

Unmanned Underwater Vehicles and the Normative Gaps of UNCLOS 1982: A Functional and Evolutionary Interpretation

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Abstract

The rapid development of unmanned underwater vehicles (UUVs) presents a significant interpretative challenge to the United Nations Convention on the Law of the Sea 1982 (UNCLOS 1982), a treaty drafted for an era of manned maritime navigation. While UNCLOS regulates ships and warships in detail, it remains silent on autonomous underwater systems. This article addresses the central legal question of whether, and under what conditions, UUVs may be classified as ships or warships under the existing UNCLOS framework. The study adopts a doctrinal legal methodology based on functional interpretation and evolutionary treaty interpretation, informed by the Vienna Convention on the Law of Treaties and relevant state practice. Rather than treating technological novelty as a basis for exclusion, the analysis examines whether the functions performed by UUVs—such as navigation, military operations, and marine scientific research—allow their regulation within established UNCLOS categories. The article argues that the legal status of UUVs cannot be determined abstractly, but depends on their operational function and the maritime zone in which they operate. Normatively, the article clarifies the limits of interpretative adaptation under UNCLOS and highlights the risks of fragmented, interest-driven state practice. It concludes that functional and evolutionary interpretation can reduce legal uncertainty, but must be complemented by bilateral and regional cooperative frameworks, including codes of conduct, to ensure regulatory coherence.

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Introduction

The preamble of the United Nations Convention on the Law of the Sea 1982 (UNCLOS 1982) indicates that the Convention's objectives are to establish a legal framework for diverse and extensive peaceful utilization of the ocean.¹ Nevertheless, as technology advances, UNCLOS 1982 does not accommodate such developments in any capacity.² This pertains specifically to the utilization of unmanned underwater vehicles (UUVs). Although a legal framework for the utilization of UUVs is absent, several enterprises, including military operations and the discovery and exploitation of oceanic resources, have employed this technology.

The development of UUV itself departed from the invention of marine technology, named Unmanned Maritime Vehicles (UMVs), which can be defined as vehicles operated over the marine space that are capable of remotely controlled as well as self-propelled movement in ocean space with no crew onboard.³ Some of these vehicles operate under the water surface, or often named as Unmanned Underwater Vehicles (UUVs). The technology advancement relating to autonomous underwater ships, in fact, have been around for quite sometimes. There are several research on such technology advancement ranging from pure technological perspectives, defense and strategic as well as policy and legal issues surrounding it. Chase, for instance, examined China's development of maritime unmanned systems with a particular emphasis on their relevance to ongoing territorial disputes in the East and South China Seas.⁴ Whereas Bendett examined the development of Russia unmanned vehicle system.⁵ From Chase and Bendett, it can be noted that China and Russia are two main States who greatly benefited by the autonomous system. Wyatt,

¹ *United Nations Convention on the Law of the Sea*, pmbl., Dec. 10, 1982, 1833 U.N.T.S. 3.

² See also Katharina Bork et al., "The Legal Regulation of Floats and Gliders—in Quest of a New Regime?," *Ocean Development & International Law* 39, no. 3 (August 6, 2008): 298–328, <https://doi.org/10.1080/00908320802235338>; Sujatha Byravan and Sudhir Chella Rajan, "Sea Level Rise and Climate Change Exiles: A Possible Solution," *Bulletin of the Atomic Scientists* 71, no. 2 (January 2015): 21–28, <https://doi.org/10.1177/0096340215571904>; Tobias Hofmann and Alexander Proelss, "The Operation of Gliders under the International Law of the Sea," *Ocean Development & International Law* 46, no. 3 (July 3, 2015): 167–87, <https://doi.org/10.1080/00908320.2015.1053374>; James Johnson, "Artificial Intelligence & Future Warfare: Implications for International Security," *Defense & Security Analysis* 35, no. 2 (April 3, 2019): 147–69, <https://doi.org/10.1080/14751798.2019.1600800>; Jeremia Humolong Prasetya Nainggolan, "Military Application of Unmanned Underwater Vehicles: In Quest of a New Legal Regime?," *Indonesian Journal of International Law* 16, no. 1 (October 31, 2018): 61–83, <https://doi.org/10.17304/ijil.vol16.1.770>; Bin Mohd Rusli, Mohd Hazmi, Roman Dremluga, and Dhiana Puspitawati, "The Rise of Unmanned Shipping in Southeast Asian Waters: Between Myth and Reality." In *Direito Digital e Inteligência Artificial*. Brazil: Editora Foco, 2021; Austin Wyatt and Jai Galliot, "Closing the Capability Gap: ASEAN Military Modernization during the Dawn of Autonomous Weapon Systems," *Asian Security* 16, no. 1 (September 26, 2018): 53–72, <https://doi.org/10.1080/14799855.2018.1516639>.

³ Robert Veal, Michael Tsimplis, and Andrew Serdy, "The Legal Status and Operation of Unmanned Maritime Vehicles," *Ocean Development & International Law* 50, no. 1 (January 2, 2019): 23–48, <https://doi.org/10.1080/00908320.2018.1502500>.

⁴ Michael Chase et al., *Emerging Trends in China's Development of Unmanned Systems* (Santa Monica, CA: RAND Corporation, 2015).

