**Title:** The legal status and operation of unmanned maritime vehicles

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**Abstract**: The number of unmanned maritime vehicles and their potential applications in the marine space are growing constantly. Because of their comparatively small size and limited operations, only modest attention has been paid to how they fit into the international legal framework. Many UMVs may not be considered to fall under the definition of "ship" so as to enjoy states' rights of navigation under UNCLOS. Therefore states, manufacturers and investors remain uncertain about the rights and obligations regarding UMV operations in the various maritime zones. This article addresses these questions for a range of UMVs with differing levels of autonomy. It argues that the international legal framework delegates the question of whether a UMV is a ship or not to the flag state's national laws. The article suggests that such a determination will be binding on other coastal states. With respect to UMVs which do not fall under the definition of ship, there is remaining uncertainty about whether any navigational rights in the jurisdictional zones of other states are available, while, it is argued that such rights do exist in the areas beyond national jurisdiction. The article also considers the extent to which today's UMVs can comply with the international framework for ensuring safety at sea. For those UMVs falling under the definition of ship, compliance with the current regulatory framework for shipping is required and compliance will be more difficult as the level of UMV autonomy increases.

**Introduction**

Unmanned Maritime Vehicles (UMVs) are vehicles which are capable of controlled, self-propelled movement in water without any personnel onboard. Some of these vehicles traverse the water *surface*; these are unmanned surface vehicles (USVs). Others operate under the water surface, surfacing only on recovery and where necessary to transfer data and take instructions; these are unmanned underwater vehicles (UUVs).

Some UMVs are controlled by personnel on the shore. Sometimes this is done with the use of radiocommunications and by using the Global Positioning System (GPS) coordinates transmitted by the UMV. Other UMVs are controlled using sophisticated satellite communication systems such as iridium to control the UMV over-the-horizon. The remote controller has a view of the positioning of the UMV on an electronic chart, receives information and readings from instruments onboard the UMV and may be further assisted by cameras and aural sensors on the UMV hull or chassis which project the UMV’s vicinity back to the shore. Due to the limited speed in communications, there is a small delay, perhaps a few seconds, between the UMV’s readings and the time these are received by the operator. Similarly there is a delay between the time the operator gives a command to the UMV and the time this is received and acted upon by the UMV. Similar delays hold true for the live feed footage of the UMV’s vicinity. Other UMVs are instead pre-programmed to perform a predetermined nautical course potentially without any human intervention whatsoever. These rely on a combination of sensors including radar. The data received from the sensors are processed and acted upon through commands provided by the algorithms of a collision avoidance system of varying sophistication. This mode is called “autonomous operation”. Between autonomous operation and remote control there are other levels of autonomy.[[1]](#footnote-1) Furthermore, a combination of control methods is possible. For instance, a UMV may be remotely controlled to a location whereupon it may be put into autonomous mode to perform a survey.

The current industry usage of UMVs is predominantly threefold, finding application in surveying activities, in marine scientific research and defence and, increasingly, in the offshore sectors.[[2]](#footnote-2) In the marine scientific research context, UMVs are deployed in a wide range of operations, from routine mapping of the ocean’s floor to the exploration of the most extreme parts of the oceanic environment including underneath the polar ice sheets.[[3]](#footnote-3) In the military context, UMVs are also used in a range of naval operations, including surveillance and reconnaissance missions and mine counter-measures.[[4]](#footnote-4) In the offshore industry, UMVs are used in the oil and gas sector, in particular in the search for non-living subsea resources for exploitation as well as in the maintenance of pipelines and large offshore installations. USVs are currently being used in challenging operations which are restricted to areas where there is a small risk of collision with other craft and which are either monitored closely, in the naval and offshore context, or are otherwise too remote to pose risks to other users of the sea, in the case of marine research.

It is perhaps because of their limited operational usage and relatively small size that only modest progress has been made in the clarification of states’ and private operators’ rights and obligations in the operation of UMVs. As UMV operations increase in both geographical and operational terms, more disputes are likely to occur regarding these rights and obligations.[[5]](#footnote-5) Indeed, in December 2016, the first diplomatic incident arose when the Chinese Navy removed from the water a U.S. Navy UUV 50nm off Subic Bay in the South China Sea. The two countries took contrary positions on the legal status of the UUV and by corollary, their respective rights and obligations regarding its operation in that area.[[6]](#footnote-6) The situation, in the end, was resolved with the Chinese returning the UUV to the U.S. Navy, without settling its legal status or resolving the legal issues that arose. The incident demonstrates how the operation of UMVs raises fundamental legal questions, some of which go to the very roots of the law of the sea. While this was a naval UUV and therefore the applicable laws were those applicable to military property, questions concerning UUVs and UMVs in general need to be resolved nationally and internationally in order to facilitate their development and operation in the national and international marine space. This paper confronts some important questions concerning the legal character of UMVs and their operations beyond the jurisdictional areas of the deploying state.

To the extent some or all UMVs constitute “ships”, the consequences of this will also be explored. Perhaps the most salient consequence will be the need for the UMVs under consideration to comply with the existing regulatory framework under the auspices of the International Maritime Organization (IMO) and its various committess and sub-committees. This regulatory framework includes detailed provisions in respect of, inter alia, construction, seaworthiness, manning, personnel training and collision avoidance mechanisms. The extent to which UMVs can comply with this labyrinth of rules, clearly designed for ships with a crew on board, will be explored in the second part of this paper.

**The Legal Status of UMVs and Their Place in the UNCLOS Framework**

The conditions for the operation of UMVs in the sea depend very much on whether their legal status is that of “ships” or not. If it is, then the restrictions and the freedoms of international shipping will be applicable to them. If a UMV is not a ship, then different rules will apply and the protection available to shipping, for example, the exclusive jurisdiction of the flag state in the high seas that bears few exceptions, may not be available for such vehicles.

The 1982 United Nations Convention on the Law of the Sea[[7]](#footnote-7) (UNCLOS) both codifies and builds upon customary international law and it prescribes detailed provisions dealing with States’ rights and obligations in respect of their flagged “ships”.[[8]](#footnote-8) It also prescribes rules for “devices”[[9]](#footnote-9) as well as “equipment”, particularly in the context of marine scientific research.[[10]](#footnote-10) Therefore, a threshold question is whether UMVs constitute “ships”, “devices”, “equipment” or, perhaps, none of the above. This, in turn, may depend on their size, their appearance, the purpose of their operation and their degree of autonomy. To complicate matters further, the categorisation of a specific UMV may differ between states. Whether such differences can legitimately exist depends on the clarity of the definition provided for each category in UNCLOS.

***UMVs as “ships”***

UMVs are capable of controlled movement on the water, exactly like ships. However, although they are able to navigate, they differ from ships in the following respects. First, some of the present generation of UMVs are relatively small in size. Most of the internationally applicable shipping regulations apply only to ships in excess of a minimum tonnage,[[11]](#footnote-11) typically 500 gross registered tons. The regulation of smaller craft which do not engage in international voyages is left to the state from which they operate. This, in fact, is an advantage for the development of UMV technology as it is left up to each state to devise a regulatory regime consonant with the pace of its (own) technological advances. In the longer term though, such an approach could be problematic as the lack of uniformity in regulations may restrict the operation of certain UMV models in the waters of other states.

Second, in their ordinary operational mode, UMVs do not have a crew on board,[[12]](#footnote-12) and for autonomous UMVs, their operation may not even involve a human in the decision making process from the shore or other remote location. Third, unlike conventional ships, today’s UMVs cannot be used in international trade because they lack the capacity to convey passengers, cargo[[13]](#footnote-13) or even a crew of their own. If UMVs are not ships then even the largest of them will not be subject to shipping regulations. For this reason, the involvement of the IMO in their international regulation could be problematic.[[14]](#footnote-14)

The UMV status issue becomes more complex because an internationally uniform legal definition of a “ship” does not exist.[[15]](#footnote-15) Consequently, and despite the various factors mentioned above, it is not straightforward to decide whether UMVs collectively or even any one particular UMV falls under the international legal framework for ships.

UNCLOS uses the terms “ship” and “vessel” interchangeably but fails to define either term. Nor do the Convention’s preparatory documents clarify the point.[[16]](#footnote-16) Definitions of these key concepts may therefore be sought in other international conventions.[[17]](#footnote-17) For instance, the International Regulations for Preventing Collisions at Sea, 1972 (COLREG) defines “vessel” 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.”[[18]](#footnote-18) The International Convention for the Prevention of Pollution from Ships, 1973 (MARPOL) defines a “ship” as “a vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft and fixed or floating platforms.”[[19]](#footnote-19) Recourse to such specialised international conventions is problematic, however. The definitions found within them, including those cited above, are often somewhat circular and tend to define the type of “ship” to which the relevant convention applies in the context of the object of that particular convention. They are also inconsistent for this reason and thus unsuitable for the allocation of general rights of navigation in the ocean.[[20]](#footnote-20) This inconsistency also makes it difficult to contend that they collectively betray a common understanding as to what generally constitutes a ship. In any case, the authors have yet to come across a definition of “ship” at the international level which clarifies, categorically, the issue of whether something which cannot be manned may constitute a ship even for the purposes of the particular instrument.

Arguably the correct interpretation must be that the definition of a ship is left to individual states’ discretion. To the extent that UNCLOS provides only for rights between states,[[21]](#footnote-21) its objective arguably is the delimitation of rights and obligations of “ships” as these are defined under national laws.[[22]](#footnote-22) Each state agrees with the other contracting states what rights it can exercise through the commercial, naval and other uses of its ships. Therefore the search for the definition of a ship is misguided and irrelevant in the context of UNCLOS.

Support for this argument can be found under Article 91 of UNCLOS which provides that:

Every 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.

