

## Policy-Oriented Analysis on the Navigational Rights of Unmanned Merchant Ships

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## Abstract

The emergence of unmanned merchant ships will challenge the existing international shipping law and practice. Many legal issues surrounding unmanned ships under international law await clarification, and the issues involving navigational rights are at the top of the list. This article aims to examine the navigational rights of unmanned merchant ships under the established international regulatory framework for global shipping. We find that many States, particularly the coastal States, may hold a very precautionary view towards the international navigation of unmanned ships, due to the uncertainties of safety and reliability and the questions about seaworthiness and manning, as well as the high probability of ship-source pollution incidents. Hence, we suggest that, firstly, the International Maritime Organization should take a more proactive role in interpreting and implementing the existing rules on international navigation; and secondly, that the flag States, coastal States and port States should collaborate and consider filling in the existing regulatory gaps so as to facilitate the development and use of unmanned merchant ships and justify their navigational rights.

**Keywords:** *Unmanned merchant ships, UNCLOS, navigational rights, IMO, flag/port/coastal States*

## 1. Introduction

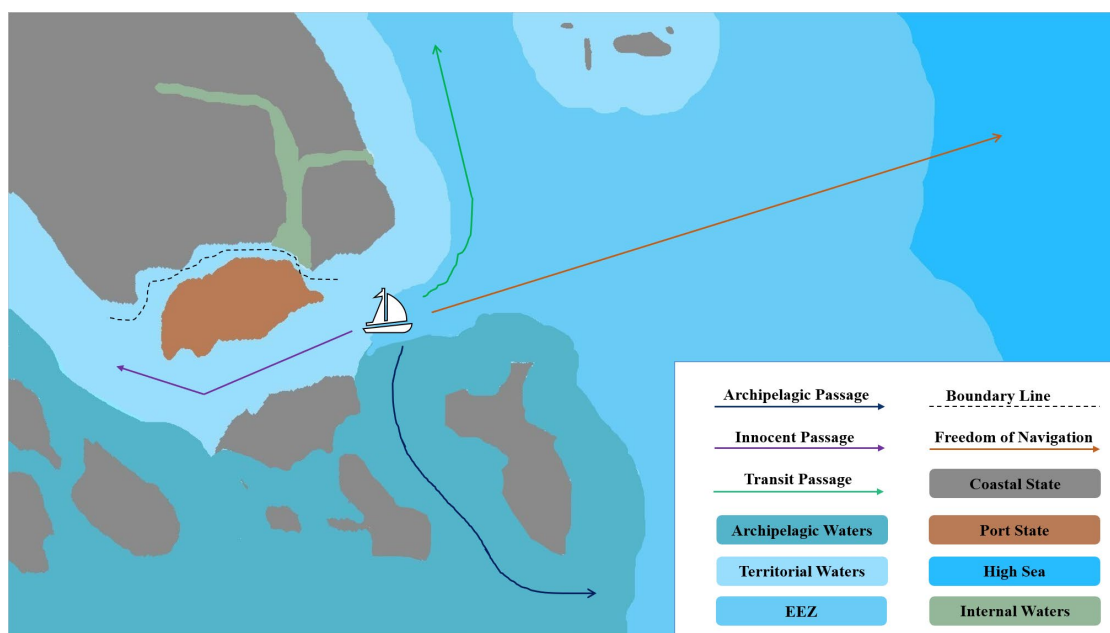
An unmanned merchant ship is a type of ship that acquires a high level of autonomy (Zhu and Xing 2019). With the application of wireless communications technology and remote-control systems (Rødseth 2012), that no crew will be on board the ship will likely become a reality. Norway (World Maritime News: Norway), Finland (World Maritime News: Finland), Australia (AMSA 2018), and China (People's Daily) have designated marine water areas for testing autonomous and unmanned ship technology. Moreover, the world's first unmanned commercial shipping operation was carried out on 7 May 2019 from Essex to Ostend, Belgium (BBC 2019).

Undoubtedly, the emergence of unmanned merchant ships will bring changes, together with challenges, to existing international shipping law and practice. One of the primary questions faced by public stakeholders (international organizations and sovereign States) concerns the navigational rights of unmanned merchant ships. Currently, the global shipping practice is mainly governed by the United Nations Convention on the Law of the Sea (UNCLOS), which has established four rights of navigation, including innocent passage - territorial sea, transit passage - international strait, archipelagic sea-lanes passage - archipelagic waters, and freedom of navigation - the EEZ and the high seas (Figure 1). The basic tenet of the right of navigation is to protect the freedom of movement of ships considering the rights and jurisdiction of different State parties (Figure 2 and 4) in different legal waters (Figure 1).

It may be questioned as to whether unmanned merchant ships could legally navigate in different jurisdictional waters under the existing regulatory framework. In particular, the following questions may attract a lot of discussions in this regard: Who would have jurisdiction over unmanned merchant ships? Where can unmanned merchant ships navigate? What may be the legal barriers to the navigation of unmanned ships? Therefore, it is the primary aim of this article to carry out a policy-oriented analysis of the navigational rights of unmanned merchant ships under the UNCLOS and other relevant international regulations, and to then provide constructive policy recommendations for the relevant public stakeholders to consider.

Figure 1 Navigational rights of ships in different waters

(The picture is painted by the author to demonstrate different navigational rights acquired by ships by roughly referencing to jurisdictions surrounding the Malacca Strait.)



## 2. International regulatory framework for unmanned merchant ships

For discussing the issues about the navigational right of unmanned merchant ships, it is essential to investigate the international regulatory framework for global shipping and to identify the provisions that may apply to unmanned merchant ships.

