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IS CANADA AT RISK? ASSESSMENT OF THE RCN'S LACK OF DEDICATED NAVAL MINE COUNTER MEASURE VESSEL

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AIM

1. The aim of this service paper is to provide the Director General Naval Force Development (DGNFD) with an assessment as to whether or not the absence of a dedicated Naval Mine Counter Measure vessel (NMCMV) creates a vulnerability and if so, at what level (tactical, operational and/or strategic). The following analysis will demonstrate that the lack of a NMCMV, does not in itself, create a vulnerability.

INTRODUCTION

2. The sea mine threat has been has been a persistent presence for over two hundred years.[1] Even since the end of the cold war the threat has not diminished. To the contrary, these weapons systems are increasingly sophisticated and more accessible to non-state actors and rogue nations. Sea mines have been a part of every major conflict including the First and Second World Wars, the Korean War, both Gulf Wars, Libya and as recently as 2011, where Tehran had threatened closing the Straits of Hormuz with the use of sea mines.[2]

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[1] Office of the Chief of Naval Operations, *21st Century U.S. Navy Mine Warfare: Ensuring Global Access and Commerce,* (Washington, DC: Office of the Chief of Naval Operations, 2009), 1.; Jason Reddish, "Forgotten Fears Present Imminent Threats To Maritime Shipping And Recreation Industries: The Risk Posed By The Availability Of Sea Mines," *Tulane Maritime Law Journal* 29 (2004), 125-7.

[2] Sydney J. Freedberg Jr., "Minefields At Sea: From Tsars to Putin." *Breaking Defense.* (March 23, 2015). https://breakingdefense.com/2015/03/shutting-down-the-sea-russia-china-iran-and-the-hidden-danger-of-sea-mines/ (accessed January 26, 2018); Defence Web, "NATO Forces Clearing Sea Mines Off Libyan Coast," *Defence Web* (May 6, 2011). http://www.defenceweb.co.za/index.php?option=com_content&view=article&id=15227:nato-forces-clearing-sea-mines-off-libyan-coast&catid=51:Sea&Itemid=106 (accessed January 26, 2018).

3. This analysis will be done by assessing the significance of the treat, current Naval Mine Counter Measure (NMCM) methods, Canadian context and those of our Allies, the advantages and disadvantages of NMCMVs as well as current and future trends in the domain.

DISCUSSION

4. General Context of the Threat. As briefly mentioned above, the mine threat is real. However, further analysis is required in order to properly place that threat in context. North Korea, China and Russia have in the order of 50 000, 100 000 and 250 000 mines respectively. Furthermore, they and 29 other countries export mines to other state and non-state actors.[3] While the sheer volume of mines is impressive it is not the only consideration; quality is important as well. The most prolific mine is the Russian made M-08, which is a First World War moored contact mine. They are very simple but also inexpensive. At the other end of the spectrum, there are "more sophisticated mines [:] Mines that can drift and reposition, mines that oscillate [i.e. change the depth at which they float], mines that enhance their burial in the ocean bottom […] by digging themselves in deeper."[4] Unlike their land counterparts, sea mines are a legal and legitimate naval weapon as long as they are not drifting and there placement is clearly marked and advertised through Notice to Mariners.[5] Therefore the danger is the undeclared mine threat, since any declared minefield can simply be avoided. Often, advocates for greater investment in NMCM illustrate the seriousness of the threat by using the statistic on USN ships taken out of

[3] Scott C. Truver, "Taking Mines Seriously: Mine Warfare In China's Near Seas." *Naval War College Review* 65, no. 2 (Spring 2012), 42.

[4] Freedberg, "Minefields At Sea….