Arguably one of those “conditions” is whether the relevant craft in question actually constitutes a “ship” according to the law of the flagging State.[[23]](#footnote-23) There is, however, an important counterargument. As UMVs were not in use at the time UNCLOS was negotiated, they were probably not within the contemplation of the drafters of UNCLOS. Thus, according to this argument, the agreed compromise of oceanic jurisdiction and the usage of ships by states in jurisdictional zones and on the high seas, or in areas beyond national jurisdiction in general, was never intended to cover the usage of such craft which cannot be considered as coming within the definition of ship but rather, fall under the general jurisdictional allocation of powers of states under UNCLOS and customary international law.

This argument can be answered in several ways. Firstly, forward-thinking in some of the more sophisticated navies on autonomous technology cannot be ruled out even though it would probably not have been discussed openly during the UNCLOS negotiations. Secondly, while it is correct that technological development triggers regulatory and legal changes,[[24]](#footnote-24) it is hardly arguable that every new technological development remains unregulated just because the law was agreed before the technology was in place.[[25]](#footnote-25) The detailed nature of the jurisdictional powers applicable to foreign ships under UNCLOS suggests that the negotiations indeed focused on existing ships. This, however, does not mean that the negotiations intended to exclude their applicability to new technologies. If that was the case, there would have been some emphasis on defining ships but there is no evidence of such discussions.

A more general argument can be made by recognising an *“*evolutionary approach”[[26]](#footnote-26)to treaty interpretation. Treaties must be interpreted in good faith and “in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose”.[[27]](#footnote-27) If the objective of UNCLOS was, as it is believed, to develop a legal framework for the oceans including the operation of “ships”, nationally defined, by states in areas under the jurisdiction of other states and in areas beyond national jurisdiction,[[28]](#footnote-28) then the inclusion of UMVs in national definitions of ships supports both the object and the purpose of the Convention. Furthermore, there is evidence of an increasingly “evolutionary approach” to treaty interpretation. For instance, the International Court of Justice (ICJ) has found[[29]](#footnote-29) that where a generic term is used, in the particular case the term, “commerce”, and where the relevant provision aims to settle a matter for an indefinite duration, treaty terms “must be understood to have the meaning they bear on each occasion on which the Treaty is to be *applied*, and not necessarily their original meaning”.[[30]](#footnote-30) If, in the context of a treaty agreed in the mid-nineteenth century, the term “commerce” can be interpreted to include “tourism”, it is certainly arguable that the term “ship” under UNCLOS can include new types of ships as well as UMVs provided that a state designates them as such. It is therefore reasonable to conclude that whether a UMV is a ship under UNCLOS is intentionally left to the contracting state.

Thirdly, the detail of what constitutes a “ship” for *particular* regulatory purposes has been established in the more specific IMO Conventions by restricting the application of such instruments to specific categories of ships. This indicates that when states wish to restrict the definition of the relevant ship for particular usage, express wording can be found. The absence of restrictive wording suggests that there was no such intention under UNCLOS.

Once the flagging state has determined the status of a craft as a “ship”, other states must accept that the specific craft deployed by the flag state is entitled to exercise navigational and other rights granted to ships. The flag state must, of course, comply with the corresponding UNCLOS obligations which include those regarding manning, training, collision avoidance and the protection of the marine environment. By failing to comply with these obligations, a flag state would be in breach of its treaty obligations but it is not necessarily the case that this would automatically entitle other states to denounce that craft as not being a “ship”. Thus, it can be stated that UNCLOS regulates how each state uses its ships but leaves the question of what constitutes a ship to be determined by national law.

This approach, although in the authors’ view correct, can lead to complications. An example is the incident in the Subic Bay outlined above. The dispute involved the US Navy protesting the illegal seizure of one of its glider UUVs which it regarded as a sovereign immune vessel[[31]](#footnote-31) while China justified its action by claiming it was an unidentified “device”.[[32]](#footnote-32) Thus the US justified the UUV’s operation on the basis of their right to sail military vessels of whatever kind. The Chinese Navy acted in the belief that the UMV was not a ship.

As could perhaps be expected, there is general agreement in regards to the main categories of craft characterised as ships under national law but there are also important differences, especially regarding smaller craft and craft significantly different in appearance or function from those generally associated with “ships”. What complicates the matter further is that each state arrives at the decision of whether a thing is a ship or not using different criteria. [[33]](#footnote-33) This makes it necessary to decide whether a certain category of UMVs or even a specific model is or is not a ship on a state-by-state basis. Some national law definitions are very broad and encompassing. For instance in the Netherlands, under the Burgerlijk Wetboek,[[34]](#footnote-34) any man-made construct designed with a floating capability may, in principle, constitute a ship.[[35]](#footnote-35) This broad approach is not however followed in the United States, where the Supreme Court[[36]](#footnote-36) interpreted “vessel” in § 3 of the Rules of Construction Act as referring to structures which a reasonable observer, looking objectively at its physical characteristics and activities would consider designed to a practical degree for the transportation of things or people on water.[[37]](#footnote-37) Under the latter definition, some of the UMVs under consideration would likely not qualify as ships.

Shipping legislation in some states permits state officials to grant effective “ship” status to structures which ordinarily would not constitute such under their general definition of “ship”, and vice versa.[[38]](#footnote-38) Furthermore, the level of codification of such definitions varies significantly between states. In Germany, for instance, there is no general and codified definition of “ship”, although case law suggests that a “ship” is “...every vehicle of more than insignificant size, capable of floating and provided with a hollow, the purpose of which is to be moved on water”.[[39]](#footnote-39) This is an example of a definition for which size matters and one that will exclude smaller UMVs. Under the UK’s Merchant Shipping Act 1995, “ship” means “any description of a vessel used in navigation”;[[40]](#footnote-40) but navigation is not defined in any statute. Neither is the appearance of the structure determinative.[[41]](#footnote-41) Whether manned operability is a prerequisite to “navigation” is less clear. Under English law, there have been cases considering the status of unmanned barges and in some instances these have been considered to be ships and in others not so, depending on their manoeuvrability and operational usage.[[42]](#footnote-42) By contrast to the US position, the ability to transport goods and people is not a prerequisite to “ship” status or to navigation under the 1995 Act.[[43]](#footnote-43)

In conclusion, in the absence of a harmonising international arrangement, the question of whether a UMV falls under the legal regime of ships has to be answered under each national law and for each UMV separately. No legislative provision which would preclude a UMV from being considered a ship merely on the grounds of its unmanned status was identified. However, UMVs may not be considered ships in several jurisdictions if they are too small or lack the capability to transport persons or cargo. Of course the larger UMVs, especially if they are built on hulls used for structures that would otherwise qualify as “ships”, would most probably be considered as such especially if they undertake the same operations as their manned counterparts. The registration in November 2017, under the UK flag, of the first unmanned ship[[44]](#footnote-44) built on a conventional hull of a small boat, demonstrates that in principle, a lack of manning is not an impediment to registration.

Given the conclusion above about the apparent irrelevance of unmanned operability on “ship” status, it seems that the control method of the UMV or its “level of autonomy”[[45]](#footnote-45) should also have little bearing on the status question. In other words, if the presence on board of seafarers is not a prerequisite for “ship” status, it should not matter either whether the unmanned vehicle is being controlled by a remote operator or is instead operating autonomously.[[46]](#footnote-46)

A distinction between U*S*V (unmanned surface vehicles) and U*U*Vs (unmanned underwater vehicles) is also not easily drawn. UNCLOS Part II, Section 3 concerning innocent passage, in subsection (a) titled “Rules applicable to *all ship*s”,[[47]](#footnote-47) includes provisions addressed specifically to submarines and “other underwater vehicles”, in particular the requirement that they rise to the surface and show their flag in exercising the right of innocent passage.[[48]](#footnote-48) The most natural construction, therefore, is that such submarines and other underwater vehicles, when exercising innocent passage, must behave like conventional ships[[49]](#footnote-49) whether considered as ships by the flag state or not. It is uncertain, however, the extent to which this provision, applicable to the right of innocent passage in the territorial sea, can be determinative of the character of UUVs in other jurisdictional zones.[[50]](#footnote-50) If the apparent assumption that they are ships does hold, however, there is no reason why such a determination should be spatially confined to the territorial sea.

Furthermore, where the deployment of a UUV is effected from a “mother vessel”, it might be argued that the UUV is akin to an item of equipment of the mother vessel, particularly in cases where the UUV retains a relatively modest mission duration and remains within close proximity to the mother vessel. However, to the extent that the same UUVs can be deployed from various platforms or from land, the logic of categorisation by launching platform is questionable, although responsibility for its operation may, of course, be linked with the launching platform.

Neither international nor most national laws currently resolve the status of all UMVs. However, it is becoming increasingly evident that the development of such technology requires a suitable generally adopted legal framework to standardise the requirements for the construction, safe operation and security of such craft.

***What type of ship?***

Even if some or all of the UMVs under consideration are “ships”, the rights and obligations appertaining to such UMVs can only be fully understood upon determination of exactly what *type* of ship they are within the UNCLOS framework.

On the assumption that submarines and “other underwater vehicles” constitute ships, it is most likely that the UUVs here considered will fall into this category of “ship”. The dividing line between submarine and other underwater vehicles is also not easily drawn. It has been suggested that the latter category may include UUVs,[[51]](#footnote-51) at least for the purpose of UNCLOS Article 20, to the extent that they are self-propelled[[52]](#footnote-52) although there is seemingly no basis in UNCLOS to confine the term submarine to those which are manned. In the context of UNCLOS, if both constitute ships, the distinction may be of only academic importance. In the context of ships constituting UMVs used for the conduct of marine scientific research, these will constitute scientific research vessels under Part XIII of UNCLOS.[[53]](#footnote-53)

UMVs are used by national navies for a broad range of naval operations.[[54]](#footnote-54) The navigational freedoms of naval UMVs will similarly depend on their “ship” status. In this regard the considerations discussed above on whether UMVs constitute “ships” apply in this context also.[[55]](#footnote-55)

However, under both UNCLOS and customary international law, different rules apply to “warships”. Unlike research vessels considered in the previous section, the term “warship” is defined in Article 29 of UNCLOS as a:

ship belonging to the armed forces of a State bearing the external marks distinguishing such ships of its nationality, under the command of an officer duly commissioned by the government of the State and whose name appears in the appropriate service list or its equivalent, and manned by a crew which is under regular armed forces discipline.

