GEOFF SLOCOMBE // VICTORIA

DEPLOYABLE MINE COUNTERMEASURES

Mines are the ultimate asymmetric warfare weapon in naval operations. Whether buried, tethered, concealed, or drifting they have the ability to deny access to a choke point, harbour, amphibious landing site, or even to deep water passages. They are very effective anti-access/area-denial (A2/AD) weapons.

The RAN's Huon Minehunter Coastal (MHC) Class is claimed to be the most advanced of their type in the world. They were commissioned into the RAN between 1999 and 2003, making them now up to 20 years old.

According to the RAN 'Like her sister ships, lead ship Huon is made of fibre reinforced plastic and has a unique single skin solid hull that has no ribs or frames and provides high underwater shock resistance and very low magnetic and noise levels. This hull is designed to flex inwards if an undersea explosion occurs nearby. All machinery/equipment is mounted on cradles or suspended from bulkheads to further enhance resistance to shock damage and protect ship systems.'

For their mine countermeasure operations, the ships are fitted with a GEC-Marconi Type 2093M variable depth sonar capable of detection ranges in excess of 1,000 metres ahead of the ship. When a mine is detected in a water column or on the seabed, the ship will 'hover' about 200 metres from the contact. Each vessel carries two Saab SUTEC Double Eagle mine disposal vehicles which will then be sent to investigate and neutralise the mine threat. In some situations, clearance divers will be sent.

The 2016 Defence Integrated Investment Review noted in sections 4.38 and 4.39 that 'Defence will extend the life of four Huon Class Coastal Mine Hunters until the 2030s, through a Service Life Extension and Capability Assurance Programme to be conducted between 2018 and 2025.

'Extending the life of four of the existing Huon Class fleet will provide time to develop and evaluate remotely operated mine countermeasures and bathymetric collection systems to inform capability development. This could include the potential future option of a modular, mine countermeasures system that could be deployed from a range of non-specialist vessels, subject to developments in technology.'

The latest information available suggests that the project SEA 1179 Phase 1 to extend the Huon Class's life to the 2030s has been scaled back. It will only concentrate on dealing with the vessel's obsolescence to keep four of them operational until Navy decides on its new mine countermeasures capability requirements and acquires them.

Essentially there are three choices Navy will be considering:

- Stand-off MCM which assumes the minefield borders are known, minehunting is done exclusively with unmanned systems carried on larger vessels than the current Huon Class,
- Non Stand-off MCM which is today's capability with the Huon Class. Typically, it comprises small vessels and clearance divers in the minefield, limited unmanned capability,
- Hybrid MCM which has some platform-fixed mine countermeasure capability on board and also deploys unmanned MCM capability.

Navy started their SEA 1778 Phase 1 project by considering deploying unmanned MCM equipment on combat vessels which could travel at speed to the suspected mine field which needed to be neutralised. They probably now give more weight to the risks of having high value combat vessels, deployed on MCM, where the extent of the suspected or actual minefield is not known.

Navy knows the challenges which need to be overcome with current Huon Class MHCs, which can operate in a minefield. They know that the MHCs are really built for Australian waters, with serious limits to their seaworthiness, transit speed and endurance. Their self-defence capabilities are limited and there are not really many upgrade options. One major plus is they can deploy their ROVs in very shallow water, for example as found in amphibious operations.

Navy is deadly serious about using unmanned vehicles for mine countermeasures. Australia's Autonomous Warrior 2018 exercise, hosted last November by Navy at HMAS Cresswell, Jervis Bay NSW, was observed in part by APDR. It involved all four domains - air, maritime (surface, sub-surface), ground and cyber/artificial intelligence. It was the largest activity of its kind ever conducted by the Five Eyes countries (Australia, Canada, New Zealand, United Kingdom, United States) and directly involved 500+ personnel each day.

Earlier in 2018, lead-in trials conducted at HMAS Cresswell had already achieved world firsts by operating multiple vehicles in all domains concurrently on one system. AW18 itself was the first time up to 38 autonomous systems had been directed in sequenced scenarios under the control of one command system.

THALES AND MINE COUNTERMEASURES

In a recent positioning paper, Thales in Europe stated 'Mines pose an ever-present threat to naval operations and commercial shipping. They are cheap, easy to deploy, and deadly. Numbers of low- tech mines are rising, and are increasingly matched by higher-tech variants, harder to find, and often programmed to detect specific signatures or use torpedoes.'