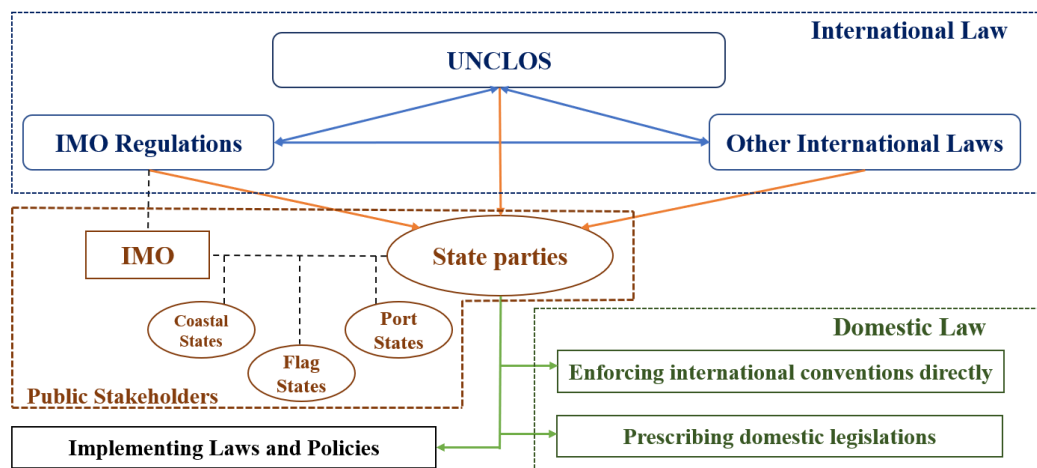
### 2.1 International regulatory framework for global shipping

The UNCLOS establishes a comprehensive legal framework for the governance of the seas and oceans, and is considered as “one of the most comprehensive and well-established bodies of international regulatory norms in existence” (Becker 2005). Under the UNCLOS, the ocean is divided into different legal waters, and the regulatory rights and obligations are accordingly apportioned to different State parties. At the same time, for States that have not ratified or acceded to the UNCLOS, the principles of the Convention may also be considered as customary international law and thus can be applicable (Treves 2017).

The International Maritime Organization (IMO) has adopted over 50 international shipping regulations and conventions covering safety and environment standards on shipping etc, such as the International Convention for the Safety of Life at Sea (SOLAS), and the International Convention for the Prevention of Pollution from Ships (MARPOL). It is widely agreed that “the competent international organization” stated in articles 22, 41, 53 and 60 of UNCLOS means the IMO (Walker 2012, p. 138), and the “generally accepted international standards established by the competent international organization” in article 60 indicates the IMO regulations, which can be applied in interpreting the provisions of the UNCLOS (Mihneva 2005; Secretariat IMO 2008).

Under most circumstances, State parties that have ratified the UNCLOS and IMO conventions are obliged to comply with them (Ringbom 2019), and thus flag States or shipping States, coastal States and port States must enforce the international convention directly or prescribe enforceable domestic legislation reflecting the international legal obligations (Figure 2).

Figure 2 Regulatory Framework on Global Shipping



## 2.2 Provisions in the UNCLOS and unmanned merchant ships

As the “Constitution for the Oceans” (CMI 2016, p. 3), the UNCLOS has established legal rules on global shipping and international navigation, including the legal status of a ship, rights of navigation, distribution of the jurisdictions, marine environment protection, and others. These rules will be the core sources for doctrinal analysis in this paper. Provisions in the UNCLOS on merchant ships can be categorised according to the following different questions (see Figure 3).

Figure 3 Provisions in UNCLOS on Merchant ships

**Provisions on jurisdictions over merchant ships**  
*Who has jurisdiction over unmanned merchant ships?*

Article 94	Duties of the flag State	Flag State Jurisdiction
Article 8 Article 25 Article 211	Internal waters Rights of protection of the coastal State Pollution from vessels	Jurisdiction of the Port State over Foreign Ships
Article 2 Article 21 Article 27 Article 28 Article 33 Article 56 Article 73 Article 211	Legal status of the territorial sea Laws and regulations of the coastal State relating to innocent passage Criminal jurisdiction on board a foreign ship Civil jurisdiction in relation to foreign ships Contiguous zone Rights, jurisdiction and duties of the coastal State in the EEZ Enforcement of laws and regulations of the coastal State Pollution from vessels	Jurisdiction of the Coastal State over Foreign Ships
Article 109 Article 110 Article 111	Unauthorized broadcasting from the high seas Right of visit Right of hot pursuit	Jurisdiction in the High Sea

**Provisions on merchant ships' right of navigation**  
*Where can unmanned merchant ships navigate??*

Article 17 Article 18 Article 19 Article 21 Article 24 Article 25	Right of innocent passage Meaning of passage Meaning of innocent passage Laws and regulations of the coastal State relating to innocent passage Duties of the coastal State Rights of protection of the coastal State	Innocent Passage: Territorial Sea
Article 38 Article 39 Article 42 Article 44	Right of transit passage Duties of ships and aircraft during transit passage Laws and regulations of States bordering straits relating to transit passage Duties of States bordering straits	Transit Passage: International Strait
Article 52 Article 53 Article 54	Right of innocent passage through archipelagic waters Right of archipelagic sea lanes passage Duties of the archipelagic State and laws and regulations of the archipelagic State relating to archipelagic sea lanes passage	Archipelagic Sea Lanes Passage: Archipelagic Waters
Article 55 Article 56 Article 58 Article 87	Specific legal regime of the exclusive economic zone Rights, jurisdiction and duties of the coastal State in the EEZ Rights and duties of other States in the exclusive economic zone Freedom of the high seas	Freedom of Navigation: EEZ and High Sea

**Provisions on legal status of merchant ships**  
*What are the legal barriers to the navigation of unmanned ships?*

Article 91 Article 92	Nationality of ships Status of ships	Safety and Reliability
Article 94 Article 219	Duties of the flag State Measures relating to seaworthiness of vessels to avoid pollution	Seaworthiness and Manning
Article 217 Article 218 Article 219	Enforcement by flag States Enforcement by port States Enforcement by coastal States	Prevent, Reduce and Control Pollution from Vessels

The terms “ship” and “vessel” in the UNCLOS are interchangeably employed, but neither one is defined (CMI 2016, p. 3). After having considered the legal status of “ship” and “vessel” in various public and private treaties (Zhu and Xing 2019), it has been identified that there is no specific legal requirement for the number of crew, and hence unmanned ships could fall within the various similar definitions of “ship” and “vessel” in different international treaties with no significant hurdle (Zhu and Xing 2020). Therefore, the current international regulatory

framework on ships can arguably be applied in discussing the navigational rights of unmanned merchant ships (Veal and et al. 2019; Chang and et al. 2020).

