



Case Western Reserve Journal of International Law

Volume 47 | Issue 1

2015

Electric Currents: Programming Legal Status into Autonomous Unmanned Maritime Vehicles

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ELECTRIC CURRENTS: PROGRAMMING LEGAL STATUS INTO AUTONOMOUS UNMANNED MARITIME VEHICLES

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The use of autonomous vehicles in the ocean is a recent phenomenon, which challenges the notions of what can and cannot be done on the battlefield. One of these challenges is defining these vehicles in the proper legal framework, a challenge made harder by their lack of human control. This note seeks to establish a new definition for these autonomous maritime vehicles within the context of maritime law, establish a standard of liability for the vehicles, and provide guidance on whether or not these vehicles can comply with the collision regulations of the ocean.

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I. INTRODUCTION

In 2011, the United States Department of Defense's Office of Naval Research awarded Virginia Polytechnic Institute & State University a research grant for "understanding the jellyfish propulsion and feeding mechanisms to bioengineer autonomous vehicles."² Two years later, the university's research team began testing the capabilities of a 170-pound, 5-foot-7 jellyfish robot named Cyro.³ Perhaps the most impressive thing about Cyro is how life-like it is. The machine is not only designed to look like a real jellyfish, but Cyro also has nearly the same autonomous capabilities as a real jellyfish. Unlike previous models that were tethered, Cyro is designed to go months without any human intervention, powered only on a tiny hydride battery.⁴ Once deployed, Cyro will be used to further develop our understanding of the ocean: it will study marine life, map the ocean floor, and monitor ocean currents.⁵ However, its primary function will be maritime surveillance.⁶

Ten years ago, the idea of Cyro seemed like a fantasy out of an Asimov novel.⁷ However, since the rise of "drone" unmanned aerial vehicles in the War on Terror, the United States has been looking to use other types of unmanned machines in different fronts of combat and defense.⁸ The benefits of this new approach are less American

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2. Press Release, U.S. Ass't Sec. Def. for Res. & Eng'g, \$37.8 Million Awarded to Universities for Research Equipment (July 11, 2011), *available at* http://www.acq.osd.mil/chieftechologist/publications/docs/FY11_DURIP_Press_Releasel.pdf [hereinafter ASD Press Release].
 3. Natalie DiBlasio, *Man-Sized Jellyfish Robot to Roam the Ocean*, USA TODAY, (Mar. 31, 2013, 12:47 PM), <http://www.usatoday.com/story/tech/sciencefair/2013/03/31/giant-jellyfish-robot-cyro/2039843/>.
 4. *Virginia Tech Researchers Unveil Large Robotic Jellyfish That One Day Could Patrol Oceans*, VA. TECH NEWS (Apr. 3, 2013), <http://www.vtnews.vt.edu/articles/2013/04/040313-engineering-robotjellyfishcyro.html> [hereinafter Virginia Tech].
 5. *Id.*
 6. Marine surveillance consists of UUVs surveying the ocean floor and protecting US territory from infiltration and piracy. *See id.*
 7. Isaac Asimov was a popular science fiction writer whose work often dealt possibilities of humans dealing with advanced autonomous robots. *See generally* ISAAC ASIMOV, I ROBOT (1950).
 8. The War on Terror is an ongoing conflict that began after the terrorist attacks of 9/11. After the attacks, President George W. Bush authorized the use of drones, and drone usage has been an ongoing method of combating terrorists and ensuring national security. *See generally* Milena Sterio, *The United States' Use of Drone in the War on Terror: The (Il)Legality of Targeted Killings Under International Law*, 42 CASE W. RES. J. INT'L L. 197 (2012); *see also* Craig Whitlock, *U.S. Military*

military fatalities and more cost-effective ways for the military to monitor interested areas. As a result, the Navy started developing Unmanned Marine Vehicles (hereinafter U MVs), which included unmanned surface vehicles and unmanned underwater vehicles.⁹ In 2007, the US Navy released The Unmanned Surface Vehicle Master Plan, detailing how the machines are to be developed, maintained, used, and defined in terms of operation.¹⁰ Yet, the Plan does not define the legal status of the unmanned surface vehicles. The Navy has been vague on properly giving a legal definition to these types of vehicles, defining U MVs as “craft,” a term which itself is undefined.¹¹ To make matters even murkier, the Navy has determined that U MV status is not dependent on the definitional “status of its launch platform.”¹²

The difficulty with defining Unmanned Maritime Vehicles is critical in assessing their functions and privileges while operating in the ocean. Furthermore, even if autonomous U MVs fit into a legal framework, there is still the problem of determining whether they should fall within the authority of the International Regulations for Preventing Collisions at Sea (COLREGS)¹³, and if so, how to properly ensure that they comply with those rules. Because U MVs will be operating in waters with manned craft, it is important to make sure they follow some set of navigation rules. The problem here is how to make them abide when they do not fit in the current definition of what a “vessel” is, as well as determining if U MVs should be given “vessel” status in the first place.

This Note seeks to put an end to this debate by arguing for autonomous U MVs to be defined as “military devices” and not as “vessels” or “ships.” As such, autonomous U MV will not have to comply with the COLREGS as they are written. Instead, they should be held to a different standard of navigational rules due to their advanced technology and autonomy. This Note presents a unique and

Drone Surveillance is Expanding to Hot Spots Beyond Declared Combat Zones, WASH. POST (Jul. 20, 2013), http://articles.washingtonpost.com/2013-07-20/world/40695383_1_drone-bases-unarmed-drones-drone-attacks

9. See U.S. NAVY DEP’T, THE NAVY UNMANNED SURFACE VEHICLE (USV) MASTER PLAN, x-xi (2007) [hereinafter USV Master Plan].
10. See *id.*
11. U.S. NAVY DEP’T, THE COMMANDER’S HANDBOOK ON THE LAW OF NAVAL OPERATIONS, 2.3.4, 2.3.5 (2007)
12. *Id.* at 2.3.6. (2007).
13. Convention on the International Regulations for Preventing Collisions at Sea, *opened for signature* Oct. 20, 1972, 1050 U.N.T.S. 16 [hereinafter COLREGS].

novel approach to giving Unmanned Marine Vehicles a new status as “military devices.”

