

THE IMPACT OF THE DEVELOPMENT OF MARITIME AUTONOMOUS SYSTEMS ON THE ETHICS OF NAVAL CONFLICTS

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Abstract: *Robotic systems are believed to be the elements of conceptual inflection in the conduct of future military conflicts. The progress made by the military industry in the field of robotics science and engineering, coupled with the practical results obtained in theatres of operations, have led us to the hypothesis of a paradigm shift regarding the role that autonomous systems will have not only in designing military operations but also in approaching the ethics of military action.*

Keywords: *robotic systems; future military conflicts; military industry; autonomous systems.*

Introuction

Significant advances in technology and military robotics technology in terms of autonomous systems, along with the success of Iraq and Afghanistan's theatres by air and land-based drones, have led to the theory that the wars of the 21st century will be driven more and more with the support of unmanned systems and autonomous systems (autonomous weapons systems – AWS)¹.

The enthusiasm created around this concept, among the military organization and political-military theory, has led to a special focus on the security environment from the perspective of using autonomous systems. The public impact on the use of unmanned aerial vehicles on board has begun a series of debates on ethical issues and the legality of military use of such equipment that may also be lethal. If, from the perspective of the use of

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¹ Gary E. Marchant, *International Governance of Autonomous Military Robots*, Columbia Science and Technology, Law Review 12/2011, pp. 272-315.

military airborne systems, literature has evolved a lot in recent years, the analysis of the use of underwater autonomous systems is at an early stage.

We believe that it is time to carry out rational analyses of the ethical dilemma resulting from the use of autonomous underwater systems, correlated with aspects of the laws of war at sea. We believe that the accelerated development of Unmanned Underwater Vehicles (UUV) and Unmanned Surface Vehicles (USV) technologies raises a distinct issue of military ethics in front of military analysts, completely different from what we know and we apply to this point.

Here are some of the questions that arise in this area:

- Should underwater or surface autonomous vehicles be assimilated as ships or as weapon systems?
- What is the typology of the military operations in which we use UUV and USV and the legitimacy offered to these capabilities in international waters, in the contiguous area and in the inland waters of riparian states?
- Is the action of lethal autonomous systems compatible with the principle of freedom of navigation in international waters?
- What is the capacity of lethal autonomous maritime systems to apply the principle of proportional response?

Identifying the answers to the aforementioned dilemmas will raise new ethical challenges regarding the use of autonomous systems in maritime operations planning. In order to better understand the topic of this article, we intend to define, first of all, the concept of an autonomous underwater system and to define the actions and missions of these systems within the legal framework of the Law of the Sea.

Defining concept and tools

What is an Unmanned Underwater Vehicle (UUV)?

Such equipment is defined as "*...a self-propelled submersible vehicle having a completely autonomous mode of operation (with pre-programmed or real-time mission control) or being under the minimal control of a human supervisor and, in exceptional circumstances, possibly of a data*

connection."². Yet, beyond the scope of such equipment in a scholastic definition, the rapid technological progress that has been made in recent years in this area makes both the definition and use of these vehicles subject to systemic changes.

The major controversy is related to embracing or not the definition of these vehicles as robotic systems. The term UUV is used here in a broad sense, although in the literature one can find a variety of such equipment as: autonomous underwater vehicles (AUV), autonomous marine vehicles (AMV) and remotely operated vehicles (ROV)³.

While autonomous systems have been under scrutiny of specialists and public opinion for a long time, the development of underwater systems that are capable of executing combat action on the surface of water or under water is currently of growing interest.

The existence of sea currents, waves, tides and obstacles in immersion, as well as the difficulty of maintaining communications in the underwater dimension, given the propagation of acoustic waves through water, make the submarine environment a much more complex space than we are accustomed to using the air drones. With all these constraints and limitations, the results that can be obtained through the future development and subsequent use of UUV and USV are announced to be substantial. Military actions at sea, especially underwater, are always full of dangers, unpredictable, with a high degree of physical and mental wear on the personnel involved, and carried out under atypical environmental conditions for the human being. From this perspective, the development and use of autonomous underwater systems in maritime operations may represent the next frontier for the next 10 years in the development of submarine robotic engineering.

