NOTE FOR NATIONAL DEFENCE:
Integration of Unmanned Underwater Technology in Convoy Protection

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Summary

The purpose of this report is to explore the active integration of unmanned underwater vehicles (UUV) in real world scenarios given the rise in its prevalence and the shifts towards utilization of the new technology. It intends to frame the technology into use case scenarios surrounding the context of potential conflict rising in the South China Sea, placing considerations into sealift, convoy protection, minesweeping capabilities, and the political implications of their use.

Context and Background

Convoys are an essential part of sustaining force projection, with its unparalleled ability to move men and materiel. However, given the rising threat of expanding technology and submarine warfare by Canadian rivals in Southeast Asia, vulnerabilities become present in conventional convoy movements. In order to best augment conventional tactics for convoy protection, integration of modern unmanned technology is paramount in maintaining naval superiority. The ever-changing landscape of warfare is progressively seeing shifts towards autonomous vehicles. Evidenced by the utility of the UAV, more environments have begun to procure autonomous vehicles to help bolster military capabilities. The unmanned Campaign Framework released by the US Navy details the importance placed on the emerging technology, and the US integration of unmanned vessels to supplement current manned vessels. This has led to procurement projects such as that of the Boeing 'Orca' XLUUV (XL Unmanned Underwater Vehicle) to help augment unmanned capabilities. Considering this shift, in order to best support its allies, Canada must follow suit and begin to understand how to most effectively integrate UUVs into conventional strategy.

Integration of UUV Capabilities in Strategic Areas

i. For Sealift and Fleet protection

Modern convoys face many of the same vulnerabilities present during World War II. The British experience with the mid-Atlantic gap and immense losses of merchant shipping can be drawn upon to frame the potential establishment of a similar gap in the Pacific by the Chinese between Pearl Harbor and Guam. The stretch, being over 3200 nautical miles extends beyond the capable range of the P-8 Poseidon, the USA's most effective Anti-Submarine aircraft. Framing the vulnerabilities of conventional convoy movements, military exercises such as RIMPAC have demonstrated allied submarines are capable of consistently sinking high value US Navy vessels. The USA, having no current need for extensive sealift capabilities, maintains an agreement to utilize private merchant vessels. With a dependency on fuel for any major conflict, under this agreement, the loss of a single ship represents a significant decrease in logistical capabilities. Therefore, the protection of sealift means becomes of utmost importance to successfully maintain a conflict for any period of time.

China in recent years has heavily focused on modernizing its naval capabilities surpassing the USA in number of deployable submarines. Current Chinese submarines, utilizing both the YU-6 torpedo as well as the YU-11 torpedo pose a legitimate threat to convoy movements across the Pacific Ocean. The YU-6 torpedo is understood to have a maximum range of 24 Nautical miles, while moving at 65 kt. To counteract the emergence of advanced Chinese torpedoes, UUVs used as a sonar picket around carrier groups in conjunction with established ASW tactics can facilitate vastly increased detection range. This would allow for a greater amount of time to either engage torpedo countermeasures or move the convoy away from the incoming threat. Given the 6500 Nautical mile operating range of the Boeing XLUUV, movement across the Pacific from a fleet staging area in Pearl Harbor could maintain this extended sonar coverage for the entirety of its transit across the Pacific until reaching Guam. Thus, negating most of the threat from Chinese submarines. Another important aspect is the cost-effective nature of current XLUUV prototypes with unit costs only at around 11 million dollars. This facilitates the ability for multiple XLUUVs to assist each convoy making the voyage across the Pacific.

ii. Hold At Risk Capabilities

Current tactics by the US Navy is utilizing spy ships such as that of the Victorious and Impeccable class to monitor PLA Navy submarine movements throughout the South China Sea. This however obviously holds shortcomings given the limited capabilities for stealth available to surface vessels. This offers a very useful application of UUV technology given their immense stealth capabilities. Outlined in The US Navy's UUV Masterplan was the integration of UUVs to monitor adversary fleet movements (hold at risk) in strategic littoral zones. An application of this strategy could be used in the port of Sonya, known to be the primary location for the movement of Chinese nuclear submarines. The utilization of UUVs in this context enables a surveillance of potential vessels moving in and out of the region offering greater security for allied vessels moving both across the Pacific and around

the South China Sea. Considering the maximum range being 6500 nautical miles of current XLUUVs in development, this permits ample distance to return to base after a given mission of reconnaissance. Current shortcomings exist with UUVs' ability to rapidly relay information back to fleets. However, with technology like underwater RF wireless networks, with a tested coverage of up to 50m depth, or Translational Acoustic-RF Communication (TARF) enabling sonar communication to aerial sensors, the ability for autonomous vehicles to communicate is becoming more and more possible. While these methods may not be viable for this context, further investment into underwater communication methods may enable use of these tactics in the future.

iii. Mine Sweeping Capabilities

The use of underwater mines has long been an effective method in crippling maritime movements. Evidenced by US mining campaigns against Japan in World War II, their efficacy must be considered, and efforts taken to counteract them given the nature of potential conflict in Southeast Asia. In the context of China, concerns have been raised around the utilization of mines in the Apra Channel outside of Guam, examined by the MIW Analyst for the US navy. Similarly, professors at China Maritime Studies Institute notes China's ability to fully blockade Taiwan as well as crucial routes in the Western Pacific. This will be accomplished through integration of both dummy mines as well as efforts to expand their 'smart mine' capabilities.

Given the importance of such routes, mine sweeping becomes a leading factor in maintaining safe passage of high value units. A strong use case scenario for the rising tech of UUVs is to help further facilitate mine hunting missions. US procurement has recently developed the Knifefish minesweeping autonomous vehicle. It operates by locating and marking mines along a given route to then later be detonated. However, with advancements in machine learning and AI such as that of the XLUUV, integration may become possible for arming the robots with mine destroying weapons. China, investing in UUV drones (HSU-001) are noted to be equipped with torpedoes to hunt submarines. Given this technology available to the Chinese, integration of such capabilities on mine hunting drones is definitely possible. This would help to alleviate alternative conventional methods such as divers or marine animals to classify mines. With the inexpensive nature of UUVs at only 2.5 million USD, further integration could permit a minesweeping UUV to accompany most if not all convoys across the Pacific, alleviating the rising threat of Chinese mining capabilities in the potential outbreak of conflict.

Political Implications of UUV Use

An important factor to acknowledge is the potential for UUVs to facilitate escalation of conflict. UUVs, being relatively inexpensive to create and operate, as well as a lack of crew, facilitates more risk acceptant missions in rival littoral zones. This poses potential risks of escalation given past responses to unmanned vehicles. In 2016, China captured a US naval drone testing water conditions in the South China Sea, describing the action as a threat to Chinese national security. A similar event occurred in 2011 with the capture of USAF RQ-170 flying over Irani airspace. With tactics such as hold at risk, detailed by the UUV masterplan, as well as increased reconnaissance

capabilities, the potential for Chinese retaliation becomes much higher. While the technology may serve incredible utility, the aspects mentioned should be heavily considered to prevent amplifying tensions in the region.

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