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# Eliminating the RCN's Mine Countermeasure Vulnerabilities

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In recent years there has been significant effort devoted in the Royal Canadian Navy (RCN) toward developing and maintaining a capacity to conduct mine countermeasures (MCM). However, challenges including human resource limitations, financial restraints, and broadened operations in non-MCM areas have resulted in MCM activities becoming less of an emphasis. These factors have generated gaps across capabilities and possibly vulnerabilities within the RCN. Compared to an anti-ship missile that costs millions to produce, anti-ship mines are comparatively inexpensive, less technologically complex, and effective at denying access to the sea lines of communication (SLOC) with less chance of detection. Over the past two decades, although the RCN's frigates have practiced minefield transits, the wealth of the knowledge in MCM has existed within Fleet Diving Units (FDUs) and the Naval Reserve community aboard the Kingston-class Maritime Coastal Defence Vessels (MCDVs). The aim of this paper is to examine whether the absence of dedicated mine countermeasure vessels creates vulnerability in the Royal Canadian Navy at both the tactical and operational levels. The paper will examine the current state of the RCN's MCM capabilities and future considerations.

## The Present

`Twelve Kingston-class Maritime Coastal Defence Vessels (MCDVs) were commissioned between 1996 and 1999. They were designed for "coastal surveillance, naval reserve force training, mine countermeasures for route survey, minesweeping and mine inspection operations."[1] However, their steel construction and commercial design "have high magnetic and acoustic signatures and [they are] therefore ill-suited for employment in a mine threat area."[2] Of the 12 Kingston-class vessels, only the first three were supplied with the complete degaussing system, which reduces the magnetic signature of the ship and makes it a valuable MCM asset. Since the commissioning of the first vessels more than 20 years ago, the equipment has deteriorated and is no longer supported by the original manufacturer, making the equipment obsolete and placing the ship in danger if it were to transit a mine threat area.

Kingston-class vessels are defined as minor warships within the RCN. According to *Leadmark 2050*, the RCN's strategic vision for the future, a minor warship "is designed for a specific naval warfare function, such as mine countermeasures, but ... is not capable of combat operations against an adversary's naval forces."[3] Kingston-class vessels have very limited self-defence capabilities. With the removal of the 40mm Bofors gun, weaponry is reduced to two .50 calibre heavy machine guns and small arms. In the history of the *Kingston*-class, they have never been deployed to an active mine threat area to perform MCM. Rather, they have been used in continental defence and security assignments, including support of hemispheric anti-narcotics operations, participation in US-sponsored exercises to improve maritime security capacity in the Americas, and capacity-building and naval diplomacy exercises in West Africa, in addition to domestic operations and sovereignty patrols.

Innovations have been made to try to improve the MCM capabilities of the Kingston-class MCDVs. Route survey systems such as Side Scan Sonar (SSS), both the Klein 5500 (requires a launch and recovery system from the ship) and Klein 3000 (portable and can be operated from the Kingston-class or a vessel of opportunity) offer a peacetime capability to support domestic operations, but do not offer a viable option against a live threat. The Bottom Object Inspection Vehicle (BOIV) is a remotely-operated vehicle (ROV) that can be installed on, launched and recovered from the sweep deck of the Kingston-class. Like the SSS, the BOIV is not feasible in a live threat area. Both SSS and BOIV are tethered to the vessel and more importantly are passive tools, which "cannot measure the range of an object unless ... used in conjunction with other passive listening devices,"[4] therefore making it difficult to determine the distance to the object.

Up until recent years, the MCDVs were crewed mainly by naval reservists with the exception of two or three regular force members. However, specific naval MCM (NMCM) training and knowledge is located almost exclusively within the clearance diving and naval reserve communities,[5] thereby limiting the knowledge of MCM warfare throughout the rest of the RCN. Unfortunately, due to the nature of the primary reserves, employment is usually short term, from a couple of weeks to two years in duration, depending on time of year and position. With the high turnover of personnel and, specifically, the required MCM training, MCM readiness in the Kingston-class is lacking. It has been seen as unnecessary to maintain individual or team training in ROV or maritime survey operations based on how the ships have been employed,[6] and lack of trained personnel. Training in the employment of equipment such as the BOIV is "currently disparate and largely ad-hoc"[7] with the absence of both individual and collective training.