² U.S. Department of Navy, *The Navy unmanned undersea vehicle (UUV) Master plan*, Nov. 9/2004, [http:// www.chinfo.navy.mil/navpalib/technology/uuvmp.pdf](http://www.chinfo.navy.mil/navpalib/technology/uuvmp.pdf), accessed on May 25th, 2018.

³ American Bureau of Shipping, *Rules for building and classing underwater vehicles, systems, and hyperbaric facilities*, 2002, [http:// www.eagle.org/absdownloads/index.cfm](http://www.eagle.org/absdownloads/index.cfm), accessed on May 25th, 2018..

The distinct ethics of war at sea and the use of autonomous systems

A complete analysis of what is ethically distinct in terms of sea war cannot be made only in the context of this article. We only intend to mention the defining elements of this issue without having an exhaustive approach to the subject.

There is a particular interest at maritime level at global level in defining autonomous systems from the point of view of the law of the sea. The United Nations Convention on the Law of the Sea (UNCLOS), 1982, is an international treaty defining the rights and obligations of States with respect to the responsibilities arising from the legal order of the seas and oceans of the world. In Romanian law, this Convention was approved by Law No 110 of 10 October 1996 on the ratification of the United Nations Convention on the Law of the Sea, concluded at Montego Bay (Jamaica) on 10 December 1982, and accession to the Agreement on the Application of the Part XI of the United Nations Convention on the Law of the Sea, made in New York on 28 July 1994.

At the international level, the debate focuses on whether or not the military autonomous vehicles have the conditions that 'warships' have to meet, as defined by the United Nations Convention on the Law of the Sea (UNCLOS). This, in article no. 29 states that: "*For the purposes of the Convention, a ship of war means any ship which is part of the armed forces of a State and carries the distinctive external marks of military ships of its nationality which are placed under the command of a navy officer in the service of that State and entered on the list of officers or an equivalent document and whose crew is subject to the rules of military discipline*"⁴.

As we can see, the subject of how we understand the classification of an autonomous underwater system is the ethics of the sphere of applications for which it was built, as well as its design. Several international maritime authorities consider that under certain circumstances, UUVs and USVs may be considered as "*ships*". If for remotely operated vehicles, it is plausible to consider these as "*extensions*" of the base ship on which they operate, systems capable of extended autonomy are the subject of intense debate.

⁴ <http://www.monitoruljuridic.ro/act/conventia-natiunilor-unite-din-10-decembrie-1982-asupra-dreptului-marii-emitent-parlamentul-publicat-in-monitorul-oficial-nr-26155.html>, accessed on May26th, 2018..

In the text of the United Nations Convention on the Law of the Sea (UNCLOS), there is only one sentence referring to submarines and submersible vehicles, which is mentioned in Article 20 of the normative act: "*In the territorial sea, submarines and other underwater vehicles are required to navigate on the surface and to show their flag*".

One of the directions on maritime law experts is that as we think autonomous systems are controlled by a board computer, and as these systems are capable of executing a wider and more complex range of missions, the more we should consider these vehicles as ships. However, once we include these vehicles in the category of ships, we should ask ourselves the following question: What is the ethical feature under which this equipment can operate, especially in relation to certain aspects of military action on proportionality, taking risks or differences between different tactical scenarios? One way to solve this puzzle and to think about the action of autonomous vehicles is to consider these systems as distinct *entities* and not simple weapon systems. Those *entities* are launched in the operation area by human operators, and they are fully responsible regarding the use of the robotic systems regarding the combat principles for each scenario.⁵

The United Nations Convention on the Law of the Sea (UNCLOS) seeks to strike a balance between the requirements of the sovereignty of riparian states and the freedom of navigation in peacetime by making water delimitations related to the status and the approval of the various activities within them.

