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Who is the master now? Regulatory and contractual challenges of unmanned vessels.

Unmanned ships are coming, and coming soon. Kongsberg's 'Yara Birkeland' will be the world's first fully electric and autonomous container ship. It will be equipped with various proximity sensors, Radar, Lidar¹, AIS², Camera, Infra Red camera, and its connectivity and communication will be through maritime broadband radio, satellite communications, and GSM.³ Loading and discharging will be done automatically using electric cranes and equipment. Berthing and unberthing will be done without human intervention, through an automatic mooring system. The ship will sail within 12 nautical miles from the coast, between 3 ports in southern Norway. There will be three centres to handle emergency and exception handling, condition monitoring, operational monitoring, decision support, surveillance of the autonomous ship and its surroundings and all other aspects of safety. The planned time frame is for testing with a captain and small crew, placed in a container-based bridge, to start in the second half of 2018, delivery from the yard and testing of autonomous capability in 2019, with fully autonomous operation starting in 2020.

Where the 'Yara Birkeland' leads, other autonomous ships are sure to follow, initially with small coastal and inland waterway vessels. Autonomous ships offer the attraction of reducing accidents, with an estimated 80% of maritime accidents being due to human error. They also offer a reduction in wage costs, estimated to form 30% of a shipowner's operating costs, by eliminating an on-board crew. They may also offer fuel savings through the reduction in weight by eliminating the accommodation structure. However, autonomous vessels bring risks, notably that of a loss of control through malicious hacking, and loss of communication with shore-side control in periods of bad weather coupled with a reduction in datalink capacity. There will also be additional operational costs, such as the provision of shore-based controllers ('SBC') who will monitor the ship and navigate it remotely during sections of its voyage, as well as taking over navigation through remote operation when the ship gets into difficulty if weather and traffic conditions change considerably. The lack of an onboard crew will mean that no maintenance work can be done during the voyage, resulting in increased time in ports for such work. The lack of an onboard crew will also rule out the use of heavy fuel oil which is maintenance intensive and require the use of costlier marine diesel oil (MDO) or marine gas oil (MGO). Additionally, owners may need to use port agents to perform functions relating to loading and unloading of cargo, including issuing of bills of lading, which are currently performed by the master and crew.

Unmanned vessels will also pose challenges for compliance with the international regulatory framework established through the various conventions of the International Maritime Organisation ('IMO'). The IMO's Maritime Safety Committee (MSC) recently embarked on a regulatory scoping exercise on how safe, secure and environmentally sound Maritime Autonomous Surface Ships (MASS) operations may be addressed in IMO instruments.⁴ It has set out the following four point scale for MASS operations.

¹ Light, Detection and Ranging.

² Automatic Identification System.

³ Global System for Mobile Communication.

⁴ At the 99th Session of MSC 16-25 May 2018 a correspondence group on MASS was set up to test the framework of this regulatory scoping with a view of reporting back to its next session, MSC 100 (3-7 December 2018). The Correspondence Group will test the methodology by conducting an initial assessment of SOLAS regulation III/17-1 (Recovery of persons from the water), which requires all ships to have ship-specific plans and procedures for recovery of persons from the water; SOLAS regulation V/19.2 (Carriage requirements for carriage of shipborne navigational equipment and systems); and Load Lines regulation 10 (Information to be supplied to the master). If

1. Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated.
2. Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location, but seafarers are on board.
3. Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board.
4. Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself.

In this paper I propose to examine the challenges posed by the absence of an onboard crew on a cargo vessel. I shall examine the third scenario in the IMO's scale where there is no onboard crew but navigation is effected by a mixture of complete autonomy through voyage programming and human intervention through SBCs monitoring the vessel's progress throughout the voyage, undertaking some navigational operations themselves through remote operation, such as entering and leaving ports, and dealing with complex situations on the open seas which the autonomous algorithms are unable to deal with. I shall be looking at the role of the master in the absence of an onboard crew. Can there still be a master through the SBC? In part one of this paper considers this question in the light of the various international regulations that govern ships. In part two this paper will examine the question from the contractual perspective, with reference to the master's role under time and voyage charters.