If the Kingston-class MCDVs are not conducting MCM, then who is doing it? Developing an effective Mine Counter Measures Tasking Authority (MCMTA) requires specialized mine warfare training which is currently conducted haphazardly. MCMTA is the "specialized command and control (C2) structure that conducts planning, coordination, evaluation and command of NMCM operations."[8] A MCMTA is usually comprised of a Commander, Naval Mine Warfare (NMW) Officer, two Watch Officers, a Coordinator and two Operators/Information Managers. As a prerequisite, MCMTA staff members are required to take both the Canadian Standard and Intermediate Mine Warfare courses, however, due to lack of qualified teaching personnel, these courses have been sporadically run, therefore creating a shortage of qualified personnel to fill the MCMTA billets. Furthermore, the MCMTA is rarely utilized thereby exacerbating the inexperience and lack of mine warfare knowledge. This inexperience and lack of the prerequisite courses could limit members of the RCN from participating at the operational level in coalition task forces or task groups.

MCM is an essential element of clearance diving activity. MCM diving "is an organic tactical component of Mine Warfare. It comprises the countering of enemy-laid mines to permit friendly manoeuvre or use of selected sea lanes through the use of Clearance Divers."[9] The two Fleet

Diving Units (FDUs), located in Esquimalt, British Columbia, and Halifax, Nova Scotia, utilize specialized equipment for the detection, classification, identification and disposal of sea mines. As well they are the only capability that can undertake active NMCM and the only asset able to dispose of sea mines in the Canadian Armed Forces (CAF).[10]

FDUs have access to SSS, the Klein 3000 model, as well as ROVs. The coordination and maintenance of the equipment currently exists in three different organizations within the formation. The ROVs have been consolidated at the FDUs while the route survey equipment (SSS) is under the coordination of two organizations – Maritime Survey and Mine Warfare cells of the coastal divisions on each coast. The fact that the equipment and maintenance is spread amongst three different organizations, means that visibility is lost on the status of scheduled and preventative maintenance of the equipment, risking equipment not being ready to deploy.

As noted, mine warfare is a core capability for Clearance Diver Officers (CLDO) and the clearance diver occupation. The training of clearance divers can take up to two years and is known to be one of the most intensive and physically demanding courses in the entire CAF. Since the clearance diving occupation is so specialized, re-certification is required every two to three years in order to remain current in the specifics of the job. Also, due to the intensity of the training, the clearance diver occupation usually graduates less than a dozen divers and even fewer CLDOs annually. Fortunate for the trade, numerous diving exercises are held around the world annually with the RCN's allies to assist in remaining current in both Canadian and NATO doctrine. However, with the long training cycle, re-certifications and numerous exercises, CLDOs and clearance divers, by the nature of their trade, are segregated from the fleet, which unfortunately leads to less emphasis and even less breadth of knowledge in the MCM aspect of warfare.

## The Future

This paper has laid out the current situation – i.e., that MCM work is concentrated in a small but well-trained element of the RCN. But is this the way things should happen in the future? The strategic vision provided in the Concept for Naval Mine Countermeasures, dated 12 September 2011 calls for "stand-off autonomous surface and underwater systems capable of being operated from any maritime platform."[11] The strategy aims to remove personnel and large assets from minefields. This is consistent with the research and development being undertaken by some of Canada's allies, including the United States Navy (USN), the Royal Navy (RN), and Royal Australian Navy (RAN). *Strong, Secure, Engaged* (SSE), Canada's current defence policy, iterates the importance to "keep pace with the rapid evolution of technology to ensure continued operational relevance, both to address threats from potential adversaries and to maintain our ability to operate alongside key allies."[12] A category of capability that has gained momentum over recent years is the development and use of remotely-piloted systems such as improved ROVs, autonomous underwater vehicles (AUVs) and unmanned underwater vessels (UUVs).

In terms of this new technology, the partnership between the RCN and Defence Research and Development Canada (DRDC) is important, leading to several innovations in MCM. DRDC is conducting extensive research on systems for the RCN to support remote naval MCM. DRDC has been cooperating with Director Science and Technology (Land) and Heriot-Watt University in Scotland. Part of their research has involved using the low frequency of the Hydrason's Biosonar broadband SSS from the UK. In their research they have been able to detect buried naval mine shapes or targets, even in areas where there is high density of clutter. This contrasts with high resolution sonar which generates too many returns for accurate assessment in areas of high density clutter.[13]

Further research and modeling are being conducted and the RCN hopes to continue collaborating with other states. Along with the low frequency sonar already mentioned, DRDC continues to develop and redefine an Automatic Target Recognition suite, which may be integrated into an AUV to assist with the automatic detection of mine shapes. In addition to AUVs, DRDC continues to assess the utility of SeeByte's SeeTrack Neptune, which is software that "provides a payload control architecture and real time autonomy engine for unmanned systems."[14] The system can generate a single integrated picture from multiple sensors and platforms, which means an area can be mapped thoroughly and ensures systematic data collection.[15] Along with DRDC's involvement, the research and development agencies from the USN and RN have become involved in SeeByte's Neptune software, forming the basis of a Maritime Architecture Framework (MAF) to facilitate autonomous collaboration among unmanned assets from multiple states.[16]

