

Unmanned and Autonomous Systems: Navigating Today's Legal Atmosphere



A Seahawk medium displacement unmanned surface vessel participates in U.S. Pacific Fleet's Unmanned Systems Integrated Battle Problem 21, 21 April 2021

[Photo](#) Credit: Chief Petty Officer Shannon Renfroe



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Introduction

In the Navy's March 2021 Unmanned Campaign Framework, the Secretary of the Navy noted that "To compete and win in an era of great power competition, the Department is committed to investing in advanced autonomy, robust networks, and unmanned systems to create true integrated human-machine teaming that is ubiquitous across the fleet."¹ The Framework further notes that "Unmanned systems will increase lethality, capacity, survivability, operational tempo, deterrence, and operational readiness."² For optimal success, the Navy must understand both the physical and legal environments in which it operates. As the technology and viability of these systems rapidly advance, it is vital to determine the legality of operation and acknowledge gaps in law and policy.³

Policy and law concerning AS and UxS is developing and states are at varying stages regarding the development and regulation of these systems. While many nations have some strategies and policies related to these systems, there is little consensus on system-specific laws or policies at the international level. As a result, the laws that apply, especially internationally, are significantly older than the advanced technology that AS and UxS represent and were not written to apply to these cutting-edge systems. While this does not make them inherently incompatible, it does not provide a comprehensive approach to the challenges inherent in the design and use of these systems. For example, treaties such as UNCLOS were not created to apply to these types of advanced technology. As a result, UNCLOS applies but with limitations and leaving outstanding legal and policy questions.

To understand the current legal and policy landscape, this report explores the following research question: what are the legal requirements for autonomous or unmanned systems to operate in international waters and exclusive economic zones (EEZ)? To answer this, an

¹ "Department of the Navy Unmanned Campaign Framework." 2021. Page 3.

² "Department of the Navy Unmanned Campaign Framework." 2021. Page 6.

³ The research and analysis found in this report are a part of a larger research project also supported by CRUSER. This umbrella project seeks to (1) provide answers to pressing legal questions affecting the design and operation of UxS and (2) provide a more thorough understanding of the considerations and requirements under multiple legal regimes and the evolving web of international governance related to UxS. This report seeks to contribute to the DoD's call to "continue to lead the national and international discussions concerning [artificial intelligence] perception, policy and laws" (Unmanned Systems Integrated Roadmap FY 2017-2042. Page 19) and the U.S. Navy's call to "develop policy to allow implementation of these capabilities and ensure that developed capabilities are legal and that they advance U.S. interests" (Department of the Navy Strategic Roadmap for Unmanned Systems. Page 4).

autonomous underwater vehicle (AUV) named Luke is taken through a hypothetical scenario to show which laws apply and where.⁴ Upon departure from a U.S. Navy installation, Luke travels through different maritime zones to conduct military surveillance. As its mission progresses, Luke must abide by certain laws/policies and its operators must understand and address the ambiguities inherent in some of the laws. This analysis focuses on three international Conventions related to maritime vessels and activities (UNCLOS, SOLAS, COLREGs); for each, Luke is assumed to be a vessel or ship.⁵

The Challenge of Defining Autonomous Systems

Defining AS and UxS is critical to understanding applicable laws and policies. Specifically, we researched and analyzed official military-oriented UxS and Autonomous Weapons System (AWS) definitions to understand commonalities and areas of differences and ensure compliance with U.S. and international law. Additionally, how a system is defined can impact how it is regulated.

Research included definitions from the DOD Directive 3000.09 and U.S. Navy AS Strategy, and definitions from China, Russia, United Kingdom, Canada, and NATO. Analysis of these definitions revealed an overall similarity amongst the definitions. However, slight differences in terminology can impact whether and how a law applies to a system. Depending on a state's priorities, it may define AS to exclude (or include) specific terminology so that a particular law applies. Internationally, there is a lack of an agreed-upon definition. This reflects the reality that laws and policies concerning AS and UxS are still developing.

