CMI QUESTIONNAIRE ON UNMANNED SHIPS

INTRODUCTION

Unmanned ships are those which are capable of controlled movement on the water in the absence of any onboard crew. Control is performed in essentially two ways. It can be performed by remote-control, whereby a shore-based remote controller uses a computer and joystick to control the unmanned ship's movement and signalling using radio and satellite communications. In doing so the controller is aided by the streaming of the ship's vicinity effected by cameras and aural sensors affixed to the ship's hull / chassis. There is a small delay in the transmission of information to and from the ship, like with all forms of satellite communication. On the other hand, the ship may be "controlled" autonomously. This involves the ship being pre-programmed before deployment, and, thereafter, performs a predetermined nautical course without any human interaction. This control, as well as a degree of collision avoidance capability, is affected with the use of highly sophisticated software technology, control algorithms and sonar radar.

Whereas unmanned ships in operation today are small in size (<20m in length) and essentially used for marine scientific research and military purposes their number has risen exponentially in recent years and so has the number or research projects aimed at developing the first unmanned merchant ships of 500 grt or more.

In order to ensure that the required regulations are in place once these ships become a technical reality, CMI Executive Council has set up an International Working Group (IWG) to study the current international legal framework and consider what amendments and/or adaptions and/or clarifications may be required in relation to unmanned ships.

In answering the questions below please assume that they are made in relation to an unmanned ship of 500 grt or more.

1. NATIONAL LAW
1.1. Would a "cargo ship" in excess of 500 grt, without a master or crew onboard , which is either 1.1.1. controlled remotely by radio communication? 1.1.2. controlled autonomously by, inter alia, a computerised collision avoidance system, without any human supervision constitute a "ship" under your national merchant shipping law?
Answer: **Yes.** **Under section 2 of the Merchant Shipping Act, a "ship" is defined as any kind of vessel used in navigation by water, however propelled or moved and includes —(a) a barge, lighter or other floating vessel; (b) an air-cushion vehicle, or other similar craft, used wholly or primarily in navigation by water; and (c) an off-shore industry mobile unit.**
1.2. Would an unmanned "ship" face difficulty under your national law in registering as such on account of its unmanned orientation?
Answer: **There is currently no regulation in place for unmanned ships.**
1.3. Under your national law, is there a mechanism through which, e.g. a Government Secretary may declare a "structure" to be a "ship" when otherwise it would not constitute such under the ordinary rules?
Answer: **There is currently no such mechanism under national law.**

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1.4. Under your national merchant shipping law, could either of the following constitute the unmanned ship's "master"

1.4.1. The chief on-shore remote-controller

1.4.2. The chief pre-programmer of an autonomous ship

1.4.3. Another 'designated' person who is responsible on paper, but is not immediately involved with the operation of the ship

Answer:

Under section 2 of the Maritime and Port Authority of Singapore Act, a "master" is defined as follows:

"master" –

(a) in relation to a vessel, includes every person (except a pilot) having charge or command of the vessel; and

(b) in relation to an inland craft includes every person having charge of the inland craft

It is not clear if this definition can be interpreted as encompassing any of the persons named in para 1.4.1, 1.4.2 or 1.4.3.

1.5. Could other remote-controllers constitute the "crew" for the purposes of your national merchant shipping laws?

Answer:

Unlikely, as the definition for "crew" includes a reference to persons employed on board the ship.

Under section 2 of the Merchant Shipping Act, "crew" is defined as follows:

"***crew" means the following:***

(a) if the ship is a ship to which the Merchant Shipping (Maritime Labour Convention) Act 2014 applies, all the seafarers employed on board that ship;

(b) if the ship is not a ship mentioned in paragraph (a), the master and all the seamen employed on board that ship;

2. UNITED NATIONS CONVENTION ON THE LAW OF THE SEA, 1982 (UNCLOS)

2.1. Do you foresee any problems in treating unmanned ships as "vessels" or "ships" under the Law of the Sea in your jurisdiction (i.e. that such ships would be subject to the same rights and duties such as freedom of navigation, rights of passage, rights of coastal and port states to intervene and duties of flag states) in the same way as corresponding manned ships are treated?

Answer:

We might face legal and technical issues with identifying the relevant autonomous vessel personnel with whom communications should be made, or by whom decisions on autonomous vessels can be made. For instance, how would unmanned ships in our control sectors communicate with MPA's VTIS officers under the STRAITREP regime, or interact with other users in real-time? It is also unclear how our pilotage requirements and regulations – which are premised on the presence of a master onboard - would apply to such vessels.

2.2. Paragraphs (3) and (4) of UNCLOS Article 94 include a number of obligations on flag states with respect to the manning of such ships. Do you think that it is possible to resolve potential inconsistencies between these provisions and the operation of

unmanned ships without a crew on board through measures at IMO (under paragraph (5) of the same Article) or do you think other measures are necessary to ensure consistency with UNCLOS. If so, what measures?

Answer:
The international legal framework must provide clarity on who the international shipping community and regulators can hold responsible for any navigational incidents and problems, including in instances of cyber-attacks, whilst States would face challenges in developing new capabilities for investigating such incidents. There must also be agreement on the technical standards which the programmes must meet, as well as a platform and framework for their continuing regulation and development.

3. IMO CONVENTIONS – THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA (SOLAS) 1974 (AS AMENDED)

3.1. Does your national law implementing the safe manning requirement in Regulation 14 of Chapter V of SOLAS require at least a small number of on board personnel or does the relevant authority have the discretion to allow unmanned operation if satisfied as to its safety?