[5] Reddish, "Forgotten Fears…, 131-2.; Sydney J. Freedberg Jr., "Sowing The Sea With Fire: The Threat Of Sea Mines," *Breaking Defense* (March 30, 2015), https://breakingdefense.com/2015/03/sowing-the-sea-with-fire-how-russia-china-iran-lay-mines-and-how-to-stop-them/ (accessed January 26, 2018).

action by mines outnumbering all other causes combined (15 compared to five). However, what usually is not mentioned is that a significant portion of those taken out by mines were themselves engaged in NMCM related activities, thereby increasing the risk significantly.[6]

5. Countering the Threat. General approaches on countering the threat can be divided in two different categories: Offensive NMCM and Defensive NMCM.[7]

a. Offensive NMCM. Offensive NMCM does not actually involve NMCM assets at all since the focus is on intelligence to detect the preparations for deployment and if necessary offensive action to eliminate the mine deploying capability through a variety of conventional means.

b. Defensive NMCM. Defensive NCM is subdivided into three categories: route survey, active NMCM and passive NMCM.

(1) Route Survey. Route Survey is a peace time operation, used to establish baseline knowledge of the sea bottom in order to detect a change in the make-up of the sea bed over a period of two or more surveys. Currently, Kingston-class vessels perform this function; an NMCMV is not required execute this task.

(2) Active NMCM. These are the actual activities that involve dealing with the mines themselves. This area is further subdivided into mine hunting,

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[6] Sydney J. Freedberg Jr., "From Sailors To Robots: A Revolution In Clearing Mines," *Breaking Defense.* April 6, 2015, https://breakingdefense.com/2015/04/from-sailors-to-robots-a-revolution-in-clearing-mines/ (accessed January 26, 2018).

[7] J. Greenlaw, *Sea Mines And Countermeasures: Are Autonomous Underwater Vehicles The Answer, And Is The Royal Canadian Navy Ready For The New Paradigm?* (Master's Thesis, Toronto: Canadian Forces College, 2013), 39-45.; All of para 5 is a taken from Greenlaw, it is cited only once for ease of reading.

minesweeping and clearance diving. The first two traditionally require a NMCMV or specialized helicopter, but as will be discussed later, this is changing.

(3) Passive NMCM. Essentially amounts to a host of risk mitigation strategies, focussing on localizing the sea mine as much as possible and avoiding it. NMCMVs are not required for this activity.

6. Analysis of the Threat. Given the context of the threat and the approaches that can be used to counter it, an analysis of some of the issues is warranted.

a. Large Scale Deployment. As previously mentioned some state actors have massed significant quantities of mines which on the surface seem to be a significant threat. However, a factor worth considering is the deployment capability and capacity of a mine laying country. China, for example, only has one purpose built mine-layer that can carry 300 mines without resupply. Other platforms whether they be aircraft (the fastest delivery method), ship or submarine (the stealthiest delivery method) could carry between two and 60 mines. When one considers the logistics involved, such as transporting the mines from their ammo depot, multiple trips to put down a significant minefield or the sacrifice of multiple other missions in order to have enough minelaying assets to put down a field without need to rearm, it becomes virtually impossible for China to put out a significant minefield, in the thousands of mines, quickly and without detection. “The more mines they move, the more people and trucks they need, which makes it more likely someone

will let something slip or that US spy satellites will notice suspicious activity."[8] Once the initial mine-laying is detected interested parties would have to decide what action to take, but it is unlikely the situation would go unchallenged. Sydney J. Freedberg Jr**.,** deputy editor of Breaking Defense, an online defense magazine, postulates any form of large scale mining would likely lead to a naval standoff like the one that occurred during the Cuban missile crisis, and regardless of the outcome of such a confrontation, the mining problem would have ceased in favour of others.[9] Therefore, the probability of actually having to deal with a mine field in the range of tens of thousands is quite remote.