This analysis did show the advancements made by the U.S. in recent years and the strength of U.S. AS strategies, with several agencies having produced roadmaps for the use of AS. For consistency, this report will use the NATO definition of AS and the U.S. Department of Defense definition of AWS. NATO defines an AS as “a system that decides and acts to accomplish desired goals, within defined parameters, based on acquired knowledge and an evolving situational awareness, following an optimal but potentially unpredictable course of action”.⁶ The DoD defines AWS as “A weapon system that, once activated, can select and engage targets without further intervention by a human operator.”⁷ These definitions contain elements commonly recognized in policies related to AS.

⁴ Fort this analysis, an AUV is used to represent both an AS and UxS.

⁵ Policy on these is evolving: the Maritime Safety Committee of the International Maritime Organization completed a regulatory scoping exercise to analyze relevant ship safety treaties, in order to assess how maritime autonomous surface ships (MASS) could be regulated. See <https://www.imo.org/en/MediaCentre/PressBriefings/pages/MASSRSE2021.aspx>.

⁶ NATO Glossary of Terms and Definitions. 2020.

⁷ DoD 3000.09. 2017. Pages 13-15.



U.S. Navy Unmanned Buoyancy Glider⁸

The Scenario: Luke's Journey

Luke is the fictional AUV similar to the unmanned buoyancy glider pictured above. Luke operates fully autonomously, without a mothership, as a military surveillance vehicle for the U.S. Navy. Luke is clearly and correctly labeled as a U.S. Navy vessel with the appropriate lights and other necessary components to prevent it from being a navigational hazard.

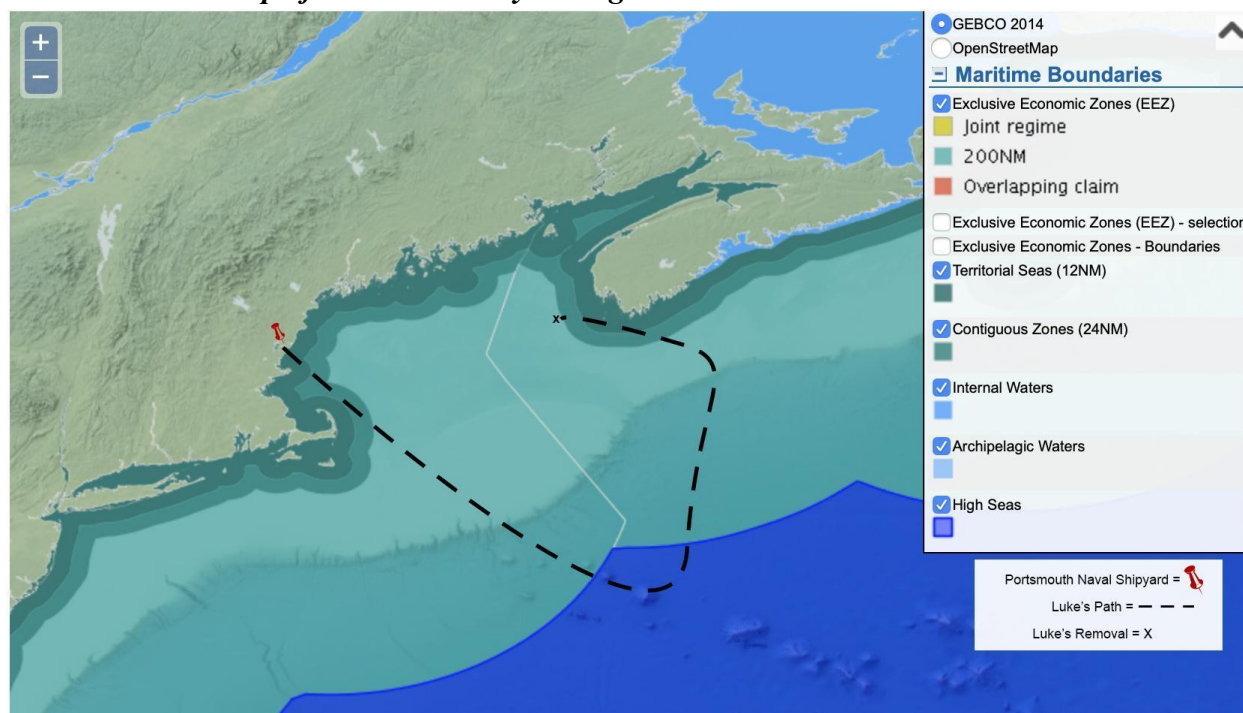
Luke's journey begins with its launch at the Portsmouth Naval Shipyard in Kittery, Maine. Luke autonomously navigates through the U.S. territorial sea and EEZ and into the high seas. After conducting surveillance in the high seas, Luke travels into the Canadian exclusive economic zone (EEZ).⁹ It continues to collect military surveillance data as it passes through the Canadian EEZ. While en route, Luke passes through Canadian territorial waters. Upon doing so, Luke surfaces until its exit of Canadian territorial waters. Once beyond the territorial sea and back into Canada's EEZ, Luke prepares to submerge again. Before this is possible, a Chinese military warship extracts the AUV from the water and onto its deck. The Chinese warship had prior consent to conduct marine scientific research in the EEZ by Canada.

