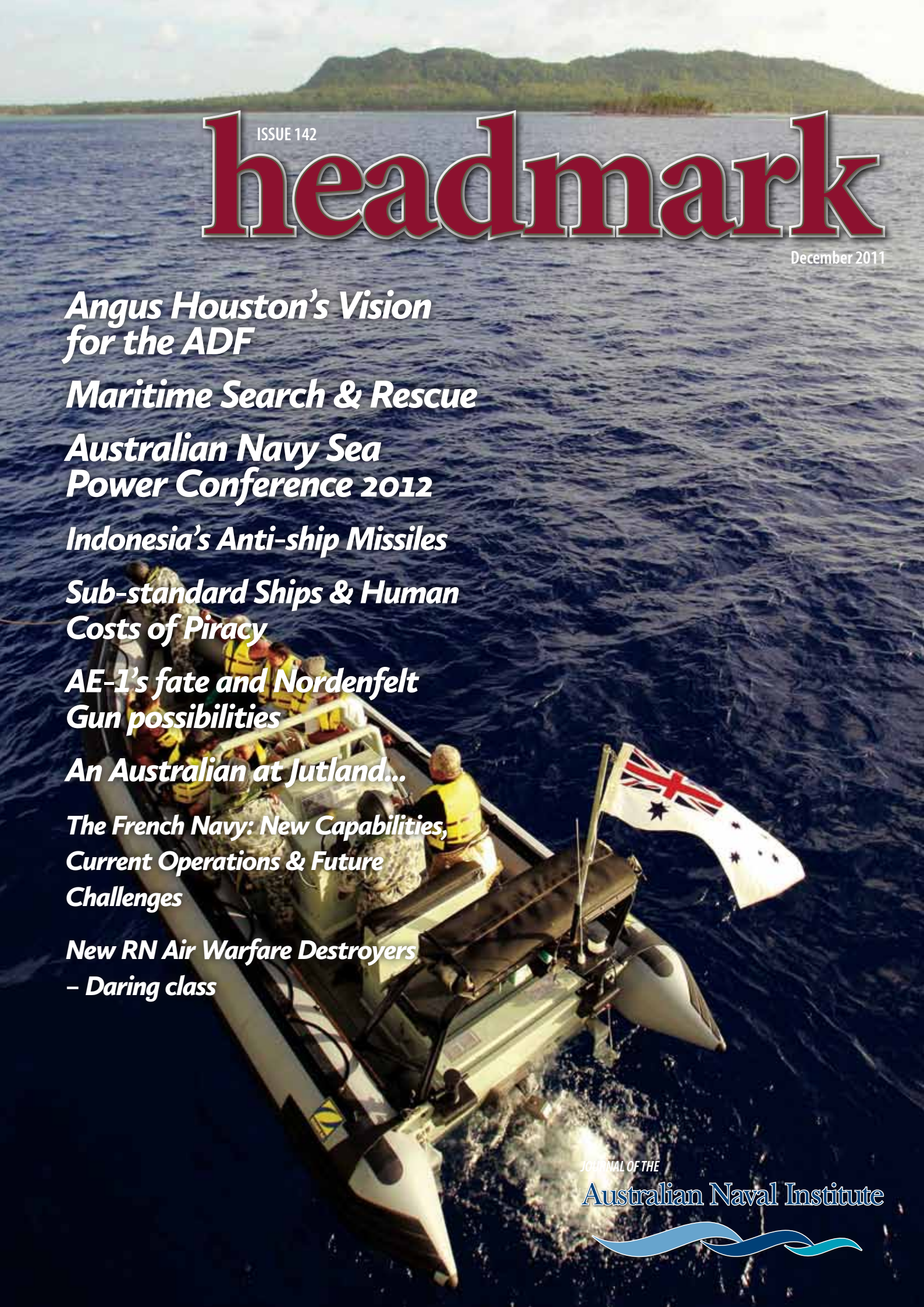

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Snapshot

Retired naval officer David Hobbs spied this "block' of the future RN carrier Queen Elizabeth recently on a trip in Britain. Artists concept image below. (Courtesy RN)

Errata:

A photo in the September edition did not clearly name Vice Admiral Nirmal Kumar Verma, the current Chief of the Indian Navy, who took office on August 31, 2009.

Admiral Verma took charge of the Naval Academy in Goa, and subsequently became commander of a series of Indian Navy ships, including *INS Ranvir*, and aircraft carrier *INS Viraat*. He rose to the rank of Flag Officer Commanding-in-Chief of the Eastern Naval Command, and was appointed Chief of the Indian Navy upon the retirement of Vice Admiral Sureesh Mehta. During his career he has been awarded several decorations, including the Param Vishisht Seva Medal and the Ati Vishisht Seva Medal.

Contents

Front page photograph: Tongan passengers travelling back home to assist family and friends affected by the disaster on the Tongan island of Niuatoputapu leave the ship on one of HMAS Tobruk's RHIB's. HMAS Tobruk has delivered equipment and supplies to assist in the aid effort for the communities affected by a recent tsunami.

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"My vision for the ADF is that we be a balanced, deployable and networked defence force" – ACM Angus Houston

INTERVIEW WITH SERGEI DESILVA-RANASINGHE

After more than 40 years service in the Australian Defence Force (ADF), and holding down the top job in Defence, Air Chief Marshal Angus Houston has faced the challenges of commanding military forces at all levels. As the Chief of the Defence Force, ACM Houston outlined his view on the major challenges facing the ADF, the current situation in Afghanistan and Australia's military contribution to the multinational coalition, the ADF's role in building force structure and capacity, and his vision for the future of Australia's Defence forces.

The-then Chief of the Defence Force Air Chief Marshal Angus Houston, AC, AFC and the-then Chief of Navy Vice Admiral Russell Crane, AO, CSM, RAN speaking at a press conference. (Photo by Lauren Black – ADF)

Q: What have been the major challenges in your role as CDF?

ACM Houston: In terms of major challenges, we have had the highest operational tempo for many years, certainly since the Vietnam War. In terms of operational diversity and complexity the ADF's current commitments are probably the most serious since World War II, because Vietnam was focused only on Vietnam.

At one stage we had Iraq and Afghanistan at the same time, and on top of that a fairly difficult situation in Timor-Leste during 2006. Indeed, in 2006 we ran five evacuation operations including one out of Lebanon. We have completed 39 operations, and we still have another 17 ongoing right now. We have committed around 11,000 troops to operations, which includes those deployed, those in training and preparing to be deployed, and those who have just returned. Even though the number deployed at any one time might be in the order of 3,300 overseas, we have to sustain that over time so it involves a lot more people than those actually there.

This year, with the Queensland floods, we deployed nearly 2, 000 personnel. For Cyclone Yasi in north Queensland we committed another 1,500 or so, and then for the floods in Victoria, about 100 personnel. We also committed some reservists into floods in the Carnarvon areas in Western Australia. In January this year, we had 3,500 people committed to natural disasters in Australia. Counting the 3,300 on overseas operations, we had more than 6500 people committed to operations.

Q: What is the current situation in Afghanistan?

ACM Houston: We are in Afghanistan to ensure that it never again becomes a haven for terrorists. We do not want to see Al Qaeda training with impunity, as they were before 9/11. We would like to see Afghanistan being able to take care of its own affairs and to provide security and governance for its people. What we need is a country that can work, that can be reasonably stable, and one that has secure borders. That really is what it is all about.

The coalition have developed a fully integrated counterinsurgency strategy, which is properly resourced for the first time with around 140,000 coalition troops and an increasing number of Afghans – fast closing on 300,000 personnel. The Afghan security forces are probably around 280,000 at the moment, but later this year they will have reached 305,000 personnel. If you add 300,000 plus the 140,000 coalition troops we are talking about a total security force strength of around 440,000 personnel. That is a huge increase over the numbers we had in 2005.

Q: Tell us about Australia's military contribution to Afghanistan?

ACM Houston: Afghanistan came at the start of my time as CDF when the government had been invited to basically join the ISAF Stage 3

Two P3 Orions parked at the airbase in the United Arab Emirates. No. 11 Squadron operates two P3 Orions in the Intelligence, Surveillance and Reconaissance role in support of Operation Slipper. (LAC Aaron Curran - ADF photo)

expansion, which required us to partner with the Dutch in Uruzgan Province. We ended up putting a small Provincial Reconstruction Team in there, preceded by the insertion of a Special Operations Task Group. Initially, we conducted what NATO might call a stabilisation operation, but the Taliban were resurging as we have seen in the past few years.

Australia is the largest contributor of forces outside of NATO. We are in fact the tenth-largest contributor to the ISAF coalition, with an average of 1550 people deployed in Afghanistan at any one time. In terms of Afghanistan we have a very effective contribution in Uruzgan, and at this point of the campaign I would say the strategy is right.

While all this is going on we are also undertaking governance, development and police work. We have large number of people involved in embedded positions within the coalition structure. We have an Australian heading up the Provincial Reconstruction Team in Uruzgan who is working very effectively with the new structure, a combined team in Uruzgan under an American colonel. We have fundamentally a partnership between Australia and the US, called Combined Team Uruzgan. Singaporeans, New Zealanders and Slovakians are also part of the team.

The Special Operations Task Group is also deployed, and their job is to provide enhanced security and force protection for our people who are doing the mentoring work with the Kandaks (battalions). They go out and target Taliban sanctuaries and leaders, and have been successful in disrupting the Taliban. Indeed over the last three to four weeks we have had a very good run – basically detaining, capturing or killing over 10 medium value Taliban leaders, including a shadow district governor.

Although we have regained the momentum, the gains are still fragile and still reversible. The next fighting season will be crucial for the coalition. It starts in May-June this year and I expect the upcoming fighting season to be very demanding. I think the Taliban will present a very capable insurgency force and we will have to confront that with our Afghan allies to prevail.

Q: Describe the ADF's role in capacity building initiatives to train local Afghan security forces?

ACM Houston: We are training the 4th Brigade, which is a different experience from Iraq where we had training teams to train the trainers and the Iraqi troops. Our contribution was significant. I was involved with the deployment of our battle group through its entirety. We trained over 30,000 Iraqi troops by the time we withdrew, and the ADF battle group did an excellent job.

In Afghanistan, the mentoring and reconstruction task force has evolved into a training and mentoring task force. We train the battalions as they come out of the training school in Kabul after only a few weeks training. They arrive in the province and we teach them the basics of combat: how to patrol and to organise themselves; how to provide the necessary support to patrols that are out there, logistics, fire support, and so on; and how to integrate the operations of two patrols in the same area of operations, and so on.

This campaign in Afghanistan will not be won by military means alone, but if we can train and mentor the 4th Brigade we will improve the security of Uruzgan Province. If we can do that we have basically achieved an important part of the mission. If we can hold the ground then we can build, and with a lot of patrol bases around the province we are in a position to hold the ground. The build part of the mission can be then be provided by aid agencies and the Afghan Government. What is challenging is to be able to provide for all the people of the province so they feel that the future lies with the government, not with the Taliban. In essence, that is the most challenging part of it. This integrated

"My vision for the ADF is that we be a balanced, deployable and networked defence force" – ACM Angus Houston

approach is a challenge, but Australia is now delivering that in a very effective way.

The kandaks we are training are now effective and they are quite capable now of planning patrols by themselves. We are moving up now into a higher level of mentoring, which involves talking to them about planning larger scale operations involving more than a patrol or a sub unit, rather employing all elements of a kandak. At the moment we are about to take on six kandaks, made up of four infantry kandaks, a combat support kandak, a combat services support kandak, and the brigade headquarters.

Where we are headed with our mentoring now, particularly once the next changeover occurs, is into higher level functions, enabling us to eventually leave the Kandaks to operate by themselves. We are currently mentoring the brigade headquarters, which is a level above the Kandak.

The other training that we do is with the artillery training school, and there are people that have been through that school. They are now out there basically using guns to provide fire support for other Afghan units. I would imagine over the next few years we will achieve our objective of being able to hand over security for the province to the Afghan National Army's 4th Brigade. That fits very well with the transition plans that have been developed by NATO.

Q: What is your vision for the future of the ADF?

ACM Houston: In terms of being a deployable defence force, my vision for the ADF is that we be a balanced, deployable and networked defence force. We have increased the size of the ADF substantially in my time from about 51,000 in 2005 to almost 58,000 today.

As part of the intent of the Defence White Paper we have increased the size of the Navy by 700, to get a better balance between the training force and the trained force. Previously, there were too many 'bottlenecks' in the navy training system, and the objective was to eliminate those training inefficiencies. We have also increased the Air Force by about 1,000. The Army has increased by almost 4,000, which included the two additional battalions. We have actually grown quite substantially.

We have gone to a lot of trouble to basically improve the environment for the Reserves, now being deployed on operations. We have given them a job to do with the Rapid Reaction companies in each state, and as a consequence we have actually improved the participation level of the Reserves.

When you look at our geography, Australia is a big country and we live in a big region so we need to be able to operate effectively throughout that area. We have to be an expeditionary force able to deploy to northern Australia if the need arises. If you look at a map of Australia, except for the brigades in Townsville and Darwin, most of our combat power is either southeast or southwest Australia.

We need to be balanced because we have strategic challenges into the future in our region, but we also need to be able to go out into the South Pacific to help the small nations in our region through any problems that they might have, be it a tsunami, a disaster of some other kind, or indeed challenges of governance. The ADF needs to be a flexible and deployable defence force.

Sergei DeSilva-Ranasinghe is a senior analyst at Perth-based strategic think tank Future Directions International. This interview was originally published in Defence Today, (Volume 9 Number 1 – June 2011).

Work continues as troops from the Mentoring and Reconstruction Task Force 1 carry out a works inspection on the progress of the Primary School redevelopment in Tarin Kowt, Afghanistan. (Photo by ADF Corporal Ricky Fuller)

Maritime Search and Rescue as Everyone's Responsibility

BY STUART KAYE

In the debate over asylum seeker boat arrivals, some attention has been directed at the circumstances under which people journey to Australia – specifically the small boats in which they cross the expanse of ocean before ever reaching our shores. This journey is necessarily a dangerous one, and large numbers of individuals have lost their lives. This necessarily raises the question, who has responsibility to rescue and protect these individuals, and what the extent of the Australian Government's responsibility to rescue actually encompasses?

The boats used in people smuggling are typically small Indonesian fishing vessels, with limited range and even more limited ability to handle adverse weather conditions. To maximise the smugglers' returns, these vessels are often severely overloaded. The most infamous case involved asylum seekers lost in the SIEV X disaster in 2001, when some 421 passengers were aboard a 19.5 metre boat which was lost en route to Australia resulting in the deaths of over 350 people. In more recent times, the explosion and loss of SIEV 36 near the Ashmore Islands, and the wreck of SIEV 221 off Christmas Island have highlighted the dangers inherent in people sailing to Australia in small and often unseaworthy craft.

These dangers raise the issue of what obligations does Australia have in respect of vessels around our coasts. The answer is a complex web of international and domestic law, which inform the manner in which search and rescue is conducted, and our responsibilities in respect of ship safety. To begin, search and rescue is potentially every mariner's responsibility. The Law of the Sea Convention provides all vessels at sea must render assistance to those in distress, as far as they are able, without putting themselves or their vessel in undue danger. This requirement is reflected in a range of other international agreements including the International Convention on Maritime Search and Rescue and the Salvage Convention. It is also part of Australian law, being incorporated into the Navigation Act.

This duty to render assistance is deeply engrained in the culture of all those who spend time out on the ocean, whether at work or play. It makes it clear that everyone at sea has not merely a moral obligation, but a duty to assist all those in distress, regardless of where they have come from and how they came to be in those

Border protector - HMAS Armidale leaves Darwin (Courtesy RAN)

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Maritime Search and Rescue as Everyone's Responsibility

circumstances. It also makes it clear it is not the responsibility of Government alone, through the Navy or Customs Service, but of everyone. For most seafarers this as a fundamental element of life at sea, and how deeply it is ingrained is evident in a variety of ways, most notably the many volunteer organisations scattered around the Australian coastline who provide assistance to anyone at sea who is in need. Seafarers recognise the necessity of this mutual obligation as reflected in international law, as the vast expanses of the world's oceans, and the extensive coastlines of so many countries, are simply far too great for any national body to undertake search and rescue alone.

Government's role is reflected in Australia's domestic law and international obligations. In terms of rescue, Australia has undertaken to coordinate rescues at sea in a truly vast area of ocean around our coasts – stretching from more than halfway across the Tasman in the Pacific, north to Indonesia, almost to India in the Indian Ocean and south to Antarctica. It represents 10% of the surface of the globe, and bears no relation to the maritime jurisdiction countries have over fishing or offshore petroleum. It is the one of the largest search and rescue regions in the world.

As vessels in distress are often in remote areas, away from shipping lanes, when a distress call comes, the Australian Maritime Safety Authority (AMSA), as the agency for coordination of search and rescue over this vast area, often contacts the Navy to effect a rescue as no other shipping will be present, but in many more cases ordinary commercial or even recreational vessels might be dispatched to render what assistance they can. It was in this way the *MV Tampa* came to collect over 400 asylum seekers aboard in 2001. This emphasises that search and rescue is a shared responsibility, not merely a Government one, and one which mariners are generally happy to discharge when the occasion arises.

Whether Australia can and should do more to prevent disasters like those that befell SIEVs X and 221 is a difficult question. It has been suggested in some quarters that a single agency should absorb Australia's search and rescue under one umbrella, and this would improve and enhance our capabilities to cope with disasters like SIEV 221. While attractive on some levels, it is worth noting whether centralised or not, already international and Australian law obliges every vessel at sea – foreign or Australian - to do what it can to render assistance to vessels in distress, and this of itself means we are maximising the reach of efforts to assist those in distress. While this will not always be the best vessel or crew for the job, with 10% of the planet to coordinate search and rescue over, we would need more vessels than exist in all the world's navies and coast guards combined to take on the task of ensuring the best vessel is always on hand.

We have in AMSA a remarkably efficient organisation to coordinate getting the nearest practical assistance to a vessel in distress as quickly as possible. Unfortunately search and rescue by its very nature must be reactive, and the size of our maritime responsibilities so large, it is difficult almost to the point of impossibility to pre-position our finite resources to prevent tragedies like those that have already occurred from occurring again. It is impossible for Government to maintain a safety surveillance vigil around all our coasts and across our oceans, and international law does not impose such an obligation upon us.

This problem however is not unique to Australia, and it is why international law has long recognised that everyone has a responsibility to render assistance at sea.

Stuart Kaye is Dean of Law at the University of Western Australia; has written a number of books, including Australia's Maritime Boundaries (2001), The Torres Strait (1997), International Fisheries Management (2001) and Maritime Claims in the Indian and Pacific Oceans (2011), and holds the rank of Commander in the Royal Australian Navy Reserve, principally providing advice in respect of international law.

National Security and Prosperity headline Royal Australian Navy Sea Power Conference in 2012

The Naval Contribution to National Security and Prosperity is the theme for the next Royal Australian Navy Sea Power Conference to be held at the Sydney Convention and Exhibition Centre, Darling Harbour from 31 January to 2 February 2012.

Captain Gordon Andrew, RAN, Director of the Sea Power Centre - Australia, said "the conference is designed to look at how navies contribute, on a daily basis, to the defence and well being of their nation and its interests."

More than 20 speakers from Australia and overseas will present papers that cover the latest in Australian and international maritime affairs, from protection of seaborne trade and conservation of ocean resources, to enforcement of maritime sovereignty and the preservation of good order at sea, including:

Dr Sam Bateman, a retired RAN Commodore and Professorial Research Fellow at the Australian National Centre for Ocean Resources and Security at the University of Wollongong, will present *Promoting Australia as a Maritime Power: the Significance of the Law of the Sea.* With the maritime environment around Australia becoming more complex and contentious, his paper will look at how Australia might meet that challenge of managing one of the largest areas of maritime jurisdiction in the world.

Dr Christian Bouchard, Associate Professor at Laurentian University in Canada, will speak about *The French Navy in the south-west Indian Ocean*, with particular focus the island communities of Réunion and Mayotte from where it operates as well as its roles in both bilateral and regional multilateral cooperation.

Professor Henry Ergas, Senior Economic Adviser for Deloitte Australia and Professor of Infrastructure Economics at the University of Wollongong, will look at the renaissance in naval shipbuilding within Australia over the past 20 years. His presentation, *Australian Ship Building*, will explore the economic and strategic costs and benefits of domestic naval construction, its implications for defence industry policy and Australia's future naval ship building programs.

Dr Norman Friedman, an internationally known strategist and naval historian, has spent more than a decade at a major US think-tank and another as consultant to the Secretary of the Navy. His paper, *Maintaining Good Order at Sea*, recognises that navies help maintain world peace by ensuring world trade flows freely and protecting the vast resources of the sea. However, a new way of helping maintain 'good order' seems to be emerging with the ability of ships at sea to intercept ballistic missiles which has implications for peacetime and wartime naval roles.

Dr Alessio Patalano is a lecturer in War Studies at the Department of War Studies, King's College, London. His presentation, *Sea Power and Security in the East and South China Seas* addresses the inherent tensions existing between the use of naval forces to exert influence and protect core national interests and the requirements to engage in maritime governance in the East and South China Seas.

Dr Sam Tangredi, Director of San Diego Operations for planning-consulting firm Strategic Insight Ltd and a retired US Navy Captain, will discuss the direct and indirect economic benefits from security cooperation between the Australian defence establishment and US naval forces in his presentation *The Economic Benefits of Security Cooperation: A Case Study of the RAN/USN Relationship.*

Professor Geoffrey Till, Emeritus Professor of Maritime Studies at King's College and Director of the Corbett Centre for Maritime Policy Studies in London, considers the economics and strategic cost-effectiveness of sea power using naval and maritime developments in both Europe and the Asia-Pacific region in his paper entitled *The Economics of Sea Power*.

Captain Frank van Rooyen, South African Navy (Rtd), presents a paper on *A Southern Perspective on the Indian Ocean*, which aims to give a perspective

of the Indian Ocean from the global south, a term covering the previously colonised, underdeveloped and impoverished nations of Africa, Latin America and most of Asia.

Additional topics on Australia's future submarine; the Australian Hydrographic Service; maritime medical diplomacy; regional maritime trade operations, Australia's seaborne trade, international naval cooperation; naval engineering, the Naval Reserve; and an update on plans for the International Fleet Review 2013 will appeal to anyone with a professional interest in maritime affairs.

The Sea Power Conference is an integral part of the biennial Pacific Maritime Congress, one of the most prestigious and comprehensive international maritime event in Australasia. Registration for the Sea Power Conference includes free access to Pacific 2012 International Maritime Exposition, conducted by Maritime Australia Limited, and all presentations of the Pacific 2012 International Maritime Conference, hosted by Engineers Australia, The Royal Institution of Naval Architects and the Institute of Marine Engineering, Science and Technology.

The conference is designed to permit all delegates to visit the many industry displays in the Exposition

itself, and to conduct informal professional discussions with exhibitors and fellow delegates. It includes a major social program comprising of official opening and closing ceremonies plus an RAN Reception on the evening of Tuesday 31 January. Guests will be treated to a centuries-old military tradition combining the Sunset Ceremony and Beat to Quarters conducted by the Royal Australian Navy Band and Australian Federation Guard Navy Detachment on the Darling Harbour foreshore.

A number of RAN fleet units will also be open to delegates, including a Guided Missile Frigate (FFG) and an ANZAC class Frigate Helicopter (FFH) at Garden Island, and an Armidale class Patrol Boat (PB) and a Mine Hunter Coastal (MHC) at Cockle Bay. Defence Force Recruiting will be attending the Pacific Congress Careers & Skills Day at which RAN sailors will be available to discuss naval careers.

The Royal Australian Navy Sea Power Conference is open to all Australian and foreign defence personnel free of charge. Non-defence personnel can attend the three day event from $750.00, with concessions and single day tickets available from $510.00. For more information, full event program or to register visit www.seapowerconference.com ❖

Indonesia's Anti-ship Missiles:
New Development in Naval Capabilities

BY KOH SWEE LEAN COLLIN

The recent Indonesian Navy test-launch of the supersonic Yakhont anti-ship missile marked yet another naval capability breakthrough in Southeast Asia. The Yakhont missile could potentially intensify the ongoing regional naval arms competition.

ON 20 April 2011, the Indonesian Navy (Tentera Nasional Indonesia – Angkatan Laut or TNI-AL) frigate *KRI Oswald Siahaan* test-fired a Russian-made Yakhont supersonic anti-ship missile during a naval exercise in the Indian Ocean. According to TNI-AL, the missile took about six minutes to travel 250 kilometres to score a direct hit on the target. This test-launch marks yet another significant capability breakthrough amongst Southeast Asian navies. It comes against the backdrop of unresolved maritime disputes and ongoing regional naval arms competition.

Specifications[1]

Weight **3,000 kg**
Length **8.9 m**
Diameter **0.7 m**
Warhead **300 kg**
Engine **ramjet using kerosene liquid fuel**
Wingspan **1.7 m**
Operational range **120 to 300 km depending on altitude**
Flight altitude **5 meters or higher**
Speed Mach **2.5**
Guidance system **active-passive, radar seeker head**
Launch platform **naval ships, fixed-wing aircraft, coastal installations**
Service history **In service since 1999**
Production history **Manufacturer NPO Mashinostroyeniya**

1 Open Source

A destabilising naval weapon?

According to David Mussington and John Sislin in a *Jane's Intelligence Review* report in 1995, weapons which could be considered destabilising in nature possess all or some of the following six characteristics: result in decreased warning time; give one country 'breakthrough capabilities'; lead to a broadening of target sets; permit no effective countermeasures; give one side better information concerning another's military preparations; and create hostility. Based on some of these criteria, the Yakhont could be deemed destabilising for the following reasons.

Firstly, the Yakhont could travel at sea-skimming altitude (5-15 metres above surface) at 2.5 times the speed of sound thus reducing warning time for the target vessel, especially those ill-equipped for long-range early warning. It is true that Southeast Asian navies are increasingly better equipped with modern sensors to provide early warning of an impending missile launch and for tracking subsonic sea-skimming missiles. Yet the Yakhont's unique flight profile could imply that even more sophisticated detection capabilities have to be acquired by regional navies.

Secondly, even though Vietnam had reportedly inducted the Yakhont into service, it exists in the land-based 'Bastion' coastal-defence variant and is thus strictly defensive. However, when mounted onto a warship which is essentially a highly-mobile platform, the Yakhont's range could be extended beyond the defensive perimeters of one's coastal confines. Prior to the introduction of the ship-launched Yakhont, anti-ship missiles – such as the Western-made Exocet and Harpoon as well as Russian-built Styx and Switchblade – carried aboard Southeast Asian warships, are characterised by subsonic speeds and possess ranges not more than 200 kilometres at most.

A modified Standard Missile 2 (SM-2) Block IV interceptor is launched from the guided-missile cruiser USS Lake Erie (CG 70) during a Missile Defense Agency test to intercept a short-range ballistic missile target (US Navy)

By contrast, the Yakhont has a maximum range of 300 kilometres when flying at high altitude, and maximum speed of Mach 2.5. The only non-Southeast Asian countries in the wider Western-Pacific with equivalent capabilities are China whose Russian-built *Sovremennny* destroyers are armed with the Sunburn missile, and Taiwan which has recently deployed the Hsiung Feng III aboard its warships.

Thirdly, the Yakhont's flight profile also permits no effective countermeasures for most Southeast Asian navies. Only the navies of Malaysia, Singapore and Thailand possess modern shipboard anti-missile missile (AMM) capabilities. Malaysia possesses two frigates armed with the Seawolf AMM and four corvettes with

the Aspide, while Singapore has six frigates armed with the Aster AMM and six corvettes with the Barak-1. Thailand has two frigates equipped with the Sea Sparrow system and two corvettes with the Aspide.

The other Southeast Asian navies are deemed poorly-equipped for air defences. Most surface warships in the region are armed with only guns and surface-to-air missiles effective only against slower-moving targets at short range but not high-performance aircraft and missiles.

What next for Southeast Asia?

The entry of TNI-AL's Yakhont missile came after the recent regional submarine scramble, and introduction of breakthrough capabilities. The Malaysians introduced the first underwater-launched anti-ship missile aboard its new Scorpene submarines while Singapore inducted a pair of ex-Swedish Vastergotland boats with air-independent propulsion for prolonged submerged endurance. In any case, these acquisitions arguably sparked off reciprocal responses from other Southeast Asian navies.

The Yakhont, with its superior capabilities over existing anti-ship missiles arming Southeast Asian surface warships, represented yet another regional naval breakthrough which could not be ignored. This is especially so when no regional navies are adequately equipped against such weaponry if a naval skirmish ever breaks out in the volatile region plagued with longstanding interstate maritime disputes. The Indonesian-Malaysian naval standoff in the disputed Ambalat region in 2009 highlighted the danger of such eventualities.

Possible reactions from neighbouring Southeast Asian navies towards the Yakhont could take certain forms, especially now that regional countries are recovering from the global economic recession and reinstating their naval modernisation programmes. One, it could spark off the acquisition of equivalent capabilities, which might not be that difficult in today's global arms market. While the current anti-ship missile market is still dominated by subsonic systems, a few supersonic examples do exist for sale, such as the Russian Klub-series or Sunburn, and the Indian-Russian BrahMos. India reportedly earlier on shelved the export of BrahMos (based on the Yakhont) to Indonesia out of security concerns but Jakarta managed to circumvent this by directly procuring the Russian 'originals.'

A second reaction is the acquisition of capabilities, such as the Barak, Seawolf and Aster AMM systems, to neutralise such supersonic threats. Acquiring such countermeasures might be considered less provocative since these are essentially defensive. A third reaction is that better-endowed navies might acquire both equivalent anti-ship armaments and AMM systems as a safety measure.

Mitigating the 'Yakhont Effect'

Whichever form it takes, the action-reaction process that could stem from the Yakhont missile would add onto the current intensity of regional naval arms competition. The Yakhont could potentially upset the Southeast Asian naval balance of power even though the Indonesians had reportedly acquired only a small consignment of this missile for limited deployment aboard TNI-AL's frigates.

The region may need to institute naval confidence-building measures such as mechanisms to prevent or mitigate naval incidents. But perhaps it is time for Southeast Asian countries to think about naval arms control to enhance transparency and help ensure that naval arms acquisitions in the region do not spiral out of control.

Yakhont missile (US Navy image)

A short-range, unitary, ballistic missile, Scud-like target lifts off from the decommissioned USS Tripoli in a Missile Defense Agency flight test at the Pacific Missile Range Facility at Barking Sands, Kauai, Hawaii (US Navy)

Koh Swee Lean Collin is an associate research fellow at the Military Studies Programme in the Institute of Defence and Strategic Studies, a constituent unit of the S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University. He is also undertaking doctoral research on Southeast Asian naval developments. This article appears courtesy of RSIS.

Sub-standard Ships and Human Costs of Piracy: The case of Captain Prem Kumar

BY DR SAM BATEMAN

The human costs of piracy off the Horn of Africa are mounting with an escalating level of violence and shipowners unwilling to pay higher ransoms while operating sub-standard ships. As the plight of Captain Prem Kumar demonstrates, innocent seafarers suffer most.

A general cargo ship *Rak Afrikana*, which was hijacked by Somali pirates in April 2010 in the Indian Ocean, sank a few hours after being released 11 months later. The *Rak Afrikana*, which was declared a total loss in March 2011, was crewed by 23 seafarers, 11 of whom were Indians, under the command of 49 year-old Captain Prem Kumar. It was owned by a company in the United Arab Emirates and under the flag of St Vincent and Grenadines.

As the ransom negotiations between the pirates and the shipowner dragged on, crew members were increasingly ill-treated and poorly fed by the pirates. Finally a ransom of US$1.2 million was paid -- much less than ransoms paid for other vessels.