Thus, the Convention in Section II establishes: "*Every State has the right to establish the breadth of its territorial sea up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with this Convention. Coastal States may, in the exercise of their sovereignty within their territorial sea, adopt laws and regulations for the prevention, reduction and control of marine pollution from foreign vessels, including vessels exercising the right of innocent passage. Such laws and regulations shall, in accordance with Part II, section 3, not hamper innocent passage of*

⁵ Cmd. Chris Rawley, USN, <https://www.usni.org/return-trust-sea-through-unmanned-autonomy>, accessed on May 26th, 2018.

foreign vessels”.⁶ The same convention establishes the *Exclusive Economic Zone* (EEZ) such as: “an area beyond and adjacent to the territorial sea, subject to the specific legal regime established in this Part, under which the rights and jurisdiction of the coastal State and the rights and freedoms of other States are governed by the relevant provisions of this Convention”.⁷

The International Law of the Sea related to the naval warfare extends this framework to regulate the relations between the belligerent and the neutral parties, as far as possible. The study and analysis required to assess USV and UUV use in these typologies is now at the beginning, and the preliminary conclusions will be presented below. Thus, for example, US Navy specialist Commander Andrew Henderson suggests that “UUV systems can act without being restricted both in the high seas and in the EEZ, and must properly take due account of the other ships and without to be considered as a direct threat to the territorial integrity of the riparian state”⁸.

The navigation of these UUV systems in the territorial sea will be done by applying UNCLOS provisions, so this equipment will have to navigate to the surface of the water and apply all the rules regarding the use of lights and acoustic signals.

Other specialists believe that maritime autonomous systems should be restricted in terms of freedom of navigation, in particular with regard to the right of innocent passage. These systems should be capable of avoiding collisions at sea, to the extent that the measures to be taken include “adequate and sufficient supervision”⁹. From this perspective, the presence of an autonomous underwater vehicle of a state within the territorial waters of another state should be considered a challenge to its sovereignty, and therefore the use of the armed force¹⁰.

⁶ http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf, accessed on May 27th, 2018.

⁷ Ibidem, part V, art.55.

⁸ Commander Andrew H. Henderson, JAGC, USN, *Murky waters: the legal status of unmanned undersea vehicles*, Naval Law Review 2006 Article, Essay and Note, <http://www.sevenhorizons.org/docs/HendersonMurkyWaters.pdf>, accessed on May 26th, 2018.

⁹ McLaughlin, *Unmanned Naval Vehicles at Sea*, Journal of Law, 2012, pp. 113-114.

¹⁰ Gogarty and Hagger, *The Laws of Man over Vehicles Unmanned*, http://www.jlisjournal.org/abstracts/gogarty_hagger.19.1.html, accessed on May 27th, 2018.

The riparian nations exercise their sovereignty over territorial waters, the continental shelf and exclusive economic zones, which allows them to prohibit the operation of underwater vehicles for purposes other than scientific ones. If riparian nations have the right to suppress other states to conduct mining operations or surveillance and research operations in the EEZ, and to restrain any action that would harm the state's security in the territorial sea, certainly the use of UUV and USV in the EEZ and the territorial sea represents a real and credible threat through the high secrecy of these systems actions.

A defining element in the extensive analysis of the ethical nature of the autonomous systems is the ability of these capabilities to avoid collision with other ships, to apply the principle of proportionality and discrimination, to protect non-combatants and to achieve protection against direct harm and intentional aggressions.¹¹

Military analyst Louis DELBEZ, a law enforcement and armed conflicts specialist, considers that the principle of "*jus ad bellum*" has as its main object the need to be recognized as the right to war and at the same time to establish the limits on the use of armed power¹². On the other hand, the "*jus in bello*" principle sets out the normative limits that need to be applied in the conduct of military actions. Although the sentences *jus ad bellum* and *jus in bello* are distinct, they still have a common element, that if the first phrase aims to eliminate the war, the second wording aims to restrict the consequences of the war.