⁵ Samuel Bendett et al., "Syria and Beyond: Russia Unmanned Vehicle Developments," *Improvisation and Adaptability in the Russian Military* (Center for Strategic and International Studies (CSIS), 2020), JSTOR, <https://doi.org/10.2307/resrep24241.9>.

on the other hand analyses the impact of the spread of unmanned systems on sub-national power dynamics, with a focus on Southeast Asia. Specifically, it looks at how this convergence could affect law enforcement, border security, and internal surveillance and repression in the region.⁶ Furthermore, Dong, Bautista and Zhu discuss issues relating to flag State jurisdiction.⁷ They analyses the main challenges that autonomous system pose to flag states in meeting their jurisdictional responsibilities under UNCLOS 1982 and also explores potential regulatory solutions to address these challenges. However, their research focuses on surface ships rather than UUV. The specific research on the legal status of UMVs come from Allen and Veal, who argues that the legal status of UMVs should be determined in accordance with established international frameworks, particularly UNCLOS 1982 and the 1969 Vienna Convention on the Law of Treaties (VCLT).⁸ He argued that treaty formation, amendment and interpretation should be considered in determining the legal status of unmanned vehicle. However, he did not specifically discuss about the use of UUV and how the operation of UUVs, in fact, qualm coastal states. Unlike Allen, Veal on the other hand, argues that in determining the legal status of UMV, one should consider a range of UMVs with differing levels of autonomy.⁹ He further argued that international legal frameworks defer to flag State law in determining the legal status of unmanned maritime vehicles (UMVs). However, the interpretation adopted under national law is likely to be shaped by the flag State's own interests and therefore does not resolve the underlying legal uncertainty surrounding the status of UMVs.

Differs from several research mention above, this paper focuses specifically on the legal status of UUV pertaining to UNCLOS 1982 and their legal implication. Since the versions and the level of autonomous of UMVs are vary, it is crucial to analyse each of the existing type of the UMVs, such as UUVs. William, while using the term Autonomous Underwater Vehicles (AUV) examines legality of the use of AUV according to International Law of the Sea.¹⁰ He concludes that since UNCLOS 1982 is silent on the operation of AUV, thus the operation of AUV in international waters require specific feasibility tests. Failure to fulfil such requirement would result in the invalidity of the AUVs' operation.¹¹ Similarly, Felencia argued that since UUVs are not ships, thus their operation in international waters is illegal.¹² They also cannot be considered as warship and therefore do not pose

⁶ Austin Wyatt, "A Southeast Asian Perspective on the Impact of Increasingly Autonomous Systems on Subnational Relations of Power," *Defence Studies* 21, no. 3 (April 1, 2021): 1-21, <https://doi.org/10.1080/14702436.2021.1908136>.

⁷ Bingying Dong, Lowell Bautista, and Ling Zhu, "Navigating Uncharted Waters: Challenges and Regulatory Solutions for Flag State Jurisdiction of Maritime Autonomous Surface Ships under UNCLOS," *Marine Policy* 161 (March 1, 2024): 106039-39, <https://doi.org/10.1016/j.marpol.2024.106039>.

⁸ Craig H. Allen, "Determining the Legal Status of Unmanned Maritime Vehicles: Formalism vs Functionalism," *SSRN Electronic Journal* 49, no. 4 (2018): 1-24, <https://doi.org/10.2139/ssrn.3244172>.

⁹ Robert Veal, Michael Tsimplis, and Andrew Serdy, "The Legal Status and Operation of Unmanned Maritime Vehicles," *Ocean Development & International Law* 50, no. 1 (January 2, 2019): 23-48, <https://doi.org/10.1080/00908320.2018.1502500>.

¹⁰ William Gian, "Legalitas Penggunaan Autonomous Underwater Vehicle Ditinjau Dari Hukum Internasional," *Belli Ac Pacis (Jurnal Hukum Internasional)* 9, no. 1 (2023): 65-74, <https://doi.org/10.20961/belli.v9i1.42861>.

¹¹ *Ibid.*

¹² Naomi Catherine, Imam Mulyana, and R. Achmad Gusman Catur Siswandi, "The Implementation of Sovereign Immunity of Warships to Unmanned Underwater Vehicles (UUV) under Law of the Sea,"

any immunities. However, both Wiliam and Felencia do not give solution to what States should done if foreign UUVs found in their water territory.

Although UNCLOS 1982 does not accommodate such technological advancement pertaining to the automation of ships, the International Maritime Organization (IMO) has developed e-navigation since 2005. It focusses on the development of ships' navigation system, ships' traffic management and ship to ship communication infrastructure and focuses on Surface Autonomous Vehicles¹³

Furthermore, relating to UUV, there are various method of UUVs' operation ranging from remotely controlled, fully autonomous to combination method, that is remotely controlled to a certain place and then put into autonomous mode to perform specific surveys and mapping.¹⁴ The uses of UUV rapidly increased with various purposes, ranging from marine research, sea-floor mapping until for certain military purposes. Currently, the use of UUVs has become more preferable since it is proven to be more cost and risk effective. It also being used in many challenging operations to narrow areas posing risk of collision with other craft; or to remote areas which may danger for human but provides important marine scientific research data.¹⁵ Thus, China has seen such unmanned system attractive and would benefit in any aspects,¹⁶ especially in monitoring territorial waters, and therefore has put more financial support for the development of UUVs.¹⁷ It is further argued that UUVs will double its power if deployed with aerial drone.¹⁸ Based on these advantages, beside China, Russia has also seen the importance of

Padjadjaran Journal of International Law 6, no. 1 (August 4, 2022): 76–95, <https://doi.org/10.23920/pjil.v6i1.954>.

¹³ Renan Hafsar, "Kapal Tanpa Awak Menantang Indonesia," *Kumparan*, November 12, 2020, <https://kumparan.com/renan-hafsar/kapal-tanpa-awak-menantang-indonesia-1uZZMpNzfZO>;

Following to this, history noted that in 2019 the first MASS was operated commercially, transporting one box of oyster from West Marsea, England to Oostende, Belgium, thus crossing EnglisWh Channel to Belgium, and was controlled from Tollesbury, Essex, where such MASS was departed. See J Amos, "Autonomous Boat Makes Oyster Run," *BBC News*, May 9, 2019, sec. Science & Environment, <https://www.bbc.com/news/science-environment-48216966>; International Maritime Organization, "Autonomous Shipping," imo.org, 2024, <https://www.imo.org/en/MediaCentre/HotTopics/Pages/Autonomous-shipping.aspx>; European Maritime Safety Agency, "Maritime Autonomous Surface Ships (MASS)," EMSA, 2020, <https://www.emsa.europa.eu/mass.html>;

As this turn out International law actually places restrictions on MASS operations only on restricted areas where the risk of collision with other craft or users of the sea, can be minimized. See Robert Veal, Michael Tsimplis, and Andrew Serdy, "The Legal Status and Operation of Unmanned Maritime Vehicles," *Ocean Development & International Law* 50, no. 1 (January 2, 2019): 23–48, <https://doi.org/10.1080/00908320.2018.1502500>

¹⁴ See also Ørnulf Jan Rødseth and Håvard Nordahl, "Definitions for Autonomous Merchant Ships" (Norwegia: Norwegian Forum for Autonomous Ships (NFAS), 2018); Robert Veal, "Maritime Autonomous Surface Ships: Autonomy, Manning and the IMO," *Shipping & Trade Law* 18, no. 5 (2018).