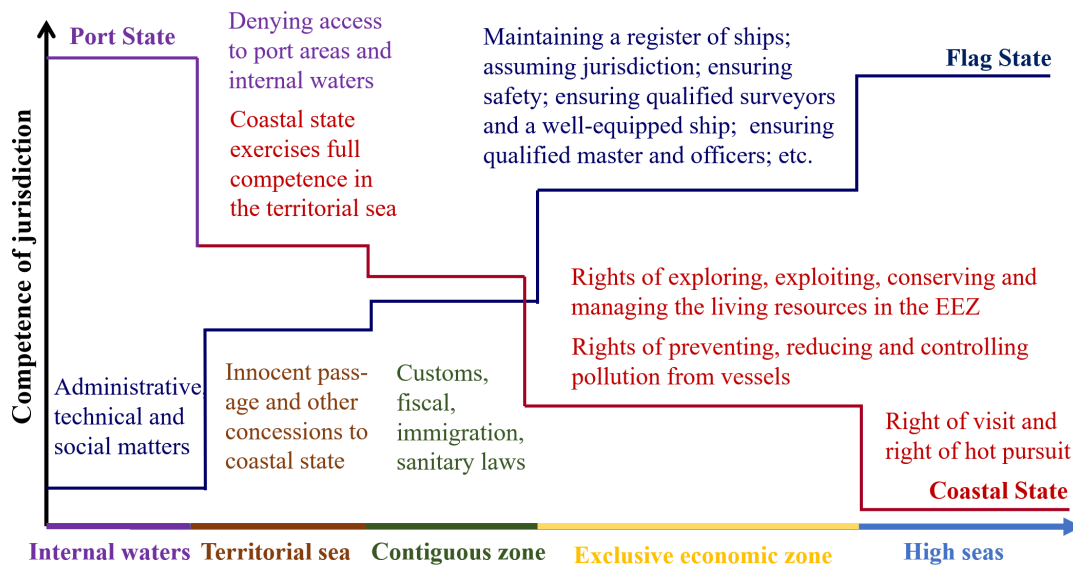
### 3. Navigational rights of unmanned merchant ships

By applying question-based doctrinal research methodologies, the above-described framework provides a context for synthesizing and discussing all the questions concerning the navigational rights of unmanned merchant ships.

#### 3.1 Who has jurisdiction over unmanned merchant ships?

Jurisdiction is a fundamental aspect of sovereignty: it refers to a State’s competence to rule the conduct of persons (Brownlie and Crawford 2012, p. 456). As to jurisdiction over unmanned ships, the question will be as to whether a State possesses the right to enact and/or enforce legislations and/or regulations to limit or prohibit the navigation of unmanned merchant ships. The UNCLOS is the main convention for finding answers (Danish Maritime Authority 2017, p. 39). The attribution of jurisdiction in the UNCLOS is territorial or zone-based (Figure 4), so that as the distance from the coast-line increases and goes from internal waters to high seas, the port States and coastal States’ competence of jurisdiction decreases, while that of the flag States’ simultaneously increases (Wolfrum 2009).

Figure 4 Attribution of Jurisdiction in the UNCLOS



##### 3.1.1 Flag State jurisdiction

Under customary international law, a flag is a necessity for a ship to navigate out of its home water (Mansell 2009, p. 13). Article 92 of the UNCLOS likewise requires that a ship shall sail under only one State flag; and the State is deemed as the flag State of that ship (Churchill and Lowe 1999, p. 208). To be able to navigate globally and receive protection from a State, a ship must obtain the nationality of a flag State (Mansell 2009, p. 28). Furthermore, Article 94 of the UNCLOS requires a “genuine link” to exist between a ship and her flag State. Such a “genuine link” indicates that the flag State exercises its “jurisdiction and control in administrative,

technical and social matters” over ships flying its flag. The flag State thus has such an obligation to control over its flagged ships to make sure their compliance with UNCLOS. Article 94 meanwhile provides various duties of a flag State with respect to: 1) Maintaining a register of ships; 2) assuming jurisdiction under its domestic law over each ship flying its flag and over its master, officers and crew; 3) ensuring the ship’s safety at sea; 4) ensuring qualified surveyors and a well-equipped ship; 5) ensuring a qualified master and officers; 6) investigating and remedying the exercise of proper jurisdiction over a ship; and 7) cooperating in the conducting of any inquiry into a marine incident, and others. It is now difficult to predict the number of flag States that would accept the registration of unmanned merchant ships; in addition, it is also questionable whether a State could exercise effective control by complying with the above-mentioned duties. The “genuine link” between the flag State and its ship is, however, weak or sometimes missing, since shipowners often prefer to register their ships in countries such as Liberia and Panama, which offer competitive political and economic preferences (Metaxas 1981). These countries, known as “flags of convenience” (FOC), register foreign ships under their flags for socioeconomic reasons and exercise minimum control over the activities and operations of these vessels (Osieke 1979). One may expect that there will also be a possibility that some unmanned ships may choose to register in FOC countries. For more discussion, please refer to Zhu and Xing (In Press).