Human Costs of Piracy

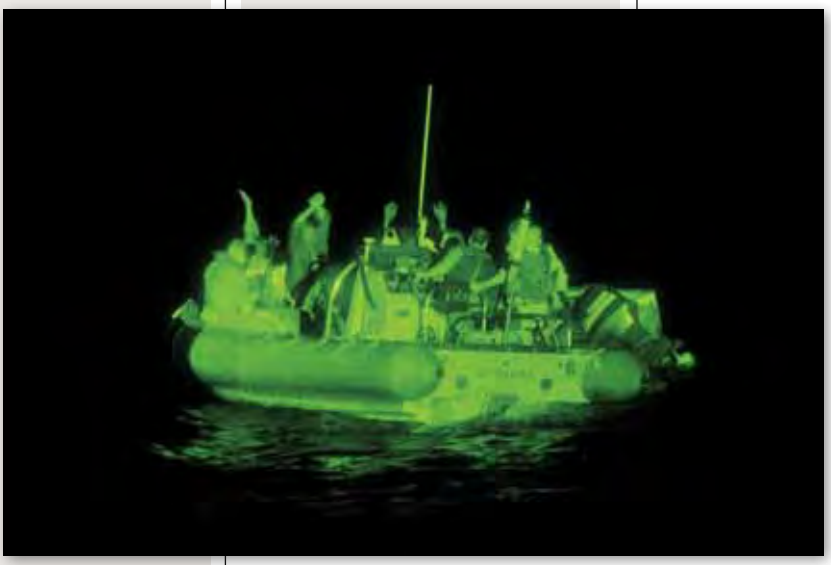
The pirates also attempted to turn the vessel into a mother ship for attacks further out in the Indian Ocean. However, these attempts were reportedly frustrated largely by the efforts of Captain Kumar, who as a consequence, had to endure mental and physical torture by the pirates. Captain Kumar paid a heavy price for his efforts. Due to ill-treatment and stress, he suffered a stroke in January 2011 and was paralysed down his left side. After his release he suffered a brain haemorrhage in April and died a few weeks later.

The case of Captain Kumar is a powerful illustration of the human costs of piracy. These costs are increasing as the level of violence escalates, shipowners become more reluctant to pay higher ransoms demanded by Somali pirates, and some shipowners continue to send ships into piracy-prone waters and yet are ill-prepared to meet the threat of hijacking.

The *Rak Arikana* was a relatively small vessel of 5, 992 gross registered tonnage. It was very slow; with an operational speed reportedly as low as 6.5 knots. It was also 30 years old -- an age when most vessels would have already been scrapped. Sub-standard ships are more likely to be hijacked than quality vessels. While there are exceptions with many older ships operated safely and efficiently, nevertheless, an older ship is more likely to be sub-standard and less well maintained and operated than a newer vessel.

Also a ship may start its life with a reputable company, but over the years, it may change its name and flag, progressively ending up with less responsible owners.

Merchant vessel Al Marjan was released from pirates off the Somali coast by the US Navy. Al Marjan had been under the control of Somalia-based pirates since Oct. 17 2007. (US Navy photo)



The pirates who attacked the Norwegian tanker MV Front Ardenne fling up their hands in surrender when their skiff is seized by a boarding party from HMCS Winnipeg in a rigid-hulled inflatable boat. Photo credit-Cpl Rick Ayer

Sub-Standard Shipping

Well-operated and maintained vessels may be expected to follow the best management practice guideline to avoid attacks, as recommended by the International Maritime Organization (IMO) and ship owner associations.

Port State Control (PSC) is the main international regime to manage the problem of sub-standard ships. Under this regime, port states verify that ships comply with required international standards of ship safety, maintenance, manning and marine environmental protection. The regime depends heavily on participating countries fulfilling their obligations to inspect vessels and on the exchange of inspection data between them. Unfortunately, this is not always the case, particularly in the northeast Indian Ocean.

The Indian Ocean Memorandum of Understanding (MOU) on PSC, which covers many ships hijacked off the Horn of Africa, is much less effective than the major PSC MOUs namely the Paris MOU for Europe and the Tokyo MOU for the Asia-Pacific. Countries such as Bangladesh, Djibouti, Myanmar, Oman, Kenya, Sri Lanka and Yemen are either outside the system or not fulfilling their inspection obligations. Significantly the *Rak Afrikana* was under a flag which is on the Paris MOU's "black list" of flags with a high incidence of sub-standard ships.

There is little doubt that the *Rak Afrikana* was a sub-standard ship that should not have been operating in piracy-prone waters unless special, and costly, precautions were taken. Records show that the Raf Afrikana had not undergone a PSC inspection since 2005. This means that the ship must only have been trading to ports without effective PSC, such as those around the northeast Indian Ocean.

Policy Implications

Irresponsible shipowners who send poorly prepared ships into piracy-prone areas must accept some share of the responsibility both for the incidence of ship hijackings off the Horn of Africa and for the associated ill-treatment of seafarers. If ransoms are not paid promptly, crews are likely to suffer more. These considerations pose difficult dilemmas for ship owners and shipping associations, but overall the situation would be improved if the PSC regime was enforced more strictly in the northeast Indian Ocean.

International shipping is recovering all too slowly from the downturn as a result of the global financial crisis. Shipowners are still finding it hard to get cargos for their ships and seafarers to get work at sea. Seafarers have little room to pick and choose the ships on which to serve, and some will end up serving on sub-standard vessels. The welfare of seafarers should be given greater consideration in developing measures to counter piracy.

As a symbolic gesture the IMO should consider a bravery award for Captain Kumar for his efforts in preventing the *Rak Afrikana* from being used as a mother ship to facilitate further acts of piracy.

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First published by the RSIS – copy used with acknowledgment and thanks.

Anti-piracy intercept operation conducted by the frigate Navarino (Nato photo)

ICE WARRIOR

HMNZS Wellington is a Protector class offshore patrol vessel of the Royal New Zealand Navy. Built by Tenix, the ship entered service in 2010.
(Photos courtesy RNZN)

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Focus on the outcome: the debate over the future of maritime aviation warfare officers in Naval Aviation[1]

BY COMMODORE TONY DALTON

On the evening of 26 March 2010, the South Korean corvette *RoKS Cheonan* was patrolling near the Northern Limit Line between the two Koreas in the vicinity of Baengnyeong Island. At around 2130 local time, a large underwater explosion broke the ship in two, after which it quickly sank taking with it 46 of the 104 strong crew. An international multidisciplinary Joint Investigation Group, which included expert input from Australia, was formed to examine the tragedy and concluded that the explosion that sank the *Cheonan* was triggered by a CHT-02D heavy-weight acoustic homing torpedo manufactured in North Korea. The most likely delivery platform was a North Korean *Sang-O* coastal submarine.[2]

While the world focus on this event has mainly centred on what appears to be the succession path for Kim Jong-un, it also clearly demonstrates both the tactical and strategic effect a submarine, even a small one, can bring to bear; a message certainly not lost on the international community in our regional sphere of interest. Indeed, a quick scan through *Jane's* would indicate that 12 countries in our region, including Australia, now operate some 211 submarines (64 nuclear powered) with more on the way, and this doesn't include the 100 or so smaller coastal and midget submarines also in service in the region.[3]

This proliferation of submarines means that in the panoply of skills our Defence Force is expected to maintain, an ability to combat a submarine threat will be an enduring one. For a medium sized Defence Force like ours, this is no easy task. Australian Maritime Doctrine recognises Undersea Warfare, of which anti-submarine warfare is the principal element, as generally the "most difficult naval discipline."[4] Despite the technological advances of the last several decades, the ocean remains largely opaque and is likely to stay so for at least the next generation. This gives submarines, the first real stealth fighters, the element of surprise where even just the threat of their presence can have a significant influence on maritime operations. Finding and fighting submarines is a complex, intense, expensive, high-end warfare skill that must be approached seriously and consistently; it is a skill that atrophies quickly if not continually practiced and requires a level of dedication and application to remain abreast of advances in technology and tactics.

Given the threat posed by submarines to ships, *Australian Maritime Doctrine* supports the view that our own "submarines, naval combat helicopters and MPA [maritime patrol aircraft] are among the most effective platforms in searching for, deterring and destroying enemy submarines."[5] The key role naval combat helicopters play in anti-submarine warfare has also been recognised by the Government and is reflected in the 2009 Defence White Paper which states "as a matter of urgency, the Government will acquire a fleet of at least 24 new naval combat helicopters to provide eight or more aircraft concurrently embarked on ships at sea. These new aircraft will possess advanced ASW [anti-submarine warfare] capabilities."[6]

As the project to deliver these aircraft gains momentum, a small but intense side debate has surfaced concerning the most appropriate crew model to use in employing them. In essence, the question has been asked: could these aircraft be flown by a crew consisting of two pilots (with an aircrewman sensor operator in the back) instead of the current Navy crew model consisting of a single-pilot aircraft captain and an aviation warfare officer (a non-pilot aircrew officer) mission commander in the front (again with an aircrewman sensor operator in the back).

THE TWO-PILOT MODEL

The argument for a two-pilot crew model is primarily an economic one. Presently, only Navy's Seahawk maritime combat helicopters are flown

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with a pilot/aviation warfare officer front seat crew – all of Navy's (and Army's) other front-line helicopters are normally flown by two-pilot crews (the Seasprite maritime combat helicopter would have been flown with a pilot/aviation warfare officer front seat crew).

The key aspects of the two-pilot crew argument are that Navy pilots could be generated from within the same pilot training model employed by Army and that Navy could do away with the aviation warfare officer stream entirely. Adopting this model would simplify the pilot training continuum and remove the need to train dedicated aviation warfare officers, potentially generating training savings over Navy's current two-stream system even though the total number of aircrew in the system would need to remain relatively static (all the aviation warfare officers in operational and staff positions would need to be replaced by pilots[1] while aviation warfare officer instructor positions would need to be transferred to the pilot training system to cater for the increased pilot throughput).

The key element of this model is the potential to 'grow' aircraft captains and mission commanders through on-the-job exposure. Pilots would complete the shorter, Army initial pilot training course concentrating on raw flying competencies with a reduced emphasis on captaincy decision making. They would then progress through an operational conversion, similar to that undertaken now in the single-pilot model.[2] On graduating they would proceed to sea as co-pilots under the supervision of more experienced pilots.

As a pilot's experience grows under this model, the ability to make sound captaincy decisions relating to the safety of the aircraft also matures. Exposure to the tactical environment, together with some (potentially significant) additional dedicated training, produces tactically useful aircraft captains. This is the model Army employ to generate aircraft captains in air mobile and armed reconnaissance operations (but interestingly enough it is not the model they currently use for counter-terrorist operations or Chinook). It is similar to the model the United States Navy use to generate Helicopter Aircraft Commanders in their maritime support *and* maritime combat helicopters.

The two-pilot crew model also provides a level of piloting redundancy. In environments where direct small-arms fire presents a threat, a two-pilot crew offers an obvious advantage. This is certainly one of the reasons why Navy flies its maritime support aircraft with two-pilot crews (and of course why Army fly two-pilot crews). In maritime support operations where restricted access can occasionally be an issue, such as delivering boarding parties, visibility from the cockpit also plays a factor. In these types of operations, deck space for the insertion of boarding parties is often limited and the relative wind over the target vessel usually dictates approach options. Having a pilot in both front seats increases the chances of being able to establish suitable hover references and provides a distinct tactical advantage for the two-pilot model.

THE PILOT/AVIATION WARFARE OFFICER MODEL

Navy currently operates its maritime combat aircraft with a front seat crew of a single-pilot aircraft captain and a single-aviation warfare officer mission commander. The same crew model has been specified for the next generation of Navy maritime combat helicopters.

Much of the way Navy structures and prepares itself to fight in the maritime domain is based on the shared experience of many navies evolved over many years, tailored to meet the specific realities unique to Australia.[3] The same is true of Navy's aviation component that has over the last 50 years evolved from a carrier-based force with a strong linkage back to the Royal Navy through to today's frigate-based combat helicopter force. The current crew model has also evolved over this period (but not without review) and reflects a lineage back to how similar medium size navies have sought to gain the maximum capability from a limited asset base.[4] From this perspective, the argument for the pilot/aviation warfare officer crew model is in essence a capability one.

The capability requirement at the high end is for Navy's maritime combat helicopters to be able to conduct autonomous operations over the horizon, day or night, in all weather to the limits of both the ship and helicopter envelopes.[5] There is an

1 There has been some suggestion that maritime combat helicopter embarked flights under this model could be reduced to three pilots and two aircrewmen as opposed to the current two pilots, two aviation warfare officers and two aircrewmen. To match the current capability and availability, and to maintain a viable pilot training pipeline, each maritime combat helicopter flight under this model would require two aircraft captain/mission commander qualified pilots, two co-pilots and two aircrewmen.

2 In this model, operational flying training would remain largely unchanged as pilots graduating from it would be expected to do the majority of 'hands on' flying of the aircraft while the more senior pilots act as aircraft captain and mission commander.

3 *Australian Maritime Doctrine*: RAN Doctrine 1 – 2010, Second Edition, p1

4 The navies of the United Kingdom, France, Germany, the Netherlands, Denmark, New Zealand and Malaysia, among others, all operate similar crew models in their maritime combat helicopters. The United States Navy, who currently employ a two-pilot crew model, operate their 200+ maritime combat helicopter fleet in a different manner to most medium sized navies – as Stalin is reputed to have said, quantity has a quality all of its own

5 While maintaining an anti-submarine warfare capability is arguably the most difficult maritime combat helicopter role, anti-surface warfare is also an important capability in which the new Navy maritime

expectation that the crew would be able to assume scene of action command at the tactical level and cope with the complexities and challenges of doing so as a single asset, alone, miles away from 'mother,'[6] right through to multi-asset engagements involving Joint, Allied and even Coalition partners.

In this model, the pilot aircraft captain retains overall responsibility for the safe operation of the aircraft, to the limits of the envelope. As the aircraft captain, the pilot must also maintain a high level of situational awareness and remain engaged in the tactical employment of the aircraft. In some circumstances the pilot may also have the spare capacity to contribute to some limited sensor management (such as link management during day sorties in good weather with a low air threat). The aviation warfare officer is the mission commander; a deep warfare specialist with the skills and tactical expertise to coordinate (and take tactical control of) multiple unit engagements against, in the anti-submarine scenario, a stealthy unseen adversary. While the mission and crew responsibilities are similar to those of the Air Force P-3 Orion pilot aircraft captain and air combat officer mission commander,[7] given the limited crew space inherent in combat helicopters, the Navy aviation warfare officer must also be a highly competent sensor operator to be able to fully exploit the aircraft's mission systems.

In a typical anti-submarine engagement, the Navy aviation warfare officer will be the radar operator, will manage the electronic support measures suite, the datalinks, the forward looking infra-red, the employment of weapons and the communications, and will do all of this on top of managing the tactical situation while the pilot keeps the aircraft out of the water and the sensor operator manages the acoustic sensors (which the aviation warfare officer must also fully understand to best exploit). At the same time the aviation warfare officer also has a safety of flight responsibility to back the pilot up with attitude, airspeed and altitude awareness, normal and emergency checklist actions, navigation, fuel management, and instrument approach briefs and monitoring.

Like the Orion crew model that employs a non-pilot deep warfare specialist as the mission commander, the current Navy crew model reflects Air Force's conclusion that the effective application of air power in operations "can only be achieved by people who are technical masters of air power, with the skills in their profession that deliver the highest levels of tactical competence."[7] However, this level of tactical competence does come at a cost. The pilot training system must produce fully formed aircraft captains and a parallel system must be maintained to generate aviation warfare officers; both of which cost money, create training complexities and absorb time and effort.

THE COST DELTA

So what does it cost and what are the opportunities, if any, to save money by adopting a two-pilot crew model across Navy's maritime combat helicopter fleet? Like all things to do with dollars, this is hard to pin down to a point where one can be sure of comparing apples with apples. Given that the overall personnel numbers are unlikely to change significantly under either model, the easiest way to compare costs is probably to use a consistent costing model based on the full cost per flying hour.[8] Note that the final costs derived under this analysis are for comparative purposes only and may

combat helicopter will have an increasingly significant role (and will be equipped with air-to-surface missiles to hammer home the point).

6 The brevity code word for the aircraft's parent ship.

7 Air combat officers are non-pilot aircrew officers employed by Air Force in four streams: maritime patrol and response (flying in the Orion); air combat (flying in the Super Hornet); combat air lift (flying in the Hercules); and air battle management (flying in the Wedgetail). Navy's aviation warfare officers broadly encompass the air combat officer skillsets across the maritime patrol and response (supporting maritime combat operations) and air combat (employing sensors and supporting single-pilot air combat operations) streams and lay the foundations for these skills at the Air Force School of Air Warfare, which will continue to operate with or without Navy participation.

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not reflect any actual savings in the real world.

Using this methodology, the current Navy *ab initio* pilot training system, which includes the advanced fixed-wing element with Air Force at No2 Flying Training School and the extended Squirrel-based helicopter course, costs $1.771 million to train a pilot. Training an *ab initio* Navy aviation warfare officer at the Air Force School of Air Warfare and a short Squirrel helicopter transition costs $1.031 million. An *ab initio* Army pilot, using the pilot's course limited to an extended period at the Basic Flying Training School and a shorter *Kiowa*-based helicopter course, costs $0.874 million. The figures at this point indicate that an Army pilot can be generated for half the cost of a Navy pilot and 85% of a Navy aviation warfare officer. Factoring in a similar failure rate in both pilot systems and a higher failure rate in aviation warfare officer training (reflecting the current reality) generates a potential difference of $15.042 million per year between the current Navy two-stream aircrew training model and a potential single-stream model based on the Army pilot training system.

However, there are additional costs associated with generating operational aircrew. In Navy's current model, as pilots operate outside the closely supervised squadron environment for extended periods, they need to achieve 500 flying hours before embarking as operational maritime combat helicopter captains. Using the Seahawk as a baseline, the maritime combat pilot operational flying training course involves 89 flying hours (plus 58 hours 'flying' the mission simulator) at a cost of $6.737 million per pilot. [9] To achieve the threshold 500 flying hours pilots need to commence operational flying training with a little over 400 flying hours already in their log books. The extra hours required over those achieved during *ab initio* training are presently gained on the Squirrel, equating on average to an additional cost of $1.487 million per pilot.[8]

Navy's aviation warfare officers can proceed to operational flying training directly from *ab initio* training. The maritime combat mission commander operational flying training course involves 60 flying hours (plus 96 hours in the simulator) at a cost of $4.579 million per individual.

In a single-stream pilot only model, as pilots would graduate as operational co-pilots, candidates would proceed directly to operational flying training from the shorter *ab initio* training and avoid the need to accrue the extra Squirrel hours. Their operational flying training would be similar in length to the current operational flying training course as they would still need to be at least physically capable of flying all the aircraft sequences. Based on an 80 flying hour operational conversion, this phase of maritime combat helicopter co-pilot training would cost $6.055 million per pilot. Under the single-stream pilot only model this cost would need to be applied to *all* front seat aircrew. Ultimately, 'growing' a maritime combat mission commander under this system would cost $10.218 million per mission commander (the $6.055 million pilot conversion plus $4.163 million on a tailored 55 flying hour mission commander conversion – and this does not include the additional flying training that would also need to be conducted at the School of Air Warfare gaining basic mission

commander skills). So while it may be $2.169 million cheaper to generate an operational maritime combat pilot (albeit a co-pilot), it is $5.639 million more expensive to generate a mission commander. This represents a potential overall cost *increase* of $27.760 million per annum.

It is also worth noting that all Navy aircrew need to demonstrate a raft of competencies in a series of annual flying checks.[10] While many of these checks can be flown in the simulator, it is not always practicable or desirable to fly all of them in the simulator, especially for some of the pilot checks. On average, Navy pilots fly 8.5 hours per year more than aviation warfare officers on annual checks or preparing for annual checks and these hours are flown in the much more expensive operational combat aircraft. Factoring these costs in across an expanded all pilot population generates a further *additional* cost of $22.519 million per year. What this means is that while the Army two-pilot model may generate a cheaper *ab initio* training system,

8 Navy pilots destined to fly single-pilot operational types largely build their experience before commencing operational flying training flying as Squirrel aircraft captains during aviation warfare officer and aircrewman training sorties; that is, hours that would have to be flown anyway. In the two-pilot model, basic aircrewman training sorties on the *Squirrel* will still need to be catered for.

it may also be significantly more expensive to produce the operational capability than the current Navy two-stream system.

THE CAPABILITY EQUATION

In a crew constrained vehicle (there are only three crew seats in a *Seahawk* and both of the platforms under consideration to replace the *Seahawk* would also come with just three crew seats) effective employment is all about specialisation and teamwork. Maritime combat aircraft are inherently complex systems that are operated in a very challenging environment. Navy routinely conducts blue water aviation operations without a divert option; to avoid getting wet, the flight deck you leave at the beginning of the sortie is the one you must return to at the end, regardless of the weather conditions or the state of the aircraft. This requires Navy pilots to be very confident operators with high piloting and captaincy skills and deep aircraft systems and aviation domain knowledge.

Mission commanders, be they pilots or aviation warfare officers, require very deep warfare knowledge, especially given the autonomous way we operate is generally very different to our peers in the United States Navy.[9] Mission commanders need to have a detailed understanding of the threat and threat tactics and the countervailing blue force tactics, techniques and procedures. They need to understand the sensors and weapons they operate and the theory behind them to exploit them to the greatest effect. But most critically of all, they need to be able to bring all of this knowledge together and make rapid tactical decisions, even in the fog of war (and, indeed, in just plain old fog as well). None of these are skills that can be developed quickly or maintained easily.

In the current Navy two-stream model, mission commanders are generated through the dedicated aviation warfare officer continuum. Specialised training is provided that generates a competent mission commander in three years.[10] Their *raison d'être* is to lead the fight from the air; to be the Fleet Air Arm's master tacticians. On completion of their first operational tour they become available for specialist post-graduate training as warfare instructors, aerosystems specialists and Fleet Warfare Officers (paralleling the advanced warfare training provided to surface fleet Principal Warfare Officers). A further full posting tour is then available before these individuals reach their initial minimum period of service (their first opportunity to separate from the service). From this point the aviation warfare officer separation profile is typically linear, which does not have an immediate dramatic impact on the overall capability.

In parallel to the generation of mission commanders, the Navy two-stream system also generates aircraft captains. These are tactically competent pilots with highly developed handling skills and the confidence to conduct blue water operations well outside the shore-based squadron supervisory structure. Typically they will be ready for their first fleet assignment at the five year point in their careers[11] and will be available for post-graduate training as flying instructors, test pilots and Fleet Warfare Officers at the seven year point, resulting in a full post-graduate tour prior reaching their initial minimum period of service. The pilot separation profile (without the current retention inducements) typically reflects a steeper initial separation curve that flattens off after a few years. This type of separation profile has the

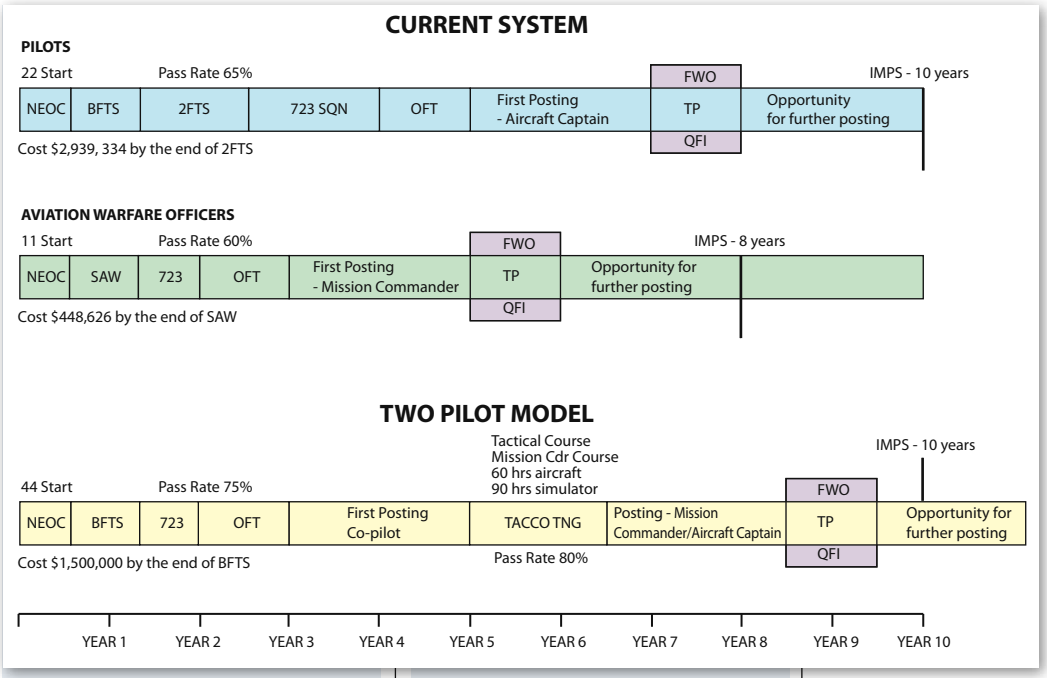

Figure 1 Direct Entry Officer Timeline Comparison

9 United States Navy maritime combat helicopters are equipped with a dedicated high bandwidth datalink that allows greater participation of parent ship warfare specialists in the tactical employment of the aircraft

10 Based on a direct entry aviation warfare officer. Aviation warfare officers graduating from the Australian Defence Force Academy would arrive at this point 6.5 years after entry (assuming a three year degree). Defence Academy aviation warfare officers join with an 11 year initial minimum period of service

11 Based on a direct entry pilot. Pilots graduating from the Australian Defence Force Academy would arrive at this point 8.5 years after entry (assuming a three year degree). Defence Academy pilots join with a 13 year initial minimum period of service

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potential to have a more significant impact on the overall capability if not carefully managed.

In the single-stream pilot only model the system would graduate tactically aware co-pilots within three years. They would then undertake their first tour under the supervision of an aircraft captain who, in the maritime combat aircraft, has also qualified as a mission commander. On completion of their first tour, they would then need to complete mission commander training before their first tour as aircraft captain/mission commander. Pilots in this stream would not be available for post-graduate training as flying instructors, aerosystem specialists, test pilots, warfare instructors and Fleet Warfare Officers until eight and a half years, leaving less than a full tour before reaching their initial minimum period of service. The pilot separation profile would have a proportionally greater impact on capability at this point in the single-stream pilot model. The two models are compared pictorially at figure 1.

It is also important to note that the single-stream pilot only model relies upon pilots being willing and motivated to undertake mission commander training that, to ensure a consistency of capability across the two models, would need to generate pilot mission commanders with the same tactical skillsets as the current aviation warfare officers. This would involve considerable additional training, much of it in a classroom or tactics simulator, at a critical point in a pilot's flying skill development cycle.[12] These relatively junior pilots would still have less than 800 flying hours in their log books as they move to pick up both the responsibility for being the aircraft captain (and by extension, the supervising pilot of more junior co-pilots) and the mission commander, where they would be expected to do less 'hands-on' flying and concentrate more on orchestrating mission outcomes.

Further complicating this issue, there is a finite amount of 'human capital' available in the aircraft. Transferring a supervisory role from the training system to the operational system will, inevitably, divert some of the aircraft captain's attention from mission management to flying supervision. In relatively benign conditions this will likely be of limited consequence but as flying conditions become more challenging it is only natural that the aircraft captain's attention will increasingly be directed towards supervising the less experienced co-pilot. In very challenging flying conditions it is feasible to imagine that the aircraft captain, as the more experienced pilot, will actually take over flying the aircraft and relegate the co-pilot to manage the mission as best he or she can with the obvious consequent impact on the level of tactical competence being applied to achieve the mission outcomes.

SAFETY

Any debate on changing the Navy helicopter crew model would be incomplete without some assessment of the relative safety between the two options. In essence, both models are safe. Navy aircrew, be they pilots, aviation warfare officers or aircrewmen, train, work and fly within a strong safety first culture. The considerable emphasis Navy places on aviation risk and crew resource management gives crews the knowledge and confidence to effectively balance mission objectives against safety and identify the threshold where those mission objectives should be traded off to maintain safety. This in effect translates the safety question back into a capability one and as we have discussed earlier, the single-pilot/aviation warfare officer crew model is likely to reach the capability trade-off threshold earlier in some combat support missions while the two-pilot model is likely to reach that threshold earlier in combat missions.

Finally, a few words on 'night aided' flight, or flight using night vision devices, as this has been raised as a potential safety issue for the pilot/aviation warfare officer crew model. Army are, without a doubt, world leaders in the art of night-aided flight and their two-pilot crew model, and the training system that supports it, reflects a strong emphasis on being able to achieve night aided missions safely. This is essential to the way the Australian Defence Force plans to fight over land and in this sense, the ability to conduct helicopter operations at low-level under the cover of darkness using night vision devices is mission *enabling*.

Navy conduct maritime combat operations at sea from the sea. While night aided flight is an important tactical skill, as the sea is (relatively) flat with boundaries and obstacles presented to the crew through a multitude of other sensors, night vision devices are mission *enhancing* rather than mission *enabling*. Indeed, the maritime combat mission can be achieved on nights when the weather or ambient lighting conditions would completely rule out the use of night vision devices through the application of low-level instrument flying skills, the

12 Pay grade progression for Navy pilots under the Graded Officer Pay Scales is also linked to attaining certain flying competencies; see the Australian Defence Force Pay and Conditions Manual, Chapter 3, Part 1B, Division 2, Part 2. Under the pilot only model, pilots within the maritime combat stream, undertaking longer, more tactically complex training, would achieve major competency milestones, such as aircraft command and post-graduate qualifications, later in their career in comparison to pilots in the maritime support stream with a concomitant impact on the relative pace of their pay grade progression.

acquisition of which is an important discriminator between the current Army and Navy pilot training systems. Significantly with respect to how night vision devices are employed, the maritime combat mission will require mission commanders (and sensor operators) to spend the majority of their time 'heads down' focused on tactical displays and data management tasks inside the cockpit leaving the flying pilot to concentrate on the scene outside the helicopter. This will hold true for both crew models, although in the two-pilot model, it will be the junior co-pilot on the controls looking out from the cockpit through the goggles.

So, is it possible to operate Navy's maritime combat helicopters with a two-pilot crew model? The answer is of course yes, it is possible.

Would it save money to operate Navy's maritime combat helicopters with a two-pilot crew model? The answer to this question is not as clear cut but it is highly unlikely a two-pilot crew model will be cheaper overall. Indeed any costs potentially saved in the training system are likely to be offset by far greater costs in the operational system generating mission commanders in an all pilot workforce, maintaining the currency requirements of the extra pilots and checking the competencies of the extra pilots.

Would it be wise to move to a two-pilot crew model for all Navy helicopters? While it makes sense to retain the two-pilot crew model in Navy's maritime support helicopters, the two-pilot crew model is unlikely, despite even the most determined effort, to generate the same level of tactical competence resident within the current maritime combat helicopter single-pilot/aviation warfare officer crew model. This would lead directly and inevitably to a reduction in the level of capability Navy would be able to field in what is arguably one of the most critical, and difficult, warfare disciplines. Given the world we live in and the proliferation of submarines just in our immediate area of interest, a reduction in capability is probably an outcome that we can least afford right now.

Commodore Dalton RAN was Commander Fleet Air Arm from 2008 to 2010. He has amassed over 5, 500 military flying hours in Iroquois, Sea King, Gazelle and Seahawk, ashore and embarked, is a graduate of the US Navy War College and is currently Director General Navy Aviation Systems within the DMO.

(Endnotes)
1 At CN AUSTRALIA R 030524Z NOV 10 the Chief of Navy approved the renaming of the Observer primary qualification as Maritime Aviation Warfare Officers or AvWOs
2 Republic of Korea Ministry of National Defense Joint Civilian-Military Investigation Group press release 20 May 2010
3 *Jane's Underwater Warfare Systems 2010*
4 *Australian Maritime Doctrine*: RAN Doctrine 1 – 2010, Second Edition, p149
5 ibid, p150
6 *Defending Australia in the Asia Pacific Century: Force 2030*, p72.
7 Australian Air Publication 1000-D: *The Air Power Manual*, 5th Edition, p25
8 *Defence Finance Manual*, Volume 4, Part 3, full cost per flying hour (excluding GST) at tables 3.3.2 for Air Force aircraft, table 3.3.3 for Navy aircraft and table 3.3.4 for Army aircraft
9 *Defence Finance Manual*, Volume 4, Part 3, using the full cost per flying hour (excluding GST) for a *Seahawk* at table 3.3.3
10 See Australian Book of Reference 5150 – *Naval Aviation Instructions*, 6th Edition, AL3, Chapters 4 and 5

What Happened to AE1?

