 1968), Russia's Golf II (1974) the K-19 and K-219 (1979), *Kopmsomolets* (1989) and *Kursk* (2000)[21] Canada's *Chicoumi* of 2004 and India's *Sindhurakshak* (2013).

Sixthly, sceptics might add that even though the submarine is indeed capable of diverse missions in war, it remains, like aircraft, less flexible and more limited in its range of activities than surface ships, especially in the grey area between peace and war. It is difficult for submarines to fire clear warning shots against other platforms or to engage in some of the lower reaches of coercive activity. Submarines are not best suited for humanitarian and maritime security operations, 'passing exercises', ship visits even the holding of diplomatic cocktail parties. Since they are nevertheless expensive, there is an argument that a country could get a greater variety of choice from an equivalent investment in modern surface ships.

Despite these difficulties, Southeast Asia and indeed the countries of the whole Asia–Pacific region seem intent on the acquisition of significant submarine capabilities, amounting to some 12% of overall naval

Table 1.1 'Guesstimate' on new submarines in the Indo–Pacific region by 2030[23]

Country	*Number of new boats*
Australia	12
Bangladesh	**2**
China	20
India	13
Indonesia	6
Japan	8
North Korea	15
South Korea	14
Myanmar	**2**
Pakistan	8
The Philippines	**2**
Singapore	2
Taiwan	8
Thailand	**3**
Vietnam	4

acquisition.[22] A guesstimate of the future consequence of these efforts might be as shown in Table 1.1:

Three questions arise then—Why are submarines being acquired, how are they being acquired and what will be the consequences of all this?

The Question: Why?

Knowing all the challenges and difficulties they face as professionally, they must, why are the leaders of the navies of the Asia–Pacific region in general and of Southeast Asia in particular presiding over the proliferation of submarines in their region? Is it always a secure and considered judgement that the submarine's future operational advantages will outweigh the dangers and the resource and organisational challenges that will confront their acquisition?

The Question: How?

How do the region's navy leaders intend to meet these challenges? To what extent will the budgetary and political support required for the acquisition or expansion of these demanding capabilities actually prove forthcoming? How will the all-important issue of its impact on the

development of the domestic economy be handled and the relationship with foreign suppliers maintained?

The Question: With What Consequences?

… and if their efforts are successful what will be the consequence of the acquisition or development of submarine capacities be for the peace and stability of the region? Some observers have pointed to the danger of accidents in Southeast Asia's crowded and sadly contested seas and argued the need for agreed operational guidelines, submarine rescue agreements and confidence-building measures.[24] Will it make the region more secure and stable as the strategic gaps between the great and the small are narrowed (assuming they are), or will it increase suspicion and the risks of misperception and so threaten to destabilise an area already subject to a worrying range of tensions? Nor, the sea being one, should we ignore the possible reaction to all this of the great navies from further afield, the Chinese, Americans and Japanese in particular, but others too.

The following chapters will address these issues and questions. They may well represent a range of differing views. In the final chapter, we will seek to summarise and synthesise the points made.

Notes

1. Quoted in Thomas Parrish, *The Submarine: A History* (London: Penguin Books, 2004) p. 174.
2. Dubbs, Chris, *America's U-boats: Terror Trophies of World War I* (Lincoln: Iniv of Nebraska Press, 2014).
3. Quoted in Thomas Parrish, *The Submarine: A History.* (London: Penguin Books, 2004) p. 289.
4. Admiral I.J. Galantin, *Submarine Admiral: From Battlewagons to Ballistic Missiles* (Urbana: Univ of Illinois Press, 1995) pp. 136–137.
5. Admiral I.J. Galantin, *Submarine Admiral: From Battlewagons to Ballistic Missiles* (Urbana: Univ of Illinois Press, 1995) pp. 75, 200–202.
6. Admiral I.J. Galantin, *Submarine Admiral: From Battlewagons to Ballistic Missiles* (Urbana: Univ of Illinois Press, 1995), pp. 149, 191, 206, 231, 239–240.
7. Most famously by T.X. Hammes 'Offshore Control: A Proposed Strategy for an Unlikely Conflict' (Washington: INSS at National Defense University, June 2012).

8. Posted as 'Sea denial, US maritime Strategy and Conventional Deterrence of China, *Information Dissemination*, 30 Nov 2014.
9. Admiral I.J. Galantin, *Submarine Admiral: From Battlewagons to Ballistic Missiles* (Urbana: Univ of Illinois Press, 1995) pp. 66–67.
10. Jon Grevatt, 'Saab pitches A26 sub to Thailand' *Jane's Defence Weekly* (*JDW)* 6 May 2015; 'A 19 upgrade'; Rahul Bedi, 'Sweden offers India Gripens, Gotland boats' *JDW* 17 May 2015.
11. Clancy, pp. 200–201.
12. Michael Evans, James Dean, 'Putin's subs target internet cables' *The Times,* 27 Oct 2015.
13. Active sonar is better providing better definition, but its ping give you away—being heard at a range five times more than it can locate a target—Clancy, op cit., p. 82.
14. The diesel engine provided the big propulsion breakthrough just before the First World War. Parrish, p. 39.
15. Christopher P. Cavas, 'Seeking Game Changers in the Undersea World' *DefenseNews* 30 Nov 2015.
16. Two of the best submarine fleets of the Second World War, the Germans and the Americans, suffered grievously from faulty torpedos. The USN's Mk XIV and X ran 11' lower than the depth set—hence the misses. This reveals the dangers of untested in-house torpedo development. Galantin, pp. 49, 91. The Japanese Type 95 Mon 21" were much better but used ineptly.
17. Their warship sinkings were tiny compared to USNavy's Galantin, p. 246. A possible exception to this might have been the first class British submarine force deployed to deal with a Japanese invasion of Malaya and Singapore but this force was withdrawn in late 1940 for other duty.
18. Jon Grevatt, 'Saab pitches A26 sub to Thailand' *JDW* 6 May 2015; 'A 19 upgrade'; Rahul Bedi, 'Sweden offers India Gripens, Gotland boats' *JDW* 17 May 2015; Richard Scott, 'Sweden signs deal for a A26 submarine order, 8 July 2015; Jon Grevatt, 'Japan pushes MHI to find foreign partners for Soryu' *JDW* 29 July 2015.
19. Thomas Parrish, *The Submarine: A History.* (London: Penguin Books, 2004) pp. 295, 423.
20. One of the worst, surely, the so-called battle of the British *K-boats* in February 1918, Thomas Parrish, *The Submarine: A History.* (London: Penguin Books, 2004) pp. 183–240.
21. Parrish op cit., pp. 495–509.
22. Wendell Minnick, 'Europe Dominates Navy Ship sales in SE Asia' *DefenseNews,* 15 June 2015.
23. I owe this table to my editorial colleague Dr Collin Koh. It is based on information available in IHS *Aerospace, Defence & Security* (formerly *Jane's*) databases, the International Institute of Strategic Studies *Military*

Balance, summary of the *Naval Systems Projections Database (NSPD)*, American Maritime International (dba AMI International) and various news reports. Entries highlighted in bold denote new submarine operators in the region.

24. Jermyn Chow 'Urgent need for guidelines on submarine ops in region' *Straits Times,* 21 May 2015.

Author Biography

Geoffrey Till is Emeritus Professor of Maritime Studies at King's College London and Chairman of the Corbett Centre for Maritime Policy Studies. Since 2009, he has also been a Visiting Professor and Senior Research Fellow at the Rajaratnam School of International Studies, Singapore. His *Understanding Victory: Naval Operations from Trafalgar to the Falklands* was published by ABC Clio in 2014, and he is currently working on a fourth edition of his *Seapower: A Guide for the 21st Century*.

CHAPTER 2

Submarine Acquisition in Southeast Asia: The Dangers

Sam Bateman

Abstract The acquisition of submarines is not only intrinsically difficult and expensive for small and medium navies, but their maintenance and operation pose real challenges for them too. In particular, their operation in such contested and demanding waters as the South China Sea in an era of rising tension between China and the USA may threaten regional stability.

Keywords Naval modernisation · Southeast Asia · Proliferation South China Sea · Accident risk · Destabilisation

Introduction

Southeast Asian nations are acquiring more submarines for a range of reasons. The utility of submarines for covert surveillance and intelligence collection may be a more significant factor than the ability to sink ships. However, perceptions of the deterrent value of submarines are also a factor. Submarines are a classic force multiplier requiring a disproportionate

S. Bateman (✉)
University of Wollongong, Wollongong, Australia

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_2

response from an adversary. National prestige and a desire to keep up with one's neighbours are other considerations with submarine acquisitions. A submarine arms race may be developing in the region with submarines being acquired or submarine fleets expanded because neighbouring countries and potential adversaries have embarked on similar programs.[1] Submarines are weapon systems that, if acquired by one country, markedly affect the defence calculations of others and it is easy to slip into a competitive arms race.

The dangers associated with these developments are fourfold.[2] First, submarines are inherently dangerous weapon systems posing numerous dangers arising from their operations. Second, there are maintenance and support problems associated with operating relatively small fleets of submarines. Third, strategic dangers arise from having more submarines operating in the relatively confined waters of Southeast Asia. Lastly, trends with submarine detection pose longer-term risks that manned submarines may lose much of their attraction to regional navies. This chapter addresses these dangers and concludes with some ideas about how the risks might be reduced.

Operational Dangers

As the regular occurrence of submarine accidents around the world demonstrates, submarines are inherently dangerous vehicles. In acquiring submarines for the first time or building up submarine fleets, regional countries may be underestimating the risks of submarine operations. Even a relatively minor accident onboard can have catastrophic consequences. Then, there are the navigational risks associated with having more submarines operating in areas with a high level of fishing activity and dense shipping traffic. Parts of regional waters, particularly in and around the Spratly Islands in the South China Sea, are poorly charted, posing the risk of a submerged submarine striking an uncharted submerged reef or pinnacle.

The most infamous submarine accident in recent decades was the sinking of the Russian submarine *Kursk* in the Barents Sea in August 2000 with the loss of its entire crew of 118 personnel. The full crew of 70 of the Chinese submarine *Ming 361* suffered a similar fate in May 2003 when they all suffocated after a technical malfunction onboard leaked toxic fumes.[3] In January 2008, an Indian Navy submarine was damaged after it collided with a merchant ship in the Arabian Sea.[4] Then

in February 2009, French and British nuclear ballistic missile submarines collided while on patrol in the Atlantic.[5] Despite the sophisticated sonar equipment onboard these vessels, apparently they were unaware of each other. Fortunately, the damage to the submarines was slight, but it could easily have been catastrophic. In August 2013, a series of explosions sank India's frontline submarine INS *Sindhurakshak*, killing 18 personnel, shortly before she was due to proceed on a classified war patrol.[6]

There have been several incidents in both Japanese and European waters when submerged submarines have caught the nets of fishing boats and dragged them under—in some cases with loss of life. A US submarine is believed to be responsible for the sinking of a French trawler off the Cornish coast in January 2004 with the loss of five lives.[7] It is the duty of a submarine, when submerged to keep clear of surface ships. Thus, the accidents that have occurred involving a submarine and a surface ship have been entirely the fault of the submarine. On the surface, a submarine obeys the rule of the road like any other vessel, but at night it can be difficult to see a surfaced submarine and appreciate its course and length. These are all important considerations for submarines operating in areas of high fishing and shipping activity such as the South China Sea, or in busy waterways such as the Malacca and Singapore straits.

Even the most proficient operators of submarines, including the US Navy and the Royal Navy, suffer submarine accidents with depressing regularity. In July 2016, HMS *Ambush*, one of Britain's newest nuclear attack submarines collided with a tanker off Gibraltar while conducting the demanding training course for submarine commanding officers, known as 'The Perisher'.[8]

Accidents involving US submarines provide a graphic reminder of the inherent risks of submarine operations. The worst incident in the past 15 years involving an American submarine occurred off Honolulu on 9 February 2001 when the USS *Greeneville* surfaced underneath the Japanese fisheries research vessel *Ehime Maru*, sinking it with the loss of nine lives.[9] Then in 2005, the USS *San Francisco* hit an undersea mountain in the Pacific, killing one sailor and injuring 24 others. In late December 2006, two sailors were swept to their deaths from the hull of the USS *Minneapolis-St Paul* in rough weather off Plymouth in the UK.[10] About a week later, the USS *Newport News*, travelling submerged, hit the large Japanese tanker *Mogamigawa* while passing through the Straits of Hormuz.[11] In March 2009, the submarine USS *Hartford* collided with the amphibious ship USS *New Orleans* in the Persian Gulf in March 2009 causing serious damage.[12]

This string of submarine accidents shows that the underwater environment is a dangerous one. Submarines face many dangers. They have an extremely small margin for error. Even a small fire, flooding, or gas leak inside a submerged submarine can have tragic consequences, possibly even the total loss of the vessel and her crew. Arguably, submarine operations are among the most dangerous operations routinely conducted by defence forces.

The dangers of submarine operations are accentuated because submarines suffer from very severe command and control (C2) limitations. Submarine C2 has made nowhere near as much progress as C2 has in other types of military operations.[13] Communications with submarines, particularly if they are engaged on sensitive missions, may not always be reliable and comprehensive standard operating procedures must be in place to deal with all eventualities. A submarine may be out of radio contact for extended periods of time. Radio waves do not penetrate sea water to any extent, and a submarine has to put itself, or an antenna, close to the surface to make radio contact. However, in many operational circumstances, this may not be possible. Required command and control procedures include ones for dealing with incidents when submarines are overdue in reporting their location or that they have surfaced (referred to as 'Submiss/Subsunk' procedures).

Maintenance and Support Risks

The problems with building up and maintaining a submarine force are significantly greater than is commonly understood or acknowledged.[14] These problems arise from the difficulties both with providing the necessary level of technical support for the vessels without reliance on overseas support and with providing crews that are adequately trained and experienced. Overall, a submarine that lacks a well-trained crew or a competent shore maintenance organisation will not accomplish much of what is expected from the capability.[15]

Submarines require a higher level of maintenance and experience longer periods out of service for routine maintenance than surface warships. This means that countries with small submarine fleets have a problem with balancing the requirements of training and operations.[16] International submarine experts also point out that a country operating a small fleet of submarines (12 boats or less) becomes locked into technical and logistic support from the country of origin of the submarines.[17]

This dependence may place limitations on the strategic employment of the submarines.

Personnel issues are a major problem. Human error is a major cause of accidents at sea generally and submarines are no exception. Submarine crews must be highly proficient, but some in Southeast Asia may fall short in this regard, particularly in the navies that have only recently entered the submarine business. As one knowledgeable observer has noted, 'It takes decades of submarine service to develop the tactics, techniques, procedures and doctrine, backed by experience, to be effective'.[18]

Submarine commanding officers in particular have a huge responsibility. Their training and experience must be commensurate with this responsibility. Navies must be confident that their submarine commanding officers are competent to handle serious incidents, including ones that could escalate into conflict, on their own initiative and without guidance and direction from ashore. Despite how well one's own submariners are trained, submarine safety is like road safety: The avoidance of an accident also depends on the skill of the other driver and the quality of the road rules. And there will be more drivers on regional undersea highways in the future without any rules in place.

Difficulties can also be experienced with attracting personnel to serve in submarines. Life aboard a submarine is tough, operations can be hectic, quarters are cramped, the vessel can be submerged for long periods, and the health of crew members can suffer as a result.[19] To make up for these unattractive working conditions, the Royal Australian Navy has found it necessary to pay large bonuses to attract and maintain personnel to crew its submarines.[20]

Strategic Dangers

Numerous implications for regional security flow from the proliferation of submarines in the region. As well as the risks of a submarine 'arms race', there is a greater possibility of incidents involving submarines leading to increased tensions or even conflict. 'Intruder' submarine incidents, such as a foreign submarine being detected submerged in another country's territorial sea, may occur in the future as submarines increase in number and regional anti-submarine warfare (ASW) capabilities improve.

States are extremely secretive when discussing submarine issues. This is contrary to the desirable principle of transparency in military acquisition programmes and operations. Surveillance, reconnaissance and

intelligence gathering are major roles for submarines in Southeast Asia. Conventional diesel-powered submarines such as those being acquired by regional navies are particularly well suited for special operations and intelligence work, especially inshore and in relatively shallow waters. Submarines can covertly listen in on communications, such as by cell phones, and other electronic emissions that are subject to ducting and not detectable from space or even from the air.[21] Also, diesel-powered submarines can sit undetected on the bottom outside harbours or in other areas of interest and only approach the surface by night.

The undersea environment of Southeast Asia will be very busy in the future with increased risks of interaction between submarines of different nationalities and of submarines being detected on covert surveillance missions or in waters that are the subject of a sovereignty dispute. The risks of such incidents are worrying and a potential cause of conflict and tension in regional waters. Greater numbers of submarines pose new challenges for preventive diplomacy and maritime trust building in the region. Checks and balances are required to prevent the escalation into a conflict of a serious incident, involving a submarine.

Submarines are routinely used by most navies for covert surveillance and intelligence collection missions, during which they may 'intrude' into the territorial sea, archipelagic waters, or even the internal waters of another state. There is an inherent risk that a submarine engaged on such a mission may be detected by the ASW systems of the coastal state. The tactics employed by naval forces detecting a submerged 'intruder' submarine will be proportional to the military threat and strategic circumstances at the time. An 'intruder' submarine detected in an area of disputed sovereignty may well be subjected to attack. If the submarine considered that circumstances justified it being where it was and remaining submerged, it would have the right of self-defence and may well counter-attack its persecutor.

When an 'intruder' submarine is detected in the territorial sea, every measure should be taken short of force to require the submarine to leave.[22] Relevant measures might include dropping non-lethal warning charges, or firing a depth charge or mortar bomb at a known safe distance from the submarine. However, ASW torpedoes are now the main weapons against submarines rather than mortar bombs and depth charges, and these cannot be used in a 'warning mode' to warn off an 'intruder' submarine.

Furthermore, anti-submarine and submarine weapons are clumsy ones with often an 'all or nothing' result. Political circumstances might well not justify large loss of human life. As the British found with the sinking of the Argentinean cruiser *General Belgrano* with large loss of life during the Falklands War,[23] it is not possible for a submarine to use 'minimum force' when it fires torpedoes. An attack by a submarine can be a drastic means of achieving limited goals. The damage that a submarine can inflict using its primary weapon systems, missiles and torpedoes, is nearly always fatal. Similarly, a successful attack on a submarine may result in total loss of the vessel and its crew, and this may be an inhumane outcome in the circumstances. It might lead to a dramatic escalation of the tension between the parties involved.

There are real risks of 'intruder' submarine incidents in the future, particularly in sensitive areas such as the South China Sea. The acquisition of submarines by Malaysia and Vietnam, as well as the expansion of the Chinese fleet, is almost certainly related to the conflicting claims of these countries to islands in the South China Sea, and the perception of a requirement to covertly monitor the activities of other claimants in the area. The ability to manage the types of situation that might arise will put a premium on command and control arrangements in regional navies and regional crisis management. Due to the risks of a submarine incident escalating into violence, the region requires agreed procedures to allow 'intruder' submarines or submarines detected submerged in the territorial sea of another state to identify themselves before being attacked.

Considerable intelligence effort is expended on obtaining the acoustic signature of foreign submarines so that they might be more readily identified in the future. The USNS *Impeccable* may have been undertaking this form of intelligence collection when it was harassed by Chinese vessels in the South China Sea in March 2009.[24] As submarine activity increases in East Asian seas, this form of intelligence collection is likely to increase.

Legal issues are an important consideration. A key limitation on submarine operations is that in accordance with the 1982 UN Convention on the Law of the Sea (UNCLOS), a submarine exercising the right of innocent passage either through the territorial sea of any country or in the archipelagic waters of Indonesia and the Philippines outside of archipelagic sea lanes is required to travel on the surface and show its flag.[25] Indonesia is particularly concerned about possible breaches of its sovereignty in its archipelagic waters.[26] It is sensitive to the movement of foreign warships and submarines through these waters, especially the possibility

of submarines travelling submerged outside of its declared archipelagic sea lanes. There have been several incidents over the years in Indonesian waters, involving Australian or American submarines, where Indonesia has queried submarine movements in its archipelagic waters. In 2000, President Wahid warned Singapore not to allow its submarines to stray into Indonesian waters, promising a swift military response should that occur.[27]

Longer-term Dangers

Longer-term dangers arise from the proliferation of submarine fleets in Southeast Asia. There is potential for worrying developments with the proliferation of cruise missiles and even weapons of mass destruction. Submarine-launched land-attack missiles, mainly cruise missiles, such as Tomahawk, by the USA and its allies, have been a major development with submarine weapons that other countries are now seeking to emulate.[28] However, while cruise missiles are superficially attractive, considerable investment in external targeting systems is required if the long-range potential of these systems is to be exploited. This is likely to be beyond Southeast Asian countries in the foreseeable future although more technologically advanced and larger navies, such as those of China, India and Japan, will pursue their development.

Looking into the future, great advances continue to be made with ASW and submarine detection. These developments may be shifting the balance against the submarine. While technological developments with making submarines stealthier have almost reached a limit, developments continue with the ability to detect submarines both with acoustic and with non-acoustic systems—and with some mix of both. Perhaps it is not going too far to predict that in the foreseeable future submarines may become more detectable in coastal waters.[29] Thus, submarines may lose some of their attractiveness to regional navies.

Vast improvements in signal processing, which allow very small signals to be processed, have increased the performance of acoustic sensors. However, they still suffer from limitations dictated by the laws of the physics, and their performance has probably been taken about as far as it comes, except for developments with networking systems and different sensors. Hence, much greater attention is now being given to non-acoustic ASW sensors. These gain importance because submarines have become quieter, and greater attention is being given to littoral waters where the performance of acoustic sensors may be significantly degraded.[30]

The ability of submarines to escape detection is decreasing as new detection techniques are developed that rely on phenomena other than sounds emanating from a submarine.[31] Non-acoustic sensors include magnetic sensors, such as the magnetic anomaly detector (MAD), that exploit the magnetic signature of a submarine; electric field (ELFE) sensors that detect the electric fields created between moving parts of a submarine's machinery manufactured from different materials; infrared systems that detect thermal radiation from the mechanical and electronic 'hot spots' of a submarine; laser-based systems; electronic sensors that detect electronic transmissions from a submarine no matter how short they might be; synthetic-aperture radar to detect the wake created by a submarine or the 'hump' in the ocean surface created as a submarine moves through the water beneath; bioluminescence to detect the submarine's disturbance of marine plant and animals. Again non-acoustic sensors have benefited from great advances in signals processing, but they also have limitations. Magnetic sensors, for example, have limited range and are generally only useful for localising a submarine and confirming that the contact is in fact a submarine.

There is much research being conducted into non-acoustic ASW sensors, particularly in the USA. Further advances might be expected, including the ability to network a range of different sensors. Developments include the development of multistatic arrangements, networking a range of sensors, so that the sources of transmissions from a source (e.g. an active sonobuoy or surface ship sonar) are not co-located with the receiver which, for example, might be a co-operating submarine. Networking might include both acoustic and non-acoustic sensors. These reflect developments in computer processes to run detailed models to detect very small environmental changes made by a quiet submarine.[32]

Other technological developments that could lead to marked changes in the regional requirement for submarines include the development of underwater drones that could take over much of the current covert surveillance and intelligence collection activities of submarines in Southeast Asia.[33]

Reducing the Risks

Experience elsewhere in the world suggests that it is only a matter of time before a serious submarine accident occurs in Southeast Asia. Measures are required to improve submarine safety in the region. Arrangements for water space management (WSM) and the prevention

of mutual interference (PMI) with submarine operations might be possible. A regional submarine Movement Advisory Authority along the lines of procedures currently followed by Western navies might be possible. This would mean that the parties to the regime know the operating areas of other submarines. However, this will be difficult in view of the covert nature of submarine operations and the sensitivity of regional countries to sovereignty issues. In the longer term, the establishment of submarine exclusion zones or 'no go' areas for submarines might be achievable, particularly in areas where sovereignty over islands and reefs is disputed.

Meanwhile, a range of prospective measures for mitigating the adverse consequences of regional submarine developments should be considered. These might include regional protocols for dealing with unidentified submarines detected in the territorial sea, including the procedures to be followed and signals to be used. These protocols might include an agreement that in normal circumstances, the submarine should not be attacked with potentially lethal force. Government-to-government 'hot-lines' between national submarine operating authorities might also be considered. Singapore has recently proposed an operational framework based to reduce the possibility of submarine-related incidents covering areas where regional cooperation is required, including common standards in terms of submarine safety regimes and agreement on a code of conduct that can guide submariners on what to do should their boat unexpectedly encounter another underwater vessel during an operation.[34]

Continued regional cooperation is required on submarine training and safety, including submarine escape exercises and the development of protocols for cooperation to deal with missing or sunk submarines (SUBMISS and SUBSUNK procedures). A regional submarine rescue organisation might be introduced in which China, as a major operator of submarines, might play a part.[35] The US Navy has established the International Submarine Escape and Rescue Liaison Office (ISMERLO) in Norfolk, which is a logical location for it in view of the US Navy's long history in submarine rescue, but other states may have sensitivities about the ISMERLO extending its responsibilities to include Southeast Asian waters.[36]

More submarines in the region are potentially destabilizing, particularly as they may be employed on covert missions in disputed waters. There are challenges here both for maritime confidence building and ensuring submarine safety. By their very nature, submarines are not well

suited to maritime confidence building measures, including an incident at sea (INCSEA) type agreements. In the longer term, arms control measures may have to be discussed to place limits on the numbers of submarines either absolutely or in particular areas. While naval arms control measures placing quantitative and qualitative limits on the numbers of submarines and their weapons systems are unlikely in the foreseeable future, they may become necessary if current trends continue.

Notes

1. Collin Koh Swee Lean, 'Submarines in Southeast Asia: Proliferation, Not a Race', *The Diplomat*, 30 January 2014, http://thediplomat.com/2014/01/submarines-in-southeast-asia-proliferation-not-a-race/.
2. This chapter draws on Sam Bateman, 'Perils of the Deep—The Dangers of Submarine Proliferation in the Seas of East Asia', *Asian Security*, 7(1) 2011, pp. 61–84.
3. '70 sailors aboard China sub die in mystery accident', *Defense-Aerospace*, 3 May 2003, http://www.defense-aerospace.com/afp/defense/030502170438.bmbz3over.html.
4. 'Submarines fails to detect ship, collides', *Hindustan Times*, 11 January 2008, http://www.hindustantimes.com/StoryPage/Print.aspx?Id=9aff982f-5c94-4439-a043-e4a5ef9bb6e5.
5. Charles Bremner and David Brown, 'Silent: French and British crash subs deaf to each other', *The Australian,* 18 February 2009, http://www.theaustralian.news.com.au/story/0,25197,25069697-31477,0.
6. P.K. Ghosh, 'Short-sighted Submarine saga', *The New Indian Express*, 28 August 2013, http://www.newindianexpress.com/columns/Short-sighted-Submarine-saga/2013/08/28/article1755117.ece.
7. 'US Navy asked to share sub detail', *BBC News*, 1 May 2010, http://news.bbc.co.uk/2/hi/uk_news/england/cornwall/8656110.stm.
8. Keiligh Baker and Richard Spillett, 'Trainees may have been at the controls of £1.1billion British nuclear submarine when it crashed into a tanker off Gibraltar', *Daily Mail*, 23 July 2016, http://www.dailymail.co.uk/news/article-3703038/Commander-Britain-s-newest-submarine-faces-court-martial-crash.html.
9. Gerry J. Gilmore, 'Sub Skipper Reprimanded for Ehime Maru Incident', *American Forces Press Service*, 25 April 2001, http://www.defense.gov/news/newsarticle.aspx?id=44945.
10. Andrew Scutro, 'Tethered sailors washed off sub, report finds', *Navy Times*, 17 April 2007, http://www.navytimes.com/news/2007/04/navy_submarineaccident_investigationfatal_070413w/.

11. 'US submarine, Japanese ship collide', *China Daily*, 9 January 2007, http://www.chinadaily.com.cn/world/2007-01/09/content_778451.htm.
12. 'Submarine rams into ship as navigator listens to iPod', *The Economic Times*, 11 April 2010, http://economictimes.indiatimes.com/news/news-by-industry/et-cetera/Submarine-rams-into-ship-as-navigator-listens-to-iPod/articleshow/5784306.cms.
13. Commander Michael Dobbs USN (Rtd), 'Preventing Undersea Mishaps', *US Naval Institute Proceedings,* 136(6) June 2010, p. 23.
14. Jan Joel Andersson, 'Submarine Capabilities and Conventional Deterrence in Southeast Asia', *Contemporary Security Policy*, 36(3) 2015, pp. 473–497.
15. Ibid., p. 478.
16. Ibid., p. 483.
17. Views expressed at the workshop on *Submarine Acquisitions in Southeast Asia: Problems and Prospects* hosted by RSIS in Singapore 13 November 2015.
18. Roger Thornhill, 'Modern Under Sea Warfare', *The Navy*, The Navy League of Australia, 69(4) October–December 2007, p. 24.
19. Kim Eun-jung, 'S. Korean Navy offers insight into demanding submarine life', *Yonhap News Agency*, 4 August 2013, http://english.yonhapnews.co.kr/n_feature/2013/08/02/57/4901000000AEN20130802008900315F.HTML?0960e110.
20. Noel Towell, 'Hello sailor! Navy offers $50,000 per man in bid to keep sub fleet afloat', *The Canberra Times*, 4 February 2016, http://www.canberratimes.com.au/national/public-service/hello-sailor-navy-offers-50000-per-man-in-bid-to-keep-sub-fleet-afloat-20160203-gml880.html.
21. Norman Friedman, *Seapower as Strategy—Navies and National Interests* (Annapolis: Naval Institute Press, 2001), p. 261.
22. A comprehensive review of the legal standards governing submarine espionage operations and the rights and duties of affected coastal states is provided in James Kraska, 'Putting Your Head in the Tiger's Mouth: Submarine Espionage in Territorial Waters', *Columbia Journal of Transnational Law*, 54 (16), 2015, pp. 164–247.
23. Desmond Rice and Arthur Gavshon, *The Sinking of the Belgrano* (London: Secker and Warburg, 1984).
24. Sam Bateman, 'Clashes at Sea: Why Chinese vessels harass US ships', *RSIS Commentary*, No. 27/2009, 13 March 2009.
25. UNCLOS Article 20.
26. Archipelagic waters are those within archipelagic baselines around the outermost limits of the archipelago drawn in accordance with Article 47 of UNCLOS. Archipelagic waters come under full sovereignty of the archipelagic state with the exceptions of the rights of innocent passage and archipelagic sea lanes passage.