### ***3.1.2 Jurisdiction of the coastal State over foreign ships***

According to provisions in the UNCLOS, the coastal State enjoys varying degrees of jurisdictional rights when the vessel is situated in different zones of the sea, which are: 1) internal waters; 2) territorial sea; 3) contiguous zone; 4) EEZ; and 5) the high seas. As the distance from the coast increases, the competence of coastal State’s jurisdiction over a foreign ship decreases.

Internal waters are on the landward side of the baselines (UNCLOS article 8.1), and are where the coastal States’ domestic regulations are applicable. In general, in the absence of other applicable treaties and except for the situations set forth in article 8 of the UNCLOS, foreign ships do not enjoy rights of navigation in the internal waters. The jurisdiction of coastal States in their internal waters is similar to the jurisdiction of a port State in their port areas. Since ports are treated as an integral part of a coastal State’s territory, thus the port State enjoys its territorial sovereignty over port areas. Port State jurisdiction refers to the competence of a coastal State to exercise its jurisdiction over ships entering its ports areas and to reject such entry (Keselj 1999). In this context, the question may arise as to whether such jurisdictional right would allow a port State to reject entry by unmanned ships. Article 211 of the UNCLOS allows a port State to deny the access of a ship when it has concerns over the manning, equipment, construction, and design of the ship (Keselj 1999). Thus, it seems that a port State may entitle to reject access by an unmanned ship merely because of, for instance, its revolutionary construction and design, or its different requirements of equipment and manning. The safety and reliability of unmanned ships will be further analysed in Section 3.3.1 to 3.3.3 of this paper.

As for the territorial sea, a coastal State exercises full competence of jurisdiction in its territorial sea with, however, certain concessions (Yang 2006, p. 33). One of the concessions is known as

innocent passage, which means that the coastal State can exercise its jurisdiction in its territorial sea, but such jurisdiction should not impair the right of innocent passage of foreign ships. Innocent passage is the most important exception for the territorial jurisdiction of coastal States, and at the same time, it is the core element of a ship's navigational right. The main doubt over unmanned merchant ships navigating through the territorial seas of any coastal State is whether such kind of ship can enjoy the right of innocent passage. This issue will be discussed in section 3.2.1.

The contiguous zone is adjacent to the territorial sea. As a special part of the EEZ, in accordance with article 33 in the UNCLOS, the coastal State may “exercise the control necessary to prevent infringement of its customs, fiscal, immigration or sanitary laws and regulations” within its contiguous zone. For the EEZ, a coastal State exercises: 1) “sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources” and 2) the jurisdiction regarding certain activities, which are about (i) artificial islands, installations and structures; (ii) marine scientific research; and (iii) marine environment (UNCLOS article 56.1.b). For the rights related to the living resource in the EEZ, the coastal State has the competence to take necessary measures against a suspected vessel, including “boarding, inspection and judicial proceedings” (UNCLOS article 73.1). In addition, a coastal State may adopt laws and regulations for the control of vessel-sourced pollution in respect of their EEZs (UNCLOS article 211.6.a). Accordingly, in the contiguous zone, although the coastal State does not have sovereignty, rather has the above-discussed specialized competences (Bardin 2002).

Therefore, in a similar way, as the distance from the coast increases, coastal States' competence of jurisdiction over a foreign unmanned merchant ship decreases. The reasons to reject or limit such ships may vary: 1) for the internal waters and territorial seas, the reasons can include the manning, equipment, construction, and design of a ship; 2) for the contiguous zone, the laws on fiscal, customs, sanitary or immigration may apply; 3) for the EEZ, the reasons may be associated with the living resources, as well as vessel-sourced pollution.

### ***3.1.3 Jurisdiction on the high seas***

According to the principle of the freedom of navigation within the high seas, a flag State enjoys a dominant jurisdiction over ships flying its flag, whereas the jurisdiction of coastal States is limited. Other States, in addition to the flag States, have limited rights to exercise jurisdiction over vessels on the high seas in two exceptional situations, these being the right of visit and the right of hot pursuit. As for unmanned ships, these two exceptions would apply even if there were no crew on board.

## **3.2 Where can unmanned merchant ships navigate?**

As one of the oldest principles governing ocean space (Wolfrum 2009), the principle of protecting navigational rights has been codified in the different provisions of the UNCLOS. They are innocent passage (Articles 17-26), transit passage (Articles 38-44), archipelagic sea lane passage (Articles 52-54), and freedom of navigation (Articles 36, 58, 87 & 90). The four rights of navigation (Figure 1) share one core principle – free movement of ships considering the jurisdiction of coastal States and port States.



### ***3.2.1 Innocent passage — territorial sea***

All ships enjoy the navigational right of innocent passage through territorial seas. Article 18 of the UNCLOS lays down the meaning of “passage”, and article 19 defines “innocent passage”. Innocent passage means that “the passage...is not prejudicial to the peace, good order or security of the coastal State.” Meanwhile, since the navigational right of innocent passage is also “subject to this Convention”, other provisions in the UNCLOS shall also be considered when discussing issues related to innocent passage (Nordquist et al. 1993, p. 156). For example, article 52 relates to innocent passage through archipelagic waters, and article 45 relates to innocent passage within straits. The navigational right is balanced against coastal States’ rights to regulate passage in their territorial waters, which reflects the priority of global navigation – an idea incorporated throughout the UNCLOS (Nordquist et al. 1993, p. 156). Since the sovereignty of a coastal State outstretches to its territorial sea (UNCLOS article 2), article 21 allows a coastal State to “...adopt laws and regulations, in conformity with the provisions of UNCLOS and other rules of international law, relating to innocent passage through the territorial sea...in respect of the safety of navigation and the regulation of maritime traffic...” Accordingly, a coastal State may restrict an unmanned merchant ship’s navigational right of innocent passage based upon concern over the safety of navigation. This is not impossible, and insights can be acquired from the cases of foreign ships carrying nuclear wastes and nuclear-powered ships (Dixon 2006). Although the UNCLOS only requires that such nuclear-related ships should “carry documents and observe special precautionary measures” when passing through the territorial sea of a coastal State (UNCLOS article 23), some coastal States still refuse and even drive such ships away from their EEZ. Currie (1996) listed 27 countries, that have voiced opposition or taken action to prevent the high-level nuclear waste shipments from passing through their territorial waters and/or EEZ. Such international practices reflect some of the coastal States’ concerns over their territorial safety regarding prevention of vessel-sourced pollution. Similarly, if an unmanned merchant ship lacks data to prove its safety and reliability, it would perhaps face a similar dilemma. For further discussion on this, please refer to Zhu and Xing (In Press).

