

# Advancing Clarity: Analysis of UxS Legal Questions



*From left to right: U.S. Coast Guard cutter, littoral combat ship, Devil Ray T-38, and SAILDRONE Explorer in the Arabian Gulf on June 26, 2022. Photo by Chief Petty Officer Roland Franklin*

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# Advancing Clarity: Analysis of UxS Legal Questions

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## I. Introduction

UxS serve as an integral part of the Naval Force Structure and their use will increase in the future. Answering pressing law and policy questions related to UxS will play a critical role as DoD and the Navy expand their use and development and the technology rapidly advances. As advancements in technology provide operational advantages through improved unmanned capabilities, questions remain within the legal and policy contexts about the appropriate design and use of unmanned systems (UxS)<sup>5</sup> and applicable laws, especially given their use around the globe. Building on law and policy work sponsored by CRUSER in 2021, this report advances clarity in three key areas through legal and policy research and analysis. The findings of the 2021 project provide the foundation of U.S. and international law that applies to UxS.<sup>6</sup> This report builds on that foundation to delve deeper into:

- Specific legal questions affecting the Navy's use of UxS;
- Application of environmental laws to expendable UxS; and
- Governance of UxS operating in the Arctic region.

While all open legal questions cannot be answered definitively, analysis can inform those setting policy and those designing and operating UxS to offer a better understanding of the applicable law and potential consequences. The research team's intent is to support the Navy's *Unmanned Campaign Framework*, the *Strategy for Intelligent Autonomous Systems* and international efforts in the Artificial Intelligence Strategic Challenge of The Technical Cooperation Program as well as collaboration with allies, especially coastal states around the globe.

## II. Consideration of Specific Legal Questions

It is important to acknowledge up front that many of the laws applicable to UxS operations were not written for platforms without a crew. For example, one can reasonably predict how the duty to render assistance to people at sea may be met by a ship's crew in the maritime environment. Also, safety regulations such as look-out requirements are reasonably managed by sailors on a crewed ship. These rational and often time-tested requirements of crewed vessels raise questions in the context of UxS, pushing the interpretation, and in some

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<sup>5</sup> This report uses the general term unmanned systems (UxS) to refer to any systems that operate without a crew and anywhere on the spectrum from completely remotely operated to fully autonomous.

<sup>6</sup> Fletcher, K., Lesse, M., DeCocco, P., & Hahn, E. (2021). *Priority Law and Policy Issues Related to Autonomous and Unmanned Systems*. Consortium for Robotics and Unmanned Systems Education and Research.

[https://nps.edu/documents/114698888/121733922/CRUSER\\_Priority+Law+%26+Policy+Issues+%28Dec+2021%29.pdf/e3b6a430-a00d-faf9-cfd3-fabea603ee1a?t=1643158769410](https://nps.edu/documents/114698888/121733922/CRUSER_Priority+Law+%26+Policy+Issues+%28Dec+2021%29.pdf/e3b6a430-a00d-faf9-cfd3-fabea603ee1a?t=1643158769410).

cases applicability, of the law. Furthermore, even if there is an agreement on how the law applies to UxS, the systems' technology changes frequently and always faster than the law. In the following sections, the analyses provide the current understanding of how certain maritime laws and regulations currently apply (or don't) and the uncertainties that remain, especially as new technologies are introduced.

### **A. Compliance with International Maritime Law and Regulations**

Many questions related to the operation of UxS in the maritime environment are well-settled for crewed vessels but not all. In fact, the foundational question of whether an UxS is a vessel is debated among legal scholars. As noted in the 2021 report, the question of whether an UxS is legally considered a ship or vessel is particularly important for rights and responsibilities under the United Nations Convention on the Law of the Sea (UNCLOS)<sup>7</sup> and customary international law including freedom of navigation and sovereign immunity claims.<sup>8</sup> For this analysis, researchers consider UxS as ships because the interpretation of 'ship' in UNCLOS is broad enough to include the spectrum of UxS. However, it is important to note that there is debate surrounding the characterization of an UxS in the maritime environment that undermines the analyses below.

If an UxS is considered a ship, a secondary question is whether they are also characterized warships. Article 29 of UNCLOS defines warships 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 commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and manned by a crew which is under regular armed forces discipline."<sup>9</sup> The "manned by a crew" requirement arguably disqualifies an UxS as the very intent of UxS is to be uncrewed. However, some states may claim that remotely controlled systems meet this requirement.<sup>10</sup> This analysis is critical to the application of certain laws.

The U.S. position indicates the acceptance of UxS as ships. According to the 2022 Commander's Handbook on the Law of Naval Operations, "Unmanned maritime systems may be used to exercise any internationally lawful use of the seas. Such uses include:

1. Intelligence, surveillance, and reconnaissance
2. Mine countermeasures
3. Antisubmarine warfare
4. Surface warfare

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<sup>7</sup> See Fletcher et al. at 9.

<sup>8</sup> McKenzie at 374.

<sup>9</sup> UN General Assembly, *Convention on the Law of the Sea*, 10 December 1982, Article 29 [hereinafter UNCLOS]. [https://www.un.org/depts/los/convention\\_agreements/texts/unclos/unclos\\_e.pdf](https://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf)

<sup>10</sup> For a more detailed analysis of whether an UxS is a ship or vessel, see Simon McKenzie. (2020). 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, 1.

5. Inspection/identification
6. Oceanography<sup>11</sup>

This position is significant; if UxS may exercise any lawful use of the sea, then they are also held to the same level of responsibility as mariners and crewed vessels. Most of these responsibilities are either codified in international conventions or accepted as customary international law and were written in a human-centric way.

Therefore, once an UxS is determined to be a ship, UNCLOS and other conventions apply, especially related to safety, the requirement to meet certain situation-specific duties and the potential to be interdicted by another state. Maritime vessels are required to comply with international regulations for safety such as look-out requirements, required to provide due regard to other vessels and required to render assistance. In addition, vessels can be interdicted as called for by the United Nations Security Council or under some national laws. The analysis that follows shows how these requirements may be applied to UxS in the maritime environment and what questions still remain.

### **1. Look-out and Safety Requirements**

The International Maritime Organization (IMO) established the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS) to define the navigation rules to be followed by vessels at sea to prevent collisions. There is significant debate in the maritime shipping industry whether unmanned vessels can strictly comply with human-centered safety provisions under COLREGS including Rule 2 (responsibility), Rule 5 (lookout requirement), Rule 8 (action to avoid collision), and Rule 18 (responsibilities between vessels).<sup>12</sup> Rule 5 requires that “every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.”<sup>13</sup> There are many rules under COLREGS, including Rule 5’s lookout requirements, which “sometimes necessitate subjective deviations in accordance with the vessel’s circumstances or a captain’s experience.”<sup>14</sup>

It is clear that COLREGS anticipates that the lookout’s sight and hearing will be by a human and in a crewed vessel; this requirement is, at least traditionally, met by a sailor on the bridge. The understanding of seeing and hearing, however, has expanded over time to include

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<sup>11</sup> Stockton Center for International Law. (2022). *The Commander’s Handbook on the Law of Naval Operations*. NWP 1-14M. U.S. Marine Corps MCTP 11-10B. U.S. Coast Guard COM DTPUB P5800.7A.

<sup>12</sup> Norton Rose Fullbright. (2020). *The Collision Regulations and Autonomous Shipping*. *Shipping Law Insights*. <https://www.nortonrosefullbright.com/en/knowledge/publications/5fedab67/the-collision-regulations-and-autonomous-shipping>

<sup>13</sup> International Maritime Organization. (1972, October 20). *Convention on the International Regulations for Preventing Collisions at Sea*. Rule 5. [hereinafter COLREGS] <https://www.imo.org/en/About/Conventions/Pages/COLREG.aspx>

<sup>14</sup> Sea Machines. (2022). *The Future of Marine Autonomy and COLREGS*. <https://sea-machines.com/the-future-of-marine-autonomy-and-colregs/>

seeing via radar or other technology and hearing through speakers that relay sound from the vessel. With this expansion of understanding, it is reasonable to consider a remote operator of an UxS a lookout.

Designers and manufacturers of autonomous technology (whether vehicles, aircraft or maritime vessels) argue that the risk of incidents is lower because of features like advanced perception and collision avoidance technology. A system is less likely than a human to get distracted or tired and, generally, has a better sense of maritime domain awareness. In addition, crews already rely upon autonomous systems on board maritime vessels, not seeing or hearing oncoming vessels from the bridge but receiving such information from a shoreside control station or second vessel. With these reliances on technology already in place, it may be deemed reasonable to trust technology rather than relying on the traditional COLREGS standards that were written at a time when the only option was a human lookout.

As noted, however, the law will move slower than the technology and without clear guidance to the contrary, either from the IMO or from the international community, the expectation will be that the human-focused standards will apply. In this vein, courts will rely upon precedent that indicates “overreliance on technology will not satisfy the principles of good seamanship.”<sup>15</sup> Thus, as a lookout, a remote operator or the actions of an autonomous or semi-autonomous vessel will be held to a similar standard as a lookout on a crewed vessel would.

## **2. Due Regard**

As noted in the 2021 report, exercising certain rights in the maritime environment is not without limitations. When operating an UxS in another coastal State’s EEZ, the system must abide by UNCLOS Article 58 (paragraph 3) which limits the system’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....”<sup>16</sup>

Due regard has been described as “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.”<sup>17</sup> For example, if an UxS is conducting military surveillance in the area, due regard requires that the execution of surveillance will have no or little impact on the coastal State’s economic and environmental rights. Furthermore, any impact should involve an appropriate balancing of competing rights.<sup>18</sup> A balance often is struck when the vessel and the coastal states have conflicting rights.

Due regard applies to both the UxS as well as the coastal State; i.e., the coastal State also must demonstrate due regard for the UxS while it is operating in its EEZ. Article 56 paragraph 2

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<sup>15</sup> Norton Rose Fulbright.

<sup>16</sup> UNCLOS at Article 58, Paragraph 3.

<sup>17</sup> McKenzie, *Autonomous Technology* at 167.

<sup>18</sup> McKenzie, *Autonomous Technology* at 172.

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.”<sup>19</sup>

In the context of UxS, what level of due regard can be provided? Not surprisingly, there is no clear international standard but there is general agreement that due regard applies both in the maritime environment and in the air whether a vessel or aircraft is manned or unmanned.<sup>20</sup> Because UNCLOS does not define due regard, it is determined on a case-by-case basis. The International Tribunal for the Law of the Sea has described a similar standard, due diligence, as

“a variable concept. It may change over time as measures considered sufficiently diligent at a certain moment may become not diligent enough in light, for instance, of new scientific or technological knowledge. It may also change in relation to the risks involved in the activity.”<sup>21</sup>

In a 2011 case regarding the former Yugoslav Republic of Macedonia v. Greece, the Tribunal “granted the states concerned a wide margin of appreciation to comply with the due regard obligation, but at the same time, it observed that it requires in any case negotiation and cooperation between themselves.”<sup>22</sup> This approach was confirmed in the *Bay of Bengal Maritime Arbitration* in 2014 regarding due regard explaining that “[i]t is for the Parties to determine the measures they consider appropriate in this respect, including through the conclusion of further agreements or the creation of a cooperative arrangement.”<sup>23</sup>

These decisions offer a glimpse into how due regard may be applied in relation to UxS. As a vessel, an UxS has the same rights and obligations in maritime zones under the UNCLOS as crewed vessels do. Therefore, it both owes and is owed due regard. Some examples of such due regard may be clear; for instance, an UxS must not inhibit navigation of other vessels or operate in such a way to violate the rules of the coastal State. At the same time, the coastal state (or another state’s vessel) may not seize an UxS in violation of UNCLOS or other international laws whether it is remotely controlled or autonomous.<sup>24</sup> The question remains about activities that fall

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<sup>19</sup> UNCLOS at Article 56, Paragraph 2.

<sup>20</sup> For analysis of due regard related to air traffic, see International Civil Aviation Organization. (2021). *Due Regard Operations, Awareness and Associated Regulations*. <https://www.icao.int/MID/MIDANPIRG/Documents/MID18%20and%20RASGMID8/WP%2046%20-%20UAE%20-0-Due%20Regard%20Ops.pdf>

<sup>21</sup> International Tribunal of the Law of the Sea. (2011) *Responsibilities and Obligations of States Sponsoring Persons and Entities with Respect to Activities in the Area, Advisory Opinion*. Case 17, 117. <https://www.cambridge.org/core/journals/american-journal-of-international-law/article/abs/responsibilities-and-obligations-of-states-sponsoring-persons-and-entities-with-respect-to-activities-in-the-area/16A829C3EFE03FFD88C60C3C540C473C>

<sup>22</sup> Forteau, M. (2019). The Legal Nature and Content of ‘Due Regard’ Obligations in Recent International Case Law. *The International Journal of Marine and Coastal Law*. Vol 34 (25-42).

<sup>23</sup> UN Arbitral Tribunal. (2014). *Bay of Bengal Maritime Boundary Arbitration between Bangladesh and India*. PCA Case No 2010-16.

<sup>24</sup> Two incidents of foreign vessels seizing U.S. maritime UxS have occurred in recent years. See Maritime Executive. (2022). *Iran Seizes and Later Releases Two U.S. Navy Unmanned Surface Vessels*. <https://maritime->



between these two ends of the spectrum but the Tribunal decisions indicate that the determination will be on a case-by-case basis, taking into account the circumstances of the incident and precedent related to due regard of crewed vessels. Given the increase in unmanned vessels, there will likely be case law developing in the future regarding UxS in the maritime environment.

### 3. Duty to Render Assistance

International Law imposes the obligation to save people in distress at sea. Scholars note that this duty reflects a “sacred and ancient maritime tradition”<sup>25</sup> and that it is considered as a general principle “recognized by civilized nations [article 38(c) of the Statute of the International Court of Justice].”<sup>26</sup> In addition, it is found in numerous international conventions including UNCLOS (Article 98), the International Convention for the Safety of Life at Sea (SOLAS)<sup>27</sup> (Regulation V/33(a)) and the International Convention on Salvage (Article 10). Such clarity exists for crewed vessels but there is uncertainty around how an UxS would comply with the duty to render assistance.

In order to understand the potential duty of an UxS, it is important to clarify what qualifies as assistance. It can vary from informative operations such as launching an S.O.S. signal to more dangerous activities such as rescues of persons in distress. The International Maritime Organization interprets the duty to require a master to do “everything possible, within the capabilities and limitations of the ship, to treat the survivors humanely and to meet their immediate needs.”<sup>28</sup> However, under UNCLOS, this requirement is excused if the assistance can seriously endanger the ship, the crew or passengers.<sup>29</sup> SOLAS adds that the mandatory duty is excluded if circumstances make assistance “unable,” “unreasonable” and/or “unnecessary.”<sup>30</sup>

In applying such a duty to UxS, the U.S. position is that being uncrewed does not preclude the applicability of the duty of rendering assistance.<sup>31</sup> With this position, scholar Danielle Madrioli notes there are two emerging issues:

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[executive.com/article/iran-seizes-and-later-releases-two-u-s-navy-unmanned-surface-vessels](https://www.defense.gov/newsroom/article.aspx?articleid=1032823) See also Cronk, T.M. (2016). Chinese Seize U.S. Navy Underwater Drone in South China Sea. U.S. Department of Defense. <https://www.defense.gov/News/News-Stories/Article/Article/1032823/chinese-seize-us-navy-underwater-drone-in-south-china-sea/> See also Section C related to sovereign immunity of UxS.

<sup>25</sup> Colombos, C.J. (1967). *The International Law of the Sea*. London. 369; O’Connell, D. P. (1982). *The International Law of the Sea*. Vol. II. New York. 807.

<sup>26</sup> See Papanicolopulu I. (2016). The duty to rescue at sea, in peacetime and in war: A general overview. *International Review of the Red Cross*. 494.