¹⁵ Russell B. Wynn et al., "Autonomous Underwater Vehicles (AUVs): Their Past, Present and Future Contributions to the Advancement of Marine Geoscience," *Marine Geology* 352 (June 2014): 451–68, <https://doi.org/10.1016/j.margeo.2014.03.012>.

¹⁶ Michael Chase et al., *Emerging Trends in China's Development of Unmanned Systems* (RAND Corporation, 2015).

¹⁷ Stephen Chen, "After Drones, China Turns to Unmanned Vessels to Boost Its Marine Power," *South China Morning Post*, December 5, 2013, <https://www.scmp.com/news/china/article/1373490/after-drones-china-turns-unmanned-vessels-boost-its-marine-power>.

¹⁸ *Ibid.*

unmanned system and has invested more in developing the UUVs usage.¹⁹ However, despite of its advantages, the use of UUVs also has some disadvantages, which include but not limited to the act of espionage and vulnerability to the act of misuse of resources data collected as well as other unlawful action, which violate the peaceful usage of the ocean.²⁰

UUV further classified into two types, namely *Autonomous Underwater Vehicles* (AUV) and *Remotely Operated Vehicle* (ROV),²¹ which often used for military purposes. Unlike MASS, these UUVs can be operated remotely farther away, even beyond national jurisdiction of a State. This condition might lead to international incident if such UUV fail to operate normally or collide with other users of the oceans as mentioned previously. The first incident of foreign flagged UUV happened in December 2016, when Chinese Navy found a US Navy UUVs 50 nautical miles off Subic Bay in the South China Sea, and removed it from water. Such removal, then raised question whether China has the right to remove foreign flagged UUVs? What is the legal status of such UUVs which would result on the rights and obligation of both China and US?²² While such incident was solved with China returning the UUVs to the US, the legal status of such UUV remains unclear. This shows that the operation of UUVs needs clarification especially upon its legal status. UNCLOS 1982 uses the term 'ships' and 'vessels' interchangeably while silent in their definitions. In addition to this, UNCLOS 1982 also uses various terms which might refers to UUV, which include 'submarine' , 'other underwater vehicle'²³, 'equipment'²⁴ and 'military device'²⁵. In the assumption that submarine and underwater vehicle can be categorized as ships, it is uneasy to clearly draw the distinction between submarine and underwater vehicle.²⁶ While submarine envisages in Article 20 UNCLOS 1982 implicitly refers to military submarine, it is unclear whether underwater vehicle mention in the same article also refers to military underwater vehicle? In this case, if UUV assumed as submarine or underwater vehicles, in fact not all UUV's operation is for military purposes. Furthermore, the term 'equipment' mention in Part XIII of UNCLOS 1982 clearly refers to marine scientific research. Whereas, not all UUV is operated for research purposes. Furthermore, the term 'military device' envisages in Article 19 paragraph 2 (f) of UNCLOS

¹⁹ Michelangelo Freyrei, "Uncrewed Underwater Vehicles: Opportunities and Challenges," in *The Underwater Environment and Europe's Defence and Security* (Roma: Istituto Affari Internazionali, 2023).

²⁰ Michael Chase et al., *Emerging Trends in China's Development of Unmanned Systems* (RAND Corporation, 2015); Jiang Tianjiao, "The Impact of Military Artificial Intelligence on Warfare," in *The Impact of Artificial Intelligence on Strategic Stability and Nuclear Risk: Volume II East Asian Perspectives*, ed. Lora Saalman (Stockholm: Stockholm International Peace Research Institute, 2019), 51-53.

²¹ Jeremia Humolong Prasetya Nainggolan, "Military Application of Unmanned Underwater Vehicles: In Quest of a New Legal Regime?," *Indonesian Journal of International Law* 16, no. 1 (2018), <https://doi.org/10.17304/ijil.vol16.1.770>.

²² See U.S. DoD News, "Statement by Pentagon Press Secretary Peter Cook on Return of U.S. Navy Unmanned Underwater," Commander, U.S. 7th Fleet (U.S. Navy, December 20, 2016), <https://www.c7f.navy.mil/Media/News/Display/Article/1038135/statement-by-pentagon-press-secretary-peter-cook-on-return-of-us-navy-unmanned/>.

²³ *United Nations Convention on the Law of the Sea*, art. 20, Dec. 10, 1982, 1833 U.N.T.S. 3.

²⁴ *United Nations Convention on the Law of the Sea*, art. 238, Dec. 10, 1982, 1833 U.N.T.S. 3.

²⁵ *United Nations Convention on the Law of the Sea*, art. 19, para. 2(f), Dec. 10, 1982, 1833 U.N.T.S. 3.

²⁶ Robert Veal, Michael Tsimplis, and Andrew Serdy, "The Legal Status and Operation of Unmanned Maritime Vehicles," *Ocean Development & International Law* 50, no. 1 (January 2, 2019): 23-48, <https://doi.org/10.1080/00908320.2018.1502500>.

1982 pose question whether UUV can be assumed as military device? However, with regard to Article 19, it is questionable whether the operation of UUV as military device can be said as violating innocent passage if it does activities envisaged in Article 19 paragraph 2?²⁷ Furthermore, if UUV is considered as warship, it is unclear whether UUV also poses certain immunities and privilege as warships under UNCLOS 1982?