27. 'Wahid warns Singapore submarines not to stray', *Reuters News*, 26 April 2000.
28. Norman Friedman, 'Diesel Electric Submarines: What's Next', *Asia Pacific Defence Reporter*, 34(10) December 2008/January 2009, p. 18.
29. Bryan Clark, *The Emerging Era in Undersea Warfare* (Washington DC: Center for Strategic and Budgetary Assessments, 22 January 2015).
30. Vice Admiral Sangram Singh Byce IN (Rtd) and Dr. Rajni Kant Tewari, *Anti-Submarine Warfare: Fighting the Invisible Enemy* (New Delhi: Anamaya Publishers and National Maritime Foundation, 2006), p. 117.
31. Clark, *The Emerging Era in Undersea Warfare*, p. 8.
32. Ibid.
33. Gemma Deavin, 'Submersible drones to render Australia's new submarines obsolete: Pentagon adviser', *ABC News*, 22 May 2015, http://www.abc.net.au/news/2015-05-22/australia-next-submarine-fleet-obsolete-due-to-drone-warfare/6488618.
34. Ridzwan Rahmat, 'IMDEX 2015: RSN warns of risks in submarine proliferation in Asia, proposes operational framework', *IHS Janes 360*, 21 May 2015, http://www.janes.com/article/51579/imdex-2015-rsn-warns-of-risks-in-submarine-proliferation-in-asia-proposes-operational-framework.
35. Lyle Goldstein and William Murray, 'International Submarine Rescue: A Constructive Role for China?' *Asia Policy*, 3, January 2008, pp. 167–183.
36. Ibid., pp. 176–177.

CHAPTER 3

Submarine Acquisition in Australia

James Goldrick

Abstract Australia's submarine acquisition programme is one of the most ambitious in the region. It is framed by the country's relationship with Southeast Asia in an era of increased tension in the South China Sea and rising tension between China and the USA. Australia faces a considerable challenge in matching technological and industrial capability, competing demands on its economy, the domestic political scene and its operational requirements. This unique combination of challenges is compared with the experience of the smaller navies of Southeast Asia.

Keywords Australia · Naval modernisation · Southeast Asia
Strategic competition · Submarines

Australia's Submarine Capability: The Requirement

Australia's *Defence White Paper 2016* has declared that, by 2035, around half the world's submarines will be operating in the Indo-Pacific region.[1] There are good reasons for this growth in regional submarine forces and they apply to Australia as well. As was emphasised in the *Defence White Paper*, submarines are powerful instruments for deterring war and a

J. Goldrick (✉)
University of New South Wales, Sydney, Australia

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_3

potent weapon of war if deterrence fails.[2] An effective submarine fleet adds greatly to a nation's military weight, and there is no current substitute for the capabilities that submarines deliver in maritime warfare. In Australia's defence strategy, protecting critical lines of trade and communication and denying the use of the sea to a potential adversary are long-standing priorities. In conflict, Australia will seek to preserve the use of the sea for essential national transport and military operations and seek to deny the same advantages to an adversary. Because of their unique characteristics, submarines will play an essential role in these endeavours. Submarines' ability to operate covertly for extended periods and to attack without warning means they can create uncertainty in the mind of an adversary about where they are and whether it is safe to sail ships (or other submarines). Their stealth has a pre-conflict value, too: in times of tension, submarines can be used to gather information about other countries' capabilities or intentions, providing early warning. Submarines can also be used for strike missions, including by inserting special forces ashore to target enemy facilities. Submarines equipped with land-attack missiles can also be an effective means to target onshore facilities and this capability may be an option for Australia in the future.

Australia's geography and vast areas of strategic interest further shape the operational roles of its submarines, which in turn determine the required size, capabilities and endurance. While there are claims about the increasing vulnerability of submarines to detection, these must be balanced against the realities of the environment. The Indo-Pacific sea areas are generally extremely challenging for acoustic sensors, whether passive or active, while other mechanisms for detection are much better at localising a submarine than achieving initial contact. It is clear that the emerging technologies of unmanned vehicles and pre-positioned sensors will make it more hazardous for submarines to enter certain areas, particularly those close to well-protected enemy bases and this may constrain them in the future. In their turn, however, submarines are likely to be able to employ unmanned vehicles (including air and surface units) as their own 'agents of influence and action' by sending them into the most high-risk areas to reconnoitre or even attack.

These considerations shape Australia's requirements for its submarines: they must be fully interoperable with allied forces, particularly those of the USA, have very long range and long endurance, be sufficiently covert, with excellent sensors and armament to overcome sophisticated threats and be able to operate in tropical waters. They should also

have the inherent capacity to carry unmanned vehicles in order to be able to take advantage of this emerging technology over the full life of the new submarine class.

Australia's Challenges in Acquiring and Operating Submarines

Submarines are *difficult*. They are inherently complex and demanding of technical expertise and national resources. They are also *expensive*, both to purchase and to operate. The design requirements for engines, power, fuel, weapon (and unmanned vehicle) capacity and provisions shape hull size and affect the numbers of people needed to operate the boats, but they need to be balanced against each other even more carefully than in surface combatants. Design envelopes are tight and any errors in calculating the parameters can have disastrous results, as recently demonstrated when the Spanish Navy was forced to halt construction of its new boats and initiate an extensive reworking of their design to overcome a 70-ton (or more) deficiency in their buoyancy.[3]

A key distinction between submarines is their main power source for propulsion. Nuclear-powered submarines have the ability to operate for extended periods underwater and at high speed without the need for refuelling. Diesel-electric submarines, by comparison, are slower (although they can achieve very fast 'burst' speeds for limited periods underwater) and need to recharge their batteries at intervals, requiring the use of noisier diesels and access to air. During these periods, they are at much greater risk of detection, whether from sensors 'listening' for their machinery or by radar (or even visual) contact with their schnorkel (air mast). Air independent propulsion (AIP) systems have been developed, but these take up space and weight and generally provide greater submerged endurance only at low speed. They also use special fuels, which may require specialised facilities to replenish.

In theory, their superior transit and operational speeds, effectively unlimited endurance and ability to remain submerged indefinitely make nuclear submarines extremely attractive for a country with Australia's strategic requirements. However, apart from being much more costly than diesel-electric boats in their own right (probably well over twice as much per unit, assuming the same sensor and weapon fit), the acquisition of nuclear boats is not feasible for Australia at this time because of the range and cost of their support systems—which the country does

not possess and would need to develop or acquire. Unlike every current nuclear submarine operator, there is no domestic nuclear power industry and Australia has only a single reactor for medical research and experiments. However, there are very few (if any) other navies that expect non-nuclear submarines to deploy at such great distances and maintain themselves in distant operating areas for so long. Having to meet the operational requirements with a conventionally propelled boat thus makes a unique, tailored-for-Australia design the only option for its navy. This was recognised as far back as the 1970s and resulted in the six *Collins* class boats, built in Australia to a Swedish design, which entered service in the late 1990s.

Submarines need expert and well-trained personnel who are psychologically suited to working for long periods in confined environments. The RAN has faced significant difficulties in maintaining its expert workforce. While some of these problems have resulted from factors related to internal culture and management, as well as the challenge of holding onto experienced technical personnel who are extremely attractive to domestic and international industry, others have related to the availability of the boats themselves. The workforce for a submarine fleet requires careful planning, and the design of a new submarine class must make the training and career requirements of its crews a key element. There are real problems achieving this with a force of six units or fewer unless extensive overseas support is available, including at-sea training facilities (such as those required to qualify new commanding officers). Submarine skills take time to develop and can degrade quickly. A shortfall in training days over even a relatively brief period can have serious consequences lasting for years and this is why serviceability problems in a small force can be so significant. It should be easier, not harder, to crew a larger fleet because more berths will be available for training and there is less likelihood of restrictions on training missions. A larger submarine force also makes it easier for air and surface anti-submarine units to develop and maintain their skills because there are more live 'targets' available. For all these reasons, although the larger submarine fleet of twelve units which Australia plans will be a formidable proposition in workforce terms, it will also reduce some of the problems which have been endemic to the Australian effort.

The formidable task of designing a modern submarine is not within the capability of Australian industry working alone, although there are domestic skills that help make Australia a 'smart customer' and the new boats will be built in-country. The involvement of an overseas partner

with recent experience in submarine design will be necessary—hence the competitive evaluation process (CEP) involving three established submarine-building countries (France, Germany and Japan) and their leading submarine builders. Selection of the design offered by the French submarine builder DCNS was announced in April 2016. While all the submissions were described as being of 'very high quality',[4] the superiority of the French proposal was described at the time by Australia's Prime Minister as 'absolutely unambiguous'.[5] This may be a combination of the efforts which the French have put into signature reduction in their nuclear attack and ballistic missile submarines over the last few decades with the likelihood that it has proved easier to adapt a moderately sized nuclear attack boat for conventional propulsion than, as the Germans in particular had to do, scale up a diesel-electric design to meet Australia's demanding requirements.

Understanding the design philosophy of the future submarine is an important part of managing the boats throughout their lives, and so will be control of intellectual property to allow progressive modification of the design. This is not just a matter of where the new boats are built; the through-life work on the future submarine will necessarily be done in Australia as well, since taking an operational boat overseas for extended periods of maintenance will be neither practical nor desirable. It is thus clear that close relationships will need to be established between Australia and France at the separate levels of government-to-government, defence organisation-to-defence organisation, navy-to-navy and shipbuilder-to-shipbuilder. The first formal design contract with DCNS was signed in September 2016.[6] Australia's interest in US systems and weapons also means that the future submarine design and build process will necessarily be a three-way collaboration between Australia, France and the USA. Lockheed Martin Australia was selected as the Combat System Integrator at the same time as DCNS received its design contract.[7]

Being able to manage the security and intellectual property requirements of all three nations will be vital and DCNS received a sharp shock with the partial publication in Australia of leaked documents relating to the submarine design it has provided for the Indian Navy. This brought a reminder from the Australian government that security remains 'absolutely critical'.[8] Land-based test sites for the ship systems (particularly propulsion) and combat systems and sensors will also be important in reducing the risks inherent in a new design. Australia learnt this lesson the hard way with the *Collins* class in the 1990s.

There is also the need to accept and factor into the budget any premium for in-country construction. Recent media reporting suggested that 30% will be the estimated additional cost of building the new submarines in Australia over constructing them in the designer's yard overseas.[9] Fierce debates rage amongst economists over the likely benefits for the rest of the economy from such activity, or whether the opportunity costs may be too great.[10]

Unless work on the future Australian submarine begins soon, there is a possibility that a 'capability gap'—a period during which the Australian Navy does not have enough submarines to meet its operational tasking and training requirements—will result sometime late next decade. There is very little scope for further delay. Because of earlier tardiness in getting the future submarine programme moving, Australia may have only just enough time to produce a new fleet of submarines before the *Collins* class boats retire. This assumes that all goes well with a life-extension programme for the *Collins* boats—and even a 10-year extension leaves little margin to further delay the future submarine programme.

There is, however, no compelling business case for an 'interim' submarine capability to help bridge any gap. Australia would then have to manage two or three classes of submarine over more than a decade, and the cost, complexity and personnel challenges in doing that would be likely to exceed the capacities of the Australian Navy, the rest of the Australian Defence Organisation and the defence industry. The recent release of the latest of five reports on the sustainment of the submarine force has also given much more confidence in the ability to provide the capability at the level required as well as an explicit warning about what lies ahead. The improvements over the last few years have been called a 'significant achievement' and the Australian submarine force looks to be in good shape, but there will be many challenges in managing the 'intertwined' requirements of the existing fleet and its replacement.[11]

Submarine Acquisitions in the Indo-Asia-Pacific: The Anti-Submarine Warfare Implications

Given that the numbers and capabilities of submarines operating in the Indo-Pacific region are increasing, this requires responses by Australia additional to the modernisation and expansion of the submarine force. While some countries are developing submarine capabilities able to project force at great distances, many states in the region are strengthening

submarine capacities for coastal or limited-range missions, and such boats could affect the operations of Australian naval forces. The inherent difficulty of the anti-submarine warfare (ASW) task means that the advantage will remain with those countries that have the necessary resources, experience and scientific expertise to field, maintain and operate advanced ASW systems suitable for their particular operating conditions. Australia has to be able to conduct increasingly challenging anti-submarine operations across a large theatre, both independently and in concert with allies and coalition partners. The future submarine fleet will be a vital element in our ASW force, but not the only one. Australia's decisions to purchase up to fifteen P8-A maritime patrol aircraft to replace the AP3-C *Orion* fleet, build nine future ASW frigates to replace the eight *Anzac* class and acquire 24 new SH-60R helicopters for embarked operations will all contribute to the nation's ASW capability.

It is likely that other regional nations will also seek to improve their own ASW capabilities in response to the proliferation of new submarines. Together, these two lines of development may become the real 'naval arms race' in Asia. However, the nature of ASW suggests that many developments will be largely hidden from the outside observer. They will relate much more to the evolution of command, control and intelligence, improved communications and remote sensors, as well as advancing the skills of surveillance and attack systems, than to the acquisition of individual ships or aircraft.

The Challenges Facing Regional Submarine Forces

While most regional operators do not have the operational ambitions of the RAN, most face the same challenges in maintaining an effective capability. One which does have similar ambitions and is one of the largest and oldest submarine forces in Asia, that of India, is facing problems of serviceability in its diesel-electric classes, evidenced by the explosion which resulted in the 2013 sinking of one of its Russian-built *Kilo*-class submarines in harbour. Replacement of an ageing fleet has not proved easy, either, with extensive delays in the construction in India of the French-designed *Scorpene* class. The first of the class is likely to enter service some five years late. Although there are 13 conventional submarines in the Indian Navy's order of battle, only three were available for the fleet review in February 2016, in stark comparison to the turn-out of practically the entire surface navy. The Indian Navy has additional

stresses on its technical expertise and material resources in that it is introducing a new indigenously produced nuclear-powered ballistic missile submarine into service, as well as operating a leased Russian nuclear attack boat. It is clear that the Indian Navy is also having to battle hard for sufficient share of the defence budget—the percentage allocated to the naval service has been falling over the last few years.

China itself, although modernising its nuclear and conventional submarine forces as fast as it can, may have its own problems. China's technological challenges in areas such as noise quieting, underwater-launched ballistic missiles, and torpedoes and propulsion remain formidable.[12] It can be no coincidence that China has repeatedly turned to Russia for conventional submarines and it is likely that the Chinese have been forced to copy many elements of Russian design in their own new classes, just as they have reverse-engineered a number of European systems. Significantly, American estimates of the PLA Navy's achievement of a fully operational ballistic missile submarine capability have repeatedly been revised as delays have become apparent in the Chinese programme.

Yet some navies may have even greater problems, particularly those such as Indonesia and Malaysia which have only two or three boats. With just a handful of submarines, it is practically impossible to promise continual operational availability and there must inevitably be a degree of risk management in balancing maintenance, training, and operations. Because of the need for 'full cycle' refits at intervals of anywhere between five and ten years, it may even be necessary to accept that there will be no effective capability on call for extended periods. Given the national importance of submarines as a deterrent force for any country, this means that the life cycle of the boats has to be considered very carefully in relation to the developing strategic situation.

A domestic development agenda can complicate matters even further than it has in Australia or India. Indonesia's third new submarine will be assembled at the national yard of PT PAL in Surabaya. It is likely to take much longer to get into service and cost a great deal more than the two units which are being built to the same German derivative design in South Korea. This is a serious matter for the resource-limited Indonesian Navy (TNI-AL). With the TNI-AL tightly constrained by its finances, the requirement to use the domestic shipbuilder is likely to slow or even arrest the long-desired expansion of the submarine force—and the Indonesians have long wanted to increase the fleet to at least a dozen units. There are similar problems with submarine refits. While it is highly

desirable for them to be conducted in-country, any force smaller than six units means an inevitable 'start-stop' regime for the dockyard concerned. This creates both inefficiencies and greater costs, since it is difficult to shift the expert workforce to other employment between refits. The 30% premium estimated for the planned Australian effort may be much greater in Indonesia's case.

There is also a constant tension between national sovereignty and the extent to which a small submarine force must rely upon external support. This is particularly critical for weapons and tactical doctrine. As the Argentinean Navy discovered during the 1982 Falklands War, there is a significant gap between the delivery of a foreign-built submarine and achievement of full capability.[13] Unless the buyer nation is prepared to take a great deal on trust, it is necessary either to evolve a close and open relationship with the provider nation and its navy to share information, or the buyer must be prepared to expend substantial resources in conducting its own weapon trials and tactical development. Australia's solution has been to strengthen its relationship with the US Navy, embedding its own personnel in the American torpedo and combat data system programmes and buying directly from the American production lines. How close this relationship has become was demonstrated by the fact that the first live warshot firing of the latest variant of the main USN heavyweight torpedo, the Mark 48 CBASS, was conducted by an Australian submarine. Singapore has achieved a great deal with its own force, but this was very carefully managed from the outset through a close relationship with the Swedish Navy and a staged transition to reliance upon national infrastructure and resources. This cannot be cheap and the Republic of Singapore Navy now faces a new challenge in switching from reconditioned Swedish boats to new construction German units. Inevitably, this will require a whole new network of relationships and agreements to be developed and will create pressures on Singapore's inevitably limited pool of submarine expertise. Thailand faces similar problems in the future with its plan to acquire Chinese submarines. The Royal Thai Navy (RTN) has always had to operate within very tight financial limits and this is unlikely to change. The RTN will need not only to find the money for through-life support but make some difficult decisions as to how close its relationship will be with the PLA Navy and Chinese industry.

Vietnam in particular, as perhaps the most ambitious of the regional submarine operators—and certainly as the country which has created

a submarine force in the shortest time—must be facing its own challenges in evolving a relationship with Russia and the Russian Navy, as well as the alternative (for some purposes) of India. Although Vietnam claims that its submarines have begun operational patrols in the South China Sea—and that they have gone to sea without any Russian advisers embarked—it is clear that the Vietnamese will be relying upon Russian and Indian training for some years yet. This will need to extend to live training (particularly for prospective commanding officers) as well as to classrooms and simulators. Vietnam has already had to increase the pay and allowances of its seagoing submariners and is under some pressure to improve the conditions of its technical support personnel ashore. The extent to which Russia and India will support Vietnam with tactical doctrine and higher-level operational training is another open question, since it will be some years before the Vietnamese Navy can possibly assemble a sufficient base of expertise to experiment and innovate with weapons and tactics. On the other hand, Vietnamese operations in the South China Sea could serve as something of a laboratory in their own right and Vietnam may be able to bargain with the data that its submarines gather as an exchange for Russian and Indian information.

The Way Ahead

Despite all the difficulties which the acquisition of submarines presents to any would-be operator, it is clear that they will continue to represent an extremely attractive capability for all but the smallest navies in the region. Their ability to complicate the situation and restrict the actions of any would-be aggressor in the maritime domain remains unmatched and, despite the rate of technological change, is unlikely to be challenged for at least a generation. Asia is thus likely to see even more submarines go to sea in the next few decades than it has since 2000 and any maritime rivalries will inevitably have an underwater dimension. At the same time, however, in a complex strategic situation with developments not only in platform numbers, but also in their sophistication, 'token' forces will become much less credible. Some of the smaller navies may either have to increase their efforts substantially—which will require significant national commitment—or consider getting out of the game. This will not be an easy choice.

Notes

1. *Defence White Paper 2016* 4.25, p. 90.
2. *Defence White Paper 2016* 4.25, p. 90.
3. http://www.telegraph.co.uk/news/worldnews/europe/spain/10073951/2-billion-Spanish-navy-submarine-will-sink-to-bottom-of-sea.html and https://navaltoday.com/2016/07/19/spain-approves-critical-design-review-of-s-80-submarine/ See also: Stephen Saunders *IHS Jane's Fighting Ships 2016-2017* (Coulsdon, HIS, 2016).
4. http://www.minister.defence.gov.au/2016/04/26/prime-minister-minister-for-defence-joint-media-release-future-submarine-program/.
5. http://adbr.com.au/france-triumphs-in-future-submarine-design-competition/.
6. http://www.minister.defence.gov.au/2016/09/30/first-contract-signed-with-dcns-to-commence-design-phase/.
7. http://www.minister.defence.gov.au/2016/09/30/combat-system-integrator-for-future-submarines/.
8. http://www.abc.net.au/news/2016-09-05/dcns-submarine-leak-'highly-regrettable':-turnbull/7815694.
9. http://www.theaustralian.com.au/national-affairs/defence/local-build-adds-30pc-to-submarine-costs/news-story/d05094789f5920e0c24b09cb15fc4102.
10. http://www.lowyinterpreter.org/post/2016/08/09/French-submarines-and-Australias-21st-century-economy.aspx.
11. http://www.defence.gov.au/casg/Multimedia/Coles%20Beyond%20Benchmark%20Report.pdf.
12. See US Office of Naval Intelligence report: *The PLA Navy: New Capabilities and Missions for the 21st Century* (Washington DC, ONI, 2015), especially pp. 18–20. http://www.oni.navy.mil/Portals/12/Intel%20agencies/China_Media/2015_PLA_NAVY_PUB_Print_Low_Res.pdf?ver=2015-12-02-081233-733.
13. Robert L. Scheina, 'Where Were Those Argentine Subs?' *U.S. Naval Institute Proceedings*, March 1984, pp. 115–120.

Author Biography

James Goldrick is a retired Rear Admiral, RAN. He joined the RAN in 1974, and, after completing an Arts Degree at UNSW Kensington, graduated from the RAN College at the end of 1978. He commanded HMA Ships Cessnock and Sydney (twice), the multinational maritime interception force in the Persian Gulf, the Australian Defence Force Academy (twice), Border Protection Command and the Australian Defence College. He is an Adjunct Professor in the School

of Humanities and Social Sciences at UNSW at Canberra (ADFA) and in SDSC at ANU, as well as a Professorial Fellow at ANCORS at the University of Wollongong. He was a visiting fellow at All Souls College, Oxford University in 2015. He is a member of the Defence Honours and Awards Appeals Tribunal and the Defence Force Remuneration Tribunal. He was a member of the Expert Panel supporting the development of the 2016 Defence White Paper. He was awarded a Doctorate of Letters (honoris causa) by UNSW in 2006. His books include *No Easy Answers: The Development of the Navies of India, Pakistan, Bangladesh and Sri Lanka* and *Before Jutland: The Naval War in Northern European Waters August 1914-February 1915* and, with Jack McCaffrie, *Navies of South-East Asia: A Comparative Study*. Amongst other projects, he is currently working on *After Jutland: The Naval War in Northern European Waters June 1916–November 1918*.

CHAPTER 4

Submarine Acquisition in Japan

Yoji Koda

Abstract Japan has had considerable experience in submarines operations. A historical review of this experience suggests many lessons for contemporary policy makers operating in a challenging strategic context of increased tension in the South and East China Seas, an assertive North Korea, and rising tension between China and the USA. For many years, Japan has presented a model for regular and sustainable submarine acquisition, but now it faces new challenges as it responds to the naval rise of China. One of Japan's responses is to make their hard-won expertise more widely available to possible partners in Southeast Asia.

Keywords Naval modernisation · Submarines · Japan · China's military rise Strategic competition · East China Sea · Southeast Asia

The Japan Maritime Self-Defense Force (JMSDF) has been operating diesel-electric submarine (SSK) since its foundation in 1954. In addition to that Imperial Japanese Navy (IJN) introduced its first Holland-type submarine from the USA in 1905—the same year as the Battle of the

Preface: 100 Years Experiences of 100 Years ¥

Y. Koda (✉)
Japan Maritime Self-Defense Force (JMSDF), Tokyo, Japan

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_4

Tsushima Strait in the Russo–Japanese war. The IJN subsequently built 241 SSKs and had operated the boats for 40 years, until Japan's surrender in 1945.

The main mission of the IJN submarine force before the Second World War, especially in the 1930s, was simple and clear. That was to conduct anti-surface engagements using the legendary "Long Lance" torpedo against the US Pacific Fleet—especially its battleship forces transiting from their main bases in Pearl Harbor, Hawaii, or the West coast of the US Mainland, to the Philippine Sea and/or Japanese waters. The IJN, whose battleship force was only 60% of the size of the US Navy, as enforced by the Washington Naval Treaty of 1922, tasked the Combined Fleet's submarine force to conduct a series of repeated torpedo attacks against the westbound US battleship force, prior to the expected big-gun engagement closer to Japan.

However, the progress of the Second World War in the Pacific was very different from the scenario that IJN envisioned before the conflict started. This included submarine operations. Except for some successful engagements against the US Fleet, most of which happened in waters around Guadalcanal and the Solomon Islands in the southwestern Pacific in 1942, the Combined Fleet's submarines were employed in many transport missions to isolated Japanese-occupied islands in the Solomons, from August 1942 and until the US Navy's complete victory in the night engagement of the battle of Cape Saint George in November 1943.

As the US forces' counterattack operations against Japan progressed in the Solomon Islands, the Combined Fleet started losing its air superiority, at first gradually and then much more rapidly. Due to the fading air superiority, the Combined Fleet's surface forces operating in those areas started suffering severe casualties that seriously weakened its overall operational capabilities.

Even so, the IJN still had one indispensable mission in those days, to conduct a series of supply operations to Japanese-occupied remote islands located at frontline and/or those which were left behind, in waters controlled by the US-controlled waters. For the IJN, in 1943 and afterward, these supply operations to isolated islands were only made possible by using its submarine force. Only submersible vehicles could safely navigate and maneuver under the overwhelming US airpower in these operational theaters.

However, for the Combined Fleet's submarine force, these transport operations were totally unplanned and unprepared missions, and the

force started losing some of its best trained boats, which were, once, counted as one of the most reliable assets against the US Pacific Fleet. While the IJN's submarine force was employed in indispensable transport operations, which were most unsuitable missions for fleet submarines, the force started suffering attrition in quantity in the later months of 1943.

Another factor in the IJN's submarine operations in the Second World War was an operational development that eventually became a real game changer in anti-submarine warfare (ASW) operations in the Pacific. Improvements and adjustments made by the US Navy were deathblows to the Combined Fleet's submarine force. By late 1943, the US Navy had transplanted to the Pacific the new ASW equipment and tactics which had been developed in the Battles of the Atlantic, which were the real causes of the Allied victory over German U-boats.

Ironically, as casualties of once formidable IJN aviation forces had accumulated to a dangerous level through a series of combats and engagements, from Midway to the Solomon Islands, the Combined Fleet had no other options but to shift its core striking force from exhausted aviation units, to the relatively still-capable submarine force, in late 1943. For example, the Combined Feet, for the first time, deployed large numbers of submarines for ambush and intercept operations against US carrier task force and invasion units operating near the Gilbert Islands, since only a limited number of land-based aircraft were available to attack the US invasion forces from nearby islands. However, in spite of a huge predeployment estimate and high expectations for the submarine forces, many of the boats were sunk. Because of the large losses, moreover, there was no way to confirm the damage that the deployed submarines had inflicted US forces invading the Gilbert islands. Even worse for the Combined Fleet was that the real casualties of its submarine force—losing of six fleet submarines out of nine deployed for the operation—turned to be extremely serious.

These boats were the first victims of IJN's submarine force, in quantity, hunted by the US Navy's ASW forces using new operational concepts. This marked just the beginning of the full demise of the IJN's submarine force 20 months later.

There was another serious problem in the Combined Fleet's inability to gain lessons learned. Due to the large loss of the boats, the Combined Fleet could not receive sufficient post-action reports, in terms of both quality and quantity. Therefore, only extremely limited information about the US Navy's new ASW capabilities was reported by the surviving

boats. So, the Combined Fleet had no idea about the real reasons for the huge losses of its best boats, which had been expected to be used as "trump cards" against the US fleet. Thus, the IJN failed to draw practical lessons to counter the US Navy's new ASW operations.

Unfortunately, the Combined Fleet, ignorant of the US Navy's ASW improvements, simply employed the same operational doctrines in subsequent major naval engagements at Mariana Islands (lost 17/deployed 29) in June 1944 and the Philippines Archipelago (lost 7/deployed 14), in October and November 1944, respectively. In those operations, the submarine force had failed to establish their strategic goals, i.e., repelling US invading forces and protecting the islands by destroying the US Navy's major units—especially aircraft carriers and transports. Instead, the IJN submarines were annihilated in a series of Pacific Island battles.