<sup>27</sup> International Maritime Organization. (1974, November 1). *International Convention for the Safety of Life at Sea*. Regulation V/33. [hereinafter SOLAS] <https://www.refworld.org/docid/46920bf32.html>

<sup>28</sup> International Maritime Organization. (NEED DATE). *Guidelines on the Treatment Of Persons Rescued At Sea*. Resolution MSC.167(78).

<sup>29</sup> UNCLOS at Article 98.

<sup>30</sup> SOLAS at V/33.

<sup>31</sup> In addition to the U.S., states that adopt this position are Canada, Denmark, Finland, France, Germany, Italy, Singapore, Spain, Argentina, Croatia and Panama. Source: Comité Maritime International survey. For more information on the survey realized by the CMI, visit <https://comitemaritime.org/work/mass/>

- Can this obligation be concretely applied if these ships have not a master on board?
- And, what kind of assistance must be required to ships whose design is conceived not to host persons on board?<sup>32</sup>

Under international law, if it is assumed that the remote operator of an UxS is able to take some action to assist, that individual may be considered the master of the ship. Hence, it is the responsibility of that individual to determine the level and type of assistance to offer in a particular circumstance. Furthermore, with the advances in the control and communication technology related to UxS, it is likely that this burden on a remote operator will be clarified in the legal realm in the near future.

The type of assistance owed is characterized in international law by flexibility. Circumstances that may affect the assistance owed includes environmental and weather conditions and safety of the crew of both vessels. Madrioli notes that even if UxS “are technically limited in providing full assistance, flag States are still complying with the international duty, because this rule merely imposes to configure the maximum level of assistance achievable in the light of the existing circumstances.”<sup>33</sup>

This position is supported by United Kingdom maritime policy. In its Maritime Autonomous Surface Ships UK Code of Practice, it states that operators of UxS shall “make best endeavours to inform the appropriate search and rescue authorities.”<sup>34</sup> A statement by Finland supports this interpretation, noting “Regardless of the application of this regulation, a [maritime autonomous surface ship] may be required to engage in rescue operations other than recovery of persons from water, and these operations would be considered as giving assistance to those in distress at sea.”<sup>35</sup> An opposing interpretation also relies on the flexible nature of the duty to assist. Because international law makes clear that the duty to assist is flexible and dependent upon circumstances, other states argue that UxS would be considered unable to assist people at sea due to their nature of being uncrewed. In other words, “this technical feature would legitimately preclude the operability of the duty with respect to” UxS.<sup>36</sup>

This analysis aligns with current technology as most UxS have some level of remote operability. When UxS reach a level of true autonomy, these questions become more complex. Will a designer or operator be considered a master when it does not have control over the vessel? Will the design of an autonomous maritime system always require the ability to retake control of the system? Or, will technology or international law advance to find a balance between full

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<sup>32</sup> Madrioli, D. (2020). The International Duty to Assist People in Distress at Sea in the Era of Unmanned Navigation. No Place for People on Board. *Humanidades & Tecnologia*. Vol 26, 87. [https://www.academia.edu/43686085/THE\\_INTERNATIONAL\\_DUTY\\_TO\\_ASSIST\\_PEOPLE\\_IN\\_DISTRESS\\_A\\_T\\_SEA\\_IN\\_THE\\_ERA\\_OF\\_UNMANNED\\_NAVIGATION\\_NO\\_PLACE\\_FOR\\_PEOPLE\\_ON\\_BOARD](https://www.academia.edu/43686085/THE_INTERNATIONAL_DUTY_TO_ASSIST_PEOPLE_IN_DISTRESS_A_T_SEA_IN_THE_ERA_OF_UNMANNED_NAVIGATION_NO_PLACE_FOR_PEOPLE_ON_BOARD)

<sup>33</sup> Madrioli at 89.

<sup>34</sup> Maritime UK. (2019). *Maritime Autonomous Surface Ships UK Code of Practice*. 99.

<sup>35</sup> International Maritime Organization. (2018). *Regulatory Scoping Exercise on the use of Maritime Autonomous Surface Ships (MASS)*. Report of the Correspondence Group on MASS, MSC/5.

<sup>36</sup> Madrioli at 90.



autonomy and the duty to assist at sea? Will it ever be unlawful to produce unmanned ships that are unable to rescue people at sea? While policies and technology advances, these questions remain open.

#### 4. Interdiction<sup>37</sup>

Under international maritime law, a coastal state may exercise its lawful maritime authorities of visit, board, search and seizure and maritime interdiction operations within its own EEZ and within the EEZ of another nation.<sup>38</sup> Many maritime states have experience in interdiction of both manned and unmanned vessels. In the U.S., the Drug Trafficking Vessel Interdiction Act facilitated prosecution of those involved in the use of semi-submersibles, manned or unmanned, to traffic drugs.<sup>39</sup> Generally, these maritime interdictions occur by crewed vessels but could an UxS perform an interdiction?

At least in the unclassified setting, there is no evidence that a state has used an UxS alone to conduct an interdiction. However, there is evidence and promise in the use of UxS (both by air and by sea) as partners to crewed vessels for maritime domain awareness and execution of interdiction.<sup>40</sup> The U.S. Coast Guard is pursuing the use of UxS to fill capability and capacity gaps, automate and augment crewed missions to preserve readiness and improve situational awareness of manned systems, and conduct higher risk missions safer and more effectively.<sup>41</sup> They envision “a new ecosystem of vehicles, sensors, networks, and systems would fundamentally transform operations.”<sup>42</sup> The Navy seeks to fully embed unmanned technology in naval operations because they can “enable naval forces to understand quicker, act faster, and adapt continuously.”<sup>43</sup> In the future, they may take a heavier load than manned systems by networking UxS, similar to the Navy’s Integrated Undersea Surveillance System, “established to monitor large swaths of the oceans and provide early warning and information superiority in the maritime domain.”<sup>44</sup> These are important contributions by UxS in interdiction, although each presumes human intervention at some stage in the interdiction.

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<sup>37</sup> For more analysis on interdiction and its use by maritime law enforcement, see Rob McLaughlin. (2016). Authorizations for maritime law enforcement operations.

*International Review of the Red Cross*. <https://library.icrc.org/library/docs/DOC/irrc-902-maclaughlin.pdf>

<sup>38</sup> Kraska, J. & Pedrozo R. (2013). *International Maritime Security Law* (2<sup>nd</sup> ed). Routledge.

<sup>39</sup> See Kraska & Pedrozo at 592-593. See also Brian Wilson. (2011). Submersibles and Transnational Criminal Organisations. *Ocean and Coastal Law Journal*. 17.

<sup>40</sup> Healey, A.J., Horner, D.P., Kragelund, S.P., Wring, B., Monarrez, A. (2007). *Collaborative Unmanned Systems for Maritime and Port Security Operations*. Naval Postgraduate School.

<https://apps.dtic.mil/sti/pdfs/ADA484372.pdf>

<sup>41</sup> Remmers, Thom. (2022). *U.S. Coast Guard Unmanned Systems*. [https://www.dcms.uscg.mil/Portals/10/CG-9/SAS/SAS2022\\_UxS.pdf](https://www.dcms.uscg.mil/Portals/10/CG-9/SAS/SAS2022_UxS.pdf)

<sup>42</sup> Id.

<sup>43</sup> Eckstein, M. (2016, 12 October). Interview: Rear Admiral Robert Girrier on the Future of the Navy’s Unmanned Systems. *USNI News*. <https://news.usni.org/2016/10/12/22016>

<sup>44</sup> Schmitt, M.N., Goddard, D.S. (2016). International law and the military use of unmanned maritime systems. *International Review of the Red Cross*. 98(2), 570. [https://international-review.icrc.org/sites/default/files/irc98\\_10.pdf](https://international-review.icrc.org/sites/default/files/irc98_10.pdf)

## 5. Sea Lanes and Communications

From the above discussion, it is clear that UxS must comply with coastal state requirements just as a vessel would, including requirements for passage through designated sea lanes and communications with shore facilities.

Under international law, a coastal State may establish certain restrictions upon the right of innocent passage of foreign vessels for purposes such as resource conservation, environmental protection, and navigational safety.<sup>45</sup> The restrictions must be reasonable and necessary, not deny or impair the right of innocent passage, and not discriminate against the ships of any State. As noted above, if UxS are considered ships, they retain the right of innocent passage and freedom from discrimination. In addition, if an UxS is considered a sovereign-immune vessel (see Section B below), an UxS is not required to abide by designated sea lanes and traffic separation schemes but may do so voluntarily where practicable and compatible with the military mission and navigational safety dictates.<sup>46</sup>

In addition, properly flagged UxS enjoy the right of innocent passage in the territorial sea and archipelagic waters of other States, transit passage in international straits, and archipelagic sea lanes passage in archipelagic sea lanes. Even for those UxS not classified as ships, they may be deployed by larger vessels engaged in innocent passage, transit passage, or archipelagic sea lanes passage as long as their employment complies with the navigational regime of innocent passage, transit passage, or archipelagic sea lanes passage.<sup>47</sup>

Some note the superiority of the technology in helping other vessels meet transit and communications requirements; for example, “during both peacetime and periods of armed conflict, [UxS] are likely to prove themselves invaluable in maintaining the security of the fragile sea lanes of communication upon which global economic prosperity depends.”<sup>48</sup> The U.S. Coast Guard is currently using cutters and a growing network of unmanned systems to detect and respond in the maritime environment.<sup>49</sup>

In terms of maritime domain awareness, an UxS would benefit from similar technology as a crewed vessel and, at least in remotely controlled or semi-autonomous systems, have the benefit of a human-in-the-loop. Given this, UxS pose challenges when communications are lost or the system fails in some way and becomes a navigational hazard but likely no more so than a crewed vessel suffering the same failures. Technology (for both crewed and UxS) is advancing on these fronts: currently in use is a “cognitive communications architecture that uses intelligent, adaptive and secure underwater networking techniques.”<sup>50</sup> In the case of communications or

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<sup>45</sup> UNCLOS at Article 19.

<sup>46</sup> The Commander’s Handbook at 2-7.

<sup>47</sup> The Commander’s Handbook at 2-8.

<sup>48</sup> Schmitt & Goddard at 569.

<sup>49</sup> Marine News. (2022, December). The More ‘Eyes on the Water’, The Better. *Maritime Magazine*. <https://www.maritimemagazines.com/marine-news/202212/the-more-eyes-on-the-water-the-better/>

<sup>50</sup> Costanzi, R., Fenucci, D., Manzari, V., Micheli, M., Morlando, L., Terracciano D., Caiti A., Stifani, M., Tesei, A. (2020). Interoperability Among Unmanned Maritime Vehicles: Review and First In-Field Experimentation. *Frontiers in Robotics and AI*. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7805912/pdf/frobt-07-00091.pdf>

navigation failures, international maritime law would apply to the UxS the same as it would a crewed vessel.

## **B. Sovereign Immunity of UxS**

Navy policy states that under customary international law, both “manned and unmanned vessels and aircraft owned or operated by a State, and used, for the time being, only for government non-commercial service are entitled to sovereign immunity.”<sup>51</sup> This position is confirmed in The Commander’s Handbook on the Law of Naval Operations which states:

In all cases, U.S. Navy [UxS] are the sovereign property of the United States and immune from foreign jurisdiction. When flagged as a ship, [an UxS] may exercise the navigational rights and freedoms and other internationally lawful uses of the seas related to those freedoms. Unmanned systems may be designated as [a United States Ship] if they are under the command of a commissioned officer and manned by a crew under regular armed forces discipline, by remote or other means.<sup>52</sup>

This is affirmed by the State Department release following the 2016 seizure by China stating “The UUV is a sovereign immune vessel of the United States. We call upon China to return our UUV immediately, and to comply with all of its obligations under international law.”<sup>53</sup>

This position is consistent with UNCLOS interpretation and customary international law. As long as an UxS qualifies as a ship and is operated by a government for exclusively non-commercial purposes, the UxS will enjoy effectively the same sovereign immunity under UNCLOS as a warship.<sup>54</sup> Accordingly, the UxS is immune from arrest, search and inspection by foreign authorities, exempt from certain foreign taxes, duties or fees and officers, commanders and masters retain the right to protect property aboard the vessel.

As noted in the due regard discussion above, in the case of foreign entities seizing UxS, there is limited legal basis for such an action. There are circumstances in which warships may pick up an unmanned floating vessel and inspect it. However, it may be kept only if it is deemed a navigational hazard and is unlabeled. Therefore, if a U.S. UxS is not a navigational hazard and labeled, as they were in the 2016 seizure by China and the 2022 seizure by Iran, there is no legal basis to seize the UxS. The Navy’s UxS are also designed in accordance with the navigational, seaworthiness, and safety requirements as outlined in COLREGs and SOLAS.

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<sup>51</sup> Sovereign Immunity Policy. (2021). NAVADMIN 165/21. <https://www.mynavyhr.navy.mil/Portals/55/Messages/NAVADMIN/NAV2021/NAV21165.txt?ver=EHzWaiORe7avzdSafZm9g%3D%3D>

<sup>52</sup> The Commander’s Handbook at 2-5.

<sup>53</sup> U.S. State Department. (2016). Statement by Pentagon Press Secretary Peter Cook on incident in South China Sea. <https://www.defense.gov/News/Releases/Release/Article/1032611/statement-by-pentagon-press-secretary-peter-cook-on-incident-in-south-china-sea/>

<sup>54</sup> Schmitt & Goddard at 580.

### C. UxS and ISR

As noted above, UxS may be used to exercise any internationally lawful use of the seas including intelligence, surveillance, and reconnaissance (ISR).<sup>55</sup> Maritime UxS have so proven their worth in the area of ISR, many are designed specifically for this purpose, able to scan “both deep seas and comb shallow harbours for up to 16 hours at a time, un-piloted, and with its stronger low-frequency sound signals, it can discern a mine from a refrigerator littering the ocean floor.”<sup>56</sup> These technologies also are used in the area of port surveillance and security and offshore research applications.

Current research is also developing ways to enhance autonomy and team/swarm mission capabilities by improving interoperability among UxS and providing communication networks, which is often a challenge in the maritime environment.<sup>57</sup> Figure 2 (below) shows a conceptual scenario of underwater surveillance based on UxS. The conceptual scenario depicts a network of UxS with different missions but within the same communications network and connected digitally to a support ship.

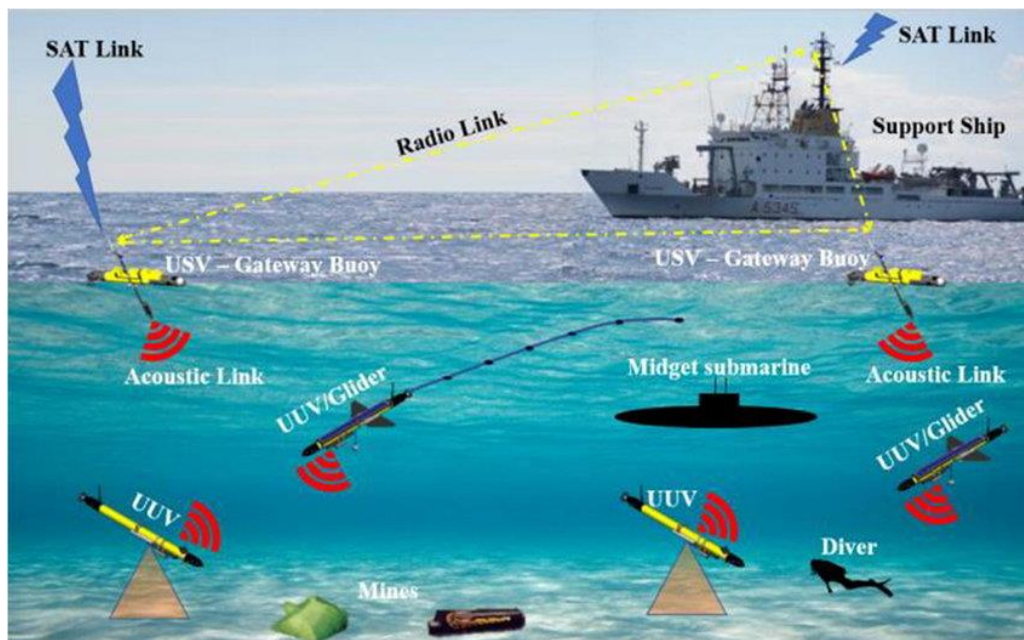


Figure 2. Conceptual scenario of underwater surveillance using UxS. Source: [https://www.researchgate.net/figure/A-conceptual-scenario-of-underwater-surveillance-based-on-unmanned-systems-A-network-of\\_fig1\\_343916024](https://www.researchgate.net/figure/A-conceptual-scenario-of-underwater-surveillance-based-on-unmanned-systems-A-network-of_fig1_343916024)

<sup>55</sup> The Commander’s Handbook at 2-4.