This Note begins in Part II by providing background information on the Navy’s development of UUVs, as well as the COLREGS themselves. Next, Part III discusses the definitional problems facing legal classification, and argues that autonomous UUVs should not be classified as “vessels” or “ships.” Defining UUVs as “vessels” or “ships” would be impossible the way the COLREGS are currently written. Further, amending the COLREGS would not be in the best interest of time because the military will most likely deploy UUVs before the regulations can be amended. Part IV then examines tort liability of UUVs: whether or not UUVs have a duty of care to other ships, establishing the standard of negligence of a UUV, and establishing liability in the case of an accident. Finally, Part V examines the way UUVs will navigate free of the COLREGS, and addresses safety concerns.

II. BACKGROUND

While the military’s use of autonomous weaponry is nothing new, the high level of the autonomy seen in UUVs is the key factor in causing controversy on how to classify the vehicles. Not only does the history of UUVs have to be discussed, but also the history and purpose of the COLREGS. Understanding these two main elements will make the analysis on harmonizing the two a much easier task.

A. The History of Unmanned Maritime Vehicles

The US Navy’s interest in UUVs has spiked in recent years; however, research in the capabilities of autonomous watercrafts has been ongoing for years. In 1993, the MIT Sea Grant College Program developed an autonomous surface craft called ARTEMIS, a small “scale replica of a fishing trawler.”¹⁴ This model proved to be too small to endure autonomy for longer periods of time, and subsequent models that came out of MIT were larger, such as a programmed kayak fitted with an acoustic tracking system used to follow tagged fish.¹⁵ The early development of UUVs was mostly in an academic setting, created for oceanic research. It was during these years of academic research that the Navy took notice of these projects’ potential.

While the Navy’s first focus of development was on the unmanned underwater vehicles, the publishing of its 2007 Master Plan focuses

14. J.E. Manley, *Unmanned Surface Vehicles, 15 Years of Development, Battelle Applied Coastal and Environmental Services*, OCEANS 2008 CONFERENCE (Sept. 15-18 2008).

15. *Id.*

strictly on unmanned surface vehicles.¹⁶ This is mostly because unmanned surface vehicles serve as a facilitator for operation of other unmanned vehicles: they can relay radio frequency transmission above to unmanned aerial vehicles and other aircraft, and below to unmanned underwater vehicles and other sea vessels.¹⁷ The functionality of UMVs varies, but the Navy intends to use them for harbor and sea security, mine sweeping, sea exploration, and eventually to engage in combat and active defense.¹⁸

Within the framework of UMVs exist varying levels of autonomous functionality, based on how “unmanned” different classes of UMVs actually are. The Navy has defined each level of autonomy as follows:

- Manual- Man in loop continuously or near-continuously
- Semi-Autonomous- some vehicle behaviors are completely autonomous (e.g., transit to station, activate sensors). Vehicle refers to its operator when directed by the operator or by its own awareness of the situation (e.g., for permission to fire).
- Autonomous or Fully Autonomous- The vehicle governs its own decisions and makes its own decisions from launch to recovery point.¹⁹

For the purposes of this Note, all UMVs referred to from here on out will be categorized under the third classification, “Autonomous or Fully Autonomous.” Under the current language of the COLREGS and other applicable frameworks, such as the United Nations Convention on the Law of the Sea, the first two categories may be easier to classify than the third, as discussed in Section III of the note.

B. The COLREGS and the International Maritime Organization

The International Regulations for Preventing Collisions at Sea, informally known as The COLREGS, are a set of rules enacted in 1972 that apply “to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.”²⁰ The COLREGS are made up of 38 rules divided into five different sections: general

16. The difference is that unmanned underwater vehicles are submarines, and unmanned surface vehicles are more like boats in that they cannot go under the surface of the ocean. UMVs have both capabilities. *Id.*

17. *Id.*

18. CAPT. ANDREW NORRIS, LEGAL ISSUES RELATING TO UNMANNED MARITIME SYSTEMS 1–2, available at <https://www.hsdl.org/?view&did=731705>.

19. See USV Master Plan, *supra* note 8.

20. COLREGS, *supra* note 12, at rule 1(a).

rules, steering and sailing, lights and shapes, sound and light signals, and exemptions.²¹ The International Maritime Organization (IMO) contends that a particularly important aspect of the COLREGS was “the recognition given to traffic separation schemes” in Rule 10, which outlines ways to determine safe speed and collision risk, and outlines the conduct of vessels operating around traffic separation schemes.²² In addition to the rules, there are Annexes providing technical details.²³

The COLREGS have been amended a number of times, most recently in 2007 when Annex IV regarding distress signals was rewritten.²⁴ The amending process is time consuming and complex. Simply put, proposed amendments must go through a “tacit acceptance” procedure, where amendments can enter into force between 18 to 24 months after proposal unless the amendment is objected to by a specific number of parties.²⁵ The COLREGS were amended in 1981 and 1987.²⁶ The COLREGS were ratified by the United States in 1977.²⁷

III. DEFINING UMVS

UMVs are sea craft built to navigate the ocean and provide defense on maritime fronts.²⁸ The navigational regulations spelled out in the COLREGS are written to only apply to “vessels.”²⁹ To say that there is an implicit connection here and that UMVs fall within the guidance of the COLREGS is an easy assumption to make, but would ultimately cause confusion upon a deeper analysis. The COLREGS have specific definitions of what classifies as a “vessel,” and have

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21. *List of Conventions—COLREGS*, INT’L MAR. ORG., <http://www.imo.org/About/Conventions/ListOfConventions/Pages/COLREG.aspx> (last visited Nov. 9, 2013) [hereinafter IMO and the COLREGS].
 22. *Id.*
 23. *See* COLREGS, *supra* note 12, at annex I-IV.
 24. *COLREGS—Preventing Collisions at Sea*, INTL MAR. ORG., <http://www.imo.org/OurWork/Safety/Navigation/Pages/Preventing-Collisions.aspx> (last visited Nov. 9, 2013).
 25. *See Introduction: Adopting a Convention, Entry into Force, Accession, Amendment, Enforcement, Tacit Acceptance Procedure*, INT’L MAR. ORG., <http://www.imo.org/about/conventions/pages/home.aspx> (last visited March 16, 2014) [hereinafter IMO Procedure].
 26. *See* IMO and the COLREGS, *supra* note 20.
 27. *Id.*
 28. *See* Virginia Tech, *supra* note 3.
 29. *See* COLREGS, *supra* note 12, at rule 1 (“These rules shall apply to all vessels upon the high seas and in all waters connector therewith navigable by seagoing vessels.”).

stringent qualifications that “vessels” must meet in order to fall under this classification.³⁰ In order to determine whether UMGs qualify as “vessels” under the COLREGS, the language of the rules must be thoroughly examined. If UMGs do not in fact qualify as vessels then further analysis is necessary to fit them into a particular legal status.

