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Enforcement challenges of Maritime Autonomous Surface Ships in the territorial sea

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1 Introduction

In the last decade there has been a strong global emphasis on the digitalization and automation of all parts of the society. One of the terms to describe this process has been the “fourth industrial revolution”, which was first mentioned in 2011 during the Hannover trade fair. The General Norwegian Encyclopedia describes this term as an increased digitalisation of industrial systems in which machines and people work together as part of an integrated network.¹ The field of Artificial Intelligence (hereafter AI) plays a major role in this process, which has recently experienced major breakthroughs in machine learning.

These technological advancements are happening against the backdrop of geopolitical tensions, environmental changes and ship accidents. The attacks in the Red Sea in 2023 reminded that civilian crews can be vulnerable in times of war.² Another example is the obstruction of the Suez Canal in 2021, which is suspected to be a consequence of a “technical error, or a human error”.³ Moreover, the process of digitalisation has been accelerated by the COVID-19 pandemic, which caused operational issues related to human crews on ships. A common theme for all these occurrences, is that they highlight the fragility of maritime transportation and possible advantages of autonomous technology. The incidents force both private and State actors to adapt and explore new tools to overcome these challenges.

Maritime Autonomous Surface Ships (hereafter MASS) are a part of the greater automation trend. *M/V Yara Birkeland* is currently one of the pioneer vessels to use autonomous technology.⁴ Other major international actors are also exploring this concept, but it is still in its early stage. Nevertheless, the use of autonomous vessels including MASS, is likely to increase in the future.⁵ There is therefore a need to identify and resolve legal issues of applying law of the sea to MASS. This paper seeks to contribute to this process.

The objective of this master’s thesis is to examine the enforcement challenges of MASS in the territorial sea. The word “enforcement” is used in accordance with the Cambridge Dictionary,

¹ (Martinsen 2023) – translated to English by the thesis author

² (Saul 2024)

³ (George 2021)

⁴ (Yara n.d.)

⁵ (Churchill, Lowe and Sander 2022, 512)

which defines it as “the process of making people obey a law or rule, or making a particular situation happen or be accepted”.⁶ This is a broad definition that is not restrained to the use of force. Additionally, “challenges” is meant to narrow the paper down to the most problematic parts identified by the thesis author. The goal is to highlight and discuss these issues. Thus, this is not meant to be an exhaustive presentation of the applicability of LOSC⁷ and other legal sources on MASS.

For a rule to be enforced, there must be a legal subject which enforces these rules upon another legal subject. The discussions in this paper will be limited to enforcement by State actors. In the law of the sea, the two main types of State actors that can enforce their jurisdictions are the coastal States and the flag States. Moreover, a geographical constraint will be applied: only enforcement in the territorial sea will be discussed. To further clarify, specific questions related to internal waters, transit passage and port State jurisdiction will not be touched upon. All of the forementioned narrowing down is done in regard to the length criterion, and for the purpose of providing a more focused discussion. Personal opinions will often be provided by the use of the third person (“the thesis author”).

Enforcement will be primarily discussed based on the provisions in LOSC, but also from the perspective of other conventions. The LOSC has been signed by 157 States and ratified by 60 States. The United States, Turkey and Kazakhstan among others, have not signed nor ratified the convention. Despite some States not taking part, the Convention is widely considered to be a “constitution for the oceans”. The role of a “constitution” makes LOSC fundamental for the law of the sea as a whole, for example in relation to the interpretation of other law of the sea works.

In addition to conventions, case practice will also be used extensively. LOSC art. 288 (1) states that a “court or a tribunal referred to in article 287 shall have jurisdiction over any dispute concerning the interpretation or application of this Convention which is submitted to it in accordance with this Part”. LOSC art. 287 (1) (a) – (d) provides an exhaustive list of four courts that State Parties can pick: “the International Tribunal for the Law of the Sea established in accordance with Annex VI” (hereafter ITLOS), “the International Court of Justice” (hereafter ICJ) and “an arbitral tribunal constituted in accordance with Annex VII”.

⁶ (Cambridge Dictionary n.d.)

⁷ United Nations Convention on the Law of the Sea (signed 10.12.1982)

One of these are the Arbitral Tribunals organized by the Permanent Court of Arbitration (hereafter PCA), the practice of which will be used in this paper. The last dispute resolution path provided in LOSC art. 287 (1) is “a special arbitral tribunal constituted in accordance with Annex VIII for one or more of the categories of disputes specified therein”.

Another legal source that will be used in this paper is the scoping exercise of the International Maritime Organization (hereafter IMO). The IMO is an agency that is established under the UN, and tasked with different matters related to shipping like safety, effectiveness and environment. Additionally, various legal literature will be used to give an extensive perspective on the matter.

The legal provisions discussed in this thesis will be interpreted in accordance with the VCLT⁸. Art. 31 of this Convention stipulates that all conventions are to be interpreted by their “ordinary meaning”. In other words, the text must be understood in a way that is natural for a native speaker. Not all members of the LOSC have ratified this Convention, however, it is perceived to be a reflection of customary international law (hereafter CIL) by most scholars. VCLT art. 32 also stipulates that “supplementary means of interpretation” could be used, if the interpretation by art. 31 “[l]eaves the meaning ambiguous or obscure” or “[l]eads to a result which is manifestly absurd or unreasonable”. In other words, subsidiary sources are relevant when the ordinary meaning of the term is not sufficiently clear.

For the sake of convenience, this last paragraph will give a brief summary of this paper’s contents and the order in which they will be presented. Firstly, definitions related to autonomous ships and the territorial sea will be given, in order to create a proper basis for further discussion. Secondly, the thesis will present the underlying issues related to enforcement of coastal State and flag State jurisdiction. Each issue and article will be addressed under its own separate headline. The discussions will revolve around the application of provisions on hypothetical scenarios. These do not necessarily have to come to fruition, but they will be used extensively for illustrative purposes. Thirdly, this thesis will explore de lege ferenda possibilities in how these issues can be resolved. Lastly, a conclusion will be made, which will reflect the key points of the paper and provide final remarks.

⁸ Vienna Convention on the Law of Treaties (signed 23.05.1969)

2 Important definitions and the question of LOSC application on MASS

2.1 The definition and characteristics of MASS

Before delving into the technical aspects, it must be noted that there are numerous ways in which autonomous ships and vehicles can be labelled and categorized. However, the core in all of these terms is the word “autonomous”. First, it must be noted that there is distinction between MASS and Maritime Autonomous Vehicles (hereafter MAVs). MAVs can be split into Unmanned Surface Vehicles (hereafter USV) and Unmanned Underwater Vehicles (hereafter UUV).⁹ Based on an interpretation of the ordinary meaning, the word “vehicle” has a wider range compared to “ship”. In spoken language, cars are also considered to be vehicles. A vehicle can be smaller in size, be launched in alternative ways, and have different modes of navigation. For instance, the distinction between “ship” and “vehicle” entails that vehicles can be launched from other vessels, and in that sense be considered a part of that vessel.

The IMO defines MASS as a “ship which, to a varying degree, can operate independent of human interaction”.¹⁰ Moreover, the IMO has separated these ships by four degrees of autonomy. Ships of first-degree are ships with automated processes and decision support. These ships have crew onboard which supervises the shipboard systems and functions, and can intervene in the process. The second-degree is characterized by the ship being remotely controlled and operated from another location. However, crew members are still on board of this vessel and have the possibility to take control of the ship. The third stage of automation goes further, and lets the ship be controlled and operated from a remote location without anyone on board. The fourth-degree revolves entirely around an AI that makes the decisions and actions by itself without the need of human intervention.

Researchers at UiT have also proposed a categorization that is based on operational distinctions.¹¹ The first model is the “master slave-system”, which builds on the idea that a single “master ship” with competent crew on board, coordinates a cluster of “slave ships” that are fully autonomous. The second model is “captain on land”, in which the vessel is controlled by an onshore crew. However, this model also envisions the ship operating fully

⁹ (Klein 2019, 248)

¹⁰ (International Maritime Organization 2021, 3)

¹¹ (Batalden, Leikanger and Wide 2017, 3)

autonomously in low-traffic areas. Humans would be able to take control of the vessel in difficult areas like straits and canals. In this sense, it can be considered a combination of level three and four autonomy categories, as proposed by the IMO. The third model is the “fully autonomous operation”, which is based on the notion that the ship navigates without human interference by gathering information on its surroundings. This model relies on communication with other autonomous ships, by sending and receiving data which will be necessary for navigation.

There are different arguments that can be used to promote the adoption of MASS technology. Firstly, approximately 80% of accidents are caused by human failure.¹² Therefore, it can be assumed that accidents would be lower if not disappear completely, if all vessels were to be autonomous. On the other hand, the number of accidents can remain the same or increase during the time in which traditional and autonomous vessels will operate side by side. This is due to “significant communication, compatibility, and coordination issues” between autonomous systems and human operators.¹³ A second reason that would justify a transition to autonomous vessels is economic in nature. There could be more space for cargo on the ship, and the staff could enjoy “a more structural work-load”.¹⁴ This is especially relevant for MASS that are used for shipping and utilise large crews for operation. Additionally, the use of MASS can be positive for the environment, for instance due to better route optimization.¹⁵

Nevertheless, there are also issues related to the use of MASS. The prime examples are linked to hacking, malfunctioning and liability. The passive supervisory role of the operators can also cause “poor awareness of the interaction between the state of the vessels and their environment and possibly hazardous decision-making processes”.¹⁶ Arguably, these issues are shared with other fields where AI and digital solutions can be utilised. The essence of these problems is the decrease of dependency on human control. Based on the forementioned definitions by the IMO, it is the degree three and degree four level of automation that is

¹² (Rothblum, et al. 2002, 82)

¹³ (Kim, et al. 2022, 154)

¹⁴ (Batalden, Leikanger and Wide 2017, 1)

¹⁵ (Batalden, Leikanger and Wide 2017, 1)

¹⁶ (Kim, et al. 2022, 154)

primarily affected by these issues. Therefore, for the purpose of creating discussion, this paper will only focus on third- and fourth-degree automation.

2.2 The definition of “ship” in LOSC

All of the LOSC articles that will be discussed in this thesis use the term “ship”. However, LOSC does not provide a legal definition of the word “ship”. The underlying question is therefore if the term “ship” also encompasses MASS. The importance of this determination cannot be undermined, as the interpretation of this term has a direct consequence on the applicability of the Convention to MASS. Paragraph 8 of the preamble of the LOSC stipulates that matters not regulated by the Convention, are to be “governed by the rules and principles of general international law”, meaning that it would be necessary to rely on other sources for clarification on the rights and obligations of MASS.

Whether a MASS can be considered a “ship” also has a significance for the rules of immunity in LOSC. In LOSC, warships have special rights that grant them immunity from coastal State jurisdiction, because they are considered an expression of the flag State’s sovereignty (LOSC art. 29 and “belonging to”). Warships are considered to be “ships” and rules on warship immunity follow from LOSC art. 29-32. Other government ships that are used non-commercially are also considered to have this immunity.¹⁷ It is logical that the same rules on immunity should apply to a MASS, if it is considered a “ship”.

Cambridge dictionary defines “ship” as “a large boat for travelling on water, especially across the sea”.¹⁸ This can be considered as a mostly functional approach, as it only describes “ship” by the act it must partake in. Merriam-Webster defines it as a “a large seagoing vessel” or “a sailing vessel having a bowsprit and usually three masts each composed of a lower mast, a topmast, and a topgallant mast”.¹⁹ This explanation is also based on the ship’s function, but in addition, it gives a description of its technical aspects. Neither of the two dictionary definitions list the crew as being a compulsory part of what constitutes a “ship”.

Based on the sources above, a MASS would also be considered a ship. A MASS is a large boat that travels on water, and is functionally speaking built like a regular ship. The two main

¹⁷ (Klein 2019, 252)

¹⁸ (Cambridge Dictionary n.d.)

¹⁹ (Merriam-Webster n.d.)

criteria provided by these definitions is the size and the ability to travel on water. It does not matter if vessels have different methods of propulsion, differ somewhat in size or have other construction differences.

In MARPOL²⁰ art. 2 (4) “ship” is defined as “vessel of any type whatsoever operating in the maritime environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft and fixed or floating platforms”. In COLREG²¹ rule 3 (a) the word “vessel” is defined as “every description of water craft, including non-displacement craft, WIG craft and seaplanes, used or capable of being used as a means of transportation on water”. These legal definitions are very broad in nature as they include vehicles and seaplanes. This is an argument for that MASS should be considered as “ships” in LOSC.

McKenzie argues that “it should be accepted that UMVs [Uncrewed Maritime Vehicles] can be ships for the purposes of *UNCLOS*”.²² His view is that an evolutionary interpretation of “ship” in LOSC is consistent with the Convention’s object and purpose. Furthermore, McKenzie makes the point that the term “ship” is “a generic concept capable of being applied to a wide range of devices” and that the “lack of an onboard crew does not fundamentally change the nature of a ship”.²³ Even though McKenzie refers to UMVs, the same arguments can be made for MASS. Moreover, MAVs (or UMVs) differ more from a traditional “ship” compared to a MASS, since UMVs are vehicles. McKenzie’s perspective of “evolutionary interpretation” would therefore be even stronger when applied to MASS.

Autonomous ships were not discussed when the LOSC was being negotiated. This can be attributed to the fact that the technology was still far behind at that time, and that there were many other issues that were more relevant and had to be addressed. Thus, the ordinary meaning of “ship” in LOSC was originally not meant to include autonomous ships, which is also backed by the fact that all provisions presuppose crew members on board. The creators of LOSC did not foresee the application of this instrument on MASS. The historic context of the LOSC can therefore be viewed as an argument against considering MASS to be categorized as a “ship” in the Convention.