Since UNCLOS 1982 is silent on this matter, clarification of UUV's legal status is crucial.²⁸ While it is argued that the legal position of UUVs is contingent upon their operational function, bilateral and regional agreement governing the operation and legal framework of UUVs is important. This paper will firstly address the advancement of technology in the field of UMV and its purpose of operation. Secondly, the distinct concept of warships and ships will be examined, and the immunity of warship also will be discussed. The subsequent section pertains to the status of UUVs from the perspectives of warships, and then the conclusion.

Problem Statement

It is a brief statement about the standing position of the problem to be studied. Therefore, before doing the whole set of the fifth amendment of the Constitution of NRI 1945, it is necessary to examine the formation of a constitutional commission in the amendment to the Constitution of NRI 1945 to the fifth amendment, with the boundary problem will be described are, first, any corrections to the Constitution of NRI 1945 which need to be improved and perfected on the fifth amendment. Second, Do Constitutional Commission before the fifth amendment made will reduce the authority of the Assembly in conducting NRI Constitution Amendment of 1945.

Methods

This article adopts a doctrinal legal research methodology to examine the regulation of Unmanned Underwater Vehicles (UUVs) under the United Nations Convention on the Law of the Sea 1982 (UNCLOS). The analysis is grounded in the interpretative framework of the Vienna Convention on the Law of Treaties (VCLT), particularly Articles 31 and 32, which govern treaty interpretation. First, the study applies evolutionary treaty interpretation to assess whether the object and purpose of UNCLOS permit its provisions on ships and warships to accommodate technological developments that were not contemplated at the time of drafting. This approach treats UNCLOS as a living instrument whose terms may evolve in light of contemporary maritime practices. Secondly, functional interpretation is employed to evaluate the legal status of UUVs based on the functions they perform—such as navigation, military operations, or marine scientific research—rather than on their technological form. Through this lens, the article examines whether UUV operations can be subsumed within existing legal categories under UNCLOS. The doctrinal analysis is complemented by a limited comparative assessment of relevant state practice and national legislation to illustrate divergent

²⁷ *United Nations Convention on the Law of the Sea*, art. 19, para. 2(f), Dec. 10, 1982, 1833 U.N.T.S. 3.

²⁸ Stephen Li and K.S. Fung, "Maritime Autonomous Surface Ships (MASS): Implementation and Legal Issues," *Maritime Business Review* 4, no. 4 (November 18, 2019): 330–39, <https://doi.org/10.1108/mabr-01-2019-0006>.

interpretative approaches and their implications. By combining evolutionary and functional interpretation within the VCLT framework, the study aims to identify normative gaps and interpretative limits in the current law of the sea regime, and to assess the need for bilateral or regional cooperative arrangements to address legal uncertainty affecting maritime security, sovereignty, and the peaceful use of the oceans.

Technology Development on Unmanned Maritime Vehicle

As discussed previously, one of the various maritime technology developments refers to the use of UMV. The usage of such technology, in fact, was encouraged by the risk posed by ocean space for various human activities, both military²⁹ as well as commercial purposes. For instance, with regard to international trade using vessels as the mean of transportation, often pose higher risk relating to weather condition, human error as well as technical error, which mostly unpredictable. Thus, with the invention of unmanned maritime vehicle, human activities over the ocean were benefited in order to minimize risks posed by traversing crewed vessels. Autonomous shipping then become preferable under the following reasons: (i) it can reduce transportation costs; (ii) preventing immobilized vessels due to the seafarer shortage; (iii) reducing emission pollution and (iv) relating to shipping safety.³⁰

The discussion on ships' autonomous system took place as long ago as 1964, during the 8th session's agenda item 11 of Maritime Safety Committee (MSC) meeting.³¹ In MSC's document (MSC VIII/ 11, 9 March 1964), the automation was defined as "those processes in which machines – often including electronic controls – adjust and control their own performance with little or no human intervention".³² At that time, IMO has noticed the distinction between a fully automated system, a partly automated system and remote control.³³ Surprisingly, the concern on the development of ship's autonomous system turn silent until 2010 when shipping industries were faced with tightening labor market relating to the shortage of ships officers, pressure relating to freight rate as well as excess capacity, obligation to prevent and reduce pollution by using a low or even zero carbon fuels. In facing such conditions, the emergence of Maritime Autonomous Surface Ships (MASS) usage is imminent. Technology development in ships' automation further improve controlling capabilities, communication and interfaces through the current information and technology. As this turn out, the ships' automation was further applied

²⁹ See James Johnson, "Artificial Intelligence & Future Warfare: Implications for International Security," *Defense & Security Analysis* 35, no. 2 (April 3, 2019): 147-69, <https://doi.org/10.1080/14751798.2019.1600800>; Austin Wyatt and Jai Galliot, "Closing the Capability Gap: ASEAN Military Modernization during the Dawn of Autonomous Weapon Systems," *Asian Security* 16, no. 1 (September 26, 2018): 53-72, <https://doi.org/10.1080/14799855.2018.1516639>.

³⁰ Mohamad Issa et al., "Maritime Autonomous Surface Ships: Problems and Challenges Facing the Regulatory Process," *Sustainability* 14, no. 23 (November 24, 2022): 15630, <https://doi.org/10.3390/su142315630>.

³¹ "Autonomous Ships Given Regulatory Guidance," *Sea and Job*, 2023, <https://www.seaandjob.com/autonomous-ships-given-regulatory-guidance/>

³² Ibid.

³³ Ibid.

in deep-sea exploration. As acknowledge that while deep-sea contains of explorable resources, yet the human abilities to explore the ocean, in particular deep-sea, are limited. Thus, the usage of UUVs emerged.

