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A RECOMMENDATION FOR THE FUTURE OF MINE COUNTERMEASURES CAPABILITY IN THE ROYAL CANADIAN NAVY

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AIM

1. The aim of this service paper is to investigate the current Royal Canadian Navy (RCN) Mine Countermeasures (MCM) capability in comparison to the capabilities of similar allied navies and to make a recommendation with regard to the development and acquisition of future RCN capability. The paper is intended as an informative survey of the current state of capability in today's marketplace as well as the trends that are driving procurement and development in allied navies.

INTRODUCTION

2. Anti-ship mines are an inexpensive and technologically simple method of denying access to the Sea Lines of Communication (SLOC). The mines used in recent conflicts range from simple barrels filled with high explosives to very sophisticated semi-autonomous mines laid by submarines. Modern navies must be equipped to detect and dispose of mines if they are to achieve the goal of maintaining access to the SLOC.

3. When the KINGSTON Class ships were initially designed and built in the mid to late 1990s the initial roles for the vessels were "officer training, core at-sea training for the Naval Reserve, and mine countermeasure tasks to include mechanical minesweeping and route survey using remotely-operated vehicles and side-scan sonars, and support to clearance diving operations"[1] The original procurement project included several sets of mechanical minesweeping equipment and the requisite training for the crews of the designated ships. In the years since the initial acquisition of the KINGSTON Class ships the equipment has worn out and spares have

[1] Blakeley, Darlene, "Maritime Coastal Defence Vessels sail beyond expectations," *Crowsnest,* 3 November 2015.

been expended to the point that currently there is one complete mechanical minesweeping kit available. This coupled with the shift in employment of the KINGSTON Class to duties other than MCM has resulted in the atrophy of MCM skills within the community and therefore a capability gap in the RCN.

DISCUSSION

Current Canadian Capability

4. As mentioned above a capability gap exists in the RCN in the area of MCM. In order to understand the gap the history that led to its existence must be understood. The initial capability construct of the KINGSTON Class ships was modular in design. In order to meet the many roles assigned to the platform capabilities could be added or removed through equipment modules ranging from route survey side-scan sonars to accommodation containers allowing for additional trainee bunks. MCM was but one of these modular capabilities. There was the option to embark Clearance Divers to support a MCM mission, but the ships were crewed by members of the Naval Reserve (NAVRES). While some NAVRES members received training in MCM operations, not all did. This created a situation where all ships of the class were not equipped to conduct all mission sets. An additional problem as the ships were increasingly tasked with training duties was that the specialized skillsets were allowed to atrophy and some were lost completely. The current state of MCM capability is almost non-existent. The lack of serviceable minesweeping gear and the lack of qualified and experienced crews have created this gap in capability but it could be argued that having MCM exist as only one of many possible roles for a warship was the catalyst that eventually caused the problem. The RCN

Current Allied Capability

5. The United States Navy (USN) began the development of its current MCM capability in the 1980s in response to the growing threat of mine use in the Persian Gulf Area of Operations (AOR).[2] The USN solution was to commission the AVENGER Class MCM ships. The ships are fibreglass-sheathed wooden-hulled vessels and are capable of conventional detection of mines as well as mechanical mine sweeping and remote disposal of detected mines. The AVENGER Class are staffed by Clearance Divers who provide further disposal capability. The USN currently has 11 AVENGER Class ships in service.[3] The USN also uses helicopters for mechanical minesweeping, which has the benefits of reducing the direct threat to surface vessels and rapid deployability. The current Airborne Mine Countermeasures (AMCM) platform in the USN is the MH-53C SEA DRAGON helicopter, which can operate from aircraft carriers as well as other helicopter-capable warships.[4] In addition to the conventional MCM units, the USN has contracted Textron Systems to develop an unmanned surface vessel system, currently called the Unmanned Influence Sweep System (UISS). The system is intended to deploy with the littoral combat ships but will also be capable of operating out of ports.[5] This contract is one of many US initiatives to focus research on unmanned systems in all areas of warfare.

6. The Royal Navy (RN) operates two classes of conventional MCM ships. The SANDOWN and HUNT Class ships are fibreglass-hulled conventionally powered ships and are crewed by Clearance Divers. The RN employs the ships to clear legacy ordnance from its shores and to provide ships to the Standing NATO Mine Counter-Measures Forces. The ships employ

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[2] United States Navy, "United States Navy Fact File: Mine Countermeasures Ships," Last accessed 03 February 2016, http://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=1900&ct=4

[3] Ibid.