<sup>56</sup> For a summary of the evolution of UxS for this purpose, see Martinic, G. (2014). Unmanned Maritime Surveillance and Weapons Systems. *Journal of the Australian Naval Institute*. Issue 151, 86-91. [https://www.researchgate.net/publication/283724123\\_Unmanned\\_maritime\\_surveillance\\_and\\_weapons\\_systems](https://www.researchgate.net/publication/283724123_Unmanned_maritime_surveillance_and_weapons_systems)

<sup>57</sup> Terracciano, D.S., Bazzarello, L., Caiti, A., Costanzi, R., Manzari, V. (2020, August 27). Marine Robots for Underwater Surveillance. *Current Robotics Reports*. <https://doi.org/10.1007/s43154-020-00028-z>

It is well-settled law that intrusive ISR is legal in certain maritime zones. Specifically, ISR within a coastal state's internal waters would be treated the same as intelligence collection is treated on land: within a coastal state's territorial sea, intelligence collection by ships transiting through is inconsistent with that maritime zone's innocent passage regime. Beyond the territorial sea, however, "is considered an internationally lawful use of the sea that is not subject to coastal State jurisdiction or interference."<sup>58</sup>

Two significant challenges to the right to ISR beyond the territorial sea have arisen. Some states, notably China, claim that intrusive ISR is inconsistent with the "peaceful purposes provisions of UNCLOS"<sup>59</sup> which generally state that the seas should be used to advance peaceful purposes.<sup>60</sup> However, state practice and Security Council deliberations affirm that the peaceful purposes clauses "do not prohibit all military activities on the high seas and in EEZs, but only those that threaten or use force in a manner inconsistent with the UN Charter."<sup>61</sup> In addition, in the 1960s, the Soviet Union challenged the U.S.' right to ISR in air and by sea as an act of aggression. However, Soviet efforts to have a U.S. surveillance flight designated an act of aggression failed by a vote of 9 to 2.<sup>62</sup>

While there likely will continue to be challenges to UxS use for ISR, it appears that as long as the sole purpose of the UxS is ISR and not aggressive pursuits, international law allows for the design and operation of UxS for these purposes.

#### **D. Weaponized UxS**

There is ethical and legal debate around weaponized UxS, also called lethal autonomous weapon systems. Non-weaponized UxS are already used during enforcement and conflict. They have

greatly expanded the monitoring capability of law enforcement and naval forces during counter-piracy, counter-drug, counter-weapons of mass destruction proliferation, and refugee operations. During wartime, they are particularly promising with respect to improving transparency of the maritime battlespace, enhancing anti-access/area denial (A2/AD) capabilities, and anti-submarine and anti-mine warfare.<sup>63</sup>

Questions remain, however, related to how weaponized UxS are treated whether in a time of peace or a time of conflict or war. Because so many rights and responsibilities flow from the

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<sup>58</sup> Pedrozo, R. (2022). The Legal Framework Applicable to Intrusive Intelligence, Surveillance, and Reconnaissance Operations in the Air and Maritime Domains. *International Law Studies*. Vol 99, 847-864. <https://digital-commons.usnwc.edu/cgi/viewcontent.cgi?article=3030&context=ils>

<sup>59</sup> Id.

<sup>60</sup> See UNCLOS Articles 88, 141, 143.

<sup>61</sup> Hayashi, M. (2005). Military and Intelligence Gathering Activities in the EEZ: Definition of Key Terms. *Marine Policy*. Vol 29, 123.

<sup>62</sup> United Nations Security Council. (1960, July 26). 15th Sess., 883d mtg., ¶ 187, U.N. Doc. S/PV.883 and Add.1.

<sup>63</sup> Schmitt & Goddard at 569.

characterization of a maritime vessel, the analysis must begin at whether a weaponized UxS can be considered a warship or a weapon system. Depending on that characterization, analysis can consider under what conditions an UxS can defend itself with lethal force and how “hostile intent” will be interpreted with respect to an UxS.

In many ways, the law has not determined how to best treat a weaponized maritime UxS. Following its deliberation on lethal autonomous weapons systems, the Group of Governmental Experts of the High Contracting Parties to the Convention on Certain Conventional Weapons<sup>64</sup> concluded that the

“potential use of weapons systems based on emerging technologies in the area of lethal autonomous weapons systems must be conducted in accordance with applicable international law, in particular IHL [international humanitarian law] and its requirements and principles, including inter alia distinction, proportionality and precautions in attack.”<sup>65</sup>

How IHL will apply depends upon whether the UxS is characterized as a warship or a weapon system such as a torpedo or naval mine.

UNCLOS Article 29 defines a 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 commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and *manned by a crew* which is under regular armed forces discipline.”<sup>66</sup> (italics added)

It is the manned crew requirement that leads many legal scholars to the conclusion that “as UMSs are unmanned (or at best, manned remotely), on a plain text reading of the requirement to be manned by a crew subject to military discipline, they do not qualify as warships. In time these criteria may shift or soften, but as things presently stand, even if UMSs qualify as ships, they cannot be warships.”<sup>67</sup> However, The Commander’s Handbook posits that UxS may be categorized as warships; it states that “Warships, manned or unmanned, may be used by States to

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<sup>64</sup> Group of Governmental Experts, *Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects*, 10 April 1981, 1342 U.N.T.S. 137.

<sup>65</sup> Draft Report of the 2019 Session of the Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons Systems. (2019). U.N. Doc. CCW/GGE.1/2019/CRP.1/Rev.2. ¶ 17(a). *see also* Report of the 2018 Session of the Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons Systems. (2018). U.N. Doc. CCW/GGE.1/2018/3. ¶ 26(g).

<sup>66</sup> UNCLOS at Article 49.

<sup>67</sup> Schmitt & Goddard at 579.



exercise belligerent rights at sea. Belligerent rights at sea are those rights to engage in hostilities....”<sup>68</sup>

One of the most thorough analyses of the issues is by Nasu and Letts in 2020.<sup>69</sup> In their analysis, they note that some established areas of law can provide a potential legal framework for the regulation of lethal autonomous maritime systems including legal status afforded warships, torpedoes and naval mines. However, over history, the legal regime for maritime platforms is premised on the functional distinction between warships as the means to project naval power and other naval weapons as the means of warfare. UxS and other emerging technology such as artificial intelligence challenge this distinction. Nasu and Letts note that “[l]ong-settled understandings of key legal concepts, such as the manned warship exercising navigational and belligerent rights, must now accommodate the new reality that naval technology will merge multiple functions in the form of [lethal autonomous maritime systems].”<sup>70</sup> UxS represent a new, hybrid system that can navigate and self-detonate and, legally speaking, offering them the same rights and responsibilities as a warship versus a weapon system is unsettled. The predominant use of the system and the intended and unintended consequences of designating a system as a warship or a weapon system must be considered, including “the legal implications for the exercise of navigational rights in peacetime and belligerent rights in the conduct of hostilities during armed conflict.”<sup>71</sup>

The categorization can also affect how actions by the UxS are interpreted. For example, Schmitt and Goddard note that

“it is unquestionable that [UxS] operations are governed by the law of naval warfare during an international armed conflict, as are operations involving any other means of warfare. Indeed, the use of [an UxS], including one that operates with a high degree of autonomy, to engage in hostilities against another State would initiate such an armed conflict.... Thus, even if [an UxS] conducted hostile operations only against another such system, the laws governing international armed conflict would apply.”<sup>72</sup>

However, if an UxS is not interpreted as a warship, it loses the entitlement to exercise belligerent rights. This may require that sufficient control be maintained over such a system (by a warship) to facilitate the exercise of belligerent rights. Thus, there is currently no international legal regime that supports a fully autonomous warship. Furthermore, the UxS actions that result “in destruction or damage to objects or death or injury of persons would otherwise be restricted to

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<sup>68</sup> The Commander’s Handbook at 2-2.

<sup>69</sup> Nasu, H. and Letts, D. (2020). The Legal Characterization of Lethal Autonomous Maritime Systems: Warship, Torpedo, or Naval Mine? *International Law Studies* 96, 79-97.

<sup>70</sup> Nasu & Letts at 96.

<sup>71</sup> Id.

<sup>72</sup> Schmitt & Goddard at 582.

situations of self-defense.”<sup>73</sup> It is arguable that such lethal action by an UxS would also require it to be under the control of a warship.

Understandably, international law concerning conflict and the right to belligerent actions has not caught up with the use of weaponized UxS and how they will be characterized and treated in the variety of circumstances that occur in the maritime domain between states. Establishing U.S. policy on these issues is important to guide operators of the system and to help commanders and masters of nearby vessels understand how the UxS is to be used and treated.

### **E. Legal and Policy Recommendations**

A better understanding of these issues can help to establish U.S. policy and help leaders and operators make better decisions in theatre while also contributing to better designed UxS in the future. The research team recommends the following considerations for the Navy as it moves forward with use of UxS as part of the force structure.

***Recommendation 1.*** Solidify the assertion that UxS are considered vessels under UNCLOS and customary international law. To the extent that other coastal states do not recognize UxS as vessels under international law, they no longer enjoy navigation and other rights in the maritime environment. This can affect the above analysis including what level of due regard is owed to an UxS as well as a state asserting sovereign immunity over such a system.

***Recommendation 2.*** Integrate legal and policy considerations into the design and the operation of UxS. Often, these types of legal and policy questions are left to be considered once there is a problem, such as the activity or mission of an UxS is challenged or the system itself is seized. Consideration of how a system may be treated under international law will yield a better-designed system that can more easily withstand legal challenges. Operators who understand what is well-settled under international law and what is not may be able to respond to circumstances in a way that legally benefits the U.S.

***Recommendation 3.*** Collaborate with allies on UxS design, use and policy. Given the increase in use and interaction of UxS with other vessels, the U.S. should prioritize collaboration with allies on the design and operation of UxS and the development of policies that can contribute to the establishment of customary international law or UxS-specific conventions in the future. By addressing the policy alongside the technological advancements, the U.S. and its allies can address the challenges of rapidly-changing technology with slow-adapting laws. These collaborations also can help the policy of weaponized UxS mature in order to better understand the characterization of their use in peacetime and conflict.

### **III. Expendable Systems and U.S. Environmental Laws**

UxS are used increasingly by both military and nonmilitary actors and while many are retrieved following their missions, others are intentionally left behind or deemed expendable. Over time, the buildup of expendable UxS will have impacts on terrestrial and maritime

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<sup>73</sup> Nasu & Letts at 86.

environments. This section reviews federal, state, and regional environmental statutes and the potential applicability to expendable UxS.

In order to assess the applicability of environmental laws to expendable systems, it is important to first define how the term ‘expendable’ is applied to UxS. Then, two hypothetical scenarios are presented, one based in the maritime environment and the other in air and over land. These scenarios help to show how certain U.S. environmental statutes apply to expendable systems that are owned, operated, and deployed by the U.S. Navy. This section provides a review of the water-based hypothetical scenario, including analysis and findings, and a similar review for the air-and-land scenario.

Included in the discussion of potential justification for the use of expendable are legal exemptions that have been granted to the Navy for comparable operations. Analysis of the two scenarios and review of legal national defense exemptions indicates that the deployment and operation of Navy expendable systems is largely legal within the maritime domain, although there may be limitations based on material, activity, and geography. Finally, this section concludes with recommendations for the Navy in its use of expendable systems.

### **A. Expendable Systems**

Definitions are important factors to be considered in understanding applicable laws and policies. However, definitions are often not delineated or incorporated in neither official government nor military doctrines.<sup>74</sup> This is especially true for expendable systems as there is a lack of literature and absence of an official definition for these types of systems. This report defines ‘expendable systems’ as an UxS that, after being used, little or no attempt is made to retrieve it. This definition recognizes that UxS may operate under varying levels of autonomy and include different system types, such as aerial, submersible, and surface vessels. As noted above, while there is debate as to whether an UxS is legally considered a vessel, this section assumes that expendable systems used in the maritime environment are considered vessels. This characterization and the abandonment of these systems into the environment raises questions surrounding their status as potentially being classified as pollution and litter.

Expendable systems may complement and support an operation or mission by providing enhanced ISR capabilities. There are financial, logistical, and strategic reasons why an expendable system may be employed over a non-expendable system. Expendable systems currently exist in various stages of development, production, and operation for the Navy, and are increasingly being implemented into naval strategy.

The Coyote Unmanned Aerial System (UAS) was developed by Raytheon and originally designed for military use. The small UAS has been utilized by the National Oceanic and Atmospheric Administration (NOAA) to collect weather data from hurricanes.<sup>75</sup> In 2017, several

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<sup>74</sup> Fletcher, et al. at 20.

<sup>75</sup> Tim Wright. (2017, October 10). Meet Coyote, the Latest (and Smallest) Hurricane Hunter. *Smithsonian Air and Space Magazine*. <https://www.smithsonianmag.com/air-space-magazine/noaa-sacrifices-drones-appease-poseidon-180965188/>

Coyotes were dropped out of a P-3 Orion aircraft during Hurricane Maria. After being remotely operated for roughly an hour, the batteries were depleted with the systems ultimately falling into the ocean and never recovered.<sup>76</sup>

Other existing expendable systems often include operational and training counter mining warfare systems. The Lockheed Martin Expendable Mobile ASW Training Target (EMATT) is a small, A-size (4 7/8-inch diameter, 36-inch length), autonomous underwater vehicle (AUV).<sup>77</sup> The system was originally designed for use in antisubmarine warfare training. The systems' directions concerning its depth, speed, direction, and sound may all be programmed prior to its placement into water.<sup>78</sup> Once the system's batteries are depleted, it sinks to the bottom, making recovery improbable.

The use of expendable systems in the military environment are continually researched. As seen in the Department of Defense Fiscal Year 2022 Budget Estimates, the Navy is developing multiple systems that are deemed "expendable" indicating the continued interest in these types of systems. Of the expendable systems included in the Research and Development Budget, there is a small/medium unmanned underwater vehicle (UUV), the Mining Expendable Delivery Unmanned Submarine Asset (MEDUSA).<sup>79</sup> The MEDUSA is a medium class UxS. It will be used for offensive mining missions and is capable of being launched from a submarine through a torpedo tube. After delivering the allotted payload, the system is deemed as expendable and is not required to be recovered.<sup>80</sup>

The types of materials used in expendable systems may indicate the system's impact on the environment. Understanding the system's impact on the environment can help in illustrating how certain statutes apply. For example, an abandoned system may be considered marine debris. NOAA defines marine debris as "any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment or the Great Lakes."<sup>81</sup> Marine debris has the potential to injure and kill marine life, interfere with navigational safety, and pose a risk to human health.<sup>82</sup>

Some materials left in the environment may deteriorate within a few years while others may take several centuries. According to the Bureau of Safety and Environmental Enforcement, with information sourced from the U.S. EPA Gulf of Mexico Program, the biodegradation for marine debris is as follows: cardboard box (2-4 weeks), plywood (3 years), Styrofoam cup and

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<sup>76</sup> Id.