It is acknowledged that technology advancement of UUVs outperform personnel relating to safety, efficiency as well as environmental protection. Thus, the usage of UUVs is increasing. Although there are advantages brought by the UUV's technology, there are also higher possibilities for the UUV to be potentially misuse, especially when used as military property. The first incident relating to the use of UUV happened in the end of 2016 between Chinese Navy and US Navy.³⁴ The US Navy UUV was found by the Chinese Navy in 50 nm off the Subic Bay in the South China Sea. The incident arose due to the opposite positions taken by both States over the legal status of UUV. Although the incident was resolve with the Chinese returning the UUV to US Navy, unfortunately, the legal status of UUV remains according to each State's interpretations and positions. It is argued that while the US Navy UUV can be considered as military property and thus certain laws applied, the operation of such UUV off the Subic Bay may posed questions on the purpose of the deployment of the UUV. Another incident on UUVs' operation also happen in 2091 when a China's UUV was found near Selayar Island in South Sulawesi.

Similar type of UUV was also discovered in Riau Islands nearer to the South-China Sea in March 2019. Further discovery of UUV was found in January 2020 in East Java. It is reported that such UUV is a Chinese Sea Wing which was deployed to collect seawater temperature, salinity, turbidity and oxygen levels as well as current movement, which was reported in the real-time.³⁵ However, Indonesian security analyst, Muhamad Fauzan questioned whether such UUV was being used for intelligence gathering or illegal surveying.³⁶ Geopolitically, Indonesia's position is at a crossroads of international shipping.³⁷ He further submitted that since the UUV was found quite far from Chinese along the maritime route between China and northern Australia, the UUV might have conducted future submarine routes.³⁸ Since Indonesia already determines the archipelagic sea lanes passage in accommodating the passage of foreign ships, including submarines, the mapping of future submarine's route outside the archipelagic sea lanes would qualm coastal State.

³⁴ Terri Moon Cronk, "Chinese Seize U.S. Navy Underwater Drone in South China Sea," U.S. Department of Defense, December 16, 2016, <https://www.defense.gov/News/News-Stories/Article/Article/1032823/chinese-seize-us-navy-underwater-drone-in-south-china-sea/>.

³⁵ Ibid.

³⁶ Ibid.

³⁷ Suparto, and Admiral. "The Overplay Functions And Authority Of The Sea Security Board (Bakamla) And The Sea And Coast Guard In Keeping Marine Security In Indonesia". *Jurnal IUS Kajian Hukum dan Keadilan* vol. 10 no. 2 (August 2022): 436-447. <https://doi.org/10.29303/ius.v10i2.999>

³⁸ Helen Davidson, "Indonesian Fisher Finds Drone Submarine on Possible Covert Mission," *The Guardian*, December 31, 2020, sec. World news, <https://www.theguardian.com/world/2020/dec/31/indonesian-fisher-finds-drone-submarine-on-possible-covert-mission>.

The Nature UUV

Underwater environment differs to ocean surface. It can be defined as the area where the absence of human eyes exists.³⁹ Historically, the exploration and exploitation of underwater resources was hampered by the limited ability of human in underwater environment. Along with technology development, UUV claims as a very useful technology for human to know more about underwater environment as well as resources. In its development, the use of UUV is vary, ranging from recreational purposes, such as the exploration of coral reefs to the beauty of shipwreck harboring historical story of the ship, to the military purposes. The exploration of deep-sea also uses UUVs. The current UUV today is more developed since it is already equipped with an advance sensory equipment which allows the UUV to gain detailed information of underwater environment. However, this superb capability often raises a question to what is actually the limit of information that UUV is allowed to collect and monitor, especially over the ocean territory and jurisdiction of a State? It is submitted that environmental characteristic where the UUV is operated and the purpose of the operation will determine the legal status of it. It is argued that unlike aerial drone, communication of UUV while submerged, with the surface poses a unique challenge. Underwater robotic has difficulties to be reach with traditional signals. Thus, it is submitted that the nature of UUV cannot be stray away from its mother ships. In such, it is submitted that UUV must have communication connection with whoever in charge of its deployment. Nevertheless, legal status of such vehicle raised questions as to how the responsibility of State if the UUVs cause damage to other State or threaten States.

Purpose of Operation

The benefit of UUV has made various sector uses UUV. Military, commercial as well as scientist have longstanding relationship with ROV prior to the development of UUV technologies. Thus, these sectors have also familiar with the use of UUV in general. Whereas recreational purposes are relatively new user to UUV and increasingly using it since the UUV usage become more prevalent and affordable.

The usage of UUV in commercial sector ranging from oil and mineral exploration, underwater infrastructure's installation, and salvage work.⁴⁰ Commercial sector also uses UUV relating to surveys of underwater geology and archaeology as well as activities relating to determination of undersea cable routes in order to explore the deep-sea wrecks.⁴¹ UUV also very useful for survey and monitoring of marine environment.⁴²

As for scientific and research purposes, scientist has also used underwater robotic for their various research especially deep-sea research areas. For this purpose, the questions

³⁹ Annie Brett, "Secrets of the Deep: Defining Privacy Underwater," *Missouri Law Review* 84, no. 1 (January 1, 2019): 47.

⁴⁰ Andrew H. Henderson, "Murky Waters: The Legal Status of Unmanned Undersea Vehicles," *Naval L. Rev* 55 (2006).

⁴¹ *Ibid.*

⁴² Imam Hariadi et al., "Analisis Resiko Penggunaan Unmanned Underwater Vehicle (UUV) Terhadap Keamanan Maritim Indonesia," *Judge: Jurnal Hukum* 5, no. 2 (August 27, 2024), <https://doi.org/10.54209/judge.v5i02.590>

relating to legal status of such UUV lies in the legal status of UUV if foreign UUV conducting research in the areas of ocean within coastal State's sovereignty of jurisdiction. Who will bear responsibilities? Can flag State jurisdiction be applied to such situation? How to distinguish whether such UUV is operated for scientific purposes only or as a part of military purposes? As for recreational use, the use of UUV is relatively new and gained increasing interests as well as widespread use.

Furthermore, the usage of marine robotic in military sector is never new, since this sector is the longest user of ROV. Military sector, mostly uses the UUV for surveillance purposes. It is argued that from military point of view, it is also important to have UUV beside the traditional manned submarine, since the UUV may assists military with collecting information more discretely. The use of UUV in military also preferable in case the military should send the UUV to hostile area, as well as in dangerous missions, such as mine sweeping.