This report will work through the hypothetical and analyze the laws that apply in each of the maritime zones along Luke's journey. The report also will address the legality of the Chinese vessel's actions.

⁸ Mazzolin. Updated: Chinese Seize U.S. Navy Unmanned Vehicle. December 16, 2016.

⁹ Information on maritime zones can be found at: <https://nauticalcharts.noaa.gov/data/us-maritime-limits-and-boundaries.html#general-information>.

Map of Luke's Journey through U.S and Canadian Maritime Zones¹⁰



Scenario Background

Before addressing the legality of Luke's journey and acquisition by the Chinese warship, it is important to understand how Luke is characterized under maritime laws. The analysis focuses on the United Nations Convention on the Law of the Sea (UNCLOS), the international agreement that establishes a legal framework for all marine and maritime activities, and related maritime laws including SOLAS and COLREGs. Because these conventions predate advanced autonomous technology, application of these laws sometimes requires assumptions. Arguing the basis for Luke as a vessel is beyond the scope of this report but there is room for debate about how to accurately characterize these systems, especially given the different systems and programs in use.¹¹

Vessel or Warship

Even before it is launched, Luke's characterization under UNCLOS must be determined; i.e., is Luke a vessel/ship or a warship? The distinction is important because UNCLOS does not hold a warship to the same standards as a vessel or ship. While UNCLOS does not define the terms vessel or ship, it does define warship. UNCLOS defines a warship as "a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality... and manned by a crew which is under regular armed forces discipline."¹² The

¹⁰ Maritime Boundaries Geodatabase: Maritime Boundaries and Exclusive Economic Zones (200NM). Version 11.

¹¹ For further discussion, see: 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." 2020.

¹² UNCLOS. 1982. Article 29. Page 34-35.

requirement of “manned by a crew” excludes Luke from a warship designation. For this analysis, Luke is assumed to be a vessel under UNCLOS.

Characterizing Luke is important for U.S. law as well. For example, if Luke was a large unmanned surface vessel (LUSV) or a medium unmanned surface vehicle (MUSV), it would have to gain special authorization before its operation. The National Defense Authorization Act of 2021 requires that these vessels gain prior approval from the Secretary of Defense as meeting DoD standards including having “demonstrated in vessel-representative form, fit, and function.”¹³

Types of control

Additionally, it is important to identify and understand the level of human control in maritime AS. Depending on how it is controlled, certain liability and regulations may apply. If a mothership is nearby and controlling the AS (even partially or periodically), it is not a fully autonomous system. With a remote controlled AS, a human is in the loop controlling its actions. As the name implies, with a fully autonomous system, the system has complete autonomy in which the human is out of the loop.¹⁴ It is possible for a system to have a variety of controls. For example, a system could be remotely controlled from a mothership or be autonomous in certain phases of its mission and controlled in others. In this scenario, Luke is fully autonomous during its mission.