### ***3.2.2 Transit passage — international strait***

There would be no obvious legal barriers for unmanned merchant ships to enjoy navigational rights of the transit passage. According to the UNCLOS, transit passage means where the ships pass through an international strait between one part of the EEZ or high seas and another part of the EEZ or high seas (UNCLOS articles 37-44). Article 42 allows the States bordering straits to “adopt laws and regulations relating to transit passage through straits”, regarding the navigation safety and the maritime traffic regulation. Nevertheless, the legislative scope of the states bordering straits is limited, since article 41 restricts the scope of the domestic laws and regulations to the designation of sea lanes and prescription of traffic separation schemes. It also requires that straits States refer any proposals to the “competent international organization” before “designating or substituting sea lanes or prescribing or substituting traffic separation schemes”. The IMO is the only global institution with the authority to develop international regulations regarding routing systems for ships (Secretariat IMO 2008, paras. 45a and 10b;

Nordquist et al. 1993, p. 364). Therefore, unless the flag States and the IMO do not accept this kind of ship, unmanned merchant ships can enjoy the navigational rights of transit passage.

### ***3.2.3 Archipelagic sea lanes passage — archipelagic waters***

A “archipelagic State” is “a State constituted wholly by one or more archipelagos and may include other islands” (UNCLOS article 46). An archipelagic State exercises full sovereignty over its archipelagic waters, where they are enclosed by the archipelagic baselines (UNCLOS article 49.1). Hence, the archipelagic waters have some of the legal characteristics of the territorial seas as well as some unique characteristics (Nordquist et al. 1993, p. 401). In such archipelagic waters, foreign ships enjoy the navigational right of archipelagic sea lane passage (UNCLOS article 53.2). Article 53, taken with articles 52 and 54, constitutes the regime of passage through archipelagic waters. Article 53 further establishes the rights and duties of the archipelagic States and ships regarding archipelagic sea lane passage. The passage must be in sea lanes designated by the archipelagic States or, in the absence of such designation, on routes normally “used for international navigation through the archipelago” (Kumala and Sunyowati 2016). For the “designation of sea lanes and traffic separation schemes”, the archipelagic States shall conform to “generally accepted international regulations” (UNCLOS article 53.8) and shall “refer proposals to the competent international organization with a view to their adoption” (UNCLOS article 53.9). Article 53 further provides a limited right for the archipelagic States to designate and regulate the archipelagic sea lane. Therefore, unless such merchant ships cannot fulfil the requirements of “generally accepted international regulations” or cannot acquire a legal status from the IMO, it is the authors’ view that the limited rights of archipelagic States do not include the right to exclude unmanned ships’ navigation.

### ***3.2.4 Freedom of navigation — the EEZ and the high sea***

The recognition of the EEZ probably represents the biggest change to the law of the sea after 1958 (Kullenberg 1999). By establishing the EEZ, the jurisdiction of coastal States extends beyond no more than “200 nautical miles from the baselines” (UNCLOS article 57). Although the area of the EEZ is no longer part of the high seas, the freedom of navigation in the EEZ is however maintained according to article 58 of the UNCLOS. In addition, articles 88 to 115 include general provisions relating to the high sea, including duties of the flag States, right of visit, right of hot pursuit, and duty to render assistance, as well as “other pertinent rules of international law” applicable to the EEZ (Nordquist et al. 1993, p. 565). Even if they have the right of freedom of navigation, though, foreign ships must comply with “the laws and regulations adopted by the coastal States in accordance with the UNCLOS and international laws” (UNCLOS article 58.3). For instance, foreign ships navigating through the EEZ are subject to the coastal States’ jurisdiction relating to vessel-sourced pollution and its control over the natural resources (Beckman and Davenport 2012). Article 87 provides for all ships with the right of free navigation on the high seas under the dominate jurisdiction of the flag States (Max Planck Foundation), although this does not mean that there is no limitation for freedom of navigation on the high seas. In general, the high sea is open to any ships of any States; therefore, unmanned ships would likely be included; ships on the high sea should also pay due regard to

the other States' interests (UNCLOS article 87.2), subjecting themselves to "the conditions laid down by the UNCLOS and other rules of international law" (UNCLOS article 82.1).

### **3.3 What are the legal barriers to the navigation of unmanned ships?**

Learning from the above analysis, it can be found that, whether within the internal waters, territorial waters, EEZs, or the high seas, the further from the land, the fewer restrictions would there be from coastal States on unmanned ships. As to the navigational rights of unmanned ships, the main conflict is apparently between the flag States and coastal/port States. The flag States, as shipping States, in most cases want to maintain free navigational rights; whereas the coastal States and port States want to protect their territorial safety by extending their jurisdictions and imposing restrictions on the navigation of such unmanned ships. The restrictions imposed on unmanned merchant ships would include the following: 1) unmanned ships would be prohibited from sailing by the flag States and/or be rejected by the coastal States, unless they comply with fundamental safety and security requirements when proceeding to sea; 2) they must meet the basic requirements of seaworthiness and manning; and 3) scientific certainties for controlling pollution must be established to build the confidence of the relevant stakeholders in the operation of unmanned ships.