At the end of 2018 Thales and Aquabotix announced that they had signed a Memorandum of Understanding for strategic cooperation in the research, design and development of a rapidly deployable Mine Counter Measures (MCM), Rapid Environment Assessment (REA) and Military Hydrographic autonomous system mission solutions.

This project is a collaboration with Australian Academia and SMEs including the University of Sydney, University of Technology Sydney, Australian Centre for Field Robotics (ACFR), Flinders University, Western Sydney University, Mission Systems Pty Ltd and Ineni Realtime Pty Ltd. It will focus on the development and integration of Aquabotix's next generation ultra-portable swarming technology. To achieve a variety of missions, swarms of micro-sized Autonomous Underwater Vehicles (AUVs), hosted by a larger AUV or Autonomous Surface Vehicle (ASV), are deployed to prepare and facilitate an amphibious landing zone to support any Advanced Force.

This task is enabled by the integration of next generation micro-sized Autonomous Underwater Vehicles (AUVs) with an autonomy engine that will plan the mission, task the swarm and monitor the rate of mission completion, rapidly adapting to changes in environment throughout the mission while coordinating with the parent task group. This advanced autonomous capability will greatly increase the speed and that mined areas can be cleared in the littoral, delivering a game changing advantage by minimising the adverse impact of mines on naval and commercial shipping activities

both domestically and abroad.

Thales said the technologies of artificial intelligence, big data, connectivity and cyber security are now reaching the levels of performance that will enable transformational change in the capability to autonomously undertake hydrography and mine countermeasures missions. With the potential to further remove ADF members from harm's way and accelerate the speed of mission execution, this initiative will contribute to enhanced maritime security and freedom of action for amphibious forces.

Thales is looking to harness the technologies and capabilities of its recent acquisitions of Guavus and Gemalto to develop unparalleled solutions for the capture, analysis and secure distribution of increasingly large quantities of data that will need to be processed as the technology evolves.

Globally, Thales is leading projects such as the Maritime Mine Countermeasures Programme (the cornerstone of future Mine Counter Measures for the British and French navies). Which are demonstrating substantial developments in autonomy, integration, trials and certification. These advances will be drawn on in Australia to deliver a world class capability for the Royal Australian Navy.

The Indian Navy has just closed a $42 Million deal with Thales Australia for eight mine counter-measure clip-on influence sweeps.

STEBER HAS CONTRACTED TO BUILD UNMANNED NAVY VESSELS FOR MCM

In February 2018 well-known fibreglass boat manufacturer Steber International, located in Taree NSW, started work on the first of the five new vessels to support the RAN's SEA 1778 project. They had been awarded a contract worth more than $6 million by Thales Australia to deliver the five 38-foot vessels to support the RAN.

The unmanned surface vessels will have a top speed of 25 knots, a payload in excess of three tonnes and feature a new naval paint scheme. At the time, Steber general manager Alan Steber said the project will not only support more jobs at the company, but will also open up opportunities to join the Thales global supply chain.

"The vessels are being built to strict specifications, including Australian Marine Safety Authority requirements, involving surveyors and naval architects. In recent times we have ramped up our presence in the defence capability space with development of the Bluebottle range of unmanned surface vessels, and now this contract is a win-win for the Commonwealth of Australia and Steber International" he said.

These Steber vessels comprise three configured as Mine Countermeasures Support Boats and two configured as Unmanned Surface Vessels (USV). They will deploy mine countermeasures systems used to protect RAN assets.

Steber is also a key partner with NSW's Ocius Technology in the innovative Bluebottle Programme. The Bluebottle unmanned surface vessel runs on solar, wind and wave energy and can remain at sea for months at a time, offering the potential for future cutting-edge capability enhancements.

SONARTECH ATLAS SEAFOX®

The SeaFox® system is a mine disposal system based on the most advanced concept using the Expendable Mine Disposal Vehicle principle (EMDV). The system is effective against long and short tethered mines, proud ground mines and floating mines.

Small, unmanned underwater drones are used for direct disposal of historical and most modern mine types; identical, reusable vehicles (without charge) are used for inspection, identification and training purposes.