²⁰ International Convention for the Prevention of Pollution from Ships (signed 29.12.1972)

²¹ International Regulations for Preventing Collisions at Sea (signed 20.10.1972)

²² (McKenzie 2020, 401)

²³ (McKenzie 2020, 401)

On the other hand, a parallel can be drawn with one of the original views on the breadth of the territorial sea. Through the nineteenth century the international custom was that the territorial sea was three nautical miles wide.²⁴ This view was partially based on an older “cannon-shot” doctrine. The forementioned length of three nautical miles was approximately the distance from which cannons could fire from the shore. As technology evolved, this idea became obsolete since weapons and naval warfare progressed consequently. It could therefore be questioned if similar thinking should apply to MASS. The technology has gone far enough that a crew is no longer needed on these vessels. Just as the common understanding of the territorial sea has evolved, so should the term “ship” evolve to cover various types of MASS. Besides, there is a practical need for States to have the same interpretation of the word “ship”. If a coastal State defines a “ship” differently compared to a flag State, then that could lead to misunderstandings in the applicability and the rights given by the Convention. This, in a general sense, can cause unnecessary disruptions and have adverse effects on maritime traffic as a whole.

2.3 The terms “master” and “crew” in relation to MASS

LOSC art. 94 and 27 will be discussed in detail in section 7 and 6.1, respectively. These provisions refer to the terms “master” and “crew”, which are not defined in LOSC. Due to the technical features of MASS, these terms will be discussed separately as this is a substantial issue.

Cambridge dictionary defines “master” as the “captain” who is “in charge” of the ship.²⁵ The ordinary meaning of “in charge” is that the person is controlling the movement of the vessel. Furthermore, “crew” is defined as a “group of people who work together, especially all those who work on and operate a ship, aircraft, etc”.²⁶ This description can still apply to remote controllers as it includes those who “operate a ship”.

Nevertheless, both of these definitions have a component of human control. MASS with fourth-degree autonomy lack this component, since it is assumed that they will only be operated by an AI in their final phase. For vessels that would still rely on a human operator,

²⁴ (Churchill, Lowe and Sander 2022, 137)

²⁵ (Cambridge Dictionary n.d.)

²⁶ (Cambridge Dictionary n.d.)

for instance MASS with third-degree autonomy, the definitions of “master” and “crew” are not as controversial. However, this topic has been thoroughly nuanced and discussed in law literature. It would be difficult to present all the views related to this terminology here, but some key points will be provided.

Choi and Lee argue that remote operators should have the status of a ship employee, based on multiple arguments.²⁷ Although, it must be noted that these comments are made in relation to the term “seafarer” in STCW.²⁸ Due to similarities between “crew” and “seafarer” these arguments could also be applied to “crew” in LOSC. Firstly, if the remote operator is not considered as a seafarer, then “potentially a person without appropriate education, training, and qualifications required” will take control of the vessel.²⁹ Secondly, the remote operators are working in a “special place similar to a sea-going ship”, with tools and features that are shared with a traditional ship.³⁰ The functions of each seafarer on the vessel can therefore be transferred to remote operators. The seamanship and role of each operator can also be recognized. Furthermore, the remote operator should be able to go “aboard a manned ship, ensuring harmonious implementation of crew employment policy and sea safety”.³¹

For the term “master” Choi and Lee have identified two different approaches.³² The first approach is that the traditional term “master” cannot be applied to a remote operator. As support for this statement, they point out that the competence of conventional masters and remote operators differ. The remote operators do not need the same level of knowledge that the conventional masters have, to carry out their functions. Additionally, Choi and Lee bring up that it would be difficult to find a conventional master with “on board experience” in MASS. From this perspective, it would be more effective to create a new position or role, rather than equating the remote operator with master.

The second possible approach by Choi and Lee is that the remote operator is granted the status of “master”. A central argument for this is that it would still remain “necessary to retain

²⁷ (Choi and Lee 2022, 455-456)

²⁸ International Convention on Standards of Training Certification and Watchkeeping for Seafarers (signed 01.12.1978)

²⁹ (Choi and Lee 2022, 455-456)

³⁰ (Choi and Lee 2022, 455-456)

³¹ (Choi and Lee 2022, 455-456)

³² (Choi and Lee 2022, 458-459)

a master who acts on behalf of the shipowner” and also has the ultimate responsibility “for decision making in order to ensure the smooth operation and safety” of MASS.³³ The benefits of this view are that it “supports legal stability” and would require minimal revisions of LOSC and other instruments.³⁴ Choi and Lee support this second approach in which the remote operator of MASS should have the legal status as the ship master. They also advocate that fourth-degree MASS would always need some sort of oversight and the ability to take controls in case of failure. This remote operator tasked with oversight, would be the master of a MASS that is mainly controlled by an AI.³⁵

Parlov also points out in relation LOSC art. 94 that the terms as “manning,” “seamanship,” “master,” “officers,” and “crew” do not “intuitively imply the involvement of humans”.³⁶ She is also of the opinion that a “flexible” definition of the term “master” could “cover both remote control centres and AI, although clarification to this end would again be advisable”.³⁷ To interpret the “master” and “crew” as the remote operator(s) seems like the best option from the perspective of legal stability. However, some of the provisions in LOSC would lose their purpose, as they account for physical interaction. The solutions to this will be discussed more thoroughly in section 8.

It must also be noted that there is a significant difference between “master” and “crew” in relation to tasks and competence. To ensure that these terms maintain their intended meaning, this distinction has to be reflected in the roles of the remote controllers. For a degree four autonomous vessel, the possibility of complete detachment of human interference is quite far away. If fourth-degree MASS would operate entirely on their own, hypothetically, there are only two options for who could fit the role of “master” and “crew”. It would either be the AI or the software developer. Treating the developer as master would be problematic, since the developer would not be in direct control of the MASS in present time. At this stage of automation, the AI would probably be developed enough to perform the functions of “master”

³³ (Choi and Lee 2022, 459)

³⁴ (Choi and Lee 2022, 459)

³⁵ (Choi and Lee 2022, 454)

³⁶ (Parlov, Can the International Regulatory Framework on Ships' Routing, Ship Reporting, and Vessel Traffic Service (VTS) Accom 2023, 175)

³⁷ (Parlov, Can the International Regulatory Framework on Ships' Routing, Ship Reporting, and Vessel Traffic Service (VTS) Accom 2023, 175)

and “crew”. The difference between AI and humans would, however, warrant new terminology in this situation.

2.4 Territorial sea

Rules on the territorial sea follow from LOSC part 2, sections 1-3. The territorial sea is defined in LOSC art. 2 (1) as an area in which the coastal State has “sovereignty”.

Sovereignty entails that the coastal State has full prescriptive and enforcement jurisdiction. Every State has the right to a territorial sea “up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with this Convention” (LOSC art. 3). However, this sovereignty is subject to the rules on innocent passage.

Not all States that have signed the LOSC follow its stipulations on the territorial sea. As of December 2019, only the State of Togo has claimed a territorial sea in excess of 12 nautical miles, which is a breach of international law.³⁸ Moreover, some States have a smaller territorial sea. This is not against the Convention, but underlines the need for compromises in the law of the sea, because geography or shared history might necessitate this. Some examples are the United Kingdom, Jordan and Japan, which have smaller territorial sea in specific locations. Another exception is Turkey and Greece in the Aegean Sea because of a political maritime boundary dispute.³⁹

2.5 Innocent passage

LOSC art. 17 stipulates that all ships “enjoy the right of innocent passage through the territorial sea”. The word “right” underscores that this is something that cannot be set aside except when this is provided by the Convention. The act of “innocent passage” consists of two independent terms which are represented by the words “innocent” and “passage”, with their own respective articles.

What constitutes as “passage” is defined in LOSC art. 18 (1). It must be “navigation” that is done for the “purpose of” achieving one of two objectives. The first objective is traversing the sea “without entering internal waters or calling at a roadstead or port facility outside internal waters” (LOSC art. 18 (1) (a)). This is known as lateral passage. The second objective is

³⁸ (Churchill, Lowe and Sander 2022, 139)

³⁹ (Churchill, Lowe and Sander 2022, 139-140)

“proceeding to or from internal waters or a call at such roadstead or port facility” LOSC art. 18 (1) (b)).

Furthermore, LOSC art. 18 (2) requires the passage to be “continuous and expeditious”. An ordinary meaning of this clause is that the ship must avoid other actions that differ from navigation. Nevertheless, LOSC art. 18 (2) specifies that “stopping and anchoring” are permitted, as long these are “incidental to ordinary navigation or are rendered necessary by force majeure or distress”. The word “incidental” underscores that the act must be incremental for the basic functioning of the vessel, and a consequence of its normal operation. Stopping and anchoring is also allowed “for the purpose of rendering assistance to persons, ships or aircraft in danger or distress”.

The words “continuous and expeditious” have been subject to interpretations by tribunals and legal literature. For instance, a vessel that stopped to prepare for a ship-to-ship (STS) cargo transfer was not regarded as being in passage, because the passage was no longer continuous and expeditious.⁴⁰ Moreover, ships are not allowed to “hover” or “cruise” around in the territorial sea as that does not constitute “passage”.⁴¹

The passage must also be “innocent”. An ordinary meaning of “innocent” is that the passage must be non-threatening to the coastal State’s interests. What can be considered as “innocent” is defined in LOSC art. 19. The first paragraph of this provision states that passage is innocent, so far as it is not “prejudicial to the peace, good order or security of the coastal State.” Additionally, this passage must be exercised “in conformity with this Convention and with other rules of international law”, including the UN Charter. The meaning of “prejudicial to the peace, good order or security of the coastal State” is further specified in LOSC art. 19 (2). This paragraph lists numerous examples of behaviour that is not in accordance with the provision. For instance, LOSC art. 19 (2) (c) prohibits “any act aimed at collecting information to the prejudice of the defence or security of the coastal State”.

Moreover, LOSC art. 19 (2) (i) stipulates that “any other activity not having a direct bearing on passage” can be considered non-innocent. It can be argued that this letter makes the list non-exhaustive, as it does not specify the types of acts deemed as infringement. Whether the

⁴⁰ *M/V Duzgit Integrity Arbitration (Malta v. São Tomé and Príncipe)* (2016), PCA Case No. 2014-07 case para. 310

⁴¹ (Churchill, Lowe and Sander 2022, 142)

list is non-exhaustive or not is debated in academia. However, it would be out of scope to provide alternative opinions related to this. The thesis author's point of view is that the wording "any other activity" provides for a non-exhaustive term. Other types of conduct not explicitly mentioned in the article, can therefore possibly be deemed as "non-innocent". Still, this is reliant on whether the term "direct bearing on passage" is satisfied or not. The clause "direct bearing" hints at this act being necessary for the full exercise of passage. If the passage is not reliant on this conduct, and the act is auxiliary in nature, then the whole passage is no longer innocent.

As examples of other conduct, Yang mentions "rebellion on board" and "unwarranted stopping and anchoring other than as provided for in LOSC art 18 (2) of the Convention as well as navigation in zigzags".⁴² These acts are interesting from the perspective of MASS navigation. Although MASS can technically not have a "rebellion on board" in a regular sense, the remote operators might act against their orders. Unwarranted stopping and zigzagging can also occur because of malfunctions related to MASS controls, something that will be explored in section 5.2.

3 Ship regulations applied on MASS

3.1 LOSC art. 21 (1) – an instrument for regulation of MASS?

The twentieth century led to major technologic breakthroughs, which were accompanied by globalisation. This resulted in increased transportation of goods at sea, harvesting of marine living resources, and the extraction of oil on the seabed. Despite the economic benefits, the negative consequences and the effects these uses of the sea could have on the marine environment, were still unknown in the early phase of globalisation. However, after the major oil spill incident of Exxon Valdez in 1989 and similar events, different governments started to pay closer attention to the safety and construction of ships. The ability for a coastal State to guard itself from dangerous ships is provided in LOSC art. 21.

LOSC art. 21 (1) stipulates that a coastal State "may" adopt "laws and regulations" that are related to "innocent passage through the territorial sea". However, this must be done in "conformity with the provisions of this Convention and other rules of international law". For example, national legislature that would prohibit this passage regime would be against

⁴² (Yang 2006, 167)

international law. Additionally, the regulatory provisions must be related to the acts listed in the exhaustive list of LOSC art. 21 (1). One of these acts is “the safety of navigation and the regulation of maritime traffic” (LOSC art. 21 (1) (a)). An ordinary meaning of “safety of navigation” would entail the security and safety of vessels and their crews at sea. The wording also indicates that it is not necessary for full clarity on the effectiveness of the regulation. As long as the measure has the possibility to fulfil the goal in the provision, it can be enacted.

An important question is whether LOSC art. 21 (1) can be used to regulate the design, construction and equipment of MASS. Currently, the technology is still in its early phase and there is no case practice in regards to MASS and this provision. Despite the lack of legal practice, it is plausible to think that this provision may be used by coastal States to limit MASS passage in the future. As it has been presented previously, autonomous vessels are very unique in their operational methods. Thus, in their initial form, this technology can pose a threat to other vessels traversing the sea, something that was mentioned in section 2.1. For instance, third-degree of autonomy has a strong reliance on human control in the form of an operator on land. The motives and actions of a person cannot be as easily predicted compared to an AI, which can in turn create new type of human caused errors due to remote controls.