#### ***3.3.1 Safety and reliability***

The safety of unmanned ships is still under debate. Would unmanned ships be at a higher risk of piracy and cyberattack (Mahoney 2016)? Who is there to inspect the cargo in case of leak or break and a fire incident if there are no crew on board the ship? How long might it take to reach the ship if there were a computer malfunction, or if the ship were involved in any sudden incident (Mahoney 2016)? It is expected that more issues may arise (Zhu and Xing 2019), since having no crew on board and with full autonomy will be an evolutionary change for shipping practice (Wróbel et al. 2017). Fortunately, some scientific researches (Burmeister et al. 2014) have established that by using unmanned ships, accidents caused by human error could decrease (MUNIN). Article 94(3) of the UNCLOS provides that the flag State shall ensure safety of the ship at sea with regard, inter alia, to both the seaworthiness and the manning. In this regard, it is thus vital to consider two basic aspects: 1) Does the UNCLOS define "seaworthiness", and how? and 2) What is the meaning of "manning" in the UNCLOS? Based upon the answers to these two aspects, can unmanned ships satisfy the relevant seaworthiness and manning provisions?

#### ***3.3.2 Seaworthiness***

There is no explicit definition of "seaworthiness" in the UNCLOS. The word "seaworthiness" appears only in two articles: Article 219 lists measures relating to the seaworthiness of ships to avoid pollution (Nordquist et al. 1990, p. 273), and article 94(3) mentions "seaworthiness" in the context of the construction and equipment of ships to ensure the navigation safety. The understanding of "seaworthiness" of the vessel must also consider those aspects indicated in article 21 of the UNCLOS (Nordquist et al. 1995, p. 147), as well as other maritime conventions (for instance, Hague-Visby Rules) and private common law cases (Hodges 2012, p. 308). Article 21 provides that the laws adopted by the coastal States shall not apply to "the design,

construction, manning or equipment of foreign ships”. Under private common law, though, seaworthiness is a case-by-case issue, which generally takes into consideration such elements as: “design and construction; machinery, equipment and navigational aids; sufficiency and competence of the crew;” etc (Zhu and Xing 2019). If so, “manning” would be an obvious barrier for the unmanned ship to prove seaworthiness (Carey 2017), since an unmanned ship have no crew on board, whereas article 94(3) explicitly requires that flag States ensure the manning of ships. More specifically, Article 94(4) requires that each ship shall be “in the charge of a master and officers”.

### ***3.3.3 Manning***

Under the UNCLOS, one of the most obvious barriers for flag States is their duty to ensure qualified and sufficient master and officers. In practice, it is the master, as a physical person, on board the ship who is responsible for a ship (and any person or thing on board the ship) (Danish Maritime Authority 2017, p. 64; Cartner et al. 2009, p. 86) as well as for the enforcement of the flag State’s jurisdictions (Vojković and Milenković 2019); this means that the flag States exercise their control over the ship through the masters. However, how can the flag States exercise such control if there are no master on-board unmanned ships? According to the Lloyd's Register’s Unmanned Marine Systems Code, unmanned ships mainly require the emerging shore-based controller or on-board operator to replace the Master, ship’s officer and crew to operate the ship with the assistance of artificial intelligence (Van Hooydonk 2014). Accordingly, unmanned ships may no longer need any master and/or any crew in the traditional sense; rather, a controller or an operator either on or off board would play an important role. If that were the case, would the emerging controller or operator be the representative of the flag States in exercising jurisdiction over the unmanned ships? The requirement of manning in the UNCLOS would present a practical barrier for the use of unmanned ships. On this matter, there are different opinions. The Danish Maritime Authority in its final report has treated this issue of the manning of unmanned ships as a major problem under the UNCLOS, since an unmanned ship in navigation and steering will not comply with article 94(4)(b) (Danish Maritime Authority 2017, p. 58). By contrast, the CMI International Working Group on Unmanned Ships holds a different opinion, stating that the definition of “ship” in various existing international conventions does not include any reference to crewing; and the definition of a ship in domestic legislations is usually not connected to the question of whether the ship is manned (CMI 2016, p. 3).

### ***3.3.4 Prevent, reduce and control pollution from unmanned ships***

Regulations concerning pollution from vessels have aggravated the conflict between flag States and coastal States (Bodansky 1991): Flag States mainly have shipping interests, and coastal States have either powerful fishing interests or strong environmentalist groups wanting to prevent pollution from the ships (Vallarta 1983). In that regard, Part XII of the UNCLOS recognises a port State’s jurisdiction over punishing a ship’s discharge violation, wherever the violation has occurred (Nordquist et al. 1990, p. 261). In this way the coastal States and port States would be able to hold polluters responsible for their actions. Part XII of the UNCLOS sets out the legal framework as follows: 1) A flag State enjoys an dominate legislative

jurisdiction over the ships flying its flag regarding its domestic laws and the applicable international laws (Article 217); 2) a coastal State has, within its EEZs, the right to enforce applicable international laws of marine environment protection on foreign ships (Article 220); and 3) a port State has jurisdiction over punishing discharge violations of ships in accordance with international laws (Article 218).

An unmanned merchant ships must prove that she will not present an increased risk of pollution incidents. Flag States shall “take appropriate measures in order to ensure that vessels flying their flag or of their registry are prohibited from sailing until they can proceed to sea in compliance with the requirements of international rules and standards” (UNCLOS article 217 2). The “applicable international rules and standards” include those adopted by the IMO; and the most pertinent international convention is the MARPOL 73/78. In fact, unmanned merchant ships cannot yet fulfil the requirements of the MARPOL 73/78. Since the coastal States directly suffer from marine pollution and therefore have the greatest interests in preventing vessel sourced pollution (Bodansky 1991), the UNCLOS refines the coastal State’s competence of prescriptive and enforcement jurisdiction within their internal waters, territorial waters, and EEZs (UNCLOS article 220.1). Because of the scientific uncertainties, there are reasonable grounds to suspect that unmanned merchant ships may cause collisions or severe incidents, leading to catastrophic oil spills or marine environment decline. According to the “precautionary principle”, this would give a coastal State the reasons to deny an unmanned merchant ship’s entry to all its jurisdictional waters. A port State may “undertake investigations of and institute proceedings” against an unmanned merchant ship when the vessel is voluntarily visiting the port areas (UNCLOS article 218.1). According to articles 2, 25, 211, and 255, a port State may refuse an unmanned ship access to its ports.