By 1945, the Combined Fleet's surviving submarine force was very low after a huge attrition of its force in 1944, and those boats were deployed to defend against the US invasion of Okinawa, from April to June, but practically gained nothing.

Instead, the final attempt and struggle of the submarine force in 1945, was marked by a shift from ordinary anti-surface operations using Long Lance torpedo, to attacks using "manned torpedoes." The torpedo system used for this operation was a modified Long Lance with one-skipper's seat, and was named "Kaiten" (reverse), with the strong hope of changing the flow of the tide that was most unfavorable to Imperial Japan at that time.

The earlier failure to stop US counterattacks both in Solomon Islands and in mid-Pacific Islands theaters eventually forced the IJN and the Combined Fleet to shift their main tactics from ordinary attacks to special operations by manned weapons. The well-known "Kamikaze" was a name for the special attack units in Japan's aviation forces, but the IJN also conducted manned attacks in all branches of the service. Kaiten was the name for the submarine force.

For Imperial Japan in 1945, all of the last-gasp attempts to stop the advance of US and Allied forces failed, and thus, the decisions to terminate the war and to surrender were made in mid-August in 1945. In summary, the IJN operated 156 submarines during the campaigns of the Pacific war and lost 127 boats at the cost of about 11,000 crew members.

The Success of US Navy Submarine Operations

In contrast to the IJN's unsuccessful submarine operations, those of the US Navy were extremely successful, especially in the interruption and destruction of the Sea Lines of Communication (SLOCs) of resource-poor Japan. For Imperial Japan, uninterrupted flow of natural resources, foodstuffs, and troops was a fundamental condition for its war efforts and national survival. So, the security of SLOCs was the clear Achilles' heel of Japan. The US Army and Navy wisely identified Japan's fatal weak spot and conducted unconditional submarine warfare against Japan's shipping from the very beginning of the war in December 1941.

In this way, losses to Japan's shipping caused by the US Navy's submarine forces had started accumulating gradually during 1942, when the IJN still maintained operational momentum in the combat theaters, and then rose rapidly from mid-1943, when the US Navy began wresting operational control from the Japanese. In this manner, the casualties in both Japan's naval and merchant shipping had reached unrepairable levels by mid-/late 1944 and started to negatively affect both the war efforts and peoples' lives in Imperial Japan's itself.

Below are losses of Japan's merchant ships, in each year, in gross tons: 1942, 600,000 tons; 1943, 1,400,000 tons; 1944, 2,500,000 tons.

Due to the essential disappearance of Japan's merchant shipping fleet following the loss of the Philippines in early 1945, Japan lost its wartime industrial manufacturing capabilities, and the average calories consumed per adult in July of that year, i.e., after the fall of Okinawa, was estimated to be below 1000 kcal/day, which raised the fear of the start of mass civilian deaths through starvation. This cold reality was another key factor involved in Imperial Japan's decision to terminate the war.

Lessons of IJN's Failed Submarine and ASW Operations in the Second World War

Japan drew five essential lessons from the experience of the Pacific war, namely:

1. For Japan, as a resource-poor nation, SLOC security is the highest priority for national survival.
2. Among all the naval warfare areas, ASW should be the most important one for Japan.

3. Technological advantage, in both ASW and submarine warfare, is the key for successful naval operations. In particular, for example, the new ASW capabilities in which IJN was far behind the standards of the Allied nations, such as radar, CIC, sonar, and submarine torpedo fire control system (FCS), were systems which Japan should have developed and used, at any cost.
4. With regard to ASW, air and surface ASW, using the best and most modern equipment and tactics, will be the key for future survival of our island nation from potential commerce raiding by a potential adversary.
5. The importance of gathering intelligence on an adversary's equipment technologies, operations, and tactics, as well as code-breaking, which was a hidden but a real contributor to the allied victory in the Second World War, should be recognized.

The Postwar Revival of Japan's Submarine Force

Japan's surrender in August 1945 brought the total demobilization of the once-powerful IJN, and the Combined Fleet was abolished. The submarine force was not an exception, and all the few surviving boats were examined technically by US Navy teams, before being sunk. Submarine-related shore facilities were also thoroughly dismantled, in order to disable Japan's future rearmament. Therefore, the flow of Japan's "submarine blood" was interrupted for some time.

But, after a 9-year gap, Japan's new navy, called the Japanese Maritime Self-Defense Force (JMSDF), was established in 1954. Thereafter, the JMSDF worked hard to start up various programs for the reconstruction of new maritime forces in surface, air, submarine, and mine countermeasures (MCM) branches. Upon rebuilding the JMSDF's new capacity and capability, precious lessons gained from the extremely high cost of the combat operations of the Second World War were fully implemented with the highest attention and determination. These lessons became the firm building blocks for the JMSDF's future strategy and force buildup plans.

With regard to the submarine force, the JMSDF received one of the US Navy's Second World War vintage "Gato" class boats—USS *Mingo* SS-261—on August 15, 1955, at the US Navy base in San Diego, California. This was the birth of the JMSDF's submarine force. In this context, August 15, 2015, also marked the 60-year anniversary of the JMSDF's submarine history. Thus, the US Navy's submarine blood was

transfused into the once interrupted blood flow of Japan's submarine community at that time. The year 2015 also marked the 100 years anniversary of Japan's submarine history, i.e., 40 years in IJN and 60 years in JMSDF.

The JMSDF has built nine classes of submarines, totaling 51 SSKs, since 1955—and, as of June 30, 2016, 17 operational and 2 training diesel submarines are in commission. However, the way the JMSDF operates its submarine force is much different from that of the IJN. The main mission of the JMSDF's submarine force has been the conduct of ASW operations against adversary submarine forces.

The US Alliance: A Strategy of Shield (JSDF) and Spear (US Forces)

Due to the Government of Japan's interpretation of Article 9 of the Japanese Constitution (sometimes called the "Pacifist Constitution"), the Japanese Self-Defense Force (JSDF) has been prohibited from possessing the capability to conduct strategic strikes on enemy territory, which elsewhere is considered a core operational function for the deterrence and termination of war. This restrictive defense policy has caused the JSDF to be developed solely as a protective force, without any significant power projection capabilities.

In order for Japan, under its Pacifist Constitution, to make up for this fundamental inherent defect, it has agreed with the USA to introduce a unique strategic mission-sharing concept between the JSDF and US forces within an alliance framework. This structure has been called the "Spear and Shield" relationship, since the beginning of the Japan–US Alliance. The meaning and concept of this "Spear and Shield" relationship is that the missions of the JSDF are focused on strategic defense operations, which also include protection of US forces, in and around Japan. This posture relieves the US forces from conducting defensive operations of Japan, when aggression against Japan is attempted.

At the same time, US forces will conduct strategic power projection operations against the enemy's homeland/territories and invading forces, to bring the war to an end. Even in peacetime, because of the JSDF's responsibilities of homeland defense, this posture provides the USA with political and operational flexibilities to deploy its forces to any crises in the region or to operate from forward-deployed bases in Japan to establish its national objectives.

Based on this concept, the military strategy of the JSDF has been to build and maintain the defense posture of Japan by close cooperation between the JSDF and US forces under the Japan–US alliance. Exceptions would be the outbreak of a military conflict, or aggression of a small and limited size against Japan, and in those cases, the JSDF should be solely responsible for taking appropriate military measures to defend Japan. Therefore, the operational concept of the JSDF and US forces has clearly been complimentary mission sharing, in which US forces maximize their offensive operations, while the JSDF maximizes their defensive operations. This is the fundamental essence of the so-called Spear and Shield relationship between the JSDF and US forces.

The Main Mission of JMSDF: SLOCs Protection Supported by ASW Capability

With regard to maritime operations around Japan, SLOC protection has always been a key mission of JMSDF. In order for Japan, which is without strategic strike capabilities, to receive US reinforcements from across the Pacific Ocean and to guarantee safety of US naval forces operating around Japan, as well as to have carrier strike groups (CSGs) of the US Navy concentrate on strike operations against enemy naval forces and land targets, ensuring the safety and security of waters around Japan, would be the most important mission for the JMSDF. At the same time, for Japan, as a country of poor natural resources and food, the safety of merchant shipping should also be continuously maintained for national survival, not only in peacetime, but also in crisis or wartime. In Japan, all of these operations are defined as the protection of "SLOCs" in the northwest Pacific. By fully recognizing these simple realities, the JMSDF sets clear strategic objectives from this point of view and defined its missions.

In this context, the main missions of the JMSDF have consistently been the protection of SLOCs and then homeland defense, in case of the threat of direct invasion to Japanese territory by enemy ground forces. In support of this defense strategy and its two main missions, the JMSDF has set ASW as its main task. It is needless to say that in developing its maritime strategy and defense concept, the JMSDF has fully incorporated into its new strategy the hard but precious lessons learned from the bitter experience of the Second World War in the Pacific.

The operational concept under the Japan–US Alliance was that in case of a national or regional contingency, the US Navy would deploy CSGs into the seas around Japan and/or western Pacific, and maximize its strike capability, which was lacking in the JMSDF, to deter an enemy from invading Japan and/or attacking the SLOCs around Japan. A key to this initiative was to exclude firmly the enemy's submarines, which could be the greatest threat to disturb CVSG operations in Japanese waters. Also, in order to secure the safety of SLOCs around Japan, submarines were considered to be the most difficult threats to deal with.

As a result of this concept, with these two missions as a premise, ASW became a main pillar for the JMSDF to achieve its missions. Even in the present security environment, 25 years after the end of the Cold War, the basic two factors: i.e., the Japan–US Alliance and Japan's deep dependency on imported natural resources, are unchanged—so, the protection of SLOCs in this regard has continued to be the main mission for JMSDF, up to today.

In addition to these operational missions, Japan has been providing various military facilities to US forces in and around Japan. This division of labor between Japan and the USA may look unbalanced, but really forms a functioning and complementary strategic relationship, both in the bilateral operations theater and in mutual support arena, under the "Shield (JSDF) and Spear (USF)" concept.

Tailored ASW as a Basic Force Building Concept of the JMSDF

Within this framework, the JMSDF has set anti-submarine warfare (ASW) as its most important mission priority to achieve its main objectives, SLOC protection. In the JMSDF's mission definition, SLOCs protection comprises two major elements:

1. Operations to maintain safety of maritime transportation, and
2. Support operations for US naval forces being engaged in the defense of Japan and the region.

Under this concept, since its formation in 1954, the JMSDF started building up all its forces in various operational branches, such as surface,

air, and submarine forces, to serve as custom-made ASW forces. The only exception to this was the MCM force.

In its National Defense Program Outline (NDPO) in 1976, the Government of Japan set targets for the force strength of the JSDF's three component services and those of JMSDF are listed below.

Surface Force
Four Escort Flotillas: 1 DDH, 2 DDGs, 5 DDs with 8 ASW Helicopters
Ten Escort Divisions: 3 DD/FF for coastal ASW operations
Total: 60 plus Destroyers and Frigates

Submarine Force
Six Submarine Divisions: 2~3 SSs/Division for Choke Point ASW
Total: 16 SSs

Fleet Air Force
Eight Fixed-wing ASW SQDNs
Eight Helicopter ASW SQDNs
Total: 100 Fixed-wing ASW Aircraft and 100 Helicopter ASW Aircraft

The target force levels above clearly show the fundamental nature of the JMSDF as an all-dedicated ASW force to protect Japan's SLOCS.

1960s and 1970s: A Time of Training

In order for the JMSDF to become a real ASW force, it was clear that for the training and readiness of related units—i.e., surface and fleet air forces—it was essential to have good and tough targets/adversary forces available for them to practice against in various exercises. This was the initial rationale for JMSDF to introduce its first submarine in 1955. So, the JMSDF started building a few small SSKs in the early days. For example, in the 1956 ship construction program, the JMSDF built a single domestically designed SSK[1] (1100/1400 ton: Note-1), and thereafter two classes—totaling four small SSKs (750/950 ton)—followed in the 1959 and 1960 programs.

At the same time, the JMSDF, even immediately after its foundation, had a strong intent to build a robust functioning SSK force in order to cope with future maritime threats from the Soviet Pacific Fleet, under the Japan–US Alliance umbrella. In this regard, producing a large number of well-trained submariners, over a short period, was one of the key elements

in realizing this objective. These five small boats, which were relatively low level in their performance compared to international standards at that time, really contributed to realize this goal, and almost all submariners of JMSDF in 1970s and 1980s were trained and qualified in them.

1970s–1980s: First Real Mission Capable SSKs

From 1961 and after, the JMSDF started building relatively large SSKs—totaling five boats (1650/2250 ton) for its first practical missions. Hull design was low underwater drag conventional, but non-teardrop type. This class was designed to meet surface and subsurface maneuvers and to establish missions.

The SSK forces might be counted as having the capability to attack firstly Soviet surface forces transiting from the Sea of Japan to the Pacific Ocean through three strategic straits in and around Japan or, secondly, Soviet landing forces approaching Japan's mainland.

However, the JMSDF at that time still remained in a growing stage as an ASW navy, and the main role of these larger boats in peacetime was to serve as tough-to-detect and die-hard targets for friendly ASW forces. Thanks to these boats, with better performance than the initial five small boats, the ASW capability of JMSDF greatly matured in comparison with US Navy standards. The JMSDF was steadily becoming a capable force to support its allied partner, the USN 7th Fleet, in this period.

1970s–1990s: Using Technology to Become a Real ASW Force

In this period, the US Navy, which was an all-nuclear propulsion submarine navy, fully shifted to "teardrop" or "cigar"-like-shaped boats, with a single propulsion shaft to improve underwater maneuverability. This design also realized an idea to install a huge spherical/cylindrical sonar at the bow, to improve the boats' acoustic performance, and this was a critical factor for enabling more effective submarine ASW than before.

In the mid-1970s, the Soviet Union's growing submarine force in the Pacific was recognized as a major threat to the JMSDF and the US Navy. Therefore, the JMSDF reviewed its ASW concepts to meet the situation and launched a series of robust 5-year force development programs after 1977. This is exactly the time when the Government of Japan issued its

first NDPO with an ambitious force strength target, as mentioned above. The main force structures to meet this objective were:

1. 100 P-3Cs for wide-area ocean surveillance and ASW,
2. 60 Destroyers for escort operations for high-value units, and
3. 16 Submarines for controlling three strategic Japanese straits, against the Soviet Pacific Fleet.

It was clear that the main operational objective of this force structure was to make JMSDF a real ASW force.

Fully recognizing the advantages of new hull designs and original ASW missions, JMSDF started constructing three classes of teardrop-hulled boats. The first group of seven boats (Uzushio class: 1850/2400 ton) were built, starting in 1967. From 1975, an enlarged and improved class of ten boats (Yushio class: 2200/2900 ton) were built. One noteworthy improvement on this class was made by introducing a Harpoon launch capability, and Harpoon missiles were installed as standard equipment from the fifth boat of this class and after.

Following the second class, the JMSDF started construction of further improved SSKs with the same teardrop style, but a slightly larger hull, in 1986. The displacement of the new class (Harushio class) had reached 2450/3200 ton, and seven of these boats were built from 1986 to 1992. Submarine towed array sonar (S-TASS) was installed on this class, for the first time in the JMSDF, in order to improve their ASW capabilities.

These three classes of SSKs, especially the second and third classes, became the first real ASW capable submarines in JMSDF history and were postured against the SSKs/SSNs of the Soviet Pacific Fleet. Their operational concept was to patrol and ambush adversary units at three strategic straits in and around Japan.

And After: Fully Matured ASW and Multi-Mission SSKs

In the second half of the 1980s, lessons from the previous three classes of real ASW SSKs with teardrop hull were fully examined, and new operational requirements for follow-on boats were developed. The new boats, which tried to meet all of the emergent operational requirements, were planned and designed, and the first boat was authorized in JFY

1993 as JS *Oyashio*. This class displaces 2750/3500 ton. Prominent features of this class are:

1. Combination of single hull (central part) and double hull (fore and after parts) with cigar-shaped design,
2. Fully digitalized and integrated command and control system, and new sonar system with rubber dome and flank arrays,
3. Installation of acoustic tiles, and
4. Introduction of further improved noise reduction measures.

In total, six boats were built, and all of them are still operational and in fleet service. Additionally, a newly developed Type 89 torpedo, which is considered to be an equivalent with US Navy's Mk-48, was introduced for this class. This torpedo really enhanced attack capabilities of the Oyashio class.

In this period, the JMSDF initiated a new program to introduce an air-independent propulsion (AIP) system that was expected to make up for the inherent inferiority of underwater endurance of the diesel-electric submarine. After intense paper examinations, the JMSDF selected Sweden's Stirling engine (SE) as an actual power plant for evaluation and testing, and imported one set. Then, JMSDF spent 2 years shore-testing this AIP system.

Then, an 8-meter (26 feet)-long hull compartment, carrying four sets of SE and oxygen tanks, was inserted into the main hull of JS *Asashio,* the last boat of the Harushio class (2450/3200 ton), and a precise and in-depth shipboard test was conducted for another 2 years.

After solving all the problems and malfunctions found in the tests, the safety and reliability of the SE were certified and confirmed for operational use. Then, the plant was finally authorized to be put into the follow-on Soryu-class submarines. This class is an improved version of the Oyashio class with new integrated sonar and combat systems.

One of the reasons why construction of Oyashio class was terminated only at the sixth boat was an estimate that this long-waited SE-AIP system would be available in time for the JFY-2004-construction boat, and the JMSDF shifted from Oyashio design to a new hull in order to accommodate putting the SE onboard. SE at this time was really considered to be a game changer in submarine's ASW operations for the coming years.

JS *Soryu* (2950/4200 ton) was funded and built in the JFY 2004 program, and six sisters are now in fleet service, and four are under construction. Then, from the JFY 2015 boat (the 11th boat in the series), a newly developed lithium-ion battery system will replace the SE, while maintaining all the other systems of the original Soryu. Thus, the boat with a new battery is still designated as a Soryu class.

AIP or the Lithium-Ion Battery: Potential and Problems

There are several AIP systems for submarines in the world today; however, when all the merits and demerits of each type of AIP are taken into account, SE and fuel cell (FC) have the most potential for future use in SSKs. Thanks to its high reliability, low life cycle cost, and low initial purchase cost, SE has a good chance to survive the race. However, due to its fully matured status in technology as an AIP, there will be little room left for SE to realize future growth or substantial improvement in its performance.

By contrast, FC is still less matured in technological development than SE, but areas of applications for FC in non-military markets, such as automobiles and household appliances, have been expanding quickly in the world. So, FC-related industries and other research organizations have been allocating a lot of resources for development efforts in order to improve its reliability and endurance, as well as reduce costs. These have resulted, for example, in the introduction of new catalyst and hydrogen storage alloys. Thus, FC has greater development potential as a submarine-installed AIP system in the future, compared to SE.

Having said this, however, in JMSDF's experience, AIP has not turned out to be a game changer, as originally expected, in underwater warfare from operational point view. A key element of this issue is the fact that AIP is really an air-independent engine, but at the same time, AIP is an oxygen-dependent engine too, so running out of the oxygen, that has to be carried onboard means the end of AIP for that patrol. When this happens, AIP becomes only extra deadweight and takes up space for no further use in SSK operations.

Especially and hypothetically, the average endurance of the two types of AIPs onboard today's diesel boats (2–4000 tons) is said to be about 3 to 4 weeks, and this is about one-quarter of the average general

deployment period (i.e., about 3 months, depending on the type of mission) of ordinary SSKs. In this case, an SSK normally allocates about 1 month each for deploying to and from its patrol area, and keeps the rest of 6 to 8 weeks for operations on station. As such, a deployed SSK can only use AIP for about half of the on-station period, and for the remaining half of the operation, it depends on conventional lead batteries. The weight and space of onboard AIP in this lead battery-driven period simply becomes a drag-generating element and makes no operational contribution. In addition to this, extremely weak power output limits operational maneuvers at high speed, so loading of additional lead batteries as backups is normally required to make up for this limitation, but requires additional weight and space as well.

In summary, a decision on the appropriate use of AIP and lead batteries is a key for success of operations and survival of the boat, and in this regard, AIP partially solved problems of conventional diesel-electric submarines, but not fully. This is the reason why the JMSDF is reevaluating SE and getting rid of over-expectation on SE as a game changer in underwater warfare.

The only solution for this problem is to develop a new super high-performance battery that replaces both SE and lead battery systems. The answer to this problem is the rechargeable lithium-ion battery with much higher performance capability than lead battery.

With regard to lithium-ion battery, the JMSDF and battery manufacturing industry have spent about 10 years for its development, first as a future potential replacement for conventional lead battery. As the JMSDF has accumulated AIP experience, it has also conducted years-long evaluation tests between SE and lead batteries propulsion systems, and lithium-ion system. JMASF came to a conclusion with strong confidence that the latter had certain degrees of advantages over the former in various evaluation elements that were mentioned above. This is the background reason for JMSDF's shift from AIP Soryu at the tenth boat to all lithium-ion Soryu from the eleventh boat.

For the JMSDF, both Oyashio-class and Soryu-class submarines are the two most satisfactory boats to date in all aspects. Keeping ASW as their primary mission, these 17 boats (and 22 boats by the early 2020s[2]) of two classes are capable of conducting all JMSDF tasks, such as ASUW, strategic surveillance, intelligence collecting, and support for other branches of JSDF services.

Conclusion

As the strategic environments in Asia Pacific region change, so do the operational concepts of the JMSDF submarine force, while keeping ASW as its main mission. In order to meet today's security challenges, the JMSDF's submarine force is shifting its traditional mission of choke points control from northern Japan to southwestern Japan. Also, it is clear that maritime operations around the Japanese archipelago that surrounds the East China Sea will be more important than before.

So, the JMSDF decided to increase the number of its submarines from 16 to 22 in 2010. This enlarged force will provide a good deterrence force for Japan against neighboring nations by its chokepoints control and ASUW capabilities. Even a large surface combatant, such as an aircraft carrier, could be severely damaged and eventually be sunk by an anti-ship missile and torpedo attack by submarine(s) which might inflict killer flooding in the ship.

However, in order for the JMSDF to maintain the high quality of submarines, which have been treasures of JMSDF, the tempo of submarine expansion should be incremental, roughly, to build about one boat every year. This is the bottom line to keep real war fighting capability balanced with operational safety in the JMSDF submarine force.

Recently, Japan's submarine community was involved in the recent bidding for the next-generation submarine of Royal Australian Navy (RAN). The final year-long decision of Australian Government to select France's proposal was a matter influenced by Australia's domestic political situation and a sovereign matter for that country. As such, there is no room for Japan, which was one of three bidding nations and a loser of the game, to raise any objections to a decision made by Australian people. So, whatever the hard and sincere challenges Japanese team made through the process to achieve victory, Japan clearly accepts the Australian decision and is happy to respect the decision. Japan sincerely hopes that the Franco-Australian project succeeds and that the next-generation boat will be totally successful. The new boat will surely enhance and improve the multilateral operational posture between Japan, USA, and Australia to meet future challenges against the stability of the Indo-Pacific Region. The last thing Japan would want to do is to weaken our decades-long close relationship with Australia. We should not make any political gift to any willful third nation in the region.

Lastly, I would like to introduce my strong belief and confidence in the JMSDF's submarine force, as a former CinC JMSDF Fleet. Without a well-trained submarine force, real capable surface and air ASW forces are impossible. Without real capable surface and air ASW forces, a real combat and capable submarine force is also impossible—and the overall force structures, strategy, and missions of JMSDF have been developed to fully realize this concept for more than 60 years.

Today, the JMSDF's surface and fleet air force are the world's best ASW forces both in quality and in quantity, and our SSK force is the best in the world.

In addition to them, there is one more thing that improves and polishes our submarine force that is Japan's geographical features. In other words, Japan's proximity to former Soviet/Russia, North Korea, and China will always shape and train the JMSDF's submarine force. In particular, Russia and China will always conduct their own ASW surveillance against JMSDF's boats, all the time, at any area around Japan. For the JMSD submarine, once it gets underway, it has no other option but exposes itself to the ASW forces of those two navies. In this context, the operational environments of JMSDF submarines have been most suitable to train and raise real combat-ready submariners, who have sufficient experience of being the object of intense ASW surveillance from unfriendly navies, for more than half a century.

If I take all the elements discussed here, I as a former CinC FLT have a strong confidence and pride, which is not a rootless self-conceit, in the JMSDF's submarine force.

Notes

1. Displacements of each class in this article are standard/submerged. Source: Sekai-no-Kansen (Ships of the World), September 2015 (p. 821). The Definition of JMSDF Standard Displacement is Full-load Displacement—(minus) Fuel, Freshwater, Munitions, Crew, and Consumables.
2. In the National Defense Program Guideline of 2010, the Government of Japan decided to increase the number of submarines in the JMSDF from 16 to 22, in order to meet regional security situations.

Author Biography

Yoji Koda (VADM (Ret.)) Admiral Koda was in the class of 1972 at the Japan Defense Academy and spent 36 years in the JMSDF as a qualified Surface Warfare Officer. He took various command billets, including Commander-in-Chief JMSDF Fleet, and his last shore staff assignment was as Director General for Strategy, Plans and Policy in the Maritime Staff Office. After his retirement, he spent 2 years as a Senior Fellow at the Asia Center, Harvard University, focusing on PLA Navy strategy and is currently serving as an advisor to the National Security Bureau.

CHAPTER 5

Submarine Acquisition in Indonesia

Ristian Atriandi Supriyanto

Abstract The reasons for submarine acquisition in Indonesia are explored against the general strategic context in Southeast Asia and the country's unique approach to the challenges it identifies is demonstrated, not least through the concept of Indonesia as a Global Maritime Fulcrum. The contribution that submarines are thought to make to Indonesia's security is discussed and the technological, economic and demographic problems their acquisition poses are identified.

Keywords Naval modernisation · Submarines · Indonesia · Global Maritime fulcrum · Stability in Southeast Asia

Submarines, have been, are and will be central to Indonesian naval development. In commemoration of the 50th anniversary of the Indonesian Submarine Corps (*Korps Hiu Kencana*), Indonesia's then Defence Minister Juwono Sudarsono wrote in December 2008 that "irrespective of the country's financial situation, the Indonesian military, (TNI) must acquire submarines because of their excellent deterrence value".[1] Indeed, on 24 March 2016, South Korean shipbuilder Daewoo Shipbuilding and

R. Atriandi Supriyanto (✉)
Strategic and Defence Studies Centre, Australian National University, Acton, Canberra, ACT 2601, Australia
e-mail: arasfor145@yahoo.co.id

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_5

Marine Engineering (DSME) at its Okpo shipyard launched the first of the three Type-209/1400 diesel-electric submarines, KRI *Nagabanda,* the Indonesian Navy had ordered in December 2011.[2] Costing around USD1.1 billion in total, the three submarines represent an enhanced version of the South Korean *Chang Bogo* type. Shortly thereafter, Indonesia also announced that it would build a third submarine base in the Natuna Besar Island, the largest island in the Natuna Islands located in the South China Sea.[3] This submarine base will be paired with Indonesia's ambitions to acquire up to twelve new submarines as was outlined in the 15-year military modernisation programme beginning in 2010.

Indonesia's submarine acquisition is by no means unique in the region. In 2011, *Jane's Navy International* estimated that Southeast Asia would acquire at least 13 submarines by 2020.[4] Yet, the persistence of Indonesian submarine ambitions begs some fundamental questions: Why did Indonesia acquire and continue to operate submarines? How do submarines fare in Indonesia's naval strategy? What are the challenges and implications of Indonesia's submarine ambitions to regional stability? This chapter argues that three imperatives underline Indonesia's decision to continue operating submarines: historical experience, geographical context, and the concept of "strategic funnels". It cautions, however, that these imperatives do not make Indonesia immune to the operational and strategic challenges common to other submarine operators.

Historical Experience

The continuous service of Indonesian submarines and the important roles they played in history left a deep and long-lasting impression in Indonesia's naval traditions. Indonesian submarines were involved in major operations that remain pre-eminent in national historical narratives. The importance and contributions of Indonesian submarines in these events have created the imperative to retain them: since submarines were important in the past, they are important at present and will remain so in the future. Relinquishing the submarine would be tantamount to betraying the critical roles it played in Indonesia's history.

Compared to other Southeast Asian navies, with almost six decades of experience, Indonesia is the region's longest submarine operator. After Thailand decommissioned its *Matchanu*-class in 1951, Indonesia became the first Southeast Asian submarine operator with the two *Whiskey*-class boats acquired from the Soviet Union via Poland in 1959, the RI *Tjakra* and *Nanggala*. Ten more *Whiskey* boats followed until

1962: RI *Trisula*, RI *Tjandrasa*, RI *Nagarangsang*, RI *Nagabanda*, RI *Wijajadanu*, RI *Hendrajaja*, RI *Pasopati*, RI *Tjudamani*, RI *Bramasta*, and RI *Alugoro*.[5] The acquisitions of these boats came as part of Indonesia's naval modernisation drives during the 1950s and 1960s that sought as much foreign assistance as the navy could possibly get.[6] These boats arrived when Indonesian President Sukarno's regime was confronting the Netherlands in the territory of West Irian (West New Guinea) in 1961–1963.