[4] United States Navy, "United States Navy Fact File: MH-53E SEA DRAGON Helicopter," Last accessed 03 February 2016, http://www.navy.mil/navydata/fact_display.asp?cid=1200&tid=400&ct=1

[5] Tadjdeh, Yasmin, "Navy's Minesweeping Unmanned Vessel on Schedule," *National Defence Magazine,* June 2015, http://www.nationaldefensemagazine.org/archive/2015/June/Pages/NavysMinesweepingUnmannedVesselonSchedule.aspx

traditional mechanical sweeping and disposal techniques and the HUNT Class ships are equipped with specialized sonar allowing for mine hunting operations.[6] While the ships employed by the RN are conventional in design and role, the evolution of unmanned technology is present as well. The HUNT Class ships are equipped with remote unmanned disposal weapons to assist in reducing risk to Clearance Divers.

7. The Royal Australian Navy (RAN) operates a single class of MCM ship called the HUON Class. There are six ships in the class and they are conventional in design. They feature fibreglass hulls and a reduced magnetic signature to allow operation in hostile mine environments. The ships are crewed by Clearance Divers and are also capable of operating remote unmanned disposal vehicles. The HUON Class ships are also equipped with a Variable-Depth Sonar (VDS) that allows them to detect mines in excess of 1000 metres ahead of the ship for classification and disposal.

8. In the examination of allied navy MCM capabilities several trends have been identified. All three allied navies detailed above utilize some combination of conventional MCM ships manned by divers specifically trained to dispose of mines. The importance of purpose-built ships with a specialized role of MCM is important to recognize at this point. None of the navies described above use major surface combatants to conduct MCM. This fact will become relevant later as future capability development is discussed. All the navies described above also use some type of remote unmanned vehicle to allow for lower-risk detection and disposal of mines. While several navies have indicated interest in the further use of more long-range unmanned systems for use in MCM, none of those systems is yet fully operational.

Currently Available Technology

[6] Royal Navy, "Surface Fleet: Mine Counter-Measures Ships, " last accessed 04 February 2016, http://www.royalnavy.mod.uk/the-equipment/ships/patrol-and-mine-hunters/mine-counter-measure-vessels .

9. MCM technology has evolved significantly in the last ten years. The main driver of this evolution has been improved performance of unmanned vehicles. The use of Unmanned Aerial Vehicles (UAV) in conflicts around the world has driven advances in control technology as well as battery performance and miniaturization of components. Those advances are now being used in the design and manufacture of unmanned MCM vehicles (UMCMV). The main types of UMCMV currently under development differ in that some are meant to operate on the surface, much like a conventional MCM ship, and others operate submerged or semi-submerged. Some examples of each as well as the strengths and weaknesses will be discussed below.

10. The most familiar type of UMCMV is the submersible Remotely Operated Vehicle (ROV). Navies around the world have employed ROVs for decades in various roles. The majority of those roles were exploratory in nature and the power requirements of the ROVs required the use of heavy tethers to allow for control of movement as well as the transfer of data to the operator. Modern ROVs have the benefit of powerful batteries and are controlled through fibre optic cables. This allows the ROVs to operate at greater distances from the control unit with no degradation in data transfer. This translates into greater safety distances for MCM control ships. The ROV has now become the primary choice for MCM activities. Below several examples of in-service systems will be described.

11. Atlas Elektronik of Germany produces the SeaFox family of ROVs for MCM. The vehicles feature an integral sonar which allows them to locate mines without input from the control vessel as well as a shaped charge weapon capable of destroying mines. The vehicle comes in reusable or disposable variants and is man-portable. The control cable is available in lengths up to 3000 metres and is fibre optic. While many navies employ SeaFox from traditional

MCM vessels, it would be possible to operate the ROV from larger warships if required.[7] Many similar ROV systems exist and provide very similar features and performance to that of SeaFox.

12. Another variant of the Unmanned Underwater Vehicle (UUV) is Talisman, manufactured by BAE Systems in the United Kingdom (UK). The main difference between Talisman and other ROVs such as SeaFox is that Talisman is untethered. The vehicle is semi-autonomous in that it seeks out a mine with its sonar and then approaches and records video of the object. It then surfaces and transmits the video to the control unit by radio.[8] This is a major drawback to the system, as the UUV must break contact with the mine in order to relay the data. Unfortunately the inability of radio to penetrate water at depth will limit such UUVs.

13. The other major group of UMCMV under development currently are those that operate on the surface. As mentioned above, Textron Systems is developing the UISS system for use in the USN's littoral combat ships. The system consists of remotely controlled surface vessels (small boats) that tow a variety of sensors and emitters behind them through an area suspected to contain influence mines. The emitters are designed to mimic the magnetic or acoustic emissions that would be radiated by a passing warship. The system moves through a suspected mine field and detonates the mines that are present there prior to warships entering the area. The system also uses very sensitive sonar to locate other mines for disposal by other ROVs or divers if required. While surface based UMCMV provide an attractive feature of speed, they have not been operationally proven at this point and development is ongoing.