b. Small Scale Deployment. A small scale deployment is far less likely to strike a ship because of the vastness of the seas. Unlike a road side bomb, where placing an improvised explosive device in a road gives a high probability of detonation because there is no choice but to drive on the road, a few naval mines offer a very small chance of detonation even when placed in a "narrow" strait. Furthermore, mining any of the commercial choke points would probably hurt the offending country just as much if not more. For example if China were to mine the straits of Malacca, it would be cutting off its primary trade route for oil and it would not halt traffic merely delay it by using alternate routes.[10]

c. Offensive and Passive NMCM. History has proven that it is far easier to prevent the laying of mine than it is to remove one that is deployed. Western forces learned this lesson from the two Gulf Wars. During the first Gulf War two U.S. ships were disabled by drifting mines while in support of demining operations in order to permit an

[8] Freedberg, "Sowing The Sea With Fire….
[9] *Ibid.*
[10] *Ibid.*

amphibious landing, which was subsequently canceled due to the mine threat. Prior to the Second Gulf War, on the eve of the invasion, Australian forces intercepted Iraqi minelayers carrying mines to be deployed, thus eliminating the threat.[11] More recently in 2011, Gaddafi forces deployed three mines but were neutralized.[12]When conducting NMCM against mines already deployed, it is not always necessary to disarm the mines; identifying and then avoiding the affected areas often will be sufficient.[13]

7. Canadian Context. Considering that the mine threat to Canadian waters is very low,[14] the overall intent for Canada with respect to NMCM is to maintain "a modest, yet credible, NMCM force."[15] In the early 1990s, the defence policy of the time expressed a desire for an increase in NMCM capability, but due to the low risk in Canadian waters and the high costs, a dedicated NMCMV was not feasible. Therefore, the capability was inserted into the Maritime Coastal Defence Vessel project which was underway. Even then, a requirement for remote NMCM systems was added to the project scope but was later removed when deemed that the technology was not mature enough.[16] Compared to many of Canada's allies in the Five Eyes (FVEY) and the North Atlantic Treaty Organization (NATO), we have not invested nearly as much in this domain. This fact should not be viewed as Canada being a laggard but simply the reality that other countries have a much more vested interest in maintaining this capability. Most northern NATO countries that do, have also been dealing with mine threats in their waters since the First

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[11] *Ibid.*
[12] Defence Web, "NATO Forces… .
[13] Greenlaw, *Sea Mines And Countermeasures…,* 33.
[14] Maritime Operations Group 5, *Naval Mine Counter Measure (NMCM) Review.* (Halifax: Commander Maritme Forces Atlantic, 2015), Annex G-1.
[15] Maritime Operations Group 5, *Naval Mine Counte …,*Executive Summary 3.
[16] Greenlaw, *Sea Mines And Countermeasures…,* 92.

World War and are still threatened by the remnants of those mine fields. In fact, most international NMCM exercises and operations often involve the disposal of actual mines leftover from past conflicts.[17] The United States and the United Kingdom are the only two countries with advanced NMCM capabilities, which are not directly threatened by sea mines, because of a deliberate political decision to be substantially involved in the Arabian Gulf area and in the Indo-Pacific region.[18] Also, all of these countries recognize that none of them, on their own, can conduct large scale Active NMCM and that any such effort would be a coalition venture, where NMCMVs would be provided by some nations and Canada would contribute in other ways such as providing Clearance Divers.[19]

8. Characteristics of NMCMVs.

a. Advantages. Due to magnetic and acoustic actuators in more advanced mines, NMCMVs must have a reduced magnetic signature and be very quiet. This is achieved usually by having a hull made entirely of a reinforced form of fibre-glass and onboard machinery which is very quiet. The composition of the hull is also such that if an explosion under water were to occur, the hull would flex to the shockwave because it has no frames.[20]The other important aspect of these types of ships is the specialized equipment they carry including ultra-precise sonars and various robotic devices that can be launched from the ship.

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[17] Freedberg, "Minefields At Sea….;[17] Maritime Operations Group 5, *Naval Mine Counte ...*,Annex G-4.; John J. Rios, *Naval Mines in the 21st Century: Can NATO Navies Meet The Challenge?* (Master's Thesis, Monterey: Naval Post Graduate School, 2005), 28-29.

[18] Maritime Operations Group 5, *Naval Mine Counte ...*,Annex G-4.