In June 2017, Kraken Sonar Systems announced that it would be teaming with Germany's Atlas Elektronik to focus on the RCN's Remote Mine Disposal System (RMDS). With the assistance of the joint developers, the RCN is looking to develop "a modular stand-off mine countermeasure capability, which is able to detect, classify, localise, identify, and dispose of sea mines and underwater improvised explosive devices."[17] The project, which was to be awarded to Kraken-Atlas, will be utilizing commercial-of-the-shelf (COTS) unmanned systems combined with portable and lightweight AUVs.

Further to the RMDS project, Deep Trekker is to supply the RCN with 12 of its latest DTG2 ROVs. These ROVs are equipped with a real-time video feed to a hand-held controller on the surface, allowing the operator to pilot the vehicle. The sensors provide the operational characteristics (including heading, depth, camera angle, pitch and roll), which allow an operator to control them. The camera system can provide a view of the environment around the ROV. Once an object is seen, the ROV can be guided towards the object to investigate and identify it.[18] This will allow ships, and divers, to keep a safe distance from suspected mines. Adding to the ability to work with allies, Deep Trekker also has contracts with both the RN and USN.

As noted, personnel and training are issues with which both the Kingston-class and FDU communities must contend. Until recently, naval reservists were mostly employed in the MCDVs. However, with the 'One Navy' concept introduced by the Commander Royal Canadian Navy in 2016/17, both reservists and regular force personnel are being employed on both the Kingston-class MCDVs and the frigates within the RCN. This blended crewing is assisting with improving the knowledge of the fleet in general and of the complexity of mine warfare.

There is still the problem of training. Designated warfare courses such as the Operations Room Officer (ORO) or Anti-Submarine Warfare (ASW) director-level course should feature a more robust mine warfare component. Furthermore, Commanding Officers and Operations Officers of the Kingston-class ships and Clearance Diver Officers should attend more specialized courses in MCM warfare. The benefits of exposing senior personnel to the intricacies of MCM warfare are two-fold. First, it would assist in establishing a cadre of subject matter experts within all aspects of the RCN and, second, there would be more people from which to draw in the event that a MCMTA was to be stood up.

What does new technology mean for mine countermeasures? Even with the development of new innovations, there will be a reliance on FDU personnel to operate the equipment if a mine must be detonated. To facilitate the coordination of the additional equipment, the operation and maintenance of all the equipment should be consolidated at the FDUs. This will provide the "potential for operators to cross train on all equipment with a centralized maintenance capability

... also provide a one stop shop for all related equipment."[19]

## Conclusion

Although the Maritime Coastal Defence Vessels of the Kingston-class were originally intended to be used for mine countermeasures, the metal construction of the ships and lack of enough degaussing equipment to conduct proper MCM operations has made them ineffective at this mission. Therefore, the RCN has been without a dedicated MCM platform even since the inception of the Kingston-class ships. The ships have proven themselves to be effective for domestic operations, counter-drug operations, and trans-Atlantic passages to conduct naval diplomacy missions. However, they have not conducted live MCM operations. In the past, the RCN has relied on allies, which have dedicated MCM ships, to clear a mine threat area while RCN ships provide protection.

How can the RCN change this situation? With a procurement cycle that takes years if not decades to select and build a dedicated platform, the RCN should focus on both commercial-off-the-shelf technology and new innovations that can be packaged or modularized and put on RCN ships. Although the RCN would not have a dedicated MCM ship, by modularizing and using vessels that are available, all ships that carried the equipment would essentially become MCM vessels.

Even though major warships practice mine transits, they are not designed to enter a mine threat area. Warships are a massive national investment so by utilizing new technology – such as remotely-operated vessels, unmanned underwater vessels, or autonomous underwater vehicles – lives and money will be spared.

The RCN is small relative to the USN but it can contribute to a coalition at both the tactical and operational level. By focusing on technology to keep on par with allies, and bolstering the RCN mine warfare training system to enable the insertion of trained personnel into coalition MCM task groups or task forces, the RCN will eliminate vulnerabilities, and keep pace with the advancements of MCM in Canada's allies.

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*The paper is a scholastic document and thus contains facts and opinions for which the author alone takes responsibility. It does not necessarily reflect the policy or the opinion of any agency, including the government of Canada and the Department of National Defence.*

## Notes

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