There will be a long phase, where both manned and unmanned vessels will be used for transport. Perhaps some States would actively maintain this operational variety, by passing laws that mandate certain vessels to be controlled by a crew on board. For example, this could be used for MASS that will transport hazardous goods. In theory, some States could prohibit third-degree and fourth-degree of autonomy on the grounds that these vessels lack crews. Degree four of autonomy is the most technically complicated control method, and it is therefore likely that many countries will try to limit it. Some States might outright prohibit it, while others might create restrictions or regulations on types of software used for this AI.

Based on the ordinary interpretation of LOSC art. 21 (1) (a), the member States would be in their right to implement these restrictions, provided that these regulations would improve navigational security. However, in relation to MAVs, Klein argues that a ban would not be possible “simply based on its lack of crew on board”.⁴³ A counterpoint to this is that MAVs differ in size and are not in the same way reliant on other vessels. Nevertheless, LOSC art. 24

⁴³ (Klein 2019, 269)

can constitute a barrier for an absolute ban on MASS, something that will be discussed further in section 3.2.

Other possible obligations on construction could be related to the duty to render assistance at sea. In LOSC, this duty follows from LOSC art. 98. The provision stipulates that member States “shall require the master of a ship flying its flag, in so far as he can do so without serious danger to the ship, the crew or the passengers” to partake in three types of rescue activities. The clause “without serious danger” underscores that this is a qualified obligation and not an absolute one. What the vessel can be obliged to do, can therefore differ in relation to the type of accident and technical aspects of the rescue ship. Nevertheless, it can be asked if the duty to assist should still be of qualified form, when the MASS will not have crew members on board. In worst case scenario, while providing aid the MASS will be destroyed. On the other hand, human lives on a traditional vessel can be lost if the MASS ignores the request. The mere possibility of saving human lives would outweigh the risk of the MASS sinking in the process.

An example of the rescue activity mentioned in LOSC art. 98 (1) is rendering assistance to “to any person found at sea in danger of being lost” (LOSC art. 98 (1) (a)). Although this article is placed under the high seas chapter, the same rule applies to the territorial sea through CIL.⁴⁴ LOSC art. 18 (2) makes it possible for ships to divert from passage and provide aid to vessels in “danger or distress”. The duty to render assistance can also be found in SOLAS⁴⁵ Chapter V Regulation 33 (1). Additionally, this provision also obliges the vessel to inform the correct authorities in case the vessel cannot render assistance and satisfies all the conditions for the exempt.

Since third- and fourth-degree vessels would lack crews on board, one must ask how these ships would render assistance to traditional ships with people on board. In theory, this could be conceivable through technological solutions. Without diving too deep into the engineering aspects, one could think of lifeboats that automatically detach from the ship, tools for extinguishing fires on other vessels, etc. In law literature, the provision of medical supplies, food, water or towing has also been suggested as means to fulfil this obligation.⁴⁶ An

⁴⁴ (Churchill, Lowe and Sander 2022, 19)

⁴⁵ International Convention for the Safety of Life at Sea (signed 01.11.1974)

⁴⁶ (Dong, Bautista and Zhu 2024, 4)

alternative to this could be an external solution, like the onshore controller being obliged to call in assistance, which can come in form of a helicopter. However, this approach is somewhat problematic, since help from a third party would not always be possible during bad weather conditions. It can be reasoned that the rescue obligation is provided precisely because help from a third party would not be able to reach on time, or not have the ability to arrive at all because of the sea conditions.

The next question would then be how much one can expect from these ships in light of LOSC, when it comes to rescuing people in need of assistance at sea. Since MASS lack crews on board, an argument could be made that there should be stronger requirements for rendering assistance imposed on these vessels. Traditional ships have mandatory equipment and facilities that can render assistance to other vessels. Nevertheless, the equipment and the skills of the crew are primarily meant to deal with incidents on board, which is an argument against strict requirements for MASS. Still, crews on board can provide basic forms of aid in many complicated ways in which machines cannot. The fact that an autonomous vessel cannot provide the same type of human care, is something that can have a negative impact on the safety of other traditionally manned vessels.

The coastal State's ability to adopt regulations in relation to these issues, is also strengthened by the existence of IMO's Principles of safe manning.⁴⁷ These principles are not directly applicable to MASS, but they provide important minimal requirements for the crew to navigate with respect to the law of the sea. From a safety perspective, a State should be able to prescribe restrictions on MASS if the owners cannot prove that the MASS can operate on par with traditional ships that follow these principles. The existence of standards for crew on traditional ships in itself, can be used in defence for States' ability to regulate MASS controls. In other words, since there already are rules for normal vessel operators, then one should also be able to make the same type of laws for autonomous vessels.

Moreover, the idea of tougher equipment requirements for MASS can be encouraged on the basis of arguments used for strict liability. If the vessel owner chooses to use autonomous technology, then he or she must also bear all the risks and obligations that are a result of this. If this new type of technology will lower the costs of operation, then the general safety at sea should improve or at least remain on the same level. One cannot make a compromise between

⁴⁷ (International Maritime Organization 2011)

safety and economic benefits, since security of all vessels on the oceans is a more important principle. This ties closely to the historic notion of *mare liberum*, by which everyone has the right to use the ocean just as everyone has the right to breathe air, as this is a common good. Specific dangers related to MASS could therefore undermine the *mare liberum* principle. The use of MASS should not negatively affect the navigational safety of traditional vessels, for instance even when it is indirect because of an absence of rescue capabilities.

Another plausible regulation is mandatory transition of control of the MASS to the coastal State in straits or canals. Similar regulations are being enforced in the Suez Canal and the Torres strait where there are special methods for procedure. In relation to MASS, one could envision land-based centres in canals and straits tasked with taking remote control of the vessels in these specific areas. This would potentially require special equipment to be installed on MASS and national laws related to this could be grounded in LOSC art. 21 (1) (a). Furthermore, a coastal State could consider legislating that all fourth-degree autonomous vessels entering its territorial waters, have equipment that would make it possible for humans to take remote control of the vessel. This would make it possible to switch between levels of automation, which could be relevant in areas with high traffic or difficult geography.

In addition to LOSC art. 21 (1) (a), there is likewise nothing in the way for a coastal State to prescribe and enforce other laws in conformity with (b) – (h). Since MASS are considered to be ships, they must be subjected to the same obligations as their manned counterparts. If the terms for these regulations are fulfilled in LOSC, then there are no reasons to treat MASS differently compared to normal ships. Whether these regulations can be applied to MASS, is again related to the general definition issue, and whether MASS can be considered as “ships” something that was discussed in section 2.1.

LOSC art. 21 (4) stipulates that “[f]oreign ships exercising the right of innocent passage through the territorial sea shall comply with all such laws and regulations”. They shall also comply with “generally accepted international regulations relating to the prevention of collisions at sea.” The object of this provision is a “ship”, meaning that there is nothing in the way for direct usage of this article on MASS without regular crew. Provided that “crew” and “master” could be interpreted in broad sense, the “ship” would also include the operators in the control station. For fourth-degree MASS, this would be the AI that is operating the vessel. Perhaps one could ask if the software developer would be considered a part of the “ship” in this case. Such a broad interpretation would be too general, as it is the specific vessel that is the object of the provision. On the other hand, if the owners would not be able to control the

AI, then an argument can be made that the software developer should also be obliged to take into the account the laws and regulations. This could be attributed to the AI making decisions based on the software developer's code.

3.2 LOSC art. 21 (2) and LOSC art. 24 – the obligation to not hamper passage

The rule in LOSC art. 21 (1) is not without exemptions. LOSC art. 21 (2) stipulates that the regulations made on the basis of LOSC art. 21 (1) “shall not apply to the design, construction, manning or equipment of foreign ships”. Prescription and enforcement related to ship control, usage of AI, and design specifics of an autonomous ship would fall into the ordinary meaning of LOSC art. 21 (1).

This provision must be viewed in the light of LOSC art. 24 (1) which stipulates that coastal States “shall not hamper the innocent passage of foreign ships”, except when it is in accordance with the Convention. The article provides two examples in LOSC art. 24 (1) (a) and (b). Firstly, the coastal State shall not “impose requirements on foreign ships which have the practical effect of denying or impairing the right of innocent passage” (LOSC art. 24 (1) (a)). Impairing can be understood as creating a hindrance and making it more difficult to navigate. A denial of the right of innocent passage would make it outright impossible to navigate. One can for example think of a coastal State mandating fourth-degree autonomous vessels to disable AI when navigating in its territorial waters. This would have the practical effect of denying passage, as the AI would be necessary for vessel operation. Another scenario could relate to certain sensors being prohibited, which would be a form of “impairing”.

Secondly, the coastal State shall not “discriminate in form or in fact against the ships of any State or against ships carrying cargoes to, from or on behalf of any State” (LOSC art. 24 (1) (b)). An important question here is how the word “discriminate” has to be understood. The ordinary meaning of “discriminate” is that entity A is being treated differently compared to entity B. One way to look at this provision is from the viewpoint that the coastal States shall not discriminate between its own vessels and other States' vessels, when these vessels have the same characteristics. In this sense, one can make a comparison with the interpretation of the four freedoms in the EU, i.e. the member States shall compete with each other on the same terms. By this logic, if the coastal State and the flag State both utilise MASS, then the coastal State cannot discriminate against the MASS of a flag State.

However, discrimination can also take on a different form: In this scenario, coastal State A only has manned vessels, while flag State B utilises traditional and autonomous vessels. The coastal State then chooses to discriminate against autonomous vessels, which in reality would only affect flag State B. The national laws of State A would treat all autonomous vessels the same, but the practical consequences of this would be that only the autonomous vessels of the flag State B are affected. One can make an argument that this is not discrimination, since all autonomous vessels are treated equally. The coastal State is within its right to not have MASS within the territorial sea because of technological or legislative reasons. However, this view becomes more problematic if the flag State only has autonomous vessels in its fleet. It is not unlikely that there will be smaller countries with stronger focus on modern technologies (i.e. governments that would actively attract investments and focus solely on autonomous ships). National laws that would prohibit MASS, would in reality impair the flag States reliant on MASS from using the territorial sea, which would be an argument against allowing this type of discrimination.

The exempt in LOSC art. 21 (1) does not apply if the rules are “giving effect to generally accepted international rules or standards” which follows from LOSC art. 21 (2). What is considered as “generally international rules or standards” is not defined in the Convention. The contents of this clause (hereafter GAIRS) have been provided in arbitration and law literature. This term is commonly considered to be a part of “rules of reference”. By using GAIRS the LOSC “ensures that the regulatory framework for shipping is at all times supported by global consensus, rather than imposed by a single State or a small group of States”.⁴⁸ In the *South China sea* case, it has been elaborated that it is comprised of COLREG.⁴⁹ SOLAS and other IMO instruments are also considered as GAIRS.⁵⁰

Currently, there are no conventions specifically regulating MASS, but a non-mandatory code is being developed by the IMO and is set to be finished in 2025.⁵¹ It is questionable whether a

⁴⁸ (Parlov, Coastal State Jurisdiction over Ships in Need of Assistance, Maritime Casualties and Shipwrecks 2022, 73)

⁴⁹ *South China Sea (The Republic of Philippines v. The People's Republic of China)* (2016), PCA Case No. 2013-19, RIAA XXXIII (2020) para. 1083

⁵⁰ (Parlov, Coastal State Jurisdiction over Ships in Need of Assistance, Maritime Casualties and Shipwrecks 2022, 73)

⁵¹ (International Maritime Organization n.d.)

non-mandatory code can be considered as GAIRS. Nevertheless, it would be logical to assume that a convention on the likes of SOLAS and COLREG would be treated as GAIRS. This makes sense from a standpoint of legal coherence, as the SOLAS convention is also a convention made by the IMO and is accepted as GAIRS. An exemption to not consider a MASS convention by the IMO as GAIRS, would need to be backed by extensive legal reasoning.

It can also be problematized if multiple States can form rules or standards through similar custom. In the French version of LOSC, GAIRS uses the word “normes” which is akin to the English “norms”. The Russian version also uses the word “norms”. This word is defined as “an accepted standard or a way of behaving or doing things that most people agree with”.⁵² Norm is by this definition a synonym of custom. The ICJ Statute⁵³ art. 38 (1) b defines “international custom” as “evidence of a general practice accepted as law”. The subjective term of acceptance is commonly referred to as *opinio juris*.

As an illustration, one can think of several countries prohibiting certain types of vessels or technology in their territorial sea through national laws. If multiple States are prescribing and enforcing similar laws based on the same reasoning, then that would be an argument for the existence of an established international custom. Furthermore, if this practice was to be aligned with a non-mandatory IMO-code, then it would strengthen the view of this practice being a “norm” under GAIRS. IMO-code as a basis would provide these customs the international authority and reinforce the existence of global consensus.

3.3 LOSC art. 26 – can charges be levied on MASS?

It follows from LOSC art. 26 (1) that “[n]o charge may be levied upon foreign ships by reason only of their passage through the territorial sea.” For this article, there is no valid reason to apply a wide interpretation. The ship itself is the object, and not the operators. Charges shall not be applied, even if the ship is controlled from a land-based control station or an AI.

An exception to the general rule is provided in LOSC art. 26 (2), which states that “[c]harges may be levied upon a foreign ship passing through the territorial sea as payment only for

⁵² (Cambridge Dictionary n.d.)

⁵³ The Charter of the United Nations (signed 26.06.1945)

specific services rendered to the ship”. The word “specific” narrows the scope of these charges. Churchill, Lowe and Sander argue that the coastal State “cannot demand a contribution towards the cost of installing and maintaining navigational aids in its territorial sea from foreign ships that simply transit its territorial sea”.⁵⁴ At the same time, the authors make the example that coastal States may include charges for navigational aids as part of the dues when the vessels are using the coastal State’s ports. The United Kingdom practices this in relation to the costs of lighthouses, buoys and beacons.

