Tac Talks

Issue: 24 | 2021

Organic Mine Countermeasures in the littoral environment

By LEUT M.E. COOK

© Commonwealth of Australia 2021

This work is copyright. You may download, display, print, and reproduce this material in unaltered form only (retaining this notice and imagery metadata) for your personal, non-commercial use, or use within your organisation. This material cannot be used to imply an endorsement from, or an association with, the Department of Defence. Apart from any use as permitted under the Copyright Act 1968, all other rights are reserved.

Introduction

Historically Mine Countermeasure (MCM) vessels were designed for WWII and Cold War applications, which emphasised clearance of our ports/Q-routes and gave amphibious assault low priority. Today's naval mission requires regional contingency operations where allied forces must be capable of projecting power ashore. For example, in February 1991 the USN lost command of the North Arabian Gulf to more than 1300 mines Iraqi forces had shown that. Mines severely damaged two Navy ships and commanders aborted an amphibious assault for fear of more casualties.[1] This event demonstrated the difficulty of executing an amphibious assault where the enemy's coast is defended with mines, obstacles, and shore fire. To fight effectively in the littoral, naval forces must develop a capability for inserting personnel and materiel from sea to shore where the shallow water and beaches are defended.

Aim

This paper provides a framework for developing naval MCM concepts in the littoral environment, focusing on operations circa 2015, with organic MCM. It describes the anticipated battlespace, states the objectives for developing MCM capabilities, and describes required operational capabilities to support MCM requirements for enabling Sea Control and Maritime Power Projection when mines and obstacles have been deployed.

Littoral MCM concept

The ADF plays an essential role in shaping the international environment through means such as the deployment of forces, defence cooperation, security assistance and exercising with allies and it requires significant Forward Presence involving naval forces in often crisis-prone regions.

Forward Presence and Maritime Influence are themes of Australian Maritime Doctrine 2010, which is supported by the Navy's concept of Sea Control and Maritime Power Projection.[2] The common link between these concepts is a clear requirement to manoeuvre naval forces from the sea into the littoral. The concept foresees the use of the sea as a manoeuvre space to project combat power ashore. With the shift in focus by naval forces from open ocean strategies of the Cold War to the littoral regions, the potential for mines to aggravate naval plans has increased. Naval forces must have an effective MCM capability to operate in distant waters, in the early stages of hostilities, to protect amphibious forces and allow swift Ship to Objective Manoeuvre (STOM) during littoral power projection operations.

The RAN has to transition from legacy MCM operations, which focus on port break-in/out, to operations involving expeditionary MCM, in forward operating areas, or "littoral MCM". MCM in littoral power projection will facilitate manoeuvre warfare by providing a capability for applying strength against weakness. This requires the ability to quickly identify and exploit such weaknesses rather than pursue an attrition approach to MCM.[3] This concept means the commander must subject the enemy's mines and obstacles to extensive surveillance and reconnaissance to locate and avoid them altogether or manoeuvre through available gaps. When avoidance is not an option and adequate gaps are not readily identifiable, rapid, in-stride breaching of the enemy's mines and obstacles will be conducted. Organic MCM will provide forward-deployed naval forces with the capability to accomplish early mine detection, classification, identification, avoidance, and if achievable, neutralisation at speed. Supporting MCM forces that are specifically trained and equipped will reinforce if the risk associated with organic MCM is no longer acceptable, or when the mission demands a capability beyond the capacity of organic systems.

Changes in future operations will place a premium on highly mobile naval forces with responsive, accurate and specific MCM capabilities that are continuously available to the Task Group Commander. Current MCM capabilities do not satisfy the requirements of the future battlespace

environment because they are limited by lengthy timelines for MCM vessels to arrive in the area of operation, minimal reconnaissance means, and an operational pause that is created by the slow and deliberate nature of MCM operations. This in turn means the advantages of surprise and relative operational speed are lost. Limitations on the RAN's capability for conducting truly rapid breaching and in stride MCM operations will yield tactical advantages to the enemy.

This concept examines future operational capabilities and considers the level of hostilities from intra-national disputes to war, across a range of military operations and battlespaces. This concept focuses on factors that affect MCM in support of operations in the littoral and briefly discuss four probable mine threat scenarios:

a. Transiting the Sea Lines of Communication (SLOC) / Choke Point;
b. Ship to Objective Manoeuvre (STOM) - the seamless transition of operations from deep water to the objective inland.
c. Amphibious Task Group Operating Area; and
d. Operations in support of port break-in, break out and clearance.