Part One. Regulation and the Master⁵

The term 'master' is not defined in any international convention. *The International Law of the Shipmaster* defines the master as "a natural person who is responsible for a vessel and all things and persons in it and is responsible for enforcing the maritime laws of the flag state" – a definition which does not require such person be on board the vessel under their command.⁶ National laws provide various definitions. In the UK s.313 of the Merchant Shipping Act 1995 defines 'master' as "every person (except a pilot) having command or charge of a ship". The definition does not require on-board presence and could therefore encompass the SBC as remote operator of the vessel. It would not cover completely autonomous vessels as there would no longer be a person in command or charge of a ship whose navigation would be entirely under the control of the artificial intelligence with which it had been programmed. Other national laws define 'master' in such a way as to require presence on board the vessel.⁷

Manning requirements

time allows, it will also consider SOLAS regulations II-1/3-4 (Emergency towing arrangements and procedures) and V/22 (Navigation bridge visibility).

⁵ This paper will proceed on the assumption that an unmanned vessel will constitute a 'ship'. Professor Sozer, in a report attached to the CMI Working Group on Ship Nomenclature, <http://comitemaritime.org/wp-content/uploads/2018/05/Letter-to-Presidents-of-NMLAs-re-IWG-on-Vessel-Nomenclature-080316.pdf> <accessed 3September 2018>, analysed the definition of the terms in almost 20 key maritime conventions, and none link the definition of ship to the presence of crew on board.

⁶ John A C Cartner, Richard P Fiske, Tara L Leiter, Informa 2009, 86.

⁷ The CMI recently sent out a questionnaire on unmanned vessels to the Maritime Law Associations (MLA) of 19 States. The MLAs of Brazil, China, and Croatia stated that the master is defined as a person on board the ship. All 19 MLAs answered that neither the chief pre-programmer of an autonomous ship nor another designated person not immediately involved in the operation of the ship could constitute the master. See, 'Summary of responses to the CMI questionnaire. <http://www.comitemaritime.org/Unmanned-Ships/0,27153,115332,00.html> <accessed 26 July 2018>.

It will be for flag states to determine the acceptability of unmanned vessels. Under art. 91 of UNCLOS it is for every State “to 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.”⁸ However, the focus on the position of flag states as regards unmanned vessels should not let us lose sight of the equally important position of port states. UNCLOS does not qualify the rights of states to regulate the admission of vessels to their ports.⁹ In the absence of a satisfactory regulatory framework being established through the IMO it is likely that many states will deny admission to unmanned vessels into their ports. The initial phase of unmanned vessels is likely to be coastal trading within the territorial sea of the flag state – as contemplated for the ‘Yara Birkeland’.

Article 94 of UNCLOS sets out the duties of the flag state on manning of vessels. Paragraph 3 requires every State to “take such measures for ships flying its flag as are necessary to ensure safety at sea with regard, *inter alia*, to: (b) the manning of ships, labour conditions and the training of crews, taking into account the applicable international instruments;” Paragraph 4 provides that “Such measures shall include those necessary to ensure:(b) 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;” Paragraph 5 requires the flag state in taking these measures “[t]o conform to generally accepted international regulations, procedures and practices and to take any steps which may be necessary to secure their observance”.

These accepted international regulations are contained in the IMO Conventions. SOLAS¹⁰ chapter V, regulation 14 requires that “[f]rom the point of view of the safety of life at sea, all ships shall be sufficiently and efficiently manned”. This does not prescribe any particular level of manning, and does not require the presence of a crew on board. It is left to the flag state to decide what constitutes sufficient and efficient manning. There is no express requirement in any of the above provisions for at least one seafarer to be on board and it would be open for the flag state to decide that there would be sufficient and efficient manning with no onboard crew, provided there is proper assumption of crew functions by the SBC. The British Maritime Law Association, giving the UK response to the CMI’s recent questionnaire on unmanned vessels, stated that art. 94’s requirements were not prescriptive and arguably permitted unmanned operation if the relevant ship’s autonomous navigation system were sufficiently safe.