Types of data collection

The type of data collection being performed will affect how the law applies to the vessel. For example, UNCLOS regulates marine scientific research (MSR) differently than military data collection. UNCLOS defines MSR as “any study, whether fundamental or applied, intended to increase knowledge about the marine environment, including all its resources and living organisms, and embraces all related scientific activity.”¹⁵ MSR falls under the sovereignty of a coastal state. Accordingly, permission by a coastal State is required to conduct MSR in its EEZ & territorial waters. Military data includes a variety of information collected by the military for military use such as data collected for transit or oceanographic data. Military surveillance is the collection of surveillance data by and for the military; this could include hydrographic or acoustic monitoring.

Military surveillance and military data are not considered MSR. It is the U.S. position that vessels conducting military surveillance and data collection need no permission from the coastal State. However, other States posit that collecting military data and/or surveillance does

¹³ H.R. 6395 - National Defense Authorization Act for Fiscal Year 2021. 2020. Section 227.

¹⁴ Human in the loop and human out of the loop are important concepts in the control of autonomous systems and artificial intelligence. For a general understanding, see Robert Mazzolin. Artificial Intelligence and Keeping Humans “in the Loop.” 2020. Available at: <https://www.cigionline.org/articles/artificial-intelligence-and-keeping-humans-loop/>.

¹⁵ Marine Scientific Research: A revised guide to the implementation of the relevant provisions of the United Nations Convention on the Law of the Sea. 2010.

require prior permission from the coastal State. In addition to different state positions, defining these categories can be difficult as there are many instances where the lines between military surveillance, data collection and MSR are blurred.

Application of Law in Luke's Journey

Luke in U.S. Territorial Waters and EEZ

As a U.S. vessel, Luke's passage through U.S. territorial waters and EEZ is a straightforward analysis under UNCLOS. Upon departure from Kittery, Maine, Luke may legally operate in the territorial waters and EEZ without additional measures.

In addition to UNCLOS, however, other legal standards apply even in U.S. waters. Luke must abide by the International Convention for the Safety of Life at Sea (SOLAS) rules and standards; SOLAS applies throughout Luke's journey. The convention's goal is to ensure that maritime vessels are safe to operate, whether in a vessel's construction or navigation techniques. Chapter V of SOLAS focuses on safety of navigation and applies to all vessels and ships aside from "warships, naval auxiliaries and other ships owned or operated by a Contracting Government and used only on government non-commercial Service."¹⁶ Even though an AUV like Luke does not fit the anticipated criteria for a vessel or ship, most nations that operate AS or UxS take the position that SOLAS applies to these systems as vessels. As our analysis assumes Luke is a vessel, it must abide by these requirements. Accordingly, the chapter focuses on the vessel's navigational capabilities to ensure its safety and other vessels in the area.

As a vessel, Luke must also abide by the Convention on the International Regulations for Preventing Collisions at Sea of 1972 (COLREGs). COLREGs ensure the safety of the operating vessel and those around. Safety is ensured through certain requirements, such as the appropriate use of lighting or "right of way" rules. Applicable COLREGs rules are to be followed during Luke's entire trip. The International Maritime Organization (IMO) passes the obligation of enforcement/implementation of many rules, including those from COLREGs, onto a nation's credible authority. Thus, the U.S. Coast Guard is in charge of implementing and enforcing IMO rules for U.S. vessels.