<sup>77</sup> Lockheed Martin. (2022). *A-Size Autonomous Underwater Vehicles*. <https://www.lockheedmartin.com/en-us/products/a-size-autonomous-underwater-vehicles.html>

<sup>78</sup> Lockheed Martin. (2013). *MK39 Expendable Mobile ASW Training Target and Field Programmability System (EMATT): A Small, Dynamic Submarine-Like Target*. <https://www.lockheedmartin.com/content/dam/lockheed-martin/rms/documents/a-size-autonomous-underwater-vehicles/MK-39-productcard.pdf>

<sup>79</sup> Department of Defense (2022). *Fiscal Year (FY) 2022 Budget Estimates: Research, Development, Test & Evaluation, Navy*. Vol. 2.

<sup>80</sup> David Hambling. (2021, June 4). MEDUSA Is U.S. Navy's Secret Minelaying Submarine. *Forbes*. <https://www.forbes.com/sites/davidhambling/2021/06/04/medusa-is-us-navys-secret-minelaying-submarine/?sh=72a532111121>

<sup>81</sup> National Ocean Service. (2022). *What is marine debris?* <https://oceanservice.noaa.gov/facts/marinedebris.html>

<sup>82</sup> Id.

tin can (50 years), Styrofoam buoy (80 years), aluminum can (200 years), plastic bottle (600 years).<sup>83</sup> Many materials become toxic as they interact or decay in the environment. Researchers published in the *Environmental Science Technology* journal state that:

Some plastic debris acts as a source of toxic chemicals: substances that were added to the plastic during manufacturing leach from plastic debris. Plastic debris also acts as a sink for toxic chemicals. Plastic absorbs persistent, bioaccumulative, and toxic substances (PBTs)... from the water or sediment.<sup>84</sup>

This risk includes harm to wildlife. Wildlife that ingests plastic are at an increased risk for toxic effects or accumulation of toxins. These toxins may be passed up the food chain and into human diets through biomagnification.

The type and quantity of materials used may differ depending on the environment in which the system operates. Material requirements for a unmanned underwater vehicle vary compared to a unmanned surface vehicle. However, certain materials are typically essential regardless of the platform such as the fuel source and electronic components. Material composition is important in determining the lasting impact of expendable systems in the environment and how U.S. statutes apply.

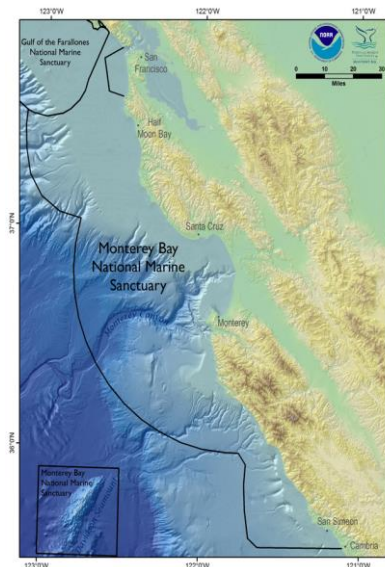


Figure 2: MBNMS Boundary Map<sup>85</sup>



Figure 3: Deployment of EMATT<sup>86</sup>

<sup>83</sup> Bureau of Safety and Environmental Enforcement. (2022). *Marine Debris Timeline of Biodegradation*. <https://www.bsee.gov/sites/bsee.gov/files/marine-debris-timeline-epa.pdf>.

<sup>84</sup> Engler, R. (2012). The Complex Interaction between Marine Debris and Toxic Chemicals in the Ocean. *Environmental Science Technology*. 46 (22), 12302–12315. <https://doi.org/10.1021/es3027105>

<sup>85</sup> Monterey Bay National Marine Sanctuary. (2022). *MBNMS Map – Color*. <https://montereybay.noaa.gov/materials/mappages/mbnmscolormap.html>

<sup>86</sup> Murch, M. (2016, April 22). *160422-N-TC720-038 BALTIC SEA*. Photograph, U.S. Navy, Baltic Sea. <https://www.flickr.com/photos/cne-cna-c6f/26508657621/in/photostream/>

## B. Scenario 1: Maritime Scenario

Scenario 1 is set in the maritime environment in the Monterey Bay region. The Monterey Bay National Marine Sanctuary (MBNMS) covers all of Monterey Bay and measures 276 miles of coastline and 6,094 square statute miles (4,601 nmi<sup>2</sup>) of ocean.<sup>87</sup> The average distance is thirty miles from the shore and its deepest point is 12,743 feet.<sup>88</sup> In scenario 1, the UxS is an Expendable Mobile ASW Training Target (EMATT) which travels through the MBNMS. Because of the area's status as a marine sanctuary, activities that may negatively affect the area's natural resources are managed more heavily than other areas off California's coast and sometimes prohibited.

One of the most prominent laws relating to water discharges and pollution is the Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA). The CWA requires a permit for the discharge of a pollutant into the waters of the U.S. which, for purposes of this scenario, includes Monterey Bay out to the edge of the territorial sea twelve nautical miles offshore.<sup>89</sup> Under the act, a National Pollutant Discharge Elimination System (NPDES) permit is required for discharges. NPDES permits may be processed by federal and/or state agencies depending on the activity's scope and location.<sup>90</sup> Certain activities may also fall under general nationwide permits which permit a category of discharges.<sup>91</sup>

Other federal acts relevant to deployment of an expendable system in the MBNMS include the Marine Plastic Pollution Research and Control Act (MPPRCA), Oil Pollution Act (OPA), Coastal Zone Management Act (CZMA), the Marine Protection, Research, and Sanctuaries Act (MPRSA), and the National Marine Sanctuaries Act (NMSA). The MPPRCA regulates the type of pollution that may be discharged into water.<sup>92</sup> Generally, there are fewer limitations the farther from shore the discharge takes place.<sup>93</sup> However, the MPPRCA explicitly prohibits the discharge of plastic in the Sanctuary regardless of the distance offshore.<sup>94</sup> The OPA primarily focuses on the prevention, reporting, and liability concerning oil spills.<sup>95</sup> The CZMA encourages states to create coastal management programs and, once approved, a state may review activities that affect its coast that are being conducted even in federal waters.<sup>96</sup> Except as

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<sup>87</sup> Monterey Bay National Marine Sanctuary. (2022). *Quick Facts: The Sanctuary at a Glance*. [https://montereybay.noaa.gov/intro/mbnms\\_quickfacts.html](https://montereybay.noaa.gov/intro/mbnms_quickfacts.html)

<sup>88</sup> Id.

<sup>89</sup> CWA definitions of "discharge of pollutant" and "pollutant" may be found in 33 U.S.C. 1362. For more information, see U.S. Environmental Protection Agency. (2022). *Summary of the Clean Water Act*. <https://www.epa.gov/laws-regulations/summary-clean-water-act>

<sup>90</sup> U.S. Environmental Protection Agency. (2022). *NPDES Permit Basics*. <https://www.epa.gov/npdes/npdes-permit-basics>

<sup>91</sup> U.S. Environmental Protection Agency. (2022). *Nationwide Permits Chronology and Related Materials under CWA Section 404*. <https://www.epa.gov/cwa-404/nationwide-permits-chronology-and-related-materials-under-cwa-section-404>

<sup>92</sup> 33 U.S.C. § 1401-1445 (2022).

<sup>93</sup> 33 U.S.C. § 1411-1421 (2022).

<sup>94</sup> 33 U.S.C. § 1411-1421 (2022).

<sup>95</sup> U.S. Environmental Protection Agency. (2022). *Summary of the Oil Pollution Act*. <https://www.epa.gov/laws-regulations/summary-oil-pollution-act>

<sup>96</sup> California Coastal Commission. (2022). *Federal Consistency*. <https://coastal.ca.gov/fedcd/fedcndx.html>



authorized by a permit, MPRSA prohibits the transportation of materials with the purpose of dumping into the ocean.<sup>97</sup> The NMSA provides the authority for the designation and regulation of national marine sanctuaries.<sup>98</sup>

Excluding the CWA, the acts listed have varying degrees of exemptions for a U.S. Navy deployed EMATT. The OPA, for example, has exemptions for public vessels including an expendable system owned and operated by the U.S. military.<sup>99</sup> The MPRSA does not apply to these systems due to its definition of dumping.<sup>100</sup> The MPRSA's definition of dumping excludes "the intentional placement of any device in the ocean... for a purpose other than disposal, when such construction or such placement... occurs pursuant to an authorized Federal or State program."<sup>101</sup> In addition, security related concerns may sometimes limit the ability of a state to review certain federal actions that are deemed "necessary in the interest of national security."<sup>102</sup> The Navy's position may likely be that its deployment of an EMATT is in furtherance of national security and is exempt from the dumping prohibition in MPRSA and consistency review under the CZMA.<sup>103</sup>

Deploying an expendable system within the MBNMS may require prior authorization or notice to the following agencies: the Environmental Protection Agency (EPA), U.S. Coast Guard (USCG), California State Water Resources Control Board, federal and/or state fish and wildlife agencies, Office of National Marine Sanctuaries, California State Lands Commission and the California Coastal Commission. The list of agencies to contact grows or shrinks depending on the use, location, and impact of the expendable system.

The permitting process is important in deploying expendable systems in the MBNMS. The Code of Federal Regulations (CFR) provides direction on permissible, prohibited, and permit requiring activities.<sup>104</sup> Under those regulations, permit requests are processed by the sanctuary. MBNMS is not able to permit some prohibited activities, such as drilling for oil, but the MBNMS may issue a permit, subject to terms and conditions, to conduct prohibited activities if certain criteria are met. When processing permit applications for deploying expendable systems, sanctuary staff must balance the impact of a discharge and abandonment on the sanctuary with the potential benefit yielded from its use.<sup>105</sup> Certain processes and plans may be required to mitigate risk to the sanctuary; for example, requiring aerial drones to float ensures easy retrieval if they fall into the sanctuary's waters.<sup>106</sup>

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<sup>97</sup> 33 U.S. Code § 1402(f). 2022.

<sup>98</sup> National Marine Sanctuaries. (2022). *Legislative History of the National Marine Sanctuaries Act*. [https://sanctuaries.noaa.gov/about/legislation/leg\\_history.html](https://sanctuaries.noaa.gov/about/legislation/leg_history.html)

<sup>99</sup> 33 U.S.C. § 2702 (c)(1). 2022.

<sup>100</sup> 33 U.S.C. § 2701 (29). 2022.

<sup>101</sup> 33 U.S.C. § 1402(f). 2022.

<sup>102</sup> 16 U.S.C. § 1456(3)(a). 2022.

<sup>103</sup> Kraska, J. (1995). Oceanographic and naval deployments of expendable marine instruments under U.S. and international law. *Ocean Development & International Law*. 26 (4), 334. <https://doi.org/10.1080/00908329509546066>

<sup>104</sup> 15 C.F.R. 922 (2022).

<sup>105</sup> Sophie De Beukelaer, Permit Coordinator at MBNMS, video interviewed by Philip DeCocco, 8 July 2022.

<sup>106</sup> Id.

Other variables affect the agencies involved in a deployment including the system's impact on the ecosystem, endangered species, marine mammals, and navigation of other vessels. If an expendable system becomes a navigational hazard to other mariners, the USCG should be alerted.<sup>107</sup> When a system's activities constitute an incidental take or harassment of marine mammals or certain protected species, then one or all the following agencies may need to be contacted for consultation, authorization, or permitting: NOAA Fisheries, California Department of Fish and Wildlife, and U.S. Fish and Wildlife (as required by the Endangered Species Act, Marine Mammal Protection Act, Migratory Bird Treaty Act, and California Endangered Species Act).<sup>108</sup> Harassment of a marine mammal can be caused by noise pollution; one way the EMATT mitigates its disturbance is by keeping its sound emission under 160db, a de minimis amount.<sup>109</sup>

The scenario of an EMATT deployment within the MBNMS is based on actual research deployment of these systems. Naval Postgraduate School (NPS) researchers obtained a permit for the temporary deployment of up to four EMATTs in the MBNMS each year.<sup>110</sup> The permit's provisions help mitigate risks to the Sanctuary and ensure compliance with Sanctuary guidelines. One example of such a provision arises from the rule that prevents the abandonment of a vessel in the Sanctuary.<sup>111</sup> Accordingly, provisions in the permit require the EMATT to pass through the Sanctuary and be expended in the waters outside of the Sanctuary. The permit also stipulates that a plan must be submitted prior to deployment of the system.<sup>112</sup> A typical EMATT has an estimated maximum range of around 40 nautical miles before battery depletion. Given that the Sanctuary can be as wide as 53 nautical miles, the system must be discharged well offshore to meet this requirements. The system's inability to be tracked and auto-correct its path, with no way to determine whether the EMATT was abandoned beyond the Sanctuary's boundary or not, further supports the importance of making a detailed pre-deployment plan that accounts for such risk.<sup>113</sup> Overall, the EMATT can legally be deployed in the maritime environment under environmental statutes and agency requirements. However, there may be conditions on operation due to the system's use, geographic location, and impact in the region.

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<sup>107</sup> Marine Debris Program. (2022). *Vessel Damage and Navigation Hazard*. <https://marinedebris.noaa.gov/why-marine-debris-problem/vessel-damage-and-navigation-hazard>

<sup>108</sup> Note: Take under the Endangered Species Act is "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." 16 U.S.C. § 1532. 2022. See also NOAA Fisheries. (2022). *Incidental Take Authorizations Under the Marine Mammal Protection Act*.

<https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act>; California Department of Fish and Wildlife. (2022). *Incidental Take Permits*. <https://wildlife.ca.gov/Conservation/CESA/Permitting/Incidental-Take-Permits#50033467-applications>; U.S. Fish and Wildlife. (2022). *Migratory Bird Treaty Act of 1918*. <https://www.fws.gov/law/migratory-bird-treaty-act-1918>; U.S. Environmental Protection Agency. (2020). *Summary of the Endangered Species Act*. <https://www.epa.gov/laws-regulations/summary-endangered-species-act>

<sup>109</sup> Dr. John Joseph, Research Faculty, Naval Postgraduate School. Interviewed by Philip DeCocco, Monterey, California, 13 July 2022.

<sup>110</sup> Monterey Bay National Marine Sanctuary. (2022). *Quick Facts: The Sanctuary at a Glance*. Office of National Marine Sanctuaries (2020). *Monterey Bay National Marine Sanctuary Research Permit: Permit #MBNMS-2020-001*.

<sup>111</sup> 15 C.F.R. 922.132 (2022).

<sup>112</sup> Id.

<sup>113</sup> Dr. John Joseph. Interviewed by Philip DeCocco, Monterey, California, 13 July 2022.



Figure 4: CICADA (Red Drones) and Deployment Drone<sup>114</sup>

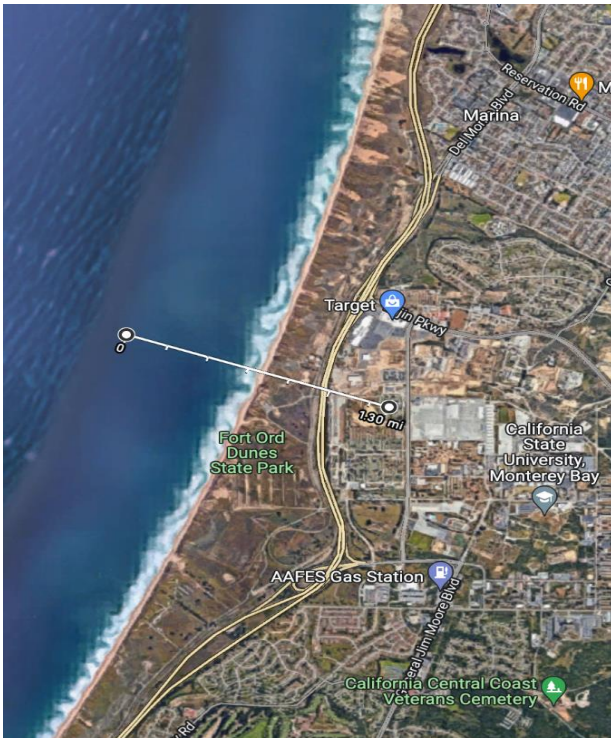


Figure 5: Satellite Image Flight Path<sup>115</sup>

<sup>114</sup> Bowman, D. (2019). NASA software engineer, Matthew Vaughan (left), and a fellow researcher prepare the payload of Close-In Covert Autonomous Disposable Aircraft, or CICADAS, for the Hives.