The SeaFox® system mainly comprises a console, a launcher and the SeaFox® vehicles. The system

can be delivered as a stand-alone or a fully integrated version.

There are two different vehicles ensure quick disposal of mines during operation from a combat vehicle.

The cost-saving reusable identification version is called SeaFox I. However, the Inspection vehicle (SeaFox I) can be fitted with Cobra. COBRA is an acronym for Clip-On-Buoyancy neutral ROV Accessory and can be attached to SeaFox I for very shallow water mine neutralisation. Using the SeaFox I the COBRA is positioned and fixed onto the mine target. COBRA is furnished with a Nail Attachment Unit (NAU) which enables the device to hold on to the target while the SeaFox I safely returns to the ship. After recovery of SeaFox I, the COBRA charge can be ignited in order to cause a high order detonation of the mine target by handheld initiator, surface initiation float, tow-behind float, and soon an acoustic initiator. Other methods of initiation are possible.

SeaFox C is a fibre-optic guided, one shot mine disposal vehicle is used for semi-autonomous disposal of naval mines and other ordnance found at sea. It is able to automatically relocate previously acquired

MINE COUNTERMEASURES
Interview

While preparing his article, APDR's **Geoff Slocombe** interviewed two veterans who in both Navy and civilian life have had wide experience with mine warfare strategies and technologies. **Darren Burrowes** is Chief Technology Officer of Australia's Blue Zone Group. His colleague **Neil Hodges** is Blue Zone Group's Chief Executive Officer.

APDR: Where do you think deployable mine countermeasures are heading?

Darren Burrowes: We have a few ideas about that. In March this year I was at Underwater Defence & Security in Southampton. It was a very good conference covering mine countermeasures (MCM) and anti-submarine warfare (ASW), with the real thought leaders from industry and defence attending.

APDR: What was the major message that you heard?

Darren Burrowes: The biggest takeaway for me was that there is a split in Europe regarding the way forward on MCM. The Belgian/Dutch project proposes to use maritime unmanned systems (MUS) operating from outside of the minefield. The ships used to transport the MUS will not be protected from shock damage etc. In contrast, the German and Italian Navies have concluded there is no real way to know the extent of the minefield.

APDR: So, is the first step to map the extent of the minefield?

Darren Burrowes: Opposition forces will not advertise this and a combination of a lack of information, tactics, and weather can place a ship in a minefield very easily. The German and Italian Navies have determined that an MCM vessel capable of operating inside a minefield will be required. MUS will also be used and in order to operate them the MCM vessel size must grow to the 1,000 to 1,200-tonne range.

APDR: Which approach do you believe is more suitable for the RAN?

Darren Burrowes: We agree most strongly with the German/Italian point of view. While "keeping the man out of the minefield" is a sexy tagline it is not achievable in the foreseeable future. MUS will take some time to get right and will be very vulnerable to jamming of GPS, communications systems and even tactics as simple as fishing nets deployed around minefields.

APDR: Having found mines, classified them and identified their type(s), how can Navy neutralise them?

Darren Burrowes: My point is that only a Remotely Operated Vessel (ROV - operated via a tether), or Divers, can be used for mine disposal. This is the final and most critical step in MCM. There is no such thing as an "underwater missile" to point and shoot at a mine. The ROV must be piloted to the mine to lay a mine disposal charge or detonate on impact. ROVs like the Huon Class's Double Eagle will remain an essential capability for mine countermeasures in the foreseeable future.

APDR: What are the main minehunting challenges?

Neil Hodges: MCM is a dull, dark and dangerous occupation. An enemy will lay mines in places that make finding and neutralising them very difficult. In addition to actual mines, an enemy will lay non-mines, such as oil barrels, to slow the MCM process. Add in a few fishing nets and bingo, autonomous vehicles are rendered largely ineffective.

APDR: So, you think the Belgian/Dutch approach of using vessels unprotected against explosive shock while deploying autonomous vehicles from outside the minefield is an insufficient approach?

Neil Hodges: We believe that autonomous vehicles and unmanned surface vehicles provide a fantastic force multiplier to dedicated MCM platforms. But autonomous underwater vehicles and unmanned surface vehicles alone may potentially leave a country with no effective MCM capability.
The German Navy sums it up well when they say "Hunt where you can, sweep where you must! Unmanned where you can, manned where you must!"