BY REAR ADMIRAL PETER BRIGGS RAN (RTD)

2015 hrs, HMAS AE2 to HMAS Australia, 'submit; had HMAS AE1 a destroyer scouting with her today. She has not yet returned to harbour' (HMAS Australia signal log).

Thus began the story of the loss of *HMAS AE1*, Australia's 1st submarine, whilst on patrol off German New Guinea on 14 September 1914. It remains the RAN's greatest outstanding maritime mystery. The submarine has never been found, nor were any traces discovered by the searching ships following its loss. A volunteer team of maritime historians and submarine experts have come together to review the history and endeavour to set out a search area to find *AE1* prior to the 100th anniversary of her loss.

This article provides a summary of the research and interim conclusions of the *AE1* Inc team. Whilst the cause of the loss cannot be definitively stated we have evaluated the clues against a range of scenarios, to assess their probability of occurrence and impact on the search area.

Two E class submarines were ordered by the Australian Government in December 1910 and delivered from the builders at the end of 1913. *AE1* and *AE2* were primitive by today's standards, but were state of the art in 1914.

AE1 had a riveted steel hull, four torpedo tubes with four reloads, a dived operating depth of 100 feet, although this was extended to 200 later in the war and displaced 800 tons dived. They were fitted with two diesel engines giving a maximum speed of 15 knots on the surface. Two electric motors and banks of lead acid batteries provided a maximum dived speed of 9 knots for a brief period or five knots for nine hours. The crew of 31 was a mixture of Royal Navy submarine personnel on loan and volunteers drawn from the fledgling RAN.

The submarines were commissioned into the RAN on the 28th February 1914 in Portsmouth where they were fitted with a medium frequency WT set and a gyrocompass. The trip to Australia was extremely arduous and set a world record for submarine voyages at the time. Numerous technical challenges were overcome before reaching Sydney on Sunday the 24th of May 1914. Each submarine had steamed about two thirds of the 12,000 miles from Portsmouth to Sydney and was under tow for the remainder.

The submarines undertook a three week docking in Fitzroy Dock at Cockatoo Island during June. Their refit was truncated as the news from Europe indicated that war was on the horizon.

Shortly after the declaration of War on 6 August the Australia Fleet deployed to German New Guinea to capture the German colony and wireless stations. *AE1* sailed from Sydney at the end of August to rendezvous with the other fleet units in the Louisiade Island chain south-east of New Guinea on 9th September. Fleet units including the two submarines, entered Rabaul and nearby anchorages on 11 September and successfully captured the German colony and WT station – but that is another story.

AE1 with HMAS Australia and HMAS Yarra in the background, in September 1914 a few days before her loss-(Photo courtesy HMAS Stirling naval base)

The submarines were employed guarding the approaches to the landing anchorages against an attack by the German cruisers, *Scharnhorst* and *Gneisenau*. A torpedo boat destroyer accompanied them on their patrols; *AE2* and *Yarra* undertook the 1st patrol on 13 September, *Parramatta* and *AE1* patrolled on 14 September.

AE1 had a defect on one shaft, limiting her propulsion dived or when going astern, to 1 shaft. This defect would have greatly handicapped any recovery from a depth excursion or flooding when dived and reduced the astern power available on the surface. Both shafts were available propelling ahead on the surface under diesel propulsion. Going astern on the surface whilst on diesel power was already a slow process as the diesels had to be declutched before energising the electric motors to provide astern power. Arrangements had been made to rectify the defect that evening – in retrospect it seems extraordinary that *AE1* was at sea on the 14th.

We are reliant on *Parramatta*'s brief account of the day's events as none of the signals that passed between them on that day was recorded by any other units, nor have we been able to locate any record of the Board of Inquiry that was ordered by the Fleet Commander. It does not appear to have been convened – overtaken by the exigencies of war perhaps?

The method of passing the signals between *AE1* and *Parramatta* on this fateful day are not known as we have not located *Parramatta*'s signal logs. WT could have been used but this would have required *AE1* to rig her wireless mast, a cumbersome and time consuming operation. Since the submarine would have had to unrig it prior to diving this seems an unlikely proposition for a submarine heading out potentially to intercept the enemy. Alternatively, communications could have been by flashing light or megaphone.

After rendezvousing at sea on the morning of the 14th *AE1* and *Parramatta* parted company, *Parramatta* patrolling to the southward off Cape Gazelle and *AE1* proceeding to the northeast towards the Duke of York Islands possibly to investigate a report of a German steamer sighted by *Yarra* on the previous evening. *Parramatta* turned north to close the submarine later that morning and reported that they were close to *AE1* located in a position 2 miles off the southeast corner of Duke of York Island at 1430. Visibility was approximately 5 nautical miles in a tropical afternoon haze common in this part of the world. It is not obvious how *Parramatta* was able to quickly relocate *AE1* in these conditions, the Fleet Commander reported that they were communicating by WT, but no other units logged these signals.

The simple tracing off *Parramatta*'s chart in use that accompanied their report of the loss is the last record we have of *AE1*. At 1520 *Parramatta* lost sight of *AE1* and turned back towards the last seen position but no further sightings were made.

The remainder of this account is based on knowledgeable supposition and evaluation of the probabilities.

AE1 was under strict instructions to return to the anchorage in Rabaul Harbour by dark; sunset was at 1750. This directive was reinforced by a personal signal from the Fleet Commander as she sailed that morning.

At 2015 *AE2* alongside the submarine depot ship *SS Upolu* in Rabaul harbour, was concerned about *AE1*'s failure to return as expected and raised the alarm. *Yarra* and *Parramatta* sailed to search for *AE1* at 2320. Using searchlights and flares as required they circumnavigated the Duke of York islands and searched to the northwest for 30 nm to cover likely drift on the strong tidal stream. *Encounter* joined the search at first light (0545) before anchoring at 1045 and *Warrego* rejoining from a trip to Kavieng to the north joined in late morning enroute to Rabaul. No trace of wreckage or bodies was found. *Encounter* reported an oil slick, but advises that this was assessed as from passing ship as it had dispersed by midday – no position was given for the slick. Motorboats and a steam yacht were used to search the adjacent coastlines that afternoon, without success.

That afternoon the Fleet Commander, enroute to Sydney in *HMAS Australia* advised the Naval Board that *AE1* with a crew of 35 was feared lost.

Whatever happened to *AE1* occurred so quickly and in a fashion that it was not possible to send a distress call (if the Fleet Commander's account is correct, the WT mast was rigged and the set working at 1430). The absence of debris, bodies or a persistent oil slick indicates that the submarine sank with all or most of its crew secured inside and that the pressure hull remained intact with the submarine disabled on the bottom.

Could *AE1* have been sunk in a battle with an armed German steamer? This scenario would fit some of the clues reasonably well. A German Petty Officer prisoner claimed that he was in command of the river steamer, *Kolonialgesellschaft* when just such an attack occurred. This steamer was found 70 nm to the west, aground on a reef on 19 September. She was fitted with a 1" (25mm) cannon and reported to be carrying a party of 12 German Army reservists to join the defence of Rabaul, so the capability to attack *AE1* was there. Based on an analysis by Dr Roger Neill, the cannon was

What Happened to AE1?

almost certainly capable of holing *AE1*'s pressure hull from close range. Could this be the 'smoking gun'?

Whilst the records are far from complete we have reached the conclusion that the German account of sailing from Madang on 9 September prior to becoming wrecked on the reef off Cape Lambert on 16 September, 70 miles short of Rabaul, is probably correct. The low powered river steamer appears to have lacked the endurance to steam continuously for 4 days at five knots in order to be off Duke of York Island on the afternoon of 13 September. She had a crew of two and is unlikely to be able to carry sufficient firewood or fresh water for the boiler for four days; such stores are readily available on a river, but not the open sea. No stories corroborating this account of an attack on *AE1* have since emerged – an extraordinarily effective conspiracy if the Petty Officer's story is correct. Finally the local people have no account of a battle between a German steamer and submarine; the encounter must almost certainly have taken place within visual and audible range of Mioko Harbour.

Could *AE1* have dived for some reason and then been inadvertently run down by a surface ship? This scenario also fits the clues quite well. Rumours at the time told of collisions with submerged objects. Apart from *Yarra*'s grounding on a reef whilst searching for *AE1* on the afternoon of the 15th, none of the surface ships reported a collision or damage. It is more likely that the unknown bumps were semi submerged logs that seem to have been common in the area.

What was *AE1* most likely to have done on the afternoon of the 14th? Allowing for the strong currents observed in the area it would have taken 2 hours and 25 minutes to cover the 24 nautical miles back to the anchorage – at 1500 she had little time to spare so it is highly likely that she headed back on the surface at best speed by the shortest route, perhaps coming close in off Mioko Harbour for a last look for that steamer? If so, what could have befallen her?

In 2002 John Foster recorded a local native story handed down from their forebears of a submarine approaching from the north east, about to round Wirian reef on the south eastern point of Mioko Island before stopping then drifting or moving off to the north east on the current and disappearing. The story is time and date stamped by other stories relating *Encounter*'s bombardment that morning and the searchlights and flares used by the searching ships that night.

The final scenario postulates a glancing grounding, causing extensive damage to some or all the external ballast tanks in the 'saddle bags on one side of the pressure hull. This scenario best fits all the clues. The loss of these tanks would leave *AE1* with a heavy list and in a precariously unstable state. It is postulated that this caused the submarine to roll onto her damaged side and sink slowly to the bottom. Given the absence of an oil slick, *AE1* probably remained intact, ie bottomed at a depth shallower than its crush depth. *AE1* remained on the bottom, pressure hull intact, therefore not leaking oil but disabled, unable to release its emergency ballast keel or generate sufficient buoyancy to return to the surface.

Armed with this analysis we are able to construct a search area to cover the range of scenarios. Finding the submarine is possibly the only way of solving the puzzle, bringing closure to the dependents of the 35 men onboard, solving the RAN's greatest mystery and providing a fitting recognition of the centennial of *AE1*'s sacrifice.

Rear Admiral Peter Briggs RAN retired in 2001 after a 39 year career including command of HMAS Otway, Oxley, Platypus, Stirling, Flag Officer Naval Training Command, Head of the Strategic Command Division and Head Submarine Capability Team.

An analysis of probable Nordenfelt Gun effectiveness in an engagement with a surfaced submarine

BY DR ROGER NEILL, DEFENCE SCIENCE AND TECHNOLOGY ORGANISATION

On 14 September 1914 the Australian Submarine HMAS AE1 was operating on a surface patrol, in company with HMAS Parramatta, in the vicinity of Duke of York Island. At some time in the afternoon, following a last sighting by Parramatta around 1520 hours, the submarine disappeared without trace. Various scenarios have been proposed to explain the loss of the submarine. One of these involves the boat being engaged by machine gun fire from a small vessel which was known to be in the vicinity, possibly followed by a ramming from the same vessel. When captured this vessel was found to carry a One Inch Nordenfelt Gun.

There is at least a finite possibility that the missing Australian World War I submarine *HMAS AE1*[1] may have been attacked at close range by an armed surface craft carrying a so-called One Inch Nordenfelt Gun.[2] The surface craft, the *Kolonialgesellschaft,*[3] was a 75-foot long wooden steamer which had been armed by a German Militia [Foster 2006, p 71].

This raises two critical questions: (1) how likely is it that such an attack took place?; and (2) if it did, could the gun have caused critical damage to the submarine?

It is beyond the scope of this document to give consideration to the first question. In addressing the second question, at least two things need to be considered. The first consideration is whether a bullet fired from this weapon could have penetrated the pressure hull. The second consideration is whether the weapon, given its characteristics and the nature of its installation on board the vessel, would have had the ability to be trained sufficiently accurately to enable the submarine to be hit. This paper describes a series of brief studies undertaken to provide indicative answers to the two aspects of Question 2.

Three separate analyses were undertaken to support the study. The first could be regarded as semi-quantitative and it was undertaken to determine whether the proposition that the pressure hull or conning tower could have been penetrated was a reasonable one. Study One assumed normal angle of incidence for impact of the projectile. If the predicted penetration depth had been less than one half of the thickness of the pressure hull, then the submarine would have been assumed to be invulnerable to attack from the Nordenfelt Gun and the second study would not have been undertaken. The fact that the second study *was* undertaken gives some clue to the results of Study One.

For the second study care was taken to model the bullet fired by the Nordenfelt Gun, plus account was taken of instances where the bullet may have impacted the submarine's pressure hull at non-normal incidence. In this case the study was based upon empirically-derived penetration formulae. The results should be regarded as reasonable and indicative. If a very high level of confidence is required with respect to the results, however, the study would need to be complemented by analyses based upon high-fidelity computer modelling and simulation.

Nordenfelt gun on display

The reader is requested to pay particular attention to the units which have been used throughout this report. The materiel which are the subject of the report were all specified, designed, constructed and tested using the imperial measurement system. The penetration depth prediction equations that have been used in the study use a range of measurement system conventions. The formulation used in Study One is loosely based on the old CGS formulations. Even within

Barrel-Nordenfelt Rifle Calibre Gun Naval Carriage

1 The author believes that, in 1914, it was not normal practice to append the '*HMAS*' identifier to submarines. It is, however, now normal practice to do so and the author chose to follow this convention by naming the submarine *HMAS AE1*.
2 Also known as Nordenfelt One Pounder Gun and, in non-naval applications, the Nordenfelt Cannon.
3 Hereafter referred to as the *Kolonia.*

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this formulation, however, there is an apparent (but not actual) inconsistency in that dimensions measured in centimetres are mixed with velocities expressed in terms of kilometres per second. The formulation used in Study Two used the imperial measurement system and the final study was undertaken using SI units. Attempting to unify the various elements of the report into a single measurement system results in some very messy descriptions (for example to use the phrase '0.0254 metre Nordenfelt Gun' simply doesn't work) so where it was deemed most appropriate, the decision was taken to work with original units.

Study One: Semi-quantitative estimate of Penetration Depth Method

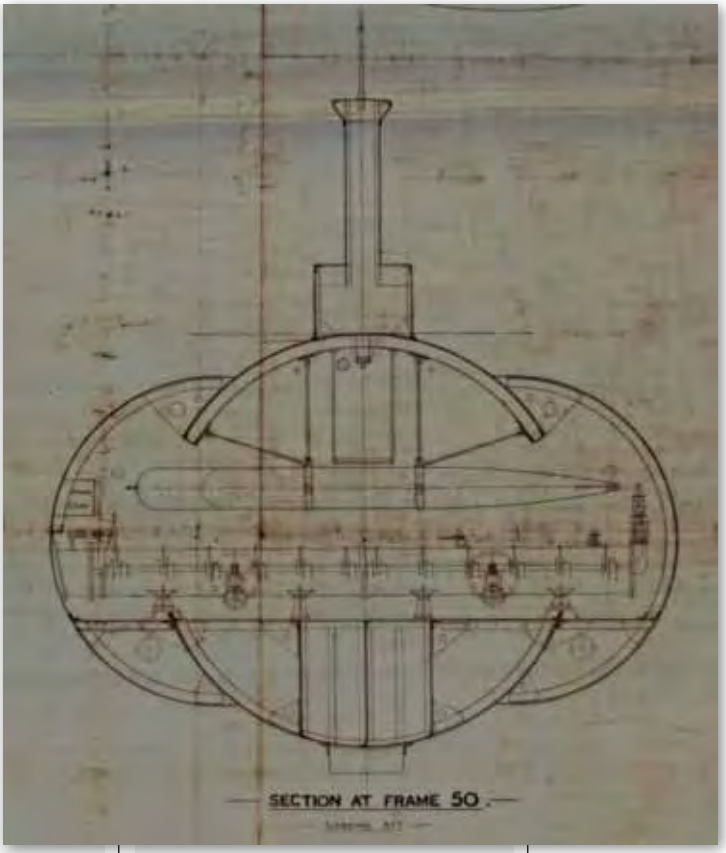
This study made use of a penetration model which was developed on behalf of NASA to support the US space program [Hayashida and Robinson 1991]. The model, known as the Modified Cour-Palais Equation, was developed to predict the penetration protection performance of shields against supersonic and hypersonic impact with objects during space flight in low-Earth orbit. Despite the fact this formulation was developed to support spaceflight-related research and development, it was deemed that it could be legitimately applied to this preliminary, 'reality check' assessment because:

1. It can be applied to a range of materials, including the ferrous and non-ferrous materials that were used in construction of *HMAS AE1*;
2. The speed of the projectile fired from the Nordenfelt Gun was (just) within the range of velocities for which the model can be applied; and
3. The effect of the atmosphere can effectively be ignored if the assumption is made that the engagement took place at very close range.

It has been stated above that Study One was semi-quantitative. Its purpose was to determine whether the effort involved in undertaking a more comprehensive assessment could be justified. The reasons the outputs of the model should be regarded as semi-quantitative when applied to the current problem include:

- Being at the lower limit of the supersonic range, the velocity of the Nordenfelt Gun projectile is rather low compared with the velocity range for which the formula was developed;
- The model assumes that penetration depth is only influenced by the normal component of the projectile's velocity vector. Given the shape of the submarine's pressure hull, it is unlikely that in an engagement, even at very close range, the bullets would have been striking the pressure hull at normal incidence;
- The model assumes the high-velocity object is spherical in shape. The Nordenfelt bullet was not spherical.

Having given consideration to the above qualifications, it was judged that if Study One predicted a penetration depth greater than one half of the thickness of the pressure hull, further study would be warranted.



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The Modified Cour-Palais Equation for prediction of crater depth is [Hayashida and Robinson 1991]:

$$P = 5.24\, d^{19/18}\, BH^{-0.25}\, [\rho_p/\rho_t]^{0.5}\, [V_n/C]^{2/3}$$

Where

P = crater depth on target (cm)

d = projectile diameter (cm)

BH = Brinnell hardness for target

ρ_p = projectile density (gm/cm^3)

ρ_t = target density (gm/cm^3)

V_n = impact velocity (normal component of the projectile relative velocity) (km/s)

C = speed of sound for the target (km/s) = $[E/\rho_t]^{1/2}$

E = Young's Modulus for the target

Cour-Palais defined a pair of multiplication factors to specify minimum acceptable thickness of shields. Multiplying the crater depth by a factor of 1.8 defines the thickness of a shield which will provide adequate ballistic protection against penetration. This means that the depth of the crater on the front face, combined with the depth of spallation off the back face of the target will not exceed the thickness of the target and hence penetration won't occur. Beyond that thickness it is still possible for spallation to occur off the back surface of the shield even in the absence of penetration. The factor defining thickness for adequate protection against spallation is 2.2 times the crater depth. For this study it was decided that it was appropriate to use the 1.8 x ballistic protection factor.

Given that the above equation assumes a spherical projectile, the researcher was left with the choice of matching the diameter of the projectile, which would model a projectile of considerably less mass than the actual bullet, or matching the mass of the projectile to that of the bullet, hence allowing the modelled diameter to considerably exceed the actual diameter. In the event both conditions were modelled.

In the case where a spherical, mild steel projectile was modelled to match the one-inch (2.54 cm) diameter of the bullet, the mass equated to 67.3 grams.

There is information available on the characteristics of the Nordenfelt Gun and the bullets they fired [Nordenfelt 1884; Mackinlay 1887]. The latter source quotes muzzle velocity for the bullets as 1464 feet per second (Page 313, Table XVI) and the mass of the steel bullet, including its brass envelope is quoted as 3170 grains (205 grams). Nordenfelt [1884] quotes slightly different velocities for the bullets at various ranges (1550 fps muzzle velocity, 1164 fps at 300 yards, 1014 fps at 500 yards), but the 1464 fps figure was regarded as representative and hence was used throughout the study unless otherwise specified.

While the brass envelope travels with the bullet in flight, the advice from DSTO ballistics experts is that the envelope strips away from the steel projectile upon impact with the target, and therefore effectively doesn't contribute to the penetration process [Cimpoeru and Ryan 2011]. Analysis of the drawings for the bullet, described under Study Two below, indicates that exclusion of the brass jacket will reduce the mass of the bullet to 175 grams. Therefore, in the case where the spherical projectile matched the mass of the Nordenfelt Bullet, its diameter was assumed to be 3.49 cm.

Information on the target (pressure hull and conning tower) was derived from the specification documents and plans for the Australian E Class submarines. In the case of the pressure hull the specification document states that, in parts of the submarine where the diameter of the hull exceeds 15.5 feet, the steel should be of 20 pound weight (Section 11). This corresponds to a thickness of one half inch. Furthermore, the steel was specified to be of a 'special' type with required ultimate strength of 30 to 34 tons per square inch (414-469 MPa). This corresponds fairly closely with modern mild steel. For example the US ASTM standard A36 for mild steel specifies that it should have ultimate strength in the range 400-550 MPa [ASTM Standard A36 / A36M 2008], hence data appropriate to that standard were used for the study:

Density = 7.85 gm per cubic centimetre
Young's Modulus = 195 GPa
Brinell Hardness = 120

With respect to determining the thickness of the material from which the brass conning tower was constructed, the only information that was available to the author was a cross-section drawing of the conning tower [Vickers 1914a] which included a cross section drawing entitled 'Section at Frame 57 (Looking Forward)'. This drawing had an identified dimension of 2'9" from the top of the pressure hull to the centre of the conning tower steering wheel. This dimension was used to derive a scaling factor for the drawing, and from that it was determined the brass conning tower was up to 1.5 inches thick. Given the scale of the plan, and the fact the cross section was not actually dimensioned, this should be regarded as an indicative thickness. In the case of Brass, the following data were used:

Density = 8.55 gm per cubic centimetre
Young's Modulus = 112.5 GPa
Brinell Hardness = 100

Results and Discussion

The predicted ballistic protection thickness for the various modelled conditions are summarised in Table 1.

Given that the maximum thickness of the pressure hull was one half inch [Vickers 1914b], with the thickness progressively reducing to 3/8 inch (15 pound plate) as the diameter of the hull reduced, predicted penetration depths indicate that the submarine would have been in a position of considerable risk if attacked at close range by a Nordenfelt Gun. The modelled results for the conning tower, which appears to have been cast in brass to a considerably greater thickness than the pressure

Mass of Projectile (gm)	Diameter of Projectile (cm)	Impact Site	Ballistic Protection Thickness (Inches)	Ballistic Protection Thickness (cm)
67	2.54	Pressure Hull	0.6	1.5
175	3.49	Pressure Hull	0.8	2.1
67	2.54	Conning Tower	0.7	1.9
175	3.49	Conning Tower	1.0	2.7

Table 1
Predicted ballistic protection thickness for impact of a spherical projectile onto a flat plate comprising either mild steel (Pressure Hull) or Brass (Conning Tower). Normal incidence impact is assumed.

An analysis of probable Nordenfelt Gun effectiveness in an engagement with a surfaced submarine

hull, indicate that there is a reasonable chance the tower may have been capable of withstanding such an attack.

The criterion which was established for making the decision to proceed to the more quantitative Study Two, that predicted depth of penetration exceeds one half of the thickness of the pressure hull or conning tower, was easily met.

Study Two: Estimate of Penetration Depth Accounting for Bullet Geometry

Method

A number of formulae have been developed which can be used to predict the penetration performance of projectiles against flat plates. These include a simple formulation by Woodward [1977] and a more complex set of formulae known as the JTCG/ME equations [Anon. 1985]. For the present study it was decided to make use of a set of equations developed as part of a 1950's era, intermediate ballistic missile program called Project Thor [Anon 1961]. Formulae were developed from the test data which can be used to predict residual velocity of fragments that have penetrated a flat target. These equations are able to take account of off-normal impacts and they are also able to model the penetration performance of non-uniform objects. The Thor equations weren't strictly developed to model projectiles such as bullets, but they are valid for length/diameter ratios up to 3, hence it was deemed appropriate to apply them in modelling the penetration performance of a one-inch diameter Nordenfelt bullet.

The equation which is of particular relevance to the present study is:

$$Vr = Vs - 10^{C} [TA]^{\alpha} W_f^{\beta} [\sec \theta]^{\gamma} Vs^{\lambda}$$

Where $C, \alpha, \beta, \gamma, \lambda$ are empirically-determined constants provided in Anon [1961] for a range of common target materials.

Vr = residual fragment velocity, in feet per second (fps)

Vs = striking velocity (fps)

T = target thickness in inches

A = average impact area of the fragment (i.e. the average cross-sectional area of the bullet in square inches)

W_f = fragment weight in grains

θ = the angle of incidence of target trajectory where an angle of 0 degrees represents normal incidence impact.

To determine penetration performance, this equation can be used in two ways. For the first approach the thickness of the target (say half inch in the case of the submarine's pressure hull) can be input directly into the equation and if the residual velocity is greater than zero, then penetration can be assumed to have taken place. The second approach is to assume that the residual velocity is zero, and rearrange the equation to make the target thickness the subject. This will then give a measure of the thickness of plate which the bullet could potentially have penetrated. It was judged that the latter approach would give the average reader a better intuitive sense of either how well or how badly the pressure hull of *HMAS AE1* would fare against a Nordenfelt bullet.

The rearranged equation is:

$$T = 1/A [Vs^{1-\lambda} 10^{-C} W_f^{-\beta} [\sec \theta]^{-\gamma}]^{1/\alpha}$$

As for Study One, the velocity of the bullet was assumed to be 1464 fps. The data for the empirical constants were for so-called 'mild homogenous steel' as defined in the Thor report [Anon 1961].

The average area of the bullet was determined according to the following procedure. An image of the British one inch Mk VI bullet was imported into imaging software. This image is reproduced as Figure 1. The cross section drawing of the steel bullet and brass envelope was presented at maximum resolution and the vertical dimension, identified as 2.9 inches on the drawing, was measured in pixel units. This enabled a scaling factor to be derived – i.e. one inch = 234 pixels.

The steel part of the bullet was then sectioned in 0.1 inch increments, rounded to the nearest pixel, and at each section the diameter was measured in pixels and converted back

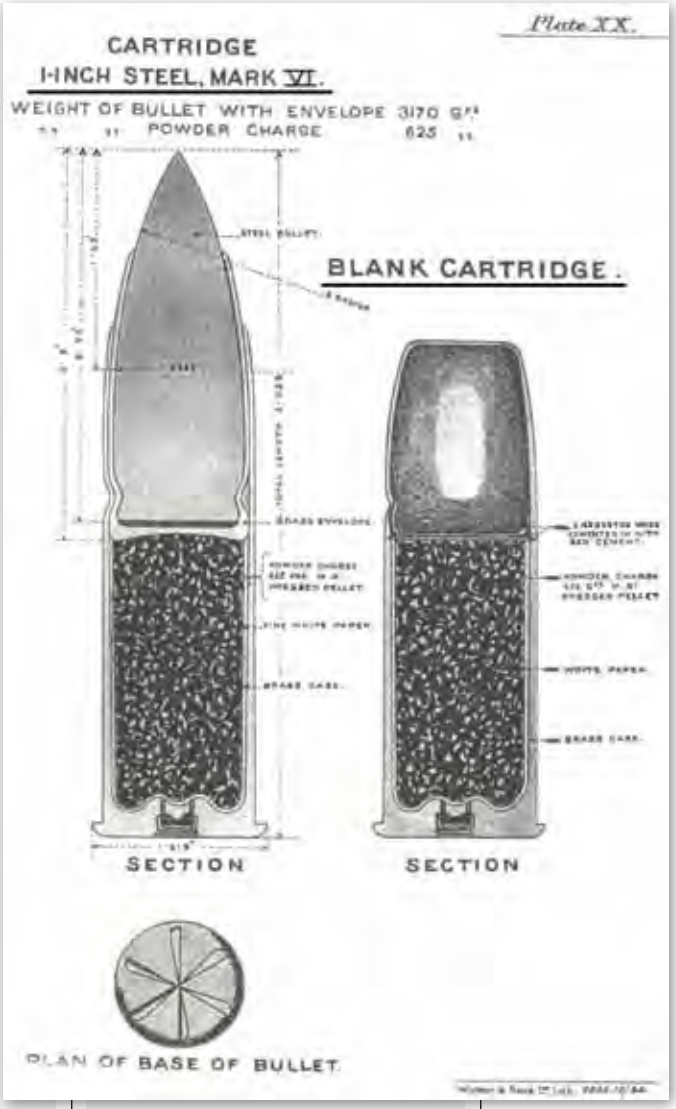

Figure 1 Cross section drawing of one inch bullet. The image is from Plate XX of the Treatise on Ammunition, 5th Edition 1894, War office, UK (Crown Copyright Expired). Note that there are a number of dimensions included in the drawing which enabled the author to establish scaling factors. Details of the manner in which data were derived from this image are detailed in the text.

to inches. These data were used for two purposes. The average cross sectional area was calculated. Averaged from the tip of the bullet up to 2.7 inches, the average area was estimated to be 0.487 square inches. In addition the volume of the bullet was estimated by dividing it into 0.1 inch long segments (plus a 0.05 inch segment at the base), calculating the volume of each segment and summing. This volume was then converted into a measure of mass of the steel part of the bullet. The volume was estimated to be 1.36 cubic inches, corresponding to a mass of 2705 grains (175 grams).

Calculations were then made of the penetration thickness for angles of incidence ranging from 0 degrees to 85 degrees.

Unfortunately the Thor study did not derive relevant constants for brass. As these are empirically derived constants, it was not possible to extrapolate or interpolate from other materials, hence it was not possible to undertake the equivalent calculation for the conning tower.

As part of Study Two another line of enquiry was undertaken as a parallel activity. Trials of the Nordenfelt Gun were undertaken in the 1880s. A number of internet websites make passing reference to these trials, but considerable time and effort needed to be expended to find the original reports. Once again, the results of Study One were deemed to be sufficiently indicative to warrant this background research being undertaken. The results of the 1880-era trials are also discussed in Sections 3.2. and 4.2.

Results and Discussion

The predicted penetration depth for the various angles of incidence are summarised in Table 2.

These predicted penetration depths are consistent with the results of trials undertaken in 1880. Nordenfelt [1884] summarised the results of a number of trials of the gun, undertaken at various European locations. Some of these trials specifically assessed the ability of the gun to perforate targets of various thicknesses, at a number of ranges and angles of incidence. Pertinent results are summarised in Table 3, in which 'Perforated' means the bullet has passed right through the target, 'Partial' means the rear surface of the target has been breached, but that the projectile has not passed right through it, and 'Stopped' means there was no material ejected from the rear side of the target. Angles of incidence have been transformed to correspond with the definition used elsewhere in this report. As was the prediction of the modelling, the results of the 1880 trials indicate that impact on the submarine's pressure hull at angles up to 45-60 degrees could have resulted in it being perforated.

If account is taken of the loss in velocity of the bullet that occurred with range then, as expected, the model predicts reductions in both the penetration depths and the maximum impact angle for which penetration would take place. Using Nordenfelt's quoted velocity at 500 yards range of 1014 fps [Nordenfelt 1884], the model yields predicted penetration depth of 1.2 inches and maximum impact angle for penetration of ½ inch steel of 50 degrees (penetration depth 0.6 inches).

The implication of these results is that the *HMAS AE1*'s pressure hull would have been very vulnerable to close range attack from a Nordenfelt Gun. The fact that angles of impact of up to 60 degrees could result in penetration of the pressure hull means a substantial percentage of the boat's above-water hullform would have been vulnerable, presuming that the she was unable to dive. This is discussed in further detail in Section 4.

These results are sufficiently definitive that there is really no need to undertake equivalent calculations for the brass conning tower. It is known that the penetration resistance performance for steel exceeds that of brass, hence penetration depths would have exceeded the thickness of the conning tower out to quite substantial angles of incidence (~45 degrees or more).