However, the challenges lie in the possibilities of such UUV infringe coastal State's jurisdiction, as to penetrate ocean areas under the sovereignty of coastal State, and might cause damage. In this case, to determine the obligation that the UUV bears is to determine first the legal status of such UUV. If it is used for military purposes, it is obviously military property, but can it be considered as warship or part of warship? As mentioned, that the operation of some UUV cannot stray far away from its mother ship? Thus, it is important to discuss whether such UUV can be categorized as warship and thus poses special treatment according to international laws?

Is the UUV considered a Ship?

UNCLOS 1982 interchangeably uses the word 'ships' and 'vessels' without further elaboration on what is meant by 'ships' or 'vessels.' However, other provisions provided by UNCLOS 1982 can be considered in the effort of defining 'ships.' Article 94 paragraph (4) b and c of UNCLOS 1982 envisages:

"(b) that each ship is in the charge of a master and officers who possess appropriate qualifications, in particular in seamanship, navigation, communications and marine engineering, and that the crew is appropriate in qualification and numbers for the type, size, machinery and equipment of the ship;

*I that the master, officers and, to the extent appropriate ,the crew are fully conversant with and required to observe the applicable international regulations concerning the safety of life at sea, the prevention of collisions, the prevention, reduction and control of marine pollution, and the maintenance of communications by radio."*⁴³

From the above provisions, it can be noticed that to be able to considered as 'ships', there should be a master and officers as well as crews and presumably those seamen should be on-board the ships. On the other hand, various Conventions issued by IMO, such as Safety of Life at Sea (SOLAS), the International Convention for the Prevention of Pollution form

⁴³ *United Nations Convention on the Law of the Sea*, art. 94, para. 4(b)-(c), Dec. 10, 1982, 1833 U.N.T.S. 3.

Ships (MARPOL) dan Collision Regulation 1972 (COLREG), envisages clearly on the definition of 'ships.' Rule 3 of COLREG provides "[v]essel includes every definition of craft, including non-displacement craft and seaplanes, used or capable of being used as a means of transportation on water."⁴⁴ Whereas Article 2 paragraph (4) of MARPOL defines ship as "a vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft and fixed or floating platforms."⁴⁵ Furthermore, since SOLAS principally regulates almost every aspect of life at sea, it defines ships specifically based on each type of ships.⁴⁶ From the definitions on 'ships' or 'vessels', it can be noticed that the elements forming 'ships' or 'vessels' include (i) any vehicle/ equipment that can be used as transportation by sea; (ii) able to navigate at sea and (iii) include submersible vehicles. Unlike UNCLOS 1982, which implicitly require the intervention of masters/ officers and crews, various international conventions issued by IMO, do not mention anything regarding ships' manning. The definition of MARPOL also suggests that ship includes submersible vessel and thus UUV can be assumed as ship under this definition.

Furthermore, registration implication of an UUV should also be considered. According to international law, ships, aircraft or any other vehicle flying a flag of certain state are considered as extended territorial of the State, this principle known as "floating islands principles." UNCLOS 1982 provides certain ships' registration system that should be adopted by States parties to the Convention. Although there is also open registration system for ships to fly the flag of certain State,⁴⁷ UNCLOS 1982 clearly adopted a genuine link requirement between the ships and the State, in order for a ship to be able to fly the flag of such State. This regulation can be found in Article 91 of UNCLOS 1982 on the nationality of ships, which envisages:

"1. Every State shall fix the conditions for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag. Ships have the nationality of the State whose flag they are entitled to fly. There must exist a genuine link between the State and the ship.

2. Every State shall issue to ships to which it has granted the right to fly its flag documents to that effect" (UNCLOS, 1982).⁴⁸

Article 94 of the Convention further envisages about the duties of flag States and provide that flag State shall has jurisdiction and control over ships flying its flag. Such jurisdiction and control, further include administrative, technical and social aspect over ships flying

⁴⁴ *Convention on the International Regulations for preventing Collisions at Sea*, Oct. 20, 1972, 1050 U.N.T.S. 16.

⁴⁵ International Maritime Organization, 'International Convention for the Prevention of Pollution from Ships (MARPOL): Article 2 Paragraph (4)' (www.imo.org2019) <[https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-\(MARPOL\).aspx](https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx)>.

⁴⁶ *International Convention for the Safety of Life at Sea*, Nov. 1, 1974, 1184 U.N.T.S. 2.

⁴⁷ Dhiana Puspitawati, Renny Meirina and Fransiska Ayulistya Susanto, *Hukum Maritim* (Malang: Universitas Brawijaya Press, 2019).

⁴⁸ *United Nations Convention on the Law of the Sea*, art. 91, Dec. 10, 1982, 1833 U.N.T.S. 3.

its flag.⁴⁹ Another United Nations Conventions relating to ships' registration, the United Nations Convention on Conditions for Registration of Ships 1986 re-emphasizes the need to have a genuine link requirement between ships flying the flag of a certain state, as stated in its Article 1 as follows:

"For the purpose of ensuring or, as the case may be, strengthening the genuine link between a State and ships flying its flag, and in order to exercise effectively its jurisdiction and control over such ships with regard to identification and accountability of shipowners and operators as well as with regard to administrative, technical, economic and social matters, a flag State shall apply the provisions contained in this Convention"(United Nations Convention on Conditions for Registration of S.⁵⁰

For the purpose of registration, this Convention provides the definition of ships as "[a]ny self-propelled sea-going vessel used in international seaborne trade for the transport of goods, passengers, or both with the exception of vessels of less than 500 gross registered tons."⁵¹ Under this definition, UUV cannot be considered as ships relating to the need of ships' registration and thus cannot be registered. Nevertheless, any UUV would bear identification such as flag of certain state printed on its body. It is questionable to what extend the jurisdiction of such flag State?