A question is therefore if the same restrictions should apply to MASS-related navigational aids. This could for instance be control stations or communication devices that are necessary for MASS operations. If the equipment would only be essential for the operation of MASS and not traditional vessels, then it can be reasoned that charges should be applicable. Firstly, the use of MASS technology is not compulsory for innocent passage. Secondly, the obligation of the coastal State to carry the costs of such equipment can be viewed as an infringement of its sovereignty. This is due to the coastal State being indirectly forced into investing in the business of MASS owners, by enabling the operations of their ships.

On the other hand, LOSC art. 26 is related to safety of vessels at sea.⁵⁵ The coastal State should therefore carry the costs that are related to navigational security. If the control stations or communication devices improve the function of MASS and decrease the risk of incidents, then a point can be made that the coastal State should pay these costs. Simultaneously, if the MASS is also using the coastal State’s ports, then the coastal State should have the option to levy charges as the United Kingdom does with the costs of lighthouses.

4 Control and suspension of MASS passage

4.1 LOSC art. 22 - sea lanes

LOSC art. 22 (1) provides the option to designate or prescribe “sea lanes and traffic separation schemes” for the regulation of ship passage. However, this requires a term to be met, which is that it must be “necessary having regard to safety of navigation”.

⁵⁴ (Churchill, Lowe and Sander 2022, 509)

⁵⁵ (Churchill, Lowe and Sander 2022, 509)

In addition to the conditions in LOSC art. 22 (1), LOSC art. 22 (3) provides multiple terms that the States “shall take into account”. One of these is “the recommendations of the competent international organization”, which is commonly considered as the IMO (LOSC art. 22 (3) (a)). Another term is that “special characteristics of particular ships and canals” must be taken into account (LOSC art. 22 (3) (c)). Based on the ordinary meaning, the operational methods of a vessel would constitute “special characteristics” as they differ from traditional ship control. Canals are also relevant with respect to third- and fourth-degree MASS. Some of them require special navigation procedures, like the Suez Canal. MASS would have the same obligation to abide by these procedures.

Certain ships may also “be required to confine their passage to such sea lanes” (LOSC art. 22 (2)). The wording “required” indicates a stronger obligation compared to the first paragraph. The vessels this applies to are “[i]n particular, tankers, nuclear-powered ships and ships carrying nuclear or other inherently dangerous or noxious substances or materials”. Based on the ordinary meaning, the provision primarily seeks to protect from the materials that are being transported, and not from the actual vessels. This is different than the ship itself posing a danger to the environment, like single hull vessels for example. At the same time, the provision also names “nuclear-powered ships”. Compared to the other examples listed in LOSC art. 22 (2), this one aims at the functional characteristics of the vessel. The wording “[i]n particular” also hints towards this list being non-exhaustive, which leads to the question of whether a MASS can be considered to fall within the scope of LOSC art. 22 (2).

Perhaps one could use an analogic interpretation to advocate that the same mandatory sea lane regime should apply to MASS. The reasoning here could be that both nuclear-powered ships and MASS have certain technical aspects that make them a greater danger than traditional ships. For MASS the danger can be seen in a strong reliance on automated technology, that can malfunction in a way in which humans lose complete control of the vessel. Parlov argues that scientific uncertainties and the lack of previous experience, could warrant that this provision is used to keep greater space between traditional vessels and MASS.⁵⁶

On the other hand, the same thinking can be applied to ships that are not up to par on safety standards like single hull vessels. LOSC art. 22 (2) is not meant to be applied to these vessels.

⁵⁶ (Parlov, Can the International Regulatory Framework on Ships’ Routing, Ship Reporting, and Vessel Traffic Service (VTS) Accom 2023, 173)

What makes the nuclear-powered ships stand-out, is that they carry nuclear material that has the potential to pollute and poison the environment. The dangers that are related to MASS are of a different kind, which is an argument against applying LOSC art. 22 (2) by analogy to autonomous vessels. The purpose of LOSC art. 22 (2) seems to be the protection of the environment and people as a whole from dangerous substances. In contrast, sea-lanes applied to MASS would have the task of protecting other vessels from the MASS itself, and not the contents of the vessel.

From a theoretical standpoint, sea lanes would be a good measure to provide safety of navigation for MASS and other vessels. Although, as mentioned previously, this must be “necessary”. In reality, the necessity term would most likely not be an issue. The IMO would probably recommend such sea lanes as this is a low threshold measure that would be beneficiary to owners of MASS, owners of traditional vessels, and the States themselves. Everyone would “win” if the risks of collision would be lowered, something that will be a major priority if and when, the adoption of MASS will occur on a large scale.

4.2 LOSC art. 25 (3) - restricted zones

A measure that goes a step further than sea lanes, is the suspension of innocent passage. The legal grounds for this are provided in LOSC art. 25 (3), which necessitates that multiple terms are satisfied. These conditions are stricter than the ones in LOSC art. 22. This is a consequence of LOSC art. 25 (3) giving the coastal State stronger rights than LOSC art. 22. The first term is that this suspension of passage can only be done “without discrimination in form or in fact among foreign ships”. Through the use of “form or in fact” the provision marks that both direct and indirect discrimination is prohibited. The examples of these discrimination types were mentioned in section 3.2, and the same problems related to this would be relevant here.

The second condition is that the suspension can only be done “temporarily” and in “specified areas”. In other words, this measure must be bound by time and location. The wording “temporarily” would prohibit the coastal States from legislating an endless restricted zone applied to MASS. At the same time, “temporarily” is not clearly defined in the Convention. Could the coastal State deny access to MASS “temporarily” with the argument that it would allow passage once the technology became more advanced? The answer to this would most likely be no, as the contents of the provision indicate that it is meant to be applied in specific situations and used as an exception. Additionally, the time period cannot be too abstractly

defined. In the situations where it is applied (like military exercises) the end time of the restriction is naturally provided.

Thirdly, this suspension must be “essential for the protection of [the State’s] security, including weapons exercises”. This term stipulates that the goal of this article is to establish the security of the State, and not vessels or individuals as a whole. Other issues like the environment would also be out of scope. Furthermore, the word “essential” signifies a high threshold for the applicability of this provision: there must be no other way in which the State can maintain its security, other than through the use of this limitation.

For MASS owned by the military, this provision could be relevant. However, it is hard to think of situations where a simple use of MASS for commercial purposes would fulfil the conditions in LOSC art. 25 (3), in a way that is different from a traditional vessel. There are therefore no clear reasons to distinguish between MASS and normal ships when applying LOSC art. 25 (3). If the article cannot be used to restrict passage of traditional vessels, neither will it be relevant for the restriction of the passage of MASS. This is unless a civil MASS has the potential to act in a dangerous way in which a traditional ship cannot. Perhaps a restricted zone for MASS can be used in areas where something unordinary has occurred that will affect the navigational functions of the MASS (for example an incident or a construction project). Technology that utilises AI can be sensitive in regards to abnormalities in the environment that it operates in, and can therefore fail to place itself in context with an obstacle that it does not comprehend.

5 The coastal State’s enforcement against MASS in non-innocent passage

5.1 LOSC art. 25 (1) – what can be considered as “necessary steps”?

5.1.1 Enforcement by other means than the use of force

The coastal State has the right to take the “necessary steps” in the territorial sea to “prevent passage which is not innocent”, as it follows from LOSC art. 25 (1). The clause “necessary steps” indicates that the measures must meet a certain threshold. The ordinary meaning of “necessary” is that the acts in question must be qualified to fulfil the given goal of enforcement. Furthermore, these measures cannot go further than “necessary”. The word “steps” indicates that the enforcement can consist of multiple acts, and that these acts can become more drastic based on the responses and conduct from the suspected vessel.

What can be considered as “necessary steps” has been further elaborated by international tribunals. For instance, it has been stated that in situations where a State derives its enforcement powers from LOSC, these powers are limited by “certain rules and principles of general international law, in particular the principle of reasonableness.” This principle consists of the terms “necessity” and “proportionality”. Furthermore, reasonableness has to be applied to “all measures of law enforcement”, not just to the use of force.⁵⁷ It is clear that “reasonableness” is a general clause, that has to be filled with meaning and is dynamic in nature.

As mentioned above, necessity entails proportionality and gradation in the types of enforcement acts of the coastal State. One could therefore ask which other measures are relevant to use against MASS in non-innocent passage, before exploring the necessity clause in relation to the use of physical force.

The least infringing act would be an order for the vessel to act in accordance with the coastal State’s demands. If one adopts the view that the remote controller is the “master” as mentioned in section 2.3, then these orders would need to be directed at the remote controller in order to be effective. If the coastal State chooses to inform a MASS through traditional means, like audibly transmitted messages or visual signals, then there is a chance that the remote operator or the AI of the vessel would not be able to notice this. This is particularly relevant in the case that innocent passage is breached because of equipment failure, which could also render audible and visionary signals as useless.

If the vessel does not comply, then there are numerous ways in which the coastal State can enforce its laws other than force. These acts can take advantage of the fact that MASS is without crew and relies heavily on digital instruments. In a way, this can be seen as a pro-argument for widespread MASS adoption from the coastal State’s perspective, as it could theoretically enable for easier enforcement. An example of this could be hacking of the MASS. Cyberattacks against traditional vessels are already a reality, a recent example being the cyberattack of the United States against an Iranian vessel M/V *Behshad*.⁵⁸ It is therefore plausible to think that similar attacks could be carried out against a MASS. A MASS would be a lot more susceptible to this, because the remote controls of the vessel could be comprised.

⁵⁷ The M/V *Duzgit Integrity* para. 209

⁵⁸ (Schmitt 2024)

However, since hacking can be done remotely and anonymously, there should also be an obligation of the coastal State to inform the master that this act of hacking is being conducted. Otherwise, it would be impossible to distinguish whether this is done by the authorities or a bad actor. Another possible act could involve scrambling of communications or obstruction of sensors, which could render the vessel in a “frozen” state.

5.1.2 Enforcement with the use of force

In international law, the base rule is that the use of physical force against a vessel must be the last resort of the coastal State.⁵⁹ In reality, use of physical force occurs more frequently, as it is the most effective approach. It is logical to assume that the lack of humans present on MASS would make the use of force against MASS more attractive. In the same way, this technology could also push nefarious actors to take greater risks. An example in which physical force was used during enforcement, is the case of M/V *Saiga* (no. 2). The vessel was attacked with gunfire by the coastal State’s ship while it was attempting a stop and arrest procedure. The vessel in question was an unarmed tanker, almost “fully laden with gas oil”.⁶⁰ Live ammunition was used and there were claims made that it was high-calibre ammunition.

Before applying the law, ITLOS provided a general remark on the terms for use of force. The Tribunal stated that the use of force must be “must be avoided as far as possible”. If the threshold of “unavoidable” is reached, then the use of force must also not “go beyond” the principles of “reasonableness” and “necessity”.⁶¹ The ordinary interpretation of the Tribunal’s remarks, is that ITLOS provides a two-step procedure for applying force that is grounded in the Convention. In addition to the already mentioned principles, the Tribunal also stipulated that “[c]onsiderations of humanity” are relevant for the use of force.⁶²

The human aspect does not play the same role in the case of MASS with third- or fourth-degree autonomy. By applying the logic of the ITLOS, a lack of crew would in theory lower the threshold for the use of force. This is because there would be no risk of human casualties compared to traditional ships. At the same time, one can also think of a situation where “considerations of humanity” would lower the threshold even more. For instance, a

⁵⁹ M/V *Saiga* (No. 2) (*St. Vincent and the Grenadines v. Guinea*) [1999] ITLOS Rep. 16 para. 155

⁶⁰ M/V *Saiga* (No. 2) para. 153

⁶¹ M/V *Saiga* (No. 2) para. 155

⁶² M/V *Saiga* (No. 2) para. 155

malfunction or a hack of a MASS can force it to collide with other vessels, platforms or land structures which would cause harm to humans. In this scenario, a strong argument can be made that the threshold for the use of force should be at its lowest, since an absence of necessary intervention would also constitute a breach of human rights. Here it can be noted that the European States which are members of ECHR, have a positive right to protect and reinforce the right to life in art. 2 (2). The right to life also follows from the UN Declaration of Human Rights art. 3⁶³, and is widely considered as a jus cogens rule.

What constitutes a reasonable use of force has been further elaborated upon in the *M/V Arctic Sunrise* case.⁶⁴ In this case the Greenpeace vessel *M/V Arctic Sunrise* tried to protest the operations of a Russian drilling platform located within the Russian EEZ on the 18 September of 2013. On the 19 September of 2013 the ship was seized in the Russian EEZ and towed by the authorities to the port of Murmansk. The arrest of the vessel was lifted on June 6 2014.⁶⁵ In the proceedings, the Arbitral Tribunal did not find the necessary terms for hot pursuit in LOSC art. 111 to be fulfilled.⁶⁶

The Arbitral Tribunal grounded its decision in the same terms of reasonableness, necessity and proportionality. Yet, it went further in specifying acts of prevention that would be deemed reasonable, which the court branded as “legitimate interests of coastal States”.⁶⁷ The common theme for these four provided acts, is that it is enough for the coastal State to “act to prevent” them.⁶⁸ In other words, it is not compulsory for the forbidden act to have been fulfilled, in order for the laws to be enforced against the vessel. Another important point is that this matrix was applied to the use of force in the EEZ, where the coastal State has “sovereign rights” in special circumstances, but not “sovereignty” like in the territorial sea. “Sovereignty”, on the other hand, gives the coastal State wider powers to enforce its rights in the territorial waters.