The *Whiskey* experience left a profound legacy in Indonesia's naval history. Since Indonesia was the largest single submarine operator in Southeast Asia, the *Whiskey* boats conjured up a sense of past prestige that motivates Indonesia to keep operating submarines at present. One Indonesian admiral wrote that the twelve *Whiskey* boats made the Indonesian Navy "one of the most powerful naval forces in the Asia-Pacific region—making it a regional power and serving as a source of pride and confidence for her people…Having learned from its previous experiences, the Indonesian Navy has planned to gradually increase the size of its submarine force in the years to come".[7] Anyone can easily dismiss the admiral's claim. But the truth in his claim matters much less than what he and other Indonesians perceive to be true. In the same way, Indonesia likes to reminisce about its erstwhile blossoming military cooperation with the Soviet Union/Russia, the *Whiskey* experience, as with other Soviet arms Indonesia imported, "might have become rather romanticised over time, but nevertheless, it occurred when Indonesia's conventional military strength was at its height".[8] Without its submarine fleet, the navy would feel devoid of a status that it once enjoyed.

The advent of the New Order government in 1967 under the anti-communist Army General Suharto led to the deterioration of Indonesia's relationships with the communist countries. Technical support and maintenance for Soviet naval armaments became available only on a commercial basis which Indonesia could not afford. Australian intelligence assessed in 1969 that without support from a major power, such as the Soviet Union, "the size and effectiveness of the Indonesian navy will continue to diminish" with "few ships capable of putting to sea and even fewer with serviceable weapons and electronics system".[9] At most, the form and scale of attack involving Indonesian submarines would be small-scale raids, infiltrations, and mining operations in and around the Island of New Guinea and Australian northern waters. The capability of *Whiskey*-class submarines gradually deteriorated until the last of the

class, KRI *Pasopati*, was retired in January 1990. But before *Pasopati* was officially retired from service, the Indonesian government had purchased two *U-209*-class boats from the then West Germany, KRI *Cakra* and KRI *Nanggala*[10] in 1981–1982. KRI *Cakra* and KRI *Nanggala* remained Indonesia's only submarines as of April 2016.

Although DSME refurbished the *U-209* boats, the Indonesian navy reasoned that more submarines were needed for patrols. Earlier plans to procure six second-hand Type-206 boats from Germany, however, were shelved soon after the 1997 Asian Financial Crisis hit Indonesia hard.[11] In 2005, the navy submitted its "Green-Water Navy" proposal to achieve a 274-ship proposal that was later incorporated into Indonesia's military modernisation plan beginning 2010: the "minimum essential force" (MEF). Divided into three stages (2010–2014, 2015–2019, and 2020–2024), the MEF plan outlines Indonesia's ambition to acquire up to twelve submarines by 2024.[12] After it had shown initial interest in the Russian *Kilo,* German–Turkish enhanced *U-209*, and French *Scorpene*, Indonesia finally decided to opt for the South Korean Type-209 *Chang Bogo*. The decision was intriguing, for the *Kilo* boats were what the navy really wanted since Admiral Slamet Subijanto became chief in 2005. According to Soebijanto, the desire for Russian boats owed to their "formidable reputation" and competitive prices, in addition to the "historical" attachment to the *Whiskey* during Indonesia's naval heyday in the early 1960s.[13] By October 2006, the navy had submitted a proposal to the Indonesian to procure twelve Russian submarines, including four *Kilo* and two *Amur* class by 2024.[14] Even after Indonesia decided to opt for the Korean Type-209, the navy still keeps the *Kilo* option on the table for the acquisition of the six to eight remaining boats planned under the MEF.[15] The decision to go with South Korea probably owed to the Koreans' offer with more quantity for money compared to other bidders.[16]

Moreover, Indonesia is no stranger to Korean naval shipbuilders. In the 1970s and 1980s, Indonesia ordered from Korea's Tacoma Masan four fast attack craft (*Mandau*-class) and six landing ships (*Teluk Semangka*-class). Indonesia also bought from DSME a *Makassar*-class landing platform dock (LPD) in 2000 and licence-built four more in 2007–2011. Being Seoul's single largest overseas defence export to date, the contract for the *Nagahanda*-class also came with "offset" policy to train 206 Indonesian naval engineers from PT-PAL at DSME shipyard who will build the third submarine in Indonesia.[17] Having overhauled

KRI *Cakra* and KRI *Nanggala,* respectively, in 2004–2006 and 2009–2011, in November 2015 DSME also submitted its bid for the maintenance, repair and overhaul (MRO) for KRI *Cakra* to enable it to operate until 2024.[18]

The fact that the Indonesian submarine fleet has been operating continuously since 1959 also gave it the chance and experience to assume a multitude of roles; some of which are more usually reserved for surface forces: intelligence gathering, special commando operations, naval diplomacy, and constabulary missions (see Fig. 5.1). Due to their stealth, intelligence gathering constituted the main role for Indonesian submarines as attested during the West Irian (West New Guinea) dispute against the Dutch, the Confrontation against the British-backed Malaysia, and the deployment of International Force in East Timor (INTERFET).

Intelligence was critical to identify the operational patterns of enemy warships in preparation for hostilities and to support covert amphibious infiltrations of commandos into enemy territory. In July 1962, for instance, six submarines were dispatched to gather intelligence on Dutch shipping traffic between Hollandia (now Jayapura) and Biak where most of their forces were concentrated.[19]

At the height of the Confrontation in September 1964, RI *Alugoro* observed the transit of Royal Navy task force led by HMS *Victorious* through the Lombok Strait on the surface after Indonesia had earlier refused it transit through the Sunda Strait that brought the two

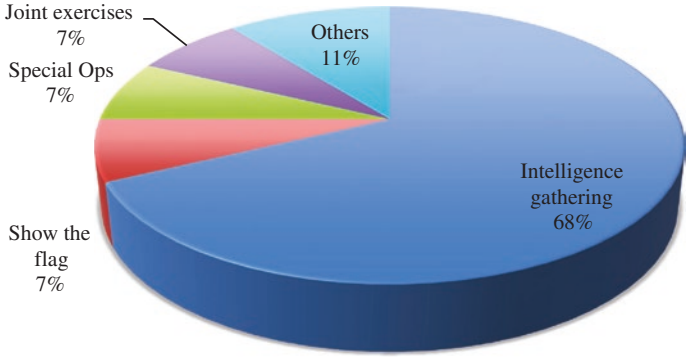

Fig. 5.1 Indonesia's submarine operations, 1959–2012. *Source* see Appendix

countries to "the brink of war".[20] Although Jakarta's offer of the Lombok Strait was a compromise, it also "enabled [the Indonesian Navy] to screen the task force more effectively from their main base in Surabaya and placed their warships in a better position to attack if ordered".[21] KRI *Cakra* and KRI *Nanggala* also "operated with tactical flare" and shadowed the INTERFET maritime forces as they were landing in East Timor in September 1999, which prompted the INTERFET "to both intensify the protection of its maritime lines of communication and to launch an intensive search to locate them".[22]

Submarines also proved valuable in covert insertion or infiltration of special commandos. These commandos would carry out sabotage against the Dutch forces in West Irian and prepared the ground for the all-out amphibious invasion, codenamed Operation *Djajawidjaja,* to be launched on 26 August 1962. On 12 August 1962, RI *Tjandrasa* infiltrated fifteen commandos into West Irian, while three other submarines similarly tasked for the mission, RI *Nagabanda,* RI *Trisula,* and RI *Nagarangsang* immediately aborted the mission after the Dutch Navy had detected them.[23] By 1962, Indonesia had infiltrated into West Irian a total of 1200 paratroopers and 340 amphibious infiltrators.[24]

Finally, submarines also performed a unique role usually reserved for surface forces: naval diplomacy and constabulary missions. Under Operation *Gugus Tugas X* on 17 October 1965, RI *Nagarangsang* and RI *Bramasta,* and two *Komars*- and two *Jaguar*-class torpedo boats, set sail to Karachi in a clandestine operation to support Pakistan and signal Indonesia's displeasure towards India following the 1965 Indo-Pakistan War in September.[25] Throughout the 1970s and 1980s, RI *Pasopati* also conducted naval exercises with partner navies and anti-poaching missions.[26]

Geographical Context

Located along the main shipping routes between the Indian and Pacific Oceans, Indonesia's archipelagic geography naturally places it as a maritime crossroads of the world (see Table 5.1). This geographical context underpins Indonesia's two important maritime strategic predicaments: the notion of national unity amid a fragmented archipelagic geography, and the dilemma of a maritime crossroads. Both strategic predicaments expose Indonesia's sense of vulnerability against foreign maritime presence in the archipelago. Such vulnerability necessitates the retention of submarines in the fleet.

Table 5.1 Indonesian maritime characteristics

Islands[a]	17,508
Land	1,890,739 km^2
Sea	6,315,222 km^2
Territorial sea	282,583 km^2
Archipelagic waters	3,092,085 km^2
EEZ	2,936,345 km^2
Continental shelf	2,749,001 km^2
Coastline	99,093 km

Source Indonesian Geospatial Agency
[a]CIA World Factbook 2015

The archipelagic geography presents Indonesia with the challenge of building, maintaining, and enforcing national unity. When independence was proclaimed in 1945 and recognised in 1949, Indonesia was more of a state than a nation. Rebellions followed soon after in Maluku, Aceh, West Sumatra, Sulawesi, and Papua, with some still simmer at present. For Indonesia, nation-building seems to be a perpetual work in progress. While the struggle against colonialism formed the ideational basis of national unity, it is only enforceable when the physical control of the seas between Indonesia's islands is assured. The words "land" and "sea" are lumped together into a single word to describe "homeland" or *tanah air* in the Indonesian language (*Bahasa Indonesia*).[27] The notion of national unity also underlined the formulation of Indonesia's core maritime policy principles: the 1957 Archipelago Principle and the 1967/1973 Archipelago Outlook (*Wawasan Nusantara*) that construct Indonesia as a single unity in political, economic, sociocultural, and security terms in spite of a fragmented archipelagic geography.[28] Any attempts and endeavours, domestic or foreign, to exploit the sea for the purposes of impeding or frustrating Indonesia's efforts at enforcing national unity consequently become a source of intense strategic anxiety.

That anxiety became real when in the late 1950s and early 1960s the Dutch and the USA (and some European powers) exploited the seas inside the archipelago to support, at different times, separatism in West Irian, Sumatra, and Sulawesi. Indeed, foreign submarines were used in covert operations to conspire against Indonesia. Three Dutch submarines (HNLM Ships *Dolfijn*, *Zeeleeuw*, and *Walrus*) saw action in West Irian in 1962,[29] as were American and British submarines that facilitated covert operations in Sumatra and Sulawesi in 1957–1958.[30] The following

argument by Indonesian diplomat and maritime law expert, Hasjim Djalal, on this period is particularly salient

> Politically, Indonesia was concerned with its domestic national unity, political stability, and national security. There are pockets of waters or the so-called high-seas cutting between her islands. Indonesia watched helplessly as submarines and other warships of foreign powers conducted manoeuvres only a short distance away from her coast in the waters on the sea between the islands, often within eyesight from the coast. The fabric of Indonesian national unity was at that time being challenged by various separatist and provincial movements largely based on "islands" sentimentality as the result of the colonial policy in the past. Indonesia's experiences have indicated that whenever there was a domestic dissension, the dissenter group was likely to receive clandestine support from the outside either by air droppings or from foreign submarine and ships along the coast.[31]

The dilemma of being a maritime crossroads makes the problem of forging national unity amid a fragmented archipelagic geography even more acute. Geography would not matter as much if Indonesia were located where New Zealand or Iceland is. But the fact that Indonesia is located along the main maritime routes between the Indian and Pacific Oceans made the archipelago a busy thoroughfare for all kinds of international shipping.[32] On the one hand, this location serves as a geo-economics blessing, for it has the potential for Indonesia to become a global maritime entrepôt—a vision that Indonesian President Joko Widodo's "Global Maritime Fulcrum" (*Poros Maritim Dunia*) concept seeks to attain.[33] On the other hand, a maritime crossroads also made the archipelago easily penetrated by foreign maritime forces of different nationalities that may be hostile to one another, if not also to Indonesia itself. Consequently, the straits and narrow seas within the archipelago could become a fertile ground for maritime espionage, including by submarines.

The adoption of UN Convention Law of the Sea (UNCLOS) in 1982 and its enforcement in 1994 gave Indonesia the legal clarity and legitimacy to exercise more control of the seas within the archipelago, which UNCLOS now terms as "archipelagic waters".[34] UNCLOS requires foreign submarines in the archipelagic waters to comply with the regime of "innocent passage", including to sail on the surface and hoist their flag.[35] Predictably, not all maritime nations completely agree with this, especially the USA, who had shown contempt for Indonesia's archipelagic status as early as 1958.[36] Indonesia's insistence for foreign submarines to

exercise innocent passage faced a stiff resistance as a result. As a trade-off, it designated three archipelagic sea lanes (ASL) running along the north–south axis of the archipelago in 1996 which allowed foreign submarines to transit under the "ASL passage" regime.[37] In other words, foreign submarines can transit the archipelagic waters via the ASL in "normal mode" or thoroughly submerged provided they do so in a "continuous, expeditious, and unobstructed" manner.[38]

Rather than assuaging the concerns of foreign maritime powers, Indonesia's ASL designation turned instead into a debate over how the ASL should ideally look like. Foreign critics reasoned that the current designation did not completely fulfil the UNCLOS provision for the ASL to accommodate "all routes normally used for navigation". Accordingly, until and unless Indonesia fully accommodates *all* routes normally used for navigation, the current ASL designation remains incomplete or "partial" and renders its enforcement legally void.[39] Calls for more designation of ASLs came as a result, especially for the east–west axis of the archipelago. Problems emerged, however, when the foreign maritime powers had different ideas of what such "normal" routes actually look like and where they are located within the archipelago.[40] By the same token, accommodating all "versions" of normal routes would defeat the very purpose of ASL designation itself. Too many ASLs would further complicate Indonesia's patrol and surveillance of international maritime traffic where ideally it should be concentrated only along a few navigational routes through the archipelago. Notwithstanding this disagreement, Indonesia after all considers the current ASL designation as final.[41] Apart from security considerations that discouraged Indonesia from establishing more ASLs, the right of "innocent passage" for international navigation still applies in areas where the ASL is not yet designated, which renders additional ASLs unnecessary.[42]

While innocent passage does not significantly affect commercial navigation, it could be problematic for military traffic. Since innocent passage requires submarines to sail on the surface, a submarine can expose its activities and/or sensitive technology to other countries, whose interests may be inimical to the country operating the submarine. In other words, submarines generally prefer to operate in the manner for which they are uniquely designed: by remaining submerged wherever and whenever they can. The problem of "stray" submarines has thus become a cause for concern as reported in Indonesia's 2014 intelligence assessments and the press.[43] In peacetime, foreign submarines might

conduct activities and manoeuvres against other or opposing navies, if not against Indonesia itself, within the archipelagic waters. For example, they could gather the relevant bathymetric and oceanographic data for future maritime warfare, loiter around to collect the acoustic and non-acoustic signatures of other warships and submarines, or tap submarine cables for espionage purposes—all possibly done without Indonesia's consent.[44] This is probably why defence ministers Purnomo Yusgiantoro and Ryamizard Ryacudu have all raised the importance of submarines in monitoring Indonesian ASLs against the presence of foreign naval forces.[45]

Considering Indonesia's sensitivity to foreign submarine presence in the archipelagic waters, and the desire to monitor foreign submarines exercising the ASL passage, anti-submarine warfare (ASW) has become a primary role for Indonesian submarines. While ASW ideally involves the integration and contribution of naval aerospace and surface capabilities, for a navy significantly bereft of such capabilities the submarine becomes the only effective ASW platform.[46] They can conduct intelligence gathering on foreign warships and submarines passing through Indonesia's key choke points and ASLs. Efforts to integrate aerospace and surface forces for ASW purposes are also improving, however. Since 2013, Indonesia has been acquiring CN-235MPA maritime patrol aircraft (fitted for sonobuoys and torpedoes) and eleven Panther ASW helicopters. The latter will be deployed onboard the *Bung Tomo*-class frigates and the future SIGMA 10514-class guided missile corvettes—themselves are equipped with hull-mounted sonars.[47] In addition, the navy has commissioned two new French-built vessels for oceanographic research purposes, KRI *Rigel* and KRI *Spica*, equipped with autonomous underwater vehicles (AUV) for underwater surveys and mapping.[48] It remains a question nonetheless whether Indonesia takes up ASW as a system of systems rather than just as a mere collection of sonars and platforms. Indonesia remains handicapped by insufficient varieties of sonar systems at its disposal and most importantly, the ability to produce the data collected into a clear and integrated picture of the undersea environment.

Strategic Funnels

Entitled the "Archipelagic Sea Defence Strategy" (*Strategi Pertahanan Laut Nusantara*, SPLN), the Indonesian naval strategy focuses attention to the "strategic funnels" (*corong strategis*) as the maritime gateways into

the archipelagic waters, such as the north–south entrances to the ASLs, the key choke points or straits and narrows located along Indonesia's archipelagic periphery.[49] The role of submarines is pivotal in all of these areas. Hasjim Djalal reiterates the predicament of archipelagic waters that underlines the importance of strategic funnels:

> Indonesia…due to its important and very strategic location, is extremely conscious of the significance of the passage of foreign warships and submarines through its archipelagic waters…For this reason, the Indonesian government would like to have the knowledge about foreign warships and submarines in its archipelagic waters.[50]

Resonating with the predicament above, the 2001 version of Indonesia's naval doctrine looks at SPLN from two dimensions: the outer and the inner–outer.[51] Briefly put, the "outer" dimension constitutes forward defence to intercept any state-based maritime adversary 500 nautical miles from Indonesia's EEZ boundary. Meanwhile, the "inner-outer" dimension constitutes the strategy to address foreign threats inside the archipelagic waters. Strategic funnels are important in the SPLN since they connect the outer with the inner dimension, which provides access for foreign maritime forces, including submarines, into the archipelagic waters. The SPLN is understood as a "defence-in-depth" consisting of deterrence, layered defence, and sea control.[52] Operationally, the layered defence pillar of SPLN is subdivided into three zones: buffer (beyond and within the EEZ), primary (between the EEZ and the territorial sea), and resistance (the territorial sea, archipelagic waters, and coastal areas).[53]

Deterrence and sea control are the peacetime roles of the navy. Realistically, Indonesia has neither the capacity nor the rationale at present for naval deterrence and sea control in the "outer" dimension which basically requires sustained naval power projection.[54] Instead, it focuses more on the "inner-outer" dimension where the consequences of Indonesia's geographical context as both an archipelago and international maritime crossroads overlap. In this dimension, the Indonesian navy and air force seek sea control and anticipate potential threats from foreign maritime forces accessing the archipelagic waters via the strategic funnels, including foreign-supported separatism, border violations, espionage, sabotage, and transnational crimes, including illegal fishing and maritime piracy.[55] A low-intensity but highly sensitive nature of

foreign-linked separatism, such as the 1992 *Lusitania Expresso* incident and the 2013 West Papuan "freedom flotilla", exemplified naval concerns of the "inner-outer" dimension, as did rampant maritime poaching in the archipelagic waters that resulted in a crackdown by the Jokowi government.[56]

Submarines play a pivotal role in the buffer and primary zones of SPLN concentrated along and near the choke points.[57] In peacetime, submarines can perform covert ISR operations of foreign maritime forces near and along the strategic funnels. In wartime, the strategic funnels are where submarines can concentrate their operations to hunt enemy warships and/or lay mines. Alternatively, submarines can also mount counter-blockade operations against the enemy fleet when the latter are deployed near or along the strategic funnels to cut Indonesia's access from the "outer" dimension.

The submarine role in Indonesia's naval strategy is by no means unique. It bears a lot of semblance to "choke point control" as a form of sea denial to "effectively block the exit or entry of hostile naval forces or the transit of an enemy's merchant ships".[58] The Straits of Malacca, Sunda, Lombok, and Makassar, as well as Ombai and Wetar, constitute some of these choke points.[59] These straits may "constitute the most vulnerable sea communications" during wartime.[60] Proximity to land also allows the navy in choke point control to deploy inshore and coastal naval forces (such as fast attack craft and coastal missile batteries) and land-based maritime strike aircraft to counter the enemy ASW forces in support of submarine operations.[61] Indeed, the SPLN emphasises the role of Indonesian air force to support naval operations across the three zones of naval defence. A 2005 naval study even proposes a "maritime defence strategy" that envisages a joint navy–air force approach for forward defence beyond the EEZ.[62] However, the air force might not have wholeheartedly supported the plan for it saw air defence as its primary role, as opposed to anti-surface warfare (ASuW) as the navy had proposed.[63]

Naval concerns over the strategic funnels motivated the decision, if partially, to construct two submarine bases additional to the one existing in Surabaya. These plans are somewhat aligned with the distribution of Indonesia's ASLs. The Palu submarine base in the western coast of Central Sulawesi has been under construction since 2013.[64] The deep gulf marking the entrance to the base makes Palu one of the best natural harbours in Indonesia. Located about halfway between the Sulawesi

Sea in the north and the Flores Sea in the south, Palu would provide Indonesian submarines a closer access than Surabaya to patrol the adjacent second ASL ("ALKI II"), which runs along the choke points of Lombok–Makassar Straits axis, as well as the third ASL ("ALKI III"), which partly encompasses other important straits, such as the Ombai and Wetar (see Table 5.2). Indeed, in the Second World War the Japanese regarded the Lombok Strait as a "submarine highway" and made it a heavily patrolled area against Allied submarines.[65] The Ombai and Wetar Straits also provide the required depth and width for safe navigation of nuclear submarines, which make them critical for US strategic deterrence purposes.[66]

Announced in March 2016, the third base will be built in the Natuna Besar Island, the largest of the Natuna Islands located in the South China Sea. Recent standoffs between Chinese and Indonesian maritime authorities due to purported overlaps of maritime claims near the Natuna Islands, and the proximity to the China-occupied and militarised features in the Spratly Islands, could make the Natuna Besar ideal for Indonesia

Table 5.2 Approximate sea distance and sail duration of *Cakra*-class from base

Base	*Destination*	*Distance (nautical miles)*	*Submerged (21.5 knots)*		*Surfaced (11 knots)*	
			Hours	*Days*	*Hours*	*Days*
Surabaya	Lombok	216	10.0	0.4	19.6	1.8
	Natuna	755	35.1	1.5	68.6	6.2
	Tarakan	821	38.2	1.6	74.6	6.8
	Ombai	772	35.9	1.5	70.2	6.4
	Sabang	1324	61.6	2.6	120.4	10.9
Palu	Lombok	533	24.8	1.0	48.5	4.4
	Tarakan	274	12.7	0.5	24.9	2.3
	Ombai	738	34.3	1.4	67.1	6.1
	Surabaya	580	27.0	1.1	52.7	4.8
Natuna	Sabang	888	41.3	1.7	80.7	7.3
	Surabaya	755	35.1	1.5	68.6	6.2
	Sepanggar Bay	502	23.3	1.0	45.6	4.1
	Sanya (Hainan)	1047	48.7	2.0	95.2	8.7
	Nha Trang	533	24.8	1.0	48.5	4.4

Source Platts McGraw Hill Financial (http://www.portworld.com/map); Nuclear Threat Initiative ((http://www.nti.org/media/pdfs/type209_1300_cakra_class.pdf?_=1367349086))

to protect its South China Sea frontier.[67] Located on the northern entrance of the first ASL ("ALKI I"), which runs along the Sunda and Karimata Straits and the Natuna Sea axis, the Natuna base also offers the submarines a better proximity to conduct ISR operations on foreign maritime forces navigating between the Indian and Pacific Oceans via the Malacca Strait—South China Sea route (see Table 5.2).

Challenges and Implications to Regional Stability

Although the imperatives to maintain submarines are present, Indonesia found their operations quite challenging. They pose technical challenges and strategic implications to regional stability. The operational challenges of submarines reside not just in the acquisition process, but also in its maintenance, service, and logistics. Sam Bateman and Jan Andersson describe such challenges limit the deterrent value of a submarine. Bateman cautions that as more regional countries are operating submarines, they become more exposed to the risks of submarine operations, the maintenance of high levels of skills and experience in submarine crews, and the need for effective command and control systems for submarine operations.[68] In short, submarine operations are "inherently dangerous" since "even a relative minor accident onboard" can have "catastrophic consequences".[69] Andersson echoes Bateman in which "deploying a submarine force effectively and safely is extremely challenging, since it requires not only boats in the water, but also the technical skills necessary to service and maintain them as well as enough trained crew to operate them", especially when regional navies also concurrently developing their submarine-hunting capabilities.[70] As a result, these submarines are less likely to achieve "the objectives of deterrence and potential 'access denial' that submarine operators in Southeast Asia are seeking to achieve".[71]

Indonesian submarines are not immune to these operational challenges. For example, since they were not tropicalised, the internal temperature of the *Whiskey* submarines increased from 20 °C in Russian waters to 52° in the tropics, which undermined the operational performance and morale of the crew, not to mention battery problems which "drastically limited their submerged endurance".[72] As a result, the operational efficiency of Indonesian *Whiskey* boats "was not high" and they "were often sighted on the surface during 'war patrols' and no mine-laying exercises were carried out".[73] Out of the twelve submarines, only four boats were operational at any one time. The same

operational challenges confronted the U-209 boats when INTERFET forces reported of seeing them operating on the surface which made them "rather quickly detected".[74] Finally, notwithstanding PT-PAL's recent progress in naval surface shipbuilding, constructing, and maintaining a submarine is a different challenge altogether.[75] Even with PT PAL's engineers involved in the construction of the first and second *Nagabanda*-class submarines at DSME shipyard, Indonesia may still face a major technological challenge in building the third and servicing them back home. At least this was the reason why DSME was initially "reluctant" to involve PT PAL engineers to take a "hands-on" approach in submarine construction at the former shipyard.[76]

At the strategic level, the challenges of submarine operations concern their role in covert ISR operations. The proliferation of Southeast Asian submarines alongside those of the major powers can render regional waters more contested and congested.[77] They can pose challenges to regional stability where the threat of submarine accidents will increase. Bateman warns that "the detection of a submarine in disputed waters, unless carefully managed, could readily lead to a serious deterioration in relations between the parties involved, increased tensions in the region, and even conflict".[78] Whereas most attention is seemingly paid to the risks of conventional submarine operations, Indonesian geographical context renders it possible for conventional submarines to share the same operational environment with nuclear submarines of the major maritime powers, such as the USA, Russia, France, and potentially, China and India.

Nuclear submarines occasionally transit the Indonesian archipelagic waters and ASL for strategic deterrent and strategic ASW purposes.[79] For example, nuclear attack submarines (SSN) can identify, track, and trail the SSN or ballistic missile submarine (SSBN) activities of others navies while exercising ASL passage. Consequently, the submarines involved might conduct dangerous manoeuvres intended to keep or lose track of one another, which could precipitate incidents at sea, if not also trigger conflict inadvertently. Such examples of brinkmanship occurred numerously during the Cold War with some resulted in accidents and remained as tightly guarded secrets until today.[80] Undersea posturing, if not collisions, between different operators of nuclear submarines, such as between those of Chinese and the USA or India, in Indonesian archipelagic waters are not impossible a scenario.[81] Unlike conventional submarines, nuclear submarines carry a higher safety risk due to the potential

of radioactive contamination. A fatal nuclear submarine accident in the ASL or archipelagic waters would almost certainly impose ecological, diplomatic, and security costs on Indonesia that it might not be able to afford.[82]

Considering the risks above, efforts to build confidence among submarine operators and improve submarine operational safety have become one of Indonesia's agendas in regional maritime security cooperation. Exercise *Orion* with Australia in March 1975 saw the first participation of an Indonesian submarine, KRI *Pasopati*, in bilateral submarine exercises since Operation *Gugus Tugas X*. In July 2012, Indonesia also signed a submarine rescue arrangement with Singapore. Marking Indonesia's first-ever bilateral submarine rescue cooperation, the arrangement "symbolises increased trust [between Indonesia and Singapore] in the traditionally sensitive undersea domain".[83] In August the same year, KRI *Nanggala* conducted a passage exercise with USS *Oklahoma City* in the Java Sea.[84] Signalling improved ties between the two navies, in April 2015 the Indonesian submarine force and US Submarine Group 7 held a table top Simulated Submarine Casualty Exercise (SMASHEX), as well as staff talks to establish routine periodic engagements and operations that will include training opportunities to integrate Indonesian and US submarine force capabilities.[85]

Despite the enthusiasm for bilateral submarine exercises, Indonesian submarines are noticeably absent from multilateral exercises. For example, Indonesian submarines have never participated in the biennial Exercise *Pacific Reach* series to "develop regional submarine escape and rescue (SMER) capabilities and strengthen interoperability in submarine rescue operations among participating navies".[86] Rather, Indonesia only sent naval observers since the exercise's inception in 2000, despite the fact that *Pacific Reach* is the only multilateral submarine exercise in the Asia-Pacific. Andersson speculates that it might owe to a lack of boats and inexperienced crews,[87] perhaps in addition to financial and technical constraints in deploying submarines out of the country. The same constraints might also set the limits to Indonesia's current submarine ambitions.

Conclusion

Historical experience, geographical context, and strategic funnels constitute the three imperatives that make submarines remain relevant in Indonesia's naval strategy. Historical experience suggests that since

submarines were proven important in past contingencies, Indonesia must continue operating them at present and in the future. Geographical context underlines the importance of submarines in supporting national unity amid a fragmented archipelagic geography and in resolving the dilemma of a maritime crossroads. Finally, naval concerns over the strategic funnels explain Indonesia's rationale to have submarines conduct ISR operations on foreign warships in peacetime and apply choke-point control in wartime.

