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Emerging Technologies and Maritime Security: Key Lessons from the Red and Black Seas

Chong De Xian

SYNOPSIS

Reflecting on the Russia-Ukraine conflict in the Black Sea and the Red Sea crisis, ***Chong De Xian*** *attempts to elicit relevant lessons on emerging technologies for maritime security enforcement agencies in Southeast Asia.*

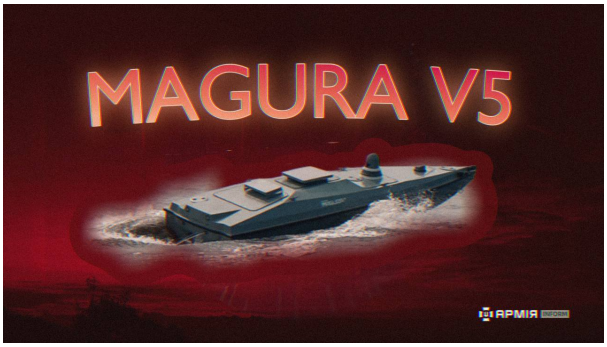
COMMENTARY

The recent major security incidents in the Black and Red Seas underscore the transformative impact of emerging technologies on maritime security operations. The ongoing Russia-Ukraine war has seen rapid innovations in drone technology, enabling Ukraine to mount effective counteroffensives in the Black Sea. In the Red Sea, the Houthis, an Iran-backed rebel group in Yemen, leveraged drone technology and readily available shipping intelligence to significantly disrupt maritime traffic through the strategically vital Strait of Hormuz. This paper explores the key lessons that maritime enforcement agencies can draw from these developments, focusing on unmanned systems, artificial intelligence (AI), and digital collaborative platforms.

Unmanned Systems

The Ukraine conflict has rapidly accelerated advancements in drone technology, highlighted by Ukraine's deployment of sophisticated platforms such as the "Magura V5" unmanned naval drone, which achieved notable successes against Russian helicopters in December 2024. Additionally, Ukraine successfully deployed unmanned surface platforms to launch aerial drones against Russian ground-based air defence systems for the first time in January 2025. Similarly, the Houthis' campaign in the Red Sea effectively utilised suicide drones for precision strikes and reusable drones for reconnaissance and bombing missions. Both experiences underscore the force-multiplier effects of unmanned systems.

As maritime enforcement agencies frequently grapple with the perennial challenge of resource limitations that hinder comprehensive surveillance and enforcement across expansive maritime areas, the force-multiplier capacity provided by unmanned platforms offers a practical solution. The Republic of Singapore Navy (RSN)'s use of its Maritime Security Unmanned Surface Vessels (MARSEC USVs), which have begun operational patrols since January 2025, illustrates a successful application of unmanned technology to overcome operational limitations. Leveraging unmanned technology has allowed the RSN to achieve multiple strategic objectives, such as extending its operational capabilities without drawing down on a dwindling pool of conscripts, reducing risk to its sailors' lives, and increasing its operational response capacity to patrol one of the world's busiest waterways.



In December 2024, Ukraine reportedly downed a Russian helicopter with the Magura V5 drone, making history as the first sea drone to destroy an aerial target.
Image source: ArmyInform, Ministry of Defense, Ukraine.

Artificial Intelligence

The success of drone warfare cannot be viewed in isolation from AI, with the latter being used in the drones' visual systems for target identification and terrain mapping to assist in navigation. The application of AI in maritime security goes beyond the manoeuvring of unmanned platforms or firing of weapons. In surveillance and monitoring operations, AI can be plugged into the digital maritime picture to rapidly identify anomalies from established patterns of life and to cover any potential blind spots that elude the human eye. Aside from enhancing response time, AI's ability to quickly identify potential threats helps reduce risk to people and assets and closes the operating time and space for perpetrators such as sea robbers, poachers, or illegal migrants to escape, thereby increasing the chances of successful apprehensions. We are already seeing the nascent adoption of AI into maritime security enforcement within the region: AI has been used in the RSN's maritime security operations to identify potential intruders from land and sea via its surveillance systems. In January 2025, the Malaysian Maritime Enforcement Agency was chosen by the Malaysian government to pioneer the integration of AI in its operations. The Indonesian fisheries authorities, for their part, partnered with the United Nations Office on Drugs and Crime and commercial satellite provider Skylight to conduct enforcement operations in 2024.

Information-Sharing and Collaborative Digital Platforms

The Houthis were able to identify targets for their drone and missile attacks based on automatic identification system (AIS) information from commercial maritime intelligence service providers. Aside from raising questions about the securitisation of shipping information, this example highlights the strategic value of timely information and collaborative digital platforms in facilitating operational success. Recognising the importance of information-sharing in maritime security operations, there is value in harnessing commercial technological solutions in addressing one's maritime security needs and ensuring robust information-sharing between allies and partners. Regional information-sharing portals such as CRIMARIO II's Indian Ocean Region Information Sharing system (IORIS) and the Information Fusion Centre (IFC)'s Realtime Info-sharing System (IRIS), as well as the US Department of Transportation's SeaVision, are well poised to amalgamate the plethora of information sources and commercial technologies available. Recent developments seem to indicate that the regional information-sharing portals are on the right trajectory, with CRIMARIO II recently launching the 4th version of its IORIS system, and the IFC currently in the midst of upgrading IRIS.

Avenues for Cooperation

Such developments will also look to spur new avenues for cooperation. To better appreciate the application of unmanned technology in the Red and Black Seas, one must keep in mind the technological and logistical ecosystem that has sustained and sharpened the capabilities of the "cost-effective" drones. Ukrainian drone operations were successful only because they had access to American spy satellites, supplemented by intelligence from NATO air surveillance. The Houthis' campaign was sustained with logistical support from Iran, which purportedly included the setting up of drone factories within Yemen.

It is therefore important to recognise that these technological developments did not occur in isolation but instead constituted an extension of a complex technological web. Tapping into this ecosystem would open up greater opportunities for like-minded partners to expand cooperation in areas such as technology-sharing and establishing operating procedures or regulatory frameworks. The adoption of new technologies, particularly for maritime domain awareness, will also necessitate more joint training and exercises to ensure sustained interoperability. Regional enforcement agencies should capitalise on the present interest from extra-regional partners to enhance maritime security enforcement capabilities through initiatives such as the QUAD's Indo-Pacific Partnership for Maritime Domain Awareness, Japan's Official Security Assistance, or the US Department of Defense's Maritime Security Consortium.

Conclusion

We are already witnessing unmanned systems, AI, and other emerging technologies taking root within Southeast Asia. Maritime enforcement agencies would do well to heed the pertinent lessons from the Ukrainian and Houthi experiences as such technologies become more prevalent over time. Regional enforcement agencies should actively explore viable means to harness these tech-enabled capabilities and

to engage meaningfully with like-minded partners through the additional avenues of cooperation these technologies may offer.

Chong De Xian *is an Associate Research Fellow in the Maritime Security Programme at the S. Rajaratnam School of International Studies (RSIS).*

S. Rajaratnam School of International Studies, NTU Singapore
Block S4, Level B3, 50 Nanyang Avenue, Singapore 639798