⁶³ The European Convention on Human Rights (signed 03.09.1953) and The UN Universal Declaration of Human Rights (adopted 10.12.1948)

⁶⁴ *M/V Arctic Sunrise Arbitration (Netherlands v. Russia)*, PCA Case No. 2014-02, Award on Jurisdiction (2014), RIAA XXXII (2019)

⁶⁵ *M/V Arctic Sunrise* para. 3

⁶⁶ *M/V Arctic Sunrise* para. 278

⁶⁷ *M/V Arctic Sunrise* para. 327

⁶⁸ *M/V Arctic Sunrise* para. 327

Based on this distinction between “sovereign rights” and “sovereignty”, it can be argued that the threshold for considering something as “necessary” should be lower in the territorial sea than in the EEZ. On the other hand, it could be argued that the difference for enforcement in the EEZ and the territorial sea is only quantitative and not qualitative: the coastal State can only enforce laws related to “certain” rights, but this limitation does not affect the “necessity” criterion.

The first example of a reasonable act given by the Arbitral Tribunal in the *M/V Arctic Sunrise* case is when the coastal State acts to prevent “violations of its laws adopted in conformity with the Convention”.⁶⁹ What can be considered as “in conformity” with the LOSC is not made clear, i.e. is the coastal State’s subjective view of conformity enough, or must the validity of the rule be tested by a national court? The second example is the prevention of “dangerous situations that can result in injuries to persons and damage to equipment and installations”.⁷⁰ This quote is reminiscent of the scenario that was presented in the discussion of *M/V Saiga* (No. 2) case: the “considerations of humanity” is not in its ordinary meaning limited to vessel crew. These first two elaborations on the contents of the “reasonableness” principle are in line with practice from ITLOS.

However, the last two justifications go somewhat further than earlier practice. The third provided example is when the State acts to prevent “negative environmental consequences”. The fourth example is a “delay or interruption in essential operations”.⁷¹ What is considered to be “essential operations” was not defined by the Arbitral Tribunal. However, in the context of the *M/V Arctic Sunrise*, this refers to the delay and interruption of other subjects by the vessel in question. Applied to MASS, one can perhaps envision a case in which a fourth-degree autonomous ship has picked a route that interrupts the fishing activities of the coastal State. The coastal State would be in its right to take necessary steps for the purpose of changing the path of the MASS, in order for this fishing activities to resume.

Moreover, the reference made to the protection of environment, raises an important question in regards to the use of force against MASS. In a possible situation, one can imagine a MASS engaged in pollution or dumping while it is under passage. What type of enforcement acts can

⁶⁹ *M/V Arctic Sunrise* para. 327

⁷⁰ *M/V Arctic Sunrise* para. 327

⁷¹ *M/V Arctic Sunrise* para. 327

be considered as “necessary” (LOSC art. 25 (1)) for a coastal State? For instance, the coastal State is under the consideration of sinking the vessel or letting it sink, as it would cause minimal damage to the environment.

A similar scenario occurred when the tanker *M/V Prestige* sunk off the Spanish coast in 2002. Spanish authorities refused the vessel entry to port. Instead, it sunk 130 miles off the coast.⁷² Churchill, Lowe and Sander argue that States may forbid “such ships” entry to internal waters, provided that measures have been taken to rescue the people on board.⁷³ However, here it must be noted that this example is not directly relevant, as the regime of innocent passage does not apply in the internal waters, except for specific situations related to delimitation with straight baselines. Furthermore, if it is clear that the vessel is about to pollute the environment when it enters the territorial sea, then the passage is already non-innocent.

The third- and fourth-degree MASS have no crew, so the human aspect would not be endangered if the vessel is sunk by the coastal State immediately. If there are no better options, then the sinking of the vessel would be “necessary”. But what if there are other alternatives of dealing with the issue (which would most likely be the case), compared to sinking? If the acts of the vessel will cause cumulative environmental damage over time, then the necessary option would be the one that is the quickest. Furthermore, the lack of the crew would in theory allow for a broader range of enforcement acts as there would be no need for evacuation.

Even if sinking would be infringing on the property rights of the MASS owners, it could still be “necessary” as member States to LOSC have a stronger obligation to respect the humanitarian and environmental aspect of passage compared to individual property rights of private actors. This perspective can be backed by the contents of paragraph 4 and 5 of the LOSC preamble: LOSC is meant to provide for the conservation of “living resources, and the study, protection and preservation of the marine environment” and the Convention aims to take “into account the interests and needs of mankind as a whole”.

On the other hand, paragraph 5 also mentions the pursuit for a “just and equitable international economic order”. Sinking of a MASS would possibly undermine this goal,

⁷² (Churchill, Lowe and Sander 2022, 115)

⁷³ (Churchill, Lowe and Sander 2022, 115)

provided that the environmental or humanitarian interests do not outweigh the property interests of the MASS owner.

5.2 Challenges related to the “innocent” criterion

Another term that must be satisfied for LOSC art. 25 (1) to apply, is that the passage of the vessel must be non-innocent. As it has been presented earlier, LOSC art. 19 gives examples of what can be considered non-innocent passage. One of these examples is in LOSC art. 19 (2) (c) which is “any act aimed at collecting information to the prejudice of the defence or security of the coastal State”. The words “any act” through an ordinary interpretation, create an impression of this provision having a broad range of application.

A point has been made by Klein that any type of surveillance done by a MAV would be a breach of the right of innocent passage under LOSC art. 19.⁷⁴ Klein does not find it necessary to distinguish between traditional and autonomous vessels in this scenario, as “the lack of a master or commander and crew on board makes no difference in assessing the activities of a vessel and whether they prejudice the peace, good order, or security of the coastal State”.⁷⁵

Surveillance and the coastal State’s rights to protect itself raises questions on what can be considered as “necessary steps” (LOSC art. 25 (1)). Although MASS are still at a very early development stage, MAVs are being used more extensively by modern militaries. In 2016 China seized a U.S underwater MAV that was launched from the *USNC Bowditch*. This was done in the high seas. Following this incident, it was argued by Pedrozo and Kraska that this seizure was unlawful since the MAV belonged to the U.S government and therefore had immunity, in addition to the seizure being an obstruction of its navigational rights in the high seas.⁷⁶

In the forementioned case regarding MAVs, the surveillance that was done is not that different from what traditional vessels have been doing for centuries. However, in the 21st century more unconventional types of warfare and reconnaissance are becoming more and more common. States might use hacking, proxy actors, fake companies and NGOs to covertly fulfil their interests as a way to minimize the risk of larger conflicts. An example is the Iranian

⁷⁴ (Klein 2019, 269)

⁷⁵ (Klein 2019, 269)

⁷⁶ (Kraska and Pedrozo 2016)

cargo ship *M/V Behshad*. Analysts and officials from the United States accused the vessel of providing “electronic intelligence” and targeting assistance to Houthi rebels in the Red Sea.⁷⁷ The United States itself was in 2013 accused of spying on the Brazilian oil company Petrobras. Allegedly it hacked into the computer network of the company, which was preparing to auction rights to extract oil off its coast in the Libra reserve.⁷⁸

One can therefore think of a scenario where a MASS is used for covert surveillance and is not formally considered a part of the State. Since this type of vessel does not belong to the government, then it does not have the same immunity as a warship. The location of the surveillance act would therefore be even more important. If this surveillance is being done in the territorial sea, then that would constitute a breach of the innocence criteria. As with other previously presented scenarios, it can be asked how far the coastal State can go in the enforcement of its laws on surveillance. Modern communication technologies have evolved far and allow for live transmission of information. This entails that it is no longer necessary for a vessel to return with recorded information, as data can now be transmitted directly through a satellite connection. For third- and fourth-degree MASS operation, extensive satellite data transfers from MASS to a land control station will be mandatory for the ship to be controlled remotely. As mentioned in section 2.1, it might also be necessary for several MASS to communicate and exchange data with each other to function properly.

McKenzie points out that “an underwater UMV would have to be able to surface and turn off some of its surveying and information collecting functions” in order for the passage to remain innocent.⁷⁹ There are, however, issues related to this, something Norris has explored in relation to MAVs operated by governments. Norris foresees the possibility to turn off surveillance functions, but he has also identified two problems with this.⁸⁰ The first one is that it would be technically difficult to turn these systems on and off specifically for when “the device is in a foreign territorial sea”. The second problem is that it is unclear how the coastal State would be able to verify whether the vessel is conducting illegal surveillance. Although

⁷⁷ (Mulligan 2024)

⁷⁸ (Boadle 2013)

⁷⁹ (McKenzie 2020, 389)

⁸⁰ (Norris 2013, 36)

these comments are made in connection to government-controlled MAVs, they can also be applied to MASS that are suspected of conducting espionage for a State.

It can therefore be problematized if the coastal State can outright destroy or seize a MASS that is suspected in surveillance, in the fear that it is gathering and transmitting crucial data. As mentioned previously, the necessity term mandates a gradual approach, meaning that the coastal State must begin enforcement with the least infringing act. But what if inquiries to provide or delete data are ignored? The lack of potential human casualty is a pro-argument for the destruction of a MASS being possible and “necessary” in circumstances of non-compliance. Furthermore, all nations enjoy “sovereignty” in their territorial waters (LOSC art. 2 (1)). The regime of innocent passage does not apply to ships that partake in espionage, even if the vessel simultaneously transports goods as part of its cover operation. On the other hand, the requirements for proof should be higher when a MASS is suspected in the conduct of surveillance activities. In theory, all MASS with third- and fourth-degree autonomy would have equipment that would be capable of gathering intel that can be transmitted through satellite. This would make it hard if not impossible for a coastal State to distinguish illicit activity (espionage) from innocent passage.

A possible solution for the espionage issue could be the establishment of designated data centres and control stations. These data centres could be created by international organizations like the IMO or the UN, which would in theory provide for transparency and neutrality. This concept can also be strengthened by practical reasoning. Currently, one of the major obstacles for MASS of third-degree autonomy is the massive amounts of data that have to be transmitted.⁸¹ It is logical to assume that only a few companies would have access to this technology in the starting phase. Furthermore, complicated autonomous systems could require quantum computing, which would need cold temperatures to operate.⁸² Perhaps companies that could deliver these solutions, would provide these data centres for the IMO or the UN, so that these organizations can guarantee peaceful use. A form of lending contract could constitute a basis for this.

The “necessity” clause for enforcement can be further problematised by lesser violations of the “innocence” criterion. What if the conduct of the MASS is non-innocent, but the act does

⁸¹ Thanks to Tae-eun Kim for this insight.

⁸² (Valich 2023)

not pose as big of a danger to the sovereignty of the coastal State as the forementioned examples? For instance, one can think of a MASS malfunctioning and deviating of its route or stopping. Moreover, what if the MASS must stop and wait for a certain period because its sensors are obstructed? What can be considered as “necessary” in these situations? If one would apply the logic used for traditional ships to MASS, cases that involve malfunction would likely be considered as force majeure (LOSC art. 18 (2)).

This brings up another question, and that is what can be considered as force majeure for a MASS? One could think of a situation where a third-degree autonomy MASS loses connection to the land control station. In this situation, it would be plausible to label this as a force majeure, as the vessel can no longer be controlled.

On the other hand, one can envision a fourth-degree autonomy MASS making “wrong” decisions because of AI. What if this AI makes a decision that is functionally compatible and safe, but legally is a breach of the “passage” or “innocence” criterion? For instance, the vessel decides to stop for a period of a few days or miscalculates and picks a route which makes it breach the “innocence” criterion. The act of the MASS does not endanger anyone. In this scenario, the thesis author takes the position that this act cannot be considered as force majeure, but is a regular breach of innocent passage. The reason for this, is that the MASS is operating in its normal mode of fourth-degree autonomy. If the vessel breaches LOSC art. 18 and 19, then the vessel must be held liable as any other ship. It would be the obligation of the AI developer and the vessel owner to maintain and check the operational status of the AI.

However, when enforcing a MASS that is involved in a minor breach, the proportionality criterion should constitute a limit on the acts of the coastal State. If the vessel does not endanger humans or the environment, then the threshold for applying physical force on the vessel should be above average. For instance, if operators on land can override the control of the vessel, then the coastal State should let the operators on land or software developers try to resolve the issue first. One can also doubt if towing the vessel would be “necessary” in this case, if the breach of innocent passage can be restored by contacting the owners of the vessel or the AI developers. Moreover, bringing the vessel to the port of the coastal State would not have the same punitive effects as it does for a traditional ship, since there would be no crew that could be arrested for the breach of the passage regime.

Nevertheless, these arguments apply only as long as there are no severe reasons that would dictate otherwise. For example, it could be essential for maritime traffic that the vessel is

removed as fast as possible because of obstruction. Furthermore, if the owners of the vessels are not taking the responsibility for resolving the issue, then it would be “necessary” for the coastal State to apply force (towage etc.). Force could also be considered “necessary” if the owners of the vessel are not acting in good faith, ignoring communications and inquiries and prioritising personal interests over rules that follow from LOSC.