These imperatives, however, do not imply that Indonesian submarines are immune to the operational and strategic challenges common to other submarine operators. Operationally, challenges in the fields of maintenance, service, and logistics, as well as experience and training of crew continue to stymie the deterrent value of submarines from reaching its full potential. Strategically, submarine operations are inherently sensitive and in some cases, provocative, which if not carefully managed, can escalate tensions and provoke inadvertent conflicts. Indonesia can try to mitigate these challenges by involving the submarine in cooperative naval diplomacy, such as submarine rescue and multilateral exercises. Not only would these activities enrich the experience of Indonesian submariners and familiarise them with submariners from other countries, they could also gradually mitigate the usual suspicions associated with submarine operations.

Notes

1. Juwono Sudarsono, "Sambutan Menteri Pertahanan dalam Penerbitan Buku'50 Tahun Pengabdian Hiu Kencana" [Preface by the Defence Minister on the Publication of the "50 Years' Service of *Hiu Kencana*"], in Wahyono S. K., ed., *50 Tahun Pengabdian Hiu Kencana 1959–2009* (Jakarta: Panitia Penerbitan Buku 50 Tahun Pengabdian HIU KENCANA, 2009), viii.
2. Ridzwan Rahmat, "DSME launches first Indonesian SSK", *Jane's Navy International*, 24 March 2016.
3. Ridzwan Rahmat, "Indonesian Navy plans for submarine base in South China Sea", *Jane's Navy International,* 31 March 2016.
4. Mrityunjoy Mazumdar, "Underwater aspirations break the surface in SE Asia", *Jane's Navy International, 7* October 2011.
5. Indroyono Susilo and Budiman, *Kapal Selam Indonesia* [Indonesian Submarines] (Bogor: Penerbit Buku Ilmiah Populer, 2008), 70.

6. James Goldrick and Jack McCaffrie, *Navies of South-East Asia* (Abingdon, Oxon: Routledge, 2014), 64–66.
7. Agung Pramono, "The History of the Indonesian Submarine Squadron", *Undersea Warfare,* Issue No. 5 (2013), http://www.public.navy.mil/subfor/underseawarfaremagazine/Issues/Archives/issue_50/IndonesianSubSquadron.html.
8. Alexey Muraviev and Colin Brown, "Strategic Realignment or Déjà vu? Russia-Indonesia Defence Cooperation in the Twenty-First Century", *SDSC Working Paper No. 411* (Canberra: Strategic and Defence Studies Centre, 2008), 25.
9. NAA A1946 1969/866, *Indonesian Military Capability—Including Long Range Forecasting*, "JIC (AUST)(69)42: Form and Scale of Attack by Indonesia on Australia", February 1969.
10. They had the same name as the first two *Whiskeys* but with new Indonesian spelling and pennant numbers.
11. Jack McCaffrie, "Submarines for South-east Asia: A major step?" in Geoffrey Till and Jane Chan, ed., *Naval Modernisation in South-East Asia: Nature, causes and consequences* (Abingdon, Oxon: Routledge, 2014), 33.
12. Indonesia's Ministry of Defence, *Minimum Essential Force Komponen Utama* (Jakarta: Kementerian Pertahanan Republik Indonesia, 2010), 68–69.
13. "Indonesian navy's decision to buy Russian-made submarines raises suspicion", *Tempo,* 31 January 2006; RI navy to procure submarines in stages", *Antara,* 12 October 2006.
14. "Indonesia set to buy Russian submarines—news agency", *RIA Novosti,* 19 October 2006.
15. Jon Grevatt, "Indonesia edges closer to decision on Kilo-class submarines", *Jane's Navy International,* 9 December 2013; Gabriel Dominguez, "Indonesia considering purchase of Russian Kilo-class submarines, says ambassador", *Jane's Defence Weekly,* 1 June 2016.
16. Ristian Atriandi Supriyanto, "Indonesia's New Submarine Bids: An undersea Buildup?" *RSIS Commentary*, No. 159/2011, 4 November 2011. https://www.rsis.edu.sg/wp-content/uploads/2014/07/CO11159.pdf.
17. A. Malik Ibrahim, "PT PAL Indonesia to launch submarine infrastructure", *Antara,* 7 April 2016, http://www.antaranews.com/en/news/104069/pt-pal-indonesia-to-launch-submarine-infrastructure.
18. Ridzwan Rahmat, "Indonesia receives bids from DCNS, DSME for submarine overhaul contract", *Jane's Navy International,* 26 November 2015.
19. Indonesian Navy Headquarters, *Sejarah TNI Angkatan Laut 1959–1965* [The History of the Indonesian Navy, 1959–1965] (Jakarta: Dinas Penerangan TNI Angkatan Laut, 2001), 172.

20. Goldrick and McCaffrie, *Navies,* 71; Toh Boon Kwan, "Brinkmanship and Deterrence Success during the Anglo-Indonesian Sunda Straits Crisis, 1964–1966", *Journal of Southeast Asian Studies,* 36:3 (2005): 410.
21. Kwan, "Brinkmanship", 410–411.
22. David Dickens, "The United Nations in East Timor: Intervention at the Military Operational Level", *Contemporary Southeast Asia,* 23:2 (2001): 223.
23. Indonesian Navy Headquarters, *Sejarah,* 173.
24. Wies Platje, "Dutch Sigint and the Conflict with Indonesia, 1950–62", *Intelligence and National Security,* 16:1 (2001): 305.
25. Goldrick and McCaffrie, *Navies,* 71.
26. Soentoro, "Pengalaman Bertugas di Kapal Selam" [The Experience Serving on Submarines] in Wahyono, *50 Tahun,* 158–174.
27. Hasjim Djalal, *Indonesia and the Law of the Sea* (Jakarta: Centre for Strategic and International Studies, 1995), 294.
28. Dino Patti Djalal, *The Geopolitics of Indonesia's Maritime Territorial Policy* (Jakarta: Centre for Strategic and International Studies, 1996), 63–69.
29. Julious Pour, *Laksamana Sudomo: Mengatasi Gelombang Kehidupan* [Admiral Sudomo: Overcoming the Swells of Life] (Jakarta: Gramedia Widiasarana, 1997), 143; "Walrus", *Dutch Submarines,* http://www.dutchsubmarines.com/boats/boat_walrus1.htm.
30. Audrey Kahin and George Kahin, *Subversion as Foreign Policy: The Secret Eisenhower and Dulles Debacle in Indonesia* (Seattle: University of Washington Press, 1997), 121.
31. Djalal, *Indonesia,* 337.
32. Marsetio, *Sea Power Indonesia* (Jakarta: Universitas Pertahanan, 2014), 91.
33. Ristian Atriandi Supriyanto, "Developing Indonesia's Maritime Strategy under President Jokowi", *The Asan Forum,* 4:1 (2016). http://www.theasanforum.org/developing-indonesias-maritime-strategy-under-president-jokowi-1/.
34. UNCLOS article 49; Donald Rothwell, "The Indonesian Straits incident: Transit or archipelagic sea lanes passage?" *Marine Policy,* 14:6 (1990): 501.
35. Sam Bateman, "Perils of the Deep: The Dangers of Submarine Proliferation in the Seas of East Asia", *Asian Security,* 7:1 (2011): 72–73.
36. Kwan, "Deterrence", 402.
37. Leonard Sebastian, Ristian Atriandi Supriyanto, and I. Made Andi Arsana, "Beyond the Archipelagic Outlook: The Law of the Sea, Maritime Security and the Great Powers", in Christopher Roberts, Ahmad Habir, and Leonard Sebastian, ed., *Indonesia's Ascent: Power, Leadership, and the Regional Order* (New York: Palgrave Macmillan, 2015), 313.

38. Bateman, "Perils", 72; UNCLOS article 53(3).
39. Chris Forward, "Archipelagic Sea-Lanes in Indonesia—Their legality in International Law", *Australian and New Zealand Maritime Law Journal,* 23 (2009): 143.
40. Kresno Buntoro, *Alur Laut Kepulauan Indonesia (ALKI): Prospek dan Kendala* [Indonesian Archipelagic Sea Lanes (ALKI): Prospect and Challenges] (Jakarta: Seskoal, 2012), 176–181.
41. Marsetio, *Sea Power,* 57.
42. Sebastian, Supriyanto, and Arsana, "Beyond the Archipelagic Outlook", 315–318.
43. Muhammad Hikam, ed., *Menyongsong 2014–2019: Memperkuat Indonesia Dalam Dunia Yang Berubah* [Braciing for 2014–2019: Strengthening Indonesian in a Changing World] (Jakarta: Badan Intelijen Negara, 2014), 392; Sucipto, "TNI AL Halau Kapal Selam Amerika Masuk Perairan Indonesia" [The Indonesian navy prevented American submarine from entering Indonesian waters], *Sindonews,* 4 February 2016, http://nasional.sindonews.com/read/1082875/14/tni-al-halau-kapal-selam-amerika-masuk-perairan-indonesia-1454595515; Anggi Kusumadewi, "Kapal Selam Asing Masuk RI: Alasan TNI Hidupkan Skuadron 100" [Foreign submarine entering RI: The reason navy resurrected Squadron 100], *CNN Indonesia*, 25 June 2015, http://www.cnnindonesia.com/nasional/20150625113259-20-62283/kapal-selam-asing-masuk-ri-alasan-tni-hidupkan-skuadron-100/.
44. Bateman, "Perils", 64.
45. Interview with Purnomo Yusgiantoro, Jakarta, 16 January 2014, cited in Amitav Acharya, *Indonesia Matters: Asia's Emerging Democratic Power* (Singapore: World Scientific, 2015), 91; Diemas Kresna and Abraham Utama, "Menhan Ingin Siagakan Kapal Selam di Alur Laut Indonesia" [Defence Minister wants to station submarines in Indonesian sea lanes], *CNN Indonesia,* 7 April 2016, http://www.cnnindonesia.com/nasional/20160407181428-20-122450/menhan-ingin-siagakan-kapal-selam-di-alur-laut-indonesia.
46. Karl Lautenschlager, "The Submarine in Naval Warfare, 1901–2001", *International Security,* 11:3 (1986–1987): 109.
47. Ridzwan Rahmat, "Indonesia to re-establish dedicated ASW squadron", *Jane's Navy International,* 19 June 2015.
48. Ridzwan Rahmat, "Indonesia inducts French-built OSV into military sealift command", *Jane's Navy International*, 23 December 2015.
49. Indonesian Navy Headquarters, *Gagasan Tentang Strategi Pertahanan Maritim Indonesia (SPMI) Sebagai Strategi Pertahanan Negara Kepulauan* [A Proposal on Maritime Defence Strategy as a Capstone Defence Strategy of an Archipelagic State] (Jakarta: Mabes TNI-AL,

2005), 3; Bernard Kent Sondakh, "Strategi Peperangan Laut Kepulauan" [Archipelagic Naval Warfare Strategy], 12–13. Paper presented to "Satria" defence magazine in February 2005; Indonesian Navy Headquarters, *Doktrin TNI-AL Eka Sasana Jaya* (Jakarta: Mabes TNI-AL, 2001), 19; Ristian Atriandi Supriyanto, "Strategic Funnels': Deciphering Indonesia's Submarine Ambitions", *RSIS Commentary*, No. 263, 3 December 2015, https://www.rsis.edu.sg/wp-content/uploads/2015/12/CO15263.pdf.

50. Djalal, *Indonesia,* 316.
51. Indonesian Navy Headquarters, *Doktrin,* 57–58.
52. Indonesian Navy Headquarters, *Strategi Pertahanan Laut Nusantara* (Jakarta: Markas Besar TNI-AL, 2003), 13.
53. Evan Laksmana, "Rebalancing Indonesia's naval force: Trends, nature, and drivers", in Till and Chan, *Naval,* 188–189.
54. Benjamin Schreer, *Moving beyond ambitions? Indonesia's military modernisation* (Canberra: Australian Strategic Policy Institute, 2013), 22.
55. Indonesian Navy Headquarters, *Doktrin TNI-AL Eka Sasana Jaya* (Jakarta: Mabes TNI-AL, 2006), 20.
56. Donald Rothwell, "Coastal state sovereignty and innocent passage: The voyage of the *Lusitania Expresso*", *Marine Policy,* 16:6 (1992): 428–429; Marni Cordell, "Indonesia warns it may use force against West Papuan Freedom Flotilla", *The Guardian,* 20 August 2013, http://www.theguardian.com/world/2013/aug/20/indonesia-west-papua-flotilla-force; Aaron Connelly, "Sovereignty and the Sea: President Joko Widodo's Foreign Policy Challenges", *Contemporary Southeast Asia,* 37:1 (2015): 18.
57. Sondakh, "Strategi", 12–13.
58. Milan Vego, *Operational Warfare at Sea: Theory and practice* (Abingdon, Oxon: Routledge, 2009), 36; Marsetio, *Sea Power,* 67.
59. John Noer with David Gregory, *Chokepoints: Maritime Economic Concerns in Southeast Asia* (Washington, DC: National Defense University Press, 1996), 1–2.
60. Milan Vego, *Naval Strategy and Operations in Narrow Seas,* 2nd ed. (London: Frank Cass, 2003), 121.
61. Veego, *Naval Strategy*, 122.
62. Indonesian Navy Headquarters, *Gagasan,* 5.
63. Discussion with Indonesian air force officers, Jakarta, 3 November 2014.
64. Ruslan Sangadji, "Submarine base to accommodate Russian, South Korean vessels", *The Jakarta Post,* 3 February 2016, http://www.thejakartapost.com/news/2016/02/03/submarine-base-accommodate-russian-south-korean-vessels.html.
65. Edward Beach, *Around the World Submerged: The Voyage of the* Triton (Annapolis: Naval Institute Press, 1962), 228.

66. Robert Osgood, "U.S. Security Interests in Ocean Law", *Survival,* 17:3 (1975), 122; Peter Polomka, *Ocean Politics in Southeast Asia* (Singapore: Institute of Southeast Asian Studies, 1978), 36.
67. Ristian Atriandi Supriyanto, "Breaking the Silence: Indonesia vs. China in the Natuna Islands", *The Diplomat,* 23 March 2016, http://thediplomat.com/2016/03/breaking-the-silence-indonesia-vs-china-in-the-natuna-islands/.
68. Bateman, "Perils", 61.
69. Ibid., 63.
70. Jan Joel Andersson, "Submarine Capabilities and Conventional Deterrence in Southeast Asia", *Contemporary Security Policy,* 36:3 (2015): 478.
71. Ibid., 490.
72. Goldrick and McCaffrie, *Navies,* 66; R. P. Poernomo, "Sekilas Kenangan dari Sesepuh Kapal Selam RI" [A Memory from a Senior Indonesian Submariner] in Wahyono, *50 Tahun,* 13.
73. Chris Tuck, "The Royal Navy and Confrontation, 1963–66", in Greg Kennedy, ed., *British Naval Strategy East of Suez 1900–2000* (London: Frank Cass, 2005), 204.
74. Andersson, "Submarine", 486.
75. Andersson, "Submarine", 486–487; Felicity Norman, *Indonesian Naval Modernisation: Why did Indonesia increase naval modernisation efforts between 2004 and 2014?* Master Sub-thesis, Australian University, 30 October 2014, 38.
76. Indra Wijaya, "Ini Alasan Korea Batasi RI Belajar Kapal Selam" [This is the reason why Korea limits RI in studying submarines], *Tempo,* 26 June 2013. https://m.tempo.co/read/news/2013/06/26/078491478/ini-alasan-korea-batasi-ri-belajar-kapal-selam.
77. Jack McCaffrie, "Submarines", 42–43.
78. Bateman, "Perils", 61.
79. Michael Leifer, *International Straits of the World: Malacca, Singapore, and Indonesia* (The Netherlands: Sijthoff & Noordhoff, 1978), 161–163.
80. See, Sherry Sontag et al., *Blind Man's Bluff: The Untold Story of American Submarine Espionage* (New York: HarperPaperbacks, 1998).
81. Brendan Thomas-Noone and Rory Medcalf, *Nuclear-armed submarines in Indo-Pacific Asia: Stabiliser or menace?* (Sydney: Lowy Institute for International Policy, 2015), 11.
82. Ristian Atriandi Supriyanto, "The US Rebalancing to Asia: Indonesia's Maritime Dilemma", *PacNet,* no. 30A, May 2, 2013, http://csis.org/files/publication/Pac1330A.pdf.
83. Koh Swee Lean Collin, "Indonesia-Singapore Submarine Rescue Pact: Promoting Southeast Asian Naval Cooperation", *RSIS Commentaries,*

No. 134/2012, 24 July 2012, https://www.rsis.edu.sg/wp-content/uploads/2014/07/CO12134.pdf.
84. Ade Marboen, "KRI Nanggala-402 dan USS Oklahoma City latihan bersama di Laut Jawa" [KRI *Nanggala-402* and USS *Oklahoma City* exercise together in Java Sea], *Antara*, 30 August 2012, http://www.antaranews.com/berita/330367/kri-nanggala-402-dan-uss-oklahoma-city-latihan-bersama-di-laut-jawa.
85. Brian Reynolds, "Submarine Group 7 Strengthen Ties with the Indonesian Submarine Force", *Navy.mil*, 20 April 2015, http://www.navy.mil/submit/display.asp?story_id=86645.
86. Singapore's Ministry of Defence, "Singapore Hosts Regional Submarine Rescue Exercise", 18 August 2010, http://www.mindef.gov.sg/imindef/press_room/official_releases/nr/2010/aug/18aug10_nr2.html#.VxZmChN97Eo.
87. Andersson, "Submarine", 486.

Author Biography

Ristian Atriandi Supriyanto Indonesian Presidential Ph.D. Scholar with the Strategic and Defence Studies Centre at the Australian National University. He is also a former Associate Research Fellow with the Maritime Security Programme at the S. Rajaratnam School of International Studies at Nanyang Technological University, Singapore.

CHAPTER 6

Submarine Acquisition in Singapore

Collin Koh Swee Lean

Abstract The reasons for submarine acquisition in Singapore are explored against the general strategic context in Southeast Asia, and the country's unique approach to the challenges it identifies is demonstrated. The contribution that submarines are thought to make to Singapore's security is discussed, and the technological, economic and demographic problems and their acquisition poses are identified.

Keywords Naval modernisation · Submarines · Singapore Stability in Southeast Asia

Introduction

A submarine is an inherently offensive weapon system that combines stealth, mobility and firepower, enabling it to conduct various peace and wartime missions. Prior to the advent of nuclear propulsion, the diesel-electric powered submarine (SSK) has already proven its worth in combat. There are many recent examples. A Dutch SSK supported anti-piracy

C. Koh Swee Lean (✉)
Institute of Defence and Strategic Studies, S. Rajaratnam School of International Studies (RSIS), Blk S4 Nanyang Avenue, Singapore 639798, Singapore
e-mail: ISCollinKoh@natu.ed.sg

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_6

operations off the Horn of Africa under NATO's Operation Ocean Shield in 2010.[1] More recently in November 2015, the Russian SSK *Rostov-On-Don* launched long-range cruise missile strikes at Islamic State targets in Syria—a task that has traditionally been conducted by nuclear-powered boats. These examples demonstrate the continued value of the SSK.

Small navies certainly cannot hope to acquire nuclear-powered undersea capabilities given the cost, technical complexity and vast infrastructure involved. The modern SSK—equipped with advanced combat systems, better quieting features and performance-enhancing "add-ons" such as air independent propulsion (AIP)—is therefore a "strategic asset" of significance for lower-tier navies. Despite the finances and technical complexity involved, the investment is, at least in theory, well worth it: the SSK provides the weak navy with an asymmetric means of deterrence which helps complicate the stronger naval adversary's planning. A well-equipped SSK manned by a well-trained crew capable of taking advantage of familiarity with the local operating environment can still attain disproportionately significant strategic effects. In other words, the SSK can be a credible force multiplier for small navies. Thus, it is no wonder that a small navy such as Singapore's is keen on maintaining a submarine capability.

The Singapore case is interestingly unique since it is a small country without the vast maritime zones of its neighbours and yet maintains a submarine force that is larger and arguably more capable than theirs. Accordingly, Singapore's submarine policy shows how it views national security. The SSK offers a way out of Singapore's geostrategic and geopolitical conundrum, by essentially serving as a force multiplier for its overall ability to defend its national interests effectively.

Why Submarines for the "Little Red Dot"?

Singapore is a "Little Red Dot"—a physically tiny city state that is reliant on uninterrupted access to sea lines of communications (SLOCs) for national survival and prosperity, yet at the same time without appreciable geostrategic depth and surrounded by larger neighbours with whom Singapore has its fair share of acrimonious relations in the past.

Particularly since the end of the Cold War, the Republic of Singapore Navy (RSN) has played a pivotal role in Singapore's defence because of the many maritime traditional and non-traditional security concerns it faces such as territorial and sovereignty disputes in the South China Sea (SCS),[2] maritime terrorism, as well as piracy and armed robbery against

ships. Like any navy worldwide, the RSN is also a flexible foreign policy instrument not only playing a primary role in the country's immediate geographic area, but also contributing a secondary role to "out-of-area" international security, for instance counter-piracy operations in the Gulf of Aden.[3] Thus, the RSN illustrates the two fundamental pillars of Singapore's defence: deterrence and diplomacy. As such, it has to maintain a balanced set of capabilities to cover a spectrum of peacetime constabulary (or, Operations Other Than War, OOTW) and wartime missions.

Nonetheless, it is going to remain a small navy due to financial and manpower constraints. The latter factor is a particular key consideration, given Singapore's declining birth rates. The RSN therefore has to transcend these limitations in order to maximise its effectiveness. One way is to leverage on military hi-tech to compensate for manpower difficulties. A "lean and mean" RSN submarine force could then be a very useful force multiplier for peacetime deterrence and in times of war, for extending Singapore's seaward defence, complicating the adversary's plans and interdicting its forces in the likely sea approaches in the Straits of Malacca and Singapore as well as the SCS.[4]

Singapore's policymakers also sometimes claim that a strong navy contributes to regional security.[5] This is in the context of the spate of naval armament taking place in the broader Indo-Pacific region in which submarine proliferation has become a key element as regional countries become wealthier and likewise see the advantages of an undersea "force multiplier" capability.

However, taking no chances while exploiting its relatively stable economic health, Singapore continues to try to leapfrog its potential competitors in military technology. To this end, in December 2013, Singapore purchased a pair of new German-built SSKs, dubbed Type-218SG, the first of which is slated to enter service before 2020. This pair will allow the eventual phasing out of the ageing *Challenger* (Swedish A12 *Sjöormen*) and augment the newer pair of *Archer* (Swedish A17 *Västergotland*) boats.

The question nonetheless arises: Are submarines merely prestige items for Singapore? On the one hand, they have considerable utility for the RSN's littoral environment. The South China Sea, for example, is a "submarine haven" with its deep patches, varied saline conditions, rugged underwater terrain and rich marine biodiversity that altogether complicate and frustrate enemy anti-submarine efforts. Submarines clearly serve immediate practical defence and security needs for Singapore.

Table 6.1 RSN's phased approach to building submarine capability

Phase	*Initiatives undertaken*
One	Feasibility studies conducted in the 1980s–early 1990s
Two	Purchase of second-hand Swedish A12 boats for training and familiarisation purposes[a]
Three	Purchase of bigger, technologically more complex second-hand A17 boats to operationalise the submarine capability
Four	Establish a more comprehensive submarine capability infrastructure, including emergency response and onshore training capacities
Five	Purchase of bigger new-build Type-218SG boats with enhanced ocean-going capability

Source By author drawing on various official and news reports
[a]The RSN made the initial purchase of the first A12 boat in 1995 as part of a comprehensive submarine training programme to train about 40 personnel. This was then followed by the purchase of three additional A12 boats in 1997 and the signing of a landmark submarine training agreement with Sweden in February 1998.

On the other hand, prestige also generates its own deterrent effect.[6] For this, simply having submarines is not enough: Singapore must show it can sustain, operate and maintain them too. The RSN's undersea capability development is deliberately planned and implemented, as shown in Table 6.1.

Singapore's interest in acquiring an undersea capability stretches back to the 1980s, when it began a feasibility study, including a visit by a RSN delegation to Sweden.[7] However, with funding constraints submarines had less priority than building surface forces, particularly new missile corvettes to provide an ASW capability for the first time.

It was not until the early 1990s that fiscal circumstances facilitated concrete moves into submarine acquisition. To this end, virtually the entire fleet of A12 boats retired by the Swedes was acquired. The rationale was based on prudence. Firstly, the RSN was a newcomer into the undersea arena, and these second-hand SSKs provided a suitable platform for training and assimilation purposes. Secondly, acquiring second-hand instead of new-build submarines minimised the risks involved in first building such a capability. The A12 boats were much less expensive as a cost-effective "starter platform," for training and actual operations[8] especially as they had been well maintained by the Swedes and remained in good condition.

The A12 boats, christened the *Challenger* class, helped build the core of the RSN's submariners and institutional expertise and know-how. This "seed capability" came at a time when many Southeast Asian navies were also engaged in modernisation, but the RSN was able to forge ahead

despite the Asian Financial Crisis in 1997–1998 thanks to consistent defence funding which allowed the RSN not only to leapfrog its neighbours, but also to consider a more capable follow-on submarine.

In 2005, just as the region was gradually recovering from the financial crisis and reviving its naval programmes, Singapore decided to procure Swedish A17 boats. In no small part, this was attributed to the good Singapore–Sweden defence relations previously developed and the navy's familiarity with Swedish submarine technology which had developed by this time.

The A17 was another prudent second-hand purchase. At least a decade younger than the preceding A12, the A17 had similar hydrodynamic characteristics (the standard teardrop, albacore hull with the distinctly Swedish X-configuration rudders) but was equipped with more capable combat systems. The boats were well maintained and still had significant amount of service life in them. But this time, the RSN was bolder—the A17 was cut into halves and had an additional section inserted amidships.

This additional module was to house the Stirling AIP—a Swedish innovation. It extended underwater endurance from days to at least two weeks before requiring snorkelling to recharge the batteries. But this modification is not unique to Singapore's boats; the Swedes performed similar work on the A17 boats they retained in service, designating it the *Södermanland* class.[9] Singapore could well have "piggy-backed" on the Swedes' modification programme.

Even with this modification, these two boats, designated the *Archer* class in RSN service, were probably cheaper than new-builds while still offering the RSN an operational edge; thus far, it remains the only navy in Southeast Asia operating AIP-equipped submarines. The *Archers*' commissioning allowed the gradual retirement of some *Challenger* SSKs. However, the RSN was already mulling more new boats to completely retire the *Challengers*. It would also enable the maintenance of a working fleet of more than just two *Archers*, providing at least one boat on patrol at any time.

More recently the RSN, besides consolidating the newly established 171 Submarine Squadron (an independent unit that is directly subordinate to the Navy Headquarters), has constructed an elaborate supporting infrastructure for its undersea fleet at Changi Naval Base, including a covered shelter (or "submarine pen")[10] and submarine training centre replete with a German-designed simulator.[11]

Accepting the expense of the submarine rescue vessel *Swift Rescue*, equipped with special facilities (e.g. decompression chambers), and most notably the DSAR-5 deep-submergence rescue vehicle, as a further part of an incremental supporting infrastructure, training and emergency response capacities, shows clear evidences that the RSN is determined to establish a functional undersea capability for deterrence and defence, and is not simply interested in considerations of prestige.

The RSN possesses arguably the most advanced and comprehensive suite of undersea capabilities in Southeast Asia although its neighbours are likewise making progress in infrastructure support and/or submarine rescue. The RSN is further consolidating this suite of capabilities while purchasing new German-built Type-218SG boats as part of the blueprint for the future Singapore Armed Forces (SAF) by 2030.[12] Little information on this hitherto-unheard-of class has so far emerged beyond official press releases.[13] Based on available information, including photographic evidences, the Type-218SG is not a bottom-up design-from-scratch submarine but somewhere in between the Type-214—a 1400-ton export variant of the Type-212/212A that serves both the German and Italian navies—and the enlarged Type-216 which is optimised as a 3000-ton plus, long-range ocean-going submarine and currently being offered to the Australians.[14]

As such, the Type-218SG would represent another milestone for Singapore's submarine quest, implying the navy's development of the expertise to step up to operate larger, more capable boats which will be equipped with German fuel-cell AIP and possibly unmanned underwater vehicles (UUVs). It still reflects operational and fiscal prudence on the part of the RSN in proceeding purposefully yet cautiously with this capacity-building process, through the acquisition of second-hand boats before finally settling on new-builds.

By 2020, it is envisaged that the RSN would progressively retire all *Challengers*, thus bequeathing its submarine fleet with just two *Archers* and two Type-218SGs.[15]

Enablers and Constraints

Singapore is able consistently to pursue its phased submarine capacity-building programme in no small part due to a number of favourable factors. The key enabler is funding commitment, which is important because of the high costs of acquiring, operating and maintaining a working

submarine fleet, including its supporting infrastructure. Fortuitously, despite the Asian Financial Crisis in 1997–1998, the Singapore Government kept defence spending more or less consistent, whereas neighbouring countries in Southeast Asia adopted a "feast and famine" approach in defence appropriations[16] which put their defence acquisition programmes, including submarines, on the back-burner.