Anticipated threat

In the future, the RAN must be prepared to face a range of mine threats potentially far more dangerous than those available today. Today more than 48 of the world's navies have mine-laying capabilities and access to mine inventories. At least 30 countries are developing and manufacturing sophisticated new mines and 20 of these are known, mine exporters. Although often described as "poor man's artillery", mines present a significant threat on land, the beach and in waters shallower than 100 meters.[4] This is where the greatest number of mines are most effective and where power projection missions require Australian forces to operate.
These nations may field advanced mines, often with the specific goal of defeating RAN objectives. They will likely mine choke points, SLOCs and, in addition, use obstacles in protective and defensive fields as a means to reduce the mobility of weapons at anticipated landing or port break-in sites. Minefields and obstacles can be laid on land, in deep to shallow water, in very shallow water, in the surf zone and over the beach. These defences along with the physical littoral environment will be an integrated part of an adversary's overall plan.

The diverse range of geography and environment often experienced within the littoral environment intensifies the problems and challenges associated with MCM battlespace knowledge. The diverse physical operating environment above and below the water's surface, and overland, provides the foundation for MCM planning, preparation and operations. There are several geophysical parameters to consider when operating in the littoral. For example, ocean fronts, freshwater run-off, tidal fluctuations, synoptic and local weather disturbances. These phenomena make it difficult to accurately observe and forecast environmental parameters and, most importantly, predict their effect on sensors, and thus military operations, especially MCM. Successful MCM operations will provide naval forces with the ability to manoeuvre and protect seaborne and land force assets critical to the mission. The ability to strike with little prior notice will remain a critical requirement for future naval operations. The littoral environment and minefields demand significant attention and resources to avoid their restricting ability to manoeuvre at, or from, the sea. While successful MCM alone will not ensure a successful mission outcome, the effect of a mine strike might be enough to threaten the mission outcome due to delays caused by the loss of capability for projecting power ashore.

Future operations

Military forces of the future will fight in several different theatres, and naval forces will often be required to lead such operations as they combine mobility with a manoeuvre to significantly expand the battlespace. Mines and obstacles have the potential to hinder that ability.
To accomplish the mission the Commander must know the role that mines, obstacles and the environment play in the enemy's overall offensive/defensive plan. The Commander must be

aware of avoidance techniques, the force's MCM capabilities and Self Protective Measures (SPM). The Commander must judge whether the operational advantages gained from crossing into a Mine Danger Area (MDA) outweigh those anticipated from inaction or avoiding the minefield altogether. To meet that challenge, the capability must exist to identify, collect and disseminate intelligence and mark the limits of the MDA. In certain cases, the Commander may be given no alternative but to breach a minefield and perform limited clearing operations in support of the overall operation. In small-scale operations, the objective may be to clear all mines instead of avoiding them.

Therefore, in a mine threat environment, MCM operations are a key enabling activity used to achieve manoeuvre warfare and must be given a high priority and be fully integrated into planning. Such planning will ensure the Commander's ability to maintain the flexibility that freedom of manoeuvre provides. Organic MCM is integral to the forward-deployed force and must be capable of spanning the range of military operations. It must be equally effective at negating the impact of a mine threat on a dispersed force, or forces operating nearby. Supporting forces will primarily be employed for large area clearances, when the battlespace permits, and for follow-on MCM operations.

MCM tasks and infrastructure

MCM operations support and enable the Commander in his or her ability to accomplish the mission. The littoral MCM concept forms the basis for the MCM infrastructure (organisation, materiel, doctrine, education and training) and MCM tasks (actions required to complete MCM missions), which build upon each other to provide naval forces with the capability to counter the mine threat. MCM tasks can be grouped under four general types:

a. Intelligence preparation;
b. Deterrence and prevention;
c. Surveillance and reconnaissance operations; and
d. Clear, breach and avoid.

Intelligence Preparation

Intelligence derived from a combination of human sources and platforms will be essential. Improved national, theatre and tactical sensors, processing and analysis are required to assess enemy mining intentions, capabilities, locations of mines and barriers, and the composition of overall defences. The results of these efforts must reside in a database that can be assessed, fused, and made available to the Tactical Commander at short notice.

Deterrence and Prevention

In peacetime forward presence, operations, such as training and exercises, are a form of deterrence. They allow peacetime intelligence collection of the operational posture of potential adversaries by identifying mine stockpiles and dispositions of mine-laying forces, whilst convincing potential adversaries of the RAN's MCM capabilities.

Crisis/conflict pre-emption reduces an adversary's ability to deploy mine-laying forces by using either lethal or non-lethal force to deny the use of mines, or the ability to effectively deploy them. When Rules of Engagement allow, offensive measures can achieve prevention through the neutralisation of enemy mining capabilities and can deny access to critical areas for mine-laying forces.