At first glance, even if a UMV is a “ship”, it will probably not constitute a “warship” because it will not be manned by the required personnel, under Article 29. However, perhaps a modicum of flexibility ought to be afforded to the interpretation of Article 29. In the era of increasing military use of drone technology in armed conflict, the Article 29 definition seems outdated in its manning requirement. One approach may be to apply a liberal interpretation to manning so as to include remote-control and pre-programming.[[56]](#footnote-56) This seems in keeping with the technological reality, particularly to the extent that remote control gives the shore-based controller comparable real-time control over the UMV, operating at the surface, to a manned equivalent. It is perhaps less appropriate in the context of pre-programmed autonomous operations since in such cases, the requisite control is exercised entirely *ex ante.*  Such an expansive interpretation of “manning” for pre-programmed autonomous operations, however, stretches the unambiguous wording of Article 29 too far. The technological state of play is such that it is difficult to see how entirely pre-programmed auronomous UMVs could, for instance, be used for inspections on the high seas. It is perhaps conceivable, however, that inspections could be carried out by remotely controlled UMVs with qualified shore-based personnel and sufficiently sophisticated voice projection capability.

From a sovereign immunity perspective, the consequences of the above finding are limited. While the immunity from non-flag state jurisdiction on the high seas may be unavailable under Article 95 for want of “warship” status, it may nonetheless be enjoyed under Article 96 to the extent that the relevant UMV constitutes a ship “used only on government non-commercial service” which is not tied to the express manning requirement.

*UMVs as “devices”*

An alternative categorisation of those UMVs that cannot be considered as ships would be to classify them as “devices”. UNCLOS makes infrequent but significant reference to the term “device” but the term is not defined therein.[[57]](#footnote-57) One dictionary definition of “device” provides that it is “a thing made or adapted for a particular purpose”.[[58]](#footnote-58) The term “device” is not defined in UNCLOS nor, generally, in national laws. Article 19(2)(f) of UNCLOS provides that one of the activities which is expressly “prejudicial to the peace, good order or security of the coastal State” in the exercise of innocent passage is the “launching, landing or taking on board of any military device.”[[59]](#footnote-59) In Part XII (Protection and Preservation of the Marine Environment), Article 194(c) requires States to take measures to, inter alia, minimize “pollution from installations and devices used in exploration or exploitation of the natural resources of the seabed and subsoil, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea, and regulating the design, construction, equipment, operation and manning of such installations or devices”.[[60]](#footnote-60) Under Article 209, States must adopt “laws and regulations to prevent, reduce and control pollution of the marine environment from activities in the Area undertaken by vessels, installations, structures and other devices flying their flag”. The wording of the aforementioned sections suggest that some, perhaps smaller, UMVs could fall under these provisions. In particular, the reference to military devices would seem to cover the use of UMVs deployed from military ships.

The, the right of navigation under Article 90 and the general right of innocent passage under article 17 do not purport to apply to “devices” and refer only to *“*ships”. This does not mean that the use of any UMVs classified as “devices” is not permissible. To the extent that they are operated on or under the high seas, there is little doubt that their use cannot be restricted. However, whether the exclusive rights granted to the flag state over ships would also be recognized for such UMVs is unclear. If this exclusive jurisdiction is not recognized, naval vessels of all states could interfere with them. Perhaps Part VII of UNCLOS should be interpreted as granting rights of visit to foreign war ships on the High Seas only in the specific cases mentioned under article 110 but that such rights of visit and inspection do not exist in relation to any other craft or structures. In areas where exclusive jurisdictional rights are granted to the coastal state, it would be reasonable to assume that the right of innocent passage would be available to such “devices” unless the coastal State required permission.

*UMVs as “equipment”*

A third possibility for some UMVs would be to categorize them as “equipment”, another term not defined within the 1982 Convention. The term is used in UNCLOS in two distinct ways: first, to refer to equipment on board a relevant ship[[61]](#footnote-61); and second, within the context of marine research, to equipment deployed *from* the ship.[[62]](#footnote-62) An important question is whether “ship” and “scientific research equipment” status are mutually exclusive; in other words, whether a UMV that falls under the definition of scientific equipment cannot also be a ship. For the purpose of Part XIII covering marine scientific research, “vessel” and “equipment” are used in contradistinction, which suggests that this is the case.[[63]](#footnote-63) It can be argued that this conclusion facilitates the conduct of maritime research. If everything launched from a ship is research equipment, then the process of permitting and supervising marine research is restricted to the “mother” ship. If everything launched is, by contrast, a ship in its own right, then numerous authorisations would be required. It is submitted that UMVs which are marine scientific equipment under Part XIII can also be “ships” in their own right when navigating independently.

Another possibility is that some of the UMVs under consideration are neither “ships”, “devices” nor “equipment”. This, however, seems unlikely as both the terms “device” and “equipment” are of residual character.[[64]](#footnote-64) If such is the case, neither the freedoms and obligations in respect of flagged “ships” nor the rules prescribed for “devices” and “equipment” under UNCLOS necessarily apply to them. It is not clear whether customary international law grants *sui generis* UMVs any navigational rights or other freedoms in the jurisdictional areas of other states. However, their usage in the high seas cannot be restricted more intrusively than the ordinary limits on the enjoyment of high seas freedoms.

Those UMVs which fulfil the requirements to be classed as ships will have to comply with the regulatory framework in existence and will be entitled to operate around the world. Of course, depending on the work undertaken, e.g. military operations, research, surveying etc., their operation in the jurisdictional areas of other states may be subject to additional restrictions by the relevant coastal State.

**Where Can UMVs Navigate?**

The sovereignty of the coastal State extends beyond its internal waters to its territorial sea.[[65]](#footnote-65) This presents considerable scope for a coastal State’s UMV operations within its territorial waters regardless of the legal status of the UMV in question. As regards operations exclusively within the deploying State’s territorial waters, the coastal State may regulate and prescribe the operational freedoms it considers appropriate for the UMV.

The passage of UMVs deployed by states other than the coastal state is questionable. It is unclear whether foreign UMVs enjoy the right of innocent passage through a coastal State’s territorial waters. Those UMVs which constitute “ships”, are entitled to the “right of innocent passage through the territorial sea” under Article 17 of UNCLOS.[[66]](#footnote-66) Those which are not ships will probably not be able to navigate through the territorial sea of another state without obtaining specific permission by the national authorities. It is reasonable to suggest that UUVs are required to surface for the duration of their innocent passage in exactly the same way as UUVs which are considered to be ships.[[67]](#footnote-67)

The coastal State may adopt laws to regulate the exercise of the right of innocent passage through its territorial sea to the extent they conform to the other provisions of UNCLOS and rules of international law.[[68]](#footnote-68) These include laws to ensure the safety of navigation and the regulation of maritime traffic. Ships must exercise the right of innocent passage in compliance with these laws. However, such laws must not concern the “design, construction, manning or equipment of foreign ships unless they are giving effect to generally accepted international … standards”.[[69]](#footnote-69)

Thus, for UMVs having the status of ships, compliance with international shipping regulations in relation to construction, design, equipment and manning (CDEM) standards is essential. Manning standards are set out in Chapter V of the SOLAS Convention considered below.[[70]](#footnote-70) If, as it has been submitted, UMVs-as-ships are not prohibited by the SOLAS regime, the coastal State would not be at liberty to enact unilateral manning provisions which could effectively prohibit the passage of UMVs on account of their unmanned character. More generic laws and regulations having this practical effect are similarly proscribed by article 24(1)(a).

If any naval UMVs were to constitute warships, they would likely have the right of innocent passage, that much has long been confirmed by customary law for straits,[[71]](#footnote-71) now reinforced by the right of transit passage under UNCLOS. However, neither customary international law nor UNCLOS settle the point beyond doubt,[[72]](#footnote-72) espectially the unqualified nature of that right. [[73]](#footnote-73) UNCLOS does, however, hint strongly at the answer. The first clue is that the right of innocent passage is in a sub-section titled “Rules applicable to *all* ships”.[[74]](#footnote-74) Without any further elaboration, this title certainly appears to include warships.[[75]](#footnote-75) Furthermore, the activities prescribed by Article 19(2) UNCLOS which render innocent passage ‘prejudicial to the peace, good order or security of the coastal State” include “any exercise or practice with weapons of any kind” and “the launching, landing or taking on board of any military device”. Such activities are unlikely to be relevant to the innocent passage of merchant ships. This suggests that warships can exercise the Article 17 right to the same extent as their civilian counterparts. The uncertainty surrounding the issue has nevertheless emboldened some states to interfere with such passage, citing the “ambiguous” provisions as a justification for their actions.[[76]](#footnote-76)

In their own Exclusive Economic Zones, coastal States enjoy “sovereign rights” for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed…”.[[77]](#footnote-77) The coastal State also enjoys the jurisdiction prescribed in UNCLOS with regard to, *inter alia*, marine scientific research.

The sovereign rights regarding the exploration and exploitation of the natural resources of the EEZ by the coastal State are not confined to any particular vehicular means and thus the enjoyment of those rights ought not to be diminished because a State seeks to explore its EEZ through, for example, a surveying UUV rather than a conventional manned ship.