A. UMGs as “Vessels” and “Ships”

The term “vessel” appears frequently in the COLREGS. In fact, the regulations only apply to “vessels” as stated in the definitions of the regulations.³¹ “Vessels” are defined in Rule 3(a) of the COLREGS, which states “the word ‘vessel’ includes every description of water craft, including non-displacement craft, WIG craft³² and seaplanes, used or capable of being used as a means of transportation on water.”³³ The term “ship” is not defined in the COLREGS, but is defined in another IMO treaty, the International Convention for the Prevention of Pollution from Ships (“MARPOL”). That convention defines a “ship” as “a vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft and fixed or floating platforms.”³⁴ Because the same international organization, the IMO, is responsible for the implementation and interpretation of both these treaties, and because the COLREGS preceded MARPOL, there exists a strong implication that when defining “ships” the IMO had the previously established definition of “vessels” as a baseline. Thus, the term “ship” is presupposed to fall under the definition of a “vessel.”³⁵

Defining a UMG within these terms proves troublesome. Perhaps the largest problem with according UMGs the status of “vessels” is the fact that a “vessel” must be used as a means of transportation. Current UMGs in design are not for transportation means; The Navy is developing UMGs mainly for reconnaissance purposes, but also as

30. The definitions section of the COLREGS defines 12 types of “vessels” and their various components. See COLREGS, *supra* note 12, at rule 3(a).

31. *Id.*

32. WIG (Wing-In-Ground) crafts are machines operated by aerodynamic forces that allow them to operate at low altitudes above sea surface, and do not have any direct contact with the sea. See *Wing In Ground (WIG) Craft*, INT’L MAR. ORG., <http://www.imo.org/OurWork/Safety/Regulations/Pages/WIG.aspx> (last visited March 16, 2014).

33. See COLREGS, *supra* note 12, at rule 1(a).

34. See NORRIS, *supra* note 17, at 24.

35. Capt. Norris says these definitions are interchangeable, while I maintain that they are not interchangeable but one is built upon the other. See *id.*

tools for maritime exploration and scientific development.³⁶ Perhaps in the future UMVs will be used to transport goods and people, but this is not currently the case.

Some scholars argue that because some UMVs carry weapons and other tools, this qualifies them under the “transportation” requirement for vessel status.³⁷ This is stretching the definition of “transportation” too thin. If a UMV, or any other vehicle is carrying a weapon, the purpose of carrying such a weapon is to deploy it in the case of an altercation or for other purposes of defense. The purpose of maintaining weapons onboard is not to transport them from one destination to the next. While it is true that the weapon deployed has an ultimate destination, the intended target, the actual physical weapon (which in this case would be a missile or torpedo) would be destroyed upon impact, as well as the missile’s intended target. If this definition was expanded as some advocate, then perhaps warships could also be construed as cargo ships, and that would cause friction in other areas of international law, such as rules regulating what can and cannot be shipped through international waters.³⁸

When other sections of the COLREGS are applied to UMVs, another definitional problem comes to light. In the regulations it is implied that a “vessel” is one that is controlled by a human, as in a human steers it and makes decisions for the machine. This is evidenced by other treaties promulgated by the IMO. The definitions found in the International Convention for the Safety of Life at Sea (“SOLAS”), for example, applies only to passenger ships of more than 12 passengers, cargo ships, tankers, fishing vessels, nuclear ships (a ship provided with a nuclear power plant), “new ships” (ships of the keel created after the date of the Convention), or ships that existed before the creation of the Convention.³⁹ Another example is the IMO’s International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (“STCW”).⁴⁰ The whole purpose of that Convention is to ensure that people are trained to abide by certain rules of merchant ships.⁴¹ Clearly these treaties were not written with

36. DiBlasio, *supra* note 2.

37. See Norris, *supra* note 17, at 49 (“Unfortunately, there is no universally accepted understanding of ‘means of transportation on water.’”).

38. See, e.g., Model Law on International Commercial Arbitration of the United Nations Commission on International Trade Law, A/Res/40/72 (1985).

39. International Convention for the Safety of Life at Sea, reg. 2, *opened for signature* Nov. 1, 1974, 1184 U.N.T.S. 278.

40. See generally International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, STCW/CONF.2/33 (1985).

41. See Generally COLREGS, *supra* note 12.

the possibility of Unmanned Marine Vehicles in mind. This means other statuses must be considered.

B. UMVs as “Warships”

Another possible consideration of status for Unmanned Marine Vehicles is to classify them as “warships.” UNCLOS defines a warship as “a ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, 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.”⁴² Because Unmanned Marine Vehicles are owned by the military and will be used primarily for reconnaissance purposes, it is easy to think of these as warships under the current UNCLOS definitions.⁴³ However, once the definition is examined a number of issues arise that make this a difficult status to confer upon Unmanned Marine Vehicles.

The precise language of the statute describes a warship as being “under the command of an officer,” and “manned by a crew which is under regular forces discipline.”⁴⁴ The statutory requirement that the ship be “manned by a crew” disqualifies UMVs from this definition, as UMVs are not “manned” by a crew, but programmed to function autonomously. Furthermore, because of the strict autonomy of the vehicle, the question of how a UMV is “commanded” becomes even murkier. Is the vehicle commanded when it is programmed or when it is launched? Starting the point of command when the vehicle is programmed may make more logical sense than when the programmed vehicle is launched from the ship. However if this is the case, then technically the person who commanded the vehicle would be the programmer uploading the command data rather than the commander who merely tells the programmer which data to input into the machine. Further, there would be no set commands if the machine had to make decisions that the crew could not account for, such as dealing with certain types of sea-life. In this case, there is a possibility the machine could compute to make on its own due to its high level of autonomy. Because of these issues, the option of giving Unmanned Marine Vehicles warship status should be abandoned.

42. United Nations Convention on the Law of the Sea (Dec. 10 1882), art. 29, 1833 U.N.T.S. 397 [hereinafter UNCLOS]

43. *Id.*

44. *Id.*

C. UUVs as “Military Devices”

Another school of thought does not define UUVs as “vessels,” but seeks to find another category of legal status to assign to the vehicles. While there are many different avenues of classifying UUVs, the easiest and most logical way to do so would be to call them “military devices.” There are several definitional and policy reasons behind calling UUVs “military devices.” While this is a new area of law and is still being developed, classifying UUVs, as “military devices,” will not only save time but is the best choice of status as to avoid conflict in the international law community.