Surveillance and Reconnaissance

Early and sustained surveillance and reconnaissance operations are fundamental to MCM operations. These activities are designed to allow for a rapid assessment of the seabed to determine the limits and density of the minefield. If operational surprise is imperative, then

clandestine preparations are required. Early in any campaign, commanders will require the location and extent of enemy obstacles and minefields. The identification of areas of high clutter density and exploitable areas will be tactically significant. Development of the areas and timetables for reconnaissance action requires a complete understanding of the intelligence picture, environment, objectives, timelines, and the number and capabilities of MCM assets available for the task.

There is no such thing as complete single-source surveillance and reconnaissance system and therefore the Commander requires a mix of MCM systems to achieve these tasks. This mix must be of low vulnerability, autonomous and organic to the forward-deployed force and provide rapid and wide-area detection, classification and identification. Autonomous vehicles should be recoverable and have a rapid turnaround time to provide a near real-time assessment of the mine threat and must be effective from deep water to objectives inland.

While an organic MCM capability is necessary for immediate use in some high threat scenarios, supporting MCM platforms and systems must be available for preparation, follow-on operations, post-conflict operations, and large areas (e.g., amphibious task group operating areas), when battlespace dominance is attained, and time is no longer critical to the mission. The Commander may require a large area and total mine clearance in scenarios such as small-scale conflicts and humanitarian mine clearance.

Clear, Breach, and Avoid

Following the identification and location of mines and depending on the operational situation, the Commander must decide to either destroy or mark the mines for tactical avoidance. Mine clearance operations with organic systems must have a high degree of assurance and be integral to the host platform to enable rapid 'search to destruction' of the mine threat. Other mine clearance techniques, such as influence sweeping or jamming, may be required in areas where sensor searches are ineffective, typically due to environmental conditions or mine burial. Support MCM forces will provide ‘total’ mine clearance when zero-tolerance situations exist.

The Commander must also have available “in-stride” breaching systems to take advantage of surprise to maintain momentum without causing pause or delay. These systems will be used by assault forces and must be effective against a wide range of mine threats from deep water through to the objective ashore.

MCM scenarios

The following scenarios briefly outline the threat that may be faced by forward-deployed forces. In each case, the problems associated with the scenario are different but equally challenging. The MCM tasks described above are relevant to each scenario but the difficulties in each vary. For example, surveillance and reconnaissance in a strait may be confined to a limited area when compared to an operating area, which could be thousands of square miles in size. Important to all, however, is intelligence preparation of the battlefield. The commander needs to know whether an adversary has laid mines, which areas are absent of mines and the impact on the environment.

SLOCs

SLOCs, in particular, constrained areas such as chokepoints and straits are easy and obvious targets for mining activity. Naval forces must be able to transit these high threat routes to demonstrate presence as hostilities escalate and position for forward operations and power projection. MCM operations will be imperative if timelines are shortened to meet operational demands. One method to allow for a higher speed of advance is the use of off-board organic MCM sensors ahead of the force. Mines can be electronically marked for avoidance or neutralised to allow safe passage of forces.

STOM

STOM is the tactical implementation of Sea Control. It incorporates the philosophy of manoeuvre warfare, which is based upon pitting strength against the enemy's weaknesses by avoiding defences and exploiting gaps. STOM is a radical departure from the traditional linear approach to amphibious operations. In STOM, the Landing Force will have the freedom to launch its attack from over the horizon at sea. Elements of the Landing Force will manoeuvre during the approach to the beach under the orders of their tactical commanders just as they would if attacking on land. Commanders of Landing Force units will select specific littoral penetration points for their units based on the changing tactical situation.

In STOM, the surprise is critical to success. Unlike traditional amphibious operations, which are typically preceded by lengthy and deliberate battlespace preparation, including mine/obstacle reconnaissance, marking, breaching, and clearing, STOM operations will be planned to achieve tactical surprise. Any pre-assault preparations will be performed clandestinely; many of the functions traditionally performed before the amphibious assault will be conducted in stride. STOM presents special challenges for MCM operations. The goal is to streamline the existing deliberate sequence of MCM actions to achieve a capability, which will support rapid manoeuvre by the Landing Force at sea, as well as on land. Elements of the Landing Force may be required to conduct mine and obstacle breaching from deep water to objectives located well inland. In STOM, the Landing Force cannot be constrained by a requirement to attack along prescribed lanes, as in traditional amphibious operations. Elements of the Landing Force must possess freedom of manoeuvre, both at sea and on the land, by avoiding mines and obstacles, or by conducting very rapid in-stride breaching operations.