From the above analyses, it can be noted that according to UNCLOS 1982 and United Nations Convention on Conditions for Registration of Ships 1986, UUV might not be considered as ships. On the other hand, according to various conventions issued by IMO, especially MARPOL, UUV maybe be considered as ships, in this case included within the category of submersible vehicle. However, it is unclear whether UUV can be categorized as the means of transportation, since the purpose of the UUV also varies. Therefore, it can be concluded that there is no exact answer to whether UUV can be considered as ships or not. It depends on the legal instruments used.

What classification does UUV belong to?

While various conventions have different definitions on ships, as discussed above some definitions include the criteria of submersible as well as underwater. MARPOL clearly includes the submersible vehicle in defining ship and thus under this definition UUV can be considered as ship. However, the requirement of ships to be registered under the United Nations Conventions on Conditions for Registration of Ships 1986 failed the categorization of UUV to be considered as ship. So, what category does UUV fall into?

Although the purpose of UUVs' operation is varied, in some extend, the presence of foreign UUV in a coastal State's waters would alarm such State.⁵² This is a reference to

⁴⁹ *United Nations Convention on the Law of the Sea, art. 94, Dec 1982, 1833 U.N.T.S. 3.*

⁵⁰ *United Nations Convention on Conditions for Registration of Ships, art. 1, Feb. 7, 1986, 1676 U.N.T.S. 3.*

⁵¹ *Ibid.*

⁵² Imam Hariadi et al., "Analisis Resiko Penggunaan Unmanned Underwater Vehicle (UUV) Terhadap Keamanan Maritim Indonesia," *Judge: Jurnal Hukum* 5, no. 2 (August 27, 2024): , <https://doi.org/10.54209/judge.v5i02.590>.

the presence of submarine and thus it is questionable whether the UUV can be deemed as submarine? This led to another aspect related to the rights of navigation as envisaged by UNCLOS 1982. Article 20 of UNCLOS 1982 provides that “[i]n the territorial sea, submarines and other underwater vehicles are required to navigate on the surface and to show their flag.”⁵³ While again, UNCLOS 1982 is silent on what is meant by ‘submarine’ ‘underwater vehicle’, it is argued that ‘submarine’ provides in Article 20 of UNCLOS 1982 implicitly refers to a military submarine. Additionally, since ‘underwater vehicle’ is mentioned together with ‘submarine’ in Article 20, one would interpret it as, but not limited to, any underwater vehicle for the military purposes. If so, it is uneasy to clearly draw the distinction between submarine and underwater vehicle.⁵⁴ In this case, if UUV assumed as submarine or underwater vehicles, in fact not all UUV’s operation is for military purposes. Additionally, referring to the provisions relating to the rights of navigation provided by UNCLOS 1982, it is unclear whether the UUV is capable to switch to surface in the middle of the voyage if it traverse territorial waters of a foreign State. Similarly, Beckman further questions if UUVs are considered as ‘ship’ can it possibly require to surface and fly its flag as well as use the sea-lanes and traffic separation schemes when exercising innocent passage under Article 20, 22 and 52 of UNCLOS 1982?⁵⁵ On the other hand, if UUVs is not considered as ship, can coastal States prohibit its passage rights through their waters or even confiscate it?

Other terminologies found in UNCLOS 1982 which might refer to UUV are ‘equipment’ mentioned in Part XIII of UNCLOS 1982 and ‘military device’ envisaged in Article 19 paragraph 2 (f) of UNCLOS 1982. Part XIII of UNCLOS 1982 provides deployment and use of any type of scientific research ‘equipment’; this clearly refers to marine scientific research. Whereas, not all UUV is operated for research purposes. Furthermore, the term ‘military device’ envisaged in Article 19 paragraph 2 (f) of UNCLOS 1982 pose question whether UUV can be assumed as ‘military device’? This provision mentions any ‘military device’ in relating to the prohibition of launching, landing and taking on board of any military device while exercising innocent passage. This ‘military device’ implicitly refers to drone, but it is unclear whether it also include UUV such as sea glider. It is further questionable whether the operation of UUV as ‘military device’ can be said as violating innocent passage if it does activities envisaged in Article 19 paragraph 2?⁵⁶

While submarine for military purposes is clearly warship, if UUV is categorized as ‘underwater vehicle’ as well as ‘military device’, does it fall into the category of warship? Article 29 of UNCLOS 1982 defines warship as:

“...a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly

⁵³ *United Nations Convention on the Law of the Sea*, art. 20, Dec. 10, 1982, 1833 U.N.T.S. 3.

⁵⁴ Robert Veal, “Maritime Autonomous Surface Ships: Autonomy, Manning and the IMO,” *Shipping & Trade Law* 18, no. 5 (2018).

⁵⁵ Robert Beckman, “Unmanned Naval Craft and Passage Regimes in 1982 UNCLOS,” in *NUS Centre for International Law*, (Blue Security Joint Seminar on Maritime Security Challenges in Southeast Asia, 2023) (Blue Security Joint Seminar on Maritime Security Challenges in Southeast Asia, 2023).

⁵⁶ *United Nations Convention on the Law of the Sea*, art. 20, Dec. 10, 1982, 1833 U.N.T.S. 3.

commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and manned by the crew which is under regular armed forces discipline.”

From such provision, it can be concluded that in order to be categorized as warship, several requirements should exist. These include (i) owned by armed forces of a State and bearing the marks; (ii) operated under the command of a recognized officer and (iii) manned by the crew under the armed forces discipline. Accordingly, UUV cannot satisfies the third requirement, that is manned by crew. It is still debatable whether UUV can fulfil the second requirement. It is unclear whether the officer should be on-board the ship or can be replaced by remote command? The presence of master/ officer on-board the ships envisage in Article 29 is similar to Article 94 of UNCLOS 1982 discussed earlier.