Answer:
National law requires that an appropriate minimum safe manning be established for every ship, under Chapter V Regulation 14(b)(ii) of the Merchant Shipping (Safety Convention) Regulations Chapter V.

Under Chapter V Regulation 3(b) of the Merchant Shipping (Safety Convention) Regulations, the Director of Marine may grant exemptions or equivalents of a partial or conditional nature, when conditions affecting safety are such as to render the full application of Chapter V unreasonable or unnecessary.

The relevant legislative text is as follows:
Regulation 3
Exemptions and Equivalents

(b) The Director may grant to individual ships exemptions or equivalents of a partial or conditional nature, when any such ship is engaged on a voyage where the maximum distance of the ship from the shore, the length and nature of the voyage, the absence of general navigational hazards, and other conditions affecting safety are such as to render the full application of this Chapter unreasonable or unnecessary, provided that the Director has taken into account the effect such exemptions and equivalents may have upon the safety of all other ships.

3.2. Regulation 15 of SOLAS Chapter V concerns principles relating to bridge design. It requires decisions on bridge design to be taken with the aim of, inter alia, "facilitating the tasks to be performed by the bridge team and the pilot in making full appraisal of the situation…". In the contest of a remote controlled unmanned ship, could this requirement be satisfied by an equivalent shore-based facility with a visual and aural stream of the ship's vicinity?

Answer:
This requires further technical discussions at IMO.

3.3. As interpreted under national law, could an unmanned ship, failing to proceed with all speed to the assistance of persons in distress at sea as required by Regulation 33 of SOLAS Chapter V, successfully invoke the lack of an on-board crew as the reason

for omitting to do so (provided that the ship undertook other measures such as relaying distress signals etc.)?

Answer:
It is unlikely that autonomous vessels will be found culpable if it is physically impossible for them to have rendered such assistance.

4. THE INTERNATIONAL REGULATIONS FOR PREVENTING OF COLLISIONS AT SEA, 1972 (COLREGS)

4.1. Would the operation of an unmanned "ship" without any on board personnel, per se, be contrary to the duty / principle of "good seamanship" under the COLREGS, as interpreted nationally, regardless of the safety credentials of the remote control system?

Answer:
Good seamanship may require the seaman to take action in response to unexpected or unforeseen circumstances which an autonomous system may not be programmed to do.

4.2. Would the autonomous operation of a "ship", without any on-board personnel or any human supervision, be contrary to the duty / principle of "good seamanship", under the COLREGS, as interpreted nationally, regardless of the safety credentials of the autonomous control system?

Answer:
Good seamanship may require the seaman to take action in response to unexpected or unforeseen circumstances which an autonomous system may not be programmed to do.

4.3. As interpreted under national law, could the COLREG Rule 5 requirement to maintain a "proper lookout" be satisfied by camera and aural censoring equipment fixed to the ship transmitting the ship's vicinity to those "navigating" the ship from the shore?

Answer:
COLREGs was not intended to apply to unmanned or autonomous vessels. This requires further technical discussions at IMO.

The traditional understanding of maintaining a proper look-out under COLREGs requires that a watchman be placed on look-out duty. The lookout must be maintained in accordance with Section A-VIII/2, Part IV of the STCW Code.

4.4. Would a ship navigating without an on-board crew constitute a "vessel not under command" for the purposes of COLREG Rule 3(f), read together with COLREG Rule 18, as interpreted under your national law?

Answer:
No. Rule 3(f) defines "vessel not under command" as a vessel which through some exceptional circumstances is unable to manoeuvre as required by these Rules, and is therefore unable to keep out of the way of another vessel.

The words "exceptional circumstances" indicate that COLREGs was not intended to apply to unmanned or autonomous ships. Further, the definition indicates that such ships must be "unable to keep out of the way of another vessel", which is unlikely to be the case.

5. THE INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING CERTIFICATION AND WARCHKEEPING, 1978 (STCW CONVENTION)

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5.1. The STCW Convention purports to apply to "seafarers serving on board seagoing ships". Would it therefore find no application to a remotely controlled unmanned ship?
Answer: **This would depend on whether the term "seafarers" is given a new definition, and whether seafarers working to control an unmanned or autonomous vessel would be deemed as "serving on board".**
5.2. As interpreted under national law, can the STCW requirement that the watchkeeping officers are physically present on the bridge and engine room control room according to Part 4 of Section A-VIII/2 be satisfied where the ship is remotely controlled? Is the situation different with respect to ships with a significantly reduced manning (bearing in mind that the scope of the convention only applies to seafarers on board seagoing ships)?
Answer: **Same answer to 5.1 applies.**
6. LIABILITY
6.1. Suppose a "ship" was navigating autonomously i.e. through an entirely computerised navigation / collision avoidance system and the system malfunctions and this malfunction is the sole cause of collision damage – broadly, how might liability be apportioned between shipowner and the manufacturers of the autonomous system under your national law?
Answer: **There is no existing law governing the regulation of unmanned or autonomous ships. In the absence of regulation, apportionment of liability will be governed by tort law.**
6.2. Arts. 3 and 4 of the 1910 Collision Convention provide for liability in cases of fault. As interpreted under your national law, does the fact that the non-liability situations listed in Art. 2 are not conversely linked to no-fault, leave room for the introduction of a no-fault (i.e. strict) liability (for e.g. unmanned ships) at a national level?
Answer: **Singapore is not a party to the 1910 Collision Convention. It is not impossible that a no-fault liability system could be introduced for unmanned or autonomous ships in future.**