Luke in International Waters

As Luke departs the U.S. EEZ, it enters the high seas or international waters. Under UNCLOS Article 87, Luke may legally enter the high seas. Article 87 establishes the freedom of the high seas and stipulates that "the high seas are open to all States, whether coastal or land-locked."¹⁷ This article protects freedom of navigation and freedom of scientific research (with some limits). Even with this freedom, while Luke exercises its rights, it must do so with "due regard for the interests of other States in their exercise of the freedom of the high seas"¹⁸ or

¹⁶ SOLAS. 1974. Chapter V: Safety of Navigation.

¹⁷ UNCLOS. 1982. Article 87.

¹⁸ Ibid.

exercising their other rights. Thus, as long as Luke operates with due regard, there is no special authorization needed while in international waters.

Luke in Canada's EEZ

After operating in the high seas, Luke enters Canada's EEZ. UNCLOS Article 58 allows Luke to operate (with limits) in Canada's EEZ. Many of the allowable activities are similar to that of Article 87 (see *Luke in International Waters*), such as navigation and overflight or the laying of submarine cables.¹⁹ In general, Article 58 protects the freedom of a state to use another state's EEZs for non-economic purposes.²⁰

Luke is more restricted in Canada's EEZ, however. Notably, UNCLOS Articles 56 and 246 reserve certain rights for the coastal state. Article 56 states that the coastal states reserve the "sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living"²¹ within their EEZ. One of the specified freedoms is the sole right to authorize or perform marine scientific research (MSR) in the EEZ. Accordingly, as noted in Article 246 "Coastal States... have the right to regulate, authorize and conduct marine scientific research in their exclusive economic zone and on their continental shelf in accordance with the relevant provisions of this Convention."²² Because Luke is performing military surveillance and not MSR, Luke may continue its activities in Canada's EEZ.

Due Regard

Exercising the right to surveillance (or military data collection) is not without limitations. While in Canada's EEZ, Luke must abide by Article 58 paragraph 3 which limits Luke's freedoms to those which maintain due regard for the coastal State. Specifically, it states, "States shall have due regard to the rights and duties of the coastal State and shall comply with the laws and regulations adopted by the coastal State...."²³

Due regard is "allowing for the 'accommodation of competing interests' by balancing states' freedom of action with the necessity for self-restraint. States must balance their own freedom of action and claims of jurisdiction against the freedoms and claims of others."²⁴ In terms of Luke's military surveillance in the area, due regard requires that the execution of surveillance will have no or little impact on Canada's economic and environmental rights as the coastal State. Furthermore, any impact should involve an appropriate balancing of competing

¹⁹ UNCLOS. 1982. Article 58.

²⁰ McKenzie. "Autonomous technology and dynamic obligations: uncrewed maritime vehicles and the regulation of maritime military surveillance in the exclusive economic zone". 2021. Page 146-175.

²¹ UNCLOS. 1982. Article 56.

²² UNCLOS. 1982. Article 246.

²³ UNCLOS. 1982. Article 58. Paragraph 3.

²⁴ McKenzie. "Autonomous technology..." Page 167

rights.²⁵ Due regard is not clearly defined but rather determined on a case-by-case basis. A balance often is struck when the vessel and the coastal states have conflicting rights.

Due regard applies to both Luke as the vessel and Canada as the coastal State: Canada also must demonstrate due regard for Luke while in its EEZ. Article 56 paragraph 2 states, “the coastal State shall have due regard to the rights and duties of other States and shall act in a manner compatible with the provisions of this Convention.”²⁶ Luke must also have due regard as mentioned in Luke in *International Waters* section (specifically Article 87) and as mentioned in *Luke in Canada’s EEZ* (Article 58, paragraph three).