In exercising the rights and duties prescribed to the coastal State in the EEZ, the relevant coastal State must have “due regard to the rights and duties of other States and shall act in a manner compatible with [the other UNCLOS provisions]”. Article 58 transposes the navigational freedoms of navigation and “other internationally lawful uses of the sea” of States under article 87 into foreign EEZs. Thus UMVs with ship status will have the right to navigate in foreign EEZs with “due regard to the rights and duties of the coastal State and shall comply with the laws and regulations adopted by the coastal State in accordance with the provisions of [UNCLOS] and other rules of international law”. Of course the performance of their operations, whether naval, surveying or research, will depend on how the specific activities are regulated

If a UMV is not a “ship”, its rights are not prescribed in UNCLOS. However, it is submitted that there is a right to operate them in a foreign EEZ as otherwise the coastal state’s rights would not be confined to resources and the marine environment but would exend to other activities. For those UMVs which are not ships, the important point is that UNCLOS does not expressly attribute the relevant rights and obligations to either the flag or coastal state. Therefore, it seems that recourse must be had to the rather vague Article 59 which calls for such conflicts to be resolved “on the basis of equity and in the light of all the relevant circustances…” It may be doubted the extent to which this provision is capable of decisively resolving any such issue, particularly in the naval context. This is because the “respective importance of the interests involved to the parties as well as to the international community as a whole” is not easily assessed when states’ justifications are based on considerations of national security and freedom of navigation – the justifications respectively invoked by the parties involved in the 2016 UMV seizure.

The high seas are open to all states and the freedom of the high seas includes, although is expressly not limited to, the freedom of navigation[[78]](#footnote-78) and freedom to conduct marine scientific research.[[79]](#footnote-79) The “right of navigation” is further particularised in Article 90, which gives every State “the right to sail ships flying its flag on the high seas.” Article 90 thus confines the codified right of navigation in UNCLOS to “ships.” It was stated above that to the extent that any UMVs constitute “ships”, they may, in principle, exercise the States’ right of navigation in the ordinary way. Those UMVs which do not constitute ships enjoy no codified right to navigation under UNCLOS. However, the listed freedoms are non-exhaustive and the high seas are open to all states. Thus, it is very difficult to argue that an authorised activity by a state can be subjected to the control of any other state in that area. Thus, it is submitted that the operation of UMVs on the high seas is unrestricted but only to the extent that such operations are conducted with due regard to the interests of other states in the exercise of their freedoms and that such UMV operations are not incompatible with any conditions laid down by UNCLOS and by other rules of international law.[[80]](#footnote-80) One should also note the Article 88 reservation of the high seas for peaceful purposes.

Rules for the Operation of UMVs which are Ships

The previous sections illustrate the importance of UMV status as ships or otherwise not least for the enjoyment of navigational rights. However, *quid pro quo,* for those UMVs which do constitute ships, in spite of their relatively small size they will nonetheless fall within a framework of obligations designed to make international shipping safer and cleaner.

The foundation, once again, is UNCLOS and it requires that every State must “effectively exercise its jurisdiction and control in administrative, technical and social matters over ships flying its flag”.[[81]](#footnote-81) Each state has to “maintain a register of ships containing the names and particulars of ships flying its flag”.[[82]](#footnote-82) Article 94(3) requires that states take necessary measures in respect of their flagged ships to ensure safety at sea with regard inter alia, to (a) construction equipment and seaworthiness (b) the manning of ships and training (c) the use of signals, the maintenance of communications and the prevention of collisions. These distinct obligations will be considered in turn.

*Construction, equipment and seaworthiness*

For conventional manned ships, there exists a comprehensive volume of standards for their construction and subsequent maintenance, in particular those contained in the detailed technical annex to SOLAS. However, many, if not all, of the existing UMVs are not of sufficient tonnage to be subject to most of the SOLAS annex chapters.[[83]](#footnote-83) Furthermore, SOLAS generally applies to ships engaged in international voyages,[[84]](#footnote-84) that is, a “voyage from a country to which [SOLAS] applies to a port outside such a country, or conversely.”[[85]](#footnote-85) Many current UMV operations will involve no such voyage even if they are “ships” for the purpose of the convention.[[86]](#footnote-86)

The consequences of the inapplicability of the SOLAS framework for UMV construction is twofold. It means that UMV owners need not to comply with a body of rules designed for ships that are far larger and designed to carry people and cargo. The drawback is that operators of UMVs have no certification benchmark to guard them against civil liability resulting from shortcomings in UMV design, for instance. The lack of an analogue certification regime also means that the coastal or port State may impose its own idiosyncratic standards on UMVs if it so wishes. In respect of design and construction, industry and select classification societies[[87]](#footnote-87) have taken the initiative and produced bespoke guidance documentation for unmanned marine systems, which is a positive step forward, although international harmonization is still some way off.

*Minimum manning and training*

Article 94(4)(b) UNCLOS requires:

that each ship is in the charge of a master and officers who possess appropriate qualifications, in particular in seamanship, navigation, communications and marine engineering, and that the crew is appropriate in qualification and numbers for the type, size, machinery and equipment of the ship.

From a compliance standpoint, a threshold question is whether an unmanned ship may be in the charge of a master or crew by definition. Historically, a ship’s master and crew comprise suitably qualified mariners performing functions on board. The question is whether the role is limited to onboard personnel or, instead, whether shore-based remote controllers and programming staff may constitute the UMV’s master and crew. Neither of these roles is defined in the 1982 Convention. Similarly, customary international law offers no guidance on this particular point and because of the lack of clarity at the international level, recourse must be had to national law for guidance. Some states’ national merchant shipping legislation includes a definition for the term “master”. In some cases, the term is defined not by on board attendance but instead by the relevant individuals’ responsibility for the ship. For instance, Title 46 of the Code of Laws of the United States defines the “master” as simply “the individual having command of a vessel”. This definition and those similar to it[[88]](#footnote-88) are seemingly broad enough to encompass the highest ranking UMV remote controller assuming overall responsibility for the navigation of that UMV. In the context of a remote controlled UMV, the controller, although not on board, is no less in control of the UMV’s movement and thus in a very real sense has “command and control” of the UMV. Thus such individuals could be designated as the UMV’s master.[[89]](#footnote-89) Clearly, however, the definition of “master”, like the definition of “ship” in the UMV context, is an important issue for the international regulatory regime, a point not lost on the IMO Maritime Safety Committee.[[90]](#footnote-90)

Ships’ manning is dealt with in SOLAS Chapter V. Chapter V is of particular significance to the UMVs under consideration since it does not prescribe a minimum tonnage for the applicability of its provisions. Its applicability is broad, applying to “all ships on all voyages” with the exception of “warships, naval auxiliary and other ships owned or operated by a Contracting Government and used only on government non-commercial service”, unless stated otherwise. Importantly, “ships” are defined as “any ship, vessel, or craft irrespective of type and purpose”. No requirement for it to be engaged on an international voyage is imposed. Thus those UMVs which may be characterised at least as “craft” would be subject to this part of SOLAS.

In particular, Regulation 14 of Chapter V deals with ships’ manning and it requires Contracting Governments to adopt measures to ensure that “from the point of view of safety of life at sea, all ships [are] sufficiently and efficiently manned.” The relevant maritime Administration must establish appropriate minimum safe manning following a transparent procedure and issue an appropriate document as evidence of the minimum manning considered necessary. Thus SOLAS relies on states to ensure the safe manning of their ships. There is no minimum number of persons required to be on board so long as the primary safety concern is met. It can therefore be argued that a crew numbering zero is technically “adequate” provided the operation is safe. Indeed, according to the IMO[[91]](#footnote-91), high levels of ship automation and also shore-based support may serve to reduce a ship’s onboard manning requirements.[[92]](#footnote-92) On the other hand, a ship with no persons on board cannot be said to be manned and thus construed literally, a requirement for manning adequacy cannot be complied with.

The former view is probably preferable. Regulation 14 provides a mechanism by which national Administrations may satisfy themselves as to the safety credentials of a ship with respect to its navigation, rather than calling for any particular mode of operability.[[93]](#footnote-93) Thus, a national Administration may, as a matter of discretion, permit the operation of an unmanned ship, to the extent that it is persuaded as to the safety credentials of the ship’s alternative communications arrangements and equipment.[[94]](#footnote-94) In the absence of uniform international standards for unmanned communications technology and practices, however, demonstrating conclusively the safety and performance credentials of such systems will be very difficult on anything other than an *ad hoc* basis. Over time, however, maritime authorities will develop their understanding of this automated technology so as to make certification of the safety of such systesm more expediemt.

At the international level, training for seafarers is addressed in the Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 and the detailed training requirements are particularised in the STCW Code. The STCW Convention, however, does not apply to UMV remote controllers or pre-programmers.[[95]](#footnote-95) Article 3 of the STCW Convention states that it applies to “seafarers *serving on board* seagoing ships entitled to fly the flag of a Party.”[[96]](#footnote-96) There is currently no internationally uniform standard for the training and qualifications of the shore-based personnel conducting UMV operations.[[97]](#footnote-97) This makes states’ discharge of the UNCLOS Article 94 obligation in respect of the training of this shore-based “crew” much more difficult. Once more, in the absence of standardisation, such training can only be done on an *ad hoc* basis. However, it would be wrong to discount the STCW Convention and Code entirely. As will be discussed below, to the extent that UMVs will operate alongside conventional manned ships and craft in the maritime domain, their remote controllers will need to have knowledge of how manned craft are operated. [[98]](#footnote-98) Thus they will require some training, at least to an extent akin to that which is currently required of seafarers, in addition to that which is required by the new communications technology.

The training of UMV operators will have to ensure at least a minimum level of competence to shield owners from fault-based civil liability and the development of a bespoke training regime for unmanned operations must be a priority if the technology is to be used safely and widely exploited commercially. This is no doubt why delegations at the June 2017 meeting of the IMO’s Maritime Safety Committee were concerned to ensure there was proper consideration given to the “human element”[[99]](#footnote-99) in addition to the safety requirements of the unmanned systems technology.[[100]](#footnote-100)

*Collision avoidance*

Safety of navigation of UMVs which are ships is based on the standard of good seamanship which includes compliance with the International Regulations for Preventing Collisions at Sea, 1972 (as amended) (COLREGs). COLREGs apply to “… all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.”[[101]](#footnote-101) Significantly, “vessels” are defined in the COLREGs as including “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.” The definition thus makes transportation capability a prerequisite to applicability. Construed literally, this serves to exclude most of the UMVs under consideration from the reach of the COLREGs. Only the very largest of today’s USVs, which retain dual operability, have transportation credentials, at least as conventionally understood.