Angle of incidence (degrees)	Penetration Depth (Inches)	Penetration Depth (cm)
0	1.8	4.6
10	1.8	4.5
20	1.7	4.2
30	1.5	3.7
40	1.2	3.1
50	1.0	2.5
60	0.7	1.7
70	0.4	1.0
80	0.2	0.4
85	0.06	0.1

Table 2 Predicted penetration depths for impact of a one inch diameter steel bullet onto a flat plate comprising mild steel. Zero angle of incidence corresponds to normal incidence, angles close to 90 degrees would represent grazing impact.

Study Three: Would a Nordenfelt Gun have Reasonable Probability of Hitting the Submarine?

Method

It has been established in Section 3 that, at angles of incidence up to 60 degrees, an impact from a bullet fired from a Nordenfelt Gun had the

Table 3. Summarising trials of the ability of steel bullets fired from One Inch Nordenfelt Guns to penetrate target plates, as reported by Nordenfelt [1884]

Trial Location	Range (yds)	Impact Angle (degrees)	Target Material	Target Thickness (inches)	Result
Portsmouth	100	0	Steel	½	Perforated
Germany	100	0	Steel	½	Perforated
Portsmouth	100	0	Steel	¾	Perforated
Portsmouth	300	0	Steel	¾	Partial
St Petersburg	200	0	Iron	1	Perforated
Portsmouth	300	0	Steel	1	Stopped
Portsmouth	300	30	Steel	½	Perforated
Portsmouth	300	45	Steel	½	Perforated
Portsmouth	300	45	Steel	$^{1}/_{16}$ + ½ (18 inches apart)	Perforated
Germany	300	60	Iron	½	Perforated

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potential to penetrate the submarine's pressure hull. In an instance where a close-range engagement involves a gun mounted on the deck of a relatively small surface craft, the trajectory of the bullets will be close to horizontal. Because of the shape of the submarine's hull, this means that there would be a vulnerable region starting in the vicinity of the water line (or just above the ballast tank in cases where a saddle tank was proud of the water) and extending up the hull until the point is reached where angle of incidence exceeds about 60 degrees. This vulnerable region determines the vertical arc of fire for the gun.

The Nordenfelt Gun used very simple, hand-driven training controls. There was no provision for actively compensating for ship's roll. Consequently a reasonably wide vertical arc of fire would have been required to ensure a target could be reliably struck. The analysis below estimates how the vertical arc of fire varied with range and it uses the results to give some understanding of the limits in standoff range, beyond which there was little or no probability of *HMAS AE1* being struck.

The geometry of this situation is illustrated in Figure 2. For this study, in most locations along the submarine the lowest point of vulnerability for the pressure hull was assumed to be the point of junction between it and the saddle (ballast) tank. The exceptions were at bow and stern, where the saddle tanks were entirely below the water line, and in the vicinity of Frame 50, where the saddle tank actually formed part of the pressure hull (to accommodate athwartships torpedo tubes). In these cases the lowest point of vulnerability was assumed to be the waterline. Three equations can be used to summarise the geometry of Figure 2.

At the point of the bullet's impact on the hull, the radius of the hull subtends an angle with respect to the horizontal, γ, which equates to the sum of the angle of impact, β, and the angle of depression of the gun, ϕ. That is:

$$\gamma = \beta + \phi$$

Furthermore, the angle γ can be expressed in terms of the radius of the submarine's hull, A, the vertical offset between the centre of the hull and the waterline, O, and the height above the waterline at which the bullet impacts the hull, H:

$$\sin(\gamma) = (O + H)/A$$

As the gun is trained upwards from the waterline, both the height of impact (H) and the angle of impact (β) will increase. At some point the angle of impact will exceed that for which penetration can occur. This is the maximum height of penetration. For the purpose of this analysis, based on the results of Section 3, an impact angle of 60 degrees is taken to be the maximum impact angle. The above equations then become

$$\gamma = 60 + \phi_{60} \qquad (1)$$

and

$$\sin(\gamma) = (O + H_{60})/A \quad (2)$$

The geometry of the situation from the gunner's perspective is that the angle of depression can be related to the range from the gun to the target, R, the height of the gun, G, and the maximum height of impact on the submarine H_{60} via the equation

$$\tan(\phi_{60}) = (G - H_{60})/R \quad (3)$$

Equations (1) through (3) can be combined and rearranged to yield the following expression for the maximum height of impact on the submarine:

Section	8	24	36	50	58	77	88
Radius (m)	1.27	2.12	2.3	2.29	2.29	2.01	1.47
Offset (m)	0.42	1.13	1.27	1.25	1.24	1.14	0.84

Table 4
Hull radius and offset estimates for the submarine at various points along its hull. In this case units have been converted from feet into metres.

$$H_{60}^4 + 2(O - G)H_{60}^3 + (O^2 + 4OG + R^2 + G^2 - A^2/4)H_{60}^2 +$$

$$(2R^2O - 2GO^2 + 2OG^2 + A^2G/2 + A^2R.\sin(60))H_{60} +$$

$$R^2O^2 + O^2G^2 - A^2G^2/4 - A^2RG\sin(60) - A^2R^2Sin^2(60) = 0 \qquad (4)$$

Equation (4) is amenable to solution using computer-based mathematical software. The resulting solutions directly relate the range of the engagement and the maximum height of impact on the submarine for which modelling indicates penetration can take place. It was possible to determine values for all of the other elements in this equation.

A pair of drawings exist, which enabled estimates to be made of the variables, O and A, at various points along the hull. The first drawing [Vickers 1913] details the amidships waterline of the submarine when in normal surface trim. It also provides a specified radius (at Section 50).

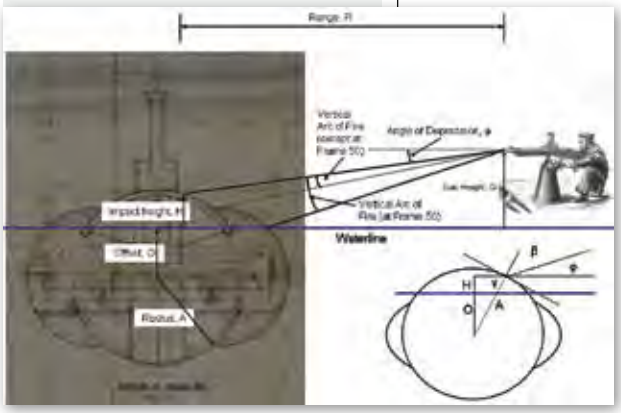

Figure 2.
Illustrating the geometry of a speculated, close-range engagement between HMAS AE1 and the gunboat Kolonia. Refer to the text for a full explanation. The submarine section image is copied from the General Arrangement Drawing [Vickers 1914c], held by the Royal Australian Navy Specification and Technical Documentation Centre. The image of the gunner, which is Figure 3, Plate X in Nordenfelt [1884], actually shows a smaller, rifle calibre Nordenfelt Gun (Courtesy Naval and Military Press).

The second drawing [Vickers 1914c] provides seven cross section drawings of the boat at various points along its length. Moving forward, these cross sections are at Frames 8 (near the stern), 24, 36, 50 (amidships), 58, 77 and 88. Each cross section drawing included a horizontal reference line which corresponded with the top of the hull at Frame 50. The two drawings provided sufficient information to enable a series of estimates to be made of hull radius, A, and offset height, O. These data are included in Table 4.

The Nordenfelt Gun is reported to have been mounted at the bows of the *Kolonia* [Foster 2006]. In addition to its main deck, the vessel had an upper deck which ran virtually to the bows, as can be inferred from the photograph in Figure 3. It is unclear whether the gun was mounted on the main or upper decks. For the purpose of this analysis, the assumption was made that it was mounted in the bows on the main deck. Of the two possibilities, this is the most conservative assumption because it predicts a smaller vertical arc of fire. The vessel appears to have had a reasonable rake on the main deck (visible in other surviving photographs), perhaps as much as three feet relative to amidships. The Certificate of Survey [Goddard and Douglas 1912] indicates the beam is 15 feet and moulded depth is 8' 5". Height from the waterline to the main deck amidships would therefore have been in the order of three feet. Thus the height of the deck at the bows is estimated to be in the order of six feet. Surviving examples of ship-mounted Nordenfelt Gun, in either actual or photographic form, indicate the gun was typically mounted on a low pedestal, much as is shown in Figure 2 or on a bulwark mount. In either case this would add another 3-4 feet. Thus, referring to the geometry of Figure 2, and converting to metric units, the height of the gun, *G*, is estimated to be approximately three metres above the waterline.

With respect to calculation of the range from gun to target, some simplifying assumptions were made. For each nominal range condition the distance from gun to submarine was considered to be constant. This ignored the slight increase in range which would have occurred as the line of fire traversed vertically from the vicinity of the waterline towards the casing. It was also assumed the horizontal line of fire was perpendicular to the longitudinal axis of the submarine. The final assumption was that the engagement was at such close range that the trajectory of the bullet could be considered to be straight. None of these assumptions carry significant impost in terms of the analysis. If the Nordenfelt Gun was mounted on the main deck (or on a bulwark mount near the bow), as assumed, the shape of *Kolonia*'s bow would have substantially limited the line of fire to abeam directions so, consistent with the assumptions, a short-range, alongside engagement is the most likely scenario to have applied.

For a series of ranges, the values of the various factors *A*, *O*, and *G* were entered into Equation 4 and analysed using the computer-based mathematical solver, MatLab, thereby yielding estimates for the corresponding value of H_{60}. The nominal ranges selected for the study were 20, 50, 100, 200 and 500 metres.

In contrast to the rather complex expression (Equation 4) required to yield an estimate of the highest effective point of impact, the lowest point of impact, H_{min}, is either at the waterline or at the point where the saddle tank meets the pressure hull. For each section, this height could be determined directly from the drawing [Vickers 1914c].

Once the two intercept heights H_{60} and H_{min} had been determined, it was a simple matter to calculate the corresponding angles of depression for the gun ϕ_{60} and ϕ_{max}. For each range condition the vertical arc of fire, $V_{\Delta\phi}$, was then calculated using the equation:

$$V_{\Delta\phi} = \phi_{max} - \phi_{60} \qquad (5)$$

Combining this equation with Equation (3) results in the following expression for the vertical arc of fire:

$$V_{\Delta\phi} = \tan^{-1}((G - H_{min})/R) - \tan^{-1}((G - H_{60})/R) \qquad (6)$$

Nominal Range (m)	Hull Section	H_{min} (m)	H_{60} (m)	Vertical Arc of Fire (Degrees)
20	8	0.0	0.74	2.1
	24	0.0	0.81	2.3
	36	0.25	0.83	1.6
	50	0.0	0.84	2.4
	58	0.48	0.84	1.0
	77	0.0	0.70	2.0
	88	0.0	0.51	1.4
50	8	0.0	0.71	0.8
	24	0.0	0.75	0.9
	36	0.25	0.77	0.6
	50	0.0	0.78	0.9
	58	0.48	0.78	0.3
	77	0.0	0.65	0.7
	88	0.0	0.47	0.5
100	8	0.0	0.69	0.4
	24	0.0	0.73	0.4
	36	0.25	0.75	0.3
	50	0.0	0.79	0.4
	58	0.48	0.79	0.2
	77	0.0	0.62	0.4
	88	0.0	0.45	0.3
200	8	0.0	0.69	0.2
	24	0.0	0.72	0.2
	36	0.25	0.74	0.1
	50	0.0	0.75	0.2
	58	0.48	0.75	0.1
	77	0.0	0.61	0.2
	88	0.0	0.44	0.1
500	8	0.0	0.68	0.1
	24	0.0	0.71	0.1
	36	0.25	0.73	0.1
	50	0.0	0.74	0.1
	58	0.48	0.74	<0.1
	77	0.0	0.61	0.1
	88	0.0	0.44	0.1

Table 5. Minimum and maximum heights of impact which modelling indicates would result in penetration of the pressure hull, and the corresponding vertical arc of fire.

Results and Discussion

The various measures of significance for Section 4 of this report are summarised in Table 5. Note that, for Hull Section 50, the pressure hull extended into the saddle tank to accommodate a pair of transverse-

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firing torpedoes, as shown in Figure 2. Hence at this location the minimum height corresponded with the waterline.

At very close range the vertical arc of fire is reasonably broad (1.8 degrees average along the boat for a range of 20 metres). This rapidly diminishes as range increases, to the point where the vertical arc of fire is only 0.1 degrees at ranges of 500 metres. To put these results in context, it should be remembered that the gun was mounted on a small (75 foot long, 73 ton) steamer which, even in the reported conditions of sea state 2 (as recorded in the Fair Deck Log of *HMAS Parramatta*, which was in the vicinity at the time), would have represented a reasonably 'lively' gunnery platform. Although he presents his results in a very favourable light, Nordenfelt [1884] gives some insight into the challenge of firing these guns from a small warship. He described a trial, undertaken in 1880, in which a Nordenfelt Gun was mounted on the top-gallant forecastle of the iron gunboat *HMS Medway*[4]. In a 'tolerably smooth sea' the ship steamed at 8 knots at various headings with respect to a stationary model torpedo boat.

While the size of the target is not specified, the first Royal Navy Motor Torpedo Boat, *HMS Lightning*, had only been launched three years prior to these trials, so it is reasonable to assume her class design would have been used as the template for the target. *Lightning* was 85 feet long, had a beam of 11 feet and height from boot topping to deck of approximately 3 feet [National Maritime Museum 2011]. Whilst this was a somewhat shorter target than the length of *AE1*, its height and width were very similar to that of the surfaced submarine. The gunboat fired 932 shots at ranges from 1500 yards down to 100 yards, and of those there were 359 hits on the target. Nordenfelt does not specify what the relationship was between range and strike rate, but it is reasonable to assume the closer-range firings would have contributed a much higher percentage of the 359 hits than the longer-range shots.

Another 1880 trial, reported by Nordenfelt [1884, Page 70] aimed to assess the accuracy of the Nordenfelt Gun. For this trial a single barrel of a shore-mounted, four barrel gun 'rapid-fired', but with deliberate aim between each firing, 44 rounds alternatively towards each of two 12 foot x 6 foot wooden targets set up at a range of 300 yards. The reported mean deviation for 23 hits on one target was 18.3 inches and 21 hits on the second target had mean deviation of 14.5 inches. This represents a rounded angular spread of fire of 0.1 degrees.

The *London Times* [re-printed in *The New York Times* 1882] reported another trial, undertaken using three candidate bulwark gun mounts (for 10, 5, and 3 barrel variants of the gun) in which volleys were fired (i.e. 10, 5, and 3 rounds per volley) in rapid order at targets 300 yards from the gun. The three guns delivered the following results:

At a range of 300 yards, a vertical spread in the order of 6 feet translates to, *at best*, fifty percent strike rate on a target of the size of *AE1*.

The conclusion that can be drawn from the various trials of the Nordenfelt Gun is that, in the case of an engagement with a target of *AE1*'s vertical dimensions, for ranges above 200 metres the inherent inaccuracy of the gun resulted in a spread of fire that was of the same order of magnitude as the size of target itself.

In the discussion above there was a reference to the potential impact of *Kolonia*'s motion on the shooting performance of the gun crew and the following paragraph returns to the topic. Unfortunately, at the time of writing there was insufficient information available on *Kolonia* to enable a full assessment to be made

Figure 3. Kolonia. The upper deck ran virtually to the bows (Photo courtesy Mr Gus Mellon).

4 *HMS Medway* was a Medina Class Gunboat. These were a very unusual design of 363 tons (110 x 34 x 7 ft), reflecting the period of transition between sail and steam, featuring two screws and a three-masted barquentine rig. The top-gallant forecastle was a raised deck, aft of the bow, which supported the foremast. The wreck of *Medway* is reported as lying in shallow water at Meyers Slip, Bermuda. A general reference of interest is at www.battleships-cruisers.co.uk/r_n_gunboats.htm

of her seakeeping characteristics. The following discussion is thus qualitative, but hopefully representative.

There is a long-standing, widely-used rule of thumb which says an acceptable minimum natural roll period of a vessel (in seconds), should be equal to the numeric value of the vessel's maximum waterline beam (measured in yards/metres) (see, for example Annex IX of IMO [2010]). This rule of thumb seems to apply across a broad spectrum of vessels - as can be inferred from a table of typical roll periods, of ships ranging from fishing boats (5.5 – 7 seconds) to passenger liners (20 – 25 seconds), included in Bhattacharyya [1978, page 83]. Using this rule of thumb the natural roll period of *Kolonia* was likely to be in the order of 5 seconds.

HMAS Parramatta reported the conditions as being seastate 2, representing a wavelength of about 12 metres and average wave period in the order 3.2 seconds. From these data it is possible to calculate the apparent wave period that *Kolonia* would have seen for various ship's speed and heading conditions. *Kolonia* has been reported to be a '5 knot steamer' [Brown, 2011]. At that speed the apparent periods of the seas for headings ranging between head seas (180 degrees) and following seas (0 degrees) would cover the interval from 2 seconds to 10 seconds. *Kolonia*'s natural frequency would fall within that range. Using the assumed 5 second natural roll period, and a method described by Bhattacharyya [1978, page 89], the heading at which maximum roll occurred would be around 42 degrees. If it could be avoided, it is therefore unlikely a gun engagement would have been initiated with *Kolonia* heading down-seas.

For beam-seas, and when heading into the swell, her motion would have been relatively unforced so these would have represented the most favourable headings to undertake a gun engagement. Given this is an acknowledged qualitative discussion, for the following sentences three assumptions are made: (1) it is assumed the engagement took place with the ship steering a beam-seas course[5]; (2) it is also assumed that the ship's motion is both undamped (i.e. she did not have stabilisation aids such as bilge keels etc) and forced; (3) the waveform of the seas is assumed to be essentially a simple sinusoid. Seastate 2 has an average wave height in the order of 0.5 metres [Bhattacharyya, 1978, page 104]. A sinusoidal approximation for the wave shape yields an estimate of the maximum slope of an 'average' wave, α, as in the order of 7.5 degrees. In beam seas the tuning factor, Λ, which determines the ship's response to the prevailing seas, is simply the ratio of the wave frequency versus the natural frequency of the vessel. In this scenario the tuning factor is 1.8. The resulting roll of the vessel is given by the expression [Bhattacharyya 1978, page 90]

$$\Phi = \alpha/(1 - \Lambda^2) = 7.5*\text{pi}/180/(1 - 1.8^2)$$

This expression predicts *Kolonia* could be expected to have been rolling through a range of angles up to $\pm$ 3.3 degrees. As the Nordenfelt Gun was manually trained by the gun crew, their likely approach to aiming in the vertical plane would have been to set the angle of depression to a mean value and then attempt to fire the gun as the target swept through its sights. There would be two approaches to this: (1) rely on the gunner's ability to anticipate when to fire; or (2) rely on the rate of fire combined with the vertical angle swept by the gun to ensure the target would (eventually) be struck. In the 500 metre range condition the 0.1 degree vertical arc of fire represents only 1/66th of the total swept angle. With either of the approaches the limitations and variability of human reaction time, combined with the inherent limitations of the gun, make this a very challenging target to hit. The situation is not much more favourable at 200 metres range. Hence, at these ranges it is likely many rounds would need to be fired before a significant number of hits could be scored on the target. Two other factors worked in the favour of *AE1*. The first is that the gun was manually fired by toggling a firing lever back and forth, which would have made it very difficult to sustain a long-duration attack at high rate of fire. The second is that the ammunition hopper held only ten rounds per barrel. This meant that, after every ten volleys, firing had to be paused so that the gun could be reloaded.

At short ranges, however, the vertical arc of fire becomes quite substantial and consequently relatively short bursts of fire would be likely to result in the pressure hull of the submarine being struck. At fifty metres range, for instance, the vertical arc of fire was 0.7 degrees, and this means the gun would have been bearing on the target for at least 10% of the time. Even allowing for the inaccuracy of the gun, a relatively short burst of fire would certainly result in a hit.

Gun/Mounting	Rounds Fired	Hits on Target	Horizontal spread of hits (feet)	Vertical spread of hits (feet)
10 barrel/Heavy	100	83	7	5
5 barrel/Medium	50	34	8.5	6
3 barrel/Light	39	28	7	6

Table 6. Reported results of a 1882 trial of three Nordenfelt Guns

5 The author is not an early 20th century gunner, but it seemed to him intuitive to either steer a course which would minimise roll (head into the seas – but this would have the disadvantage of inducing relatively high frequency motions in the ship in pitch, heave and, due to sea spreading, roll), or steer a course which gave a relatively slow roll of low amplitude – in this case as would occur with beam seas. The decision was taken to assume the latter condition.

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General Conclusions

The inherent inaccuracy of the Nordenfelt Gun, the fact it was mounted on a relatively small steamer and the manner in which it was fired all combine to make a reasonable case for claiming that *HMAS AE1* would have been relatively invulnerable to longer-range attack. At short ranges of 100 metres or less, however, the submarine would have been very vulnerable: in Section 3 it was shown that bullets fired from these guns would penetrate the submarine's pressure hull and in Section 4 it was shown that the gun had the capability of scoring hits on the submarine.

The *AE1* Search Committee have prepared an interim report, addressing various scenarios that may explain the loss of the submarine [Draft Report]. One of the scenarios proposed follows a claim by a German POW, Petty Officer Reuschel, that he was on board the *Kolonia* when it engaged *AE1*. PO Reuschel reported *AE1* as having hove-to to enable his vessel to make an approach under the coverage of a white ensign. He claimed this enabled *Kolonia* to engage the submarine with gunfire at close range, and that the German boat followed up by ramming *AE1* [see Section 4.4.2 of the Draft Report]. The engagement and ramming could have caused *AE1* to irretrievably lose trim and depth control [see Section 6.3 of the Draft Report], resulting in her loss. The results of the current paper can't in any way be used to support an evaluation of the likelihood such an attack actually took place. The results do, however, give credence to the proposition in the sense that the close range demanded for a successful gun engagement would also render possible a ramming manoeuvre by the *Kolonia*[6]. ☆

6 In fact it is difficult to identify any alternative scenario whereby the steamer could make such a close approach to the submarine. The *Kolonia*, being a displacement craft only 75 feet in length, had a theoretical top speed of 11.6 knots but was reported to be of relatively low power and therefore having an actual service speed of 5 knots [Brown, 2011]. *AE1* had a claimed surface speed of 16 knots [Cocker 2008, page 28]. While VADM Patey's report [1914] states the weather was hazy, there was no reported fog on the day, so short of *AE1* surfacing directly adjacent to *Kolonia*, it should have been impossible for the steamer to overhaul the submarine. A known existing fault on *AE1* was that the starboard main engine clutch was jammed in the engaged state [*AE1* Search Committee Draft Report]. This should not have impacted the boat's ability to manoeuvre while surfaced.

Dr Roger Neill, initially a medical physicist, has been a defence scientist in the maritime domain for a quarter century. His research activities currently include unmanned systems studies and future undersea warfare concept development. He is also a recognised expert in the interpretation and visualization of historic naval shipwrecks.

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Ed Dawson has provided guidance regarding matters associated with seakeeping of displacement hulls. Ed was able to show me that, no matter how enthusiastic I was, there simply wasn't sufficient data available to build a full seakeeping model for *Kolonia*. I still live in hope that, one day, a set of plans and stability test data will emerge from someone's archives.

Finally, a number of members of the *AE1* Inc. Search Committee have freely given their time in support of my enquiries. In particular thanks are due to Darren, Gus, Ian and Peter.

An Australian at Jutland: the story of Robert Walker onboard *HMS Shark*

BY ANDREW PITTAWAY

When war was declared in 1914, thousand of Australians rushed to enlist in the Australian Imperial Force (AIF) but Robert Walker was one of the many who didn't. Instead, due to circumstances, he offered his services to the Royal Navy and in 1916 found himself at sea in the greatest naval battle of World War I.

Robert Walker was born in Fremantle on 19 February 1893 to Charles and Annie Walker. Charles Walker was a well known boat builder in the Fremantle area and the family resided at 21 Tuckfield Street, Fremantle. From his home Robert only had a short distance walk to attend the nearby Fremantle Boys School where he excelled in his studies. In 1905, at age 12, Robert was awarded a scholarship of 50 Pounds value, over four years, which enabled him to continue his study at Scotch College in Claremont.

For the next six years he traveled daily from his house in Fremantle to attend Scotch College, where he continued to excel in all his subjects. Robert and several good friends, including fellow student Dick Caldwell, spent much of their spare time sailing and rowing on the Swan River. In his last year at Scotch, in 1910, he was a Prefect and also on the staff of the school newspaper; the *Reporter*. His hard work paid off when at the end of 1910 he became the Dux of the College.

Robert craved further opportunities to continue his education as he had decided he wanted to study medicine. In 1911 he won the first Western Australian University Exhibition and travelled to Adelaide where he won second place on the General Honours list at Adelaide University. He also received Special Honours in Modern History, Greek, Latin, French and Pure Mathematics. It seems he had narrowly missed out on a Rhodes scholarship, but his success at Adelaide University won him a place as a Student of Medicine at Edinburgh University in Scotland.

His dream realised, Robert headed for Scotland in 1912. His aptitude soon showed itself very clearly as during the period 1912-1915 he won Edinburgh University medals for his study in Physics, Chemical Physiology and Anatomy. Although study and course work took up a large amount of his time, Robert still had time for other pursuits and joined the Royal Naval Volunteer Reserve. The declaration of war coincided with his final years of study and he had made the decision to serve in the Royal Navy.

On 23 July 1915 he commenced service in the Royal Navy with the rank of Surgeon Probationer and a month later was posted to the destroyer, *HMS Lynx*, however he never joined her – she struck a mine and sank in the North Sea. Robert was re-assigned to *HMS Shark*; a K class Torpedo Boat Destroyer of 950 tons, built in 1912. She was armed with three 4-inch guns and four 21-inch torpedo tubes. With engines capable of producing up to 25,000 horsepower she could steam at 31-32 knots.

In a letter home to his old college, Robert describes some of his initial experiences:

> My experience of the Navy is one that I am not likely to forget. I applied for my commission and was appointed to *HMS Lynx*. After all my preparations and arrangements were complete I traveled to ----- to join my ship. It was a long, tedious journey of some days duration, and I was at last glad and relieved to be able to report myself to Senior Naval Officer, preparatory to going on board my first ship. Can you imagine my feelings when this officer congratulated me on my good luck and narrow escape. My ship had been mined that very morning, and 74 men were lost! A narrow escape indeed. I was then recalled to the Admiralty and appointed to the *HMS Shark*. Fortunately I was more lucky this time, and I got on board this ship without mishap, and here I have been ever since.'
>
> I cannot tell anything concerning this ship or her movements – only that the latter are sometimes too numerous and varied for my palate. We roam all over the seas, unchallenged and defiant; and we are proud to think that we are pretty safe from any hostile submarines, in that we have now disposed of them all. Now I am attached to the Grand Fleet, and, of course, have daily opportunities of seeing sights that I will never forget; and I am convinced that should "Der Tag," (The day) when the fleets meet come, there will only be one in it and that one will certainly not be the German.[1]

Robert Walker (Scotch College Archives Claremont)

HMS Shark was one of the many ships that patrolled the waters of the English Channel on watch for

HMS Shark

An Australian at Jutland: the story of Robert Walker onboard *HMS Shark*

marauding ships of the German Navy. This was a daily occurrence in Robert Walker's first 10 months on the ship. After receiving some mail and news from home, Robert wrote back and congratulated his old mate Dick Caldwell[1] for being awarded Scotch's 2nd ever Rhodes scholarship, and as for himself, the ship:

> is still tossing round the North Sea, keeping an unceasing vigil in all weathers. We have our times of excitement and lately have been having some good "thrills" but of these I must remain silent. Suffice to say, we are ever ready at a moment's notice to strafe and strafe thoroughly any number they like to send against us. The navy is doing a power of work every day and every night, too, of which nobody knows anything at present. [2]

Little did Robert know then that in late May his ship would be destined to play a significant role in the largest sea battle of World War I: the Battle of Jutland.

On 31 May 1916 the Battle of Jutland commenced with the two great Navies trading opening blows. In response to a German attack on their ships Admiral Hood ordered *HMS Shark*, one of the destroyers screening the battle cruiser *HMS Invincible*, to attack the oncoming German ships.

> The British Destroyers led by Captain Loftus Jones in the *Shark*, accompanied by *Acasta*, *Ophelia* and *Christopher*, turned towards the enemy with thick smoke pouring from their funnels and bow waves streaming over their narrow fo'c'sles. Their attack foiled the German onslaught, so that only twelve torpedoes were fired, all of which were skillfully avoided. But the *Shark* and the Acasta were severely mauled"[3].

Battlecruiser HMS Invincible (1907) exploding at the Battle of Jutland, 31 May 1916 (Public domain).

The attack was made with such fearlessness by the four destroyers that the Germans were forced to turn away, but at a large cost to the *Shark*. Her Commanding Officer, Loftus Jones, was mortally wounded as German shells continued to hit the ship. Robert Walker attended the many casualties despite coming under devastating German fire.

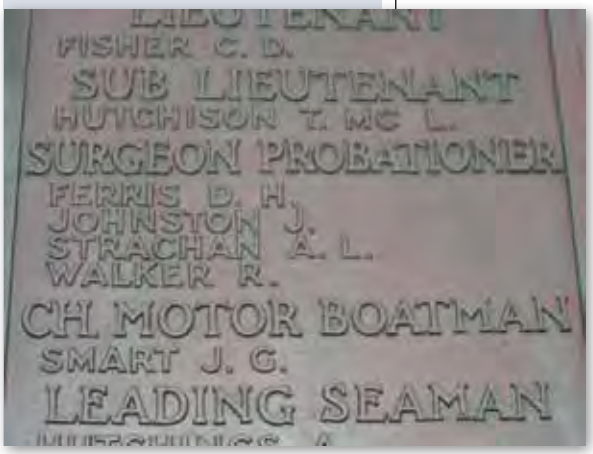
> Under heavy enemy gunfire *HMS Shark* suffered steerage damage and was disabled. As a spare torpedo was being hoisted prior to being launched into the tube, it was struck by a shell with a violent explosion causing heavy casualties. The ship continued to sink and was heavily fired upon…. One by one the wounded crawled brokenly into the lee of the casings and funnels in pitiful attempts to find shelter; among them knelt the devoted figure of the surgeon endeavoring single handed to cope with his gallant hopeless task. When last seen he was bandaging a man who had lost a hand when the torpedo exploded. He was then himself severely wounded and was apparently shortly afterwards killed.[4]

HMS Shark sank shortly afterwards and Robert Walker was never seen alive again, nor was his body recovered. Along with other missing sailors from the battle he is commemorated on the Portsmouth Naval Memorial. The *Shark*'s Commanding Officer was later awarded a posthumous Victoria Cross for his actions.

Robert's parents at home in Fremantle received the terrible news of his death and among those who provided sympathy was the Keeper of the Privy Purse who sent a cablegram which read: "The King & Queen deeply regret the loss both you and the navy sustained by the death of your son in the service of his country. Their Majesties truly sympathise with you in your sorrow."

A glowing tribute was also printed in the Edinburgh University magazine.

> By the death of Surgeon-



Portsmouth Naval Memorial - Robert Walker.

1 Caldwell delayed his Rhode Scholarship to enlist in the AIF. He served in the 48th Battalion AIF and reached the rank of Captain. He survived the fighting and post war completed his Rhodes scholarship. He later worked for the League of Nations in Geneva.

Probationer Robert Walker, who was killed in action on 31st May, the University has lost an especially brilliant and popular student. Before he left his home in Western Australia, Walker had shown that he was a student of more than passing scholastic ability. His activities in Edinburgh were mainly confined to the pursuit of his medical studies, and in all the varied branches of this study he showed consistent brilliancy – winning in all nine medals. In Anatomy, perhaps no student has shown such consistent proficiency as Walker, in which he won four medals, a Mackenzie and a John Aitken Carlyle Bursary, the Cunningham Memorial medal, and the Van Duns Scholarship.