A significant number of military analysts suggests that if we analyze the fundamental criteria of the *jus in bello* principle applied to autonomous systems, under the ethical aspect of the process of a military making the decision to use force, we can assume that the lack of human will at the moment of execution of the attack, in the case of autonomous capabilities, does not respect this principle at all.

Perhaps the most important ethical issue to analyze and debate in the event of a conflict is the focus of exacting action on military targets and the drastic reduction of civilian collateral victims. Thus, the *jus in bello*

¹¹ <http://www.arduph.ro/domenii/diu-doctrina/razboiul-drept-si-dreptul-razboiului>, accessed on May 27th, 2018.

¹² Louis Delbez, *Les principes généraux du droit international public*, III ème éd., Paris, 1964, p. 507.

principle of discrimination requires military personnel to be able to clearly delineate military targets for civilian targets and drastically reduce the number of collateral victims among non-combatants. For this reason, some of those who criticize the use of autonomous systems in conducting combat actions believe that robotic weapons are not capable of making a clear distinction between the targets. For example, in the particular scenario of counter-insurgency actions, the process of identifying a person, whether a combatant or not, is based on a set of contextual criteria, which are unlikely to be properly interpreted by the autonomous systems. Regarding underwater autonomous systems, the principle of discrimination is not a critical element at this time, as in the underwater warfare the number of potential targets is greatly reduced and thanks to the information received from the radar and sonar, the identification and classification of the targets depending on their destination, military or civilian, can be performed. Indeed, a positive aspect in favour of the use of autonomous systems in the actions above water or in the underwater environment is the fact that, especially in the high seas, the "*footprint*" of civilian targets is much reduced if compared to the air or land environment. In addition, the issue of target discrimination seems to be very simple in the area of anti submarine warfare, as the number of civilian submarines used for commercial purposes, similar to those of military submarines, is limited and the use of civilian systems is good for certain clearly-delimited districts and for a small number of functionalities.

The ethical condition of proportionality, based on *jus in bello*, is whether the military advantage gained from a strike on the hostile target is sufficient to justify the victims and the destructions that the attack could reasonably cause. Although the legal requirement of proportionality is understood as the balance between the force used, the advantages and losses of the other party, with particular attention to the collateral losses among the non-combatants, in this equation, the loss of life of the soldiers has the same weight and significance as those of the civilians.

The principle of ethics also values the life of any human being, be that military or non-combatant. For example, a deliberate attack on an enemy military ship that shelters or transports a large number of combatants and which does not represent any immediate threat, when it is already known that the enemy has signed an act of surrender, would be unethical because of being disproportionate. Requirements and proportionality

analysis are a major impediment to the use of autonomous systems. Assessments of the military benefits needed to estimate whether a certain number of victims (civil or military) are proportionate and legitimate cannot be achieved by robotic systems because of the complexity and lack of ability to perceive the context of the operational environment.

Therefore, we consider that if robotic systems improve their ability to achieve target discrimination, the first area in which they can project their military capability will be that of underwater warfare. Even in this case, we have identified four situations where the ability of systems to discriminate is a particular challenge from the point of view of military action ethics in the naval war.

1. In order to avoid attacks on military vessels, the autonomous maritime systems should be able to identify the nature and nationality of the potential targets, not just to determine whether they are military or civilian ships. In some situations, this case can be easily resolved if combat vessels of the enemy task group are easily identifiable by those of the neutral based on the radar image and/ or the acoustic fingerprint. However, under certain circumstances, the identification of whether a ship is equipped with torpedoes or has artillery facilities or whether it has a particular displacement or is of a particular class of ships is not sufficient to achieve the target classification or to establish that it is an enemy target. Instead, in order to achieve friend/ foe identification, autonomous systems should have the ability to formulate reasonable conclusions about the identity of a target, based on an algorithm that might analyze its navigation history and whether the positions previously occupied by it put its own forces in danger and in what way. One way of compromising for the moment would be to introduce a temporary limitation in UUV and USV programming, not to deliberately attack targets identified as warships. This would, however, significantly reduce the role of the use of maritime autonomous systems in the execution of strikes in A2 / AD (Anti-Access/Area Denial) zones. We believe that in the near future (3-5 years), the computers onboard UUV and USV will be able to perform target identification operations and overcome current restrictions.¹³

¹³ John S. Canning, *A Concept of Operations for Armed Autonomous Systems*, Washington, DC, 2006, available at www.dtic.mil/, accessed on June 13th, 2018.