5.3 Which vessel can be subjected to enforcement in LOSC art. 25?

An interesting question that can be posed is whether other vessels that the MASS is reliant upon, can become the subject of enforcement. This is especially relevant for the “master slave” operational method, or other methods in which a MASS or multiple MASS are guided or escorted by another vessel. In this scenario it can be problematic to call the “slave” vessel a distinct entity, since these MASS would be completely reliant on another vessel. It would be more natural, and more aligned with the legal framework, to interpret the “slave” ships as accessories or additions to the master vessel. This approach is taken for MAVs launched from other ships.⁸³

The ordinary wording of LOSC art. 25 (1) does not require the enforcement to be directed towards the actual vessel. The provision only stipulates that the coastal State may “prevent passage”. In which way the coastal State will satisfy this criterion is not provided. At the same time, LOSC art. 27 (1) explicitly mentions jurisdiction enforced on a “foreign ship”, which is a narrower definition, as it refers to a single entity. For traditional ships, these differences are not an issue, since enforcement usually has to be directed towards the vessel in question for it to be effective.

However, for MASS, one can envision a scenario in which the coastal State applies force to a “master vessel”, in order to enforce its laws on the “slave” MASS. The wording of LOSC art. 25 does not prohibit this on paper, as the act will be successful in preventing the non-innocent passage of the MASS. On the other hand, this can become more problematic if the coastal State decides to go further and arrest both the “master” and the “slave” vessel. In this situation, the coastal State would have fulfilled its goal to prevent non-innocent passage of MASS. Thus, an argument can be made that any further acts cannot be considered

⁸³ (McLaughlin 2011, 109)

“necessary”. This viewpoint would especially be relevant for situations in which the infringement of the MASS is due to a malfunction, in which the “master” vessel has lost control of the autonomous ship.

5.4 Enforcement grounded in LOSC art. 220

It follows from LOSC art. 220 (2) that the coastal State may “without prejudice to the application of the relevant provisions of Part II, section 3 [...] undertake physical inspection of the vessel relating to the violation”. The wording “vessel” indicates that there is no direct legal conflict from applying this provision to MASS, if one considers them as ships. It is the ship that is the object and not the physical crew members.

Furthermore, the State may “where the evidence so warrants, institute proceedings, including detention of the vessel, in accordance with its laws, subject to the provisions of section 7”.

The violation in question must be related to “laws and regulations” of the coastal State that are “adopted in accordance with this Convention or applicable international rules and standards for the prevention, reduction and control of pollution from vessels”. Likewise, it is essential for the enforcement of this pollution legislature, that multiple terms are satisfied. Firstly, the vessel must be “navigating in the territorial sea” of the State. Secondly, there must be “clear grounds for believing” that this violation occurred “during its passage” (LOSC art. 220 (2)). One cannot rule out the possibility of a malfunction or a software bug that may cause pollution. In this situation, it is plausible to think that it will be easy to find “clear grounds”, as autonomous vessels will likely collect, send and store data on its decisions and system usage.

LOSC art. 220 (3) specifies that the coastal State may in the same scenario “require the vessel to give information regarding its identity and port of registry, its last and its next port of call and other relevant information required to establish whether a violation has occurred”. For this however, the same entry terms as in LOSC art. 220 (2) must be fulfilled. This paragraph is more problematic than the second one, as the word “require” implies that the vessel has some sort of a decision-making mechanism. Normally, this would be the human crew. With a third-degree MASS, it is logical to assume that this would be the land station controller.

For fourth-degree MASS, it is more complicated. The natural assumption would be that the “provider of information” is the AI that is controlling the ship. However, if the pollution has happened due to an AI malfunction, then this provision loses its purpose, since there is a

chance that the AI will give out wrong information because of the malfunction. This paragraph can therefore be used to advocate for fourth-degree MASS to retain the ability to be fully monitored and controlled by a remote human operator. This would make it possible to give more accurate data in case of failure, and avoid total loss of vessel control.

One can also ask how “other relevant information required” shall be interpreted. The ordinary meaning of “relevant” and “required” indicates that there is a certain threshold, or a gradation scale that limits which types of data can be considered essential. As mentioned, a MASS would be able to provide lots of data which would be beneficial in these types of incidents. At the same time, a lot of unnecessary information can make it hard to filter out the important facts, which can in turn cause longer investigations. Large amounts of information would therefore not always be “relevant”, as the provision requires. There can also be outright wrong information due to malfunction. Additionally, it can be reasoned that some data could be redacted, if it is not “required” for the investigation. Redaction could for example be applied by private parties to data on secret patented technology, that the vessel utilises.

This leads to another issue, and that is who can provide and limit data. What if the manufacturer and the owner of the ship have colliding interests? The owner of the ship would rather provide all information about the pollution, in order to not be held responsible for the failure that has occurred. The manufacturer on the other hand, would also not want to be liable. Moreover, the manufacturer would want to avoid bad reputation and possible leaks of its technological secrets. Based on the ordinary meaning of LOSC art 220 (3), the owner of the vessel would have an obligation to provide necessary data. This must be enforced by the flag State (LOSC art. 220 (4)). But what if only the manufacturer has necessary data, and refuses to collaborate with the ship owner? From the LOSC perspective, the manufacturer and the ship owner would have to identify with each other in this case. The flag State can only apply the measures in LOSC art. 220 (4) to the “vessels”, meaning that the owner would have to account for the manufacturer’s decisions.

LOSC art. 220 (5) regulates the scenario in which the ship “has refused to give information” or when the “information supplied by the vessel is manifestly at variance with the evident factual situation and if the circumstances of the case justify such inspection”. The coastal State can in this situation initiate “physical inspection of the vessel for matters relating to the violation”, provided that there are “clear grounds” and that the violation resulted “in a substantial discharge causing or threatening significant pollution of the marine environment”.

This rule is different from the forementioned paragraph, since “significant discharge” is enough for enforcement. The ordinary meaning of discharge is that a form of substance is released, something that can occur if the automated ship systems miscalculate or malfunction in some way. As the provision implies, it is only necessary for this discharge to manifest in a threat.

The coastal State could then initiate a physical inspection, but the question is whether this would be of any benefit. First of all, the MASS must be designed in such a way which makes it possible for inspectors to get on board. Second of all, there must be an actual possibility of this inspection providing some sort of results. Based on the arguments made previously, it is probable that the manufacturer would keep as much information inaccessible from third parties as possible. In order for these physical inspections to serve their purpose, one would have to mandate all manufacturers to accommodate for access to necessary data stored on a MASS. This would have to be done individually by States in conformity with LOSC art. 220 (4).

It would be positive for the coastal State to have the same powers listed in LOSC art. 220 in relation to MASS, since the protection of the environment is a global priority. The application of this provision on autonomous vessels, could lead to manufacturers and ship owners taking their environmental responsibilities more seriously. A consequence of this is that better attention would have to be paid to design and emission standards, as no one would want to buy and use a MASS which would have a high risk of breaking the rules in LOSC art. 220.

6 The coastal State’s enforcement against MASS in innocent passage

6.1 LOSC art. 27 – criminal jurisdiction

The base rule in the law of the sea, which follows from CIL, is that the flag State has legislative jurisdiction over its ships and the occurrences on board of the vessel wherever it may be.⁸⁴ When the vessel is within a maritime zone or port of another country, the legislative jurisdiction is concurrent with the coastal State’s jurisdiction. The issue of concurrency will

⁸⁴ (Churchill, Lowe and Sander 2022, 473-474)

be discussed further in section 7.3. The flag State's jurisdiction will be limited by the rules of LOSC in regards to the coastal State's rights in the respective maritime zones.

LOSC art. 27 provides a legal basis for the coastal State to exercise criminal jurisdiction on board of a ship "passing through the territorial sea". The general rule is that this jurisdiction "should not be exercised", with the exception of examples given. The "should not" wording is a consequence of the flag State's jurisdiction rights mentioned above. LOSC art. 27 can only be applied if enforcement pursuits one of two goals. The first is the arrest of "any person" (LOSC art. 27 (1)). The ordinary meaning of "person" is that there must be a human on board that can be arrested. For third- and fourth-degree autonomous vessels, this would not be physically possible, as they lack crew on board. This would a priori rule out the application of this article with the goal of "arrest" in mind.

Simultaneously, LOSC art. 27 (1) provides an alternative goal for criminal jurisdiction, which is to "conduct investigation". This investigation must be done "in connection with any crime committed on board the ship during its passage". This term does not explicitly mention that there must be a person on board of the vessel. Despite this, one could argue that this follows implicitly from the obligation of the crime being committed on board during passage. As mentioned previously, the authors of LOSC did not take MASS into account during the creation of the Convention. Thus, the question is whether this text can only be interpreted as it was intended in the beginning, or if an evolutionary interpretation of the LOSC in this case is reasonable. An evolutionary interpretation does not necessarily have to clash with the original understanding of the provision, something that can be illustrated by a few examples.

For instance, a MASS can be used to smuggle illicit goods or people. Klein anticipates that MAVs will be used for this activity.⁸⁵ There is a good reason to make the same assumption for MASS, as criminals are constantly on the lookout for new and safer ways to transport illegal goods. In order to make the example of smuggling with MASS more problematic, one can envision the act of goods being placed on the ship while it is in the territorial sea of the coastal State. A RHIB can plant the goods or people on the MASS, that are then delivered to the port of a coastal State. From the perspective of a criminal, the lack of crew on MASS

⁸⁵ (Klein 2019, 260)

would make this form of smuggling attractive, as it eliminates the added risk of dealing with additional people that can compromise the operation.

The investigation by the coastal State would have to be done in connection to four types of acts listed in LOSC art. 27 (1). LOSC art. 21 (1) (d) explicitly mentions suppression of illicit traffic in drugs. LOSC art. 27 (1) (a) and (b) also allow enforcement when the “consequences of the crime extend to the coastal State” and when the “crime is of a kind to disturb the peace of the country or the good order of the territorial sea”. These conditions are usually satisfied in relation to smuggling.

The potential relevancy of LOSC art. 27 is further underscored by the second paragraph. It expresses that the first paragraph does “not affect” the right of the coastal State to “take any steps authorized by its laws for the purpose of an arrest or investigation on board a foreign ship passing through the territorial sea after leaving internal waters”. In other words, if a MASS has left the internal waters of a coastal State, then that said State can conduct an investigation even though the vessel is in innocent passage. This would be relevant if something illicit has been placed on the MASS while it was in port, and the national authorities have legal grounds to investigate this. LOSC art. 27 (2) would enable this act of enforcement, provided that the other terms in LOSC art. 27 are satisfied.

LOSC art. 27 (3) stipulates that for enforcement provided in paragraph one and two, the coastal State “shall” notify a “diplomatic agent or consular officer of the flag State before taking any steps”. The coastal State also has an obligation to “facilitate contact between such agent or officer and the ship's crew”. However, these acts must be requested by the “master” of the vessel. The terms “master” and “crew” have been discussed in section 2.3. If one interprets “master” as the remote operator, then it is this person that should be able to request notification of flag State representatives. However, this provision would effectively lose its purpose since the “crew” and “master” would be situated in a control centre away from the vessel, during enforcement.

6.2 LOSC art. 28 – civil jurisdiction

LOSC art. 28 (1) stipulates that the “coastal State should not stop or divert a foreign ship passing through the territorial sea for the purpose of exercising civil jurisdiction”. According to this provision, the jurisdiction must be “in relation to a person on board the ship”. The “person” term raises an issue similar to the interpretation of LOSC art. 27. Does this provision apply to a MASS that has no crew? If it does not apply, then does that entail that the provision

can be interpreted antithetically so that the coastal State can enforce any type of civil jurisdiction on MASS? These questions can be answered by referring to LOSC art. (2).

It follows from LOSC art. 28 (2) that the coastal State “may not levy execution against or arrest the ship for the purpose of any civil proceedings [...]”. This paragraph is only applied to “the ship”, in contrast to “person” in paragraph one, which makes it suitable for applying to MASS. The most logical use of LOSC art. 28 would therefore be that paragraph two and paragraph three are applied to MASS without crew, while paragraph one can be ignored. Another way to view LOSC art. 28 is that paragraph one has to be interpreted in light of the word “ship” in paragraph two and three, when applying to MASS without crew.

7 The flag State’s enforcement against MASS in the territorial sea

7.1 Flag State jurisdiction and the “genuine link” term

The main rule on the high seas is that all vessels shall sail under the flag of one state, and “be subject to its exclusive jurisdiction” (LOSC art. 92 (1)). The duties of the flag State follow from LOSC art. 94. Additionally, flag State jurisdiction is also valid in the EEZ through the application of LOSC art. 58 (2), but is more limited due to the “sovereign rights” of the coastal State in this zone. For the territorial sea, no such provision exists that explicitly gives the flag State special rights that are as strong as the coastal State’s rights. However, as mentioned in section 6.1, in CIL the flag State has jurisdiction for actions on board the ship and of the ship itself. Flag State jurisdiction over the ship and its actions is, however, subject to the coastal State’s rights in the territorial sea.

LOSC art. 91 (1) stipulates that “[e]very State shall fix the conditions for the grant of its nationality to ships, for the registration of ships in its territory, and for the right to fly its flag”. The flag State also has the obligation to issue documents to the vessel “which it has granted the right to fly its flag” (LOSC art. 91 (2)). The nationality of the ship is “of the State whose flag they are entitled to fly”, and there must also “exist a genuine link between the State and the ship” (LOSC art. 91 (1)).

The ordinary meaning of “genuine link” is that there must be a sufficient enough connection between the flag State and the vessel. Particularly instructive are the judgements in M/V

Saiga (No. 2) and *M/V Virginia G*⁸⁶ of the ITLOS, which are considered to be authoritative.⁸⁷ The facts in both of these cases were that tankers registered in flags of convenience States (St Vincent and Panama, respectively) supplied fuel to vessels fishing in the EEZ of the enforcing States (Guinea and Guinea-Bissau, respectively).⁸⁸ One of the legal questions was therefore whether there was a “genuine link” between the tankers and their flag States, since the owners were not of the flag State nationality.