Options

[7] Atlas Elektronik, "SeaFox Mine Disposal Vehicle," last accessed 5 February 2016, https://www.atlas-elektronik.com/what-we-do/unmanned-vehicles/seafox/

[8] Bluebird Electric, "Naval Mine Countermeasures," last accessed 5 February 2016, http://www.bluebirdelectric.net/submarines/naval_mines_mine_countermeasures_hunting_sweeping_destroyer_neutralization_counter_measures.htm

14. Navies around the world are evolving in the way in which they conduct MCM. Many navies have moved to a much more automated system involving the use of ROVs in the place previously occupied by divers. Some have dispensed with the use of dedicated MCM ships in favour of equipping all surface ships with UMCMVs. Still other navies have decided to maintain the traditional MCM ships staffed by divers who have simply added more sophisticated UMCMVs to their "toolboxes". The RCN must now decide which option will best suit its needs for the future.

15. The current fleet of 12 KINGSTON Class ships remain operational and will likely continue to serve for the next 10 to 15 years. While the original MCM payloads are no longer available for use the ships remain capable of embarking modular payloads in the same way they always have. Blended NAVRES and regular force RCN crews are now staffing the KINGSTON Class and several ships could potentially be devoted to MCM duties with Clearance Diver crews. This would provide dedicated and skilled MCM assets to the RCN which could be employed in a role that has been unfilled for many years at a low cost.

16. Many of the UMCMVs that are currently in service with allied navies are capable of operating from large surface combatant ships. Minor modifications to allow for storage of the vehicles are required, but come at a very low cost when compared to the building of dedicated MCM ships. The small size of new UMCMVs would also allow surface ships to carry multiple vehicles. The longer operating distances provided by modern UMCMVs would allow for ships to effectively clear their own path through a mine danger area without the need for other, often slow moving, MCM assets. The trend of RCN units deploying as single-ship units makes integral MCM capability very attractive to ship commanders. The problem with this concept is that major warships are not designed to enter mine danger areas and they represent huge national

investment in both money and human lives. It would not be easy to accept the risk of losing a major warship with 250 sailors aboard as it attempts to clear a mine danger area.

CONCLUSION

17. The RCN must make a conscious decision to renew its MCM capability. The discussion above has detailed some of the options available to the RCN in the current environment as well as examples of what some allied navies have done to maintain MCM competency. The choice of which option to choose will not be easy in the current climate of fiscal limitations but the choice must be made nonetheless. An important thing to note is that the RCN is not building a new capability; it is simply re-building one that has been allowed to degrade.

RECOMMENDATION

18. Due to the continued operation of the KINGSTON Class ships it is recommended that several of them be re-roled as dedicated MCM ships. The procurement of UMCMVs could be used to augment the platform capabilities at relatively low cost. Commercial off the shelf (COTS) technology is the preferred method of acquisition for this technology to avoid lengthy and costly experimental programs. It is also recommended that the ships designated for MCM specialization be crewed by dedicated clearance diver crews as much as possible. This would allow the specialization of the crews to be as intense as that of the ship itself. These changes could all be made using existing personnel and at low financial cost, while they would bring huge competency gains to the RCN. Re-establishing MCM as a core competency in the RCN would improve interoperability with allied navies and assist in the fulfilment of the navy's mandate to secure Canada's sea lines of communication at home and abroad.

BIBLIOGRAPHY

Atlas Elektronik, "SeaFox Mine Disposal Vehicle," last accessed 5 February 2016, https://www.atlas-elektronik.com/what-we-do/unmanned-vehicles/seafox/

Blakeley, Darlene, "Maritime Coastal Defence Vessels sail beyond expectations," *Crowsnest*, 3 November 2015.

Bluebird Electric, "Naval Mine Countermeasures," last accessed 5 February 2016, http://www.bluebirdelectric.net/submarines/naval_mines_mine_countermeasures_hunting_sweeping_destroyer_neutralization_counter_measures.htm

United States Navy, "United States Navy Fact File: Mine Countermeasures Ships," Last accessed 03 February 2016, http://www.navy.mil/navydata/fact_display.asp?cid=4200&tid=1900&ct=4

United States Navy, "United States Navy Fact File: MH-53E SEA DRAGON Helicopter," Last accessed 03 February 2016, http://www.navy.mil/navydata/fact_display.asp?cid=1200&tid=400&ct=1