<https://www.nasa.gov/feature/langley/drones-swarm-over-beaver-dam>

<sup>115</sup> Google. (n.d.) City of Marina Map. Retrieved July 19, 2022 from

<https://www.google.com/maps/place/Marina,+CA/data=!4m2!3m1!1s0x808de4a0ba711be1:0xc22827b95df909d6?s=a=X&ved=2ahUKewjYyoKzmzLD5AhWfKkQIHVGQBQkQ8gF6BAgCEAE>

### C. Scenario 2: Air and Land Scenario

In this scenario, a remotely piloted unmanned aerial system (UAS) owned and operated by the U.S. Navy is launched from land and vertically flies to an altitude of 3,000 feet and flies 3,500 feet offshore. Upon reaching its mark offshore, the UAS's payload of twenty-five Close-In Covert Autonomous Disposable Aircrafts (CICADA) is released. The CICADAs, which have a glide ratio of 3.5 to 1 (distance forward to altitude lost) and weight of 1.2 ounces, begin their descent toward their destination on land.<sup>116</sup> After release of the 25 CICADAs, the deployment UAS returns to its launch location for recovery. Upon initial release, five of the CICADAs malfunction and freefall into the water of the Sanctuary and drift on the water's surface. The remaining twenty CICADAs fulfill their mission to collect and relay weather data during their journey inland. The CICADAs are programmed to land at a predetermined destination property owned by the City of Marina, CA; the property holds former Army barracks that are slated for redevelopment.<sup>117</sup> Upon landing within fifteen feet of the CICADA's preprogrammed GPS target, the batteries are depleted and the systems are not recovered.

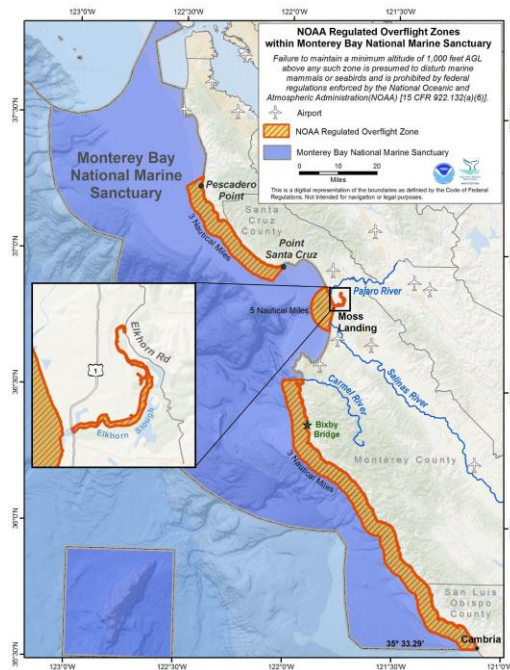


Figure 6: MBNMS Overflight Zones Map<sup>118</sup>

<sup>116</sup> Weisberger, M. (2017). Swarms of CICADA Drones Could Aid Hurricane Research. *Live Science*. <https://www.livescience.com/59966-tiny-stackable-gliding-drones.html>; Note: Glide ratio of 3.5:1 means meaning the system can travel forward 3.5ft for every 1ft of altitude.

<sup>117</sup> City of Marina, California. (2022). *City Parks Barracks and Cypress Knolls Buildings Blight Removal*. <https://www.cityofmarina.org/1145/City-Parks-Barracks-and-Cypress-Knolls-B>

<sup>118</sup> Monterey Bay National Marine Sanctuary. (2022). *Overflight Map*. <https://montereybay.noaa.gov/materials/mappages/overflightmap.html>





Figure 7: Enhanced Map<sup>119</sup>

The pertinent laws and permitting agencies for operation in the air and land environments is determined based on the location and impact of the expendable system. To be deemed as “no impact,” the operation of the CICADAs must not disturb or incidentally take certain regulated species. The Federal and California Endangered Species Acts, the Marine Mammal Protection Act, and the Migratory Bird Treaty Acts prohibit the harassment or incidental take of certain species without proper authorization and permitting.<sup>120</sup> Accordingly, permitting and authorization for such actions to these species are processed through NOAA Fisheries, California Department of Fish and Wildlife, and U.S. Fish and Wildlife offices.

Although the CICADAs and other drones do not plan for interaction with the water, the MBNMS and National Marine Fisheries Service remain important authorities for operation over the maritime environment. Within the MBNMS, there are four regulated overflight zones. Within these zones, flight below 1,000 feet is prohibited without authorization from the Sanctuary.<sup>121</sup> In this scenario, the CICADA’s flight path is planned to steer clear of these zones to ensure adherence to regulations. The five CICADAs that malfunctioned are now floating in the Sanctuary are in violation of the NMSA and MBNMS regulations prohibiting the depositing of material in the Sanctuary.<sup>122</sup> Accordingly, the five CICADAs that are floating in the Sanctuary should be recovered by the responsible party.

<sup>119</sup> Id.

<sup>120</sup> Monterey Bay National Marine Sanctuary. (2022). *Resource Issues: Aircraft, Model Aircraft, & Drones*. <https://montereybay.noaa.gov/resourcepro/resmanissues/aircraft.html>.

<sup>121</sup> Id.

<sup>122</sup> 15 C.F.R. 922.132 (a)(2) (2022).

The Federal Aviation Administration (FAA) is the regulatory authority over UAS operation, including CICADAs. The Navy can operate under civil small unmanned aircraft systems regulations<sup>123</sup> or as a public aircraft with a Certificate of Waiver or Authorization (COA) under 49 U.S.C. § 40102(a) and § 40125.<sup>124</sup>

In addition, both state and county statutes apply to the twenty remaining CICADAs that landed in their designated area. The abandonment of the CICADAs may be considered illegal dumping under California Penal Code Section 374.3.<sup>125</sup> The abandonment of the systems within the City of Marina may also be considered littering under Monterey County Code of Ordinance 10.41.040.<sup>126</sup> Interestingly, there is little in the literature or case records to indicate that the state and county codes have been used to prosecute or fine expendable systems that are abandoned. Furthermore, the Navy may argue it is exempt from these laws in the interest of national security or its impact is de minimis.

Weather balloons are a similar system that may be deemed as “expendable” after deployment as they are not likely to be recovered. Comparable to the CICADA scenario, there may be laws that exempt weather balloons from environmental statutes. Approximately 75,000 weather balloons are launched in the U.S. every year.<sup>127</sup> These unmanned balloons are essential to the collection of weather forecasting data. Weather balloons, primarily made of latex or synthetic latex, often carry a parachute and radiosonde (a device that relays temperature, humidity, and pressure data from the balloon while the parachute ensures a safe descent) as a payload.<sup>128</sup> The National Weather Service describes the instrument as being “expendable”, with roughly only 20% of the weather balloon radiosondes deployed each year in the U.S. recovered, leaving about 56,000 abandoned.<sup>129</sup>

Weather balloons seem to exist in a gray area of the law with a scarce amount of literature regarding the legal standing of spent balloons once they land. Due to winds and their high-altitude nature, balloons could travel many miles from their launch point to land in various unintended environments.<sup>130</sup> While the parachute helps to mitigate the risk that no property or humans are directly injured by the descending balloon material and radiosonde, it cannot be guaranteed. Furthermore, the balloon scraps and parachute can pose a risk to wildlife; birds and other animals, mistaking them for food, may eat and later die from balloon ingestion.<sup>131</sup> California statutes prohibit the release of balloons made from electrically conductive material,

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<sup>123</sup> 14 C.F.R. 1 (F) (107) (2022).

<sup>124</sup> Federal Aviation Administration. (2022). *Operate a Drone, Start a Drone Program*. [https://www.faa.gov/uas/public\\_safety\\_gov/drone\\_program](https://www.faa.gov/uas/public_safety_gov/drone_program)

<sup>125</sup> Cal. Pen. Code § 374.3 (2022).

<sup>126</sup> Monterey County, CA, Ch. 10.41 § 10.41.040 (2022).

<sup>127</sup> National Weather Service (2022). *Weather Balloons*. [https://www.weather.gov/bmx/kidscorner\\_weatherballoons](https://www.weather.gov/bmx/kidscorner_weatherballoons).

<sup>128</sup> Id.

<sup>129</sup> Id.

<sup>130</sup> Id.

<sup>131</sup> Wageningen University. (2022). *Degradable balloons are not the solution*. <https://www.wur.nl/en/article/3.-Degradable-balloons-are-not-the-solution.htm>



such as mylar.<sup>132</sup> However, exemptions have been made for balloons used in governmental or scientific research projects that do contain conductive material. To note, latex is not an electrically conductive material, thus balloons of this type are not restricted under the California state statute. Additionally, the state statute does not address the balloon's legal status upon landing. If a weather balloon landed in the same location as the CICADA, there is a question whether the abandoned balloon would be considered littering or dumping similar to the CICADA.

CICADAs and weather balloons are clearly different systems that have varying environmental impacts yet still comparable in function. Both systems collect data for a federal agency with the size of the systems' payload posing little direct risk to property or humans during descent. Importantly, both are unlikely to be recovered. There is a similar deficiency of legal literature and precedents on the treatment of both CICADAs and weather balloons. However, until guidance comes from policy, law, or courts, there is too little evidence to suggest that CICADAs would be treated the same as weather balloons which have been in use for much longer. Further, it seems unreasonable to apply the exemptions that weather balloons receive to CICADAs when weather balloons seem to have questionable legal status themselves.

#### **D. US Navy and DoD Environmental Statute Exemptions**

As noted above, there are exemptions under federal environmental statutes for military and national security. This section details two such exemptions including the National Environmental Policy Act (NEPA) and Clean Water Act.

NEPA was enacted and signed into law in 1970. NEPA established the Council on Environmental Quality (CEQ) to oversee NEPA implementation, with the law also establishing a national policy for the environment, requiring that all Federal agencies are to assess the environmental effects of any proposed by the agencies prior to any further action. NEPA further holds agencies accountable in the consideration of any significant environmental impacts. The purpose of NEPA is:

To declare a national policy which will encourage productive and enjoyable harmony between man and his environment to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.<sup>133</sup>

An example of how NEPA relates to Navy use of UxS is the usage of a Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) Sonar. A Supplemental

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<sup>132</sup> Cal. Pen. Code § 653.1 (2022).

<sup>133</sup> National Environmental Policy Act, 42 U.S.C. § 4321 Section 2 (1969).  
[https://www.fsa.usda.gov/Internet/FSA\\_File/nepa\\_statute.pdf](https://www.fsa.usda.gov/Internet/FSA_File/nepa_statute.pdf)

Environmental Impact Statement was conducted by the National Marine Fisheries Service (NMFS) in review of the SURTASS over concerns of the Navy's operations possibly violating the Marine Mammal Protection Act. Because the systems fall under the Navy's Title 10 Authority of training and testing, the permits for use of the sonar were granted under the National Defense Exemption.<sup>134</sup>

Another example of an exemption is the justified usage of munitions at sea. The Clean Water Act regulates the discharge of pollutants in US waters and is implemented by the EPA.<sup>135</sup> Because the munitions were being used for the intended purpose, the action of not collecting used munitions at sea was not considered ocean disposal. Further codifying the exemption, the Uniform National Discharge Standards create an overarching set of national discharge standards for ships and vessels owned by the Department of Defense (DoD) operating in both coastal and inland waters.<sup>136</sup>

### **E. Environmental Recommendations**

These emerging issues reveal areas for improvement in U.S. law as well as Navy policy. The research team recommends the following considerations for the Navy as it moves forward with use of expendable UxS and the creation of future UxS.

**Recommendation 4.** Comply with statutes when possible even when exemptions exist. As noted above, several statutes include exemptions for a Navy deployed expendable system that would otherwise be considered abandonment, littering or dumping. Despite these exemptions, there is rationale for the Navy to comply with these statutes during peace-time operations. By doing so, the Navy would limit pollution in all environments by recovering the systems or by using alternative methods or materials that will limit these systems impact on the environment.

**Recommendation 5:** Conduct financially responsible use of expendable systems. The Navy's compliance with these statutes would show financial responsibility. In the coming years, hundreds of millions of dollars will be spent on ocean and marine debris clean-up programs.<sup>137</sup> For the Navy to be creating and contributing to marine debris while Congress funds other agencies to clear and prevent it makes little financial sense. Adherence to the statutes also

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<sup>134</sup> Chief of Naval Operations. (June 2019). *Final Supplemental Environmental Impact Statement/Supplemental Overseas Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar*. Department of the Navy. [https://www.nepa.navy.mil/Portals/20/Documents/surtass-lfa/2019/06/Navy\\_SURTASS-LFA-FSEIS-SOEIS.pdf](https://www.nepa.navy.mil/Portals/20/Documents/surtass-lfa/2019/06/Navy_SURTASS-LFA-FSEIS-SOEIS.pdf)

<sup>135</sup> Clean Water Act, 33 U.S.C. § 1251 et seq. (1972). <https://www.govinfo.gov/content/pkg/USCODE-2018-title33/pdf/USCODE-2018-title33-chap26.pdf>

<sup>136</sup> Uniform National Discharge Standards (UNDS) for Vessels of the Armed Forces, 40 C.F.R. 1700 (1999). <https://www.ecfr.gov/current/title-40/chapter-VII/part-1700?toc=1>

<sup>137</sup> U.S. Environmental Protection Agency. (2022, April 18). *EPA Announces \$524 Million Investment to Improve Health of Waterways and Oceans as Biden-Harris Administration Celebrates Earth Week*. <https://www.epa.gov/newsreleases/epa-announces-524-million-investment-improve-health-waterways-and-oceans-biden-harris>

will help the Navy to meet Executive Orders and Navy/DoD policies concerning protection of the environment.<sup>138</sup>

**Recommendation 6.** Acknowledge and respond to lasting impacts of expendable systems. The deployment of expendable systems over a long period of time can result in obstacles for future military and civil operations in the maritime environment. Despite singular cases being permitted as de minimis, the collective, continued, and increased use of expendable systems in the maritime domain may create a navigational hazard to vessels and obscure the true state of the sea floor. Overall, limiting the use of these systems and fully complying with statutes is beneficial for achieving current and future Navy objectives.

The lack of both literature and current legal statutes concerning AS, UxS, and expendable systems remains an obstacle for a comprehensive analysis of the legal landscape. The Navy will continue to deploy expendable systems but it is important for operators to understand the gaps in the law and how the impact these systems have on the environment may dictate their scope of use.

#### **IV. Governance of UxS in the Arctic Region**

In a related project, researchers undertook an analysis of the policy related to the use of UxS in the Arctic region. While UxS can be useful in the harsh Arctic environment with an increasingly unpredictable climate, the conventions and bilateral agreements that make up the governance of this region were not written for these systems. In fact, UxS do not appear in the governance documents of the region, despite their prevalent use there. This is not unusual; UxS are used around the globe but systems and technology are ahead of the law and policy governing them. In an effort to determine the status of governance in the Arctic, researchers focused on the following research question: how do existing policies or laws under Arctic governance apply to unmanned systems in the maritime environment and the airspace?