SOLAS Chapter V contains two regulations that may be problematic for unmanned vessels. First, Regulation 24 provides for reversion to manual steering in hazardous navigational situations when heading and/or track control systems are in use.

1. In areas of high traffic density, in conditions of restricted visibility and in all other hazardous navigational situations where heading and/or track control systems are in use, it shall be possible to establish manual control of the ship’s steering immediately.

⁸ Subject to the existence of a genuine link between the State and the ship. Article 91(2) provides that “Every State shall issue to ships to which it has granted the right to fly its flag documents to that effect.

⁹ An unmanned vessel will almost certainly constitute a ship and as such under art. 17 of UNCLOS would have the right of innocent passage through the territorial sea.

¹⁰ Exemptions. Chapter 1. Reg 4(b) allows the flag state to exempt any ship which embodies features of a novel kind from requirements of Chapters II-1, II-2, III and IV. Flag administrations may accept equivalent solutions if satisfied at least as effective as that required by SOLAS.

2. In circumstances as above, the officer in charge of the navigational watch shall have available without delay the services of a qualified helmsperson who shall be ready at all times to take over steering control.
3. The changeover from automatic to manual steering and vice versa shall be made by or under the supervision of a responsible officer.
4. The manual steering shall be tested after prolonged use of heading and/or track control systems, and before entering areas where navigation demands special caution.

Second, Regulation 15 deals with the requirements for Bridge layout and contemplates a physical bridge on the vessel. The virtual bridge on shore for unmanned vessels falls outside the requirements. However, Regulation 3(2) of Part 3, exemptions, provides:

The Administration 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 Administration has taken into account the effect such exemptions and equivalents may have upon the safety of all other ships.

With an unmanned vessel, the existence of a virtual bridge on shore would constitute a “condition affecting safety such as to make the full application of the chapter unreasonable or unnecessary”.

The International Regulations for the Preventing Collisions at Sea, 1972 (COLREGs)

The COLREGS provide the navigational rules for vessels to follow with the aim of avoiding collisions. In the UK they are currently implemented by regulation 6 of the Merchant Shipping (Distress Signals and Prevention of Collisions) Regulations 1996 (UK), which provides:

- (1) Where any of these Regulations is contravened, the owner of the vessel, the master and any person for the time being responsible for the conduct of the vessel shall each be guilty of an offence punishable on conviction on indictment by imprisonment for a term not exceeding two years and a fine, or on summary conviction by a fine:

The Rules apply “to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels” and would therefore apply equally to unmanned vessels as to manned. Compliance with the COLREGs could be programmed into the unmanned vessel’s navigation software, but there will be a dynamic interaction in the navigation of the vessel between completely autonomous navigation in accordance with the voyage programming, and navigation by remote control by the SBC. If the SBC can be regarded as the master, they would only fulfil that role during their periods of remote navigation, and monitoring during autonomous navigation. Alternatively, they would be a ‘person for the time being responsible for the conduct of the vessel.’ If there is a breach of COLREGs during a period of autonomous navigation, due to a defect in the navigational software or defective voyage programming, the SBC would probably not commit an offence, unless there was a failure to intervene and assume remote control of the vessel on becoming aware of the impending breach of the Regulation.¹¹ A further question would be whether the software manufacturer would have committed an offence as a person ‘for the time being responsible for the conduct of the vessel.’

Three particular Regulations pose challenges for compliance by unmanned vessels. First, there is Rule 2 ‘Responsibility’ which provides:

¹¹ Unless the SBC was also the voyage programmer and they had incorrectly programmed the voyage.

(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 special circumstances of the case.

(b) In construing and complying with these Rules due regard shall be had to all dangers of navigation and collision and 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 gives precedence to good seamanship over COLREG provisions. The rule presupposes the exercise of human judgment in the ‘ordinary practice of seamen’ and in the making of a decision to depart from the Rule when necessary to avoid immediate danger. This could be satisfied if the operating system provides the SBC with the ability to make informed nautical decisions and allows the vessel to act on the SBC’s remote instructions in good time. However, it would not be satisfied with a completely autonomous vessel.