#### **4. Discussion**

The following discussion will summarize and further analyse the legal and policy barriers to unmanned merchant ships’ navigational rights, and will then propose policy recommendations to the relevant policy stakeholders.

##### **4.1 The issues**

Within the context of the UNCLOS, as discussed, the issues of an unmanned ship’s navigational rights mainly relate to the following three aspects: (1) It will have difficulties in meeting the requirements of “manning”; in particular, they will not have a master on board as a norm, meaning that a flag State cannot exercise its jurisdiction over the ship through the master; (2) the legality of an unmanned merchant ship under the UNCLOS may be questioned, since there currently lacks adequate scientific certainties to prove the safety, reliability and seaworthiness of unmanned merchant ships; and (3) the ability of an unmanned merchant ship to comply with the international requirements of preventing, reducing and controlling vessel-sourced pollution may be questioned.

If a flag State agrees to register an unmanned ship, the unmanned ship could then legally navigate in the waters belonging to this flag State. Nevertheless, the rights of navigation of these unmanned ships in international and foreign waters would still be under challenge,

particularly from port States and coastal States. A port State is entitled to deny an unmanned ship from having access to its port areas and internal waters. A port State that permits the entry of an unmanned ship remains entitled to undertake investigations or institute proceedings over the prevention vessel-sourced pollution, whereas there would, however, be no crew on board the unmanned ships for such inspection or institution proceedings. Taking into account navigational safety, a coastal State or a port State may restrict an unmanned merchant ship's navigational right of innocent passage through its territorial sea. For example, a coastal State may deny the unmanned merchant ship entry to its jurisdictional waters because of suspecting that it could cause collisions or other severe incidents. Also, based upon the "precautionary principle" in marine environmental law, a State could stop unmanned ships from entering, considering the high probability of a pollution incident; they may have reasonable grounds to deny the entry of unmanned ships to both internal waters and territorial waters, sometimes also to their EEZs.

#### **4.2 Interpreting relevant provisions in the UNCLOS**

The adoption and operation of unmanned merchant ships is only a matter of time, yet many legal and policy issues still await solutions. As far as the UNCLOS is concerned, in order to meet the possible challenges brought about by the navigation of unmanned ships, there are two solutions: one is to directly amend the UNCLOS, and the other is to clearly interpret the existing provisions.

Considering the marathon process of drafting the UNCLOS and the complexities of its provisions, there is little chance at this stage of amending the UNCLOS in order to facilitate the use of unmanned merchant ships. By contrast, the general rule of interpretation under international law may leave a path for the dynamic utilization of the UNCLOS to dispel the apparent legal barriers to the navigational rights of unmanned ships. International conventions are not just dry parchments (ILC 2008, p. 152); they must adapt to new situations. Therefore, they are often required to be interpreted when a specific problem needs to be resolved. The Vienna Convention on the Law of Treaties (VCLT) establishes a fundamental rule for the interpretation of international treaties. It requires that "a treaty shall be interpreted in good faith in accordance with the ordinary meaning" (VCLT article 31.1). At the same time, the interpretation of a treaty shall be dynamic, considering the relevant rules of international law as well as subsequent agreements and practices (VCLT article 31.3). Therefore, the policy recommendations proposed in this article will be based on how a dynamic interpretation of the UNCLOS can be achieved, according to the VCLT rule for the interpretation of international treaties.

##### ***4.2.1 Considering relevant rules of international law***

The international regulatory framework on shipping, as illustrated in Figure 2 discussed above, is fragmented. The UNCLOS is the core convention for international governance of the ocean, and the IMO instruments are over global shipping. According to the general rule of the VCLT and specific provisions of the UNCLOS, the IMO regulations are regarded as "any relevant rules of international law applicable in the relations between the parties" (VCLT article 31.3.c), and are applied to interpreting the UNCLOS. The UNCLOS provisions may be interpreted more

dynamically by considering the requirements on ships established by the IMO regulations (Mihneva 2005; Secretariat IMO 2008). Therefore, if the relevant IMO conventions can give a green light to the emergence of unmanned ships, some of the legal dilemmas resulting from the UNCLOS might be avoided (Danish Maritime Authority 2017, p. 58).

The IMO has been working on a scoping exercise for identifying current provisions in IMO instruments, and for assessing how they may or may not apply to “ships with varying degrees of autonomy”, and/or whether they may preclude Maritime Autonomous Surface Ship (MASS) operations (IMO Media Centre). The result of the scoping exercise may suggest that the IMO and State parties take the next regulatory steps to: 1) develop interpretations of the instruments; and/or 2) amend existing instruments; and/or 3) enact new instruments; or 4) none of the above. After reviewing the MASS under IMO instruments, the IMO may determine the next regulatory steps on MASS operations. Meanwhile, various studies have been conducted on the unmanned merchant ships’ compliance with the IMO conventions (e.g. Noma 2016; Van Hooydonk 2014; Danish Maritime Authority 2017, pp. 71-82; CMI 2016, p. 3).

The current scoping exercise undertaken by the IMO is on one hand too slow to catch up with the fast developments of autonomous technology; on the other hand, it should note the relationship between the UNCLOS and IMO instruments (IMO. LEG/MISC.8). The process of the IMO scoping exercise is still uncompleted, and the next step of regulatory exercises will last for longer, as the drafting, negotiation and adoption phase may take years to complete. Thus, the IMO should take a more proactive role. Apart from considering the applicability of the relevant IMO instruments, the IMO could also take into account the importance of the UNCLOS provisions, and the relationships between the UNCLOS and IMO instruments. At the same time, to promote the current scoping exercise and future regulatory exercise, the IMO may adopt a “fast track” by providing soft-law instruments, such as the codes of conduct, standards and guidelines, to help inform and develop good practice. Such soft-law instruments could be both informative and influential in terms of guiding public stakeholders, which would help melt the international contradictions over unmanned navigation, and would help cultivate consensus among State parties on the development of unmanned ships.