Classifying UUVs as “military devices” when defining the term is the most simple way possible. The UUVs are owned and being funded by the Navy.⁴⁵ Because we cannot call these vehicles “vessels” under the current definition outlined by the COLREGS, referring to UUVs as “military devices” makes the most sense categorically. However, this alone cannot qualify “military devices” as a status for UUVs. In order to come up with a solid definition, we must first look to current law regarding the term.

“Military device” is currently not a term of art under international law. However, the term has been defined in the American legal system. Section 845 of Title 18 of the United States Code defines “military devices” as, but does not restrict its definition to, “shells, bombs, projectiles, mines, missiles, rockets, shaped charges, grenades, perforators, mines, and similar devices manufactures exclusively for military or police purposes.”⁴⁶ Title 18 has is not applicable to international law in and of itself and the language found in Title 18 are not terms of art not found in any treaty or convention. Instead, Title 18 concerns crimes and criminal procedure within the military.⁴⁷ Furthermore, the section begins clearly stating that the definition is “for the purposes of this subsection,” which essentially limits the definition to only pertain to the part of the code for which it was written.⁴⁸ Also, it is important to see how the United States government defined “military device” in the past since the United States government, along with the government of the United Kingdom, own over half of the active UUVs in the world.⁴⁹

45. See ASD Press Release, *supra* note 1.

46. 18 U.S.C. § 845(c)(3) (2006).

47. 18 U.S.C. § 845.

48. 18 U.S.C. § 845(c)(3) (2006).

49. While the United States and the United Kingdom own 56% of the UUVs in the world, the United States has the most active UUVs (196) and the greatest number of UUV manufacturing companies. ASSOC. FOR UNMANNED MAR. VEHICLE SYS. INT’L, UNMANNED MARITIME VEHICLES: CORE CAPABILITIES & MARKET BACKGROUND 5 (2013).

The definition makes sense for the current planned use and development of UMVs when examined from the physical perspective of the vehicle and the purpose and functionality of the vehicle. Unmanned Marine Vehicles are launched, or cased away from their ships.⁵⁰ The closest thing on the list that the definition provides is “projectile.” Yet Merriam-Webster defines “projectile” as “a body projected by external force and continuing in motion by its own inertia.”⁵¹ Because UMVs are launched off ships but ultimately propelled by their own motors, this definition does not seem to fit. However, the statute provides that the definition of “military device” also applies to “similar devices manufactured exclusively for military or police purposes.”⁵²

UMVs are being used for reconnaissance purposes as their primary function. While the purposes aren’t exclusively for military purposes, such as their research functions discussed earlier in this Note, they are still owned by the Military. Furthermore, defining Unmanned Marine Vehicles as “military vehicles” doesn’t have to strictly comply with the definition in the United States Code; the Code merely serves as a starting point in defining what these machines actually are. Based on the similarities between the previous codification of this term and the characteristics and purposes of the machines, conferring the status of “military device” onto Unmanned Marine Vehicles makes more sense than any previously suggested definition.

There is also a public policy argument to be made for defining UMVs as “military devices.” That argument has to do with timing and avoiding potential international conflicts. The amending process for the COLREGS is time consuming and has to go through a number of hurdles and group approval before they come into effect. Article VI of the 1972 COLREGS map out the process for amending articles, specifying a “2/3 majority of those present and voting in the Maritime Safety Committee of the Organization,” and that the amendment shall be communicated to “all Contracting Parties and Members of the Organization at least six months prior to its consideration by the Assembly.”⁵³ Because of the large number of countries that have adopted the COLREGS, communication and ratification could potentially take years.⁵⁴

When thinking of a hypothetical situation where a crash occurred, or a UMV fired upon an innocent vessel, it would be extremely difficult to determine how to treat the situation, and even harder to

50. See USV Master Plan, *supra* note 8, at 33.

51. *Projectile*, MERRIAM-WEBSTER’S DICTIONARY (11th ed. 2003)

52. 18 U.S.C. § 845(c)(3) (2006).

53. See COLREGS, *supra* note 12, at Art. VI.

54. See IMO Procedure, *supra* note 24.

investigate the circumstances if there was no defined legal status of the UMV. Because time is of the essence UMVs must be defined in a manner that ensures that there is status if anything is to go wrong. The IMO recently recognized the fact that the amendment has the potential to last for a number of years, and established procedure for a “tacit acceptance” of amendments by the States that are part of their Conventions.⁵⁵ This procedure specifies that instead of 2/3 approval of an amendment to become part of a Convention, the “procedure provides that an amendment shall enter into force at a particular time unless before that date, objections to the amendment are received from a specified number of Parties.”⁵⁶ While this process is much faster than the old 2/3 rules, there is still the time considered for the Amendments to enter into force, which can usually take 18 to 24 months.⁵⁷ The technological advances that can happen in a two-year period are great, and the likelihood that Unmanned Maritime Vehicles will be in the ocean in that time is almost a certainty. Thus, waiting for the IMO to adopt amendments is too risky, as leaving UMVs without a status would complicate potential confrontation due to an undefined device harming another ship. As such, liability for Unmanned Marine Vehicles must also be established.

IV. TORT LIABILITY OF UNMANNED MARITIME VEHICLES

UMVs are military property and have the ability to attack other maritime vehicles.⁵⁸ The highly autonomous nature of UMVs coupled with their groundbreaking technology leaves room for technological error. Based on probability alone, it is likely that in the time that UMVs are used, eventually one machine could malfunction and strike a ship it was not meant to strike.⁵⁹ When such an event occurs, the question of liability of UMVs will arise for the first time. Determining liability in an accidental UMV attack will be difficult because of how highly autonomous the machines are, and because of the level of

55. *Id.*

56. *Id.*

57. *Id.*

58. See Joe Pappalardo, *Thar She Drone: Are the High Seas Ready for Robots?*, POPULAR MECHANICS (Aug. 20, 2013, 2:57 PM), <http://www.popularmechanics.com/technology/military/robots/thar-she-drones-are-the-high-seas-ready-for-robots-15829949>

59. Accidental strikes have not been uncommon since the military implemented the drone program in the War on Terror. Recent mistakes have occurred in air drones, which usually involve less autonomous machines, mistaking civilians for their targets. See *Air Strike Kills 15 Civilians in Yemen by Mistake: Officials*, REUTERS (Dec. 12, 2013), <http://www.reuters.com/article/2013/12/12/us-yemen-strike-idUSBRE9BB10020131212>.

disconnect the machines have from human oversight. This section of the Note presents a hypothetical: a UMV has attacked a civilian ship or submarine, killed people on board, and has damaged the property of a private ship owner. The section will then determine if a duty existed, the elements of negligence, and establishing UMV liability.