Singapore's defence spending is generally insulated from economic performance and is capped at up to 6% of the annual gross domestic product. It not only allows the SAF to generally maintain its operational readiness but also facilitates capability enhancement programs, including indigenous defence research and development.[17]

Defence funding is also insulated from domestic political intrigue. Of course, this is greatly helped by the fact that the parliament is dominated by the ruling People's Action Party. However, it would be misleading to say that the political opposition is against this policy; on the contrary, the opposition parties in the parliament have been generally supportive. Parliament debates over defence and security issues revolve around largely the National Service policy—which is widely tied to broader socio-economic, social security and national identity issues after the recent foreign immigrant influx. Only the Singapore Democratic Party has argued for reduced defence allocations in favour of more investments in social security but it failed to gain any seats during the September 2015 General Elections; this may imply that the electorate does not generally subscribe to "radical" ideas of slashing defence budget.[18]

Having one of the world's highest levels of Internet penetration,[19] Singapore also has better-informed populace which has taken an increased and generally supportive interest in government policy. Prior to the 2015 General Election, a public opinion survey (see Fig. 6.1) conducted by an independent consultancy showed clearly that an overwhelming majority of Singaporeans continue to support current government policy in the area of defence and national security. This could have foretold the dramatic increase in vote share for the PAP during that election, thereby signalling public support for the continuation of such policies in the next four years at least.

Therefore, fiscal and domestic political factors do not significant hinder Singapore's submarine capability development. Furthermore, Singapore does enjoy another key enabler for smoother assimilation of such complex technology—a populace, especially the younger segments, is not just literate and generally well educated but also technologically "savvy".

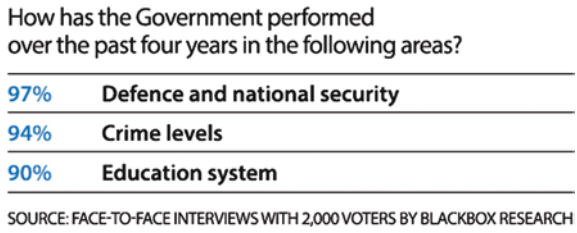

Fig. 6.1 Singaporean perceptions towards defence and national security, 2015. *Source* Extracted from: "Satisfaction with Government since GE 2011 at high level, survey shows", *Channel NewsAsia*, 22 August 2015; at: http://www.channelnewsasia.com/news/singapore/satisfaction-with/2050828.html. Blackbox Research full report can be found at: http://www.blackbox.com.sg/wp_new/wp-content/uploads/2015/02/Blackbox-Year-in-Review-2014.pdf

Finally, the other enabler is a burgeoning local defence industry. Since the induction of the A12 boats, Singapore Technologies Engineering Marine (ST Marine) has cultivated a working relationship with Swedish submarine builder Kockums, acquiring experience in modifying the boats to suit the tropical operating environment as well as in the area of system maintenance.[20]

Having a small submarine force and given the well-entrenched positions of established foreign submarine builders, it does not make economic or commercial sense for Singapore to venture into the industry of building submarines for domestic and export purposes, but it is already delving into niche areas of submarine technology. Notably, an indigenous submarine combat management system co-developed by ST Electronics and Atlas Elektronik will be installed on board the Type-218SG.[21] This approach of focusing on niche capabilities for incremental upgrades or enhancements of existing platforms can be seen in the other SAF services as well.

Singapore's only constraint is geopolitical in nature. While apparently "arming itself to the teeth", Singapore needs to demonstrate that it carries no ill strategic intent and that the capabilities acquired are merely for defensive purposes. Being in a sensitive neighbourhood, it has to consider the perceptions of its close neighbours. Much is known about Total Defence as the centrepiece of Singapore's national security approach as well as its double-pronged defence policy of deterrence and diplomacy. Nonetheless, there is little discussion about how Singapore

conceptualises its security policy, which certainly goes beyond deterrence and diplomacy.

The only defence white paper published so far by Singapore in 2000 provided a general overview but lacked detail. Nonetheless, it is possible to get a hint from Singapore's security policy instead, which is based on: (1) good neighbourliness; (2) sense of community; (3) multilateralism; (4) relevance and usefulness; and (5) deterrence and defence.[22] The last aspect supports the process of building a credible submarine capability in Singapore. But other aspects are particularly interesting.

The first concerns unilateral naval arms control restraint, which is evident in the RSN's apparent choice of capabilities. Despite Malaysia's acquisition of the SM-39 Exocet and Vietnam's acquisition of Klub-S land-attack cruise missiles, Singapore has not followed in their footsteps by acquiring these long-range, stand-off underwater-to-surface guided weapons (USGW) to give its submarines such a force projection capability.

The second aspect is defence diplomacy and "rules-shaping", for instance Singapore's efforts to date in promoting regional submarine cooperation. Since 2001, the RSN has regularly participated in the Asia-Pacific Submarine Conference—a platform for navies to promote confidence-building and share best practices in submarine operations—and Pacific Reach, a multinational submarine emergency management and response exercise. It also shared its suite of submarine rescue capabilities, thus becoming some sort of a "common security goods provider"—notably signing bilateral submarine rescue agreements with Indonesia and Vietnam. The latest one was signed in May 2015 with the US Navy which will further hone the RSN's capability in this respect. Besides such confidence-building and reactive measures, Singapore has strongly championed for preventive, water-space management measures, most notably an institutionalised submarine operational safety framework.[23]

Altogether, these initiatives can be seen as Singapore's attempt to dampen external perceptions of its submarine capacity-building efforts. As such, its navy's subsurface arm literally serves a defence diplomacy function.[24]

Conclusions

In view of its strategic imperatives, the submarine forms a key facet of Singapore's quest for a balanced navy. Fortuitously, Singapore's quest for a submarine capability has been made possible by a series of economic,

societal and industrial enablers. However, being a small state with a peculiar geostrategic location and surrounding security environment, Singapore has cautiously and prudently to pursue its undersea capability programme and needs to play the role of responsible security stakeholder in the region. In developing its submarine capabilities, Singapore needs to balance between national deterrence and defence requirements on the one hand, and managing external perceptions on the other.

Notes

1. "Dutch submarine to help NATO combat piracy off Somali coast", North Atlantic Treaty Organization, 28 June 2010; at: http://www.nato.int/cps/en/natolive/news_64706.htm.
2. Though not a claimant, Singapore is keen on upholding freedom of navigation and overflight in the area to insure its national survival and prosperity.
3. Swee Lean Collin Koh, "'Best Little Navy in Southeast Asia': The Case of the Republic of Singapore Navy", in Michael Mulqueen, Deborah Sanders and Ian Speller, *Small Navies: Strategy and Policy for Small Navies in War in Peace* (Surrey, UK: Ashgate Publishing Ltd.), 120–121.
4. Swee Lean Collin Koh, "Seeking Balance: Force Projection, Confidence Building, and the Republic of Singapore Navy", *Naval War College Review*, Vol. 65, No. 1 (Winter 2012), pp. 75–92.
5. Sanjay Pereira, "Singapore may buy subs if needed, says Dr Lau", *Straits Times*, 11 December 1994; "New sub enhances stealth, endurance capabilities of the RSN", Ministry of Defence, Republic of Singapore, 17 June 2009.
6. Ken Booth, *Navies and Foreign Policy* (London: Croom Helm; NY: Crane, Russak, 1977), 51, 54.
7. "Singapore to take close look at Kockums submarines", *Svenska Dagbladet*, 16 August 1989.
8. Less than a month after the RSN purchased the first A12 boat from Sweden, then Senior Minister Lee Kuan Yew remarked that the submarine purchase was not attributed to any regional anxiety over China's military build-up but because it was cheap. "Here is the Swedish submarine", he said. "The economy is doing well and it is a cheap sub. Its purchase will still be within the five percent of GDP (gross domestic product) assigned to defence. So, why not use it for some training?" "New submarine not linked to Asian arms race – Lee", *Reuters News*, 11 October 1995.
9. Even though the *Archer* class was commonly touted as the A17 *Västergotland*, actually it should be more accurately seen as a Singapore version of the *Södermanland* class instead.

10. The author made this observation during one of his visits to the base, when seen from the deck of a foreign warship on port visit to Singapore, and via RSN-released photographs (including those of President Tony Tan's visit to Changi Naval Base by in early March 2016; see third picture in the photo gallery on the Ministry of Defence webpage, at: http://www.mindef.gov.sg/imindef/press_room/official_releases/nr/2016/mar/02mar16_nr.html). This facility is co-located with the open berths and appears to be sturdily built and hardened with concrete and reinforced steel. It is also situated in front of the 171 Squadron Headquarters building. The structure is clearly designed to house submarines, since the opening is too low in height for any surface warships with a sizeable superstructure and mast to enter (except unmanned surface vessels or USVs, but the facility would be too large to just house them). It could well be a multi-purpose hardened shelter, but the most likely asset to require such protective measures should be the submarine.
11. "Republic of Singapore Navy Launches New Submarine Training Centre", Ministry of Defence, Republic of Singapore, 11 March 2015.
12. This blueprint outlined three key capability enhancements to revitalise the RSN and keep in pace with contemporary technological developments and evolving security environment: a fleet of eight Littoral Mission Vessels (LMVs) to replace the existing Fearless class patrol vessels and *Bedok* class mine countermeasures vessels; two Type-218SG submarines as well as one or two Joint Multi-Mission Ships (JMSS) which are to possess larger capacity than the existing landing platform docks. *Speech by Dr Ng Eng Hen, Minister for Defence, at Committee of Supply Debate 2014*, Ministry of Defence, Republic of Singapore, 6 March 2014.
13. Fresh details of the Type-218SG were revealed during the International Maritime Defence Exhibition (IMDEX) Asia 2015, when its model was showcased at the ThyssenKrupp Marine System GmbH (TKMS) booth. The boat measures 70 m long and 6.3 m wide, weighing 2000 tons. Besides sharing certain characteristics as the RSN's former Swedish boats, for example the X-shaped rudders, this boat has eight torpedo tubes and is equipped with an AIP. "Model of Singapore's new submarines on display", *Straits Times*, May 20, 2015. See also, Kelvin Wong, "TKMS starts construction of Singapore's Type 218SG submarines", *Jane's Navy International*, 28 June 2015.
14. The author gathered from his conversation with industrial representatives involved in the Type-218SG project that the RSN would have been keen to stick to Swedish boats, for example the A19 *Götland* or new-generation A26, if not because Kockums—which constructed the A12 and A17 and has cultivated a long working relationship with the RSN—was forbidden to submit its bid, especially given its earlier acquisition by TKMS in 2011.

15. "MINDEF Signs Contract to Acquire Two Submarines", Ministry of Defence, Republic of Singapore, 2 December 2013.
16. See, for instance, *Speech by Minister for Defence Teo Chee Hean, at Committee of Supply Debate 2009*, Ministry of Defence, Republic of Singapore, 12 February 2009.
17. For example, Defence Minister Ng Eng Hen said at the Committee of Supply debate in 2015: "when we plan, we plan over a long term horizon and not year-on-year, but over a five- to ten-year period. It allows us to make sure that we don't adjust suddenly, whether it is manpower training or platform acquisition. It is also productive because you plan over a longer time horizon. We do not buy a platform when it is just new. We watch when the price comes down; before production goes down and the price goes up again. It allows us to plan when to acquire". *Speech by Dr Ng Eng Hen, Minister for Defence, at Committee of Supply Debate 2015*, Ministry of Defence, Republic of Singapore, 6 March 2015.
18. In fact, SDP did not perform as well for GE2015 as in the previous 2011 round. For example, a team contesting the Holland-Bukit Timah Group Representative Constituency, made up of several of party's heavyweights, only garnered 33.4% of the votes, a drop from 39.9% back in 2011. Lee Min Kok, "GE2015: SDP chief Chee Soon Juan moots possibility of working with WP at next election", *Straits Times*, 13 September 2015.
19. By 2014, the number of internet users per 100 persons in Singapore amounted to 82, the highest in Southeast Asia compared to Brunei (68.8), Cambodia (9), Indonesia (17.1), Laos (14.3), Malaysia (67.5), Myanmar (2.1), the Philippines (39.7), Thailand (34.9) and Vietnam (48.3). *Internet users (per 100 people)*, The World Bank, at: http://data.worldbank.org/indicator/IT.NET.USER.P2.
20. In April 2012, ST Marine and Kockums established a 51/49 joint venture known as Fortis Marine Solutions Pte Ltd that was intended to refit and maintain the RSN's Swedish-built SSKs. ST Marine was said to invest US$510,000 whereas Kockums invested US$490,000. "ST Marine, Kockums join forces for Singaporean Navy's submarines", *SeeNews Shipping*, 4 April 2012; "ST Engineering's Marine Arm Injects Additional Capital into Fortis Marine Solutions", Singapore Technologies Engineering, October 9, 2012. See: http://www.stengg.com/press-centre/press-releases/st-engineerings-marine-arm-injects-additional-capital-into-fortis-marine-solutions. See also, David Boey, "ST Marine acquiring skills for submarine maintenance", *Business Times Singapore*, 27 February 1998.
21. Kelvin Wong, "TKMS starts construction of Singapore's Type 218SG submarines", *Jane's Navy International*, 28 June 2015.

22. *Speech by Mr Lim Hng Kiang, Minister for National Development and Second Minister for Foreign Affairs*, on "The Challenges to Small Nations' Foreign Policies", at the Ministry of National Development (MND) Auditorium on Saturday, 29 July 1995 at 3.00 PM, Ministry of Foreign Affairs, Republic of Singapore.
23. *Address by the Republic of Singapore Navy, Chief of Navy, Rear-Admiral Lai Chung Han, at the 15th Asia Pacific Submarine Conference Opening Ceremony*, Ministry of Defence, Republic of Singapore, 19 May 2015.
24. For example, the *Swift Rescue*, which is part of the RSN's subsurface component, was instrumental in the search-and-locate operations following the crash of AirAsia flight QZ8501 in late December 2014. "The SAF Concludes Deployment for QZ8501 Search Operations", Ministry of Defence, Republic of Singapore, 18 January 2015.

Author Biography

Collin Koh Swee Lean is a Research Fellow at the Maritime Security Programme, part of the Institute of Defence and Strategic Studies which is a constituent unit of the S. Rajaratnam School of International Studies (RSIS). He is especially interested in researching on naval affairs in the Indo-Pacific, focusing on Southeast Asia in particular, and generally issues related to naval technologies, naval modernisation, naval arms control and the offence–defence theory. Collin also taught at the Military Studies Programme and taught various professional military education and training courses with the Singapore Armed Forces Training Institute. Prior to join the Maritime Security Programme, Collin worked at the Military Studies Programme (2010–2014) and the Centre for Non-Traditional Security Studies (2008–2010), also at RSIS.

CHAPTER 7

Submarine Acquisition in Malaysia

Dzirhan Mhadzir

Abstract The reasons for submarine acquisition in Malaysia are explored against the general strategic context in Southeast Asia and the country's unique approach to the challenges it identifies is demonstrated. The contribution that submarines are thought to make to Malaysia's security is discussed, and the technological, economic and demographic problems their acquisition poses are identified.

Keywords Naval modernisation · Submarines · Malaysia
Stability in Southeast Asia

Malaysia's submarine programme provides a unique example of the way in which external factors outside the military can impact their plans. In Malaysia's situation, the two factors that have an effect on the country's submarine programme are firstly the issue of public perception and politicization of the submarines' purchase and existence and secondly the state of Malaysia's economy. While both factors have not currently affected significantly any aspects of the actual operations of Malaysian submarines, they will be expected to have a significant impact in regard to the future direction and possible expansion of Malaysia's submarine fleet.

D. Mhadzir (✉)
Malaysian Armed Forces Defence College, Kuala Lumpur, Malaysia

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_7

Before going further into this, a brief summary of the history of Malaysia's submarine program is provided to set forth the context. Since the 1980s, the Royal Malaysian Navy had sought a submarine capability and sent a small number of personnel to undergo submarine qualification training overseas. However, it was not until 2000 that a serious competition for submarines came into play with Armaris (now known as DCNS) of France and TKMS being the leading contenders.

A sidebar to this was the presence of two decommissioned ex-Dutch Navy Zwaardvis-class submarine which were shipped to Lumut to the PSC Naval Dockyard facilities in 2000 as part of a venture between Dutch company RDM Submarines and PSC Naval Dockyard to sell the submarines to Malaysia. At the time, PSC Naval Dockyard was riding high, having previously secured the contract to build the six Kedah class Next Generation Patrol Vessels. Yet already during that time the RMN was not keen to have further dealings with PSC because it was not confidant that the company was as fully capable as it was made out to be, something which was borne out subsequently by the later failure of PSC to complete the Kedah class ship. This subsequently led to the government having to inject additional funds along with orchestrating a takeover of PSC through the government-linked Boustead company in order to complete the ships. With the failure to secure a sale to Malaysia and to any other country, the submarines were left in Lumut and deteriorated to the extent that they were only fit for scrap and matters were not helped with the collapse of RDM Submarines, which had pinned its viability on the sale of their Moray submarine design but failed to find a buyer. Eventually, the Dutch government, mindful of the implications of the transfer of technology and knowledge that could be gleaned from the hulls, paid to have both submarines scrapped in 2006.

In June 2002, the signing of a 1.04 billion Euro contract for two Scorpene class submarines with the French company Armaris and the Spanish company Izar (now known as Navantia), the joint builders of the Scorpene, was carried out and this was followed in July 2003 with a contract with Armaris for training 150 personnel of the Royal Malaysian Navy (RMN) as submariners; the contract also provided for the withdrawal from service French Navy submarine *Ouessant*, an Agosta class submarine, to serve as a training vessel. The first batch of RMN personnel arrived in Brest, France, at the end of April 2005 to begin training.

At that time, controversy had already arisen over the role of Mr Razak Baginda in the purchase and also the award of a contract to Perimekar,

a company linked to Mr Razak Baginda, for handling the logistical support for the RMN's submarine force personnel in France. Given that Mr Razak Baginda was known to be closely linked to and a former adviser to the then Defence Minister Dato Seri NajibTun Razak, the political opposition questioned the nature of the awards plus whether the payments made by Malaysia for the submarines included the commission fee said to be paid by Armaris to Razak Baginda. Matters came to a head in 2006 with the murder of Altantuya Shaariibuu, whose murder was alleged to be linked to the sale of the submarines and also to her involvement with Razak Baginda.[1]

At the same time, while this drama was being played out, the RMN had decided to invite the public to suggest names for the two submarines with the inevitable result that there were less than charitable suggestions from some quarters of the public for the names of the submarines. The RMN subsequently decided to name the submarines after the first two Prime Ministers of Malaysia. On 5 May 2008, the then Malaysian opposition leader Datin Seri Wan Azizah Wan Ismail, during a Parliament session, called for an inquiry into the purchase of the two Scorpene submarines saying that an independent board of inquiry should be established because the government had paid inflated prices and hefty commissions. "The government is urged not to hesitate to carry out a thorough investigation into any bias or fraud that occurred", she said. "It is important to ensure that there is no attempt to protect any senior government officials or to cover up a weapons-purchase scandal which involves billions of taxpayer dollars" she said, adding that in the purchase of the Scorpene submarines a commission of RM530 million was paid by manufacturer Armaris to Perimekar, Responding in a 6 May 2008 press conference, Dato Seri Najib said that the purchase had been in line with government procedures and that there had been no wrongdoing. "Don't make wild allegations", he said. "You must focus on actual facts".[2]

Training of the submarine crews and constructions of the submarine in the meantime continued unimpeded though, with the first submarine, KD *Tunku Abdul Rahman* launched in France in October 2007 and commissioned in January 2009, while the second submarine KD *Tun Abdul Razak* was launched in Spain in October 2008 and commissioned in December 2009. The decision had been made to have the submarines based at RMN Kota Kinabalu located in Teluk Sepanggar in East Malaysia. This was due to the fact that RMN Lumut was not operationally suitable for the submarines given that the submarines would have to

transit through the narrow Straits of Malacca every time if it was based there but deploying eastwards. The RMN naval base at Kuantan while giving access to open seas was too small and too close to the commercial port for the submarines to operate from there and building another base on the East Coast of Peninsular Malaysia was rejected due to the East Coast's propensity for flooding and being more vulnerable to the monsoon season. In any event, Peninsular Malaysia was too close to neighbouring countries for submarines to be operated unnoticed. RMN Kota Kinabalu on the other hand was ideal, being well away from neighboring countries and enjoying easy access to open seas and it was slated to be the main naval headquarters and base in East Malaysia with the planned relocation from RMN Labuan, which was being handed back to the civil authorities there. As far as the writer knows, the proximity of Sepanggar to the Spratly Islands played very little part in the decision, which was unsurprising given that at that time, the issue of competing claims in the South China Sea had quietened down. Cost factors prevented the RMN's original plan of a submarine base built into a cavern as the Swedish Navy had.

The RMN's first submarine, KD *Tunku Abdul Rahman* returned to Malaysia in September 2009 where it subsequently began operational trials. Reports then emerged in January to February 2010 where it was revealed that there were several defects in the submarine which temporarily rendered it unable to dive. This was successfully seized upon by the political opposition and made into a mantra that the Malaysian submarines could not dive at all times plus coupled with the ongoing controversy over the submarine purchase and the murder of Altantuya led to the submarines having a poor image among some segments of the public. In 2011, in order to quell persistent claims that the submarines could not operate and dive, then Defence Minister Dato Seri Ahmad Zahid Hamidi arranged for Penang Chief Minister Lim Guan Eng, a key opposition figure to embark on the submarine KD *Tun Abdul Razak* and experience the submarine travelling underwater. While this temporarily quelled the mantra of the submarines being unable to operate, the image of the Malaysian submarines as a byword for wastage and corruption along with the linkages to a murder continues to persist particularly with Dato Seri NajibTun Razak's tenure as Prime Minister.

During the 2013 Sulu incursion, segments of the public queried why the submarines could not prevent the incursion, and in 2014, during the search for MH370, an erroneous Singapore news report on the

commitment of the Republic of Singapore Navy's submarine rescue ship MV Swift Rescue to the search which called the ship a submarine instead of a submarine rescue vehicle led to calls by the opposition and the public as to why Singapore could commit a submarine to the search while Malaysia's two submarines did nothing. This resulted in Chief of the RMN, Adm Tan Sri Aziz Jaafar's having to issue a public statement as to why submarines were not ideal for underwater searches hence the reason for the non-participation of the RMN's submarines in the search, though this statement was undone when the UK subsequently announced the commitment of the submarine HMS *Tireless* to the search.

While the RMN has been fairly tightlipped on the operations of its submarines and publicly declaring they have been happy with the support and maintenance of the submarines, there are indications that not all was well as it seemed. Retired Rear Admiral Rosland Omar who was deputy director of the RMN's submarine project from 2003 to 2006 before becoming the director from 2006 to 2009 was quoted in an Asia Pacific Defence Reporter article on some of his dissatisfaction with the RMN submarine project.[3] Rear Admiral Rosland was cited as saying, when asked how would he do things differently given his experiences, he would ensure that the contract would include everything explicitly as the French side would not do anything not stated in the contract without a contract amendment. He also said that both submarines were supposed to be available to the RMN for 130 days per annum but that rate was not achieved. He also pointed out that substantive cause of the problem was a lack of timely spares provision. Maintenance of the submarines is done by Boustead DCNS Naval Corporation (BDNC), which was set up in June 2009 as a joint subsidiary by Boustead Heavy Industries Corporation (BHIC) and DCNS to provide support for the two DCNS Scorpene class submarines with BHIC owning 60% and DCNS owning 40% of BDNC.

On 30 March 2015, BHIC announced that BDNC had received a letter of acceptance from the Malaysian government to extend submarine support services until May 2017 with the value of the contract extension being announced as RM531.2 million. The original submarine support contract, awarded in 2010, was scheduled to expire by late 2015. The extension of the support services contact was followed in by an announcement on 16 November 2015 that BDNC had received a contract for the refit of the two submarines with a dual contract value of EUR169.8 million and RM432.4 million. The work will be carried out

at RMN Kota Kinabalu, where BDNC has several purpose built facilities for the task, with three completed workshops being handed over on 16 January 2016 by the RMN to BDNC. While the submarine support facilities are for the use of the RMN, they could in the long term form also a useful infrastructure facility for the USA and Australian submarines operating in the region. Particularly with DCNS winning the Australian Collins class replacement programme, the USA and Malaysia have been increasing submarine cooperation with annual port calls by USN submarines and submarine tenders to RMN Kota Kinabalu along with annual staff talks and so has Australia, with the most recent being the submarine HMAS *Dechaineux* carrying out a 2-day exercise with the RMN submarine KD *Tunku Abdul Rahman* between 12–14 October 2015.

Initially in 2006, Malaysia held a trilateral submarine staff talks with the Royal Australian Navy and US Navy but in 2007 this had changed into separate annual bilateral talks by the RMN with both navies and as mentioned earlier both the RAN and US Navy have had a continuous series of engagement and cooperation. The RMN also is gearing itself up for increased interoperability with the US submarine force, as was highlighted in a US Navy release in September 2015 after the RMN and US Navy Submarine Staff Talks 2015 held in Guam. Here, it was stated that the talks focused on reviewing and establishing plans for joint trainings and exercises in 2016 and beyond.[4] A further example of the RMN submarine force moving towards interoperability with their US counterparts is seen in the acquisition of a Ship Interface Template Set (SITS). On 4 January 2016, the Malaysian Ministry of Defence issued a tender for the transportation of a completed SITS from the USA to RMN Kota Kinabalu. SITS comprises support structures that are welded onto a vessel's deck enabling the rapid integration of the US Navy's Submarine Rescue Diving and Recompression System (SRDRS) and Pressurised Rescue Module System (PRMS) on a Vessel of Opportunity. In this case, the SITS would allow the RMN's submarine rescue ship MV *Mega Bakti* to deploy the US systems which in turn would only be required if conducting a rescue of a USN submarine rather than an RMN for which the MV *Mega Bakti* already has the integral equipment.[5] The MV *Mega Bakti*took part in the 2016 Pacific Reach submarine rescue exercise held in the Republic of Korea from 23 May to 3 June 2016 in which among the exercises it was involved included simulated rescues of personnel from an RAN submarine and a ROKN submarine.[6] The MV *Mega Bakti* is operated by a private Malaysian company, Target Resources SdnBhd,

under a 20 year service contract, originally the contract was to have been award in 2009, but the Finance Ministry told the Defence Ministry to renegotiate the deal and it was thus only awarded in 2012.

Malaysia hosted the annual Asia Pacific Submarine Conference in September 2014 where the theme was "Enhancing Interoperability for Safety", the conference was attended by 61 participants which as well as international navies also included the International Submarine Escape and Rescue Liaison Office (ISMERLO).[7]

Cooperation has also being going on constantly with the French Navy and French Navy officers were previously stationed at the Ministry of Defence in Kuala Lumpur to assist with the RMN submarine project before being relocated to RMN Kota Kinabalu with the arrival of the RMN submarines in Malaysia. The most recent exercise between the French Navy and RMN was a 2-day Combined Anti-Submarine Exercise (Casex) between the submarine KD *Tun Razak* and the French Navy frigate *Provence* between 16–18 February 2016. During the Casex, the RMN Submarine Force Chief of Staff, Capt Baharudin Wan Md Nor told the media that a number of RMN submarine personnel had already clocked more than 10,000 h underwater in 7 years of operations.[8]

Beyond such exercises, the RMN has made it a policy not to generally disclose the operational activities of its submarines though occasionally that policy is relaxed with postings on social media and disclosures to the media via press statements or postings on the RMN's official home page. The current RMN Chief, Admiral Tan Sri Kamarulzaman Ahmad Badaruddin posted a tweet on twitter on 28 June 2016 announcing an RMN submarine had reached a 21 days at sea milestone while the official account for the RMN Submarine Force, RMN Subforce tweeted on 21 August that it had completed a 4th Black Shark torpedo launch since the submarine's return to Malaysia.[9] It is expected that the RMN submarines are employed in the traditional submarine peacetime role of conducting covert surveillance and patrols.

The Black Shark torpedoes and the sub launched SM39 Exocet missile form the Scorpene's armament and the KD *Tunku Abdul Rahman* conducted a live test firing on 26 July 2010 in the South China Sea. The weapon, launched from a distance of 40 km and when the submarine was at a depth of 55 m, successfully destroyed a 40-m long target. The firing was part of an exercise that the submarine was taking part in. That exercise, Operation Sea Training Exercise/Fleet Integration Training With Submarine 2010 (OSTEX/SUB FIT 2010) involved 10 other

RMN ships including the frigates KD *Lekiu* and KD *Lekir* and the Patrol Vessels KD *Perak*, KD *Terengganu*, KD *Pahang* and KD *Kedah* and 1000 personnel from the RMN and Royal Malaysian Air Force (RMAF). Also participating were elements of the RMN's special forces, diving and air defence teams. The RMAF fielded two BAE Hawks, a Beechcraft 200T Maritime Patrol Aircraft and an S-61 helicopter for the exercise. The exercise was staged from the RMN's COMNAV 2 HQ at RMN Kota Kinabalu. An RMN official press release on the exercise stated that the purpose of the exercise was to assess the RMN's fleet readiness, develop the capabilities of the RMN and RMAF in operations with submarines, to highlight the RMN's presence in the South China Sea and to test contingency plans for the defence of the RMN posts located in the Spratly Islands. The RMN though has held much of the training and firing exercises involving submarines well clear of the Spratlys so as not to inflame other claimants there. Even so the need to highlight the RMN's presence in the South China Sea and to test contingency plans to defend the RMN stations also highlights some of the wartime scenarios that the RMN submarines are expected to face. As mentioned earlier, the planned location of the submarine base in Sepanggar was not related to the Spratlys but the decision proved to be fortunate for Malaysia with the Spratlys issue becoming active again after the decision to build the base there.