[19] *Ibid*., Annex G-5.

[20] Geoff Slocombe, "Sea 1778 Phase 1: Deployable MCM - Organic Mine Counter Measures," *Asia Pacific Defense Reporter* (April 2015), 15.

b. Disadvantages. These unique characteristics which provide significant capability also come with significant drawbacks:

(1) Cost. They have "often been quoted as the most expensive surface warship per tonne,"[21] both in acquisition and in maintenance. It is not surprising that countries have been trying to develop organic NMCM systems that can be fitted within a standard combatant.

(2) Single Purpose. They are not as globally deployable, because they have limited speed. Also, they possess no self-defence or combat capability, which means they will need a combatant escort in a threat environment. This limits their use to NMCM activities.

(3) USN Example. Until 2006 they had two classes of NMCMVs, the 1980s *Avenger*-class and the much more advanced *Osprey*-class, and *Sea Dragon*-class helicopters that were dedicated to NMCM. In 2006, they began phasing out the Osprey and remain with the Avenger and Sea Dragons. They also plan to phase out the other vessels in favour of systems that will be fitted into the Littoral Combat Ship and their Sea Hawks which are multipurpose platforms. [22] In order to be more efficient and effective, the U.S. is making a strategic pivot away from purpose dedicated NMCM platforms which is indicative of a where the future lies in this domain.

[21] Greenlaw, *Sea Mines And Countermeasures…,* 51.
[22] Norman Polmar, "Is There A Mine Threat?" *U.S. Naval Institute Proceedings* 134, no. 2 (2008), n.d..

9. Emerging Technology.

a. Autonomous Underwater Vehicles (AUV). As previously mentioned Canada originally explored the possibility of using remote controlled devices but decided against it because the technology was not mature enough. Now, 20 years later, it has come to the point that the concept of a remote system has evolved to an autonomous remote system. This distinction is important since instead of have an operator remotely control every movement and operation of an Uninhabited Underwater Vehicle (UUV),[23] it is now possible to program a vehicle to patrol an area, scan it and identify possible mines. This also means that it will no longer be necessary to send ships and personnel into Mine Danger Areas, unless a need exists to recover a mine for intelligence exploitation purposes, which can only be done by Clearance Divers.[24]

b. Cost Comparison. Lieutenant-Commander J. Greenlaw, a graduate of the Canadian Forces College who wrote his Master's thesis on the use of Autonomous Underwater Vehicles (AUV) in support of NMCM tasks, provides a simplified cost comparison of four AUVs to the average cost of one MCMV and the results are impressive. The AUVs use 20 to 40 times less personnel; cost approximately five times less for the acquisition and 80 times less for yearly operation and maintenance. In terms of operating capabilities, the AUV can operate in the same depth of water, but can tolerate a higher sea state and because they would be organic to conventional ships they can be deployed across the world far more quickly than the 11 knot maximum speed of

[23] The term uninhabited, instead of unmanned, has become used more and more in the nomenclature in order to use more gender neutral terminology.

[24] Greenlaw, *Sea Mines And Countermeasures…,* 43.

the Avenger-class.[25] In short, it would be cheaper, use less personnel, provide greater responsiveness and significantly safer to use four AUVs than one MCMV. Airborne systems, are going through a similar evolution in that systems are being developed that can be attached to a standard bomb rack on a maritime helicopter. In effect, Canada would be able to equip its regular surface units and/or embarked helicopter NMCM detection equipment at a fraction of the cost of NMCMV, without exposing ships and personnel to the threat. Considering, the average lifespan of a major capital project and the fact that Canada's major shipyards are operating at capacity to meet the needs of the National Shipbuilding Procurement Strategy, it is very probable that AUV technology will be fully operational far earlier than delivery could be taken of a new NMCMV.