A. Establishing a Duty of Care

It is concerning that UMVs will be navigating international water without any direct human control. What is most concerning about this idea is that there will be other ships in the water that the UMVs will have to navigate around. Dealing in a hypothetical situation where a UMV and a man-operated vessel collide, an analysis of the liability of the parties would be first and foremost. It would be easier to define the violation on part of the man-operated vessel because it has to comply with the COLREGS. The COLREGS provide a backdrop for analyzing a negligence or recklessness standard.⁶⁰ Courts have held that when taking the liability of ship collisions into account, Rule 8 (collision prevention), and Rule 13 (requiring overtaking vessels to keep out of the way of vessels being overtaken) are the proper sections of the COLREGS to weigh in analysis.⁶¹ Courts have also interpreted that the responsibility of avoiding a collision is an authority that rests “upon the master alone,” the commanding officer of the ship, rather than the navigator, in avoiding liability on behalf of the vessel.⁶²

The relevant sections and rules of the COLREGS thus outline a duty of care that vessels at sea must hold to each other in order to avoid collisions. Different courts have decided how far this duty extends.⁶³ The common theme in many rulings is that the duty of care imposed on the person responsible for navigation depends on the particular danger of the situation.⁶⁴ Courts have also been conscious

60. Such a situation would result in a violation of Section B of the COLREGS, which outline steering and sailing conduct. *See* COLREGS, *supra* note 12, at sec. B.

61. *See* *Crowley Marine Servs. v. Maritrans Inc.*, 447 F.3d 719 (9th Cir. 2006).

62. *See The Madison*, 250 F. 850 (2nd Cir. 1918).

63. *See generally* Stephanie Showalter & Justin Manley, Legal and Engineering Challenges to Widespread Adoption of Unmanned Maritime Vehicles 2 (2009), *available at* IEEE Explorer.

64. *See* *Red Star Barge, Inc. v. Lizza Asphalt Constr. Co.*, 264 F.2d 467 (2nd Cir. 1959); *see also The Saratoga*, 37 F. 119, 120-121 (S.D.N.Y. 1888) (“[I]f not wholly obscured, the vigilance of the lookout ought to be proportionate to the danger; much stricter, therefore, than in the open sea where vessels are few.”); *see also* *Nicholes v. M/V Maya*, 949 F.Supp. 391 (D.S.C. 1996) (“Rather, the persons in charge of the vessel’s navigation are obligated to position a lookout at a point best suited for that purpose, having due regard for the circumstances of the

of the size of vessels, and have held that the level of duty can be determined on factors such as size within a particular circumstance.⁶⁵ In *Capt'n Mark v. Sea Fever Corp.*, 692 F.2d 163 (1st Cir. 1982), a case involving two ships of different sizes colliding into one another, the 1st Circuit held that even though the Appellant's argument of how Appellee should have acted at sea created the safest situation, it was an "unrealistic" requirement as a matter of law to impose on "small fishing vessels with limited crews," and that the "adequacy of the lookout must be evaluated realistically in light of all the circumstances."⁶⁶

B. Establishing Negligence

The analysis of UMV liability presents a problem because these courts have examined the liability of vessels in the backdrop of the COLREGS, and UMVs are not within the scope of the COLREGS as they are presently written. The first step would be to figure out if UMVs have a duty at all to other ships at sea. UMVs will be mobile devices that will be programmed by a technician. While the UMVs have a high level of autonomy, this doesn't mean that technicians won't keep the likelihood of a collision in mind. Considering those factors, there is room for error when a new technology is thrust upon an environment like the ocean.

The test for determining negligence varies between different jurisdictions. However, there is a multi-factor test that California adopted in *Rowland v. Christian* that is most frequently adopted by other jurisdictions in the country.⁶⁷ That test involves seven elements: (1) foreseeability of harm to plaintiff, (2) degree of certainty that plaintiff suffered injury, (3) closeness of the connection between defendant's conduct and the injury suffered, (4) the moral blame

case and the conditions of the weather."). Courts have also specified the operation of sight and sound varies in different circumstance. See *Schmacher v. Cooper*, 850 F.Supp. 438, 450 (D.S.C. 1994) ("Thus, the duty of vessel operators to maintain a proper lookout by sight and sound is enhanced if special circumstances warrant increased vigilance, but not special look-out is necessary is a vessel pilot can see everything that a bow pilot lookout could see.").

65. See *Capt'n Mark v. Sea Fever Corp.*, 692 F.2d 163 (1st Cir. 1982).
66. See *id.* at 166; see, e.g., *McCarthy c. Pheasant Run, Inc.*, 826 F.2d 1554, 1557-1558 (7th Cir. 1987) ("Unreasonable conduct is merely the failure to take precautions that would generate greater benefits in avoiding accidents than the precaution would cost... It is a bedrock principal of negligence law that due care is that care which is optimal given that the potential victim is himself reasonably careful; a careless person cannot by his carelessness raise the standard of care of those he encounters.").
67. See W. Jonathan Cardi, *The Hidden Legacy of Palsgraf: Modern Duty Law in Microcosm*, 91 B.U.L. REV. 1873, 1878 (2011).

attached to defendant's conduct, (5) the policy of preventing future harm, (6) the extent of the burden to the defendant and consequences to the community of imposing a duty to exercise care with resulting liability for breach, and (7) the availability, cost, and prevalence of insurance for the risk involved.⁶⁸

Most of these factors appear appropriate in a UMV negligence analysis except for the moral blame prong. Because UMVs are autonomous machines, attaching a morality standard to their conduct would be misplaced because morality has traditionally been thought of as a human concept.⁶⁹ It is too early in technological development to extend such a concept to machines, so this element will not be considered in the negligence analysis.⁷⁰

Thus, when looking at the hypothetical presented at the beginning of this section, the first element to consider when evaluating a UMV's duty of care under this traditional tort theory should be foreseeability of harm to another party at sea. Foreseeability is a good factor in determining a negligence standard for UMVs for several reasons. First, the new technology of the UMVs is an important consideration since it is now innovative and has never been tested in a real oceanic environment. While technology may develop UMVs to unimaginable heights, at the moment the technology is not as precise as a human eye and mind. For the time being, until the UMV technology develops into another sphere of accuracy, we can only compare it to human accuracy, which itself is already subject to errors. With accuracy an issue, as well as technological concerns of such a new and vast environment, it could be reasonably foreseeable that a UMV could malfunction at sea and cause another ship harm.