By reason of his almost phenomenal success in various examinations held, Walker had become well known, and was deservedly popular amongst his fellow students. As evidence of his popularity on *HMS Shark*, he was asked by the officers of that ship to stop with them instead of accepting the honour of promotion to *HMS Tipperary* which was offered him. He elected to remain on *HMS Shark* and died fighting as one of those who showed such heroic fortitude, when subjected to a murderous fire as they lay helpless and crippled; and thus perhaps the most brilliant student of this year has added his name to the already long list of Edinburgh University heroes, and at the same time to the roll of loyal Australian sons.'[5]

A Dr R. Burns, who knew Robert, wrote another tribute from his position at the Naval Infirmary at Hull:

There is great consolation in that he died like an Australian, in the midst of his duties. The gunlayer of that famous last gun and the coxswain of the *Shark* are here. They speak in the very highest terms of "Bob" – of his kindliness and skill in the days before the great action, and of his unquestioned valour when the guns began to boom. The *Shark*, these men say, had all her steering gear shot away first of all. Shortly afterwards she was torpedoed in her oil tanks. This prevented her getting oil to her engines and she became a stationary target.

They then got the concentrated fire of "fully twenty ships" everything being swept off the decks except one gun. This the Captain manned himself. Both the coxswain and gunlayer before this saw "Bob" busily working among the wounded. The last they saw of him was in striving to reach a badly wounded man just after having attended to another. When "Bob" left him the coxswain distinctly remembers him holding his instrument bag in one hand, himself wounded, reaching out towards a wounded comrade with the other. A hurricane of metal swept the ship and he was killed. A glorious death, but sad in that he was so young, so brilliant, and every inch a man. He was everybody's pal.'

Portsmouth Naval Memorial.

Had Robert Walker lived who knows to what height his study of medicine would have taken him. By all reports he had a brilliant mind and his loss was a tragic one for both his family and the wider community.

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(Endnotes)
1 Scotch College Reporter
2 Ibid
3 Jutland 1916-Costello & Hughes
4 The Navy Eternal Bartimeus pg106
5 Edinburgh University Magazine

The French Navy: New Capabilities, Current Operations and Future Challenges

BY SERGEI DESILVA-RANASINGHE

As one of the oldest navies in the world, the French Navy (Marine Nationale in French) has a fascinating history stretching back many centuries. In the modern era it has played an instrumental role in sustaining France's overseas possessions, influence and global standing. Given that France remains a major European nuclear-power with formidable strike capabilities, its role as a key-partner in the Western alliance is likely to continue in the years ahead as seen by the global deployment of the French Navy.

Fleet Capabilities

Nuclear deterrence still remains the centrepiece of France's strategic defence capability as confirmed by former French President Jacques Chirac, who stated in 2006: "In the face of the concern of the present and the uncertainties of the future, nuclear deterrence remains the fundamental guarantee of our security. It also gives us the ability to keep our freedom to act." He added: "Deterrence has always continued to adapt...to our environment and to the threat analysis. We are in a position to inflict damage of any kind on a major power that would want to attack interests we would regard as vital. Against a regional power...the flexibility and reactivity of our strategic forces would enable us to exercise our response directly against its centres of power."

In this context the modern French Navy has been responsible for much of France's nuclear strike capability, after France announced the disbandment of its land-based launch platforms. The delivery platforms in the French Navy that can accommodate nuclear warheads include its key strategic defence asset, the "Le Triomphant" class SSBN. The other nuclear-delivery platforms in the French Navy are the Dassault Rafale- M F3 and the Dassault Super Etendard (modernised) carrier-based jets, which operate from the nuclear-powered aircraft-carrier *Charles De Gaulle*.

In the wake of the force modernization programme predicated by the French White Paper on Defence and National Security published in 2008, and the 2008-2014 Military Planning Act, the French Navy is now on the cusp of embracing a new era in transformation, capabilities and development of its force structure. In the last few years it has begun the process of introducing a number of important new vessels and capabilities to its fleet.

These include: up to 48 Dassault Rafale- M F3 multi-role jets to replace the older Dassault Super Etendard; four "Le Triomphant" class SSBN, which replaced the "Le Roundtable" class SSBN; six Barracuda-class nuclear submarines at a cost of €7.9 billion (the first of which is scheduled to be commissioned in 2017) to replace the older "Rubis" class nuclear-powered attack submarines; three "Mistral" class amphibious assault and command ships, which succeed the ageing "Foudra" class landing platform docks; two "Horizon" class frigates in 2007, a short-lived programme that has just been replaced by the new FREMM (Fregates Europeennes Multi-Missions) multi-role frigates, of which 11 are being built to succeed the older F67 and F70 class anti-submarine warfare destroyers; and finally the introduction of 27 NH90 NFH helicopters to replace the ageing Super Frelons and Lynx aircraft. These new additions constitute the French Navy's major acquisition programmes that have been implemented in recent times, or yet to be fully implemented.

At the end of last year, the Ministere De La Defense released its report Marine Nationale 2010, which illustrated the budget, size and capabilities of the French Navy. This comprised of a fleet of 78 ships and 45, 554 military and civilian personnel (out of which 37, 245 were officers and sailors), naval action force consisting of 68 combat and support ships with 12, 000 sailors; submarine force of 10 vessels and 3, 500 sailors; fleet air arm made up of 211 combat and support aircraft with 5, 800 personnel; 17 naval riflemen and commando squads

French Navy Cmdr. Denis Jolas and sailors man the rails of the amphibious transport dock ship USS Nashville. (Public domain)

numbering some 2, 400 personnel; 75 Gendarmarie Maritime squads made up of 1, 100 personnel. Accordingly, to field such a large force the French Navy's operational budget amounted to €4.25 billion, excluding acquisition costs of new vessels.

Naval and Maritime Operations

Given the history of the French Navy's involvement in UN, NATO and US-led missions most notably since 9/11, it has contributed significant forces to an array of operations globally and has been especially active in the regions of Africa, the Indian Ocean and the Middle East. Today the French Navy operates four bases and five naval air stations in continental France, and has another naval air station and a further five bases situated in French territories worldwide. It also maintains expeditionary forces based in three other countries, namely Djibouti, Senegal and the United Arab Emirates. Indeed, its capacity to influence world events was seen throughout 2010 where on average it deployed 31 ships and over 4, 000 sailors at sea every day without fail.

The French Navy's recent participation in a number challenging operations has earned it recognition worthy of mention. For instance, from November 2007 to August 2008 the French Navy-led Operation Alcyon provided security escorts to UN food convoys between Mombasa in Kenya, and Merka in Somalia. As a result 27 vessels chartered by the World Food Programme delivered 122,000 metric tons of food aid.

Due to the escalating problem of piracy which has taken on serious proportions, the EU launched Operation Atalante in late 2008, which has seen up to 30 warships and 26 nations involved, in what is the EU's first-ever overseas naval mission sanctioned until December 2012. By engaging in anti-piracy operations in the waters off the Horn of Africa, Operation Atalante reportedly provided protection for nearly 80 percent of the commercial shipping traversing through the Gulf of Aden. In doing so, the enhanced French Navy presence had some impact as seen in April 2009, when French Navy commandos stormed a French yacht commandeered by pirates. In the ensuing fire fight four French citizens were rescued, two pirates and one hostage were killed. Later, in November that year, the French Navy seized three boats and arrested 12 suspected pirates off Somalia.

Reflecting upon the Operation Atalante in late 2010, the former Force Commander of EUNAVFOR, French Navy Rear Admiral Philippe Coindreau, said: "In 2010, 72 percent of pirate attacks have failed, 81 percent since August. Those results are due to the combination of EUNAVFOR's action, the application of new concepts of operations, the use, by the maritime community, of systematic security measures on merchant vessels and high-quality cooperation with other naval forces and independent Navies."

Aptly, the French Navy's determination to tackle piracy was illustrated throughout 2010 by a number of incidents. For instance, in March that year French newspaper *Le*

The French Navy destroyer FS Forbin (USN)

The French Navy: New Capabilities, Current Operations and Future Challenges

Figaro reported that the frigate *Nivôse* intercepted four mother ships and 35 pirates in the space of three days. Similarly, in April the following month two pirate boats mistakenly attacked the French Navy ship *Somme*, which led to the interception of the mother ship and arrest of six pirates.

"In a funny way, the boat looks like a civilian vessel and we think that it was attacked by mistake," said a French Navy spokesperson.

Again, in May a French "Mistral" class amphibious ship *Tonnerre* reportedly destroyed a pirate mother ship and captured 11 suspected pirates. Cumulatively, throughout the year 2010 official statistics indicate that the French Navy had a string of successes as seen by the interception of 32 pirate groups which led to the arrest of 221 pirates.

Another significant mission undertaken by the French Navy is Operation Heracles, which represents France's ongoing naval support to US-led mission Operation Enduring Freedom in Afghanistan, offering air support to NATO forces or providing surveillance and reconnaissance to support NATO maritime supply lines in the Arabian Sea. The deployed force complement varies according to requirements, but generally consists of one frigate, and sometimes an Atlantique 2 maritime patrol aircraft, the latter operating out from Djibouti.

In 2006, the aircraft carrier *Charles de Gaulle* was assigned to Operation Heracles to engage in maritime surveillance, reconnaissance and to provide air support to NATO forces in Afghanistan. Latterly, towards the end of 2010, and for the duration of four months, the *Charles de Gaulle* participated in Operation Agapanthe with its planes flying in excess of 1000 hours providing air cover to NATO forces, and also supporting counterterrorism and anti-piracy operations in the Red Sea, Gulf of Aden and the Arabian Sea.

In recent months the French Navy has also seen extensive action in West and North Africa. For example, in March this year seven French warships operating in the Gulf of Guinea played a major role ending the Second Ivorian Civil War with the arrest of ousted President Laurent Gbagbo by providing operational and logistical support to multinational ground forces. Similarly, since mid-March 2011, the French Navy have been heavily committed to Operation Harmattan, which is the French contribution to the NATO-led initiative to enforce the no-fly zone over Libya. The French Navy has deployed the *Jean Bart* and *Forbin*, two anti-aircraft/air-defence destroyers, to conduct ongoing surveillance off Libya's coast.

France also dispatched its carrier strike group, which consists of the *Charles de Gaulle* replete with 26 aircraft and 10 helicopters, accompanied by the tanker *Meuse*, the destroyer *Dupleix* and frigate *Aconit*.

French navy frigate La Fayette

Left: French nuclear submarine Le Temeraire (Headmark archival)

As affirmed by President Nicolas Sarkosy, the French Navy, and Air Force contribution had a major impact on Libyan military forces that laid siege to rebel-held city of Benghazi:

"Our Air Force will oppose any attack from Gaddafi's aircraft against Benghazi inhabitants", he said. "Our aircraft are already preventing air attacks from occurring, and other French planes are ready to intervene against armoured vehicles which may threaten unarmed civilians."

Indeed, the Rafale and Super Etendard jets aboard *de Gaulle*, along with support from the French Air Force, enforced the no-fly zone around Benghazi and conducted air strikes against military targets, which reportedly destroyed four armoured vehicles of the Libyan Army on March 25. At this stage the inability of rebel forces to overrun Colonel Gaddafi's loyalist-forces means that France's commitment to Operation Harmattan is likely to be protracted affair.

Future Considerations

The increasingly precarious economic conditions facing European countries following the aftermath of the global financial crisis, means that EU member-states will need to seriously examine possibilities to cooperate and engage in interoperability programmes to offset the effects of major budget cuts. An example of this can be seen with the comments made by French Defense Minister Herve Morin in April this year: "It is clear that the budgetary situation concerning the equipment of our forces makes the construction of a second aircraft carrier difficult. It's a decision that we will have to taking in the coming weeks."

Clearly any decision made would be influenced by the November 2010 ground breaking Anglo-Francophone agreement for much greater defence cooperation, including the possibilities of integrating carrier-battlegroups.

Nonetheless, the French Navy clearly continues to have significant responsibilities given that, according to the Ministere De La Defense, it watches over the world's second-largest territorial maritime domain of over 11 million km2. Such responsibilities are indicative of France's willingness to remain a major power in global affairs, particularly where its national and strategic interests are concerned in regions such as the Indian Ocean, Mediterranean Sea and West Africa. The southwest and north eastern Indian Ocean quadrants particularly warrant major French interest due to the strategically vital sea lanes that facilitate trade, and energy to and from the Middle East, and the significant French populations in the region, exemplified by over 850,000 French citizens on the island of Reunion.

Indeed, this strategic reality has given rise to an effective navy which will remain a key instrument of France's foreign and defence policy well into the future, which regardless of any future budgetary constraints, will remain one of the most effective Western navies in the world.

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Prospects for maritime security cooperation 'of coral made'

Recent Australian marine research offers welcome and unexpected opportunities to make regional maritime security cooperation more effective, argues the Australian Defence College's Nicholas Floyd.

In keeping with the best seagoing traditions of serendipity, the recent Maritime Advancement Award[1] Presentation that coincided with the Royal Australian Navy's Sea Power Conference[2] at Darling Harbour, Sydney in January 2010 provided a somewhat unexpected but powerful combining of defence and ecological policy areas. The presentation by Dr Alison Jones of Central Queensland University[3] on the world-leading work she and her colleagues recently completed on marine 'refugia' in the Great Barrier Reef, certainly provided some food for thought on maritime security cooperation, at both national and international policy levels.

The pertinence of research such as this in an Australian context is reasonably self-evident. At a first-order level, the research provides Australian policy-makers in fields as diverse as environment, primary industry, recreation and natural resources with quality analysis on how best to husband biosystems that are crucial as refuges for sustainable tourism and professional fishing industries, as well as for recreational fishing. However, the research by Dr Jones and Dr Ray Berkelmans is equally opportune when applied at the international policy level, by way of its valuable potential as a marine and fisheries resources management tool for Australia's Pacific and Southeast Asian neighbours in securing their marine resources.

For these nations, maritime eco-sustainability is synonymous with economic survivability – a sobering observation when one considers that five of Australia's nearest neighbours – Indonesia, the Philippines, the Solomon Islands, Papua New Guinea and Fiji – together comprise over twenty-five thousand islands. Moreover, as humans increasingly occupy, urbanise and exploit these coastal regions, they will become increasingly pivotal to the interests of nations and the global community alike. For this reason, there is true benefit to be gained in

Diver above coral bommie, Outer Rock off Keppel Group, Great Barrier Reef Marine Park (photo supplied by D. Jones, CQU)

Diver marking seabed for refugia analysis off Keppel Group, Great Barrier Reef Marine Park (photo supplied by D. Jones, CQU)

Australia offering assistance and – where appropriate – providing aid in managing the sustainability of their marine resources.

The months of fieldwork, study and analysis conducted by Dr Jones and Dr Ray Berkelmans assessed both the survival and regeneration potential of specific coral species and their *zooxanthellae*[4] (algal) symbionts. The study area concentrated on the island fringe and bommie reef complexes in and around the Keppel Group, off Yeppoon on the central Queensland coast. The findings sought to determine which reef habitats and coral communities offered the best investment to protect for future proofing the wider reef's viability, via measurement of a range of key datasets.

Marine 'refugia' research

The analysis and biochemical architecture behind the research is deserving of a much more detailed individual treatment than is provided here – as this article's purpose is to explore the science's application to wider foreign policy options.[5] However, it is important at this point to understand a little of the research parameters and objectives.

Currently, many reefs around Australia (as well as elsewhere) are exhibiting periodic notable changes in seawater temperature and salinity, at different depths within a given column of water. Similarly, data from numerous sites reveal that increases in dissolved inorganic nitrogen (or DIN) from land runoff continues to occur at unprecedented rates, both here in Australia and globally. As many readers would be aware, it is the rate of change of factors such as these, and not necessarily their magnitude, that makes such changes a killer to marine biosystems.

'Many of the world's marine reserves have been chosen to protect fish populations rather than to protect the structural coral species that underwrite the entire reef system' says Dr Jones.

'Unfortunately many of the current system of marine reserves are now threatened by degradation from temperature stress and acidification. Protecting vulnerable reefs from anthropogenic impacts will help the regeneration process following climatic disturbance, but these reefs are unlikely to act as arks that seed regeneration elsewhere if they are already struggling to survive. It is important that we choose marine reserves very carefully now to plan for future catastrophic collapses.'

The marine 'refugia' research therefore seeks to isolate and compare select criteria that determine which coral reef areas are most resilient to change in the environmental conditions listed above; which areas

possess the greatest coral biodiversity; and which areas are most productive in terms of coral growth. In doing so, the 'refugia' research also offers a solid scientific basis for Australia's international cooperation partners.

Policy Application

In a direct sense, the results and analysis can be applied to prioritise resources and protect reefs that will act as 'stationary arks' for these anticipated climatically grim futures facing Pacific and Southeast Asian nations.

More broadly, the analysis technique also informs a range of other relevant stakeholders, such as farm holders, local councils and tourism and fisheries peak bodies, and applied to important decisions on issues such as farming practices and other land use, conservation and navigation areas for recreational and professional boating, and the approach can of course be applied more widely to other marine biosystems.

Many of the Pacific and Southeast Asian regions' island nations have insufficient maritime security resources to patrol all of their reef space, let alone the full extent of their 200 nautical mile Economic Exclusion Zones. They operate few, if any surface patrol vessels, possess minimal if any maritime aerial surveillance, and face a variety of challenges in networking and information communications and technology coordinate fisheries and sovereignty protection efforts.

Moreover, many of the world's other reefs – such as in the Caribbean and the Middle East – have been irreparably damaged. This means that the Pacific's coral communities assume a truly global importance, at a time when parts of it have the highest proportion of species facing extinction,[6] and when other research is indicating that coral reefs are as important in moistening the air as trees are considered the 'lungs' of the earth.[7] Frameworks like the *Niue Treaty Subsidiary Agreements* (as reaffirmed by Pacific Island Forum members at Cairns in August 2009),[8] seek to provide cooperative approaches towards fisheries and sovereignty protection efforts, by allowing signatory nations to help police and protect the resources of neighbouring countries. Even with innovative legislative tactics like these however, the fact is that there is simply too much area, too many vulnerable sites and too few constabulary resources to protect everything.

This is where the data capture and analytical techniques demonstrated in the research conducted by Dr Jones and her associates provide a welcome opportunity for Australia, as an adjunct to development assistance strategies currently in train with many partner nations in the region. Using these methods in those nations' bioregions at risk from overfishing or habitat degradation could greatly assist in prioritising the scant assets to protect those reefs that are the 'key terrain' of their marine ecology.

This should not be seen simply as a proposition inspired simply by Australian neighbourly *bonhomie*: the macro-interrelationship between marine biosystems is often symbiotic at several levels. For instance, many of the South Pacific island archipelagos sit astride the East Australian Current as it approaches Australia from the Equator, linking the food chains and life cycles on the Great Barrier Reef with the rest of the South Pacific, at levels of interconnectedness that we still do not comprehend. This means that a catastrophic collapse in the biodiversity of a neighbouring marine space might equally remove a vital hatchery, breeding site or migratory stage point of one or several key links in marine food chains here in Australia. It is therefore in Australia's direct interest to help in preventing such collapses.

As a focus for development assistance, Australia could do much worse than providing funding, expertise and technical support on marine refuge analysis to nations who would benefit – and indeed whose sustainability as a viable country might depend – from such analysis.

Initiatives of this style could offer as many opportunities for host country development as for the Australian participants, through the deepening of the local research base and generic understanding. Furthermore, Australia's development initiatives could be teamed with and through other similar-focussed bodies such as the *Secretariat of the Pacific Community,*[9] the Nouméa-based *Institut de Recherche pour le Développement* (IRD),[10] and the Forum Fisheries Agency.[11] The Asian Development Bank/Global Environment Facility's joint-sponsored Coral Triangle Initiative[12] or perhaps even the Pacific Patrol Boat Program[13] – a longstanding plank in the Australian Defence Force's Defence Cooperation commitment to the region – might potentially have the capacity to materially support, or assist in take-up and broadening the investment return.

The changes we see today in climate and weather patterns, in encroachment of human exploitation and other challenges to marine biosystems present risks not yet fully fathomed by either Australia or its Southeast Asian and Pacific neighbours. The need to understand where and how to apply chronically insufficient resources, underscores the importance of a collaborative approach with Australia and its other Pacific neighbours.

Central Queensland University's work on how to assess and select which marine refugia must be protected,

and which can be risk managed, has the potential to be a vital part of regional nations' marine management policies and procedures - not only fisheries protection, but also improved information sharing and decision making on maritime resources more broadly. Australia should carefully consider this opportunity to 'suffer a sea change' in its regional development assistance programs, and lay down the bones of a program of maritime security cooperation – 'of coral made'.

Lieutenant Colonel Nicholas Floyd wrote this article in 2010, while posted as the Chief of Army's Visiting Fellow at the Lowy Institute for International Policy, Sydney. The article was originally published in the 'Pacific Ecologist' in March 2011, and is reproduced in Headmark with permission. Lieutenant Colonel Floyd is currently posted as Directing Staff at the Australian Command & Staff College, at Weston Creek, Canberra.

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7 See: ABC News Online, *Less coral, less clouds says researcher* (http://www.abc.net.au/news/stories/2010/02/25/2829944.htm); Jones, GB & Ristovski, Z 2010, 'Reef emissions affect climate', *Australasian Science* (http://www.australasianscience.com.au/); and Raina, J-B. *et al* , 'Coral-Associated Bacteria and Their Role in the Biogeochemical Cycling of Sulfur', *Small Things Considered: Applied and Environmental Microbiology* (http://aem.highwire.org/cgi/content/abstract/75/11/3492).

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New RN Air Warfare Destroyers – *Daring class*

PHOTO ESSAY
BY MICHAEL NITZ

Displacement: full load: 7,570 tonnes

Length overall: 152.4 m;

Waterline: 141.1 m

Beam: 21.2 m (69.55 ft)

Draught: 5.3 m

PERFORMANCE

Speed: 31 kt

Range: standard: 7,000 n miles at 18 kt

Capacity: Complement: crew: 191; spare berths: 41

Machinery: Integrated Electric Propulsion; 2 RR WR-21 gas turbine alternators; 42 MW; 2 Wärtsilä diesel generators; 4 MW; 2 motors; 40 MW; 2 shafts; fixed props

Firepower:

- Missiles: SSM: Space for 8 Harpoon (2 quad)
- SAM: 6 DCN Sylver A 50 48 cell VLS Sea Viper (GWS 45); typical mix of 32 Aster 30; active pulse doppler radar homing to 120 km (65 n miles) at 4.5 Mach; warhead 15 kg and 16 Aster 15; active pulse doppler radar homing to 30 km (16 n miles) at 3.0 Mach.
- Guns: 1 Vickers 4.5 in (114 mm)/55 Mk 8 Mod 1 [Ref 3]. 25 rds/min to 27.5 km (14.8 n miles); weight of shell 21 kg. 2-20 mm Vulcan Phalanx Mk 15 Mod 1b (fitted for both not with) [Ref 4]. 2 REMSIG MSI DS 30A 30 mm/75; 650 rds/min to 10 km (5.4 n miles); weight of shell 0.36 kg [Ref 5].

Physical countermeasures:

- Decoys: 4 DLH (chaff, IR); DLF offboard decoys [Ref 6]. Type 2170 torpedo defence system.
- Electronic countermeasures: ECM: To be announced. RESM: Thales Type UAT (mod) [Ref 7]; intercept. CESM: To be announced.

Sensors

Sonars: EDO/ULTRA MFS-7000; bow mounted; medium frequency.

Radars:

- Air/surface search: Signaal/ Marconi Type 1046 (S 1850M) [Ref 10]; D-band.
- Surveillance/fire control: BAE Systems Type 1045 (Sampson) [Ref 11]; E/F-band; multifunction.
- Surface search: Raytheon Type 1048 [Ref 12]. E/F-band.
- Navigation: 2 Raytheon Type 1047 [Ref 13]; I-band.

Combat data systems:

CMS-1 (based on DNA SSCS with additional AAW functions); Links 11, 16 STDL and 22. SATCOM [Ref 8].

Electro-optic systems:

GSA 9 with 2 EOSP sensor heads (EOGCS) (based on Radamec 2500) [Ref 9].

Helicopters:

Lynx Mk HMA 8 (first batch) or Merlin HM.Mk 1 [Ref 14].

Programmes:

This project has gone through many stages, the result of which has been a delay in the provision of a replacement anti-air warfare capability and the concomitant extension of the ship-lives of the ageing Type 42s. Starting life as NFR 90 in the 1980s, it was taken forward via the Anglo-French Future Frigate, the tri-nation Common New Generation Frigate (Horizon) and finally, when UK withdrew from the collaborative ship programme on 25 April 1999, a national Type 45 ship project.

The contract for the design and build of the first three ships (Batch 1) was placed with the prime contractor, BAE Systems, on 20 December 2000. This was amended in late 2001 to reflect a new procurement strategy in which commitment was made to the first six ships. The second three ships comprise Batch 2.

Vosper Thornycroft is building and outfitting Blocks E/F, the forward section of each ship together with the masts and funnel. The remaining Blocks A-D are being built by BAES Surface Fleet Solutions. Final assembly of D 32 was at Scotstoun and assembly of follow-on ships is at Govan.

It was announced on 19 June 2008 that plans to build two Batch 3 ships had been cancelled.

Procurement of the missile system was pursued separately and a contract for full development and initial production of PAAMS (Sea Viper) was placed with the tri-national consortium, EUROPAAMS, in August

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1999. Test firings have been conducted from the trials barge *Longbow* from 2008. Following the failure of two Aster 30 firings in May 2009, modifications were made to the missile design. A successful series of firings was completed by June 2010. The first ship-launch was conducted by *Dauntless* on 29 September 2010.

Structure: Built to Lloyd's Naval Ship Rules. Provision for future installation of CEC, 155 mm gun or a 16-cell VLS silo, SSM, CIWS and magazine-launched torpedoes. An integrated technology mast is another potential modification. The ships are designed to support and deploy at least 30 troops. OTC facilities are to be included. The suitability of the Type 45 as a BMD platform is being studied.

Operational: *Dragon* started sea trials on 5 November 2010

(All photos are of *HMS Diamond*)

QUALITIES OF LEADERSHIP

BY LIEUTENANT COMMANDER TOM LEWIS

This series examines selected traits of leadership to compare Royal Australian Navy leaders against a criteria. The first of the articles took Admiral Lord Nelson, the hero of Trafalgar in 1805, as a model, as well as examining the characteristics of other well-known leaders, both civilian and military.

Seven qualities of leadership measure the subject matter, suggesting a capable naval leader is an achiever; expert in his or her field; inspires others, and takes initiative; impresses by their physical qualities; empathises with others, and is an effective communicator.

Achievement

Did the person under discussion improve their organisation? Did they leave it a better place by being a member? Promotion is recognised as a measure of achievement. With this and other measures which traditionally mark out achievement – education; decorations; amassing of physical wealth perhaps – we gain some beginnings of whether a person is a success.

Expert in one's Field

Anyone who aspires to be a leader and an example to others must obviously have expertise in their craft. In naval terms, that translates as being an expert "ship-driver"; an aviator *par excellence*; an engineer possessing a wealth of theoretical and practical knowledge - and so on. Nelson, for example, was a master at strategy – which becomes a commander of fleets – but also of tactics, which behoves a ship captain. He was also an inspired man-manager.

Inspirational

This leader inspires others to perform similar deeds. Often this is shown by the leader's actions in front of their subordinates. Nelson inspired his followers in being resolute, courageous and honourable. It is one measure of the man that so many did: Hardy, who was with him when he died; his fellow admiral Collingwood whose battle line he raced to be first to engage at Trafalgar; ship commander Berry, who followed him from ship to ship, and Captain Hallowell, who after the Battle of the Nile made him a present of a coffin fashioned from the French ship *L'Orient*'s mainmast – Nelson kept it in his cabin and was indeed buried in it.

Initiative

Sometimes described as "going in where angels fear to tread", this measure means to use judgement and advance where necessary. The leader is brave in psychological terms and takes the lead where necessary. It does not mean going forward rashly.

Nelson was a man who had the courage of his own convictions, who could often have left off and blamed superiors for failure. Instead, he was a man who chose to use initiative and advance when he knew the defeat of the enemy was attainable and essential. At the Battle of Copenhagen, walking the deck while the guns roared their broadsides, and deadly splinters whistled about his ears, he confided to Colonel Stewart, commander of infantry, who was with him on the quarterdeck, that he would not be «elsewhere for thousands». Whether he was fearful or not – and who would not have been – Nelson led by example. And when his uncertain superior, Admiral Parker, made the signal to leave off the action, Nelson refused to see it, putting his telescope to his blind eye and exclaiming: «I really do not see the signal». The British won the battle with much help from Nelson's use of initiative.

Impressive Physical Qualities

This might be rephrased as "looking the part of a leader". Would anyone have said that Horatio Nelson achieved this? Yes – and no. A short, thin man not blessed with good looks, he first entered the British navy in 1771 as a midshipman at 12 years and three months.[1] Despite being prone to sickness: "I have had all the diseases that are", he once said; he adapted well to the vigorous and often dangerous life that was the Navy.

Nelson was a man of raw physical courage who led by example. He lost an eye when an enemy shell, exploding during the siege of Calvi in Corsica, drove splinters and dust and rock fragments into his face. He suffered most terribly and often from wounds, quite willing to lead from the front. His right arm was amputated after the battle of Santa Cruz in Teneriffe due to his being hit by grapeshot.

This is what is meant by "looking the part of a leader": behaving in such a way that people can be inspired. It means to look resolute and act with resolution – as did Nelson. To lead by example. To not show physical cowardice. It might include «panache»; "the almost untranslatable expression of dash, of valour, the ability to do things with an air of reckless courage and inspiring leadership».[2] Finally, we might add that the bearing, carriage and speech of a leader should be of the highest standards.

Empathy

The great soldier of the 18th century, Frederick the Great, had good advice on how to attain the next quality of the leader – Empathy:

> *...talk with the soldiers, both when you pass their tents or when they are on the march. Sample often to see if the cookpots have something good; find out their small needs and do what you can to satisfy them; spare them unnecessary exertion. But let fall the full vigor of law on the mutinous soldier, the backbiter, the pillager...*[3]

Empathy means to be able to imagine yourself – as leader – in the role of your people, and to show that. It is "the power of understanding and imaginatively entering into another person's feelings".[4] General Montgomery said to his troops at the Battle of Alamein: "We will stand and fight here. If we can't stay here alive, then let us stay here dead".[5] Montgomery was entering into the feelings of all of his people, who feared that they would die. Churchill's speech of WWII did the same: "We shall defend our island, whatever the cost may be, we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills: we shall never surrender." Alexander the Great "shared in the men's dangers, as the scars of his wounds testified…he ate the same food as they did. He was highly visible….he fought hard himself but he was ever on the watch for any acts of conspicuous courage in the face of danger amongst his men.[6]

Such statements say to you that your leader will be with you, no matter what the cost.

Communication

One needs to be understood at all times. Nelson employed in his leadership style something unusual for its day: the art of effective communication. One characteristic was to invite others to contribute their ideas for a campaign, or a battle, or a change of some sort; to educate his men and get them – and him – to know each others' minds. Nelson embarked upon the Battle of the Nile in 1798 by letting his captains engage in individual fashion. The French fleet, anchored by the bows in a line in shallow coastal water, engaged in ship to ship fashion by five British vessels sailing inside the line and anchoring, and the rest engaging from outside. Thus the French were caught between two forces. At the end of hours of fighting, the French had lost 1, 700 men to the British 200; their fleet was largely pounded to pieces, and Napoleon and his army were stranded in Egypt. Nelson had hoisted just two signals through the entire battle.[7]

For the autocratic manager this would have been disastrous: an authoritarian leader would not trust his subordinates to make momentous decisions and fight on their own. Nelson trusted his individual captains. So too, in the long pursuit of the French, years later in 1805, he had regular meetings with his «Band of Brothers» – the name applied to those who fought under him at the Nile.[8] During the long chase the officers would pool their ideas for forthcoming battles; the best use of tactics; what a following ship would do when its fellow was sighted engaged and so on. Consequently even the necessity for signals within the ensuing battle was dispensed with; the captains knew each others' minds.