However, the COLREGs regime merits consideration nonetheless. Firstly, as was demonstrated in the preceding sections, some of the U*S*Vs under consideration may be considered ships. Furthermore, even in the context of the UMVs which do not retain transportation capability, it can be argued that compliance with the COLREGs is the essential means by which UMV operators may discharge the broader duty of good seamanship, which is the duty of care owed as between users of the seas. Some of the COLREGs provide the basic prudence standard such that they may enable States that do not recognise the concept of a duty of care to prove an absence of fault.[[102]](#footnote-102) The COLREGs’ provisions do not state explicitly that the Rules apply only on the water surface. However, the various Rules relating to the conduct of vessels apply in the context of surface navigation.[[103]](#footnote-103) It may be inferred from this that the Rules find application only when the relevant vessel is on the surface. This would include USVs and UUVs when on the water surface. In an underwater context, there are currently no equivalent rules. A duty of care should also apply in such circumstances together with a corresponding standard. However this is not statutorily set and has not been explored in case law.

Probably the most important of the COLREGs is Rule 2. It provides that:

(a) Nothing in these Rules shall exonerate any vessel, or the owner, master, or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the circumstances of the case.

Rule 2(b) requires regard to be had to “any special circumstances, including the limitations of the vessels involved, which may make a departure from these Rules necessary to avoid immediate danger”.

Rule 2 confirms the primacy of good seamanship over a doctrinaire compliance with the letter of the Rules and most significantly, that in select circumstances, action contrary to the express directions may be required by this broader duty.[[104]](#footnote-104) In this context, the level of UMV autonomy is critically important. To the extent that the remote controllers of a UMV can use the technology to assess the circumstances and influence the UMVs movements in good time, there is no reason in principle why the seamanship standard may not be exercised remotely, to the extent that the relevant controller is sufficiently trained to discharge the duty.[[105]](#footnote-105) Conversely, the Rule presents clear difficulty to autonomous UMVs using algorithmic collision avoidance technology. Deciding when the overarching seamanship standard necessitates departure from the Rules is a highly sophisticated cognitive process beyond even the most impressive of modern control algorithms presently employed by UMVs.[[106]](#footnote-106) Because of this, autonomous UMVs, it is suggested, cannot yet comply with Rule 2 if they are unsupervised. It is submitted, however, that an autonomous UMV can comply with the seamanship standard to the extent it is permanently supervised by remote controllers capable of assuming immediate remote control of the UMV’s movement.[[107]](#footnote-107)

Rule 5 concerns a vessel’s lookout. The Rule requires “every vessel shall at all times maintain a proper look-out by sight as well as by hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and the risk of collision.” Of course, traditionally the Rule 5 obligation has been discharged with the stationing on board of seafarers, but the question is whether the lookout requirement may be performed by alternative technological means. Once more, there is a valid distinction to be drawn between remote controlled UMVs and their autonomous counterparts. By reference to “sight and hearing” the Rule contemplates the exercise of human perception. An autonomous UMV which utilises control algorithms, while perhaps retaining a degree of spatial awareness, does not, it is suggested, satisfy the requirement of appraisal by sight and hearing.[[108]](#footnote-108) In the context of remote controlled UMVs, however, the position is more complex. Remote controlled UMVs controlled with the benefit only of GPS tracking would also fall foul of the Rule 5 requirement for the same reason. However, some of today’s USVs are fitted with highly sophisticated cameras and aural sensors which present a shore-based operator a very accurate live-feed of the relevant USV’s vicinity, albeit one that is subject to the delay outlined above.[[109]](#footnote-109) It is unclear whether this satisfies the Rule 5 requirement. However, technological advancements and electronic aids such as radar have long been recognised as integral parts of the lookout obligation, and where available, their employment is not only permitted but required. The same may be said for shore-based personnel such as harbour authorities who may receive communications via radio. Therefore, it may be said that the use of camera technology and live feed ought not to be discounted purely because of its shore-side or indeed electronic orientation. This then raises the question of the requisite specification for the sensor technology. It is perhaps unrealistic to expect that anything less than the equivalent of the sight of onboard seafarers will be accepted by regulators.[[110]](#footnote-110)

Rule 6 requires all vessels to proceed at all times at a safe speed. This rule is a corollary of Rule 5 and in particular Rule 2 and the ability of the UMVs to comply with it is dependent on many of the considerations discussed in the previous paragraphs. The same may be said for the steering directions which are detailed in the Rules.[[111]](#footnote-111) Parts C and D deal respectively, with the lights and shapes and also the sound and light signals which vessels are required to exhibit. Practical issues may arise for some of the smaller UMVs when it comes to fitting the requisite lights,[[112]](#footnote-112) although in this respect reference may be made to the dispensation available for governments to accept “closest possible compliance” by “vessels of special consruction or purpose” with the rules regarding “the number, position, range or arc of visibility of lights or shapes, as well as to the disposition and characteristics of sound-signalling appliances.[[113]](#footnote-113) Parts C and D also serve as a potential benchmark for the credentials of any electronic lookout insofar as the system must be able to detect other vessels’ signals of the COLREGs prescribed potency.

**Conclusion**

It is clear that the question of UMV legal status is important but not critical. For any given UMV, it will create a difference between having established rights of navigation across the various maritime zones as “ships” and having no such internationally accepted and codified rights. It is also the difference between the existence of an established and uniform regulatory framework and, on the other hand, a vacuum of codified standards. It has been shown, however, that the legal status of UMVs cannot currently be determined with certainty. Although unmanned operability appears not to be an impediment to “ship” status, other UMV features may be. This means that some UMVs are likely to constitute ships whereas others may not. Therefore, UMVs are likely to operate as ships, equipment or devices or just as other UMVs (to the extent the latter terms are not residual). However there is no suggestion that the UMVs’ operation would not be possible simply because they are not ships. On the contrary, it is clear that on the High Seas and in the jurisdictional areas of the deploying state their use is permissible while for the jurisdictional zones of other states, it is more likely than not that the need to develop and utilize this technology will lead to reciprocal or even international agreements permitting their use.

For those UMVs which fall within the shipping framework, the *status quo* is something of a double-edged sword. A considerable part of the existing standards framework does not apply to UMVs, even those considered “ships”, on account of their size. Furthermore, there are some provisions which the present generation of UMVs cannot comply with in the absence of amendment or supplementation. In this respect, as has been shown, the level of UMV autonomy has a profound bearing on the extent of the reform needed to enable UMVs to comply with the current framework. The framework seems indifferent as to the onboard presence of a human crew but is far clearer in its requirement for human involvement in nautical decision-making. Hence, remote controlled UMVs are much more suited to compliance with the extant framework as compared with their autonomous counterparts, particularly when unsupervised.

People will be at the center of any wide-spread success of unmanned marine technology. New shore-based roles will be created for the navigation and programming of UMVs but the experience of traditional mariners will have a role to play in this evolution, one that is at least on par with the additional skills required by the new technology. The cost of this adjustment as well as the reliability of the automated systems will have an equal bearing on the commercial case for the technology’s broader uptake. Greater automation and autonomy in the marine sector seems inevitable and it has the potential, if managed properly, to make maritime activity safer and more efficient. People, principally marine stakeholders, will need to adapt to this evolution which will not be without its set-backs but it seems clear that how and when it happens will be very much on their own terms.

Regulation by states as well as self-regulation, through the introduction of codes or best practices and general principles of operation are and will continue to be important parameters for the development and the sustainability of new technology. The development of new technology can be supported but also retarded by existing or quickly developed regulations. This has been a major concern for the development of UMVs, with shipping regulations viewed as prohibitive in many respects. However, in reality, such prohibitions are more apparent than real and are due to the fact that the relevant laws were developed at a time when UMVs were not widely contemplated.

Assessing whether precautionary or preventive approaches should be used to address the uncertainties inherent in anything new is crucial because it will determine risk avoidance or risk management attitudes. For UMVs, due to their wide range, a risk management approach differing according to the various sizes and type of operations looks the most attractive. The regulatory attitude adopted is not, however, only dependent on factual information and sufficient demonstration of testing. It depends, in addition, on public perception which in turn is more likely to become positive if the benefits are clearly demonstrated and the change is gradually introduced. It is more likely to become negative when catastrophic regulatory failures happen or even when emerging technology is perceived not to be compliant with existing regulations.

Marine autonomy disrupts the way existing platforms operate but also enables the development of new platforms engaging in activities without non-autonomous equivalents. It encompasses platforms differing significantly in size, which operate within geographical areas and modes involving busy traffic or very little traffic. Such platforms will perform tasks some of which may cause serious potential impact on humans and the environment while others will pose very little risk at all. The regulatory environment should reflect this diversity and should be able to distinguish between testing new technology and using it operationally. The mixture between self-regulation and formal regulation will also need to vary between the various platforms and be standardised as each type of UMV activity becomes standardised. There are examples of products and technologies where specific regulations followed later and were introduced for the purpose of dealing with risks that had materialised or were becoming evident as realistic. This is a path that needs to be seriously considered especially in relation to the smallest UMVs which do not fall within the ambit of the majority of extant regulations, either because they are not ships, are too small or have too modest a carrying capacity.

The lack of a specific regulatory regime does not mean that an activity is illegal, forbidden or restricted. It is permissible and lawful to engage in new activities and to develop new technology subject to the general requirements imposed by law. Nor is it correct to think that in the absence of regulations, entities undertaking such activities are beyond the scope and the power of law. General legal principles concerning criminal and civil liability will always apply to all activities. In the absence of specific regulations, public and governmental bodies with powers to oversee the safety of marine activities will normally have the general power to authorise the testing and the use of emerging technology. Regulation in the marine autonomy sphere is pushed forward primarily by companies who prefer to have quantifiable regulatory risks to attract investors rather than feel exposed to the potentially more extensive general liability regime and with unspecified regulatory obstacles that may prohibit the manufacture, sale and use of their products. Understanding that risk management rather than risk aversion is the best way of dealing objectively, realistically and openly with the risks involved will help companies and the public overcome the need for regulation and enable the use of several systems without delay in an optimum way.