Establishing a degree of certainty that the plaintiff suffered the injury may also be easier in this situation. If the UMV and civilian vessel are within a great distance of each other, and knowing one of these has weapons and the other doesn't, establishing that degree of certainty would just involve drawing a circumstantial connection. However, if the injury were resulting from a collision, more environmental factors would have to be considered to find out what else in the area could have collided with the plaintiff ship. This analysis would also be key in establishing the third element, the

68. *Rowland v. Christian*, 69 Cal.2d 108, 112-113 (1968).

69. *But see* Gary Marcus, *Moral Machines*, NEW YORKER, (Nov. 24, 2012), available at <http://www.newyorker.com/news/news-desk/moral-machines> (explaining the growing concerns regarding autonomous machine morality with respect to the safety of humans, and how technology today is "a long way from constructing a robot that can fully anticipate the consequences of any of its own actions (or inactions).").

70. *Id.*

closeness of connection between the UMVs conduct and the plaintiff's injury, because aside from establishing if the UMV had weapons, a greater inquiry would have to be made into the mission of the UMV and drawing upon that, inferences as to why it attacked the civilian ship.

The fourth element, the policy of preventing future harm, would have to be examined through a national defense lens. Imposing greater restrictions on UMVs could possibly result in less reconnaissance activity and could put United States intelligence at a disadvantage if an important front is compromised. However, depending on where the UMVs are placed, limiting UMV movement could be positive as to ensure they don't further interfere with civilian activity. Such an analysis hinges on the type of world where UMVs are readily deployed, and have been for a period of time enough for a possibility of civilian interference. These facts would also play a part in the analysis of element five, the extent of the burden imposed on the UMV and the consequences to the community for imposing the duty of care. When such a time comes, the defense-lens balancing test should be used to satisfy both of these elements.

The final element, the availability, cost, and prevalence of insurance for the risk involved, should depend on how much money the Department of Defense has put into UMVs, and how much extra money it would cost to ensure that UMVs operate safely in a civilian environment. Currently, the amount of money put into the UMV program is rising, and is projected to rise for the next several years.⁷¹ Assuming that this trend continues, extra money for ensuring more safety precautions on the machines should not be too high of a cost. However, if costs get too high, contractors might not want to build UMVs. This situation is unlikely due to the draw of the extremely high budget of the Department of Defense.⁷² Thus, in most circumstances the likely outcome of this element would weigh in favor of the plaintiff.

71. *See State Dept. Seeks Contractors for \$1B in UAV Work*, DEF. NEWS (Sep. 11, 2012), <http://www.defensenews.com/article/20120911/C4ISR01/309110003/State-Dept-Seeks-Contractors-1B-UAV-Work>.

72. The Department of Defense's budget currently exceeds \$525 Billion dollars. *See Department of Defense: The Budget for the Fiscal Year*, WHITEHOUSE.GOV (last visited 3/14/2014) available at <http://www.whitehouse.gov/sites/default/files/omb/budget/fy2013/assets/defense.pdf>.

C. Establishing Liability

There are a number of difficulties that present themselves further in the negligence analysis because an accident involving UUVs themselves could not possibly follow a reasonable person analysis. There are several different options to pursue when determining who should have been “reasonable” in a UUV accident. The analysis could be similar to the COLREGS in that the commanding officer’s reasonableness is measured alongside the accident. This would be a more difficult standard to apply due to the UUV’s high level of autonomy. The commanding officer could never have had any contact with the UUV itself, and the accident could have taken place several months after the UUV was deployed from its parent vessel.

Another option could make the technician responsible for programming the UUV responsible under the reasonable person standard. This could be an easier connection to draw because of the time and detail technicians are expected to put into large-scale defense projects. Further, it would be the last point of contact that the UUV would have with respect to a human who could be considered reasonable.

This could possibly be the end of the analysis; however, the fact that the programmer would most likely be a defense contractor for the Department of Defense would make establishing liability more difficult.⁷³ In 1950, the Supreme Court held that “the government is not liable under the Federal Torts Claims Act for injuries to servicemen where the injuries arise out of or are in the course of activity incident to service.”⁷⁴ The Court expanded and extended this rule, known as the *Feres* Doctrine, in 1988 in *Boyle v. United Techs. Corp.*, holding that government defense contractors are not liable for injuries resulting from defective products manufactured for use under

73. The Department of Defense recently sought contractors to work on Unmanned Aerial Vehicles and was prepared to spend over a billion dollars over the next five years on contractor work. These Department of Defense was looking for contractors to “own and operate the UAVs while also taking care of logistics, repairs, and spare parts.” See DEF. NEWS, *supra* note 70. The past history of contractor use, the rising government interest in UUV research and development, and the rapidly growing “drone” contractor market and diversification, make it highly likely that the Department of Defense will hire contractors for UUV usage. See *Reportlinker Adds the Emerging UUV and UGV Markets 2009-2019*, BUSINESSWIRE (Jul. 27, 2009) <http://www.businesswire.com/news/home/20090727005489/en/Reportlinker-Adds-Emerging-UUV-UGV-Markets-2009-2019#.UyIU0xZCe2w>.

74. *Feres v. United States*, 340 U.S. 135, 146 (1950).

a government contract.⁷⁵ The Court then established a three-part test in determining that “liability for design defects in military equipment cannot be imposed, pursuant to state law, when (1) the United States approved reasonable precise specifications; (2) the equipment conformed to those specifications; and (3) the supplier warned the United States about the dangers in the use of the equipment that were known to the supplier but not to the United States.”⁷⁶

In reality, it would be easy for a UMV contractor to meet the specification of the test set in *Boyle* if they followed proper procedure. The three-step test is not a difficult test to meet. Essentially, all the contractor has to do is follow the government’s specification of the machine’s functionality, and warn the government of possible dangers, which an attorney in the contractor’s business probably has already done. The key language here, as applied to UMVs, is “military equipment.” If UMVs are defined as vessels, it would be hard for the government to avoid liability and would probably result in long messy litigation over the duty of care standard. However, if we define UMVs as “military devices” then they automatically fall under the category of products that meet this liability exception. The government has an interest in avoiding lawsuits and liability especially over products as new as UMVs. Thus, defining UMVs as “military devices” would be consistent with the contractor exception listed in *Boyle*. Of course, if the UMV failed and the contractor did not follow then the contractor could be found liable under the duty of care analysis.