The main areas of governance in the region are the Polar Code and UNCLOS. Although these policies do not explicitly discuss UxS, they provide guidance for new policies or amending provisions to create room for the use of these systems. This section analyzes the Polar Code and UNCLOS as authorities over underwater systems, specifically covering Article 234 of UNCLOS for ice-covered areas. For systems in the air, the section addresses authority of the Federal Aviation Administration (FAA), International Civil Aviation Organization (ICAO), and applicability of the Specific Operations Risk Assessment (SORA) documents. Finally, the Arctic Council, the region's non-rulemaking and non-regulatory forum aimed at cooperation and coordination among the Arctic States, plays a role in laying out policy and guidance in the

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<sup>138</sup> The White House. (2022, July 1). *In Case You Missed It: Biden-Harris Administration Works with Global Partners to Drive Ocean Action to Combat the Climate Crisis and Boost Ocean Economy at UN Ocean Conference*. <https://www.whitehouse.gov/ceq/news-updates/2022/07/01/in-case-you-missed-it-biden-harris-administration-works-with-global-partners-to-drive-ocean-action-to-combat-the-climate-crisis-and-boost-ocean-economy-at-un-ocean-conference/>

region.<sup>139</sup> It can have a positive impact on providing clarity to its member states and non-Arctic states that transit the region.

To show how these authorities apply, this section presents two scenarios - one in the air with an unmanned system called Scout and one underwater with Luke as denoted above. The scenarios show how the authorities apply in specific situations and how application changes throughout their journeys, especially in contested areas in the Arctic region. Their journey will follow the same route – one in air and one underwater - starting on the west coast of Alaska, going around the Seward Peninsula, through the Bering Strait, through a portion of the Northwest Passage, concluding on the Northeast side of Alaska. While this section addresses the Navy’s use of UAS in the region which may be exempt from certain legal requirements, it focuses on application of laws and policies to any use of these systems including civilian, research and military. Thus, while all of these laws may not be applicable in every case, the section lays out a holistic view of the governance regime.

### A. Scenario One: Scout in the Air

Scout is an Unmanned Aircraft System (UAS) prototype of the ScanEagle (See Figure 8), which is a long-endurance autonomous and unmanned aircraft system that provides day, night ISR for governmental and civil purposes. In this scenario, Scout is launched at or below 20,000 feet from the platform of the Hybrid Airship. The goal in this scenario is to deploy UAS, via the Hybrid Airship’s platforms, to create a consistent presence in the Arctic as global interest in the area and these systems increase. Scout has the following dimensions: Height: ~1.2 ft, Width: 10.2 ft, Depth: 5.6 ft, Weight: 39.68 lbs. (empty), 48.5 lbs. (maximum takeoff). Its speed will be 50-60 knots cruising and 80 knots at its maximum. As a ScanEagle, Scout will be controlled by an operator in a Ground Control Station (GCS). It is foreseeable that, by 2050, it could be an autonomous system rather than controlled remotely.

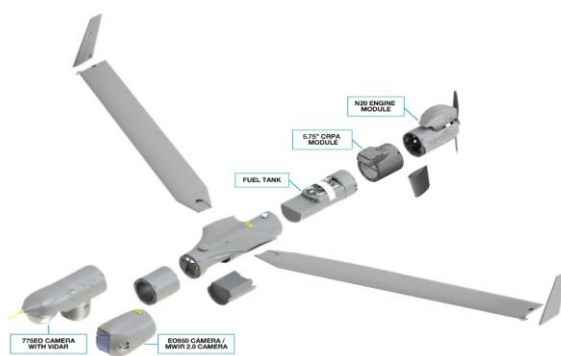


Figure 8: ScanEagle UAS Prototype<sup>140</sup>

<sup>139</sup> The Arctic Council. (2022). <https://www.arctic-council.org/>

<sup>140</sup> For more details on the ScanEagle, see Insitu. (2022, August 5). *ScanEagle*. <https://www.insitu.com/products/scaneagle>

Scout will take a route from Alaska, around the Seward Peninsula, through the Bering Strait, and through part of the Northwest Passage to conclude its route on the Northeast side of Alaska (See Figure 9).



Figure 9: Scout's Journey

This journey will include internal waters, territorial seas, and Exclusive Economic Zone (EEZs) as defined by UNCLOS (See Figure 10). Internal waters are defined as waters on the landward side of the baseline;<sup>141</sup> Both Arctic and non-Arctic States have the right of innocent passage here.<sup>142</sup> Like internal waters, States have the right of innocent passage in the territorial sea with some exceptions for protection of the coastal state. The territorial sea is generally twelve miles out from the baseline, and every state has the right to establish the breadth of this, while not exceeding the 12-mile marker.<sup>143</sup> The coastal state has sovereignty over the seabed as well as the airspace in this area.<sup>144</sup> EEZs are generally 200 miles out from the baseline; here, coastal states claim the economic value of the resources in this area, such as oil and gas or undersea minerals and fisheries.<sup>145</sup> In the EEZ, all states enjoy the freedom of overflight and navigation.<sup>146</sup> In the Contiguous Zone, which is no more than 24 miles out from the baseline, certain coastal state laws and regulations apply.<sup>147</sup> Scout does not enter the high seas, which are also called international waters and are outside the boundaries of states' EEZs.<sup>148</sup> Generally, states have the

<sup>141</sup> The normal baseline is an Arctic State's coastline, or where its low-water line is marked on charts officially recognized by the Arctic State. UNCLOS at Article 5.

<sup>142</sup> UNCLOS at Article 8.

<sup>143</sup> UNCLOS at Article 3.

<sup>144</sup> UNCLOS at Article 2.

<sup>145</sup> UNCLOS at Article 57- 56.

<sup>146</sup> UNCLOS at Article 58.

<sup>147</sup> UNCLOS at Article 33.

<sup>148</sup> UNCLOS at Article 87.

right to freely navigate and exploit the resources in the high seas<sup>149</sup> but there are certain protections in place in the Arctic Ocean such as the International Agreement to Prevent Unregulated Fishing in the High Seas of the Central Arctic Ocean which went into effect in 2021 and will be in effect for 16 years.<sup>150</sup> The legal standards that apply to the airspace are based on these maritime zones, which Scout will fly over.

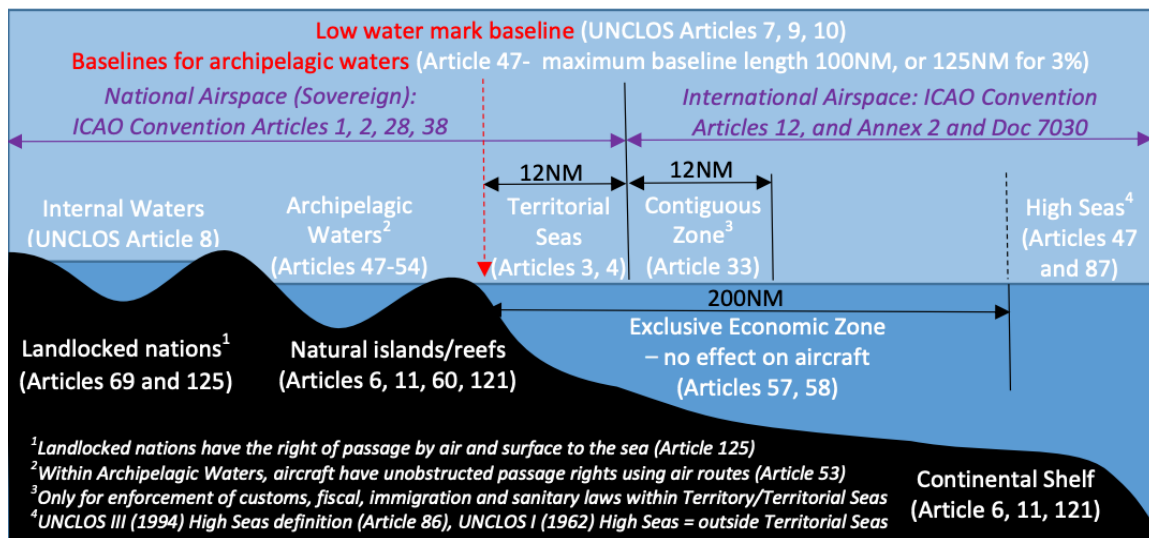


Figure 10: Governance in the Air and over the Territorial Areas

Throughout Scout’s journey, through the U.S. EEZ off Alaska, the Bering Strait, and the Northwest Passage, Scout will stay mostly in U.S. airspace. The U.S. has sovereignty over its EEZ.<sup>151</sup> However, other States<sup>152</sup> generally have freedom of overflight and navigation in EEZs.<sup>153</sup> (See Figure 11 for EEZ borders).

<sup>149</sup> Id.

<sup>150</sup> International Agreement to Prevent Unregulated Fishing in the High Seas of the Central Arctic Ocean, October 3, 2018. <https://www.mofa.go.jp/files/000449233.pdf> The agreement was signed by Canada, European Union, United States, China, Japan, Russia, Iceland, Norway, South Korea and Denmark.

<sup>151</sup> UNCLOS at Article 58.

<sup>152</sup> In this context, UNCLOS uses the term, “States,” as parties bound to or who have ratified the Convention and its provisions. UNCLOS at Article 1 subpart 2(1).

<sup>153</sup> UNCLOS at Article 58.





Figure 11: Exclusive Economic Zones<sup>154</sup>

### 1. In U.S. Airspace

Because Scout is an airborne unmanned system, while it is in U.S. national airspace, it will be governed by the Federal Aviation Administration (FAA). FAA authority extends to the outer edge of the U.S. territorial sea. The relevant FAA regulation is known as the Small UAS Rule or the Part 107 Rule. This applies to Scout because the rule applies to systems 55 pounds and less and Scout weighs 39.68 - 48.5 lbs.<sup>155</sup> Under the Part 107 Rule, the drone must be registered with the FAA at the FAA Drone Zone to fly in the national airspace.<sup>156</sup> Further, the remote pilot must be certified<sup>157</sup> and must fly the UAS within the visual line-of-sight.<sup>158</sup> The FAA’s Small UAS rule specifies the need for a remote pilot because currently, there is no unclassified mechanism approved for a fully autonomous system in the airspace, so a remote pilot or automated decision-making is required. This is satisfied by the ScanEagle being controlled by an operator in a Ground Control Station. Operators are encouraging movement toward a fully autonomous system by 2050. The FAA rule will need to be amended to allow for the operation of an autonomous system without a remote pilot.

<sup>154</sup> Jones, P., McGrath-Horn, M., Merighi, M. Murray, S., Riley, C., Rotar, B., Singh, K., et al. (2017). *The Arctic and the LOSC*. In J. Burgess, L. Foulkes, P. Jones, M. Merighi, S. Murray, J. Whiteacre (Eds.), *Law of the Sea* (pp. 59-66). Trustees of Tufts College. <https://sites.tufts.edu/lawofthesea/chapter-eight/>

<sup>155</sup> Small Unmanned Aircraft Systems, 10 C.F.R. 107.110(a)(1) (2022). <https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-107>

<sup>156</sup> UAV Coach. (2022, August 5). *Drone Laws in the United States of America*. [hereinafter UAV Coach] <https://uavcoach.com/drone-laws-in-united-states-of-america/#:~:text=You%20must%20register%20your%20UAV,a%20drone%20under%2055%20lbs>

<sup>157</sup> Small Unmanned Aircraft Systems, 10 C.F.R. 107.7(a) (2022). <https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-107>

<sup>158</sup> UAV Coach.

After registering, the UAS must be properly labeled.<sup>159</sup> In terms of anti-collision lighting requirements, COLREGs can apply to UAVs flying above the water, as they are defined as vessels.<sup>160</sup> Researchers found that UAVs flying at low altitudes above water should be characterized as a vessel by COLREGs, and thus UAVs should comply, at least generally, with the provisions of COLREGs.<sup>161</sup>

Thus far, as a ScanEagle, Scout has received restricted category type certification and clearance by the FAA in 2013, making it the first ever beyond-line-of-site operation. This is a step forward in integrating UAS into national airspace regulations.

## 2. In the Bering Strait Region

When Scout passes over the Bering Strait, it will stay over the U.S. territorial seas and EEZ. The Bering Strait lies within the territorial seas of Russia and the U.S., and its remaining waters lie within their EEZs. (See Figure 12). The Bering Strait Region is known as contested waters or a contested area, which is an area of overlapping jurisdiction or one where sovereignty is questioned. Here, both the U.S. and Russia stake a claim to the region by way of UNCLOS Articles 121 and 3 because of an extension of internal waters. Article 121 gives the coastal state the right to extend its territorial sea from each side of an island in the sea, and Article 3 defines this as up to 12 nautical miles from the baseline. Because of the rock formations and islands in the area, the U.S. has established its baseline (for purposes of determining the 12-mile territorial sea) from Little Diomed Island, Fairway Rock, and the Seward Peninsula, and Russia claims its baseline from the Chukotka Peninsula and Big Diomed Island. This creates four channels, “covered by the term Bering Strait: between the Russian mainland and Big Diomed Island; between Big Diomed Island and Little Diomed Island; between Little Diomed Island and Fairway Rock; and between Fairway Rock and the U.S. mainland.”<sup>162</sup> These channels are within the national jurisdiction of these two neighboring coastal States, while the U.S. and Russia are required to respect the right of transit/innocent passage of all ships and aircraft through this area because it is classified as a strait under UNCLOS part III.<sup>163</sup>

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<sup>159</sup> Small Unmanned Aircraft Systems (UAS) Regulations. 14 C.F.R. 107 (2020). <https://www.faa.gov/newsroom/small-unmanned-aircraft-systems-uas-regulations-part-107#:~:text=To%20operate%20the%20controls%20of,in%20one%20of%20two%20ways>

<sup>160</sup> Chuah, J. C. T. & Movaghar, A. (2021). Shore to Ship Drones – Relevance and Applicability of Maritime Navigation Rules. *Journal of Maritime Law and Commerce*. [https://openaccess.city.ac.uk/id/eprint/27753/3/Shore%20to%20Ship%20Drones%20&%20COLREGs%20\(Revised\).pdf](https://openaccess.city.ac.uk/id/eprint/27753/3/Shore%20to%20Ship%20Drones%20&%20COLREGs%20(Revised).pdf)

<sup>161</sup> Chuah, J. C. T. & Movaghar, A. (2021). Shore to Ship Drones – Relevance and Applicability of Maritime Navigation Rules. *Journal of Maritime Law and Commerce*. [https://openaccess.city.ac.uk/id/eprint/27753/3/Shore%20to%20Ship%20Drones%20&%20COLREGs%20\(Revised\).pdf](https://openaccess.city.ac.uk/id/eprint/27753/3/Shore%20to%20Ship%20Drones%20&%20COLREGs%20(Revised).pdf)

<sup>162</sup> Berkman, P. A., Vylegzhanin, A. N., Young, O. R. (2016). Governing the Bering Strait Region: Current Status, Emerging Issues and Future Options. *Ocean Development & International Law*, 47(2), 186-217. <https://doi.org/10.1080/00908320.2016.1159091>

<sup>163</sup> *Id.*

The lack of high sea areas in this region can be limiting on navigation as states have sovereign rights over their territorial seas. This is the rationale for the region to be considered an international strait, to allow for navigation even without the flexibility of rights within the high seas. The legal precedent for defining such a strait is the Corfu Channel case, which gives the “the decisive criterion [as] connecting two parts of the high seas and used for international navigation.”<sup>164</sup> The importance of international navigation is confirmed by UNCLOS Articles 37 and 38, stating that the right of transit or innocent passage shall not be impeded. Applying this rule in the Corfu Channel case, the Bering Strait connects the Bering Sea and the Chukchi Sea, as well as being the only connection between the Arctic and Pacific Oceans. It is also used for international navigation, although it is only used by eight ships per day for six months out of the year because of the navigability and climate of the region.<sup>165</sup> However, because it connects two parts of the high seas and is used for international navigation, it is classified as an international strait.