It is also true that in a non-regulated environment it is easier to contend, following an accident, that appropriate measures have not been taken and therefore the required standard of care has not been reached. Self-regulation involving risk assessment and management in addition to the development of codes of conduct and best practice guidelines can go a long way in demonstrating that the safety of operation is being dealt with even if in a particular circumstance a failure has occurred. Such a requirement, i.e. one of risk assessment in the design, general operation and specific tasks undertaken by a UMV would arguably be the first step. General guidelines dealing with such issues as well as issues concerning precautionary actions for collision avoidance, environmental protection and contingency planning for cases where malfunctions or accidents occur should be at the core of such guidance. This will go some way in demonstrating the responsibility of the UMV industry, giving confidence to both UMV stakeholders and maritime Authorities and, furthermore, in enabling the technology to realise its full potential.

1. See for instance, Ornulf Jan Rodself et al, “Definitions for Autonomous Merchant Ships”, (Norwgeian Forum for Autonomous Ships, 2017), p.11 where the following levels are propsed (1) Decision support (2) Automatic (3) Constrained autonomous (4) fully autonomous. Accessed online at http://nfas.autonomous-ship.org/resources/autonom-defs.pdf as at 7 June 2018. [↑](#footnote-ref-1)
2. Russ Wynn et al., “Autonomous Underwater Vehicles (AUVs): Their past, present and future contributions to the advancement of marine geoscience”, *Marine Geology*, Vol. 352, 2014, 451-468. See alsoAntoine Martin, “Unmanned Maritime Systems: Global Review of Technology, Roadmaps, Roles, Challenges & Opportunities, and Predictions,” 2018 available on line at https://slidex.tips/download/unmanned-maritime-systems-global-review-of-technology-roadmaps-roles-challenges as at 7 June 2018. In the marine scientific research context, see Katharina Bork et al., “The Legal Regulation of Floats and Gliders- In Quest of a New Regime?”, *Ocean Development & International Law*, 2008, 39:3, pp. 298-328. See also Edward Brown and Nicholas Gaskell, “The Operation of Autonomous Underwater Vehicles”, Vol. 2: Report on the Law, London, 2000 and Showalter S., “The Legal Status of Autonomous Underwater Vehicles”, *The Marine Technology Society Journal*, Spring, 2004, vol. 38(1), pp.80-83. [↑](#footnote-ref-2)
3. Wynn (2014) supra note 2. [↑](#footnote-ref-3)
4. Michael Schmitt and David Goddard, “International Law and the Military Use of Unmanned Maritime Systems,” *International Review of the Red Cross* (2016), 98 (2), 567-592. [↑](#footnote-ref-4)
5. A point made in a joint submission by Denmark, Estonia, Finland, Japan, Norway, the Republic of Korea, the United Kingdom and the United States to the IMO’s Maritime Safety Committee, see MSC 98/20/2, 2017 [9]. [↑](#footnote-ref-5)
6. See <www.defense.gov/News/News-Releases/News-Release-View/Article/1034224/statement-by-pentagon-press-secretary-peter-cook-on-return-of-us-navy-uuv> and <eng.mod.gov.cn/DefenseNews/2016-12/18/content\_4767100.htm>. [↑](#footnote-ref-6)
7. Montego Bay, 10 December 1982, 1833 U.N.T.S*.* 3. [↑](#footnote-ref-7)
8. Principally in Article 94 UNCLOS. [↑](#footnote-ref-8)
9. See Article 19(2)(f). [↑](#footnote-ref-9)
10. Part XIII UNCLOS. [↑](#footnote-ref-10)
11. Robert Veal, Michael Tsimplis, Andrew Serdy, Simon Quinn and Alexandos Ntovas, *Liability for Operation in Unmanned Maritime Vehicles with Differing Levels of Autonomy* (European Defence Agency, Brussels, 2016) (available from Paul O’Brien of the European Defence Agency at *paul.obrien@eda.europa.eu*). A good example are the detailed technical annexes to the International Convention for the Safety of Life at Sea, (SOLAS) 1974, 1184 U.N.T.S. 3 the provisions of which often apply only to ships of 500grt or more. [↑](#footnote-ref-11)
12. From a historical and anthropomorphic perspective, it is at least arguable that ships are things which are at least capable of being manned. See Brian Lavery, *Ship: 5,000 Years of Maritime Adventure*, (DK Publishing, London, 2004). [↑](#footnote-ref-12)
13. While it can be argued that the surveying capability of UMVs involves their sourcing of data, which is a form of electronic cargo, it is doubtful whether this may be said to involve transportation since such operations are more naturally seen as a means of ensuring safety of navigation rather than the “carrying” of something tangible. [↑](#footnote-ref-13)
14. Convention on the International Maritime Organizatio, 1958, 289 U.N.T.S. 3 , art 1(b). See Robert Veal, ‘Unmanned ships on the IMO work agenda’, [2017] 17 (6) *Shipping and Trade Law* 1. [↑](#footnote-ref-14)
15. Richard Shaw, “What is a ship in maritime law?”, *Journal of International Maritime Law* [2005] 247, 247; Eric Van Hooydonk, “The law of unmanned merchant shipping – an exploration”, *The Journal of International Maritime Law*, [2014] 20 pp.403-423. [↑](#footnote-ref-15)
16. See the compilation of UNCLOS preparatory documents in Myron Nordquist (ed.), *United Nations Convention on the Law of the Sea 1982: A Commentary*, (Martinus Nijhoff Publishers, Dordrecht, 1985). The preparatory work of a convention may be used as a supplementary means of interpreting it under Article 32 of the Vienna Convention on the Law of Treaties, 1980, 1115 U.N.T.S. 331 when the meaning is unclear or the literal interpretation leads to an absurd or unreasonable result. [↑](#footnote-ref-16)
17. This seems to be the common approach when looking at this question. See e.g.

Bork*,* supra note 2, p. 307. See also Eric Van Hooydonk, “The law of unmanned merchant shipping – an exploration”, *The Journal of International Maritime Law*, [2014] 20 pp.403-423. [↑](#footnote-ref-17)
18. Convention on the International Regulations for Preventing Collisions at Sea, 1972, 1050 U.N.T.S. 16, Rule 3(a). [↑](#footnote-ref-18)
19. International Convention for the Prevention of Pollution from Ships, 1340 U.N.T.S. 61, Article 2(4). [↑](#footnote-ref-19)
20. For instance, the COLREGs definition refers to transportation capability whereas its MARPOL counterpart does not. [↑](#footnote-ref-20)
21. C-308/06 *INTERTANKO and others* ECLI:EU:C:2008:312, [64] “…UNCLOS does not establish rules intended to apply directly and immediately to individuals and to confer upon them rights or freedoms capable of being relied upon against States, irrespective of the attitude of the ship’s flag State.” [↑](#footnote-ref-21)
22. Robert Veal and Michael Tsimplis, “The integration of unmanned ships into the *lex maritima*” [2017] *Lloyd’s Maritime and Commercial Law Quarterly,* 303, p.308. [↑](#footnote-ref-22)
23. Veal, Tsimplis, Serdy, Quinn and Ntovas, (2016), supra note 11 p.10. [↑](#footnote-ref-23)
24. See for example the changes in the collision regulations introduced, for example, to cover the use of radar. [↑](#footnote-ref-24)
25. In the UK context, a good example is the conviction of a rider of a track bicycle without a front brake, who killed a pedestrian after a collision, under the Offences Against the Person Act 1861 for "wanton or furious driving". [↑](#footnote-ref-25)
26. See generally Eirik Bjorge, *The Evolutionary Interpretation of Treaties* , (OUP, 2014). [↑](#footnote-ref-26)
27. Article 31(1) of the Vienna Convention on the Law of Treaties. [↑](#footnote-ref-27)
28. See the fifth preambular paragraph of UNCLOS which provides “Recognizing 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 and oceans, the equitable and efficient utilization of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment…”. [↑](#footnote-ref-28)
29. See for example *Costa Rica v Nicaragua (Dispute Regarding Navigational and Related Rights)* [2009] *I.C.J. Reports* 213, paras. 63-64. The dispute arose as to the navigational rights afforded to Costa Rica in the San Juan River in Nicaragua under the Treaty of Limits between Costa Rica and Nicaragua 1858. The question to be decided was whether the word “commerce” in Article VI of the treaty, which granted Costa Rica perpetual navigational rights (“con objetos de comercio”), extended to “tourism”. At the time of the Treaty’s conclusion, the meaning of “commerce” referred largely to “trade” to the exclusion of “tourism”, whereas a more modern meaning of the term was sufficiently broad to include “tourism”. The International Court of Justice (ICJ) held that the 2009 meaning of the term “commerce” was dispositive so as to, in fact, encompass “tourism”. [↑](#footnote-ref-29)
30. *Ibid*., paras. 70-71, emphasis added. [↑](#footnote-ref-30)
31. <www.defense.gov/News/News-Releases/News-Release-View/Article/1034224/statement-by-pentagon-press-secretary-peter-cook-on-return-of-us-navy-uuv>. [↑](#footnote-ref-31)
32. <eng.mod.gov.cn/DefenseNews/2016-12/18/content\_4767100.htm>. See also <www.fmprc.gov.cn/mfa\_eng/xwfw\_665399/s2510\_665401/t1425479.shtml>. [↑](#footnote-ref-32)
33. See Veal, Tsimplis, Serdy, Quinn and Ntovas, (2016), note 11, ch 3. [↑](#footnote-ref-33)
34. The Burgerlijk Wetboek (BW) is the Civil Code of the Netherlands. Book 8 is titled and concerns Transport Law and Means of Transport. [↑](#footnote-ref-34)
35. Article 194 of the Burgerlijk Wetboek (BW) Boek 8 (Civil Code, Book 8) authorises the registration of interests in “seagoing ships.” The term “seagoing ship[s]” is defined in Article 8:2(1) BW as those ships which, “according to their construction, are intended exclusively or principally for floating on the sea.” [↑](#footnote-ref-35)
36. *Lozman v City of Riviera Beach* 133 S.Ct. 735, 2013 AMC 1 (2013). The issue was whether a floating home constituted a “vessel” under § 3 of the Rules of Construction Act, thereby establishing Federal admiralty jurisdiction for a marina’s claim to assert its *in rem* maritime lien against the floating home for dockage fees and trespass damages. The home was a plywood construction above empty bilge space and was 60-foot by 12-foot (around 65 square metres). It was a two-story house-like structure. It had no watertight compartments, doors or windows and had no means of self-propulsion. [↑](#footnote-ref-36)
37. *Ibid*., p.739. [↑](#footnote-ref-37)
38. For instance, section 112(1) of the UK’s Railways and Transport Safety Act 2003 gives the relevant Secretary of State the power to make an order to:

(a) provide for a shipping provision to apply (with or without modification) in relation to specified things which are used, navigated or situated wholly or partly in or on water; [and / or]

(b) provide for a shipping provision not to apply in relation to specified things which are used, navigated or situated wholly or partly in or on water…

A “shipping provision” would include the Merchant Shipping Act 1995, including its registration rules. Similar provisions are contained in article 8:2(2) of the Dutch Burgerlijk Wetboek (BW) Boek 8. [↑](#footnote-ref-38)
39. Bundesgerichtshof, I ZR 84/51 (1951) [1952] *Neue Juristische Wochenschrift* 1135. The definition from the case is translated in Sarah Gahlen, “Ships Revisited: A Comparative Study”, *Journal of International Maritime Law*, (2014) 20, pp. 252-269, p.25. [↑](#footnote-ref-39)
40. Merchant Shipping Act 1995, s. 313. [↑](#footnote-ref-40)
41. *Michael v Musgrove (t/a YNYS Ribs)* [2012] 2 *Lloyd's Rep*. 37. [↑](#footnote-ref-41)
42. See cases such as *The Mac* (1882) 7 PD 126; *The Harlow* [1922] P. 175; *St John Pilot Commissioners v Cumberland Ry & Coal Co I* [1910] A.C 208. [↑](#footnote-ref-42)
43. *R v Goodwin* [2003] EWCA Crim 3184;[2006] 1 Lloyd's Rep. 432 p.438, [27]. Lord Phillips CJ found that for a “vessel to be ‘used in navigation’ under the Merchant Shipping Act it is not a necessary requirement that it should be used in transporting persons or property by water to an intended destination”. [↑](#footnote-ref-43)
44. <worldmaritimenews.com/archives/235207/first-unmanned-vessel-joins-uk-ship-register/>. [↑](#footnote-ref-44)
45. There are several formulations of the levels of autonomy, see note 1 above. [↑](#footnote-ref-45)
46. It could, however, affect compliance with specific requirements under the IMO Conventions, discussed below. [↑](#footnote-ref-46)
47. Emphasis added. [↑](#footnote-ref-47)
48. Article 20 UNCLOS. [↑](#footnote-ref-48)
49. See Veal, Tsimplis, Serdy, Quinn and Ntovas, 2016, supra note 11, ch 3. [↑](#footnote-ref-49)
50. For a view doubting the significance of the subsection (a) title and titles generally, see Shao Jin, The Question of innocent passage of warships after UNCLOS III, *Marine Policy* 13(1) 1989, pp. 56-67, p. 60. [↑](#footnote-ref-50)
51. Richard Barnes, “Article 20” in Alexander Proelß (ed.), The United Nations Convention on the Law of the Sea: A Commentary, (Hart Publishing, 2017), p.198. [↑](#footnote-ref-51)
52. #  David Attard (ed.), “The IMLI Manual on International Maritime Law, Volume I: The Law of the Sea,” (OUP, 2014), p.46.

 [↑](#footnote-ref-52)
53. This could potentially make their operation more difficult and the manufacturers and operators may prefer a different status. [↑](#footnote-ref-53)
54. See Michael Schmitt and David Goddard, “International law and the military use of unmanned maritime systems”, *International Review of the Red Cross* 98 (2) (2016), 567–592. See also Captain Andrew Norris, “Legal issues relating to unmanned maritime vehicles,” Research Monograph, U.S. Naval War College, 2013. [↑](#footnote-ref-54)
55. See Andrew Henderson, “Murky waters: the legal status of unmanned undersea vehicles”, *Naval Law Review*, 2006, pp. 55-71; James Kraska, “The Law of Unmanned Naval Systems in War and Peace”, *The Journal of Ocean Technology*, 2010, pp. 44-68; Robert McLaughlin, “Unmanned naval vehicles at sea: USVs, UUVs and the adequacy of the law”, *Journal of Law, Information and Science*, 2011, pp. 100-115; Captain Andrew Norris, “Legal issues relating to unmanned maritime vehicles,” Research Monograph, U.S. Naval War College, 2013. [↑](#footnote-ref-55)
56. See the The Programme on Humanitarian Policy and Conflict Research at Harvard University (HPCR), *Manual on International Law Applicable to Air and Missile Warfare* (2009, Harvard University), which suggests that under customary international law, a “military aircraft” means an aircraft (1) operated by the armed forces of a State; (2) bearing the military markings of that State; (3) commanded by a member of the armed forces; and (4) controlled, manned or pre-programmed by a crew subject to regular armed forces discipline. In the Commentary to the HPCR Manual with regard to the stipulation that a military aircraft must be operated by the armed forces of a State, it has been argued that the military aircraft need not “belong” to the armed forces; a leased aircraft operated by the armed forces, though still belonging to the lessor would qualify as a military aircraft. The same commentators have also argued that, with respect to the obligation that a military aircraft be commanded by a member of the armed forces, the relevant commander could either be in the craft itself of controlling it remotely. Latterly with regard to the manning requirement, it has been argued that:

“the requirement of a crew under military discipline does not mean that all military aircraft must be manned by a crew. Today, [unmanned aerial vehicles] ... also qualify as military aircraft, if the persons remotely controlling them are under regular armed forces discipline. The same holds true for autonomously operating UAVs, provided that their programming has been executed by individuals subject to regular armed forces control.”

See the commentary to HPCR Manual in Programme on Humanitarian Policy and Conflict Research at Harvard University (HPCR), *Manual on International Law Applicable to Air and Missile Warfare,* (2013, Cambridge University Press), p.38. [↑](#footnote-ref-56)
57. See Articles 19(2)(f); 145(b); 194(3)(c) and (d); 202(2) and 274(b). [↑](#footnote-ref-57)
58. A Stevenson and M Waite, *Concise Oxford English Dictionary*, 12th Ed, OUP, 2012, p.392. [↑](#footnote-ref-58)
59. Richard Barnes and Carmino Massarella, “Article 52” in Proelß, supra note 51, p. 194. The authors suggest that the term “military device” should be “construed purposively, having regard to the device’s intended function. It includes weapons systems, munitions, mines, traps, detection, surveilleance and communications devices, drones, unmanned submeribles and troop carrying equipment.” [↑](#footnote-ref-59)
60. Article 194 requires such measures in respect of “pollution from other installations and devices operating in the marine environment.” Under Article 274(b) in Part XIV, one of the objectives of the International Seabed Authority is to ensure that “[t]he technical documentation on the relevant equipment, machinery, devices and processes is made available to all States, in particular developing States which may need and request technical assistance in this field”. [↑](#footnote-ref-60)
61. The term is used in Article 21(2) which provides that any laws imposed by the coastal State relating to innocent passage must “not apply to the design, construction, manning or equipment of foreign ships unless they are giving effect to generally accepted international rules or standards.” This provision epitomises many of the pre-part XIII uses of the term and construed *ejusdem generis* would refer to things comprised within a ship itself. Provisions using “equipment” in such a way would not apply to the UMVs under consideration.The term “equipment” is used in the same way in Articles 94(3)(a); 94(4)(a); 194(3)(b); 211(6)(c); 217(2); 226(1)(a). [↑](#footnote-ref-61)
62. In the context of marine scientific research, Article 261 provides that “the deployment and use of any type of scientific research installations or equipment shall not constitute an obstacle to established international shipping routes”. The article’s reference to the “deployment” of the equipment confirms that the equipment in this context refers to things deployed from or outside of any other ship. Furthermore, the term is here referred to as “scientific research equipment”. Article 262 requires such equipment to “bear identification markings indicating the State of registry or the international organization to which [it] belong[s] and shall have adequate internationally agreed warning signals to ensure safety at sea and the safety of air navigation”. The smaller UMVs under consideration, which are used for marine scientific research purposes, could certainly fall within this usage of the term “equipment”. See also *Gliders for Research, Ocean Observation and Management (GROOM)*, “Legal Aspects of Glider Operations in European Waters,” (GROOM, 2013), p.22 (copy on file with authors) where the conclusion reached is that the project’s gliders indeed constitute marine scientific research equipment. See also Katharina Bork et al, “The Legal Regulation of Floats and Gliders- In Quest of a New Regime?,” *Ocean Development & International Law*, 2008, 39:3, pp. 298-328. [↑](#footnote-ref-62)
63. See e.g. Article 248(b) and (d). [↑](#footnote-ref-63)
64. Richard Barnes, “Article 19” in Proelß, supra note 51, p.194. [↑](#footnote-ref-64)
65. Article 2 UNCLOS. [↑](#footnote-ref-65)
66. One of the means by which such passage is considered “prejudicial to the peace, good order or security of the coastal State” is if in the latter’s territory, the UMV engages in the “carrying out of research or survey activities”. In light of this prescription in Article 19(2)(j), UMVs should stop any surveying or monitoring operations. [↑](#footnote-ref-66)
67. Article 20 UNCLOS. [↑](#footnote-ref-67)
68. Article 21 UNCLOS. [↑](#footnote-ref-68)
69. Article 21(2) UNCLOS. [↑](#footnote-ref-69)
70. In particular see Regulation 14, discussed below. [↑](#footnote-ref-70)
71. #  *Corfu Channel (United Kingdom of Great Britain and Northern Ireland v. People's Republic of Albania)* [1949] *I.C.J. Reports* 4.