#### ***4.2.2 Considering subsequent agreement and practice***

Article 31, paragraphs 3 (a) and 3 (b), of the VCLT, consists of the recognition of the role that “subsequent agreement and subsequent practice” play in the treaty interpretation. Both the “subsequent agreement and subsequent practice” reflect a special feature of international law, which is to ensure that evolving international agreements and practices are considered in a way that is compatible with the international treaties (ILC 2008, p. 153). Although the boundary between “subsequent agreement and subsequent practice” is rather fluid, subsequent agreement implies the consent of all the parties, which seems to indicate more formality than subsequent practice (ILC 2008, p. 156).

For subsequent agreements over unmanned merchant ships, the IMO could be prepared to do more. The IMO, as the competent international organization for regulating global shipping, could conduct investigations and researches on the scientific and regulatory issues affecting unmanned ships, and provide the latest knowledge and professional advice to State parties. The

IMO should also provide a forum or platform for State parties to discuss this issue. The IMO could also try to promote State parties into adopting new legal instruments for unmanned ships and/or amend some of the existing IMO conventions, aiming to put unmanned ships under international regulations. These new instruments or amendments of existing conventions can fall under “any subsequent agreements” (VCLT article 31.3.a) that might be applicable to interpreting provisions related to the navigational rights of unmanned ships in the UNCLOS. If unmanned ships can obtain legal status under these subsequent agreements of the IMO, then the emerging dilemma of navigational rights under the UNCLOS might be resolved.

For subsequent practices toward unmanned merchant ships, it is important to harmonize State practices among the flag States and coastal States. In principle, all States to some extent compete against each other in maritime international trade (Kretschmann et al. 2017). Accordingly, for the time being, all relevant State parties, regarded as “subsequent practice” (VCLT article 31.3.b), can play a very vital role. Flag States or shipping States will be the main driving forces in introducing unmanned merchant ships. For instance, in 2017, “Denmark, Estonia, Finland, Japan, Netherlands, Norway, Republic of Korea, United Kingdom and the United States” made a proposal for a regulatory scoping exercise in this area (IMO 2017, p. 78). However, the navigational rights of unmanned merchant ships will largely depend on the attitudes of the coastal States and port States. They may be concerned about the scientific uncertainties existing in the operation and navigation of unmanned ships. The international law on shipping always evolves alongside the evolution of shipping technology. The UNCLOS will also be subject to interpretations that consider subsequent developments in marine technology. Thus, the best way to harmonize State practices toward unmanned shipping among the flag States and coastal States is to cultivate consensus on the safety and reliability of unmanned merchant ships.

#### ***4.2.3 Policy recommendations***

The policy recommendations are focused on actions that could be taken by the IMO, as well as by the relevant state parties. It is hoped that, through cooperation among the public stakeholders, with further advancement of scientific and technological issues, any legal issues regarding the navigation of unmanned merchant ships will be resolved.

As far as the IMO is concerned, following are the specific recommendations. First, to interpret and/or amend existing IMO instruments that contain unachievable requirements for the manning or design and construction of unmanned ships. Second, to propose and adopt new instruments that may provide for special requirements and standards for the unmanned ships, leading to reduced vessel-sourced pollution and better shipping governance. Third, to provide codes of conduct, standards or guidelines for the unmanned merchant ships. Fourth, to undertake researches into the scientific and regulatory questions arising from unmanned ships, and to provide the latest knowledge and professional advice. Fifth, to provide a forum or platform for State parties to discuss the relevant issues and to promote international cooperation on accepting the navigational rights of unmanned merchant shipping.

As for the States, flag States and coastal States shall cooperate with each other to ensure that unmanned merchant ships comply with the rules to be safe, reliable, and to do no harm to the



marine environment. On the one hand, a flag State, including the flag of convenience States, shall ensure that unmanned ships are “prohibited from sailing until they can proceed to sea in compliance with the requirements of the international rules and standards” (UNCLOS article 217.2). Shipping States that support and promote unmanned merchant ships shall understand that they carry the burden of proof in proving the safety and reliability of unmanned shipping. Also, flag States and shipping States need to cooperate with the IMO to ensure that the requirements within international rules and standards are fully complied with by unmanned merchant ships. On the other hand, the port States and coastal States should investigate and observe the scientific advancements of unmanned shipping from the perspective of achieving a win-win result.

## 5. Conclusion

The operation of unmanned merchant ships seems to be inevitable, and it is even believed that they will contribute to a sustainable shipping industry. Nevertheless, many legal challenges and risks exist that to some extent sway the way forward. Among all the legal and policy issues, those relating to the navigational rights of unmanned merchant ships, as discussed in this paper, are at the top of the list. At the moment, unmanned merchant ships may be restricted from international navigation, since they may have difficulties in meeting the fundamental requirements of navigation currently established in international law. These difficulties include those relating to doubts as to their safety and reliability, the burden of satisfying the legal requirements of seaworthiness and manning, and the uncertainties in association with pollution prevention and control.

Based upon the findings in this paper, we propose a number of legal and policy recommendations, including that, firstly, the IMO should take a more proactive role in sweeping away the legal barriers to the navigational rights of unmanned merchant ships; secondly, that flag States shall ensure that ships comply with the requirements of the international rules and standards; and, thirdly, that coastal States and port States should actively participate in discussions on the issues related to unmanned ships at the IMO’s regulatory scoping exercise and any further talks. It is hoped that the navigational rights of unmanned ships can be justified, and that development and use of unmanned merchant ships can be largely facilitated.

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