While the current angst among the political opposition and some segments of the Malaysian public over the submarines have not affected the operations of Malaysia's submarines and have basically been little more than a source of constant annoyance to the RMN and Malaysia's Ministry of Defence, the long-term issue is what it bodes for the future of the RMN's submarine capability/Purchases of additional submarines would be a hard sell in the future, particularly if the political opposition gains power. It will be a while though before the RMN plans to expand its submarine fleet, however, as a written reply in May 2015 by RMN Chief Admiral Tan Sri Aziz to the writer on the future of the RMN's submarine fleet states,

> For a start, the two submarines are quite adequate for the RMN specific submarine operations requirement. Since the submarine force is still in its infant stage, we are paying particular attention to ensure that we do everything right the first time in conducting its training, maintenance and operation. It is paramount that these submarines are being operated safely, effectively and efficiently before we embark into the future plan of the submarine force. We reckon it will take us at least another 5 years or so before we are able to plan for more submarines.

Given that timeframe, however, it should be noted that the political leaders of that future time along with the public would all have been around in the time of the controversy over the submarines purchase and maybe unwilling to support any submarine purchase then due to the residual stigma from the circumstances of the initial purchase.

Aziz's successor as RMN Chief, Admiral Tan Sri Kamarulzaman Ahmad Badaruddin, who took over as RMN Chief in November 2015, has followed a similar tack on the future of additional submarines for the RMN, in that additional submarines are still far off, though his '15 to 5' RMN Strategic Plan which calls for the reduction of ship classes in the RMN from 15 classes to 5 classes acknowledges the long-term expansion of the RMN's submarine fleet to four submarines from the current two in service. The fact is that two submarines are insufficient to fully meet operational requirements effectively and the recent overhaul and refit of the Scorpene submarines means that currently, KD *Tunku Abdul Rahman* has been unavailable since November 2015 due to the work while KD *Tun Razak* begins its unavailability in June 2017 as per the DCNS press release dated 8 April 2015 which stated,

> The Malaysian government has just signed a new contract with Boustead DCNS Naval Corporation for through-life support for the two 2000 type Scorpene submarines of the Royal Malaysian Navy, based at Kota Kinabalu, Sabah. The contract signed at the end of March will remain in force for over two years (on May 31 2017). This new agreement makes it possible to extend the through-life support time for the two 2000 type Scorpène submarines currently in service before the beginning of their first major maintenance campaign. Indeed, the *Tunku Abdul Rahman* should start its period of unavailability for major repair and overhaul (ROH) in November 2015 and the *Tun Razak* in June 2017.

This means that for more than 3 years from November 2015, the RMN will only have one operational submarine and at certain periods during that time will not have an operational submarine to call upon. The limitation of operational availability due to having two submarines is why Singapore maintains a constant fleet of four submarines. Indeed in the initial stages of negotiation, it was expected that the RMN would opt for four submarines or take two with an option for a further two more but the costs of such limited the procurement of two submarines which causes difficulty in operational availability. However, expanding the fleet of submarines even by an additional two would entail significant

procurement and also operational maintenance costs, and given that the RMN's ageing fleet and the demands of operations in securing Eastern Sabah from incursions and kidnappings are already straining the RMN budget, it would not be fiscally and operationally viable for the RMN to expand its submarine fleet.

The second factor is the state of Malaysia's economy, given the continuing depreciation of the ringgit and the worsening of Malaysia's economy, it might have to be asked as to whether Malaysia can even fiscally afford to expand beyond its current fleet particularly given submarines are expensive assets to purchase and operate. While the future of any nation's economy is difficult to predict, the lesson here is that countries purchasing submarines should not only consider the fiscal situation surrounding the current or planned purchase but also beyond that. The question for naval planners might be to consider whether they can afford to continue beyond an initial purchase and nascent capability or would they be better off forgoing such given that they cannot fiscally afford to go further after the initial stage.

Given the current situation surrounding Malaysia, it would appear that for the future, the Royal Malaysian Navy is likely to remain within its current submarine fleet size for a significant time.

Notes

1. In 2008, the Malaysian High Court acquitted Abdul Razak Baginda of involvement in the murder and in the following year two Police commandoes were found guilty of the murder and sentenced to death. "Ex-Najib aide says he is living in Malaysia" *The Straits Times,* 5 Nov 2016.
2. Malaysian government denies any wrongdoing in defence deals—Dzirhan Mahadzir *Janes Defence Weekly* 15 May 2008.
3. Reference Check Part 3—The Malaysian Experience—Rex Patrick, *Asia Pacific Defence Reporter*, May 2016, pp. 38–39.
4. USA, Royal Malaysian Navy Submarine Leaders Participate in Guam Staff Talks—US Navy Press release online at the US Navy official website at http://www.navy.mil/submit/display.asp?story_id=92257.
5. Malaysia enhances submarine rescue interoperability with US Navy—Dzirhan Mahadzir, *Janes International Defence Review*, 6 January 2016.
6. Submarine rescue vessel tested and proven in drill—*The Star* 18 June 2016, online copy at http://www.thestar.com.my/news/nation/2016/06/18/submarine-rescue-vessel-tested-and-proven-in-drill/.

7. RMN To Share Knowledge On Submarine Escape and Rescue With APSC Participants—*Bernama* National News Agency 9 September 2014, online copy at http://www.bernama.com/bernama/state_news/news.php?id=1067245&cat=sbe.
8. RMN's submariners spend over a year underwater—*The Sun* 16 April 2016 online copy at http://www.thesundaily.my/news/1747784.
9. RMN Subforce tweet—https://twitter.com/RMN_Subs/status/767579150936702976.

Author Biography

Dzirhan Mahadzir is a freelance defence journalist and analyst based in Kuala Lumpur, Malaysia. He has guest lectured at the Malaysian Armed Forces Defence College on various topics pertaining to strategy and military history from 1999–2003 and regularly gives presentations on the Malaysian Armed Forces and Malaysia's defence developments to visit delegations from military institutions such as the US National Defense University, USAF Air War College and the Australian Staff College. Amongst the publications he has written for and currently writes for since 1998 include Defence Review Asia, Janes Defence Weekly, Navy International, International Defence Review, Asian Defence Journal, Defence Helicopter, Asian Military Review and the Asia-Pacific Defence Reporter. He holds an MA in Defence and Security Analysis from the University of Lancaster, UK, and an LLB Law Degree from the University of Wolverhampton, UK.

CHAPTER 8

Submarine Acquisition in Vietnam

Carlyle A. Thayer

Abstract The reasons for submarine acquisition in Vietnam are explored against the general strategic context in Southeast Asia in general and the South China Sea in particular, and the country's unique approach to the challenges it poses is demonstrated. The contribution that submarines are thought to make to Vietnam's security is discussed, and the technological, economic and institutional problems and their acquisition poses are identified.

Keywords Naval modernisation · Submariners · Vietnam
South China Sea · Stability in Southeast Asia

Background

In the mid-1980s, the Soviet Union agreed to assist Vietnam in the development of an underwater warfare capability. A Vietnamese crew was trained for service on a Project 641 diesel submarine in the Soviet Pacific Fleet and formed part of Submarine Force 196. Mikhail Gorbachev later suspended this programme.

C.A. Thayer (✉)
Thayer Consultancy, Northcott Drive, Australia

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_8

In 1997, Vietnam acquired two Yugo-class mini submarines from North Korea. They were berthed in Cam Ranh Bay. After repair and overhaul, they were used for diver-related training and operations. That same year, after the visit of a Russian Project 636 Kilo-class submarine to Cam Ranh Bay, Vietnam was reported to have raised the possibility of purchasing submarines. It was only in June 2000, however, that Vietnam and Russia reportedly signed a memorandum of understanding that included the possible sale of Kilo-class submarines to Vietnam.

In 2000, Vietnam and India signed a Defence Cooperation Agreement that included Indian assistance in training Vietnam People's Army (VPA) Navy personnel including submariners. In October 2002, Vietnam officially asked India to provide training for submariners. Four years later, in May 2006, India announced that it would commence training for VPA naval cadets and officers 'in the very near future'.

During the first quarter of 2008, Vietnam made determined steps to acquire submarines. Vietnam was reported to be interested in acquiring submarines from Serbia, but the deal fell through. In September, during the course of a visit by Vietnam's Minister of National Defence to Moscow, his counterpart announced that Russia was ready to provide the VPA with 'arms and military hardware'. Reports then circulated that Vietnam and Russia signed a letter of intent to purchase six Project 636 MV enhanced Kilo-class or *Varshavyanka*-class submarines to be delivered by 2016. The following month Vietnam's president, Nguyen Minh Triet, visited Moscow and expressed an interest in expanding 'military technical cooperation'. Shortly after, it was reported that Russia and Vietnam agreed in principle on the sale of Kilo-class submarines.

A major turning point was reached in 2009. On April 24, Vladimir Aleksandrov, General Director of Admiralteiskie Verfi in St. Petersburg, a subsidiary of the United Shipbuilding Corporation, announced that his company had been identified as executor for a contract for six Improved Kilo-class Project 636 submarines.[1]

On April 27, RIA Novosti reported that Rosoboronexport, the sole state agency responsible for the sale of weapons, confirmed negotiations with Vietnam were taking place on the sale of conventional Kilo-class submarines to Vietnam and that an export contract with the VPA Navy would be signed 'in the next few months'.

On December 3, *Vedomosti* confirmed that negotiations on completing the sales contract were proceeding successfully. According to a manager at Rossiyskiye Tekhnologii, the contract would include the delivery

of the Kilo-subs, crew training and the construction of onshore basing infrastructure.

Finally, on December 15, during the visit by Prime Minister Nguyen Tan Dung to Moscow, the contract for the sale of six *Varshavyanka*-class submarines and related equipment was signed between Rosoboronexport General Director Anatoliy Isaykin and VPA Navy Vice Admiral Nguyen Van Hien. Under the terms of the contract, Russia agreed to supply one submarine a year over the next 6 years. The cost of the submarines was valued at US $2 billion.[2] Russian specialists will be involved in training, outfitting and maintenance programmes.

Bob Nugent, a retired US Navy intelligence analyst with 22 years of experience, evaluated Vietnam's acquisition of a submarine fleet in late 2009 as follows:

> What does it take for an 'emerging' Navy to make the successful transition from two-dimensional (surface/air) to 3 dimensional force that includes subs? We have observed that it has been a struggle for some SE Asian navies with missions, force structures and funding not unlike those of Vietnam to absorb submarines and produce an effective capacity in doing so. Others seem to have handled the transition quite well…
>
> What I draw from above is that Vietnam has the resources – national and naval – to field a submarine force. It also has the manpower. And the mini-sub experience provides a basic foundation for understanding submarine operations and maintenance.
>
> What the data doesn't really help forecast is how well and how quickly Vietnam will make the transition. My "gut instinct" is that their experience will be closer to Indonesia's than Singapore's – but a major unknown is how much Russia will provide them in the way of sustained concrete support over the coming years to help them effectively absorb a force of KILOS.[3]

Russians Return to Cam Ranh Bay Military Port

On 25 March 2010, the Russian Defence Minister announced that Russia would help Vietnam build a submarine base at Cam Ranh Bay. Two years later, Russia confirmed it was planning to build a submarine base at Cam Ranh Bay. At the same time, Vietnam announced it would turn to India for full-scale underwater warfare training.[4]

In 2010, it was revealed that the cost of Vietnam's new submarine fleet had risen from US $1.8 billion to US $3.2 billion.[5] The unit cost of construction increased from US $300 million to US $350 million.[6] In addition, Vietnam will also pay an additional US $1 billion for armaments, local support infrastructure and other equipment.

Vietnam's Kilo-Class Submarines

Vietnam has purchased six diesel-electric advanced Kilo-class submarines or Project 636.3-MV *Varshavyanka*-class Fast Attack Submarines (SSK) designed by the Rubin Central Design Bureau for Marine Engineering. They have improved range, firepower, reliability, speed and sea endurance (Table 8.1).

The *Varshavyanka*-class submarines have been dubbed the 'black hole' by the US Navy because they are one of the quietest diesel-electric submarine classes in the world. Their acoustic characteristics include: improved stealth through removal of flooding ports and treating the hull with multilayer anechoic rubber tiles; fitting on casings and fins absorb sonar sound waves of active sonar thus results in reduction and distortion of return signal, and sounds from within submarine reducing the range of detection by passive sonar.

The *Varshavyanka*-class submarines are designed for anti-submarine warfare, anti-shipping and anti-surface ship warfare, patrol and general reconnaissance, and for the defence of naval bases and coastlines. They are capable of operating in relatively shallow water.

Table 8.1 Characteristics of the *Varshavyanka*-class Submarine

Characteristics	
Crew	52–57 persons
Length	73.8 metres
Width	9.9 metres
Surface displacement	2,300–2,350 tons
Draft	6.2 metres
Diving Depth	300–350 metres
Surface speed/range	20 knots/9,650 km
Under water speed/range	5 km per hour/700 km
Endurance	45 days
Range	9650 km
Armament	Torpedoes, mines, missiles

The *Varshavyanka*-class submarine is equipped with six 533 mm forward tubes capable of firing torpedoes or missiles and/or laying mines. The *Varshavyanka*-class submarine can carry 18 torpedoes (six torpedoes stored in tubes and 12 on racks) or 24 mines (two in each tube and 12 on racks). Two torpedo tubes are designed for firing remote-controlled torpedoes with very high accuracy. Vietnam's subs reportedly will be fitted with new heavyweight torpedoes such as the 53–65 or TEST 76 weapons (Table 8.2).

The *Varshavyanka*-class submarine can carry four or more missiles. According to Oleg Azizov, representative of Rosoboronexport, speaking in July 2011, Vietnam's *Varshavyanka*-class submarines will be equipped with the Novator Klub-S (SS-N 27) cruise missiles.[7] These missiles can be launched underwater from torpedo tubes and have a range of 300 km. Media reports confirmed that all of Vietnam's four *Varshavyanka*-class submarines are armed with Klub-S missiles. It is not clear whether these submarines are equipped with the 3 M-54E Klub-S (220 km range) or the 3 M-54E1 (range 300 km) anti-ship missiles. In May 2015, it was reported that Vietnam had taken delivery of twenty-eight of fifty anti-ship and land-attack missiles on order from Russia,

Table 8.2 Vietnam's Submarine Brigade 189

Number	*Name*	*Status*
HQ 182	*Ha Noi*	Construction commenced 24 August 2010. Launched on 28 August 2012. Delivered to Vietnam on 31 December 2013. Commissioned on April 2014.
HQ 183	*Ho Chi Minh*	Launched on 28 December 2012. Commenced sea trials on 28 April 2013. Delivered to Vietnam on 19 March 2014. Commissioned on April 2014.
HQ 184	*Hai Phong*	Construction began on 14 March 2012. Launched on August 2013. Delivered to Vietnam on 28 January 2015. Commissioned on 1 August 2015.
HQ 185	*Khanh Hoa*	Launched on 28 March 2014. Sea trials in January 2015. Delivered to Vietnam on 30 June 2015. Commissioned on 1 August 2015.
HQ 186	*Da Nang*	Launched on 28 December 2014. Completed sea trials in June–September 2015. Delivered to Vietnam on 2 February 2016.
HQ 187	*Ba Ria-Vung Tau*	Construction began on 28 May 2014. Launched on 28 September 2015. Scheduled for delivery early 2017.

including the 3 M-14E Klub (range 300 km) land-attack precision strike missile.

In 2015, defence analysts speculated that the final two submarines on order from Russia might be configured to embark Special Forces.

The *Varshavyanka*-class submarine is also armed with MANPADS Strela-3 (man portable air defence missile system).

Ever since Vietnam took delivery of its first Russian-built enhanced *Kilo* or *Varshavyanka*-class conventional submarines, analysts have differed over how quickly Vietnam could absorb these weapons into its navy and create a credible deterrent force to China. For example, Admiral James Goldrick (Royal Australian Navy retired) noted '(t)he Vietnamese are trying to do something very quickly that no navy in recent times has managed successfully on such a scale from such a limited base… The new boats may have significant numbers of Russians on board for years to come'.[8]

The assessment of whether or not Vietnam can absorb submarines and create a credible deterrent is now becoming clearer with reports by diplomatic observers that Vietnam's submarines are undertaking patrols along Vietnam's coast. More recent press accounts indicate that the Vietnamese submarines have commenced patrols without their Russian advisers. In addition, Vietnamese crews are currently undergoing training at India's *INS Satavahana* submarine centre in undersea warfare doctrine and tactics.

The views of defence analysts range from sceptical to cautiously optimistic about Vietnam's ability to develop an effective counter-intervention or area denial naval force to deter China in Vietnam's maritime domain. Lyle Goldstein, a professor at the US Naval War College, for example, has written an analysis of Chinese assessments of Vietnamese military capabilities. Goldstein notes that Chinese defence planners monitor Vietnam's modernisation programmes 'extremely closely' and have 'ample respect… for Vietnam overall', including the Vietnamese Air Force.[9]

With regard to Vietnam's *Varshavyanka*-class submarines, Goldstein notes that they can 'deliver lethal blows with either torpedoes or anti-ship cruise missiles'. Nonetheless, Goldstein reports that Chinese analysts have identified two major weaknesses in Vietnam's military strategy: lack of major experience in operating complex weapons systems and 'surveillance, targeting and battle management'. These weaknesses have led Chinese defence officials to conclude 'that China could prevail in any

armed clash' with Vietnam. Goldstein concludes that 'Vietnam's most promising strategy versus China is the hope that it might have sufficient forces for deterrence, while simultaneously pursuing diplomacy to resolve disputes'.

Zhang Baohui, a security specialist at Lingnan University in Hong Kong, reports that China's military planners are concerned about Vietnam's submarines. 'On a theoretical level', he notes, 'the Vietnamese are at the point where they could put them to combat use'.[10]

Brian Benedictus offers cautiously optimistic evaluations of Vietnam's counter-intervention strategy. Benedictus reviews in detail the capabilities of Vietnam's *Varshavyanka*-class submarines. He concludes that these acquisitions 'potentially allow it more options in its power projection towards claims in the South China Sea'. In his view, Vietnam's *Varshavyanka*-class submarines 'have the potential to disrupt enemy ships in a military conflict in a variety of ways', particularly as the People's Liberation Army Navy is weak in anti-submarine warfare.

Finally, Benedictus concludes by stressing the importance of the geographic factor. He argues:

> Vietnam is in close proximity to China's Hainan Province, the island which is harbor to the PLAN Southern Pacific Fleet. It is worrisome enough for Beijing to consider that harbored vessels could be easy prey to submarines off the island's shores, if conflict took place; the prospect of Vietnam someday having land-attack capabilities integrated into its submarine fleet would be a serious cause of concern.[11]

Collin Koh, from the S. Rajaratnam School of International Studies in Singapore, argues that Vietnam will use its submarines in area denial operations off its coast and in the Spratly Islands once they become fully operational. According to Koh:

> Sea denial means creating a psychological deterrent by making sure a stronger naval rival never really knows where your subs might be. It is classic asymmetric warfare utilized by the weak against the strong and something I think the Vietnamese understand very well. The question is whether they can perfect it in the underwater dimension.[12]

Siemon Wezeman, from the Stockholm International Peace Research Institute, goes further to argue that from the Chinese point of view Vietnam's deterrence is already a reality. According to Wezeman:

> The Vietnamese have changed the whole scenario – they already have two submarines, they have the crews and they appear to have the weapons and their capabilities and experience will be growing from this point. From the point of view of Chinese assumptions, the Vietnamese deterrent is already at a point where it must be very real.[13]

One Vietnamese strategic analyst interviewed by the author argued for a strategy of 'mutually assured destruction'.[14] This strategy would only apply to a situation where relations between China and Vietnam deteriorated to the point of armed conflict. Under this strategy, if armed conflict broke out, Vietnam would give priority to targeting Chinese flagged merchant shipping and oil containers ships operating in the southern extremity of the South China Sea. The Vietnamese strategists argue that the aim of this strategy is not to defeat China but to inflict sufficient damage and psychological uncertainty to cause Lloyd's insurance rates to skyrocket and for foreign investors to panic and take flight.

Conclusion

The commissioning of the first four of six *Varshavyanka*-class submarines into the VPA Navy marks a major milestone in the development of Vietnam's national defence capabilities. Vietnam is now a member of an elite group of Southeast Asian nations that deploy submarines, including Indonesia, Malaysia and Singapore. In order to turn the *Varshavyanka*-class submarines into an effective naval force, Vietnam will have to make great efforts to develop an effective doctrine for their use, recruit sailors to crew them and absorb new military technology for operating and maintaining the submarines and their weapons systems.

Vietnam's military can now operate in three dimensions—on land, in the air and under the sea. The *Varshavyanka*-class submarine is known for its ability to elude detection. In 2017, when all six submarines are operational, they will add a major capability in Vietnam's ability to develop anti-access/area denial capabilities against any country seeking to enter Vietnamese waters with hostile intent. In addition, the

Varshavyanka-class submarines will add a potent strike capability with their anti-ship and land-attack cruise missiles.

Vietnam's emerging submarine fleet will be based at Cam Ranh Bay. The ability of these submarines to deploy stealthily will be put at risk if China permanently stations anti-submarine warfare aircraft on Fiery Cross Reef where a 3-km-long runway has been constructed.

When all of Vietnam's current and future arms acquisitions are taken into account, it is evident that Vietnam has taken major steps to develop a robust capacity to resist maritime intervention by a hostile power. This has taken the form of developing a counter-intervention strategy that integrates shore-based artillery and missile systems; Su-30 multirole jet fighters; fast attack craft, corvettes and frigates armed with ship-to-ship missiles; and *Varshavyanka*-class submarines. These weapon systems should enable Vietnam to make it extremely costly for China to conduct maritime operations within a 200-300 nautical miles band of water along Vietnam's coast from the Vietnam–China border in the northeast to around Da Nang in central Vietnam if not further south.[15] Additionally, Vietnam also has the capacity to strike China's major naval base near Sanya on Hainan Island and military facilities on Woody Island.

Notes

1. It was initially reported the submarines were to be purchased by Venezuela but Rosoboronexport broke contract on April 18.
2. According to analysts, the cost indicates that the *Varshavyanka*-class submarines will not have the air independent propulsion (AIP) system.
3. 'RE: Vietnam's Navy and force modernization', email to the author, 18 December 2009.
4. *Southeast Asia Times*, 29 March 2012.
5. Centre for Strategic and Technological Analysis quoted by RIA Novosti, 3 June 2010. Earlier, it was reported that the total cost for the submarines, armaments, equipment and services was US $4 billion; RIA Novosti, 23 March 2010.
6. Tim Fish, *Jane's Navy International*, 9 June 2012.
7. The Klub-S (also Club-S) missile has a range of 300 km with a 400 kg warhead. The missile initially flies at subsonic speed but the warhead separates when it approaches its target flying at 5–10 m above the surface and accelerates to three times the speed of sound.
8. James Goldrick, 'Vietnam's Submarine Fleet', *United States Naval Institute Proceedings,* 139(9), September 2013.

9. Jane Perlez, 'Q. and A.: Lyle Goldstein on China and the Vietnamese Military', *The New York Times*, 5 July 2014.
10. Greg Torode, 'Vietnam building deterrent against China in disputed seas with submarines', Reuters, 7 September 2014.
11. Brian Benedictus, 'The Wildcard: Vietnam's Naval Modernization and Its Role in the South China Sea', *Warm Oolong Tea*, 11 February 2013.
12. Torode, 'Vietnam building deterrent against China in disputed seas with submarines'.
13. Quoted in Torode, 'Vietnam building deterrent against China in disputed seas with submarines'.
14. Carl Thayer, 'Vietnam Mulling New Strategies to Deter China', *The Diplomat*, 28 May 2014. http://thediplomat.com/2014/05/vietnam-mulling-new-strategies-to-deter-china/.
15. Thayer, 'Vietnam Mulling New Strategies to Deter China'.

Author Biography

Carl Thayer is Emeritus Professor of Politics. He is currently Director of Thayer Consultancy, a small business registered in Australia in 2002 that provides political analysis of current regional security issues and other research support to selected clients; Southeast Asia Defence and Security columnist for *The Diplomat* (2013-); Consultant, Gerson Lehrman Group (2012-); Editorial Consultant for Radio Free Asia (2014-); External Expert Contributor, *Oxford Analytica*; Senior Analyst, Wikistrat (2015-); Global Adjunct Faculty member, Ohio University (2009-); Research Associate, ASEAN Studies Center, School of International Service, American University (March 2011-); Adjunct Fellow, International Association for Counterterrorism and Security Professionals, Centre for Security Studies, Stratad Malaysia (August 2013-); and Member of the International Advisory Board of *Contemporary Southeast Asia* (2008-), *International Journal of China Studies* (2014-), *Journal for Social Sciences and Humanities* (2015-); and *Contemporary Chinese Political Economy and Strategic Relations: An International Journal.*

CHAPTER 9

Conclusion

Geoffrey Till and Collin Koh Swee Lean

Abstract The editors of this volume will seek to draw together the threads of the differing arguments presented in this volume. Will the appearance of more submarines in this volatile area prove as dangerous as is often said? To what extent does it represent a "game-changer" within the regional process of naval modernization not just for Southeast Asia but for the whole of the Indo-Pacific region, given rising tensions in the South and East China seas and strategic competition between China and the United States?

Keywords Submarines · Southeast Asia · Proliferation
South China Sea · Acquisition challenges and consequences

G. Till (✉)
Defence Studies Department, King's College London,
Swindon, Wiltshire, UK
e-mail: geofftill45@gmail.com

C. Koh Swee Lean
Institute of Defence and Strategic Studies, S. Rajaratnam School
of International Studies (RSIS), Blk S4 Nanyang Avenue,
Singapore 639798, Singapore
e-mail: ISCollinKoh@natu.ed.sg

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia, Part Two*, DOI 10.1007/978-3-319-58391-4_9

In this book, we have sought not just to explore whether a naval arms race in submarines is developing in the Asia-Pacific region, but to analyse the motivations driving those acquisitions and the prospects and challenges that each navy faces in building a submarine capability.

We have also concentrated on the small and medium navies in the region. The reason for this specific interest is not just because small and medium navies have in the main been overshadowed by major players such as China and the USA in the existing literature, but also because these "lesser players" by dint of having access to fewer resources for the most part do face unique circumstances in their naval force development, especially in the subsurface areas.

We began with several questions:

- **Why Submarines**? Why are submarines proliferating at the rate they are especially amongst navies of the Asia-Pacific region? Is it always a secure and considered judgment that their future operational advantages will outweigh the dangers and the resource and organizational challenges that will confront them?
- **What are the likely problems**? How do these countries intend to meet these challenges? To what extent will the budgetary and political support required for the acquisition or expansion of these demanding capabilities prove forthcoming? And finally, how will the all-important issue of the impact of submarine acquisition on the development of the domestic economy be handled and the relationship with foreign suppliers be maintained?
- **What are the likely consequences of submarine acquisition**? What will be the consequences of the acquisition or development of submarine capacities for the peace and stability of the region? Will it make the region more secure and stable as the strategic gaps between the great and small are narrowed (if they are) or will it increase suspicion and risks of misperceptions and so threaten to destabilize an area already subject to a worrying range of tensions? And what is likely to be the reaction to all this of the great navies from further afield, the Chinese, Americans, Russians and the Japanese in particular, but others too?

Previous chapters have shown not just the diversity of the area and of the approach that the region's navies have taken to submarine acquisition but have also revealed a variety of different views and interpretations. In this concluding chapter, we seek to review all these issues

Why Submarines?

It is clear that being in such a diverse region as the Asia-Pacific, each country independently takes account of its unique circumstances when it comes to threat perceptions, naval force developmental priorities and no less important—economic or fiscal capacities. This is a point often missed by some keen watchers of Asia-Pacific geopolitics and military dynamics. Media commentaries in particular have tended to draw over-simple linkages between submarine proliferation and interstate maritime disputes.

Some sceptics have also questioned the utility of submarines and hence the actual motives of such purchases, for example, pinning their acquisition down merely to a matter of national prestige. And indeed there may have been some evidence for this, and for other frivolous purposes. Media reporting has also linked such purchases to corrupt practices, the saga of Malaysia's submarine deal with the French, overshadowed by the controversial case surrounding the murder of a Mongolian woman, being a case in point. As Dzirhan Mahadzir has pointed out in his chapter, the ghost of this controversy continues to haunt the Malaysian Government, such that public perceptions still have significant bearing on the country's naval modernization programmes.[1]

But as the previous chapters have also shown, it is clear that most if not all these countries do have their own purposeful game plans for building subsurface capabilities. Their submarine acquisition programs ought not to be dismissed as ill-conceived projects for illusory purposes of prestige. Australia and Japan, for instance, each has a long-term strategic plan to develop their naval capabilities, including a significant subsurface capability. They happened to be not just some of the Asia-Pacific region's longstanding submarine operators, but also some of the world's most predisposed—in both fiscal, operational and technological terms—to sustain this capacity. Hence, there is not just a strategic imperative to possess submarines, but also a historical one to maintain them as James Goldrick and Yoji Koda have pointed out.