While there are many bilateral agreements between the U.S. and Russia regarding the Bering Strait region, the region is resource-rich and a shared gateway between the Pacific and Arctic Oceans which will be used increasingly in the future with melting ice from climate change. With tense relations following Russia’s invasion of Ukraine in 2022, future negotiations may prove challenging. Given the context, Scout will stay on the U.S. side of the region where the U.S. has sovereignty over the airspace with no limitations that the system would have if it entered the Russian territorial sea, where it could be open to confiscation by Russia.

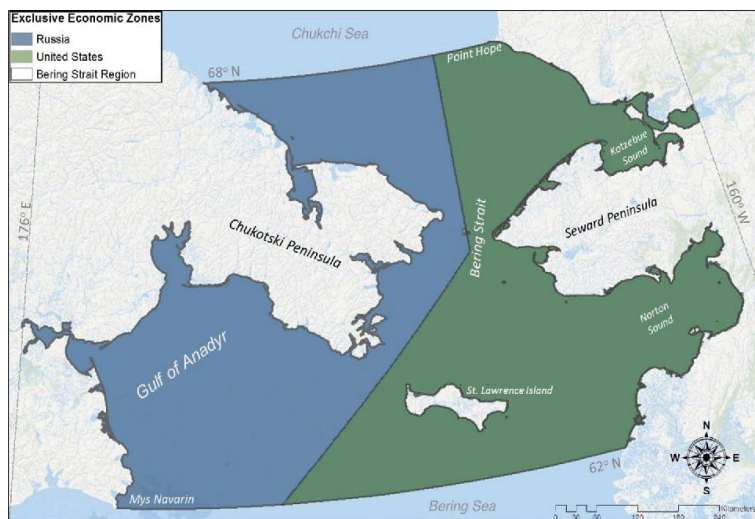


Figure 12: Bering Strait Region<sup>166</sup>

<sup>164</sup> Jones, P., McGrath-Horn, M., Merighi, M. Murray, S., Riley, C., Rotar, B., Singh, K., et al. (2017). The Arctic and the LOSC. In J. Burgess, L. Foulkes, P. Jones, M. Merighi, S. Murray, J. Whiteacre (Eds.), *Law of the Sea* (pp. 59-66). Trustees of Tufts College. <https://sites.tufts.edu/lawofthesea/chapter-eight/>

<sup>165</sup> Although the Bering Strait is currently unusable for six months out of the year, it can accommodate large shipping containers and vessels that other contested areas, such as the Northern Sea Route, cannot handle. More information here: <https://doi.org/10.1080/00908320.2016.1159091>

<sup>166</sup> Id.

### 3. In the Northwest Passage

Similarly, the Northwest Passage is also a contested area; the Northwest Passage is claimed by Canada as its internal waters under a claim of historic usage by the Inuit People.<sup>167</sup> (See Figure 13). The U.S. does not recognize this as a legal assertion and posits that the need and preference for international navigation trumps this assertion.<sup>168</sup> UNCLOS Article 38 states that “all ships and aircraft enjoy the right of transit passage, which shall not be impeded,” where transit passage is the exercise “of the freedom of navigation and overflight solely for continuous and expeditious transit of the strait.”<sup>169</sup> Some legal analysts agree that the Northwest Passage’s legal status is correctly classified as an international strait and should be free to use for international navigation.<sup>170</sup>

Although Canada asserts that it has the right to exclude ships from its internal waters if States fail to comply with local regulations, the U.S. argues that because of the freedom of the high seas, innocent or transit passage may not be obstructed by excluding vessels under Article 234.<sup>171</sup> Canada’s assertion is also incongruent with UNCLOS Article 37; if the Northwest Passage is considered a strait under Article 37, then any vessel would have the right of transit passage without any interference from Canada’s regulations.<sup>172</sup>

This disagreement on the application of UNCLOS is integral to how Scout will be treated in the region. If Scout stays in U.S. waters (within the portion of the Northwest Passage that is a part of the U.S. EEZ off Alaska), Scout will have full freedom to navigate, survey, and collect research. However, if it goes into Canadian waters (the part of the Northwest Passage claimed as internal waters by Canada), it will have to abide by Canada’s policies.<sup>173</sup>

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<sup>167</sup> Jones, P., McGrath-Horn, M., Merighi, M. Murray, S., Riley, C., Rotar, B., Singh, K., et al. (2017). The Arctic and the LOSC. In J. Burgess, L. Foulkes, P. Jones, M. Merighi, S. Murray, J. Whiteacre (Eds.), *Law of the Sea* (pp. 59-66). Trustees of Tufts College. <https://sites.tufts.edu/lawofthesea/chapter-eight/>

<sup>168</sup> Id.

<sup>169</sup> UNCLOS at Article 38.

<sup>170</sup> Note. (2020). The Potential-Use Test and the Northwest Passage. *Harvard Law Review* 133, 2579. <https://harvardlawreview.org/2020/06/the-potential-use-test-and-the-northwest-passage/>

<sup>171</sup> Id.

<sup>172</sup> Note. (2020). The Potential-Use Test and the Northwest Passage. *Harvard Law Review* 133, 2579. <https://harvardlawreview.org/2020/06/the-potential-use-test-and-the-northwest-passage/>

<sup>173</sup> For information on the Canadian Coast Guard’s latest UAS trials, see: Smith, O. (2022, February 14). *V-BAT drone Canadian Coast Guard trials show “comprehensive airspace picture”*. Unmanned Airspace. <https://www.unmannedairspace.info/latest-news-and-information/v-bat-drone-canadian-coast-guard-trials-show-comprehensive-airspace-picture/>



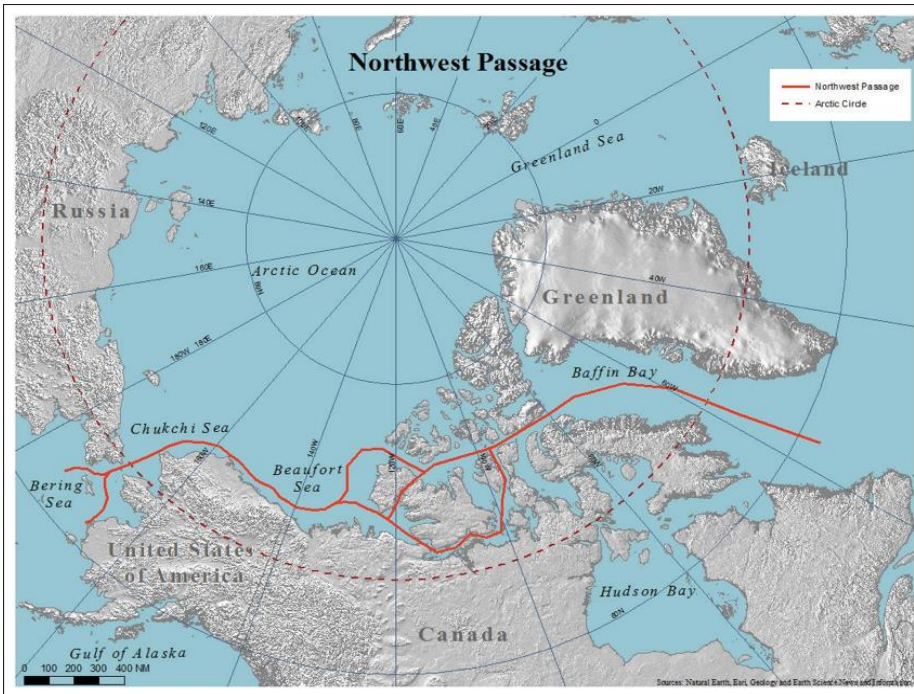


Figure 13: Northwest Passage<sup>174</sup>

#### 4. Note on International Airspace Governance

If Scout goes outside of national airspace, beyond the U.S. territorial sea, the FAA no longer has authority, and the U.S. will follow provisions under the ICAO as a council member state. The ICAO was formed under the Convention on International Civil Aviation (also known as the Chicago Convention). The ICAO’s UAS regulations include policies regarding remote piloting and unmanned free balloons. Relevant regulations are in Part 101, 102, and 149 of the convention, as well as their Companion Advisory Circulars.<sup>175</sup>

The ICAO also requires State aircraft have due regard for the safety of navigation of civil aircraft under Article 3 of the Chicago Convention.<sup>176</sup> The FAA defines due regard as “a phase of flight wherein an aircraft commander of State-operated aircraft assumes responsibility to separate his/her aircraft from all other aircraft.”<sup>177</sup>

<sup>174</sup> Jones, P., McGrath-Horn, M., Merighi, M. Murray, S., Riley, C., Rotar, B., Singh, K., et al. (2017). The Arctic and the LOSC. In J. Burgess, L. Foulkes, P. Jones, M. Merighi, S. Murray, J. Whiteacre (Eds.), *Law of the Sea* (pp. 59-66). Trustees of Tufts College. <https://sites.tufts.edu/lawofthesea/chapter-eight/>

<sup>175</sup> International Civil Aviation Organization. (n.d.). *Introduction to ICAO Model UAS Regulations and Advisory Circulars*. Retrieved 2022, from <https://www.icao.int/safety/UA/Pages/ICAO-Model-UAS-Regulations.aspx>

<sup>176</sup> ICAO European and North Atlantic Office. (2015). *Operation of State Aircraft*. <https://www.icao.int/EURNAT/Other%20Meetings%20Seminars%20and%20Workshops/ICAO%20Civil-Military%20Cooperation%20Meetings/ICAO%20Civil-military%20Cooperation%20Symposium%202015/ICMCS%20IP01.pdf>

<sup>177</sup> Id. Also see ICAO at Note 175: For maritime purposes, vessels must also maintain due regard “to the rights and duties of the coastal State and shall comply with the laws and regulations adopted by the coastal State” as defined under UNCLOS Article 58.

The Specific Operations Risk Assessment, or SORA Documents, are also used as guidance in international airspace because they provide more specificity. The SORA provides recommendations on how to safely assess and conduct UAS operations, including UAS military operations.<sup>178</sup> They are endorsed by the European Aviation Safety Agency (EASA) to fulfill the requirements of the European Union Regulations, and they were created by a working group under the Joint Authorities for Rulemaking on Unmanned Systems (JARUS) which is a group of experts from different countries' national aviation authorities.<sup>179</sup> SORA does not replace civil regulations; rather, it helps identify safety risks with the operation of UAS by laying out a clear assessment of risks associated with UAS operation.

## **B. Scenario Two: Luke Underwater**

Scenario two focuses on an underwater unmanned system; this analysis proves useful in the partnering of unmanned systems in both air and water simultaneously. As noted above, the underwater scenario through the Arctic region builds on the above scenario with the underwater glider called Luke.<sup>180</sup> Luke is an underwater vessel, much like the Slocum G3 Glider.<sup>181</sup> The glider's length is 1.5 meters, and its hull diameter is 22 cm with a mass of 55 - 70 kgs. It operates as a buoyancy glider without a mothership, and its depth ranges from 4 to 150m or 40 to 1000m as its operating depth range.<sup>182</sup> While there is some debate about whether unmanned systems are vessels under international maritime laws, for purposes of this section, researchers again assume this system meets the definition of vessel.

Here, Luke will take the same route underwater as Scout did in the air, from Alaska, around the Seward Peninsula, through the Bering Strait and Northwest Passage to conclude its journey on the other side of Alaska. While Luke begins its journey, much like Scout, coming from Alaska, it will pass through the internal waters, territorial sea, and the U.S. EEZ.

### **1. In U.S. Waters**

In these areas, UNCLOS is the overarching law that governs the use and claims over ocean areas and governs Luke as a vessel. The U.S. is a signatory to the treaty, but has not yet ratified it; however, the U.S. accepts most provisions as customary international law. According to UNCLOS Articles 8, 3, 4, and 57, the U.S. has sovereignty over these areas, so government-operated systems from the U.S., like Luke, are free to navigate, collect research, and survey these

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<sup>178</sup> European Cockpit Association. (2019). *Specific Operations Risk Assessment (SORA)*. ECA.

<https://www.eurocockpit.be/positions-publications/specific-operations-risk-assessment-sora>

<sup>179</sup> *Id.*; Joint Authorities for Rulemaking on Unmanned Systems. (n.d.). *JARUS*. Retrieved 2022, from

<http://www.jarus-rpas.org/>

<sup>180</sup> Fletcher, K., Lesse, M., DeCocco, P., Hahn, E., (2021). *Priority Law and Policy Issues Related to Autonomous and Unmanned Systems*.

[https://nps.edu/documents/114698888/121733922/CRUSER\\_Priority+Law+%26+Policy+Issues+%28Dec+2021%29.pdf/e3b6a430-a00d-faf9-cfd3-fabea603ee1a?t=1643158769410](https://nps.edu/documents/114698888/121733922/CRUSER_Priority+Law+%26+Policy+Issues+%28Dec+2021%29.pdf/e3b6a430-a00d-faf9-cfd3-fabea603ee1a?t=1643158769410)

<sup>181</sup> *Id.*

<sup>182</sup> For more information, see: Teledyne Marine. (2022, August 5). *Slocum G3 Glider*.

<http://www.teledynemarine.com/slocum-glider>



areas. In the U.S. territorial sea, the U.S. has an absolute right to the waters and its subsoil, except it must allow the innocent passage of other ships and vessels. Because the U.S. has sovereignty over its EEZ, Luke will have access to all the resources here as well as the freedom to navigate, survey, and collect research.

UNCLOS Article 234 is specific to the Arctic and allows the Arctic Coastal States to create laws to prevent, reduce, and control marine pollution from vessels in ice-covered areas.<sup>183</sup> Under Article 234, the rough climate and ice covering the areas create obstructions and hazards to navigation, which disrupts the balance of the marine environment.<sup>184</sup> Thus, the laws and regulations should have due regard for these hazards and possible pollutants, as well as protect and preserve the marine environment.<sup>185</sup>

UNCLOS Article 76 is also important to the Arctic as it lays out the limitations to the continental shelf and claims for extensions. Arctic Coastal States' EEZs generally extend 200 nautical miles out from the baseline or to the outer edge of the natural prolongation of the Coastal State's land territory, but this may not exceed more than 350 miles.<sup>186</sup> After a country ratifies UNCLOS, it has ten years to submit a claim asking to extend its continental shelf beyond the normally 200-mile mark.<sup>187</sup> The Commission on Limits of the Continental Shelf (CLCS) facilitates the establishment of these outer limits regarding the continental shelf.<sup>188</sup> States abide by the recommendations of the CLCS and by the "orderly settlement of any possible overlapping claims."<sup>189</sup>

The USCG has authority to enforce laws in the territorial sea and contiguous zone, including hazards to navigation. The USCG operates under the Department of Homeland Security and safeguards "more than 95,000 miles of U.S. maritime border shoreline and 15,000 miles of waterways, seaports, and other commercially navigable waters."<sup>190</sup> With such a large area to patrol, unmanned systems can play an important role. As of 2021, the Science and Technology Directorate received Congressional funding and initiated a research project involving the Coast Guard and six wind and solar-powered unmanned surface and underwater

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<sup>183</sup> UNCLOS at Article 234.

<sup>184</sup> *Id.*

<sup>185</sup> *Id.*

<sup>186</sup> UNCLOS at Article 76.

<sup>187</sup> BBC. (2014, December 15). *Denmark challenges Russia and Canada over North Pole.*

<https://www.bbc.com/news/world-europe-30481309>

<sup>188</sup> Commission on the Limits of the Continental Shelf (CLCS), 1997.