Operating Areas

The ability of naval forces to safely transit to, and operate in, an area ensures the flexibility to project power when and where the Commander desires. Depending on the geography, operating areas may be vulnerable to mining. Furthermore, the risk of actuating influence mines increases considerably when multiple ship passes are likely within a constrained area. For this reason, early MCM preparations will be required, using the advanced deployment of autonomous, off-board organic MCM platforms. This is necessary to ensure the operating area is thoroughly searched and/or cleared and marked before the main force arrives. Organic MCM assets will continue to search and monitor the area after the main force arrives. If the battlespace environment and time permit, supporting forces will be used to augment organic assets by conducting reconnaissance and clearance operations ahead of, and during, the naval force arrival.
Port Break-in/out Operations

An opposed port break-in presents a great risk, especially against a well-prepared and equipped opponent. Consistent with the tenets of manoeuvre warfare, ports may be neutralised, or even seized, by the use of other more efficient and less costly means. Nevertheless, a port break-in operation is conceivable, especially against a less sophisticated, poorly equipped and untrained adversary.

Organic MCM forces are required to support port break-in and breakout operations. The location of the port, assessment of the mine threat, the critical need for naval forces to be underway, and immediate availability of organic or supporting MCM forces will determine the Commander's courses of action. In a relatively benign environment, such as a terrorist mining a harbour entrance, initial organic, and then supporting, MCM forces can be used to establish a precise navigable channel clear of mines. The certainty that all mines have been cleared, or that a safe channel has been established, will be at the expense of time.

When port mining is tied to other events, such as a blockade to bottle forces, the need to get forces underway may override the mine clearance confidence factor. The Commander will use the

force's organic MCM assets for mine detection and may use immediately available supporting MCM assets to assist in clearing a channel sufficient to enable the force to deploy as soon as possible.

Future capabilities

The RAN must be able to significantly reduce the time and risk of conducting operations in a mine threat environment to an easily interpreted and straightforward, 'GO/NO GO' criteria. They must have the capability to support the Commander and rapidly overcome operational pauses resulting from mines. Naval forces must develop and integrate innovative technologies, platforms, and sensors to exploit the environment through a focused and streamlined infrastructure.

Infrastructure

Education and Training

As the onus of the MCM mission moves towards a combination of organic and supporting forces, MCM education, training and doctrine must evolve with the development and deployment of these systems. The operational situation for future naval power projection forces may significantly reduce the time available for MCM Forces to accomplish their missions. As such, MCM training in the future should emphasise to commanders “Time v’s Risk” and ensure Fleet Units, both supporting and organic, carry out all MCM tasks against difficult targets, in real-world, less than favourable littoral environments. Doctrine should be developed, evaluated and revised as experience, systems and operations evolve.

Additionally, an emphasis on multi-platform MCM tactics incorporating land, air and subsurface assets must be of a high priority. Currently, Mine Warfare plays a negligible role in exercises and is usually only exercised until units begin to manoeuvre. Mines must be exercised realistically by affecting manoeuvre and making units react as they would in a realistic mined environment.

MCM sensors and platforms

Coordinated and Multi-platform MCM. If the RAN and allied forces manoeuvre or operate in dispersed formations, the mine search area will increase exponentially. Effective surveillance and reconnaissance will rely on some form of initial intelligence to concentrate the search or, in the worst case, a datum established from a casualty. Coordinated multi-platform MCM operations will optimise available sensors and systems regardless of the host platform and will ensure that the most effective capability is used, when and where it is most needed.

Platforms

Rapid and wide-area detection, classification and identification of mines, for avoidance, clearance or breaching is dependent on platform characteristics. Future platforms will require capabilities including, but not limited to, speed, precise navigation, SPM, range, endurance, communications, sensor payloads, mission turn-around time, and in the case of off-board systems, a small 'footprint' within the host platform. An important consideration will be the autonomy of the system and the constraints it puts upon the host platform’s ability to conduct other warfare missions. The mix and numbers of organic MCM platforms and sensors required to achieve mission accomplishment are key and must undergo rigorous analysis and simulation before deployment.

For large area operations, post-conflict operations, or when organic assets are not available, supporting MCM forces must be available to the Commander within a specified period.