Communication means to be able to use words effectively to persuade others. Winston Churchill was a great exponent of this. Eisenhower, then a US General and later President of the United States, experienced the British Prime Minister in action:

Churchill was a persuader. Indeed, his skill in the use of words and logic was so great that on several occasions when he and I disagreed on some important matter – even when I was convinced of my own view and when the responsibility was clearly mine – I had a very hard time withstanding his arguments.[9]

A capable naval leader is an achiever; expert in his or her field; inspires others, and takes initiative; impresses by their physical qualities; empathises with others, and is an effective communicator. We have seen many great leaders who exhibited those traits. This series examines how many of Australia›s naval leaders performed in these fields.

1 Description of Admiral Lord Nelson and his career are drawn from Kenneth Fenwick's *HMS Victory*; Christopher Lloyd's *Nelson and Sea Power*; Peter Padfield's *Broke and the Shannon* and Robert Southey's *The Life of Horatio Lord Nelson*.
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Qualities of Leadership

Studies in Trait Leadership – a naval surveyor takes command of a warship

Rankin VC?

By Lieutenant Commander Tom Lewis

The Royal Australian Navy has never won a Victoria Cross. Why this is so is a curious matter. Valour in battle is the quality for which the Cross is awarded, and the lack of VCs seems more to do with convoluted bureaucracy than a dearth of this quality. In 1940 in the Atlantic an action took place which deservedly won a British naval officer – Fogarty Fegen – a Cross. Two years later, our own Lieutenant Commander Robert Rankin performed a very similar action, but there has been no recognition for him.

In considering him as a leader worthy of study, Rankin presents a curious case. He was a surveyor, who after a while was not happy with his chosen Branch. He was refused permission to transfer, and ended up at the beginning of World War II with senior command positions in RN warships based in the Mediterranean. Married and with a very young child, he did not see them on their being returned to Australia for over two years – where he was given active warship command, in which he died in battle, acting in accordance with the most glorious traditions of combat, taking on insurmountable odds for the good of others.

To turn first to the Royal Navy action of example. Co-incidentally, the RN officer has some curious links with our own Navy. Commander Fogarty Fegen was an Executive Officer of the RAN College in Jervis Bay from 1928-29. He was posted from the Royal Navy to the RAN, arriving in the Jervis Bay College on 20 January 1928.

Rankin Portrait

He was much admired there by the midshipmen under training: not only was he a fine Rugby coach, but his wife and he put on splendid afternoon teas for the teenage ever-hungry cadets.[1] He left the College in August 1929.

Fegen had been in the RN since 1904. He served through WWI as a Lieutenant in the ships *Amphion* and *Faulknor*, and as second in command of torpedo-boat No. 26 and the destroyers *Moy* and *Paladin*.[2] He continued in command of various destroyers after the Armistice was signed in 1918. After leaving RANC he was commander – that is, what we now call Executive Officer – of the cruiser *Suffolk* in China. During that time he was commended by the Admiralty and awarded a life-saving medal by the Dutch government as Officer-in-Charge of the boats' crews from the *Suffolk*. The boats travelled some 28 miles in very rough weather to rescue the crew of the merchant ship *Hedwig*, aground on a reef between the coast of China and the Philippines.

HMS Jervis Bay action (RCN lithograph)

Later, Fegen served at the Anti-Submarine school; on the staff of Chatham Dockyard, and in the cruisers *Dauntless*, *Dragon* and *Curlew*. Immediately before the war he was Executive Officer of the cruiser *Emerald*. He was made Acting Captain a few months before WWII began.

On 5 November 1940, *HMS Jervis Bay* – an echo of his old posting to the College – under Fegen's command, was proceeding from the United States to Europe as the sole escort for a convoy of merchant ships. *Jervis Bay*, a former[1] passenger liner built in 1922-23, had a displacement of 14,000 tons and a maximum speed of around 15 knots.

Fogarty Fegen's Victoria Cross citation takes up the story:

For valour in challenging hopeless odds and giving his life to save the many ships it was his duty to protect. On the 5th November, 1940, in heavy seas Captain Fegen, in his Majesty's Armed Merchant Cruiser

1 Before the war the RN had the foresight to ensure the decks of the best of the civilian liners were strengthened so that in time of war guns could be rapidly fitted. Thus after the outbreak of war various such vessels were requisitioned and quickly fitted out as a class of warship called Armed Merchant Cruisers. While *Jervis Bay* was armed with seven 6-inch guns – a not insignificant armament – her civilian build meant she would be very vulnerable to even a small amount of damage, and her maximum speed was barely half that of true warships.

Acting Captain Fogarty Fegen (RN photo)

Qualities of Leadership

Jervis Bay, was escorting thirty-one Merchantmen. Sighting a powerful German warship, he at once drew clear of the Convoy, made straight for the Enemy and brought his ship between the raider and her prey, so that they might scatter to escape. Crippled, in flames, unable to reply for nearly an hour the Jervis Bay held the German's fire. So she went down; but of the Merchantmen, all but four or five were saved.

The researched history[3] written after the war gives more information. The German ship was the pocket-battleship *Admiral Scheer*, a heavily-armoured vessel of 12, 200 tons, six 11" and eight 5.9" guns. Six of the merchant ships were sunk, and of the *Jervis Bay*'s complement; nearly all were lost. Fegen himself was gravely wounded in the action, almost losing one arm, but he stayed at his post on the bridge and fought on until the end of his ship, going down with her into the deep Atlantic.

One of the convoy vessels[4], the Swedish ship *Stüreholm*, returned to the scene of the action after dark and rescued the survivors. The *Jervis Bay* had been the sole escort for this convoy so for a merchant ship to return to the scene unescorted was indeed the act of brave men.

The Victoria Cross he was posthumously awarded was obviously richly deserved.

However, why not bring forward into recognition an RAN officer who was just as brave in very similar circumstances. In waters north of Australia the sloop *HMAS Yarra*, under the command of Lieutenant Commander Robert Rankin, encountered superior Japanese forces. The *Yarra* was sole escort for two merchant[2] ships and a small minesweeper steering to the south-east of Christmas Island on the morning of 4 March 1942. The Allies were in disarray before the mighty Japanese war machine sweeping south, taking Singapore, smashing Darwin, and bringing death and destruction to Allied shipping, including *USS Houston* and *HMAS Perth* with our Captain Waller in command. *Yarra* had been shadowed the previous day by enemy aircraft.

LCDR Rankin wedding photo (Courtesy Patricia Rankin)

The Australian warship had seen a tough war. In August 1940 she had left Australia's shores. She was under the capable command of Lieutenant-Commander Harrington (later to become a Vice-Admiral and an important figure in the post-war RAN), and was sent to patrol the Red Sea. Yarra had escorted convoys; engaged in gunfire support of operations ashore; worked in the "Tobruk Ferry Run" off North Africa, experienced many air attacks, and seen a vessel she had been working with – RAN sloop *HMAS Parramatta* – sunk by a U-Boat. Then Yarra had joined the South-East Asian areas of operations, and learnt her old captain was to leave her. Lieutenant Commander Robert Rankin was to command in his place.

At the end of January British troops withdrew from the mainland and destroyed the causeway to Singapore. The situation was looking very bleak but still convoys were directed to the besieged island. *Yarra* sailed south to rendezvous with another incoming convoy from Bombay (BM012). These were valuable ships carrying around 5,000 troops and their equipment. Two of the vessels, *Empress of Asia* (British; built 1913; 16,909 tons) and *Felix Roussel* (Free French; built 1930; 17,083 tons) were very large indeed. *Yarra* met them in the vicinity of Sunda Strait and proceeded northwards with the convoy.

Some days beforehand Harrington had been notified he would be replaced as captain of *Yarra* by Rankin. By the time of this convoy Rankin had joined his new ship, but with Harrington still in command. These were tense times as the crew remained closed up at action stations for long periods. A critical focal point was the long and narrow Banka Strait along the south-eastern shore of Sumatra. While leaving the strait a formation of nine twin-engined bombers attacked. They concentrated on *Empress of Asia*, the last and slowest ship. Built in 1913, she had been overdue for the scrap yard but the war had given her new life and she had been converted into a troopship. With a crew of over 400, the old ship had been given some useful defences including Oerlikons.[3] In Bombay she had embarked 2, 235 men of the 18th British Division, as well as much desperately needed arms and equipment. Given *Yarra's* status as an AA combat veteran, it is quite possible her accurate fire was the reason why the bombs fell harmlessly about a mile

2 Technically they were naval: a depot ship and a tanker.

3 Thompson p.278. *Empress of Asia*: 1 x 6-inch gun; 1 x 3-inch AA gun; 6 x 20mm Oerlikons & 8 x Hotchkiss MGs. Also added were about two dozen Bren guns from the troops aboard.

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Rankin VC?

from their target. While the remainder of the day was quiet, ominously a sole enemy plane shadowed the convoy from a distant altitude. That night the remainder of the convoy – being faster – pushed on ahead.

No ships had yet entered Singapore by daylight, it being considered too dangerous. However most of the convoy succeeded in arriving safely during the morning of 5 February, despite Tokyo radio's famous boast that "no convoys will get into or out of Singapore".[5] *Yarra* remained behind with the lagging *Empress of Asia*, as well as two other ships: *Felix Roussel* and *City of Canterbury*.[4] The old 1918-vintage light cruiser *HMS Danae* was the only other escort present, but was well astern and poorly positioned to provide AA defence. Shortly before midday, when only nine miles from the relative sanctuary of Keppel Harbour, the enemy struck, and *Yarra* was the sole effective defender. These were 27 Kawasaki Ki-48 "Lily" twin engined light bombers of the 3rd Flying Battalion.[6] The experienced crews of the aerial formation separated into small independent flights and made attacks from all directions.

A fierce fight ensued. Each of *Yarra's* guns immediately went into action, and the ship fought with a "demonic determination and fierceness".[7] It was almost a case of "business as usual" for *Yarra* as she again put up a determined barrage. Observing the action from the safety of Keppel Harbour was the captain of the Indian sloop *HMIS Sutlej*, who said that the merchant ships were saved "... by the skilful handling and determined defence of their ships coupled with the effective gunfire of *HMAS Yarra*." Harrington later wrote a report praising the action of the entire crew. He made special mention of the crew of No.3 gun which he said shot down one aircraft on the starboard quarter with their fire. He also singled out Acting Leading Seaman Taylor, the captain of No.2 gun, for providing a good example to the men around him with his "keenness and courage".[8]

Onboard *Felix Roussel* were men of the 9th Northumberland Fusiliers (part of the 18th Division). Their Bren guns put up a wall of lead, while the skipper zig-zagged with determination. Five men were killed as a result of a single bomb hit between the funnels and the subsequent strafing. A second direct hit burst a water tank which quickly doused the flames from the first hit.[9] Regardless, the damage to the French vessel was only minor. It was the fast manoeuvring of the ship, capable of 18 knots, that probably helped most, but this further ensured that the old *Empress of Asia* remained the main target.

Just as the attackers arrived, the old *Empress* had slowed to just six knots in expectation of taking on a pilot. It is unlikely that her ancient machinery could have responded very quickly. However her heavy defensive fire, together with *Yarra's*, initially put off many of the attackers. But finally a bomb hit, just behind the bridge in the officers' wardroom. The interior of the once luxuriant liner was filled with timber and fires quickly took hold. The situation went from bad to worse when an entire "stick" of three or four light bombs hit a short time later, penetrating deep inside the ship before exploding. Fires spread quickly, and the ship was soon a cripple: the engine room crew was evacuated because of intense smoke, and there was no water pressure to fight the fires. All of the soldiers and crew were told to assemble on deck, while the captain steered the ship into shallow water near Sultan Shoal Lighthouse, anchoring there with some difficulty.[10]

Despite the risk of the much larger ship exploding or sinking, Harrington closed *Yarra's* bow up underneath the stern of the *Empress*. In this way the soldiers could jump onto *Yarra's* forecastle. In all some 1,334 men from the *Empress* were evacuated. Such was the load that Harrington was concerned about the ship's stability as he eventually got clear. He had to order the passengers to sit down as he made the short passage to Singapore. Meanwhile *Yarra's* boats were out trying to pick up other survivors that had jumped from different sections of the stricken old liner, rescuing 470. With other small ships also arriving and engaged in the rescue, only about 30 of the 2,500-plus men onboard the *Empress* were lost.

Yarra had been targeted during the air raid and suffered at least one near miss with a bomb passing between her masts. Manoeuvring saved the ship, but could not stop strafing of her deck. The No.2 gun layer was wounded, as was a gunner on the 0.5-inch quad MG. Both forestays were shot away and the funnel was holed, with several bullet holes to the superstructure. The ship was unarmoured, and vulnerable to splinter damage. None of *Yarra's* 4-inch guns had shields, so her gun crews were unprotected aside from their steel helmets.

Around 400 4-inch rounds were fired by *Yarra* that day.[5] Five enemy planes were claimed[11] as shot down. Later Harrington took *Yarra* over to

4 Parry, (see p.210) refers instead to the modern *Devonshire* (Br; 1939; 11,275 tons) as being the third of these three ships. The Convoy-web site refers to this vessel being in convoy BM012 with 1,673 troops onboard. There is no mention of *City of Canterbury* being in this convoy. While reference to the latter is from Gill, the information appears to come from a Report of Proceedings of the Indian sloop *HMIS Sutlej*, and so could easily have been confused. Regardless of identity the "third" ship escaped damage and otherwise played no part during this attack.

5 The length of this attack is not known exactly. But supposed it lasted 20 minutes then *Yarra* fired 20 rounds per minute, or around six rounds per minute for each gun (one shot every 10 seconds). This was a good rate of fire for guns that were manually trained and loaded.

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see the burnt out *Empress*, primarily to see if two untouched Oerlikons on the stern of the wreck could be salvaged. The *Empress'* deck was still red hot and could not be approached, so the attempt was abandoned. That night took *Yarra* on some 50-60 ratings and a dozen officers from Singapore for passage to Batavia, convoying *Felix Roussel, City of Canterbury* and *Devonshire* with escorts *HMIS Sutlej* and *HMS Danae*.

Some air attack occurred south of Singapore but no damage resulted. On 8 February, *Yarra* detached from the convoy and in the Palembang River delta in Sumatra took over the tow of the destroyer *HMAS Vendetta*, which had been stranded mid-refit in a Singapore dockyard and had just been evacuated under tow. Despite the vulnerability of *Vendetta* as a target, Batavia was reached without incident.

While in port seven men left *Yarra* for Australia, including Harrington. The time Rankin spent aboard with Harrington was a good thing in giving him time to get to know the ship and her very tight-knit crew – most of whom had been together for almost two years and had endured the most trying of conditions and experiences. Rankin formally assumed command on 11 February 1942. One of those who left the ship was Able Seamen AF Parry, who wrote a history of the *Yarra* published in 1944.

The sloop remained at Batavia for four days doing a boiler clean. The ship's company learnt the news of the fall of Singapore – often called the greatest British military defeat of all time. The sloop was soon under way again and made the short voyage across Sunda Strait to Oosthaven, at the southern tip of Sumatra. *Yarra* escorted three ships back to Tanjong Priok: *Filleigh*; *Lulworth Hill* and *Hai Lee*.[12] The prospect of enemy attack was ever-present. Aside from the air threat, the constricted waters within the Indies were home to enemy submarines. Another danger was navigation: the waters were shallow, shoal-ridden and poorly charted.

Meanwhile Tanjong Priok was overcrowded due to the diversion of shipping from Singapore. Efforts were being made to clear the port as much as possible. On 17 February *Yarra* escorted convoy SJ3, consisting of several smaller vessels, out of the port and south through Sunda Strait. Safely out into the Indian Ocean three of the ships ships turned westwards and proceeded independently to Colombo. The remaining ships were *Giang Ann*, *Darvel* and *Ping Wo.* The latter had *Vendetta* in tow, so it was slow going. *Yarra* escorted this group to a point 200 miles south of Christmas Island, where on 22 February the light cruiser *HMAS Adelaide* was met, taking over the southwards escort.

Yarra returned to "Priok" on 24th February, arriving during a now very familiar air raid. On the 27th orders were given to clear all remaining British auxiliary craft from Tanjong Priok – a precaution as invasion convoys were approaching. Indeed any hope of a naval defence of Java was just now being lost during the confused and drawn out Battle of the Java Sea. At midnight *Yarra* left in company with the sloop HMIS *Jumna,* together escorting depot ship *HMS Anking*, tankers RFA *War Sirdar, British Judge,* and RFA *Francol*. Completing the convoy was the auxiliary minesweeper *HMS Gemas* (a converted 1925 whaler of 207 tons) and motor minesweeper *MMS.51*.

Four hours out of port, at 0420, *War Sirdar* went aground. The remainder of the convoy continued but the corvette *HMAS Wollongong*, trying to join the convoy, was nearby. She stood by and made attempts to tow off the tanker, but this was terminated after enemy aircraft arrived in the morning. They bombed the grounded tanker and set her on fire.[13] Indeed, vessels in the narrow northern part of the strait were heavily and consistently bombed that day.

Yarra's convoy too was targeted, initially by around a dozen bombers, then reportedly by multiple attackers over several hours.[6] A major problem onboard *Yarra* was a lack of AA shells for the 4-inch guns. After hundreds of shells had been expended defending the *Empress of Asia* in particular, replacements had not been re-issued (other ships, such as *Perth*, were also known to have had difficulty obtaining fuel and ammunition from Tanjong Priok at this time). So as an expedient Rankin ordered H.E. shells, normally used against surface targets, to be fired. These had no altitude fusing, so it was hoped the sight of the gun flashes would deter the enemy. Both Oerlikons were in action, manned by the master-at-arms and a bosuns mate. Such was the desperate emergency that small arms were also issued: even the ship's cooks were on deck manning Bren guns.[14] Others were manning rifles.

All the ships in the convoy were putting up whatever fire they could. Most effective of all was the modern sloop *Jumna* which had 4-inch guns of a much more modern type than *Yarra* (she also had double the number: six guns in three twin turrets).[15] The deadly barrage from the Indian ship probably saved the convoy from major damage. The air attacks began easing off around midday, and the convoy continued at just eight knots into the

6 Records regarding the Japanese side of this event are obscure. Most likely many of the attackers came from the light carrier *Ryujo* and seaplane carriers *Chitose* and *Mizuho*, which were providing air cover for the western invasion force, which was due to commence landing operations in this vicinity that night. Cruiser-launched floatplanes were possibly also active in the area, and even lone floatplanes often aggressively attacked ships.

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southern part of Sunda Strait. *Yarra* had been strafed a number of times, and now looked very worn and poorly. The aerial was down, the boats were all damaged and the funnel was holed badly.[16]

As dawn broke on 1 March Rankin continued on a southerly course into the Indian Ocean, as he did not want to turn eastwards for Tjilitjap too soon as such focal points were obvious places for submarines or mines. But about ten miles south of the strait a dull rumble of a distant explosion was heard. The officer of the watch scanned the ships in the convoy and saw smoke and fire coming from one of the tankers. Signalmen flashed their lamps and the reports were received and deciphered. The largest vessel in the convoy, the tanker *British Judge*, had been torpedoed in the bow by a submarine.[17] By now both *Yarra* and *Jumna* were receiving ASDIC contacts.

Action stations were ordered as *Yarra* closed a contact. Depth charges were launched. A periscope was spotted but soon blotted out by a tropical rainstorm. But there was still a convoy to protect, so the sloops did not have the luxury of an extended submarine hunt. This was especially the case given that the most valuable ship to protect was *HMS Anking*, packed with hundreds of surplus naval personnel, many survivors of sunken ships.

The convoy continued towards Tjilitjap, slowed down by the need to sail a zig-zag course as an anti-submarine precaution. Some miles behind, the tanker *British Judge* remained afloat, and was soon able to get under way under her own power. *Wollongong*, again behind the convoy after helping *War Sirdar*, was able to meet and escort her at slow speed.

By that morning of 1 March the Japanese were ashore on the north coast of Java in both the east and the west. The ABDA naval command was formally dissolved, giving Commodore Collins full control of the RAN units. During the course of the day, he learned that enemy surface forces were active both in the Sunda Strait and also a few hundred miles south of Java.[7] Tjilitjap was becoming a potential trap. That afternoon Collins ordered all British ships to avoid the port if necessary and if fuel permitted to make for Ceylon or Fremantle.[8]

Yarra's convoy met up with four RAN corvettes off the southern Javanese port at 11am on 2 March. With their long range the sloops had no need to enter Tjilitjap to refuel. The Indian sloop, *Jumna*, was detached westwards to Colombo and en route picked up the lagging *British Judge*.[9] During a brief but intense partnership both sloops, *Yarra* and *Jumna* had worked together well. They exchanged signals: "Good-bye. Good luck. Good hunting."[18]

Some of the RAN corvettes needed to fuel in Tjilitjap, and between them they needed to accommodate dozens of naval personnel evacuating from Java. For this reason the corvettes lagged near Tjilitjap a little longer while *Yarra* got underway with her small convoy immediately.

Yarra was entrusted with escorting *Anking*, packed with hundreds of naval personnel. Many had originated in Singapore and were probably among the hundreds of surplus RN personnel from the *Prince of Wales* or *Repulse*. *Anking* had been built in Scotland in 1925 as a cargo ship for the London-based China Navigation Co, and so was no stranger to the Far East. Of moderate size (3,472 tons), she had been requisitioned for naval service in 1941 to serve as a depot ship in Malta. With an alternate naval base needed after Singapore was threatened in early 1942, *Anking* arrived in the theatre with a plan to be a command and communications vessel in Batavia. In reality she did little other than evacuate naval personnel from Singapore and probably should have sailed out of the theatre much earlier.[19]

The other major ship remaining in *Yarra's* small naval convoy was the Royal Fleet Auxiliary *Francol*. This was a small but useful naval tanker, capable of holding 2,000 tons of fuel oil, built during the massive construction programs underway towards the end of WWI. Along with her complement of about three dozen civilian sailors, there was a DEMs (Defensively Equipped Merchant ship) crew manning an anti-submarine gun on the stern. Although elderly, *Francol* had a top speed of 14 knots, and together with *Anking's* 12 knots, the convoy should have been capable of a reasonable average speed exceeding 10 knots.

However, the last ship included in the convoy was the tiny wooden motor minesweeper *MMS.51*, built in Singapore and commissioned just before the Pacific war began. Of just 225 tons and armed with a single 3-pounder gun, these vessels were fitted with whatever diesel engines were available, and it is most unlikely she had the most powerful type delivering 10 knots. So almost certainly this tiny vessel that held the convoy to a maximum speed of barely 8½ knots.

7 Over the next two days over a dozen flying boats arrived at Broome. Others evacuated a Dutch Admiral to Ceylon. Why these aircraft were not used to locate and shadow the enemy surface forces at this time is a mystery. The tragedy of *Perth* and *Houston* is just one example. Instead the likes of Collins relied on contact reports from doomed vessels being engaged by the Japanese. So aside from these vague and often unclear reports, Collins and his ships were operating with a good degree of uncertainty in the intelligence picture.
8 Collins and his staff were able to board a corvette (*HMAS Burnie*) at Tjilitjap.
9 *HMAS Wollongong* now separated from the convoy and proceeded to Fremantle independently. The decision saved her from almost certain destruction and proved the random process in which ships tried to run the Japanese gauntlet.

The other small vessel to accompany the convoy was a 207 ton auxiliary minesweeper, an old ex-whaler *HMS Gemas*, manned by men of the Straits Settlements Royal Naval Volunteer Reserve. For unclear reasons, but probably because she would have been a liability to an oceanic convoy, she was left behind. On the night of 2-3 March, *HMAS Ballarat* took off all valuable equipment, before sinking her seven miles off Tjilitjap. Why did *MMS.51* not suffer the same fate? Possibly Collins did not understand how much she would hold back the convoy as she was almost brand new. Otherwise submarines were probably seen as the main threat, as the size of the surface forces south of Java had yet to be appreciated. *MMS.51* was too small to be torpedoed, and may have been of assistance if one of the larger vessels such as *Anking* went down.

So *Yarra*, worn and battered and badly short of ammunition, led the unlikely group of *HMS Anking*, *RFA Francol* and *MMS.51* south from Java on 2 March. The men would have been nervous but optimistic, fully believing the further they were from Java the safer they were. They had endured no end of extreme tests during the last two years away from Australia, and were now just days away from their homeland where in lieu of their service they would have expected significant leave.

The daylight hours were the most dangerous, and during the afternoon of 2 March this small convoy gradually left Java behind as all on board silently prayed they would avoid the enemy. However, they were shadowed by an enemy aircraft that afternoon. The plane stayed far out of gun range and there was nothing that could be done but somehow hope that darkness would allow the convoy to vanish into the Indian Ocean. In all probability the shadowing aircraft was a floatplane from an enemy cruiser under Vice-Admiral Kondo's force, that day busy dealing with targets such as the destroyers *HMS Stronghold* and *USS Pillsbury*. With their overwhelming power and speed, the Japanese force could pick their targets at leisure and in line with their warrior spirit, chose to engage warship targets first. After all, Kondo's warships were capable of over 30 knots and could close in on the eight-knot *Yarra* convoy at their leisure.

Yarra's radio operator may have picked up confused distress signals from some of these ships, but probably never got an accurate idea of exactly what was happening. The best chance lay of changing course under the cover of darkness and hoping not to be discovered by reconnaissance aircraft during the day. Again, at this time Tjilitjap remained in Allied hands and flying boat reconnaissance would have been of great value to the fleeing ships. Instead it was virtually a case of "every man (or ship) for himself" with very little co-ordination from the higher authorities. Darkness on the 2 March brought some relief – the little convoy had survived another day and was slightly closer to Australia.

Dawn broke on 3 March with fine conditions and open seas, and no enemy in sight.[20] The crew of *Yarra* and the other ships dared to hope. But during the day a strange sight was spotted: two sail boats in the open ocean. They were ship's lifeboats from the Dutch merchantman *Parigi* (1,172 tons), which had been sunk by the submarine *I-2* while sailing south from Tjilitjap towards Bunbury during the evening of 1 March.[21] One source gives the number of men rescued as just eight, with others having died while in the lifeboats. Others give the number as high as 30.[22] The survivors included *Paringi's* Dutch captain and Javanese crewmen. All were feeble, and several wounded. They were carried below to the ships sick bay under the care of Surgeon-Lieutenant McLaren-Robinson.

For the remainder of the day the convoy ploughed on through the calm seas, the lookouts having nothing to report. *Yarra* launched a couple of depth charges to deter a suspected submarine contact during the night. One of *Yarra's* survivors, Leading Supply Rating Latham, described the happy feeling that morning as the crew ate breakfast.[23] But then the action stations alarms were sounded.

The lookouts had seen through the early morning mist the massive "pagoda"-like superstructures of three Japanese heavy cruisers. At least two smaller vessels were sighted. It was only 0630 and each minute brought more sunlight and easy recognition of the overwhelming enemy force several miles away on the horizon. The tragedy of the location was that *Yarra* was eight miles south of the enemy force when spotted. If she had travelled just one or two knots faster overnight she would have been well over the horizon and out of sight at this time, so the cost of including the slower *MMS.51* in the convoy was an expensive one indeed.[24]

Now, sighted approaching from the north-east, came three Japanese cruisers and two destroyers[25] of Admiral Kondo's Second Fleet, positioning themselves in battle order to attack.[26] Lieutenant Commander Rankin, in his first ever command of a warship, turned and faced the enemy.

There was no possibility of escape. The enemy warships were twice as fast as *Yarra* and three times as fast as the other ships in the convoy. Darkness was another twelve hours away. The Japanese heavy cruisers fired 8-inch shells weighing 125kg each. These could prove deadly against each vessel in the unarmoured *Yarra* convoy. Each of the three *Takao*-class heavy cruisers was equipped with ten 8-inch guns (in

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five double turrets), the broadside of each being 1,250 kg. This was ignoring the firepower of the accompanying destroyers which had very effective 5-inch guns. In response the three 4-inch guns of *Yarra* appeared feeble, each firing a shell of just 14 kg. Regardless of the weight of fire was that the Japanese cruisers could bombard *Yarra* at leisure far outside the range of the Australian ship's guns; and that a 4-inch shell could hope to do little more than superficial damage against the Japanese armoured heavy cruisers.[27]

Further, the Japanese squadron was experienced, having recently fought engagements. Regardless of these aspects Rankin would have been aware of the odds stacked against him. He could have elected to surrender his ship and save lives, but instead he turned towards the enemy in an attempt to delay them and therefore save the convoy, which would scatter to all points of the compass. Further, to warn other ships in the vicinity, the wireless/telegraphy operator was ordered to report the contact. Despite the attempts, he could not get a reply from shore stations (ships would not reply as they maintained radio silence). The warning was heard by some ships, including the corvette *HMAS Ballarat*, then just a hundred miles away.[28] The broadcast may have helped some of these other ships in their subsequent escape.

Rankin ordered the engine room to make smoke to provide cover for the convoy. The sloop began to pick up speed. As *Yarra* powered towards the enemy, flashes from the great cruisers began to appear. Within a minute the shriek of approaching shells could be heard as the opening salvoes splashed into the ocean near the sloop. The enemy ships separated to encircle *Yarra*. At least one of the cruisers launched floatplanes (they each carried three) and soon two were aloft and spotting the fall of the cruisers' shells – an enormous advantage in long range shooting. *Yarra* had no chance at all, but bravely aimed towards the nearest cruiser with her 4-inch guns firing. One *Yarra* survivor claimed they hit the cruiser square in the bridge, but even if this was true little damage would have resulted against the armour.

After a brief charge Rankin turned about and sought a brief ten-minute refuge in the smoke screen. He gave orders for the boats to be lowered, and the lashings on all Carley floats to be cut; this foresight probably saved the lives of survivors. At 0645 the smoke thinned and *Yarra* was again visible to the enemy. They fired and an 8-inch shell crashed into the starboard waist and exploded in the sick bay. The ship's doctor, sick bay attendants and most of the *Parigi* survivors were killed instantly. Minutes later the decisive attack occurred. An 8-inch shell smashed into the bridge, the force of the explosion carrying it and the surrounding superstructure away, leaving just a mangled wreck of metal. Virtually all of *Yarra's* officers were killed, including Rankin, as well as various senior Petty Officers including those in the signals office. There was no longer a range finder for targeting the enemy – unless the enemy were close enough to be fired at "over open sights" the fight was truly hopeless. *Yarra* was crippled.

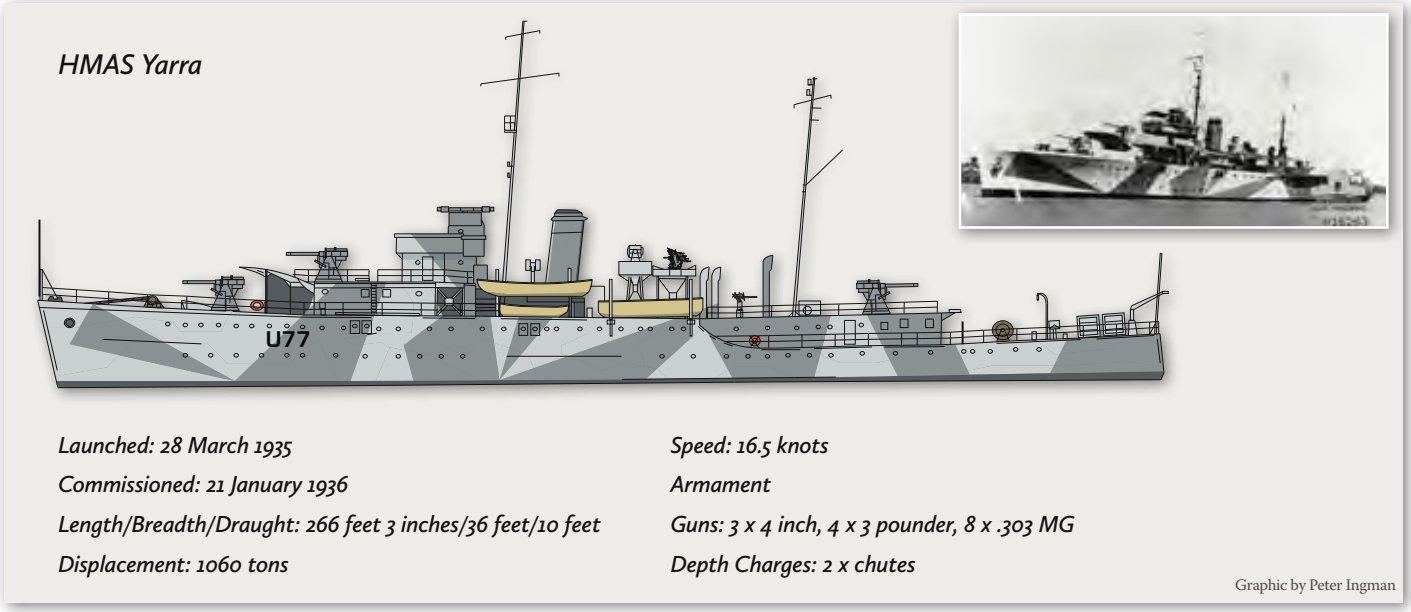
Within minutes the enemy cruisers were circling just two miles away, continuing to pump salvoes into the sloop. Shells hit the engine room and the ship was brought to a near-halt. The aft No.3 gun and quad 0.5 inch Vickers were also wiped out by a further shell, with several more men killed. Near the bow, No.1 gun and its crew were mortally hit. But then the enemies' attention was turned to the rest of the convoy.