2. Secondly, we can imagine a scenario in which enemy ships clearly indicate their intention to surrender, and in this case, they no longer represent legitimate targets under the Geneva Convention¹⁴. In this situation, autonomous systems must have the ability to recognize the new posture of enemy targets. It is to be assumed that in the future, military ships can also have a standardized and unanimously accepted safety communications channel with the autonomous systems in the military action area to signal the intention of a surface ship to quit the fight. But until then, robotic systems will have to be able to recognize and respond to an enemy surrender signal in accordance with existing means of communication and in accordance with the international conventions in force. At this point, these signals are transmitted by radio, signal pennants and light signals. The development of the current autonomous systems does not allow the recognition of all these signals, which can lead to serious violations of the international conventions on the Law of the Sea and Law of the Naval Warfare.

3. Thirdly, maritime autonomous systems must be able to identify the situations in which an enemy ship can take action, because it is possible that the ship is so badly damaged that it can no longer continue the fight and no longer pose a threat to their own forces. There may be a situation where the seriously damaged ship cannot transmit the capitulation or surrender signal and hence can no longer take combat action. Thus, from a moral, if not legal, point of view, a seriously damaged enemy ship which is no longer able to engage in hostilities and does not require capitulation or surrender is no longer a legitimate target to be completely destroyed, and the status of the personnel on board. The destruction of the ship as well as the annihilation of crew members under these circumstances fall under the principle of disproportionate action in the laws of war as defined by the Geneva Convention. Human beings are able to properly discern the circumstances of applying these rules, using the rich experience of high commanders and commanding officers, from the perspective of interpreting enemy actions, motivations, conjunctions, and international maritime law. Before we ask how ethical it is to use autonomous systems in military action, we have to ask whether these systems have the ability to analyze and interpret the situation in

¹⁴ http://www.un.org/en/genocideprevention/documents/atrocities-crimes/Doc.33_GC-IV-EN.pdf, accessed on June 3th, 2018.

the area of operation at least at the level that the commanders of naval groups in the fighting zone can do. Are the autonomous systems today able to carry out a proper analysis and interpretation of such a situation? We believe that the answer is negative.

It is important to point out that the elements presented above can be analyzed from different perspectives depending on how we categorize autonomous systems as ships or weapons. If an enemy combat ship surrenders, after being hit by a torpedo launched from a submarine with human operators onboard, the subsequent sinking of the ship may be a disaster, but not a war crime. However, if a friendly warship launches an attack on an enemy ship, which has previously transmitted signals of surrender; this is obviously a war crime. If we look at the autonomous systems as weapons, then as long as the commander who uses them does not know whether the targets concerned have surrendered or have another status during military action, the use of these systems is legitimate, even if the status of these targets suffers changes after their use begins. On the other hand, if we analyze the robotic systems as vessels, then they must have their own ability to detect and interpret whether a hostile target has surrendered or not, in order to take the necessary action to cease fighting or continue it, depending on the circumstances.

4. Fourthly, when we analyze maritime interdiction operations or the attack on merchant vessels, the issue of making the distinction between different platforms and their specific missions is particularly complicated, especially since it is sensitive in view of the principle of ensuring freedom of navigation. From this point of view, the use of autonomous systems does not seem to be the best option, for example, to make judgments and analyses on shipments on board of merchant ships. Autonomous vehicles do not have the tools to investigate whether commercial ships carry hostile troops or how they actually contribute to the operations of the enemy. The fact that robotic systems are not capable of identifying, investigating and capturing ships in maritime interdiction operations creates a major limitation on their use in such missions.