[https://www.un.org/depts/los/clcs\\_new/commission\\_purpose.htm#:~:text=The%20purpose%20of%20the%20Commission,nautical%20miles%20\(M\)%20from%20the](https://www.un.org/depts/los/clcs_new/commission_purpose.htm#:~:text=The%20purpose%20of%20the%20Commission,nautical%20miles%20(M)%20from%20the)

<sup>189</sup> Jones, P., McGrath-Horn, M., Merighi, M. Murray, S., Riley, C., Rotar, B., Singh, K., et al. (2017). The Arctic and the LOSC. In J. Burgess, L. Foulkes, P. Jones, M. Merighi, S. Murray, J. Whiteacre (Eds.), *Law of the Sea* (pp. 59-66). Trustees of Tufts College. <https://sites.tufts.edu/lawofthesea/chapter-eight/> Another contested area that is not analyzed in this section is Denmark's claim to the Lomonosov Ridge as an extension of Greenland's continental shelf. For more information, see: BBC. (2020, July 23). *The rush to claim an undersea mountain range.*

<https://www.bbc.com/future/article/20200722-the-rush-to-claim-an-undersea-mountain-range>

<sup>190</sup> U.S. Department of Homeland Security. (2021, October 26). *How Autonomous Vessels Can Help the Coast Guard Safeguard Our Waters.* <https://www.dhs.gov/science-and-technology/news/2021/10/26/feature-article-how-autonomous-vessels-can-help-coast-guard-safeguard-our-waters>.

vessels.<sup>191</sup> The Coast Guard currently has a UAS Division that uses long-range, medium-range, and short-range UAS to survey, patrol, and monitor, but the Coast Guard hopes to expand into unmanned maritime systems (UMS).<sup>192</sup>

## 2. In the Bering Strait Region

Like Scout, Luke will stay on the U.S. side of the Bering Strait to stay within the U.S. territorial sea. Luke will operate in the Bering Strait like NOAA's unmanned sailing drone that crossed the Bering Strait in 2017; it, too, remained on the U.S. side of the Strait.<sup>193</sup>

Similar to the governance over U.S. waters, UNCLOS Article 234 applies here because the Bering Strait is covered by ice for six months out of the year. Both the U.S. and Russia could argue that the "particularly severe climatic conditions and the presence of ice covering such areas for most of the year create obstructions or exceptional hazards to navigation."<sup>194</sup> This means that either state could adopt non-discriminatory laws over the ice-covered areas within their EEZs aimed at preventing marine pollution and these exceptional obstructions or hazards that could each cause irreversible harm to the marine environment.<sup>195</sup>

The Bering Strait Region is also within the scope of the Polar Code, which provides pollution prevention measures that do not mention the use of unmanned systems. The Polar Code is a collection of conventions under the IMO.<sup>196</sup> The goal of the Polar Code is to protect the polar environment and ensure the safety and security of shipping.<sup>197</sup> (See Figure 14). The Polar Code is not legally binding to government entities and does not explicitly include unmanned systems but can provide guidance for future governance. With ice melting as a result of climate change, commercial and governmental use of the region will increase; this increases the need for new regulations and amendments to the Code to stay current.

A provision in the Polar Code that may offer guidance for provisions for unmanned systems is the Code of Safety for Dynamically Supported Craft. The Code defines Dynamically Supported Craft as a "craft which is operable on or above water and which has characteristics so

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<sup>191</sup> *Id.*

<sup>192</sup> *Id.* For more information on the USCG's UAS Programs and Strategy from 2020, see: U.S. Coast Guard Office of Aviation Forces. (2020, October). *Coast Guard UAS; Programs and Strategy*. [unols.org/sites/default/files/2012scr\\_ap02.pdf](https://unols.org/sites/default/files/2012scr_ap02.pdf)

<sup>193</sup> National Oceanic and Atmospheric Administration. (2017, August 7). *Sailing drone captures dawn while crossing the Bering Strait*. <https://www.noaa.gov/news/sailing-drone-captures-dawn-while-crossing-bering-strait>

<sup>194</sup> Berkman, P. A., Vylegzhanin, A. N., Young, O. R. (2016). Governing the Bering Strait Region: Current Status, Emerging Issues and Future Options. *Ocean Development & International Law*, 47(2), 186-217. <https://doi.org/10.1080/00908320.2016.1159091>

<sup>195</sup> *Id.*

<sup>196</sup> The three conventions under the Polar Code are International Convention for the Prevention of Pollution from Ships (MARPOL), International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), and International Convention for the Safety of Life at Sea (SOLAS). International Maritime Organization. International Maritime Organization. (2013). *IMO- What it is* [Fact sheet]. [hereinafter IMO Fact Sheet] [https://wwwcdn.imo.org/localresources/en/About/Documents/What%20it%20is%20Oct%202013\\_Web.pdf](https://wwwcdn.imo.org/localresources/en/About/Documents/What%20it%20is%20Oct%202013_Web.pdf)

<sup>197</sup> International Maritime Organization. (n.d.). *Introduction to IMO*. Retrieved 2022, from <https://www.imo.org/en/About/Pages/Default.aspx>

different from those of conventional displacement ships.”<sup>198</sup> While it would not currently apply because of the passenger requirement,<sup>199</sup> the provision may provide a model for a future provision focused on unmanned systems.

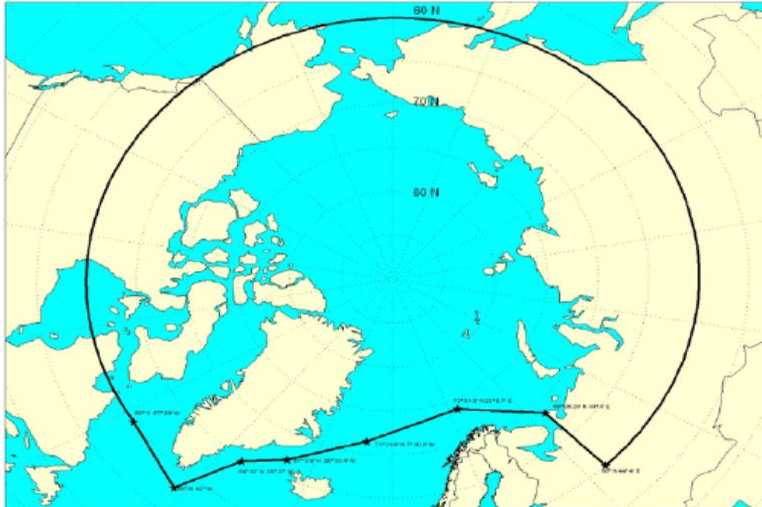


Figure 14: Scope of the Polar Code<sup>200</sup>

Because Luke operates solely in U.S. waters, he will be free to navigate, survey, and collect research without any limitations of foreign state sovereignty over the waters.

### 3. In the Northwest Passage

Similar to the governance over the Bering Strait, Article 234 also applies to the Northwest Passage. In our scenario, Luke will enter the Northwest Passage but stay within the U.S. EEZ off Alaska. If Luke were to navigate into the parts of the Northwest Passage that are claimed as internal waters by Canada, the system may be subject to Canadian regulations. (See Figure 15). A bilateral negotiation between the two countries to agree on transit through this strait could solve this issue. The U.S. would rely on UNCLOS Article 38 that states “all ships and aircraft enjoy the right of transit passage, which shall not be impeded,” and empower Luke to survey and navigate; however, it is unclear if Luke has the freedom to collect data and resources from the area. This will be left to the bilateral negotiations between the two countries. Recently, the two Arctic States held a dialogue regarding the Arctic where it was clear that both States had similar priorities of increasing international cooperation and safeguarding national and

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<sup>198</sup> IMO Fact sheet.

<sup>199</sup> Id.

<sup>200</sup> IMO Sub-Committee on Ship Design and Equipment (DE 54). (2011). *Polar Code Boundaries for the Arctic and Antarctic*. [https://www.asoc.org/wp-content/uploads/2022/02/2011\\_Polar-Code-Boundaries-for-the-Arctic-and-Antarctic.pdf](https://www.asoc.org/wp-content/uploads/2022/02/2011_Polar-Code-Boundaries-for-the-Arctic-and-Antarctic.pdf)

homeland security interests.<sup>201</sup> These conversations must continue, specifically regarding the Northwest Passage for a clearer agreement on access.



Figure 15: Northwest Passage Straight Lines that are Contested<sup>202</sup>

Throughout Luke’s journey, because it is classified as a vessel, it will need to abide by the traffic collision control regulations set out in COLREGs.<sup>203</sup> Specifically, in the Northwest Passage, because it is a narrower strait in terms of navigability, as seen in Figure 16, and Luke is less than 20 meters in length, it shall not impede the passage of a vessel that can only navigate through a narrow channel or fairway.<sup>204</sup>

<sup>201</sup> U.S. Department of State. (2021, December 16). *The United States and Canada Hold Virtual Arctic Dialogue*. <https://www.state.gov/the-united-states-and-canada-hold-virtual-arctic-dialogue/>

<sup>202</sup> Note. (2020). The Potential-Use Test and the Northwest Passage. *Harvard Law Review* 133, 2579. <https://harvardlawreview.org/2020/06/the-potential-use-test-and-the-northwest-passage/>

<sup>203</sup> COLREGS.

<sup>204</sup> *Id.* Rule 9.; There is another contested area in the Arctic similar to the Northwest Passage, the Northern Sea Route, which Russia claims to be a part of its internal waters based on a claim of historic usage and lack of transits without prior authorization. Similarly, the U.S. asserts its usefulness for international navigation, however, obliges to Russia’s demand for transit authorization. For more information, see: Fletcher School. 2022. *Chapter 8: The Arctic & the LOSC*. <https://sites.tufts.edu/lawofthesea/chapter-eight/>

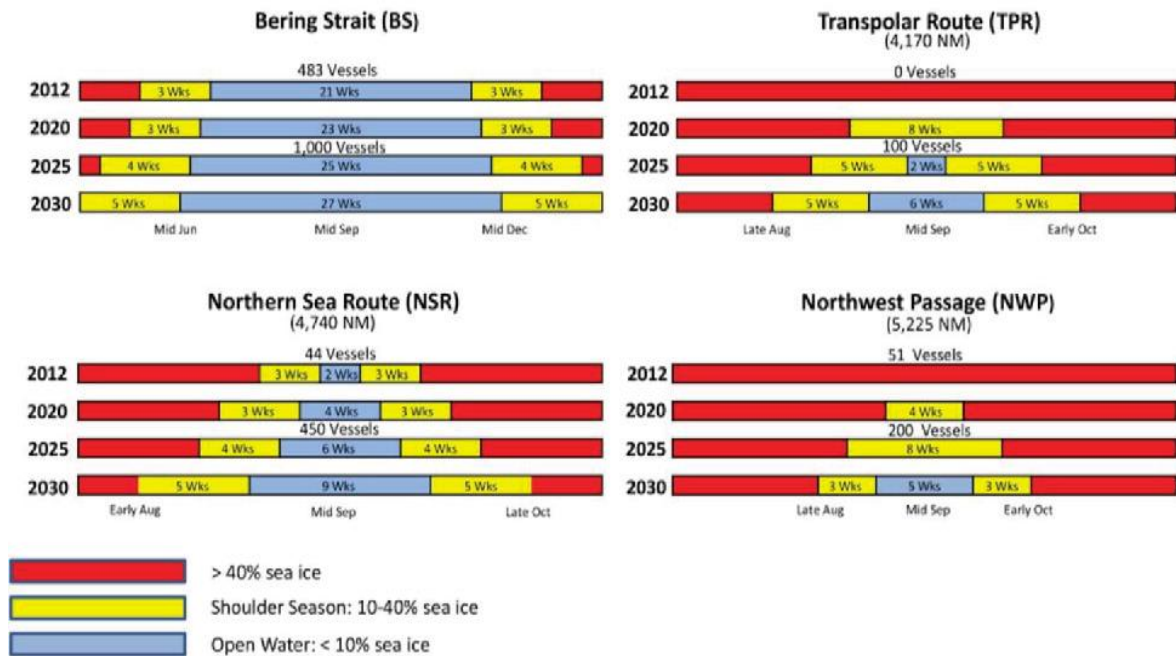


Figure 16: Bering Strait Navigability in Comparison to Other Contested Areas<sup>205</sup>

### C. Arctic Governance Recommendations

In the Arctic region, it is clear there are gaps in the law and policy regarding unmanned systems. Experts that work with these systems agree there is a need for increased clarity, especially because these systems are already in use. International collaboration can address these gaps through the following recommendations.

**Recommendation 7:** Create a U.S. interagency working group to assess the national use of unmanned systems by the USCG, DoD, NOAA, FAA, and other agencies, and organize research and development of policies related to unmanned systems. Because these groups are already using these systems, a consensus of uses, current and future needs will be most useful and applicable. With this consensus, the U.S. can better advocate for international policies to govern unmanned systems.

**Recommendation 8:** Task a working group with the Arctic Council with studying the use of unmanned systems in the region. Working groups are common with the Arctic Council to bring together the member states to focus on a particular issue. Such a study could examine the current and possible future uses of unmanned systems and the relevant monitoring and enforcement mechanisms that can be adapted in future conventions to adequately address the needs of users. Funding will be necessary to support a thorough study.

**Recommendation 9:** Fill the gap in policy regarding unmanned systems. With the completion of recommendations 1 and 2, states can revisit conventions and bilateral agreements to include references and policies related to unmanned systems. By writing unmanned systems

<sup>205</sup> *Id.*

into UNCLOS, the Polar Code, and other agreements, these laws and regulations will be more up-to-date and better prepared for the unmanned systems technologies of the future.



## Summary of Recommendations

**Recommendation 1.** Solidify the assertion that UxS are considered vessels under UNCLOS and customary international law.

**Recommendation 2.** Integrate legal and policy considerations into the design and the operation of UxS.

**Recommendation 3.** Collaborate with allies on UxS design, use and policy.

**Recommendation 4.** Comply with environmental statutes related to expendable UxS when possible even when exemptions exist.

**Recommendation 5:** Conduct financially responsible use of expendable UxS.

**Recommendation 6.** Acknowledge and respond to lasting impacts of expendable UxS.

**Recommendation 7:** Create a U.S. interagency working group to assess the national use of unmanned systems and organize research and development of policies related to unmanned systems.

**Recommendation 8:** Task a working group with the Arctic Council with studying the use of unmanned systems in the region.

**Recommendation 9:** Fill the gap in policy regarding unmanned systems use in the Arctic.

## Table of Acronyms

A2/AD	Anti-access/area denial
AUV	Autonomous Underwater Vehicle
CICADA	Close-In Covert Autonomous Disposable Aircrafts
CFR	U.S. Code of Federal Regulations
CLCS	Commission on Limits of the Continental Shelf
COA	Certificate of Waiver or Authorization
COLREGS	Convention on the International Regulations for Preventing Collisions at Sea
CWA	Clean Water Act (Federal Water Pollution Control Act)
CZMA	Coastal Zone Management Act
DoD	Department of Defense
EASA	European Aviation Safety Agency
EEZ	Exclusive Economic Zone
EMATT	Expendable Mobile ASW Training Target

EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
GCS	Ground Control Station
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
ISR	Intelligence, Surveillance, and Reconnaissance
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
LFA	Low Frequency Active Sonar
MPPRCA	Marine Plastic Pollution Research and Control Act
MPRSA	Marine Protection, Research, and Sanctuaries Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Naval Postgraduate School
OPA	Oil Pollution Act
SOLAS	International Convention for the Safety of Life at Sea
SORA	Specific Operations Risk Assessment
SURTASS	Surveillance Towed Array Sensor System
UAS	Unmanned Aerial System
UAV	Unmanned Aerial Vehicle
UMS	Unmanned Maritime Systems
UMV	Unmanned Maritime Vehicle
UNCLOS	United Nations Convention on the Law of the Sea
UUV	Unmanned Underwater Vehicle
USCG	U.S. Coast Guard
USV	Unmanned Surface Vehicle
UxS	Unmanned or Autonomous System