One of the floatplanes lined up and dive bombed *MMS.51*. This wooden vessel was already hit and ablaze, reportedly as a result of small calibre gunfire from one of the cruisers. The crew had already begun abandoning ship but two were killed. Another 14 took to life rafts and survived. In Royal Navy records she is described as having been scuttled to prevent capture.

Anking and *Francol* presented merely target practice to the Japanese. The former with her larger superstructure probably attracted more initial gunfire. With the ship manned by her original civilian Chinese crew, and with presumably little organisation, equipment or training for emergency drill, it was probably chaos aboard as shell after shell penetrated her thin sides and exploded. 260 men, including her civilian crew, were later listed as "Missing Presumed Killed" aboard *Anking*. Most would have perished as these initial salvoes wrecked the ship. 57 managed to take to life rafts before *Anking* sank just before 7am.

The tanker *Francol* did not fare any better. She had been engaged first by the cruisers then at increasingly close range by a destroyer. She too quickly sank. Her peacetime complement was 39 but she was known to have some additional DEMS men aboard. Possibly her DEMs crew got off a few desultory shots with their anti-submarine gun – a near meaningless act in practical terms but brave nevertheless. A number were killed during the shelling, including her civilian master and a DEMS sailor. Others managed to take to lifeboats. *Francol* sank at about the same time as *Anking*. *Yarra* was now the sole focus for the Japanese warships.

At around 0700 *Yarra's* First Lieutenant, Lieutenant Commander Smith, the only officer still alive on the sloop, gave orders to abandon ship. Two Carley floats were flung overboard and 33 men jumped into the sea. Smith was not among them. An



enemy destroyer approached, perhaps looking for officers. The destroyer then stood off *Yarra* from only 200 yards and pumped gunfire into her, soon joined by a second encircling destroyer. But *Yarra* stubbornly remained afloat, and No.2 gun under Leading Seaman Ron "Buck" Taylor, continued to return fire. This was witnessed by RN prisoners from the sunken destroyer *HMS Stronghold*, which had battled the same Japanese formation a couple of days earlier. They had been captured and put aboard the cruiser *Maya*. At the start of the engagement they were brought up on deck, presumably to witness the superior fighting skills of the Japanese Navy.[29] They could see *Yarra* still afloat but enveloped in flames and smoke as the two destroyers fired into her at close range. But they could see odd gun flashes still coming from *Yarra*. Soon the three cruisers set off in line ahead and the last the *Stronghold* survivors saw of *Yarra* was a column of smoke.

Yarra was now a battered wreck with anything flammable smoking and aflame. The act of Taylor, and any of his gun crew who remained, was incredible indeed. It seems that Taylor's pride and hatred of the enemy far exceeded his own need to live. He was last heard to say "this gun is still firing while I've got a breath in my body".[30] The destroyers ceased fire about 0930.

One of the witnesses aboard the Carley rafts reported seeing the cruisers catapulting more planes at this stage: possibly the larger type capable of carrying three crew and much heavier bombs.[31] One of the seaplanes dropped a bomb from very low altitude on the stationary wreck. Despite being a near miss it did the job. *Yarra* settled and slipped under the waves.

One of the destroyers again approached the rafts, but then turned about to join the rest of the attackers, soon disappearing over the horizon. Among the men aboard *Yarra's* rafts were no officers except for the captain of *Parigi* who initially provided leadership. Only the most strongly willed of men survived from that point on. Just 13 were still alive when they were picked up by the Dutch submarine *K-11* five days later on 9 March. 138 men went down with *Yarra*. The 57 survivors of *Anking* were lucky to be picked up by the Dutch steamship *Tawali* on the evening of the sinking. The dozen-odd survivors from *MMS.51* were picked up by another Dutch vessel, the *Tjimanoek*, on 7 March. Thirteen survivors from *Francol* became POWs, while others took to a raft but were never seen again.

Although *Yarra's* final action might have appeared futile, she probably helped to achieve more than was immediately apparent. *Yarra* forced the enemy formation to deploy for combat and expend a large amount of fuel and ammunition. This bought time for the other vessels escaping nearby. Indeed, the Official Historian Gill was surprised that so few (only about twenty) of the multitude of vessels fleeing Java in early March were caught by the powerful Japanese blockade force.[32] While deploying for combat the destroyers in particular consumed precious fuel. While fuel was less of an issue for the enemy cruisers, the combat deployment interrupted the operations of their reconnaissance floatplanes.

Vice-Admiral Kondo's formation of cruisers and destroyers returned to their anchorage in Staring Bay, Celebes,[33] probably exhausted in ammunition if not fuel. All of the six RAN corvettes active during the Singapore-Java campaign made Australia safely (including *HMAS Burnie* with Commodore Collins onboard), as did the sloop *HMAS Warrego* and many sundry merchant ships. *Yarra's* sacrifice may have contributed to buying enough time for

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many of these ships.

What is a sloop?

The term has fallen out of use but was often utilised in the days of sail to describe a small sailing ship not capable of lying in the line of battle. There were six "rates" of ships – originally devised according to the amount of guns carried – and sloops were too small to be included in that list, as were cutters. In WWII terms a sloop was smaller than a destroyer but larger than a corvette: the latter designed more specifically for anti-submarine work. The Bathurst-class corvette – of which Australia had 56 – were 650 tons.

Consider the similarities in the *Jervis Bay* and *Yarra* actions.

Both captains made the correct decision in terms of their ship's role – to defend their convoy by slowing the enemy enough to allow the convoy to escape. Both captains paid the ultimate price in terms of their personal safety – they were killed in action. The fact that Fegen's convoy was more successful in escape than Rankin's was due to fortune rather than any action of the RN officer. Fegen's battle took place in the afternoon approaching dusk while the Canadian ships had the oncoming night to aid their escape. Rankin's action was in the early morning with the convoy ships having no cover of darkness.

In terms of valour in the face of the enemy – the criteria for which the Victoria Cross is awarded – there appears little difference in the actions. Fegen's had read – "For valour in challenging hopeless odds and giving his life to save the many ships it was his duty to protect". How true it is that this could be Rankin's epitaph as well.

But through cumbersome administrative procedures, inertia and perhaps an unwillingness to open up questions of unrecognized valour in battles of the past, Rankin has seen no award at all for his actions. Not that it has been unnoticed: various stories of the event; histories of the RAN since, and even the Australian Prime Minister at the time lauded the actions[34] of the ship and her company.[35] As John Bradford has pointed out in his work *In the Highest Traditions*, in those days to recommend decorations within the RAN was very difficult – more so than in the RN with more restrictions on Australian ship commanders as to what their members could be recommended for. There were only two classes of posthumous award in WWII: the Victoria Cross and the Mention In Despatches; posthumous foreign awards were not permitted; RAN gallantry awards were determined by the British Admiralty, and finally, unlike commanding officers within the RN, RAN Commanding Officers were not allowed to suggest the nature of any award.[36]

This lack of recognition for Rankin is an oversight. Compared to gallant actions such as Fogarty Fegen's – and that man's much-deserved decoration – perhaps we have unjustly treated some of our naval best. The naming in 2001 of a fine submarine after Rankin – coincidentally in the same week of the year that *Jervis Bay* was lost – was perhaps only the beginning of redemption and recognition long overdue.

What sort of man was Rankin? Acting Chief Petty Officer Frank Glover, who worked as a writer (scribe) on board the ship, remembers Rankin as "easygoing...he could mix with the troops but knew what he wanted." Glover[37] served under Harrington too, and rated Rankin "as good as Harrington", which is a nice compliment: Harrington retired as Vice Admiral Sir Hastings Harrington KBE, CB, DSO, First Naval Member of the Australian Commonwealth Naval Board and Chief of Naval Staff 1962-65.[38]

HMS Resource (Courtesy Royal Navy)

Rankin was born in 1907, on 3 June, and entered the Royal Australian Naval College in 1921. He gained his Colours in Rugby, and prizes for mathematics and engineering.[39] [40]

Graduating in 1924, he joined his first ship, the cruiser *HMAS Brisbane*, in 1925. He completed the Junior Officers War Course, at Greenwich, in Britain, graduating as one of six sub-lieutenants who "received their Lordship's appreciation of essays written."[41] Serving in a range of ships, in the normal style of developing his general abilities, he was promoted to Lieutenant in 1929, and ended the 1920s with a posting as Assistant Torpedo Officer in the cruiser *HMAS Canberra*, where he also gained his watchkeeping certificate. He then was posted to *HMAS Anzac*. He applied to specialise in Communications, without success.

A shore posting to *HMAS Cerberus* followed, and by January 1934 Rankin was specialising in surveying, appointed as Assistant Surveyor 4th Class.[42] For those unfamiliar with the need for such a precise engineering ability within a Navy officer, we might look back to the early days of the Australian colony. Captain James Cook RN, one of the earliest explorers of the

Australian coastline, surveyed as he went, providing charts for those who followed in his wake. In modern days of Global Positioning Systems, where navigation to within a few metres can be provided for people or automobiles, the days of picturing naval officers with sextants and chronometers is difficult to imagine.

Charting the coastline of a country is important. Of supreme interest is the depth of the water: is it sufficient to allow a ship – and what sort of ship, because different marques draw different amounts – to freely navigate, even to draw up to near a beach, so as to allow easy ferrying of people and materials back and forth. Ships of Cook's day were always in need of fresh water, and moreover to put members of the ship's company ashore was sought – a ship is a terribly small place after a while.

Initial navigation in unknown waters can be done with the aid of a weighted line. segmented off into known lengths. But "casting the lead" is a tiring and difficult operation, and even fraught with danger: a very narrow passage might be allowing access through the Great Barrier Reef, but little sideways movement, and the finding of yourself in such a passage as the wind changes does not bear thinking about.

The making of charts does a lot to alleviate nervousness in mariners. But imagine how difficult this would be without aircraft and overhead photographs, let alone electronic depth gauges. While surveyors such as Rankin had more technical aids than Cook, the basics were still learnt – and are today, for navigation and charting must still be carried out in the event of breakdowns.

Rankin carried out various surveying duties without anything notable occurring, although sometimes he was commented upon as being a "plodder", and on one occasion harsh to subordinates. In contrast, he often carried out the secondary duty of ship Sports Officer, where he was always judged to be a success in managing this important aspect of morale.

In 1936 he expressed a desire to return to general duties, despite gaining his qualification as Assistant Surveyor 3rd Class the previous July. This was denied, with the order to complete another "season" of surveying. Promotion to Lieutenant Commander followed in 1937. He married in that year, to Mary Broughton, a trainee[43] nurse based on Thursday Island, in Brisbane, in a glittering affair keenly reported in the local newspapers, which featured Rankin's naval officer friends – who called him 'Oscar' – forming an "arch of swords," for their friend and his bride to walk under as they entered the reception.[44]

On 30 March 1938 he was posted to Britain, along with his new wife, to join *HMS Gleaner*, a minesweeper, for surveying duties. Gaining a step in his survey career as Assistant Surveyor 2nd Class in July 1938, Rankin remained with her until 11 September 1939, when he was posted to the shore training establishment of *HMS Dryad*, for a navigating course. In July his daughter Patricia was born, but she and her mother had to be evacuated to Australia as the war commenced, so a lengthy return trip, also by sea, had to be made.[45]

On 14 November 1939 Rankin was made the First Lieutenant and Navigator of the Repair ship *HMS Resource*. The ship was a large vessel of 12,300 tons displacement, and 581 men on board.[46] Serving in the Mediterranean, generally around Malta and Alexandria, *Resource* was not a fighting unit but an essential one nevertheless, for the Med was seeing the initial fleet actions of the war, with substantial fighting between the Allies and their enemies: the two Axis powers of Germany and Italy. *Resource* was much involved with the evacuation of battle survivors from Greece, and Rankin was complimented on his success at raising their morale.

It was a most trying time for the Australian officer. He was separated from his family and his Service; he was in a position of great responsibility on board a large, slow-moving under-defended vessel – the repair ship boasted only four AA guns – which was a great target for the enemy. By being appointed as the Navigator of the ship Rankin lost chances for promotion with his own Branch, and furthermore he lost monetarily in that his survey allowance was stopped. He was furthermore junior in rank to the three department heads of the ship. But his personal qualities shone through. His reports commented on his cheerfulness. He managed to perform as the Executive Officer according to his personal report from the Commanding Officer, "with the utmost reliability and with conspicuous success". The report noted his qualifications as a surveyor and how this appointment placed him at a disadvantage with others of his Branch. His Captain wrote: "I strongly recommend him for accelerated promotion."

Rankin served with *Resource* until 11 September 1941. His report on posting commented again in glowing terms and gave Rankin the credit for the successful *esprit de corps* on board. He had also apparently served with "a difficult Wardroom" with success.

Rankin travelled back to Australia. He was to carry out a survey of Pittwater, north of Sydney.[47] Although this might have been thought to have been cancelled due to his not having seen his wife and child for a considerable time, the war took priority. He completed the survey in December

Rankin VC?

1941: the Australian Hydrographic Service today still has the completed work in what is known as a "fairsheet", with his signature above the words "in charge of survey". The survey is of central Pittwater and was completed in support of a proposed torpedo firing range with facilities at Taylors Point. The range was subsequently built and used for several decades.[48]

His Record of Service notes some inconvenience in getting him moved north to command *Yarra*, but he was eventually flown by air "to Batavia" from 26 January 1942.[49] His action and death were mere weeks away. His contact with his daughter – through her entire life – had been a mere four months; another aspect of Rankin's great sacrifice.[50]

Rankin may not have been rewarded adequately, but he is not forgotten. His medals were presented to the Royal Australian Naval College in 1992.[51] His sword has also found a place of honour there.[52] The submarine *Rankin*'s keel was laid in 1995, and Rankin's wife – who had remarried as Mary McLean – laid the keel. When she died in 2005 the Navy assisted in the requested scattering of her ashes at sea in Jervis Bay.[53]

What of Rankin's qualities as a leader? We do not know a lot of his Empathy – indeed, he was perhaps somewhat curt in his early days towards those he led. But given this aspect and that of his Communication qualities we should note he took on a most trying position in wartime even before commanding *Yarra* – and excelled in his *Resource* role. With *Yarra*'s command he united these and his qualities of Leadership, Expertise, Physical Qualities to combine them into Inspirational Initiative. As his warship turned towards the enemy and Rankin and his Ship's Company looked death in the face he reached a zenith of being a true leader within the Royal Australian Navy.

But if anyone in the Navy of World War II deserves honour for unrecognised gallantry it is Rankin. Unlike others, he was not "doing his job." He gave up his regular branch of naval work at the outbreak of war, saying farewell to his new family, little knowing he would see them for yet another month of life some time in the future. He took on his new responsibilities with enthusiasm, and performed with distinction. After two years in the front line of the Mediterranean he returned to Australia – was he to return to his original speciality? Yes, for a month, and thence to combat again. He was a surveyor, who took his first command, a warship, into action, for he was also a naval officer, whose primary duty was to fight the country's enemies. Rankin took up the sword once again without demurral. He performed in his first command, and his final fight with honour, outstanding ability, and rare distinction. He exhibited particularly conspicuous valour in his actions. Yet for all of this he has received nothing.

It is time for that failure to be remedied. Lieutenant Commander Robert Rankin deserves a Victoria Cross.

Lieutenant Commander Tom Lewis PhD, OAM, RAN has served in a variety of PNF and reserve roles within the Navy. He led US forces on deployment in Baghdad in 2006.

This article is largely drawn from Tom Lewis's forthcoming publication *The Submarine Six*, published by Avonmore Books.

(Endnotes)

1 Conversation with Ian Downs, cadet at RAN College 1929-1932, September 2001.
2 Bruce, Anthony and Cogar, William. *An Encyclopedia of Naval History*. New York: Facts on File, 1998.
3 Bruce, Anthony and Cogar, William. *An Encyclopedia of Naval History*. New York: Facts on File, 1998.
4 Watts, Martin. Web site article on *HMS Jervis Bay*, the post-action proceedings, and the memorial erected to the convoy losses. http://www.saintjohn.nbcc.nb.ca/~JervisBay/. Including emails October 2000.
5 Parry, AF. *HMAS Yarra: the story of a gallant ship*. Sydney: Angus and Robertson, 1944. (p. 211)
6 Shores, Christopher and Brian Cull with Yashuo Izawa. *Bloody Shambles Volume 1 The Drift to War to the Fall of Singapore*. London: Grub Street, 1992. (p. 363)
7 Parry, p.212
8 Bradford, John. In the *Highest Traditions...RAN Heroism Darwin 19 February 1942*. Seaview Press, South Australia, 2000. (p. 173). Also partly quoted in Gill. Harrington had singled out and named five men, including Taylor, for special mention in this report. In his book, Bradford questions why Harrington did not subsequently recommend awards for these men

(when he was back in Australia and in a position to do so) on the basis of this strong evidence.

9 Thompson, Peter. *The Battle for Singapore*. London: Portrait Books, 2005. (p. 279)

10 She later sunk with three funnels visible above the water.

11 These claims appear inflated and have not been substantiated, although Harrington claimed one as "certain" in his report.

12 These ships, a few days later on 20 February, successfully evacuated Tanjong Priok for various independent destinations.

13 *War Sirdar* was declared a total loss on 1 March, with her crew rescued by a Dutch minesweeper. She was later salvaged by the Japanese and renamed *Honan Maru*, and was eventually sunk by a US submarine in 1945.

14 Jones, TM. *The silent service: action stories of the Anzac Navy. Sydney:* Angus and Robertson, 1944. (p.257)

15 *Jumna* reportedly survived in Indian naval service until the 1980s.

16 Motor minesweeper *MMS.51* was known to have been damaged on 4 March and this may have occurred during this action.

17 This was by Japanese submarine *I-58*; see http://www.combinedfleet.com/I-158.htm Accessed 20th May 2011

18 *The Silent Service*, p.258.

19 *Anking's* armament, if any, is unknown.

20 *The Silent Service*, p.258, suggests an enemy vessel was spotted this day and avoided. However she was just as likely to have been a fleeing Allied ship.

21 http://www.ozatwar.com/japsubs/parigi.htm accessed 4th March 2011; other sources suggest this ship had been attacked by the Japanese destroyers *Arashi* & *Nowaki* earlier that day. *The Silent Service* quotes the Dutch captain as saying they came under gunfire after being illuminated by a searchlight, which suggests attack by surface craft.

22 http://www.wrecksite.eu/wreck.aspx?59311 accessed 20th May 2011 describes eight survivors. *The Silent Service*, p.146, describes thirty survivors being picked up.

23 *The Silent Service*, p.260

24 Although, hypothetically, the convoy may well have been detected by the cruisers' floatplanes in any case.

25 Some accounts – eg; Eldridge – say four destroyers. Gill cites *Arashi* and *Nowaki* as the ships involved.

26 Gill, pp. 629-632.

27 Evidence suggests *Yarra* carried only High Explosive (H.E) rather the Armour Piercing (A.P.) shells as normally used in ship-ship combat. Indeed the latter type may not have even been available for a calibre as small as 4-inch.

28 *The Silent Service*, p.278.

29 Gill, p.631.

30 Parry, p.221.

31 *The Silent Service*, p.268.

32 Gill, p.632.

33 Operating further west of Kondo, in the vicinity of Christmas Island, was a vastly more powerful force under Nagumo that included four large aircraft carriers, several battleships and assorted cruisers and destroyers. This force expended a large amount of resources and time on 1 March in sinking *USS Pecos* and *Edsall* (see Kehn). However, given the importance of the landings on Java possibly this force was positioned to deter any potential threat to the Java landings by the RN Eastern Fleet. Although the flotilla accounted for a modest number of ships at sea, it did bombard both Christmas Island and more importantly, Tjilitjap.

34 Bradford points out that in Melbourne's *The Age* of March 25, 1942, John Curtin was quoted as stating:

'*Yarra* established for herself and her ship's company, a place in naval history alongside ships such as *HMS Jervis Bay* and other ships which have written the epic stories that star our naval history.'

In November 1945 the Deputy Chief of Naval Staff, Captain Herbert Buchanan inquired: 'Has sufficient recognition been given to the gallant action of HMAS Yarra? On a smaller scale the incident is comparable with HMS Jervis Bay.' (NAA 1185/8 1932/2/214 - Reports on loss of HM Ships, *Siang Wo, Grasshopper, Rahman, Anking, Stronghold* and *WoKiang*, *HMAS Yarra, RFA Frankol* and *MMS51*)

The resulting correspondence between the Second Naval Member - Commodore Henry Showers and his admiral. Vice Admiral Hamilton concluded with the Admiral commenting: 'I can only conclude that my predecessor examined this question fully in 1942.'

There is in the National Archives of Australia a three page file summarising Rankin's career three times: it may have been that someone once started an attempt to get him recognised. See: National Archives of Australia. Rankin, Lieutenant Commander Robert William Contents date range 1943 – 1994. Series number B6161; Item barcode 1723543. Location: Melbourne

35 For example Peter Firkins, when writing of Rankin and Taylor (and also Waller) said: "Few men have been more deserving of their nation's highest honour for valour and their failure to receive it underlines the deficiency of Australia's system of awards…" See Firkins, Peter. *Of Nautilus and Eagles*: History of the Royal Australian Navy. NSW: Cassell Australia, 1975. (p. 149)

36 See John Bradford's book for a detailed explanation. It may have been that one admiral declined to question the lack of proceedings by his predecessor; it may have been that it was felt post-war that too much time had passed; that there were insufficient witnesses who reported on the action in a timely fashion.

37 Glover, Acting Chief Petty Officer Frank. *HMAS Yarra* (II) Ship's Company member. Frank posted off the ship before her final convoy voyage. Interview with the author 10 May 2011.

38 Royal Australian Navy http://www.navy.gov.au/w/index.php/HMAS_Yarra_%28II%29 Accessed 11 May 2011.

39 Royal Australian Naval College history of Rankin, courtesy Greg Swinden.

40 National Archives of Australia. Rankin RW. Officers (RAN) personal record - Robert William Rankin
Series number: A3978. Item barcode: 943776. Location: Canberra.

41 Eldridge, FB. *A History of the Royal Australian Naval College*. Melbourne: Georgian House, 1949. (p. 403) "Their Lordships" were the Sea Lords, the governing admirals of the Navy, who were raised to the ranks of nobility when given the appointment.

42 National Archives of Australia. Rankin RW. Officers (RAN) personal record. Series number: A3978. Item barcode: 943776. Location: Canberra. (p. 36)

43 Rankin, Patricia, daughter of LCDR Rankin. Emails to the author, May 2011.

44 *The Courier-Mail*, 5 October 1937. (p.5) Courtesy Greg Swinden. Rankin's nickname was so pervasive amongst his naval friends that his wife thought that was his real name for a while. (As related to Swinden by Patricia Rankin. His wife called him Bob.)

45 Rankin, Patricia, daughter of LCDR Rankin. Emails to the author, May 2011.

46 U-Boat Net. http://www.uboat.net/allies/warships/ship/7289.html Accessed May 2011.

47 Eldridge, FB. *A History of the Royal Australian Naval College*. Melbourne: Georgian House, 1949. (p. 403)

48 Mike Prince, the Director Charting Services; Australian Hydrographic Service; Navy Hydrographic & Meteorological Branch advises: "Defence of Sydney was taken very seriously, with the Hawkesbury River and Broken Bay considered the last line of defence to Sydney's north". Email communications with Mr Prince and Ms Elizabeth Stacey, July 2011.

49 National Archives of Australia. Rankin RW. Record of Service. Series number: A6769. Item barcode: 5221410. Location: Canberra. (p. 36)

50 Patricia had been born in July 1939, but with her mother had left Britain for Australia no later than the outbreak of war in September: three months of life with her father. Another month of contact had just been experienced, with his daughter now nearly two and a half years old.

51 *Navy News*. "College gains Rankin medals." Article by Greg Swinden, 11 September 1992.

52 The author's period of naval duty there included time as the Curator of the RANC Historical Collection. Farncomb's and Collins' swords are also prized items within the Collection.

53 Navy official form: "Request for Committal of Ashes to the Sea." July 2005. Courtesy Greg Swinden.

Book Reviews

BLACK SHEEP: THE LIFE OF PAPPY BOYINGTON

By John F Wukovits

Naval Institute Press 2011; hard cover, 288 pages; 23 b/w photos; USD $34.95

ISBN 978-1-59114-977-4

Reviewed by CMDR David Hobbs MBE, RN (ret'd)

Published as part of the Naval Institute Press 'Library of Naval Biography' series, John Wukovits' book describes the life and career of Gregory Boyington, the USMC fighter pilot who became a legend in the South West Pacific in 1943.

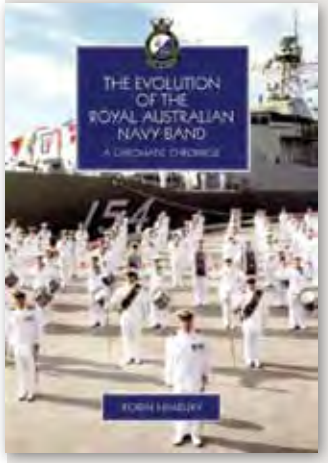
It is a well-researched and thought provoking book, dealing sensitively with a man from a broken home background who was dismissed by Claire Chennault, leader of the American Volunteer Group AVG) in China as a drunken failure, and the men of his Corsair squadron, VMF-214 the 'Black Sheep' as an inspirational leader they would have followed without question even "if he had decided to attack Hell itself". His influence was to stay with them for the rest of their lives. This is not just a book about 'Pappy' Boyington, however, it as much about leadership in war and how its application can come to bring out the very best, or the worst results in people.

Boyington arrived in the AVG in 1941 after flying Marine Corps fighters and a tour as an instructor. He expected to be taken seriously and when he was not he turned to the bottle and no attempt was made to understand him or to get the best out of him. Chennault would have consigned him to the Army Air Corps as a second lieutenant with a bad conduct record. Instead Boyington managed to return to the Marine Corps and, as a major, was given command of a new squadron in 1943, VMF-214, equipped with the outstanding Chance Vought Corsair.

His pilots comprised a number of untested replacements awaiting appointments, many of them young men recently arrived from the USA, who had no operational experience. This unusual unit composition led to the pilots calling themselves the 'Black Sheep'. The need to overcome their initial fear of combat and to instil in them a new form of strategy that was offensive rather defensive brought out the best in Boyington, and showed him to be one of the best fighter leaders of the war in any air arm. After only two short periods in action in 1943, Boyington was awarded the Medal of Honour and the Black Sheep became the stuff of legend. The myths that have come to surround that legend are carefully explained and put into context by the author.

After he had been shot down and taken prisoner by the Japanese in early 1944, Boyington's men worked with the Headquarters, Marine Aircraft, South Pacific to produce a sixty-four point booklet entitled '*The Combat Strategy and Tactics of Major Gregory Boyington USMCR*' which was printed and distributed to aviators throughout the Marine Corps. It was not the boastful words of one man about his methods, it was his team trying to put into words the teaching of a revered leader "who was responsible, more than any other, for changing our strategy". No finer mark of respect for a commanding officer from his men can be imagined. The fact that senior officers in the Marine Corps gave him the chance to "step forward and lead" makes an interesting comparison with Chennault's AVG and casts new light on his apparent lack of personal skills.

Boyington's 'Jekyll and Hyde' life makes a fascinating story and John Wukovits' careful text adds significantly to history of Allied operations in the South Pacific. The description of the flight in a Marine DC-9 which carried Boyington's coffin to his state funeral at Arlington National Cemetery is a fitting and moving end to a first class biography. I thoroughly recommend it to a broad cross-section of potential readers including those interested in the man, the legend, the theory and implementation of leadership and the history of war in the Pacific.



THE EVOLUTION OF THE ROYAL AUSTRALIAN NAVY BAND

By Robin Himbury

Available from the author for $30.00 (including postage) via email piganbilli@bigpond.com or 15 Pauline Avenue Killcare Heights, NSW 2257.

Reviewed by CMDR Greg Swinden

A welcome addition to the RAN's history is this recently produced book on Australia's little known naval bands

and the bandsmen who served in them. Written by former Bandsman Robin Himbury this 205 page paperback traces the history of naval bands in Australia from 1788 to the present day in an easy to read and informative style.

The book covers the period mainly from 1913-2010 and details the many and varied activities that the bands were involved in – particularly during the World Wars. The life of a 'bandie' was somewhat different to other members of the Navy and occasionally this could cause some difficulties as recalled by a number of recollections from those who joined as Boy Musicians in the 1950's.

Recruiting bandsman was also somewhat different. For example the Warrant Bandmaster serving in *HMAS Melbourne* in 1921 was directed by his Commanding Officer as follows:

> 'In view of the fact that the Flagship's band is short of 6 musicians, it is suggested that you take steps, if convenient during your leave, to recruit the necessary men, observing that I understand you know exactly what players are required. You should if necessary advertise in *Sydney Morning Herald* and *Daily Telegraph* directing their accounts to be forwarded to Accountant Officer HMAS MELBOURNE….. Request you will inform me of action taken and of results obtained.'

Obviously recruiting methods in those days were somewhat more lenient than today!

Overall a good read and the author has provided another insight into the RAN which is often forgotten in the mainstream texts. The book has the theme "my grandfather was in the Navy Band, I wonder what he did" and this is well and truly achieved.

DARWIN'S SUBMARINE I-124

The story of a covert Japanese Squadron waging a secret underwater war against Northern Australia.

By Dr Tom Lewis

Avonmore Books

Reviewed by LCDR Desmond Woods

The task of the careful historian is not only to explain facts but also to separate them from mythology. The history of the sinking, outside Darwin, of *I-124*, a Japanese mine laying submarine in January 1942, has gathered a thick layer of mythological concretions, like those that adhere to the hull of sunken vessel.

The wartime secrecy surrounding this conspicuous RAN success story has been the seedbed for writers keen to speculate on its contents and cargo and to embellish the facts. Tom Lewis is a national authority on wrecks inside and outside of Darwin and his new book has been many years in the research phase and in gestation. In its 164 pages he chips away mythology and in doing so he has provided a new baseline of facts from which future historians will be able to operate with confidence.

Persistent and entirely unfounded stories claiming that *I-124* was involved in the sinking of *HMAS Sydney* have finally been laid to rest by the discovery of the cruiser, but that has been only one of the many tall tales woven around the activities of the *I-124* and her sisters in the first weeks of the war in the Pacific. In excavating down to the truth Tom Lewis has honoured the memory of those who fought on both sides in this brief but deadly battle in Australia's northern waters nearly 70 years ago.