The same applies to Indonesia as Ristian Atriandi Supriyanto highlighted in his chapter, for it operated up to 12 Soviet *Whiskey* class submarines in the 1960s. But for the most the countries in Southeast Asia, subsurface warfare has traditionally been a gap in their respective quests for balanced naval capabilities. Despite ambitions that dated as far back as the Cold War, their submarine programs only came to fruition from the 1990s onwards. This did not mean that these countries do not

have a "game plan" for submarine acquisition or that these were simply "prestige buys" with little operational or strategic utility. As Carl Thayer showed in his paper, Vietnam has a well-defined purpose for its undersea ambitions. The six *Kilo* class boats may be heavily taxing Hanoi's resource capacities at a time when the country needs to modernize much more than just the navy, but the investment is intended to pay off for the country's long-term struggle against its ever-growing naval asymmetry with China—its possible adversary in the South China Sea. That Vietnam only managed to purchase submarines recently is to be attributed more to its past inability to finance such a costly purchase than any lack of desire. The fact that it acquired six boats at one go is testament to its determination to possess a fully functional subsurface fleet, not just a token one, in order to deliver credible deterrence. Like Vietnam, Singapore has also conducted an incremental approach to building a subsurface capability—first getting either low-capability (very rudimentary *Yugo* class midget submarines in Vietnam's case) or second-hand boats (*Sjöormen* class coastal submarines in Singapore's case), before moving onto newer, more capable boats.

The motivations behind submarine proliferation are diverse and complex, typically comprising a confluence of strategic and domestic factors. Yet if there is any commonality, it is most likely the widespread agreement about the utility of submarines—even if it is theoretical—in times of peace and war. The very characteristics of a submarine—stealthy, being able to operate autonomously and having the proven ability to deliver significantly/ disproportionate operational effect—do endear this particular capability to countries faced with challenging strategic circumstances.

Of course, there are likely to be advances in ASW technology and procedures. Big data approaches may transform the sensor situation and underwater drones (deployed either by the submarine or its air and surface hunters) may likewise shift the offence/defence balance. In an increasingly networked maritime domain, we already have "bistatic sonar" procedures where the returning "ping" of a sonar signal goes to a different and possibly much closer platform from the originating one and this too could make life more difficult for the submarine. And there is also the fact the many would regard the submarine itself as the chief ASW platform provided it has sufficient means of detection and strike. In this case, one country's investment in submarines might simply be overwhelmed by another country's better ones—thereby defeating its sea denial aspirations. Nonetheless, it is clear that the submarine remains an

attractive proposition in an Asia-Pacific marine environment that is politically and operationally conducive for subsurface operations.

The small and medium navies of the Asia-pacific region are also operating in an area the dynamics of which are increasingly dominated by the big two—China and the USA. Although the increase is size and capability of the submarine forces of the PLA Navy are both frequently exaggerated, and the expansion of its submarine fleet has been steady rather than transformational, it *is* clearly a question of significant expansion. This is not the case for the US Navy which now deploys "just" 52 Los Angeles, Seawolf and Virginia class SSNs and four Ohio class guided missile submarines, many of which are not, of course, present in the Pacific theatre. This force, it has recently been claimed, performs just 62% of the aims of the various combatant commanders' operational demands. It is moreover due to shrink still further to about 41 by 2029, by which time the Ohio class submarines will also have been decommissioned, with the consequent loss of some 60% of the US Navy's subsurface missile capability.[2] Although the USA will doubtless seek to mitigate this quite bleak prognosis, and US submarines still retain a very significant qualitative advantage, the fact remains that the Western Pacific is getting much more "uncommanded" than it was. In this situation, the region's other naval players have seriously to consider their options and submarines will certainly continue to offer them opportunities for achieving the kind of strategic effects they consider that they need, whether that is general deterrence, narrow homeland defence or simply the provision of a greater degree of decisional autonomy.

But, What Are the Challenges?

Obviously, for the small and medium navies of the Asia-Pacific region, the submarine is far from being just a pretty toy to boast of during fleet reviews or open days. The inherent characteristics of the submarine give its owner certain highly valued advantages in times of peace and war. For small navies in particular, submarines are essentially "capital assets" that serve as force multipliers against stronger adversaries. Vietnam's case for submarines is obvious. For Indonesia, even if short of the optimal eight to 12 boats it desires to have,[3] even having a handful of boats may well suffice for its strategic and operational purposes. In fact, even maintaining a token force of two West German-built Type-209s helps the country maintain its institutional capacity for undersea warfare, rather than to

lose it over time and then having to rebuild it from scratch when the need arises. Thailand, which was the first Southeast Asian submarine operator prior to 1945, learned the hard lessons from this after it decommissioned its last Japanese-built boats. Expanding a cadre force is much easier than completely reconstituting it.

Countries which have been operating and maintaining a submarine capability also have clear incentives to try to sustain it for as long as they can. The better-financed navies, which also may have readier access to the requisite technologies either through indigenous development or from reliable foreign sources, would potentially stand a much higher chance of sustaining an effective submarine capacity that keeps in pace with times. They may also be better predisposed to embark on their own innovative processes to derive solutions catering for their navies' specific operational requirements. Japan's shift from lead-acid batteries and air-independent propulsion to Lithium-ion batteries for their new and most plausible future classes of submarines is an example of this. This aspect adds to the already impressive repertoire of submarine-related technologies that Japan's domestic industries are already producing—combat management systems, sonars, propulsion and propellers, to name just a few. Even Australia, despite being a relatively newer entrant into the indigenous submarine industrial game, can boast of having built Swedish-design submarines in its local yards. The recent deal with France for 12 Barracuda Shortfin Block-1A submarines—adding to a pre-existing technological base, in collaboration with the Americans, for such associated systems as combat systems, sonars and the Mark-48 ADCAP heavyweight torpedoes—should sustain this capacity for the longer term.

This comparatively rosy picture, even given the inherent challenges involved, does not apply to the less well-endowed countries which, for the most part, have to rely on foreign suppliers, which thereby has a significant implication for their ability to sustain their tiny submarine fleets. But it is also clear that while costs have always been a primary limiter of submarine ambitions, there are always available solutions out there to explore. For example, instead of refurbishing their Type-209s in German yards, which would be more expensive due to the transportation distance involved amongst other tangible factors, the Indonesians sent their boats to South Korea for overhaul. And this certainly constitutes one of the reasons why Jakarta opted for South Korean-built SS209 *Chang Bogo* class submarines—thereby getting not only "more bang for the buck" but also exploiting the existing institutional linkages between client and

supplier. The plan to build the third *Chang Bogo* in its own PT-PAL yard is not without its teething problems, something which again exposes the difficulties faced by small navies which do not have ready access to all the necessary technologies and are maybe less able to enjoy economies of scale due to their tiny procurements.

Perhaps for this reason, some other countries are more cautious about building their own. Vietnam, for example, purchased *Kilo* boats all built in Russia and equipped with Russian technologies and consequently resigned itself to total reliance on this just one supplier. Purchasing more to justify economies of scale to kick-start indigenization remains a faraway ambition. The same goes for Malaysia—there are simply no funds available to purchase more than the pair of *Scorpene* class boats, let alone plan to build submarines locally. Nonetheless, this does not preclude countries from exploring niche areas of submarine self-reliance. Singapore, for example, would almost certainly not take a leap into building its own submarines, but it remains interested in acquiring a modicum of self-reliance in niche areas. Singapore's cooperation with Germany's Atlas Elektronik to develop submarine combat systems is a significant example of this.

One thing is clear: despite the challenges faced in acquiring, operating and sustaining submarine capabilities, Asia-Pacific countries continue to be keen to do so. What facilitates or fuels these aspirations has been, amongst others, an international arms market that has increasingly become "flatter"—in no small part attributed to the emergence of so-called second-tier or new suppliers. This not only expands the range of options, but also makes this "buyer's market" even more competitive—to the benefit of the submarine aspirant. This is well illustrated by, as mentioned earlier, Indonesia's decision to contract a South Korean shipbuilder for its latest submarine purchases. And so was the case with Thailand when it recently revived the decision—to proceed with purchasing three S-26T submarines, the export-oriented model of the Type-039A, from China.[4]

But Problems Persist

Clearly, there are strong strategic motivations, underpinned by historical experience for some to build submarine capacities in the Asia-Pacific. The medium navies—represented in this volume by the case studies of Australia and Japan—would be in a much better position to acquire

and sustain a much more sizeable and possibly more effective submarine capability. They would also be better poised to embark on their own innovative technological solutions that meet specific undersea mission requirements.

Small navies typical of those in Southeast Asia tend to muster relatively tiny submarine forces which thereby bring into question their ability to sustain these capacities. However, as seen in the case of Indonesia, even with a small handful of submarines it is possible to still maintain at least a "fleet in being" peacetime posture. Notwithstanding doubts about their actual operational capacity, this tiny force could not simply be ignored by any would-be adversary. One recalls not just the Australian worries of Indonesian submarine activities which might potentially interfere with INTERFET movements in 2000, but also the obvious worries displayed by such a superpower navy as the US Navy about Libya's old Soviet *Foxtrot* class boats, despite their poor state of material readiness, especially during the episodic confrontations with the Qaddafi regime in the 1980s.[5] Submarine acquisition by the small navies of Southeast Asia can be seen in the same light: notwithstanding the small size of their undersea fleets, it remains a worthwhile peacetime investment that could provide enormous deterrent effect especially in times of crisis.

But there are also clear caveats to this. While there is indeed evidence that the mere existence of a submarine capacity may have significant strategic effect in conditioning an adversary's perceptions and willingness to take risk, many navies remain wary of the wisdom of relying on such modest "existential" conceptions of deterrence. Real and reliable deterrence, they say, demands more than this. It requires credible and demonstrated capacity, otherwise there must always be the concern that an adversary allowed to conclude that he had the superior capacity might be tempted to think he could easily manage the risk of challenging the apparently weaker side. Just as on the surface or in the air above it, superior forces (whether in numbers of quality) can sweep aside the forces of sea denial, impose sea control and enjoy all the strategic benefits it offers. To prevent such perceptions arising at the strategic level, one's submarine force has not merely to exist, but to be tactically and operationally effective, even if not aspiring to realistic expectations of ultimate victory. With such expanded conceptions of deterrence, the aim will be to demonstrate to adversary that the risks and costs of aggression are likely to outweigh the benefits.

This was certainly the assumption of both sides in the Cold War in the conduct of their subsurface encounters. For that reason, they both invested heavily and continuously in a competition to have the best mix of submarine attributes in their fleets—quietness and stealth, propulsion and endurance, striking power, endurance, integration with the rest of the fleet and so forth.[6] This led inexorably to their development of the nuclear-propelled submarine—the operational advantage of which over its diesel-propelled equivalent was and remains very significant in many (but not all) ways. This was extremely demanding technologically and costs a great deal of more money. This is as true now as it was then. Britain's Astute class SSNs, for example, cost between 1.6 billion sterling and £ 747 million (the more you build, the cheaper they get) compared, say to the £ 260 million individual cost of a very capable German Type 212A SSK. Other than, possibly Australia or Japan, none of the small and medium navies of the region can realistically aspire to this in the foreseeable future, for this reason.

Even so, those smaller navies of the Asia-Pacific still confront the unavoidable requirement for continued improvement in their submarine capability if they aspire to anything more than mere existential deterrence. To be a serious player in this world of subsurface deterrence will require serious and continuous investment for the foreseeable future, and it is not clear that many of the countries in the region have either the appetite or the wherewithal to engage in this.

Perhaps even worse from their point of view, there can be no doubt that submarine technology is far from settled. The submarine's future role and power relative to the surface fleet and its air support are quite uncertain, particularly with regard to the development of unmanned underwater vehicles, deployed from ships, aircraft and submarines themselves. The historic role of the submarine as a "lonely hunter" operating more or less independently of the surface fleet was never completely true but is much more doubtful now, given the potential of networking and the communications revolution. Neither, given this, can we be sure of the future balance in tactical and operational effectiveness between the submarine and anti-submarine forces. What we can be sure of, however, is first that staying in constructive touch with all the potential advances that technology offers will be challenging and expensive especially for navies with limited resources and secondly that the strategic consequences of not doing so could be severe.

Nowhere is this truer than in investment in the delivery of what accountants like to call the human capital in subsurface operations. These constraints are not unique to small navies, for even their medium counterparts also face such issues. Human capital is arguably a major—in many ways *the* major precondition for subsurface effectiveness. As Sam Bateman pointed out in his chapter, the Royal Australian Navy had to offer generous bonuses to retain and recruit submariners. If life at sea is already tough enough for the common sailor, how much more is this true for a submariner confined within a cylindrical tube and unable to see the daylight for days, weeks or even months at a stretch? Training needs to be lengthy and especially rigorous as well, since mistakes in a submarine can easily be fatal.

Naturally, as the Asia-Pacific continues to flourish economically navies like all the military services have to compete with non-military, often corporate, sectors for educated and skilled human capital—a resource that is also essential for the upkeep of a professional submarine force. Besides having to grapple with the potential shortfall of new, capable submarine recruits, and to retain skilled existing human capital —both submarine crews and their shore-based technical personnel—a number of these navies will have to face the problem of sustaining an effective program to maintain the quality of their human capital. It is one thing to purchase the hardware, quite another to support its continuous upkeep and life cycle processes. This includes giving submariners ample sea time to hone their skills—not just for combat training purposes but also to maintain a reasonable level of proficiency in safe underwater navigation. Dispatching submarines to sea for training cruises is costly, given the necessary life cycle maintenance, repairs and overhaul processes with the attendant risk in smaller submarine forces of not having operational boats at certain periods of time. Countries such as Singapore and Vietnam, for example, have compensated for this, in view of their small fleets, with on-shore solutions such as training simulators. But nothing beats getting the submariners out at sea, training under realistic conditions and getting acquainted intimately with the typical marine operating environment. In submarines, people learn most effectively "on the job". For this, the capacity for continuous deployment is invaluable and its absence a major impediment.

Finally, it is often overlooked that an effective submarine force "package" does not just comprise the boats, the crew and technical personnel, combat systems and supporting infrastructures but also the necessary

submarine emergency response capacity. This is an area that has often been neglected in the region's quest for a subsurface capacity. Again, medium navies are better placed in this aspect of their development because of their better financial and technical resources. Australia and Japan muster well-developed submarine emergency response capabilities but this is not commonly found amongst the small navies of Southeast Asia. Of those which operate submarines, only Singapore—and to a lesser extent Malaysia—can be deemed to possess a comprehensive submarine emergency response capability. Vietnam does not. And it is puzzling that despite being a longstanding submarine operator, Indonesia seems to have no such equivalent capability. While countries try to rectify this shortfall by signing bilateral pacts with those that do possess such capacities,[7] it is hard to ignore the fact that submarine emergency response capabilities are not uniformly distributed throughout the colossal expanse of the Asia-Pacific region—dense in Northeast Asia and Australia, but much less so in Southeast Asia where those capabilities would most plausibly be required.

For all the challenges to be faced in acquiring them, submarines, by dint of their inherent characteristics, look set to remain an attractive proposition in the Asia-Pacific region's naval force development processes. In the coming years, the region will most likely see not just the expansion of existing fleets but also, the emergence of new players. The submarines they acquire may well be modern and highly capable, possibly equipped with some of the world's newly emergent underwater "innovations" such as unmanned drones for remote, off-board operations. The submarine fraternity in the region—just like all their equivalents worldwide—will continue to be an elite, privileged force with greater levels of prestige compared to their brethren in the surface fleet. That being said, however, medium and small navies of the Asia-Pacific will continue to face problems in matching commitments to resources as they seek to establish or sustain an effective subsurface capacity. Small navies will almost certainly naturally find themselves in a more tenuous position as they commonly operate tiny submarine fleets.

Arguably the most crucial requirement is that the acquisition of a functional submarine capacity needs to be viewed as a whole—comprising not just the hardware and software (boats, combat systems and supporting infrastructures) but also "wetware" (i.e. the human capital), the development of which needs careful planning. New and future submarine capability development plans need to make the training and career requirements of its crews and supporting personnel a key element. This

is not just about sustaining an effective undersea fighting force, but also one that will in peacetime perform professionally and in a safe, effective manner. This is especially pertinent in times of crises, when tension runs high. In such an operational context, the destabilizing effects of a submarine's action may be high since it would find it very difficult to calibrate its use of force, given that its first firing shot is most likely going to disable or kill the target and therefore provoke a strong response. It is hard to exaggerate the critical importance of human capital development in such specialized, elite formations as a subsurface fighting arm, and the challenges to be confronted in delivering it.

.... AND WITH WHAT CONSEQUENCES?

At this stage, we do not wish to resurrect the whole debate about whether a subsurface naval arms race is breaking out in the Asia-Pacific in general and in Southeast Asia in particular.[8] Instead, we will close with just a few observations about the possible consequences of submarine acquisition for the region's peace and stability.

As has been remarked by countless authorities before, it is less the inherent qualities of a weapon that makes it dangerous or not, than the way it is used.[9] Here, the exact motivations behind submarine acquisition are critical and if this is for general purposes of deterrence rather than a reflection of the infamous "general purposes of greatness" way of thinking,[10] what those conceptions of deterrence actually are may make all the difference. Existential deterrence of the sort discussed earlier may be much less destabilizing and escalatory than more muscular conceptions of deterrence, for in this framework, submarine usage may well not be particularly assertive. Occasional deployments to demonstrate continued seaworthiness and operational potential may be all that is required. With this comes only modest prospects of collisions and escalatory incidents, although paradoxically a possible enhanced prospect of accident due to comparative lack of practice.

If, on the other hand, something more positive in the way of subsurface deterrence is considered necessary, then the consequences for local peace and stability could be more problematic. During the Cold War, for example, as both sides developed their submarine capacities, they sought to prove those capacities to themselves, and sometime even to the opposition when considered necessary. British and US submariners progressed from the occasional deployment "against" the Soviet navy in order to

gain as much information as they could about its operational capabilities and procedures, and then to regular efforts to locate and mark every Soviet submarine they could. In order to measure themselves against the opposition, it was not enough to "trail" an adversary's submarines from 15 miles or so without inspiring counter-detection but to move in close to within a few thousand yards to achieve a "fire-control solution" and even then to carry out a simulated attack on an unknowing adversary. This aspect of the deep Cold War was extraordinarily challenging, providing the best possible source of intelligence about the other side, an ideal form of training, and was something that provided confidence that one still retained the operational edge despite the advances made by the opposition.[11] Even so, it was basically very dangerous. Close approaches were commonplace, underwater collisions far from unknown. That these did not lead to a major incident sparking a conflict is testimony to the sheer professionalism of both sides in this potentially deadly game and even more to everyone's knowledge of what was ultimately at stake.

In this way, whether a particular weapon or practice was escalatory and destabilising or not depended on larger questions of the motivation behind the policy of both sides. The dangerousness of submarine activity in other words can be a consequence of the general state of the relations between the protagonists as much as of the inherently destabilising characteristics of the submarine itself. From this perspective in the case, say, of Southeast Asia whether or not the general submarine acquisition process that is clearly taking place imperils the region's peace and stability is likely to be a reflection of the existing strategic situation in the area rather than just as something that profoundly alters it.

Even so those inherent submarine characteristics make it seem wise for all those involved to envision and anticipate a corresponding increase in operational and strategic risk. Accordingly, it may also be time for the region to seriously consider concrete measures to prevent and mitigate subsurface incidents—similar to the "Whiskey on the Rocks" episode when a Soviet *Whiskey* boat S-363 was found beached on Swedish shores close to a major naval facility in 1981, thereafter sparking diplomatic uproar. This particular risk is very real in such geopolitically volatile regions as the Asia-Pacific, where the maritime flashpoints seem to present ideal opportunities for such occurrences. If coastguards, aerial and surface naval/military forces can feud in those numerous standoffs seen so far to be happening in the East and South China Seas for instance, it may seem only become a matter of time before submarines become more

actively involved as "backup" or a form of "recessed deterrence"—essentially presenting greater range of escalatory options for the protagonists. Were this to happen, those attendant risks of inadvertent use of force would clearly increase. The time is, therefore, ripe for preventive measures, against such underwater practices and incidents along with greater levels of cooperation amongst the Asia-Pacific navies—including between those operating submarines and those which do not.

Nor should the singular qualities of the submarine lead analysts or practitioners to think about them to the extent of neglecting everything else that is happening at sea. Maritime operations in this increasingly networked world are very much a holistic affair. Submarines are affected by developments in the surface fleet, in maritime aviation, and indeed by the many of the commercial aspects of sea-usage. In the last analysis, therefore, we need to remember that submarines are best considered not as *sui generis* but instead as just a part of the general dynamics of maritime operations as a whole.

Notes

1. 101 East, *Al Jazeera*'s award-winning Asia-Pacific program, produced in late 2015 a detailed report into the sensational murder of the Mongolian woman, Altantuya Shaariibuu in October 2006 over alleged bribery of Malaysian officials by French companies to secure the submarine contract. This report provoked a vigorous response from Kuala Lumpur. This happened while Prime Minister Datuk Seri Najib Tun Razak was mired in the controversial 1MDB saga that threatened his political survival. One recalls that Najib was the Defence Minister at the time of the murder. See "Malaysia govt responds to Al Jazeera investigation," *Al Jazeera English*, 10 September 2015.
2. Rep. Randy J. Forbes, 'Not Enough Subs so Buy More: Rep. Forbes', 8 March 2016, http://breakingdefense.com/2016/03not-enough-subs-so-buymore-rep-forbes/.
3. Nani Afrida, "Indonesia needs more submarines," *The Jakarta Post*, 6 April 2016.
4. "Prawit confirms submarine purchase," *Bangkok Post*, 1 July 2016.
5. In fact, the U.S. Navy was so concerned about the reckless way Qaddafi used his Soviet weapons that each time, whenever a crisis broke out in the Mediterranean between the US Sixth Fleet and the Libyans, the navy alerted its attaché office in Belgrade to conduct an immediate

reconnaissance of the Libyan *Foxtrot* boats in Tivat, Yugoslavia, where Tripoli maintained two of the submarines for periodic overhaul. Peter A. Huchthausen and Alexandre Sheldon-Duplaix, *Hide and Seek: The Untold Story of Cold War Naval Espionage* (New Jersey: John Wiley & Sons, Inc., 2009), pp. 302–303.

6. For this see Peter Hennessy and James Jinks, *The Silent Deep: The Royal Navy Submarine Service since 1945* (London: Penguin Books, 2016).
7. The Indonesians, for example, signed a submarine rescue pact with Singapore back in 2012, but thus far the pact has not made much progress. By contrast, the Singapore-Vietnam pact came later, yet it has already progressed onto the stage of drafting the standard operating procedures.
8. This is discussed in our sister volume, *Naval Modernisation in Southeast Asia:Problems and Prospects for Small and Medium Navies.*
9. This is the position adopted for example by Colin Gray, *Weapons Don't Make War: Policy, Strategy, and Military Technology* (University Press of Kansas, 1993).
10. A much quoted remark by German Chancellor Bethman-Hollweg in October 1912 as cited in Sir Edward Llewellyn Woodward in *Great Britain in the War of 1914–1918* War (London: methuen, 1967) p. 167.
11. Hennesy and Jinks, op cit.

Authors Biography

Geoffrey Till is Emeritus Professor of Maritime Studies at King's College London and Chairman of the Corbett Centre for Maritime Policy Studies. Since 2009, he has also been a Visiting Professor and Senior Research Fellow at the Rajaratnam School of International Studies, Singapore. His *Understanding Victory: Naval Operations from Trafalgar to the Falklands* was published by ABC Clio in 2014, and he is currently working on a fourth edition of his *Seapower: A Guide for the 21st Century.*

Collin Koh Swee Lean is a Research Fellow at the Maritime Security Programme, part of the Institute of Defence and Strategic Studies which is a constituent unit of the S. Rajaratnam School of International Studies (RSIS). He is especially interested in researching on naval affairs in the Indo-Pacific, focusing on Southeast Asia in particular, and generally issues related to naval technologies, naval modernisation, naval arms control and the offence–defence theory. Collin also taught at the Military Studies Programme and taught various professional military education and training courses with the Singapore Armed Forces Training Institute. Prior to join the Maritime Security Programme, Collin worked at the Military Studies Programme (2010–14) and the Centre for Non-Traditional Security Studies (2008–10), also at RSIS.

Appendix

G. Till and C. Koh Swee Lean (eds.), *Naval Modernisation in Southeast Asia*, *Part Two,* DOI 10.1007/978-3-319-58391-4

Indonesian submarine operations

No.	*Operation*	*Unit*	*Period*	*Location*	*Antagonists/partners*	*Mission*
1	Nanggala	RI Nanggala	Jan–Mar 1960	Indian Ocean/Aceh	DI/TII Aceh	Intelligence gathering
2	Tjakra	RI Tjakra	Feb–Mar 1960	Maluku	RMS	Sabotage
3	Waspada	RI Tjakra	May–Jun 1960	Maluku	Dutch	Sabotage
4	Lumba-Lumba	RI Tjakra	Jun–Jul 1960	Java Sea	India	Joint exercise
5	Karel Doorman	RI Nanggala	Jan–Feb 1961	West Irian	Dutch	Intelligence gathering
6	Antareja	RI Nanggala	Feb–May 1962	West Irian	Dutch	Intelligence gathering
7	Jayawijaya I	RI Tjakra RI Nagabanda RI Trisula RI Tjandrasa RI Nagarangsang	Mar–Aug 1962	West Irian	Dutch	Sabotage (aborted)
8	Cakra I	RI Nanggala RI Trisula RI Tjandrasa RI Nagarangsang RI Nagabanda	Jul 1962	West Irian	Dutch	Intelligence gathering
9	Cakra II	RI Trisula RI Tjandrasa RI Nagarangsang	Aug 1962	West Irian	Dutch	Special Commando Op

(continued)

Indonesian submarine operations						
No.	*Operation*	*Unit*	*Period*	*Location*	*Antagonists/partners*	*Mission*
10	Alugoro	RI Widjajadanu RI Hendradjala RI Bramasta RI Pasopati RI Tjudamani RI Alugoro	Jul–Aug 1962	West Irian	Dutch	Sabotage (aborted)
11	Bull dog	RI Trisula	Jan–Feb 1963	Sulawesi Sea	United Kingdom	Intelligence gathering
12	Wisnu Mukti	RI Nagarangsang RI Tjudamani RI Alugoro	Apr–May 1963	West Irian	UN	Show the flag
13	War patrol	RI Nagarangsang RI Tjudamani RI Hendradjala	Sep–Dec 1963	Karimata Straits	UK, Australia, NZ	Intelligence gathering
14	Kentjana	RI Pasopati	Oct 1963–Feb 1964	Indian Ocean	United Kingdom	Intelligence gathering
15	Ganyang Malaysia	RI Nanggala RI Nagabanda RI Tjandrasa RI Tjudamani RI Hendradjala RI Alugoro	Jan–Dec 1964	Malacca, Karimata, SCS	Malaysia	Intelligence gathering
16	Kangguru	RI Nagabanda	Jun–Jul 1964	Indian Ocean	UK & Australia	Intelligence gathering
17	Tjegat	RI Pasopati RI Tjandrasa RI Alugoro RI Tjudamani	Aug–Sep 1964	Sunda, Lombok Straits	United Kingdom	Show the flag

(continued)

Indonesian submarine operations

No.	*Operation*	*Unit*	*Period*	*Location*	*Antagonists/partners*	*Mission*
18	Teliti	RI Bramasta	Aug–Sep 1965	Christmas Island	UK & Australia	Intelligence gathering
19	Gugus Tugas X	RI Nagarangsang RI Bramasta	Oct 1965–Mar 1966	Arabian Sea	Pakistan	Joint exercise
20	Waspada	RI Widjajadanu RI Bramasta	Jul–Oct 1966	SCS, Malacca	Malaysia	Patrols
21	Makassar	RI Pasopati	1972	Makasar Strait	Illegal fishermen	Patrols
22	Southern cross	KRI Pasopati	1975	Java Sea	Australia	Joint exercise
23	Seroja	KRI Pasopati	Feb–Mar 1976	Banda Sea	Fretilin	Special Commando Op
24	ASEAN meeting	KRI Pasopati	1978	Philippines	Philippines	Security assistance
25	Halilintar	KRI Pasopati KRI Bramasta	May–Sep 1979	South China Sea	Viet, Mal, Spore	Patrols
26	Wilayah Barat	KRI Nanggala	Apr–May 1992	Indian Ocean	Lusitania Expresso	Intelligence gathering
27	Timor Timur	KRI Cakra KRI Nanggala	Aug–Oct 1999	East Timor	INTERFET	Intelligence gathering
28	Ambalat	KRI Nanggala	May 2005	Sulawesi Sea	Malaysia	Intelligence gathering
29	Passex	KRI Nanggala	Aug 2012	Java Sea	United States	Joint exercise

Source Wahyono S. K., ed., *50 Tahun Pengabdian Hiu Kencana 1959–2009* (Jakarta: Panitia Penerbitan Buku 50 Tahun Pengabdian HIU KENCANA, 2009), 217–244; Ade Marboen, "KRI Nanggala-402 dan USS Oklahoma City latihan bersama di Laut Jawa", *Antara*, August 30, 2012, http://www.antaranews.com/berita/330367/kri-nanggala-402-dan-uss-oklahoma-city-latihan-bersama-di-laut-jawa