At this point, it is further questionable whether we need to formally consider UUV as a certain type of ships, or any other categorization, or do we have to give it to functionalism⁵⁷ consideration in determining the status of UUV? On this functionalism aspect, Allen argues that functionalism approach in determining any unmanned maritime vehicle, including UUV only appropriate if the said treaty provides such flexibility.⁵⁸ While none of relevant international conventions provides legal status of UUV, yet it is argued that upon such conventions an evolutionary interpretation can be conducted since the advancement in ships' technology is imminent. An evolutionary interpretation perceives that in several context the terms provided within a certain treaty are not fixed once and for all, rather it may change through time.⁵⁹ While it would be inappropriate to take an evolutionary approach to every term of the convention, it is argued that application of such approach depends most importantly on the intention of the parties,⁶⁰ in this case, objective intention. Vienna Convention on the Law of Treaties 1969 (VCLT) provides general rules of interpretation in Article 31-33. It is argued that in determining the objective intention of the parties, the term should be interpreted by looking at the text, object and purposes of the said convention and interpreted in good faith.⁶¹ Article 31 paragraph (2) of VCLT further stipulates that the context in which interpretation takes places should also include the preamble and the annexes. The preamble of UNCLOS 1982 clearly envisages that the spirit of the Convention is to establish “...legal order for the seas and oceans which will facilitate international communication, and will promote the peaceful uses of the seas and oceans...”⁶² and thus in interpreting the provisions, the peaceful usage of the ocean should be considered. This way, if the UUV is operated for marine scientific research, clearly the operation of such UUV in foreign jurisdiction will

⁵⁷ Craig H. Allen, “Determining the Legal Status of Unmanned Maritime Vehicles: Formalism vs Functionalism,” *SSRN Electronic Journal* 49, no. 4 (2018): 1–24, <https://doi.org/10.2139/ssrn.3244172>.

⁵⁸ *Ibid.*

⁵⁹ Eirik Bjørge, *The Evolutionary Interpretation of Treaties* (Oxford, United Kingdom: Oxford University Press, 2014).

⁶⁰ Simon McKenzie, “When Is a Ship a Ship? Use by State Armed Forces of Un-Crewed Maritime Vehicles and the United Nations Convention on the Law of the Sea,” *Melbourne Journal of International Law* 21, no. 2 (2020), <https://doi.org/10.31228/osf.io/a7xtc>.

⁶¹ Eirik Bjørge, *The Evolutionary Interpretation of Treaties* (Oxford, United Kingdom: Oxford University Press, 2014).

⁶² *UNCLOS*, pmb1.

follow the provisions in maritime zone envisages within UNCLOS 1982. On the other hand, the operation of UUV for military purposes remains debatable. Although evolutionary interpretation can be conducted to relevant international conventions, it is argued that States would have different results based on their own national interests. It follows from the above that giving States the freedom to do evolutionary interpretation as discussed above would not either solve the problem in determining the legal status of UUV, nor decide what to do if foreign UUV is found in coastal States' territory. Determination of UUV's legal states based on functionalism consideration also poses difficulties in the law enforcement in practice.⁶³ This way, it is best to have a certain cooperation among neighboring governments to establish a binding code of conduct, both bilaterally and regionally, that governs the operation and legal framework of UUVs is necessary. Such code of conduct serves not only as a guidance but also as a law enforcement mechanism of what to do and what not to do if foreign UUVs found within States' territory.

Limits of Interpretation: Functional Equivalence as A Constrain

A key limit on the application of evolutionary interpretation to UUVs lies in the requirement of functional equivalence. Evolutionary interpretation does not permit technological novelty alone to justify the extension of existing legal categories under UNCLOS 1982. Rather, it is applicable only where UUVs perform functions that are legally comparable to those traditionally carried out by ships or warships, such as navigation, military operations, or marine scientific research.

This functional approach constrains interpretative discretion by shifting the focus from the physical characteristics or autonomous nature of UUVs to the legal relevance of their operational role. Where a UUV is deployed to perform functions already contemplated by UNCLOS 1982—such as intelligence gathering ancillary to naval operations or scientific data collection—it may, in principle, be assessed within existing normative frameworks. Conversely, where UUVs engage in activities that are qualitatively distinct from those of conventional vessels, including persistent covert presence, autonomous decision-making with potential use of force, or continuous seabed interaction, functional equivalence breaks down.

In such circumstances, treating UUVs as ships or warships through evolutionary interpretation risks exceeding the permissible bounds of treaty interpretation and amounts to normative expansion rather than interpretation. Functional equivalence therefore operates as a substantive legal threshold, ensuring that evolutionary interpretation remains disciplined, predictable, and consistent with the text, structure, and underlying balance of rights and obligations established by UNCLOS.

⁶³ Imam Hariadi et al., "Analisis Resiko Penggunaan Unmanned Underwater Vehicle (UUV) Terhadap Keamanan Maritim Indonesia," *Judge: Jurnal Hukum* 5, no. 2 (August 27, 2024), <https://doi.org/10.54209/judge.v5i02.590>.

Conclusion

This article has demonstrated that the absence of explicit provisions on unmanned underwater vehicles (UUVs) in UNCLOS 1982 generates persistent legal uncertainty in the regulation of emerging maritime technologies. In the absence of clear treaty guidance, States have tended to rely on unilateral interpretations informed by national interests when responding to foreign UUV operations, particularly within areas subject to coastal State jurisdiction. While related international instruments may offer partial analogies, the multifunctional and technologically distinct nature of UUVs complicates any straightforward transposition of existing legal categories.

From an academic perspective, the article contributes to the law of the sea by clarifying the scope and limits of evolutionary and functional treaty interpretation in addressing technological developments unforeseen by the drafters of UNCLOS. It argues that treaty silence should not be understood as regulatory exclusion, but as a deliberate openness that allows interpretative adaptation. At the same time, the analysis shows that evolutionary interpretation is inherently constrained and cannot, on its own, ensure uniform or predictable outcomes in the face of fragmented and interest-driven State practice.

Looking forward, the article underscores the practical importance of bilateral and regional codes of conduct as complementary regulatory tools. Such instruments can operationalise shared interpretative understandings, provide guidance for enforcement responses to foreign UUV activities, and reduce the risk of escalation arising from legal ambiguity. In this way, cooperative frameworks offer a pragmatic means of enhancing legal certainty while preserving the stability and adaptability of the UNCLOS regime in the age of autonomous maritime technologies.

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