APDR: You were closely associated with the trials programme for the Huon Class. What are the current prospects for this fleet, given that two vessels have already been sold off?

Neil Hodges: Huon Class MCMVs are purpose built to safely search, classify, identify and neutralise mines. At this time autonomous systems alone are not able to achieve what a Huon Class MCMV with its Double Eagle ROVs is able to. The RANs decision to keep and extend the life of the Huon Class MCMV is to be commended.

APDR: What is the future for the Huon Class and their successors?

Neil Hodges: Navy have to make a decision about the future which will take time. This means that the remaining MHCs have to be kept going to avoid a capability gap. The MHC obsolescence issues will need to be worked through until Navy get their next fully functional mine countermeasures system.

APDR: Do you consider Navy's mine countermeasures would best be served by a combination of shock-protected manned surface vessels, much smaller unmanned surface vessels to map, classify and identify the types of mines there, and tethered ROVs to work with divers to neutralise the mines?

Neil Hodges: That's correct. The RAN has the opportunity to refit the Huon Class and prepare it for a future capability that contributes to national and coalition forces in our area of interest. Maritime Unmanned Systems are coming. However, they must be deployed from a ship of some type and to assume that the boundaries of the minefield can be conveniently "known" is wishful and dangerous thinking. Considering upgrade of the Huon Class Minehunter, which in my mind would include unmanned underwater vehicles, to meet future mine warfare threats should be an active concern of naval staff.

positions of underwater objects within minutes with the integrated homing sonar.

After relocating, these objects can be identified using the onboard CCTV camera and destroyed by the use of a built-in, large calibre shaped charge. The one-way concept significantly reduces the disposal time and extends the operational envelope.

The system has been fully qualified for military purposes and has been introduced in large numbers into various navies. It is deployable from a wide range of carrier platforms, including dedicated MCM vessels, surface combatants, craft of opportunity, rubber boats and helicopters.

EXTENDING THE SERVICE LIFE OF HUON CLASS MHC

In the APDR Interview of Darren Burrowes and Neil Hodges of Australia's Blue Zone Group, as part of this article, Neil Hodges said "Huon Class MCMVs are purpose built to safely search, classify, identify and neutralise mines. At this time autonomous systems alone are not able to achieve what a Huon Class MCMV with its Double Eagle ROVs is able to. The RANs decision to keep and extend the life of the Huon Class MCMV is to be commended.

"Navy has to make a decision about the future which will take time. This means that the remaining MHCs have to be kept going to avoid a capability gap. The MHC obsolescence issues will need to be worked through until Navy get their next fully functional mine countermeasures system."

When APDR approached Thales Australia for an explanation of their role in the Huon Class Service Life Extension and Capability Assurance Programme, their answer was guarded, indicating that it is probably still a work-in-progress between Thales and Defence.

However, there is no doubt that Thales has a great deal to contribute to technology studies, designs, development of prototypes, and other valuable work in helping Defence select its future mine countermeasures systems.

During the 2019 election campaign the Coalition Leader Scott Morrison announced in Perth 'A re-elected Morrison Government will invest up to $1 billion to increase our defence capabilities by building three naval vessels in Henderson, Western Australia – two mine warfare support vessels and a hydrographic vessel.

'Our plan to construct two further mine warfare support vessels at the Henderson shipyard precinct in West Australia is part of our new mine warfare strategy.

'We will bring forward the replacement of the Huon-class mine hunters from the 2030s to the mid-2020s, as part of our new Maritime Mine Countermeasures Programme (to be known as SEA 1905).'

RAN'S FUTURE DEPLOYABLE MINE COUNTERMEASURES

In the near future these will be as now, based on Huon Class MHCs, with their special sensors and equipped with twin Saab Double Eagle unmanned underwater mine disposal vehicles. The question remains open for the moment on whether or not the RAN's Fleet will include specialist mine hunting vessels working in conjunction autonomous underwater mine detection, classification, identification and disposal vehicles.

There are significant risks in using "normal" warships without blast protection, to deploy unmanned vehicles for mine countermeasures, especially where the minefield boundaries have not been established with certainty and kept continuously under review.

Clearly the role of unmanned surface vehicles, like the Steber ones currently being constructed, will be key in mapping any suspected minefields.

Whatever the final chosen capabilities, mines of all sorts will remain a serious threat to both surface manned vessels and submarines.