Luke in Canada’s Territorial Sea

Coastal States exercise full sovereignty over the territorial sea including the air space above the sea and over the seabed and subsoil. The only right that can be exercised by Luke is that of innocent passage. UNCLOS Article 17 states, “ships of all States... enjoy the right of innocent passage through the territorial sea.”²⁷ UNCLOS Article 20 sets requirements for this passage; it states, “In the territorial sea, submarines and other underwater vehicles are required to navigate on the surface and to show their flag.”²⁸ Upon entering Canada’s territorial sea, as a submerged vessel, Luke must resurface and be clearly marked and labeled as a U.S. autonomous system.

The most applicable rule for Luke or any vessel while passing through another coastal State’s territorial waters is to do so innocently. Article 19 of UNCLOS defines the meaning of innocent passage. It states, “[p]assage is innocent so long as it is not prejudicial to the peace, good order or security of the coastal State. Such passage shall take place in conformity with this Convention and with other rules of international law.”²⁹ Furthermore, the Article identifies activities that are against the peace, good order, and security of the coastal State. Such activities include “any act aimed at collecting information to the prejudice of the defence or security of the coastal State... any act of wilful and serious pollution contrary to this Convention... the carrying out of research or survey activities... [and] any other activity not having a direct bearing on passage.”³⁰ Luke is in compliance with Article 19 as it is not polluting during its passage and, because it has no prior permission from Canada to collect surveillance data, it limited its surveillance to that necessary for safe navigation/passage upon entering the territorial sea.

Legality of Luke Being Taken

Upon entering the Canadian EEZ and before submerging, Luke was taken out of the water by a Chinese warship. China’s rationale was that Luke was a navigational hazard and was

²⁵ McKenzie. “Autonomous technology...” Page 172

²⁶ UNCLOS. 1982. Article 56. Paragraph 2.

²⁷ UNCLOS. 1982. Article 17.

²⁸ UNCLOS. 1982. Article 20.

²⁹ UNCLOS. 1982. Article 19.

³⁰ Ibid.

unlabeled in violation of law. Warships such as the Chinese vessel can pick up an unmanned floating vessel such as Luke and inspect it. However, it may be kept only if it is deemed a navigational hazard and is unlabeled. In this scenario, Luke complied with navigation rules and was properly labeled. Luke was designed in accordance with the navigational, seaworthiness, and safety requirements as outlined in SOLAS and COLREGs. Luke also was correctly labeled and marked via previously completed requirements from SOLAS, COLREGs, and Article 20. Under this scenario, there was no legal basis to take Luke.

Note on Lethal Autonomous Weapon Systems

The analysis focused on Luke as a benign non-weaponized autonomous system; however, there is much debate around the development and use of lethal autonomous weapon systems (LAWS). While some of the same requirements will apply to Luke whether it is weaponized or not, LAWS have additional requirements and considerations.

Parties to the Convention on Conventional Weapons have been meeting since 2014 on LAWS, including the U.S., Canada, and the UK. The CCW effort includes a Group of Governmental Experts (GGE) that recommended 11 principles on LAWS which were adopted by consensus in 2019. Importantly, these principles concluded *inter alia* that “International humanitarian law applies to these systems. A human must always be responsible for the decision to use these systems. States must examine the legality of these new weapons that they are developing or requiring at the design stage.” These new principles represent the current approach to LAWS in the international community. If Luke had been a LAWS there would have been a slight difference in applicable laws, although certain maritime rules would still apply. A more thorough analysis of LAWS will be included in the larger CRUSER report.

Conclusion

The research results show general agreement that several international maritime conventions - namely UNCLOS, SOLAS and COLREGs - apply to AS and UxS. Because these conventions were written prior to the advent of advanced autonomous technology, their application is not exact and provisions may still be debated, especially at the international level. But, they do offer a legal framework for the operation of AS and UxS in various maritime zones.

The policy/legal area of these systems is evolving, particularly in the adoption of regulations specific to unmanned and autonomous systems. The research team will continue investigation into specific unanswered legal questions related to the systems, transfer of control, and environmental laws that apply in the U.S.

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