The disaster that overtook Darwin in February 1942 from the air has rather obscured the fact that the Japanese submarine service was actively attempting to close the port the previous month by making the waters hostile to safe movement of warships, tankers and freighters. *I-124* was one of a squadron of four long range minelaying patrol submarines. They were elderly boats, laid down in 1926 to a German U Boat design, but none the less a potent threat to commerce in northern waters. They were undetected while mine laying but once they started firing torpedos at targets their presence was discovered and their prosecution became a most immediate priority for the USN destroyers and the RAN corvettes and maritime patrol aircraft operating from Darwin.

Despite later claims by American historians crediting the USN with the kill it was the corvette *HMAS Deloraine*, commanded by LCDR Desmond Menlove, that locked its ASDIC onto I-124 and forced Commander Koichi Kishigami to the surface with accurate depth charging, Depth charges were then thrown with great skill right alongside the surfaced conning tower and with that the crippled submarine took her final plunge to the seabed below. This account of the battle is given vividly and in great detail. The biographies of the opposing commanders has been meticulously researched and

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recognition given to the bravery of men on both sides.

However it is the continuation of the story that makes this book so useful, for Tom Lewis takes the story of *I-124* forward over the following 70 years dealing with the dives made immediately after the sinking and both the authorised and the illegal ones since.

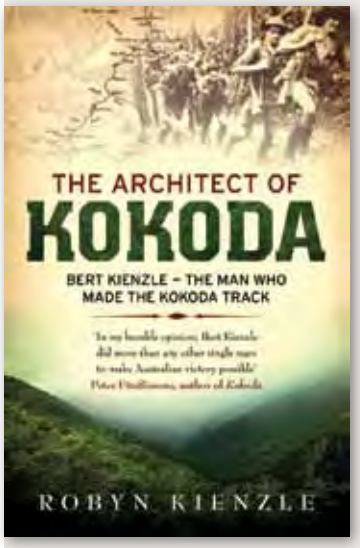
The submarine's presence outside Darwin continued to excite interest, both historical and mercenary in origin. In 1984 one LCDR Russ Crane led the RAN's dive team which finally gave an accurate and truthful account of the exterior state of the wreck and was able to state conclusively that claims by previous divers to have entered the wreck and viewed its contents were untrue.

Both before and after this navy dive a variety of bizarre and delusional adventurers have raised money from the gullible with various claims of what they knew to be within.

A persistent claim was that the submarine containing tons of mercury ballast waiting to be recovered. This has been debunked by the Japanese authorities. It is most probable that parts of the submarine still remain airtight containing the crew's remains in a toxic atmosphere caused by battery acid. There are many practical reasons for leaving the wreck to decay naturally while watching for any significant degradation of the pressure hull. Most obviously the fact that there must be many mines and may be some torpedos left onboard needs to be considered. These unstable munitions are best left undisturbed unless there is reason to believe that they could become hazardous to shipping. This is not the case at present and may never be.

The Commonwealth government has now put a stop to all schemes to raise the vessel or enter it by declaring *I-124* a war grave. The Japanese government has requested this status and it has been granted in perpetuity

It is never possible to say that any one book is the final word on a piece of history but in this case it is hard to imagine what more can possibly said on the subject of *I-124*. Tom Lewis has brought all the pieces of this story together in a masterly way. He has written a highly readable account of this earliest example of the tragic consequence for Japan's sailors of their military government's deranged ambition to create an Asian and Pacific empire by force of arms. *I-124*'s submariners were the first of Japan's WWII sailors to die a miserable death trapped inside a sunken hull. They were followed by tens of thousands more in the years that followed. ❧



THE ARCHITECT OF KOKODA

By Robyn Kienzle

Published by Hatchette RRP $35

Reviewed by Tom Lewis

It would appear that "the architect of Kokoda" would not have wanted his story to be written down. The designer of the famous New Guinea WWII Trail, or Track if you prefer, died in 1988 after several refusals to tell his story to historians. This account is written by his daughter-in-law.

Gold-miner, farmer of cattle, and rubber plantation owner, Bert Kienzle was one of the hundreds of white settlers who managed New Guinea before World War II. Once the Japanese entered the war, Kienzle signed up into the military, and due to his local knowledge, was given 1, 000 native labourers and a bulldozer, and told to build a road.

The book is overlong, for this event does not happen until page 130 of 338. It's an interesting enough story though, with good descriptive passages telling the tale of enormous difficulty in the torturous terrain of New Guinea.

The language is sometimes a little strange, as if the author has chosen to just repeat some cliches of the time without question. Thus jungles at night are "pitch-black"; planes run out "gas", and militia units are armed with "World War I weapons". That the stars shine down everywhere; Japanese planes were not powered by American slang, and the fine .303 Lee-Enfield was a standard rifle for decades of reliable and efficient service – in both WWI and WWII – seem to be ignored. There is various slang thrown in without quotation marks too: "recky" for "reconnaissance" and "schemozzle" all make an appearance, for example.

But there are two good collections of black and white photographs, and overall *The Architect of Kokoda* is a worthwhile tale. ❧

THE BRITISH PACIFIC FLEET: THE ROYAL NAVY'S MOST POWERFUL STRIKE FORCE

By David Hobbs
Seaforth Publishing. UK
keaton@pen-and-sword.co.uk
ISBN: 9781848320482 480 pages

Reviewed by LCDR Desmond Woods

It is often stated that history is the propaganda of the victors and that the defeated do not have their story told. If this is true then it is also the case that history is the story of the senior partner in an alliance, not that of the supporting power. Undoubtedly this has proved to be the case in the writing of the history of the War in the Pacific. Captain Samuel Eliot Morison was commissioned into the USN and sent to sea in 1942 to write the history of the US Navy and the Marine Corps as it unfolded before his eyes in the Pacific. His eyewitness first draft of history later became his definitive *History of United States Naval Operations in World War 11* which extended to 15 volumes. It has been the mother lode for generations of naval scholars. Captain Steven Roskill performed the same task for the RN with his *The War at Sea 1939-45* in three volumes. He recorded the exploits of the British Pacific Fleet (BPF) in 1944-5.

But since then the BPF has been a backwater of naval history writing. This fine new study by CMDR (Retd) David Hobbs is a timely reminder of the scale of an exhausted Britain's achievement in mounting and supporting a fleet which for the last six months of the war was able to take its place in Halsey and Nimitz's drive north to Yokohama Bay and final victory.

The neglect of the BPF in Australia's collective memory is surprising considering that it was RAN facilities, particularly the docks at Cockatoo Island and Garden Island, and the RAAF bases converted into RN Mobile Naval Air Bases (MONABS), that made the British and Commonwealth operations feasible. Along with Manus Island these Australian bases were the indispensible logistical support points for a fleet of carriers, battleships, cruisers and destroyers and their fleet train.

The book commences with a succinct account of the loss of *Prince of Wales* and *Repulse.* This has been extensively written about elsewhere but the point is well made that Admiral Sir Tom Phillips and his naval staff were unanimously of the view that the Navy could not sit in Singapore while the RAAF and the Army were being driven out of Northern Malaya. The option of sailing for Australia and ensuring the survival of the two capital ships was open to him and rejected. With hindsight it is easy to see that discretion would have been the better part of valour. The author also points out the little-remembered fact that when the USN was desperate for carriers in the South Pacific in 1943 the RN did "send them *Victorious*", which filled a gap until the USN could deploy into the Pacific its newly built carriers.

BPF carriers Implacable, Indefatigable and Glory visit Melbourne January 1946. The visit was described as 'spectacularly successful' by The Herald. Note the banner reading 'Welcome Home' on the shed at the end of the jetty

Victorious was the first RN carrier to fly lend lease USN Hellcats, Avengers and Corsairs which were designed to be carrier aircraft. They were a generation ahead of the vulnerable Swordfish biplanes and an improvement on the Barracuda torpedo attack aircraft. *Victorious*'s deployment demonstrated that British carriers could be adapted quickly to fly modern American aircraft. She was also the first carrier to use the USN side by side, or abeam, method for refueling as seas instead of the RN's bow to stern technique which was slower, and often caused the fuel lines between the tanker and

Formidable in Captain Cook dry dock - Garden Island

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the warship to break. These successful innovations paved the way for the successful operation of the BPF under American command in 1945.

David Hobbs then moves on to the first theatre of operations of the BPF in 1945 when the RN operated from the Indian Ocean against occupied Sumatra. He provides a strategic focus which underlines the importance of what was achieved by the RN's carrier strikes against Sumatran oil refineries. The Japanese, deprived of refined oil from the Dutch East Indies, were increasingly unable to operate the ships and aircraft they possessed. Finally having proved itself in strike operations the BPF moved on to Leyte Gulf and commenced strikes against the island airfields from which the Japanese were attacking the Americans on Okinawa.

The initial US concern that the RN would become a drain on USN resources was overcome as the BPF proved able to take heat off the landings by destroying on the ground and in the air the last capable pilots that the enemy was able to deploy forward of the homeland. The Americans realized that the armoured fight deck of the British carriers could take a punch from kamikaze strikes and recover in hours. This was impressive and earned the respect of Nimitz and Halsey who saw the attrition of their wooden decked carriers as a serious cause for concern.

David Hobbs tells a gripping tale of preparation for intense flying operations, courageous air combat, the destruction of Japanese aircraft and depots on the ground. He writes of the combat losses and of those caused by error and accident. He describes the survival at sea and rescue of pilots. Every mission and sortie and its outcomes are covered in detail. This four carrier force, supported by RAN Q and N class destroyers, learned swiftly that war in the vast Pacific was as much about fuel states, endurance, replenishment and solving a multitude of supply problems as it was about pilot training, firepower and tactics in the air. That the RN was prepared to learn from the USN, and also impart its hard won knowledge to its partner, is documented as is the wise and warm relationship which Admiral Bernard Rawlings, the fleet commander at sea, cultivated with his USN superiors.

John Winton wrote an account of the BPF in 1969 and called his book, *The Forgotten Fleet.* This is a chapter of British and Commonwealth naval and aviation history which has never been given its due entitlement. Long after the British public considered themselves at peace after VE Day, BPF pilots were fighting and dying over the Pacific and continued to do so until the last day of the war. One of them, Sub-Lieutenant Fred Hockley, bailed out of his stricken Seafire over Japan after the atom bombs had been dropped and landed uninjured. His Japanese army captors heard their Emperor order an official surrender of all Imperial forces and having done so then shot and stabbed him to death. They buried him and later exhumed and cremated his body in an unsuccessful attempt to conceal their crime. This is only one of many accounts David Hobbs gives of the sacrifice of fine young men who lost their lives in the last months and weeks of a war which the British public knew little of when it was happening and which is now largely forgotten. Many of these FAA pilots were Canadians and New Zealanders. A few were Australians but had the war gone on many more of them would have been ex-RAAF.

The reoccupation of Hong Kong by the BPF was done in the teeth of opposition from the Americans who were simultaneously re-establishing their rule in the Philippines but who wanted to see an end to European colonial rule in the Far East. During this period Admiral Sir Bruce Fraser, the C-In-C British Fleet, proved himself to be a consummate diplomat, dealing with friend and foe alike with wisdom and forbearance. He was greatly respected not only by his own men but by the Americans and by the Australian Government and people of Sydney.

Formidable after kamikaze hit

When the war ended the BPF, including RAN corvettes and destroyers, constituted a powerful force and was prepared for the invasion of Japan and for a war continuing into 1946. This logistical and combat capability was redeployed on urgent humanitarian and prisoner repatriation tasks. It was largely in the BPF's carriers' hangar decks that emaciated British, Dutch and Australian POWs were brought home from the hellholes in which the Japanese had confined them. Many Australians owed their lives to the swift and successful treatment they received at the hands of the RN medical teams caring for them. These embarked medical teams included the nurses of Queen Alexandra's Royal Naval Nursing Service, (QARNNS). These service women served at sea decades before WRNS or WRANS were allowed to do so. By late 1945 and into 1946 Australian war brides, married to British servicemen and dockyard tradesmen, were taken to the UK. It was in the RN's carriers, suitably converted for women's occupation, that Aussie girls, many of them pregnant, went to the UK to start their lives as wives and mothers. They went with chaperones and midwives.

As the British carriers finally arrived home their 'hostilities only' sailors were paid off into civilian life, their ships were placed in reserve and a bankrupt Britain faced the reality of paying the Americans for all the lend-lease equipment they still possessed in peacetime. This US policy of demanding cash for equipment that had been loaned to UK meant that new front line American-built aircraft were taken from RN MONABS and dumped at sea off Australia's East coast. Such factory fresh aircraft, had they been stored in Australia, would all be aircraft collectors' treasures worth millions of dollars today. The requirements of posterity were not a priority and so the BPF's reserve Corsairs, Avengers and Hellcats went over the side to a watery grave.

With these aircraft seems to have gone much national recollection of this exceptional Commonwealth fleet and the warm relations with the public that the officers and sailors of the BPF enjoyed ashore. There is only one place where the BPF is remembered in Sydney and that is on a wall plaque at the Fleet HQ at Potts Point. In 1973 when this memorial was unveiled Admiral of the Fleet, Lord Fraser of North Cape sent a message to be read out. He wrote: *It is very fitting that this memorial should be unveiled by Admiral Moore, who was in naval command at Sydney, and whose constant co-operation with that of many other Australians, especially the Lord Mayor of Sydney, was of such value to us. No home was too small to entertain the British sailor and no request for help to Government was ever refused. A striking example of the kindness shown and the trouble taken was the establishment of the British Centre in the middle of Hyde Park. It was a great pleasure to us that we were able in small measure to repay this kindness by using all our aircraft carriers for the repatriation of Australian prisoners of war. Happy memories, grateful thanks and best wishes to you all.*

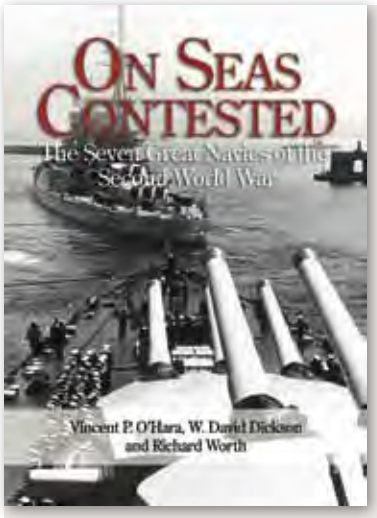
The people of Sydney raised £A200,000 by public subscription to build the British Centre mentioned by Fraser. It was staffed by over 4, 000 volunteers and provided 1,200 beds and at times 6, 000 meals each day. Three hundred young Australian women attended dances each night as hostesses, while some 12, 500 homes in New South Wales offered hospitality to British sailors from February 1945 until well after the end of the war. Despite union strikes on the waterfront Garden Island managed to perform a host of refits and repairs in support of the BPF. *HMS Formidable* alone required extensive repairs after her flight deck was torn apart by kamikaze attacks.

David Hobbs' book is wonderfully well illustrated with photos from the author's private collection. Those showing the Garden Island wharfs are of particular contemporary significance in view of the arrival of the RAN's two Landing Helicopter Dock (LHD) helicopter carriers in the next five years. They will presumably both be berthed where the BPF's carriers once secured. With the loss of the old finger wharf to residential development there will be even greater difficulty getting all the fleet alongside than clearly existed when the RN's carriers were berthed there more than 65 years ago.

This book is recommended without any reservation. It is one that will be of interest to both the naval historian and the general reader alike. It is the most recent in a series of carefully researched and very readable books by David Hobbs which remind readers that the Royal Navy, equipped with its strike carriers, was once a force to be reckoned with. The corollary of this is that a Navy that cannot launch its own strike aircraft can neither protect itself, not project air power into the battlespace and *ipso facto* must depend on more capable allies to do so for it. Despite nearly five years of draining war and the loss of hundreds of ships and thousands of men defeating Germany at sea, Churchill's coalition government decided not to leave the war in the Pacific to the Americans, but assembled the most powerful fleet in the history of the RN, based it in Australian waters and from there sent it into action.

The contrast between this bold, visionary, wartime policy, and the financially driven, wilfully ignorant, recent destruction of the RN's last Harrier carriers and their ability to strike from the sea, by the current British coalition government, could hardly be more stark.

Book Reviews



ON SEAS CONTESTED: THE SEVEN GREAT NAVIES OFTHE SECOND WORLD WAR

By Vincent P. O'Hara, W. David Dickson and Richard Worth (Eds).

Naval Institute Press, Annapolis

Reviewed by Dr Tim Coyle

In the 66th year following the end of the World War II, histories continue to appear which deal with the events of that conflict from often new and innovative angles. One such history is *On Seas Contested* which analyses the French, German, British, Italian, Japanese, United States and Russian navies' organisations, strategies, materiel and personnel and assesses their respective performances in the war at sea.

A compact volume of 333 pages, each navy receives approximately 40 pages of text – a formidable challenge to the contributors who present a range of complex topics in generally well-disciplined and precise formats. The text is supported by useful tables, appendices, notes and a valuable bibliography for further research. This latter is important because *On Seas Contested* is primarily a source book, outlining the various naval organisations as a primer for further reading in more specialised and detailed references.

Each navy's review begins with a 'Backstory', in which prewar historical developments relevant to its World War II performance are provided. 'Organisation' covers Command Structure and Doctrine. Then comes 'Material' covering ships, aviation, weapons systems and infrastructure, and finally, 'Recapitulation' summarises the analysis.

The book's strength is the holistic overview of each navy which contextualises such disparate topics as intelligence, amphibious operations, trade protection, logistics, industry, personnel and training in parallel with the more 'hard' coverage of ships and weapons systems. Many of the navies excelled in some of these disciplines but fell short in others. For example, French ships and submarines were modern, fast and well-armed, and designed as a defensive force to protect the maritime sovereignty of metropolitan France and its colonies and their sea lines of communications. While the surface force was well-resourced, naval aviation languished and anti-submarine capability suffered for the want of effective underwater sensors.

The French navy was an impressive force in 1939, but became a political pawn following the armistice with Germany which led to the destruction of many of its best ships by the Royal Navy at Mers-e-Kebir and the scuttlings at Toulon. Surface ships were fast, powerful and generally well-designed for Mediterranean engagements; however, they suffered in harsher conditions in the Atlantic in 1939-40. In many cases advanced engineering concepts were not properly executed by French industry. France's fleet and coastal submarines were also world-class designs, but coastal boats patrolling the North Sea early in the war accomplished little and the 1500 tonne fleet boats suffered major habitability shortfalls, and could not withstand shocks through depth charging. Major French units – such as the battleship *Richelieu* – had to be internally rebuilt with new electrical systems and anti-aircraft armament in US shipyards in 1944. Surviving French navy units were able to work with allied forces towards the end of the war; however, the pre-war configuration of the navy was totally changed.

English language literature has generally criticised the Italian navy's wartime performance. However, the contributor to the Italian section of *On Seas Contested* points out that the Italian navy accounted for 43 percent of Allied warship losses and 86 percent of submarine losses. German aircraft sank most of the warships because the Italian air force did not adequately support the navy, which was not permitted to operate aircraft. Italian submarines – largely ineffective at the beginning of the war in 1940 – improved their tactics and operating doctrine and became much more effective in 1942. The Italian Navy was configured essentially for defence with the battle fleet as a 'fleet in being', not seeking fleet actions

Flying operations on board USS Essex in WWII. (US Navy Historical Centre)

with the larger and more aggressive Royal Navy.

However operations against British Malta convoys in February through August 1942 were particularly effective and Italy closed the direct passage through the Mediterranean for 36 months to all but three massively protected convoys. By merely existing the Italian navy protected its littoral waters, secured its convoy routes and maintained the blockade in the Sicilian narrows. When Italy signed the armistice in 1943, the Italian navy was undefeated. The Italian section of *On Seas Contested* therefore provides a balanced analysis of the strengths and weaknesses of the other Mediterranean navy which, unlike the French navy, was able to engage in a sustained maritime conflict as a balanced force.

The 1935 German-British naval treaty allowed Germany to build up to 35 percent of the British surface fleet but restricted submarines. Admiral Raeder – the German navy's commander-in-chief – supported building battle fleets, while Captain Doenitz saw the submarine as the weapon of the future war at sea, as it had proved in the First World War. The German section of *On Seas Contested* provides good background to the design of major surface units and submarines. Gunnery is discussed in some detail, including gun construction, fire control systems and anti-aircraft weapons. Torpedoes also receive a comprehensive coverage – of the estimated 50, 000 torpedoes constructed some 13, 000 were fired, mostly by U-boats. Anti-submarine acoustic systems and mines close the weapons systems section, followed by a well discussed logistics overview. While the Kreigsmarine's formidable major surface ships heavily occupied Royal Navy assets, the greatest threat – the U-boat offensive – was nevertheless hampered by personnel and resources shortfalls, despite its initial successes to mid 1943. U-boat command operational staff lacked external scientific advice and the operational skills needed to improve combat effectiveness and tactics. This led to the U-boat arm being overwhelmed by the vast quantity of new allied escort vessels and dedicated anti-submarine aviation assets deployed from escort carriers which increasingly depleted the U-boat force after its numerical expansion in 1941-42.

Of the seven navies discussed in *On Seas Contested*, it is the Imperial Japanese Navy contribution which is arguably the best. The contributor masterfully deals with the IJN's strengths of innovative ship and weapons design and the superb training of officers and sailors – both in ships and in naval aviation. But these strengths were negated by the disastrous strategy and the hostility which existed between the army and navy, both of which had completely different views of war aims. The contributor states that 'the outset of hostilities was initiated by the navy's thunderous attack on the US fleet at Pearl Harbor, which remains to this day a marker for tactical triumph and strategic error'. He then explains in detail the formidable ships, aircraft and weapons systems which were devised for a set piece fleet action against the US Navy in the Pacific Ocean. The lack of logistic infrastructure and particularly the paucity of industry and scientific research and development to support a lengthy maritime war is described in detail which leaves no doubt in the reader's mind that the IJN badly miscalculated its maritime strategy. In 'Reflections on the Japanese Navy', the contributor sums up the tragedy of the IJN:

> 'When the Japanese navy initiated the Pacific War, it was indeed a formidable fighting force. It comprised 10 battleships, including the first of the two greatest battleships ever built; 10 aircraft carriers, 38 cruisers; heavy and light; 112 destroyers; 65 submarines and numerous auxiliary warships of various sizes. Japanese naval aviation was world-class; its aircrews were the best trained and the most experienced. The personnel of the navy, both officers and enlisted men, comprised a professional elite unsurpassed in training, bravery and dedication. Yet, certain strategic, organisational and technological decisions made by the navy in the interwar period proved fatal. To those decisions should be added inherent national impediments, many of which were beyond the navy's control but which in the end were ruinous to the navy's prospects for fighting a modern naval war'.

Of the seven navies reviewed, it is the US Navy which emerged from the conflict as the most powerful naval force in history. The review in *On Seas Contested* gives convincing arguments why this was so. In the interwar period, the US Navy was structured to engage the IJN in a mid-Pacific fleet action. War Plan Orange was practiced throughout the 1930s and in it the battlefleet, supported by carrier aircraft and cruisers scouting ahead, together with submarines, would fall upon the Japanese fleet in a titanic, decisive battle. Unlike the IJN however, the USN's officers were encouraged to act independently to achieve battle outcomes, in contrast to the initiative-stifling regimes of the IJN.

Following a comprehensive overview of Navy department administration, the US section discusses commander-in-chief Admiral Ernest King's philosophy of delegating authority, thereby instilling initiative as a fundamental tenet of naval command. Tactical doctrine developed in the interwar

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period was based on experimentation in live exercises and tabletop maneuvers, which encouraged doctrinal development flexibility. King built on this service-wide emphasis on initiative. However, the need for the navy to fight a two ocean war forced commanders and their personnel and ships to be thrown together without adequate combat preparation; a confused tactical situation which was exemplified in the Guadalcanal campaign. Theses lessons were rectified by greater centralization and standardization of procedures which was essential because of the enormous personnel and material expansion of the wartime USN. By August 1945 USN personnel numbered 325, 000 officers and over three million enlisted.

The USN section extensively covers all the naval warfare disciplines; surface warfare alone comprises five pages, together with diagrams. The Material section provides a well ordered description of surface force development. A possibly too detailed coverage of fire control systems is indicative of the wealth of data on the USN, which also includes industry and the superb logistics support provided during the island-hopping Pacific campaign.

While acknowledging the USN's tardiness in implementing coastal convoys as a counter to the Kriegsmarine's 'Operation Drum Beat'– which saw merchant ships torpedoed within sight of eastern US coast beaches in early 1942 – the contributor might have included some mention of the Pearl Harbor intelligence failure in the Intelligence section. Apart from this minor observation, the USN coverage excels as an overview of this huge subject in just 40 pages.

It is in the Great Britain section that some readers may find a slight disappointment because some of the text is overly complex and of questionable expression. For example under 'Personnel', the contributor states that 'the RNVR (Royal Navy Volunteer Reserve)…underwent massive expansion – to 48, 000 officers and 5, 000 ratings – because most of the wartime recruits went into the RNVR.' The 5, 000 ratings figure must surely be erroneous as a 'wartime expansion.' This figure might be accurate for RNVR ratings enlisted prewar and mobilised in the first months of the war. As the contributor correctly points out, all wartime enlisted ratings were entered for 'hostilities only' into the RNVR. The remainder of the 'Personnel' section dwells on unnecessary and confusing details of training establishments. 'Surface Warfare' is disposed of in 10 lines of text, introduced by the statement that 'in many ways, the Royal Navy expected that the Second World War would follow the pattern of the first.' There is no mention of gunnery advances, fire control systems – including radar – or light forces' surface warfare doctrine in the prewar era. The 'Material' section provides a readable and comprehensive overview of RN surface combatant development; however – when turning to submarines – the contributor lists submarine classes in overly complicated detail, rather than a concise and considered assessment of individual classes' strengths and weaknesses. These minor deficiencies are all the more noticeable because of the otherwise generally comprehensive and informative treatment afforded to the Royal Navy.

Finally, the Soviet navy section is a dismal read. Stalin's military purges removed most of the experienced senior commanders in the immediate prewar period, to be replaced by under-educated and inexperienced officers whose orders had to be countersigned by political officers. The exigencies of Russia's war meant that much of the navy fought on land because ships – particularly the Baltic Fleet – were immobilized by the German blockade. Despite the large size of the submarine force, its contribution was minimal, as was that of the motor torpedo boat force. Soviet officers were unable to exercise initiative and develop tactics and they greatly overrated their successes. For example, submarine commanders attacked with single torpedoes and claimed targets were sunk if they heard an explosion after firing. Soviet submarines sank 91 merchant ships from 1941-45 and MTBs only 22. Poor reconnaissance, coordination of attacks and tactics could all be traced back to the prewar purges and the expansion of personnel which disrupted naval education. The contributor assesses that the Soviet navy performed well in evacuations, fire support to the army and amphibious operations while individual officers and sailors fought with courage and determination.

Useful maps and tables, such as orders of battle at the war's beginning and naval bases aid the text. Photographs – four per section – provide a flavour of the navy in question. However, some might have been better chosen: 'a prewar shot of Japanese "Sea Scouts" practicing semaphore on the deck of the *Mikasa*' and 'Wartime recreation: US Coast Guardsmen…swim under the bow of….a Japanese transport…beached in the November 1942 battles for Guadalcanal', could possibly have been replaced by suitable examples of combatant vessels or their crews.

These minor criticisms should not deter the naval history enthusiast – or someone who simply wants a good concise naval reference book – from acquiring a copy of *On Seas Contested*.

Visions from the Vault

Perth refuels from USS Ranger – North-West Indian Ocean 1980's

During the 1970s and 1980s the Indian Ocean became the scene for much Cold War posturing between the Western powers and the Soviet Union, particularly after the Soviet invasion of Afghanistan in 1980. Between 1981 and 1985 the Royal Australian Navy maintained a semi-permanent rotation of a destroyer or frigate in the North West Indian Ocean. The Australian involvement represented an independent national task, but it was coordinated with the United States Navy, and the RAN's vessels invariably operated with the American carrier battle group on station. Close encounters with deployed Soviet forces were frequent, with regular over flights by 'May' maritime patrol aircraft and shadowing by a variety of intelligence gathering vessels. The first RAN ship involved, the guided missile destroyer *HMAS Perth*, was deployed between January and June 1981. She is seen here refuelling from *USS Ranger* on 10 February 1981.

ANI On-line: A guide to the new website.

Our new website is now on-line! In addition to the features available on the previous site, the new site also features a library of past journals, a discussion forum, a news section and member list. This short guide is designed to help you take full advantage of the new features.

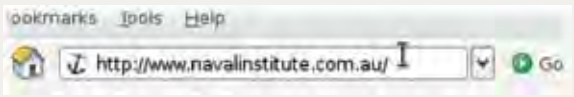

Figure 1

Obtaining an account

In order to access the new features of the site you must have a user account for the website. If you have a current subscription to the ANI, navigate to the website www.navalinstitute.com.au using your web browser (figure 1), click the "Members Login" menu item (figure 2), then click the link to download an application form. Fill in the form, then fax or post it to the ANI Business Manager. Once your account has been created, you will receive an email that outlines your member ID and password.

Figure 2

Figure 3

Logging in to your account

Once you have your account details, you are ready to login and access the new features of the site. In order to login, navigate to the website (figure 1) and click the "Members Login" item (figure 2). Enter your member ID and password as they were provided to you, then click the "Login" button. The case of the member ID and password are important: i.e. "CaSe" and "case" are considered entirely different words by the authentication system. Each letter of the password will appear as a single "*" to prevent others from seeing your password as you type. If you have entered your details correctly, you will be presented with the news page. The grey status bar at the top notifies you of the account you are using (figure 4). You are now able to access all of the new features of the site.

Figure 4

Logging out of your account

In order to protect your identity and to prevent malicious use of your account by others, you must log out of the site when you are finished browsing. This is especially important on public computers. In order to log out, click the "Logout" link in the grey status bar (figure 4).

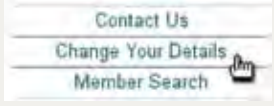

Figure 5

Figure 6

Changing your details

When your account is created, only your member ID and password are stored in the system for privacy reasons. However, you may provide other details that are visible to other ANI members. In order to change your details, login and click the "Change Your Details" menu item (figure 5). Then select the "change" link (figure 6) next to either your personal details or password. Change the text appropriately and click the "save" button (figure 7).

The personal information that you provide will be visible to other members of the ANI but will be hidden from members of the general public. You may provide as much or as little detail as you wish but none of the fields are compulsory. However, you may not change your member ID as it is the link between the on-line database and our off-line records.

Figure 7

Figure 8

Participating in the forum

In order to post topics and replies in the discussion forum, first login and click the "Forum" menu item (figure 8). Then select a forum that you would like to view by clicking its "View Topics" button (figure 9). Select a topic that you would like to read by clicking its "View this topic" link (figure 10). If you are not interested in any particular topic, you may add your own by clicking the "Add New Topic" button (figure 10). Similarly, once you are viewing a topic, you may post a reply by clicking "Add New Post". Fill in the heading and body of your reply and click the "Submit" button to add your reply to the topic. If you change your mind while writing your reply, you may click the "Cancel" button and your reply will not be added to the topic.

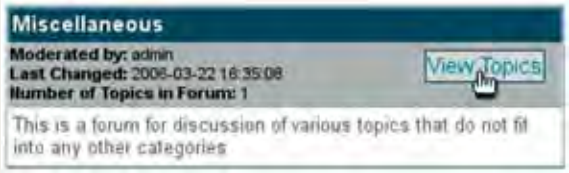

Figure 9

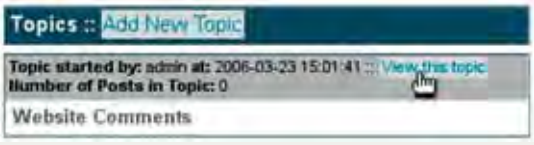

Figure 10

Further questions

If you have specific questions regarding website features or even a feature request, post a topic in the "Website Questions" forum and a site administrator will reply. Otherwise, happy browsing!

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Use single quotation marks for quotations. Do not use hyphens for any rank except Sub-Lieutenant.

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So:

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• *to encourage and promote the advancement of knowledge related to the Navy and the maritime profession; and*

• *to provide a forum for the exchange of ideas concerning subjects related to the Navy and the maritime profession.*

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