In the *M/V Saiga* (No. 2) case ITLOS noted that the granting of nationality and registration is a “matter of domestic law”⁸⁹, meaning that the conditions must be defined in the legislation of the flag State. Moreover, the Tribunal held in its conclusion that the purpose of the “genuine link” requirement in the Convention between a ship and its flag State is “to secure more effective implementation of the duties of the flag State, and not to establish criteria by reference to which the validity of the registration of ships in a flag State may be challenged by other States”.⁹⁰ This statement was reaffirmed in the *M/V Virginia G* case.⁹¹

A few particular remarks by ITLOS in the *M/V Virginia G* made this issue more difficult. The Tribunal stated that the “genuine link” requirement in LOSC art. 91 (1) shall “not be read as establishing prerequisites or conditions to be satisfied for the exercise of the right of the flag State to grant its nationality to ships”.⁹² Furthermore, ITLOS stipulated in the same paragraph that the meaning of “genuine link” is expressed in the contents of LOSC art. 94 (1). This provision obliges every State to “effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag”. The ordinary meaning of this provision is that the flag State has the responsibility to make sure that its vessels comply with international rules and standards.

Churchill, Lowe and Sander are critical of the ITLOS interpretation in the *M/V Virginia G* case and argue that “genuine link” should be understood as “capacity” and not an “obligation” to exercise effective jurisdiction and control. This would entail that the flag State must have

⁸⁶ *M/V Virginia G (Panama v. Guinea-Bissau)* [2014] ITLOS Rep. 4

⁸⁷ (Churchill, Lowe and Sander 2022, 468)

⁸⁸ (Churchill, Lowe and Sander 2022, 468)

⁸⁹ *M/V Saiga* (No. 2) para. 63

⁹⁰ *M/V Saiga* (No. 2) para. 83

⁹¹ *M/V Virginia G* para. 112

⁹² *M/V Virginia G* para. 110

“the mechanisms necessary to undertake the surveying, certification and inspection of its ships required by international law”.⁹³ Examples of such mechanisms in the M/V *Virginia G* case were technical certificates, the conduct of annual safety inspection and a continuous synopsis record in accordance with SOLAS. For ITLOS, these actions were enough to conclude that the flag State exercised effective jurisdiction and control necessary for “genuine link” to exist.⁹⁴

Nonetheless, ITLOS also suggested that the term of “genuine link” must be fulfilled “at the time of the incident”.⁹⁵ The problem with this is that there would be a need for a constant examination of whether “genuine link” is fulfilled. Churchill, Lowe, and Sanders therefore provide the critique that the flag State must prove that it has capacity to exercise necessary jurisdiction at the time when nationality is given, for a “genuine link” to exist.⁹⁶

Applying the “genuine link” term on MASS can be quite problematic. Because of the functional intricacies, the remote controller for a MASS can be in another country than the flag State. In this scenario, one can therefore ask if there would be a “genuine link” between the flag State and the MASS. On the one hand, there is the potential that the flag State would not be able to exercise its jurisdiction for controlling the remote operator in another State. This would be due to the territorial sovereignty of each State. As a consequence, the jurisdiction could be denied by the State where the remote controller is based. The fact that the control over the remote operator will not be absolute by the flag State, can be an argument against the fulfilment of the “genuine link” requirement. Furthermore, it can be reasoned that the conduct of physical checks of the whole vessel, including the remote operator, is such a substantial part of its operations that it should be compulsory for the “genuine link” requirement to be satisfied.

On the other hand, the “genuine link” condition is a form of a general assessment, as illustrated above. The obligations that are related to various paperwork could still be fulfilled and provide the flag State with necessary control jurisdiction. Moreover, the ability to have the remote controller in different locations is a technical speciality of MASS. For instance,

⁹³ M/V *Virginia G* para. 113

⁹⁴ (Churchill, Lowe and Sander 2022, 470)

⁹⁵ M/V *Virginia G* para. 114

⁹⁶ (Churchill, Lowe and Sander 2022, 470)

remote control can be transferred because it is warranted by navigational safety. This is an argument against treating the location of the remote controller as a relevant moment in the “genuine link” test. Provided that the MASS is originally controlled from the flag State, the rule about the “time of the incident” would also be highly problematic if control is transferred briefly. If one were to imply that the control centre must always be in the flag State for a “genuine link” to exist, then a brief transfer of operations could result in an unreasonable outcome of this link disappearing. Based on these arguments, there could still be a “genuine link” between flag State and the vessel, if the remote controllers were located in a third country. The flag State must, however, still exercise its jurisdiction as with traditional vessels in terms of the necessary paperwork.

Lastly, it must be noted that the absence of a “genuine link” and the consequences of this are not regulated by the LOSC.⁹⁷ Moreover, LOSC art. 94 *cannot* be used by a State as basis to refuse recognition of “the right of the ship to fly the flag of the flag State”.⁹⁸ Provided that there would not be a “genuine link” between a MASS and the flag State, then then this could not be used as legal ground to deprive the vessel of its nationality. The discussion in regards to MASS is therefore, based on the current understanding, mostly theoretical in nature. The relevance of this debate is further diminished by potential new IMO instruments for MASS. It is plausible to assume that they would account for the remote operator, and these relevant instruments would be used as *lex specialis* in a “genuine link” test.

7.2 Enforcement of technical aspects

As mentioned above, LOSC art. 94 (1) provides the flag State with a duty to “exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag”. In relation to safety at sea, LOSC art. 94 (3) mentions different aspects. LOSC art. 94 (3) (a) includes “the construction, equipment and seaworthiness of ships”. In regards to the ordinary meaning, these criteria are not as problematic, since “seaworthiness” does not imply the need for manning. The same would apply to LOSC art. 94 (c). In Hague–Visby Rules⁹⁹ art. 3 “seaworthiness” is a form of a due diligence rule which provides for flexibility.

⁹⁷ M/V *Saiga* para. 80

⁹⁸ M/V *Saiga* para. 82

⁹⁹ International Convention for the Unification of Certain Rules of Law relating to Bills of Lading 25.08.1925

However, in these rules, manning is also a part of the seaworthiness aspect. For MASS, the proper threshold for “seaworthiness” must be elaborated, since the vessel does not have a traditional crew.

The ordinary meaning of LOSC art. 94 (3) (b) is more challenging for autonomous vessels, as it seeks to regulate the “manning of ships”. Choi and Lee are of the opinion that “remote operators should be required to satisfy the same seaworthiness and competence requirements as applied to the onboard crew”.¹⁰⁰ They also point out that depending on the characteristics of the MASS, the seaworthiness criteria might differ “from those applied to conventional manned vessels”.¹⁰¹ A less controversial difference would be related to the quantity of traditional crew, compared to the number of remote operators. It is possible that there would be fewer remote operators necessary than traditional crew members, in order for a MASS to operate safely.

There would most likely be a wide discrepancy in the technologies used for MASS. What the different flag States will perceive as “necessary to ensure safety”, as LOSC art. 94 (3) stipulates, could therefore vary. For this reason, LOSC art. 94 (4) specifies that that the States would “be required” to conform to “generally accepted international regulations, procedures and practises”. As mentioned previously, the IMOs conventions would satisfy this criterion. The flag State would have to enforce the technical rules that follow from LOSC art. 94 on MASS, as it does with its traditional vessels.

7.3 The flag State’s enforcement in relation to the remote controller and the remote operator State

The aspect of remote controls makes the flag State jurisdiction substantially more relevant in the territorial sea. For traditional vessels, the physical presence of crew makes it impossible for the flag State to intervene in the territorial sea of the coastal State, without its consent. In contrast, a control station can be located in different countries, including the flag State. In the territorial sea, the flag State jurisdiction over the remote operator would overlap with the jurisdiction of the coastal State over the physical vessel. If the remote operator is in the flag

¹⁰⁰ (Choi and Lee 2022, 452)

¹⁰¹ (Choi and Lee 2022, 452)

State, then it could be asked if the flag State would either have an obligation or a right to intervene, while the vessel is in the territorial sea of the coastal State.

In the LOSC preamble paragraph 4 it is stipulated that the member nations recognize “the desirability of establishing through this Convention, with due regard for the sovereignty of all States, a legal order for the seas and oceans which will facilitate international communication, and will promote the peaceful uses of the seas”. The reference to “due regard” signals that compromises to sovereignty can be made, if the mentioned values have to be protected. Simultaneously, the States shall not exercise their “jurisdiction and freedoms” in manner which would “constitute an abuse of right” (LOSC art. 300).

The issues of overlapping jurisdictions can be illustrated by different situations. In the first scenario the vessel of the flag State A is conducting innocent passage in the territorial sea of the coastal State B. During passage, State A enforces its laws in relation to the control centre within its own borders. On the basis of territorial sovereignty, the flag State would have the right to enforce its laws on the control station in its own territory. The flag State jurisdiction that follows from CIL, would also grant the flag State enforcement rights over the control centre in its borders, as the remote operators would constitute a part of the ship. There would be no legal conflict if the rights of the coastal State are not affected while this enforcement is conducted.

However, this issue gets more complicated when the vessel breaches innocent passage. In this case, the coastal State B decides to enforce its laws in accordance with LOSC art. 25. The flag State A decides to do the same, and enforces its right on the remote operators in the control station. Perhaps the motive of flag State A is to stop the vessel from being arrested by the coastal State B. In this situation, it would be the coastal State’s sovereignty versus the rights of the flag State. If the flag State is purposefully using its jurisdiction to override the coastal State’s sovereignty, then the coastal State should be in its right. This can be reasoned by the fact that the coastal State’s sovereignty in the territorial sea explicitly follows from LOSC art 2 (1), and would therefore be above CIL. From the perspective of legal coherence, this is also logical: the flag State would not be able to enforce its laws on the physical vessel when it is in the territorial sea of the coastal State. Moreover, the flag State’s conduct would also be a breach of the good faith criterion in LOSC art. 300.

A point can be made that the flag State can have an obligation and not just the right to intervene, in the case that innocent passage is breached. Provided that the coastal State informs the flag State of the issue, and the flag State does not aid the coastal State, then this can be interpreted as a form of infringement of the coastal State's sovereignty. For instance, in a possible scenario the remote controls on land can be hijacked. It can be reasoned that the flag State would not just have the right, but an obligation to intervene in this case. This could be attributed to the severity of the situation. If human lives are at stake, then as mentioned in section 5.1.2, the right to life can be used as an argument for existing obligation. However, for less dire situations, it is harder to advocate for the flag State having an obligation to intervene. It is the coastal State's objective to enforce its own laws in its territorial sea, and these national laws are bound to its territory.

In in the third example the State C will be introduced. The vessel of flag State A breaches innocent passage in the territorial waters of coastal State B. The vessel is controlled by a remote operator in the flag State C. In this scenario, there would be no right for the flag State B to enforce its laws on the control station, as it would be impossible due to territorial sovereignty of State C. At the same time, State C would not have any relation to the vessel through the LOSC, but it would have the necessary national jurisdiction to intervene. Perhaps it could be argued that the remote controller State should have responsibilities of its own, in relation to the ship. If human lives are endangered, one could advocate that the remote controller State should also be obliged to intervene based on the same arguments applied to the flag State. However, for other matters, the flag State should bear the consequences of allowing the registration of MASS with remote controls. If the control station does not abide by the requests of either the flag State or the coastal State, then these States must enforce its laws on the actual vessels in their respective maritime zones.

8 Solutions to the legal uncertainty

8.1 Interpretation

As it has been noted in the beginning of this paper, MASS as a technological phenomenon is still in its early stage. The identified issues regarding legal sources raise an important question, and that is how the inconsistencies should be resolved. In national law this would not pose a big problem, as there would be a compulsory legislative procedure. However, in international law, this question is of utmost importance. All States are sovereign and are primarily bound by CIL and the treaties that the States have signed willingly. Furthermore,

there is no international authority that can enforce laws, if a State decides to act against CIL or the treaties it has signed. The means by which the law evolves over time can therefore play a role in its effectiveness.

One of the solutions to the legal conflicts is to apply evolutionary interpretations where it is suited. In order for the interpretations to be legally binding, they have to be done by international courts and tribunals that have jurisdiction to interpret the LOSC (LOSC art. 287 (1)). The ICJ has previously stated that when a treaty has been “entered into for a very long period or is “of continuing duration”, the parties must be presumed, as a general rule, to have intended those terms to have an evolving meaning”.¹⁰² By continuing duration, it is meant that the goal was to create a “legal régime characterized by [the Treaty’s] perpetuity”.¹⁰³ LOSC is a treaty that is intended to be of continuing duration. However, it is more questionable if all involved parties wanted that all of the terminology should have an evolving meaning.

It could be argued that an “evolutionary” interpretation is more likely to be accepted by States, as it is advocated by technological changes. This would be different than simply a “broad” definition, which could be motivated by other factors. For instance, it was mentioned in section 2.2 that “seaplanes” were regarded as vessels in COLREG. This would be a broad definition, as the differences between a plane and a maritime vessel are too substantial.

A general principle in procedural law is that only the affected parties are bound by the tribunal’s decision. Statutes of the respective tribunals often include a rule on the obligatory enforcement of these decisions. For example, the ITLOS Statute art. 39 stipulates that the decisions of the Chamber “shall be enforceable in the territories of the States Parties in the same manner as judgments or orders of the highest court of the State Party in whose territory the enforcement is sought”. Furthermore, the interpretations done by courts like ITLOS and ICJ can affect the States indirectly, since an interpretation can become a precedent, and used in future cases.