V. THE ISSUE OF NAVIGATION

Perhaps one of the greatest, and perhaps most practical, concerns of most international and academics in the field of international law is how Unmanned Marine Vehicles will safely navigate the ocean. Unmanned Maritime Vehicles may use cutting edge technology to navigate the waters, but their lack of immediate human control while in the ocean presents not only a definitional problem, but a navigational problem as well.

Aside from the definitions discussed in Section III of this Note, when reading the language of the rules to the COLREGS, the language indicated that the regulations were written with man-controlled marine vehicles in mind. In part 5 of the regulations, defining look-out requirements, the rules state that “every vessel shall at all times maintain a proper look-out by sight and hearing as by all available means appropriate...”⁷⁷ Not only do the definitions listed in

75. The Court reasoned that this applies when the government’s unique interest in its federal contracts pre-empted state tort law. *Boyle v. United Techs. Corp.*, 487 U.S. 500 (1988).

76. *Id.* at 512.

77. See generally COLREGS, *supra* note 12 at rule 5.

the regulations assign each vessel a human navigator, but the navigations itself is supposed to adhere to navigation and safety provisions based on human characteristics.⁷⁸ Bearing the advanced navigation capabilities of UMVs in mind, the COLREGS are not the appropriate means of regulating UMV activity at sea, and the machines should be held to a different standard of conduct.

A. Navigation Requirements under the COLREGS

As mentioned above, the COLREGS are international rules promulgated by the International Maritime Organization that dictate the proper means of navigation and safety of ship traffic on the high seas.⁷⁹ The COLREGS are split up into 5 parts labeled A-E: general provisions, steering and sailing rules, lights and shapes, sound and light signals, and exemptions.⁸⁰ There are also four Annexes to the articles that discuss positioning and technical detail of lights and shapes, additional signals for fishing vessels fishing in close proximity, technical details of sound signal appliances, and distress signals.⁸¹ For the purposes of this Note, only part B (steering and sailing rules) and Part D (sound and light signals) will be discussed in relation to Unmanned Marine Vehicles.

1. Part B: Steering and Sailing Rules

Part B of the COLREGS outlines the steering and safety rules of the regulations, and is divided into three parts: conduct of vessels in any condition of visibility, conduct of vessels in sight of one another, and conduct of vessels in restricted visibility.⁸² In total, the section has 16 different rules outlining the proper conduct for vessels steering clear of other vessels.⁸³

Section I of Part B, the rules outlining the conduct of vessels in any condition of visibility, is mainly concerned with the speed of vessels. There is also a rule in this section that outlines the responsibilities of a vessel's lookout.⁸⁴ Rule 6 outlines measures to ensure safe speed so a vessel "can take proper and effective action to

78. The usage of the words "sight" and "hearing" denote human characteristics of observation. *See id.* at rule 5.

79. *See generally* COLREGS, *supra* note 12.

80. *Id.*

81. *Id.*

82. *See generally* COLREGS, *supra* note 12, at part B.

83. *Id.*

84. Rule 5 states that vessels "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 condition. *See id.* at rule 5.

avoid collision and be stopped within a distance appropriate to prevailing circumstances and conditions.”⁸⁵ Rule 7 states that in order to avoid the risk of collision, vessels shall use “means appropriate to the prevailing circumstances and conditions to determine if risk of the collision exists,” not to assume a risk based on “scanty information, especially radar information.”⁸⁶ Rule 8 details actions to avoid collisions, which should be “positive, made in ample time and with due regard to the observance of good seamanship,” which includes alternating the course “large enough to be readily apparent to another vessel observing visually or by radar.”⁸⁷

Section II of Part B deals with the conduct between vessels that are in sight of one another. Most importantly, Rule 18 in this section outlines the responsibilities between vessels. The rules state that both power-driven vessels and sailing vessels shall keep out of the way of vessels not under command, a vessel restricted in her ability to move, and a vessel engaged in fishing.⁸⁸ Rule 14 states that vessels engaged in head-on situation shall avoid collisions by passing each other on the “port side” of the ship (left side), and when there is doubt as to the occurrence of a head-on collision, it should be assumed that the collision will occur.⁸⁹

Section III of Part B, the conduct of vessels in restricted visibility is made up of only Rule 19. This rule states that in restricted visibility, vessels shall “proceed at safe speeds,” use radar to determine if a close-quarters situation exists in low visibility conditions, and this if a risk of collision exists, to use a beam from a fog signal to another vessel in order to avoid a collision.⁹⁰

85. The rule outlines the following factors that determine a safe speed: state of visibility, traffic density of the water, maneuverability of the vessel, the state of wind, sea and current, and proximity of hazards, the draught in relation to the available depth of water, and at nighttime, the presence of background light. *See id.* at rule 6.

86. The rule also outlines the following determinations for assessing if a risk exists: if the compass bearing of an approaching vessel does not appreciably change, and sometimes “when an appreciable bearing change is evident, particularly when approaching a very large vessel or a tow or when approaching a vessel at close range.” *See id.* at rule 7.

87. *Id.* at Rule 8.

88. *Id.* at rule 18.

89. *Id.* at rule 14.

90. *Id.* at rule 19.

2. Part D: Sound and Light Signals

Part D of the COLREGS is made up of six rules defining the proper use of sound and light signals at sea.⁹¹ Rule 33 explains the proper equipment for sound signals: vessels under 12 meters need a whistle, and vessels of 20 meters or more need a bell and a whistle, and a vessel of 100 meters or more need a gong, whistle, and bell.⁹² Rule 34 outlines proper maneuvering and warning signals. The rule requires “power-driven vessels” to indicate warning signals to oncoming ships through blasts and light flashes, with the number of blasts and light flashes each signaling different directions the oncoming vessel.⁹³ Rule 35 outlines the proper signaling procedures when vessels are in areas of restricted visibility. Approaching vessels are required to use “no more than 2 minute prolonged blasts” to warn other ships in conditions of low-visibility.⁹⁴

When the technicalities and procedural steps of these rules are fully read and explained, it is apparent that there is more for ships to do than simply avoid colliding into other ships by maintaining proper lookouts. The biggest challenge in making UMVs compatible with the COLREGS is making sure that the machines are autonomous enough to comply with every step of these rules.