 [↑](#footnote-ref-71)
72. See Shao Jin, “The question of innocent passage of warships After UNCLOS III”, *Marine Policy*, January 1990, pp. 56-66; Alexandra Marksteiner, It's Not All FON and Games: U.S. "Freedom of Navigation" Operations and the Legal Debate Surrounding Innocent Passage, *Hemispheres*, 2017, Vol. 40, p. 19-36. 18p. See also James Houck and Nicole Anderson, “The United States, China, and Freedom of Navigation in the South China Sea,” 13 *Washington University Global Studies Law Review* 441 (2014); Gamaliel Ballester, “The Right of Innocent Passage of Warships: A Debated Issue,” 54 *Revista de Derecho Puertorriqueño* 87, 118 (2014); Erik Franckx, “Innocent Passage of Warships: Recent Developments in US-Soviet Relations, (1990) 14 *Marine Policy* pp. 484-490; Zou Keyuan, “Innocent passage for warships: The Chinese doctrine and practice,” *Ocean Development and International Law*, 29:3 (1998), 195-223. [↑](#footnote-ref-72)
73. For instance, the following states have made declarations or statements indicating the requirement (which they must therefore regard as permissible) of prior *notification* to the coastal state before warships may exercise innocent passage through its territorial waters: Bangladesh (2001, upon ratification); Croatia (statement upon succession 1995); Egypt (upon ratification, 1983); Malta (upon ratification, 1983); Serbia and Montenegro (confirmed upon succession 2001). The following State have made declarations or statements indicating the necessity of prior *authorization* of the coastal State: Algeria (upon signature, 1982); China (upon ratification, 1996); Ecuador (upon ratification, 2012); Iran (upon Signature, 1982); Oman (upon signature, 1983); Yemen (upon ratification, 1987). See <www.un.org/depts/los/convention\_agreements/convention\_declarations.htm#Bangladesh%20Upon%20ratification>, accessed 23 January 2018. [↑](#footnote-ref-73)
74. Emphasis added. [↑](#footnote-ref-74)
75. Some, however, have questioned the significance of subsection A’s title in this respect, see S Jin, “The question of innocent passage of warships After UNCLOS III,” *Marine Policy*, January 1990, pp.56-66, p.60. [↑](#footnote-ref-75)
76. Vaughan Lowe, “Some legal problems arising from the use of the seas for military purposes,” *Marine Policy*, 1986, pp.171-184, p. 175. For a Chinese perspective on current state practice see also Xue Guifang, “Surveys and Research Activities in the EEZ: Issues and Prospects,” in Peter Dutton (ed.), *Military Activities in the EEZ: A U.S.-China Dialogue on Security and International Law in the Maritime Commons*, Naval War College, (Newport, Rhode Island, 2010). [↑](#footnote-ref-76)
77. Article 56(1)(a). [↑](#footnote-ref-77)
78. Article 87(1)(a). [↑](#footnote-ref-78)
79. Article 87(1)(f). [↑](#footnote-ref-79)
80. Article 87(2). [↑](#footnote-ref-80)
81. Article 94(1). [↑](#footnote-ref-81)
82. Article 94(2)(a). [↑](#footnote-ref-82)
83. See Veal, Tsimplis, Serdy, Quinn and Ntovas, (2016), supra note 11, Chapter 4. For example, SOLAS Chapter II-1 Structure, Sub-division, and Stability, Machinery and Electrical Installations applies to passenger ships and cargo ships subject to the general exception of cargo ships less than 500 grt (Regulation II/1-3 of Chapter 1). [↑](#footnote-ref-83)
84. Chapter 1, Regulation 1(a). [↑](#footnote-ref-84)
85. Regulation 1/2. [↑](#footnote-ref-85)
86. The term “ship” is not generally defined in SOLAS, at least not directly. The Convention makes reference to five general categories of ships which include “passenger ship[s]”; “cargo ship[s]”; “tanker[s]”; “fishing vessel[s]” and “nuclear ship[s]. It can be argued that the UMVs discussed in this article are not germane to any of the listed vessels and that the Convention therefore does not apply to their operation. However, “cargo ship[s]” has a residual definition. They are defined as “any ship which is not a ‘passenger ship’” rather than with any reference to their capability to carry any cargo. The effect of this definition is that a “cargo ship” is any ship that does not carry more than 12 passengers. Since the UMVs within the scope of this article carry no passengers they could constitute “cargo ships” but only to the extent that they are “ships” of any denomination. [↑](#footnote-ref-86)
87. For instance, see Lloyd’s Register’s Unmanned Marine Systems Code, February 2017. [↑](#footnote-ref-87)
88. In the United Kingdom, s. 313 of the Merchant Shipping Act 1995 defines the master as including “every person (except a pilot) having command or charge of a ship”. Similarly, s. 291(1) of the Liberian Maritime Law defines “master” as “any person having command of a vessel”, The Marshall Islands’ Maritime Act 1990, § 803(a) defines the “master” as “any person having command of a vessel”. However, other national definitions suggest that the “master” must be on board. The Dutch 8 Burgerlijk Wetboek, Article 8:6 defines “captain and boatmaster” as being “part of the “crew”. Article 8:5 defines “persons on board of a ship” as “all persons, crew and passengers, who find themselves on board of a ship”. For a comprehensive review of the roles and international duties of shipmasters, see John Cartner, *The International Law of the Shipmaster* (Informa Law, London, 2009). [↑](#footnote-ref-88)
89. Veal and Tsimplis, 2017, supra note 22, p. 318. [↑](#footnote-ref-89)
90. Robert Veal, “Unmanned ships on the IMO work agenda” [2017] 17(5) *Shipping and Trade Law* 1. [↑](#footnote-ref-90)
91. IMO Resolution A.1047 (27) Principles of Safe Manning, adopted 20 November 2011. [↑](#footnote-ref-91)
92. *Ibid*., Annex 2, “Guidelines for Determination of Minimum Safe Manning”, para.1.1. [↑](#footnote-ref-92)
93. Veal and Tsimplis, supra note 22, p.320. [↑](#footnote-ref-93)
94. *Ibid.*  [↑](#footnote-ref-94)
95. See also Veal, Tsimplis, Serdy, Quinn and Ntovas, (2016), supra note 11, Ch 4. [↑](#footnote-ref-95)
96. Emphasis added. [↑](#footnote-ref-96)
97. At the national level, see Chapter 11 of Maritime UK, *Being a Responsible Industry: An Industry Code of Practice*, Version 1.0, 2017, available online via https://www.maritimeuk.org/media-centre/publications/being-responsible-industry-industry-code-practice/. [↑](#footnote-ref-97)
98. Veal, Tsimplis, Serdy, Quinn and Ntovas, (2016), supra note 11, ch 4. This is confirmed by Rule 2 of the International Regulation for Preventing Collisions at Sea, 1972, considered below. [↑](#footnote-ref-98)
99. This is defined in Resolution A.947(23), “Human Element Vision, Principles and Goals for the Organization”, as “a complex multi-dimensional issue that affects maritime safety, security and marine environmental protection. It involves the entire spectrum of human activities performed by ships’ crews, shore-based management, regulatory bodies, recognized organizations …”. [↑](#footnote-ref-99)
100. MSC 98/20/13, para 6. For more on IMO efforts in the area, see R Veal, “Unmanned ships on the IMO work agenda”, [2017] 17(5) *Shipping and Trade Law* 1. [↑](#footnote-ref-100)
101. Rule 1(a). [↑](#footnote-ref-101)
102. For those jurisdictions which have no concept of a “duty of care”, it may be said that the exercise of such seamanship is a means of preventing the infringement of protected rights, which is an alternative basis of liability, in particular, in some civil law jurisdictions. See R Veal, M Tsimplis, A Serdy, S Quinn and A Ntovas, 2016, supra note 11, Ch 10. [↑](#footnote-ref-102)
103. See Veal, Tsimplis, Serdy, Quinn and Ntovas, (2016), supra note 11, p. 65. [↑](#footnote-ref-103)
104. Veal and Tsimplis, 2017, supra note 22, p.325. [↑](#footnote-ref-104)
105. *Ibid*., p.325. [↑](#footnote-ref-105)
106. *Ibid.* [↑](#footnote-ref-106)
107. An analogy may be drawn here with the use of heading and track control. SOLAS permits the use of such systems only to the extent that it is “possible [for a qualified helmsperson] to establish manual control of the ship’s steering immediately”, Chapter V, Regulation 24(1). [↑](#footnote-ref-107)
108. Veal and Tsimplis, 2017, supra note 22, p.326. [↑](#footnote-ref-108)
109. Magnus Ornfelt et al, Best Practice Guide for Unmanned Maritime Systems Handling, Operations, Design and Regulations (SARUMS, Brussels, 2015). [↑](#footnote-ref-109)
110. Veal and Tsimplis, 2017, supra note 22, p.328. [↑](#footnote-ref-110)
111. These are comprised in Part B of the COLREGs. [↑](#footnote-ref-111)
112. Edward Brown and Nicholas Gaskell, The Operation of Autonomous Underwater Vehicles, Vol. 2: Report on the Law (Society of Underwater Technology, London, 2000), pp. 116-121. [↑](#footnote-ref-112)
113. COLREGs Rule 1(e). [↑](#footnote-ref-113)