On the other hand, some parties do not accept the binding nature of decisions by ITLOS and other tribunals on matters like jurisdiction, despite being members of LOSC.¹⁰⁴ For States,

¹⁰² Dispute regarding Navigational and Related Rights (*Costa Rica v. Nicaragua*), Judgment, I.C.J. Reports 2009, p. 213 para. 66

¹⁰³ (*Costa Rica v. Nicaragua*) para. 67

¹⁰⁴ *M/V Arctic Sunrise* para. 5

leaving the interpretations to international courts is not always ideal. Some States are reluctant to transfer jurisdiction to international courts over matters that concern their interests. This is because the interpretation of a tribunal can be based on other principles compared to the economic or political pursuits of affected governments. These principles can potentially play a larger role in the decision process than the States would desire.

There is a positive element to legal developments through interpretation, which is that the law evolves more gradually. Another consequence of the case-focused approach is that the most prominent issues get resolved. The benefit of this is that the development of the law does not go further than necessary, as the tribunals only deal with problems that have been requested. Another aspect of judge-based law, is that there are usually two parties involved, and only one of these parties is chosen to be right. The court provides a neutral view and an explanation for its decision, which gives the winning interpretation stronger legal authority. It is not a reflection of a compromise between two States, but a definitive answer on who is in the right and who is in the wrong.

At the same time, the courts can also adopt a different perspective from an established precedent, but this would have to be reasoned. The fact that precedents can be set aside or modified, is a point against incorporating MASS into the legal order through merely interpretations. A new type of vessel like MASS would need a rigid and stable legal basis in order for private actors to be interested in it. If the practice related to these ships becomes too complicated, then this would result in uncertainties that could slow down the adoption of MASS.

Examples of this could be that tribunals change their understandings of words like “ship” over time. Another problem can arise if courts distinguish between cases too often and create separate legal rulesets for various scenarios. Then again, a more focused approach that takes into account the specific facts of the dispute would seem more just to the parties involved. However, this can have a negative impact on the legal order as a whole. The more exceptions and rules the judges introduce, the more room there is for States to take advantage of this and stretch the boundaries even further. This can be especially problematic in international law, where there is no “police” that can enforce the “correct” approach.

8.2 Amendments to LOSC

The legal grounds for making amendments to the LOSC follow from art. 312-313. Even through a simplified procedure, it is required that no State Party objects to the amendments

(LOSC art. 313 (2)). All States have different interests, which makes it next to impossible for everyone to agree on the same proposition. Multilateral treaties are therefore hard to negotiate, and this process is time consuming.¹⁰⁵ This is echoed in reality, since changes to current LOSC never have been made.

LOSC is based on compromises made between different governments. The Convention was passed after long negotiations and States giving up grounds on various issues. Perhaps similar negotiations can take place for discussing the issue of autonomous vessels. However, this issue must be substantial enough for governments to be interested in making amendments to the Convention. There must also exist a need to resolve the autonomous issue specifically through LOSC and not through other conventions. Thus, it can be questioned if the forementioned issues regarding MASS in the Convention really are in need of the LOSC being changed, as this is the hardest achievable solution.

On the other hand, LOSC has a part that is entirely dedicated to the protection and preservation of the marine environment and a part about marine scientific research. If there is room for these issues, then a point can be made that autonomous vessels should also have a section dedicated to it. Simultaneously, aspects related to MASS uncover more general questions that are not answered by the Convention. For instance, from a perspective of legal method, it would not be logical to confine the definition of “ship” to a part about MASS. What constitutes a “ship” is relevant for the Convention as a whole. This would require the amendments to go further than merely the creation of a special part for MASS. In turn, this could make States even more reluctant to pass amendments to the Convention, as the issue of MASS would spark other, general debates that would have to be addressed.

There is also an issue related to terminology and the legal hierarchy of the conventions. As mentioned in the beginning, LOSC is widely considered to be a “constitution of the oceans”. In this sense, LOSC helps with the establishment of uniformity in the law of the sea. If LOSC, which has the main authority, does not directly address MASS, then that could potentially lead to other smaller conventions adopting definitions that are in conflict with each other. This can occur if some States decide to implement a special convention for MASS, while other conventions like SOLAS get amendments, and these two would have clashing definitions.

¹⁰⁵ (Mgeladze 2023 , 87)

MASS as a technology also has the potential to bring States together, albeit this is debatable since not everyone would have the financial means to utilise these ships to their advantage. However, there are certain economic benefits related to the use of autonomous vessels as mentioned in section 2.1. Furthermore, all States would be interested in that this technology works in the most secure ways. Perhaps these financial factors could substantiate that States would be more eager to accept amendments related to MASS. Provisions related to MASS would also not be as controversial as for example articles related to territorial delimitation.

Furthermore, private companies could have strong interests in regulations related to MASS. These companies operate internationally, and have major influence on politicians worldwide. Additionally, they all share similar profit-oriented goals. These actors would be interested in a framework that provides clear rules and obligations, and that would also have the same legal weight and authority as other provisions in LOSC. A collective effort of private parties could therefore push the member States to pass amendments that would regulate and pave the way for MASS usage. On the other side, it is logical to assume that not all shipping companies are interested in MASS technology.

8.3 New convention

An entirely new convention can also be created. The positive aspect of this solution is that it would be easier than making amendments to LOSC, while providing a stronger legal authority compared to an interpretation by an international court or tribunal. On the other hand, a new convention would not have the same legal weight as the LOSC. It is also unlikely that it will receive the same number of ratifications. A point has been made that the amount of flag States that would be needed to ratify a new convention, can create a barrier for MASS. It is “typically 25 flag states”, and their combined tonnage must be 50-60 % of the world fleet tonnage.¹⁰⁶

At the same time, major countries like the United States and Turkey are not part to LOSC. In this sense, a separate convention could potentially be more attractive to these non-member States, and in this way be more beneficiary compared to amendments to LOSC. One can assume that they would be more willing to participate in a separate convention only for autonomous vessels. This seems easier to accept than abiding to LOSC that they are not part

¹⁰⁶ (Batalden, Leikanger and Wide 2017, 2)

of, or interpretations made by a court they do not give power to. Moreover, LOSC is a “package deal” which entails that it is impossible to only adhere to certain provisions of the Convention. If a State wants to sign and ratify LOSC, all rules in it must be followed.

Alternatively, one could argue that nations like the United States or Turkey already have strong international political influence. They would therefore not be very interested in a new convention related to MASS, since they have other political and economic instruments that aid them in promoting their goals. A point can therefore be made that a new convention for MASS would be more relevant for smaller States, that lack the same financial and political tools of influence as major powers.

A new convention would also make it easier to prescribe obligations for manufacturers and operators of control stations. As mentioned previously, the unique characteristics of MASS would make the role of the control station operator crucial in third-degree autonomy. For the fourth-degree autonomy, the developers of the software would also have a major role in how the vessel functions. It would for instance be relevant to address whether the State of the remote operator, also should have some sort of rights or obligations in relation to the vessel. In relation to remote controls, the manufacturer would similarly be to some extent involved in the functioning of a third-degree MASS. Moreover, there are strong reasons for establishing separate rules for an AI operator and the manufacturer, as these fourth-degree autonomy vessels could theoretically operate without external control stations. A new convention could therefore be used to prescribe safeguards and delegate liability between all involved parties, something that would be harder to achieve through interpretations or amendments to LOSC.

At the same time, extensive provisions in a MASS convention could be a turn off for governments. One cannot rule out that there will be “sanctuary jurisdictions” where the manufacturers might locate their production for the purpose of avoiding imposed restrictions and obligations imposed by a MASS convention.

9 Conclusion

The implementation of autonomous vessels, including MASS will inevitably create challenges for the existing law of the sea instruments. These issues will have to be addressed for the purpose of establishing required legal clarity for investment and use of these vessels. As with other fields where new technology is introduced, legal uncertainty can become a major risk and a barrier for the widespread adoption of the technology.

In order for States to fully know the extent of their enforcement jurisdictions in relation to MASS in the territorial sea, plenty of questions must be answered. First and foremost, there must be an international consensus on whether MASS can be regarded as “ships” in LOSC. This would also include answering the question of whether MASS must be treated in a special manner that is reminiscent of nuclear-powered ships. Additionally, the terms “crew” and “master” should be defined in relation to autonomous ships. After the problems related to terminology have been addressed, other inconsistencies must be looked into.

For example, there is a need for elaboration on *what* can be considered as acceptable rules and regulations in regards to MASS (LOSC art. 21). The importance of this provision cannot be underestimated, as it has a direct consequence for which laws the coastal State can pass and enforce on MASS in its territorial sea. One can also imagine that this will become relevant quickly, as States would want to limit and streamline the technology in its early stage. The reason for this is that every technology takes time to improve, and that it is impossible to discover all possible issues without MASS being put into practical use. Furthermore, traditional vessels would have to get used to encounters with this technology. Thus, it must be asked which national laws can be passed to secure the operation of traditional vessels, and if this legislature will be in conformity with the relevant provisions in LOSC.

The next phase would be to determine *if* and *how* enforcement can be conducted against a MASS. The coastal State’s ability to take enforcement measures against a MASS in non-innocent passage, is not in and of itself an issue. The question lies in determining the scope of this enforcement and measures that can be viewed as acceptable in light of the crew being absent. The physical measures in regards to pollution from MASS must also be explored in the light of LOSC art. 220. Moreover, the possible relevancy of LOSC art. 27 can be discussed. In theory, MASS can be used for nefarious purposes just as any other normal ship without MASS directly breaching its innocent passage. This would be more complicated, but possible if the vessel is used for smuggling. The role of LOSC art. 28 is however, more limited as only paragraph two and three can be taken into consideration as mentioned in section 6.2.

Lastly, one can ask *who* should be able to enforce laws on MASS in the territorial sea. At a glance, this question does not pose a substantial difficulty, since the coastal State has full sovereignty in its territorial waters. However, the flag State jurisdiction has a major implication for this topic. The rights and obligations of the flag State in relation to the remote

operator within its borders, have to be clarified, when the vessel is in the territorial sea of the coastal State. The same must be done for the remote operator State.

How these challenges should be tackled is a tricky question. The international legal order is fragmented and lacks the same coherent legislative process as a national State. Since countries generally have conflicting interests, what constitutes the “best” solution is merely subjective. The thesis author’s view is that the best outcome would probably be a combination of new instruments (soft law and hard law), and interpretations of the LOSC done by ITLOS or ICJ. Lesser inconsistencies and the application of general clauses like “necessary” can be elaborated and dealt with through international adjudication. The incorporation of MASS into the maritime legal order should be primarily done by the UN’s Tribunals ITLOS and ICJ, something that is of importance when dealing with an issue in which large corporations will be involved. Arbitral Tribunals are more prone to being affected by private actors, as they have a more flexible organizational framework.

It cannot be understated that MASS are an important technological advancement. However, there is not exactly a strong need for amendments to be made to LOSC because of these vessels. This perspective makes sense when one treats LOSC as a “constitution”.

Constitutions are rarely amended even when technological advancements make it reasonable. LOSC has also not been amended, as mentioned in section 8.2. The main goal of a constitution is to provide the basis and framework of values, that can be further clarified in more specific documents that build on the premisses established in the constitution. This view is shared by Mgeladze who argues that LOSC shall “provide basic principles, so-called starting points, and a general concept of threats”.¹⁰⁷

Although this outcome is rather positive, the reality will most likely be different. As with any other fields of international law, States do not always accept or adhere to new legal standards. An example of this is Myanmar which has ratified and signed LOSC. Despite this, the State has established a 200-mile-long straight baseline. This is a clear violation of the ruleset provided in LOSC. Another example is the Australian practice of compulsory pilotage in the Torres strait, which is a breach of the right to innocent passage.¹⁰⁸ In legal literature, an argument has been made that the “the escalation of conflict between coastal State control and

¹⁰⁷ (Mgeladze 2023 , 88)

¹⁰⁸ (Breide and Saunders 2008, 10)

freedoms and rights of user States is unlikely to be reversed” in connection to innocent passage.¹⁰⁹ The discourse on the remote operator and overlapping jurisdictions would likely become a part of this escalation.

In relation to MASS, there would be a lot more “grey” legal areas where governments would have colliding views. As mentioned previously, the use of MASS would not only pose security challenges, but financial ones since vessel owners historically recruit crews from developing nations due to low costs. Therefore, not all States would welcome automation and the loss of jobs. Some countries might outright ignore the impending international ruleset on MASS. This could be done simply from the perspective that MASS would not be considered as “ships” by the State. Thus, the application of the LOSC’s innocent passage rules in the territorial sea of the coastal State on MASS, would be hindered. Other countries may only respect the parts which are beneficiary to their interests. Either way, legal clarifications will have to be made by international tribunals or conventions, in order for a widespread adoption of MASS to take place.

A staple of the first industrial revolution was the creation of the steam engine. From 1840 up to 1875 the use of this technology was rather small. Many of the early experimental steamboats “were very slow” and could not be used in narrow waterways.¹¹⁰ Ships with sails were therefore still a good, if not a better alternative. However, after 1875 the pure sailer was disappearing as the technology progressed. By the turn of twentieth century sails were no longer commercially used for passenger ships. This change was gradual, but every nation was forced to keep up with the progress despite centuries of experience with sail vessels. One cannot rule out that something similar will happen with the use of MASS. To remain competitive, the sceptics might have to be keep up with the innovations and the legal order that will be shaped by the strongest actors.

¹⁰⁹ (Hebbar 2020, 254)

¹¹⁰ (Stilwell, et al. 2024)

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