B. Navigation of UMVs

Compared to everyday technology, Unmanned Marine Vehicles reflect a great advance in technological progress. Even though these vehicles represent a new level of modern military technology, there is still great concern that they will not be able to comply with the COLREGS as they have been written.⁹⁵ Recently there has been

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91. The section begins with rule 32: Definitions, which defines: “whistle” as “any sound signaling appliance capable of producing the prescribed blasts,” “short blast” as “a blast of about one second’s duration,” and a “prolonged blast” as “a blast of from four to six seconds’ duration.” See COLREGS, *supra* note 12, at 32(a).
 92. The gongs on the 100 meter sized vessels need a tone that cannot be confused with the sound of the bell. The bell or the gong can be replaced “by equipment having the same respective sound characteristics.” See *id.* at rule 33.
 93. *Id.*
 94. Power-driven vessels, vessels not under command, sailing vessels, and towing vessels are required to follow the 2 minute prolonged blast requirement. Vessels at anchor are required to ring their bell “rapidly” for about 5 seconds. See *id.* at rule 35.
 95. See generally NORRIS, *supra* note 17; see also USV Master Plan, *supra* note 8, at 76 (Stating that the COLREGS must be taken into account in “realizing” autonomous capabilities.).

greater inquiry into the capabilities of Unmanned Marine Vehicles by scientists who want to test the length of the machine's autonomy; from there a further assessment can be made if UMVs can be adapted into the framework of the COLREGS.

There have been advances in the realm of programming UMVs for autonomous function in accordance with the COLREGS. Recently, three scientists from the Massachusetts Institute of Technology (MIT) designed a series of experiments to test the functionality of the unmanned vehicles.⁹⁶ In their paper, these scientists provide a number of different solutions to the problem of autonomous vehicles and the human-oriented COLREGS. The scientists propose what they call a solution based on Interval Programming Architecture, which they describe as "behavior-based control with interval programming."⁹⁷ What this means is that the programming element of the UMVs will be based on a mixture of pre-programmed actions, (long term decision making) and a decision making capability based on situations that the vehicle will get into once it is out in the ocean.⁹⁸

The scientists then applied this proposed solution in a few common situations (under major COLREG rules) that the vehicle could possibly get into, such as crossing and head-on collision behavior⁹⁹ The scientists show that there is a way to prevent these collisions. They make the UMV sensitive to other vehicles within certain degrees of the UMV itself, and have the vehicle go into a different direction if it's approaching another vehicle.¹⁰⁰ While these advances are impressive and could ultimately dictate how UMVs universally function in the future, the developers at MIT are concerned about the "robustness of this method."¹⁰¹ The scientists who developed the Interval Program architecture are also concerned about the method's efficiency in more complex navigation scenarios.¹⁰²

96. Michael Benjamin et al., *Navigation of Unmanned Marine Vehicles in Accordance with the Rules of the Road*, PROCEEDINGS OF THE 2006 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION, 3581 (2006).

97. *See id.* at 3582.

98. This will be based on "a scheme for representing functions of unlimited form" and "a set of algorithms for finding the globally optimal situation." *See id.* at 3583.

99. *See id.* at 3584.

100. The UMV makes this decision using "Waypoint Behavior," rating decisions higher that brings it closer to the next waypoint. This means that the machine will pick a point, and from that point determine how close another ship is using GPS. *See id.* at 3583-84.

101. *Id.* at 3586.

102. *See Benjamin et al., supra note 95, at 3586.*

The scientists who developed the Interval Program acknowledge themselves that the COLREGS' rules are "heavily dependent on human common sense in determining rule applicability as well as rule execution," especially in a situation determining when multiple rules apply simultaneously.¹⁰³ The scientists came up with the term "Bread and Butter Behaviors" to describe the multi-objective optimization programming that could possibly solve complex situation.¹⁰⁴ The first behavior, "Waypoint behavior," assesses position of a UMV and another vessel. For this behavior, the scientists developed GPS based programming that for U MVs to figure out their positioning relative to other vessels.¹⁰⁵

The second "Bread and Butter Behavior" is collision avoidance behavior. The programming that the MIT scientists developed "differs from COLGREGS behaviors only that it doesn't care how collisions are avoided."¹⁰⁶ This is a major departure from the COLREGS because Rules 6,7, and 8 detail extensively specific procedure and maneuvering that vessels have to follow when avoiding collisions, largely dependent on human behavior.¹⁰⁷ It seems as though the end result of the study produced some of the first and finest technology developed to ensure that U MVs follow a certain kind of etiquette at sea, they are not compatible with the COLREGS.

Several other situations present themselves that the scientists in the MIT study did not address. The first are the signaling rules in Section D of the COLREGS. While scientists could possibly combine GPS to send off sounds or light alerts, this doesn't account for the many months the U MVs will be spending at sea without human intervention. When a fixture breaks on a vessel, humans know about it and will fix it right away to ensure no rules are broken. However, if something in the ocean damages a sounds or light fixture, and the U MV doesn't alert an oncoming ship, this opens up danger not only to the other vessel but also to governments, especially the United States government so long as their military contractor did not foresee and warn about the possibility of a fixture breaking. U MV technology is not yet developed enough to follow the COLREGS, and because prematurely making U MVs comply with the COLREGS would potentially open up a floodgate of litigation, U MVs should not be made to comply with the COLREGS at this time. A possible solution in the interim would be for nations who have U MVs to agree on special rules governing their usage in relation to other ships.

103. *Id.*

104. *Id.* at 3583.

105. *See id.*

106. *See id.* at 3584.

107. *See* COLREGS, *supra* note 13, at rules 6–8.

IV. CONCLUSION

Unmanned Marine Vehicles should not be made to fit into the COLREGS. As they are written, the COLREGS are too based on human action and thought, and right now technology doesn't have the capability to mimic such foresight. International law cannot work if there is no consideration and respect of rules other than your own, and statutes and conventions are meaningless if governments do not abide by them.

Defining UMVs as "military devices" would be consistent with previous definitions of military devices and could shield the United States from liability in the event of a tort at sea. UMV technology is not compatible with the COLREGS as they are currently formed. One day our technological advancements may grow leaps and bounds over what we presently perceive possible, and on that day UMVs might be autonomous to the point where their decision-making comes just as easily as a vessel's lookout. However, as the study at MIT shows, that day is far ahead of us.

What is not far ahead is the practice and field use of UMVs. The United States Navy keeps granting money to research teams to develop machines that will last longer in the ocean and have greater autonomy than military technology has ever seen. What responsible countries that harness this great technology should develop is a proper mechanism to regulate the usage of UMVs, which is realistic and responsible. What exactly those rules will look like is only speculation at this point.

UMV deployment is no longer a thing of the distant future; it will be here sooner than we think. Assigning a proper definition to these autonomous machines is the first step in an exciting and groundbreaking journey into uncharted legal horizons.