We believe that the *jus in bello* principles of achieving proportionality and achieving the separation of objectives in the area of operations is not only a constraint upon the differentiation between justifiable targets and neutral objectives but it also compels the commanders to make every effort to avoid attacks on some objectives on which no clear

distinction has been made and for which the obtaining of a tactical advantage is uncertain. Thus, as stated in the San Remo Manual on International Law applicable to Armed Conflict at Sea, commanders must *"... take all possible steps to gather information to help establish situations where the objectives which are not classified as military targets, are or are not present in the attack area ... and take all measures to choose the methods and means of avoidance or reduction of collateral damage or casualties"*¹⁵.

Although the question that might be asked would be what is meant by all possible measures? Obviously, seen in context, this issue is complex and at the same time controversial. Militants have to take a risk when they look at the possible choices they have. However, a certain limit, a red line, should be set for the reasonably assumed risk that the number of victims will be minimal as long as the proposed military aim is attained. Thus, an autonomous underwater system will be required, as in the preliminary planning stages of an attack, to launch surface sensors, use the active sonar, and use all equipment to identify targets at the surface of the water. Naturally, robotic systems will have to wait for the authorization of a human operator before executing an attack.

The ability of autonomous systems to carry out more precautions before launching an attack may be an argument in the development and use of these systems in combat actions. Not having human staff on board makes them credible for use in operations and risky environments when we aim to achieve certain objectives by any possible means.

We have tried in this article to highlight all the unique attributes of unmanned underwater vehicles and the way in which these systems can be interpreted both under provisions of international maritime law and tactical and operational capabilities. An interesting case study could be made by reference to national legislation, which will have to define the provisions to be applied to defining and categorizing the autonomous systems and therefore the applicable rules for operations and navigation. This conclusion results from the fact that underwater autonomous systems will either be considered as components of their support vessels or will be regarded as complex and independent ships. We can speculate that a robotic system

¹⁵ [https://ihl-databases.icrc.org/ applic/ihl/ihl.nsf/section II/ art.46/](https://ihl-databases.icrc.org/applic/ihl/ihl.nsf/section%20II/art.46/), accessed on June 3th, 2018.

might avoid the legal provisions for some exceptional situations, such as a system without a payload, launched and operated offshore. This vehicle would not be supported by other vessels, nor would it be technically a means of transport and classified as a ship. However, for reasons of uniformity and to avoid confusion, it is Romania's interest to treat all underwater autonomous systems in a unitary manner, and although it may be tempting for some to argue why autonomous systems should not be governed by the laws of the sea, the development of such an approach is a source of vulnerabilities, primarily for the Romania and its interests. Considering the increasing availability of these vehicles to states around the world, among which also the Black Sea riparian countries, establishing clear rules for the operation of these equipments will have a major significance for Romania's security at the Black Sea and for protecting the interests of the territorial area, contiguous area and exclusive economic zone.

Conclusions

We believe that the use of maritime autonomous systems sets a paradigm shift in the ethics of war at sea, generating debates on the design and especially the operation of these systems, all seen in the light of the United Nations Convention on the Law of the Sea (UNCLOS). The importance of ensuring freedom of navigation in the high seas and the obligation to save shipwrecked or lost at sea persons are complicated challenges for the ethical use of autonomous systems. The controversy over the status of a ship or an armaments system of unmanned underwater vehicles will lead to interpretations of legal conventions and historic controversy over secretly lethal capabilities, as well as modelling future military actions in close correlation with technological development. The fact that, at this time, the use of autonomous maritime vehicles dilutes ship-to-ship demarcation lines, from a legal and ethical point of view, leads us to the conclusion that it is necessary to rethink and redefine the military doctrine and humanitarian obligations in the perspective of the laws and principles of war, to achieve a balance, taking into account the future challenges of the naval war.



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