CONCLUSION

10. In conclusion, when determining if the absence of a NMCMV presents a vulnerability, several factors must be examined. While naval mines can be an effective weapon, there are also drawbacks that limit its effectiveness: large scale deployments would be complex and difficult to execute and small scale deployments are not nearly as effective. Offensive and Passive NMCM is used to great effect to reduce the risk of mines significantly. Canada would not take on current mine laying antagonists by itself, nor is there a significant risk to Canadian waters from naval mines. Hence, our policy of modest but credible NMCM capability. Even our allies who have significantly more mature NMCM capability and invest considerably more cannot conduct major NMCM operations independently. They are moving away from NMCMVs because of high costs

[25] *Ibid.,* 98.

and are embracing technology that would make NMCM capability more cost effective and far less hazardous by removing the personnel from the minefield. Therefore, the risk of not having a dedicated NMCMV is minimal.

RECOMMENDATION

11. It is therefore recommend that the RCN prioritize Offensive and Passive NMCM to reduce the need to engage in Active NMCM while continuing to invest in organic remote Active NMCM capabilities that can be deployed in most if not all of the RCN's platforms.

Bibliography

Canada. Maritime Operations Group 5. *Naval Mine Counter Measure (NMCM) Review.* Halifax: Commander Maritme Forces Atlantic, 2015.

Defence Web. "NATO Forces Clearing Sea Mines Off Libyan Coast." *Defence Web.* May 6, 2011. http://www.defenceweb.co.za/index.php?option=com_content&view=article&id=15227:nato-forces-clearing-sea-mines-off-libyan-coast&catid=51:Sea&Itemid=106 (accessed January 26, 2018).

Freedberg Jr., Sydney J. "From Sailors To Robots: A Revolution In Clearing Mines." *Breaking Defense.* April 6, 2015. https://breakingdefense.com/2015/04/from-sailors-to-robots-a-revolution-in-clearing-mines/ (accessed January 26, 2018).

—. "Minefields At Sea: From Tsars to Putin." *Breaking Defense.* March 23, 2015. https://breakingdefense.com/2015/03/shutting-down-the-sea-russia-china-iran-and-the-hidden-danger-of-sea-mines/ (accessed January 26, 2018).

—. "Sowing The Sea With Fire: The Threat Of Sea Mines." *Breaking Defense.* March 30, 2015. https://breakingdefense.com/2015/03/sowing-the-sea-with-fire-how-russia-china-iran-lay-mines-and-how-to-stop-them/ (accessed January 26, 2018).

Greenlaw, J. *Sea Mines And Countermeasures: Are Autonomous Underwater Vehicles The Answer, And Is The Royal Canadian Navy Ready For The New Paradigm?* Master's Thesis, Toronto: Canadian Forces College, 2013.

Polmar, Norman. "Is There A Mine Threat?" *U.S. Naval Institute Proceedings* 134, no. 2 (2008).

Reddish, Jason. "Forgotten Fears Present Imminent Threats To Maritime Shipping And Recreation Industries: The Risk Posed By The Availability Of Sea Mines." *Tulane Maritime Law Journal* 29 (2004): 125-138.

Rios, John J. *Naval Mines in the 21st Century: Can NATO Navies Meet The Challenge?* Master's Thesis, Monterey: Naval Post Graduate School, 2005.

Slocombe, Geoff. "Sea 1778 Phase 1: Deployable MCM - Organic Mine Counter Measures." *Asia Pacific Defense Reporter*, April 2015: 14-18.

Truver, Scott C. "What 'Weapons That Wait?'." *Seapower*, June 2011: 6-7.

Truver, Scott C. "Taking Mines Seriously: Mine Warfare In China's Near Seas." *Naval War College Review* 65, no. 2 (Spring 2012): 30-66.

Truver, Scott C. "Wanted: U.S. Navy Mine Warfare Champion." *Naval War College Review* 68, no. 2 (Spring 2015): 116-127.

United States. Office of the Chief of Naval Operations. *21st Century U.S. Navy Mine Warfare: Ensuring Global Access and Commerce.* Washington, DC: Office of the Chief of Naval Operations, 2009.