Sensors

The harsh littoral environment markedly reduces the effectiveness of mine search and classification sensors. This degradation is most dramatic in the surf zone and river areas and requires adaptive sensors capable of overcoming poor environmental conditions at a significant standoff distance. MCM sensors must have the capability to conduct autonomous rapid mine detection, classification and identification. As the need for a high-speed manoeuvre increases so too must the need for MCM sensors' capabilities to be fully integrated with manoeuvring forces in mind. Sensors must be sufficiently trustworthy to quickly and automatically discriminate clutter and non-mine like objects from mines. Systems must be both highly reliable and produce confidence factors that enable mission objectives. Furthermore, these sensors must be able to provide real and/or rapid data feedback to operators on their performance.

Mine clearance, breaching and avoidance systems

The Commander must have the ability to confidently avoid mines or achieve neutralisation in minimum time. However, the RAN has Mine and Obstacle Avoidance SONAR (MOAS) fitted to most vessels, it is limited in its operational capabilities. Future systems must be effective against buried, ground, moored or floating mines from the deep water to the anti-invasion mine, anti-tank or anti-personnel mine on land.

An organic in-stride mine and obstacle breaching capability are required for the landing force to facilitate the rapid transition from deep water through the shallow water, surf zone, over the beach and to inland objectives. The ability to expand the opposing forces breached point is also of great importance to enable the sustainment of follow-on forces. Supporting forces and selective organic platforms will require the ability to deploy autonomous vehicles to neutralise mines using a variety/combination of methods such as influence sweeping or other techniques.

Conclusion

There is no simple solution to enemy mining. Naval forces must develop and integrate innovative technologies, platforms, and sensors, and exploit the environment through a focused and streamlined infrastructure. The RAN must be committed to the development of MCM and treat it as an equal among the other major warfare disciplines by integrating it totally into Joint and Fleet planning and training exercises. The RAN must develop both supporting and organic MCM systems which are capable of rapid deployment, high area search/detection/classification rates, with the ability to avoid or conduct rapid in-stride mine and obstacle clearance.

If the RAN expects to have an MCM capability available for future maritime power projection operations MCM must be a priority in an operational environment that focuses on littoral warfare. A reduced commitment to MCM capability will have serious ramifications for manoeuvre warfare and STOM.

Endnotes

1. Scott, T. 2011, 'TAKING MINES SERIOUSLY, Mine Warfare in China's Near Seas', Naval War College Review, Spring 2012, Vol. 65, No. 2, pg. 1
2. Department of Defence, 2010, RAN Doctrine 1 – Australian Maritime Doctrine 2010, Department of Defence: Canberra, 2010
3. Scott, R. 2001, "Organic Alternative" – Janes Defence Weekly, London, 2001
4. Janes Fighting Ships, http://www.janes.com

Bibliography

- Commonwealth of Australia, Defence White Paper 2009 – Defending Australia in the Asia Pacific Century: Force 2030, Department of Defence: Canberra, 2009
- Commonwealth of Australia, 2005, DSTO-CR-2005-0332 – Organic Mine Countermeasures, Defence Science and Technology Organisation: Canberra, 2005
- Department of Defence, 2010, RAN Doctrine 1 – Australian Maritime Doctrine 2010, Department of Defence: Canberra, 2010
- Department of Defence, 2005, Operational Concepts for Future Mine Countermeasures 2025, Department of Defence: Canberra, 2005
- Department of Defence, 2002, RAN Doctrine Manual 4 – Mine Warfare and Clearance Diving, Department of Defence: Canberra, 2002
- Love, T., 2011, You Can't Ride a Concept to the Beach: The Gaps in Australia's Envisaged Amphibious Capability, Australian Defence Force Journal Issue No 186, 2011, Department of Defence: Canberra, 2011
- Morris, B., 2010, DSTO-TR-2473 – A Process to Establish the Common Functions Performed by a Multi-Role Vessel, Defence Science and Technology Organisation Maritime Platforms Division: Canberra, 2010
- NATO, 2004, ATP-8(B) Volume 1 – Doctrine for Amphibious Operations, NATO: USA, 2004
- NATO, 2002, MTP-24(C) Volume 1 – Naval Mine Countermeasures – Tactics and Execution, NATO: Belgium, 2002
- Reid, S., 2007, 1778-01-02 – Capability Proposal – First Pass, Department of Defence: Canberra, 2007
- Sea Power Centre, 2010, Future Maritime Operating Concept 2030 – Maritime Influence and Power Projection, Department of Defence: Canberra, 2010
- United States Marine Corps, 2008, Expeditionary Manoeuvre from the Sea: The Capstone Operational Concept 2008, USMC: USA, 2008
- United States Marine Corps, 2012, Ship to Objective Manoeuvre, Concept Overview Video, MCCDC G-31G-5, 01 Mar 2012