Second, there is Rule 5 ‘Look out’ which provides: “Every vessel shall at all times maintain a proper look-out by sight and 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 of the risk of collision.” The reference to “by sight and hearing” requires human agency, but does not require an onboard presence. A look out through an on shore virtual bridge manned by an SBC would satisfy this requirement. However, a completely autonomous vessel would not comply with Rule 5.

Third, there is Rule 18 ‘Responsibilities between vessels’ which provides:

(a) A power-driven vessel must give way to all other vessels (except a seaplane); sailing vessel must give way to a vessel not under command, a vessel restricted in her ability to manoeuvre and a vessel engaged in fishing; a vessel engaged in fishing gives way to vessel not under command and a vessel restricted in her ability to manoeuvre.

Gogarty and Hagger have argued that manned vessels must give way to unmanned vessels as these are either ‘not under command’ or ‘restricted in her ability to manoeuvre’.¹²

These terms are defined in rule 3 as follows. “(f) The term “vessel not under command” means a vessel which through some exceptional circumstance is unable to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel.” The reference to ‘some exceptional circumstance’ would not cover a vessel which by its nature is unable to manoeuvre as required by the Rules, but probably would cover a situation where the vessel has lost communication with the shore. This would be subject to the unmanned vessel’s ability to display the appropriate lights and signals in the event of a loss of shore communication.¹³

“The term “vessel restricted in her ability to manoeuvre” means a vessel which from the nature of her work is restricted in her ability to manoeuvre as required by these Rules and is therefore unable to keep out of the way of another vessel. The term “vessels restricted in their ability to manoeuvre” shall include but not be limited to:

¹² Brendan Gogarty and Meredith Hagger, ‘The Laws of Man over Vehicles Unmanned: The Legal Response to Robotic Revolution on Sea, Land and Air’ (2008) 19 *Journal of Law, Information and Science* 73, 115.

¹³ Rule 27(a).

- (i) a vessel engaged in laying, servicing or picking up a navigation mark, submarine cable or pipeline;
- (ii) a vessel engaged in dredging, surveying or underwater operations;
- (iii) a vessel engaged in replenishment or transferring persons, provisions or cargo while underway;
- (iv) a vessel engaged in the launching or recovery of aircraft;
- (v) a vessel engaged in mine clearance operations;
- (vi) a vessel engaged in a towing operation such as severely restricts the towing vessel and her tow in their ability to deviate from their course.”

The restriction in ability to manoeuvre derives from the nature of the vessel’s work and not from the nature of the vessel itself and none of the specific instances would cover the ordinary operation of an unmanned cargo vessel. Accordingly, unmanned vessels will be subject to the same priority rules as apply to manned vessels.

The master’s duty to render assistance

Three conventions impose a personal duty on the master to render assistance to persons in distress at sea. This raises issues as who, if anyone, will constitute the master, and what would be the content of the obligation in the case of an unmanned ship. Article 98 (1) of the 1982 UN Convention on the Law of the Sea (‘UNCLOS’) provides:

Every state shall require the master of a ship flying its flag, *in so far as he can do so without serious danger to the ship* (emphasis added), the crew or the passengers:

- (a) to render assistance to any person found at sea in danger of being lost;
- (b) to proceed with all possible speed to the rescue of persons in distress, if informed of their need of assistance, *in so far as such action may reasonably be expected of him* (emphasis added);
- (c) after a collision, to render assistance to the other ship, its crew and its passengers and, where possible, to inform the other ship of the name of his own ship, its port of registry and the nearest port at which it will call.

Chapter V, Regulation 33 of the 1974 International Convention on the Safety of Life at Sea (‘SOLAS’) provides:

the master of *a ship at sea which is in a position to be able to provide assistance* (emphasis added), on receiving a signal from any source that persons are in distress at sea, is bound to proceed with all speed to their assistance, if possible informing them or the search and rescue service that the ship is doing so.

Article 11 of the 1910 Salvage Convention and Article 10(1) of the 1989 Salvage Convention provide:

Every master is bound, *so far as he can do so without serious danger to his vessel* (emphasis added) and persons thereon, to render assistance to any person in danger of being lost at sea.

The master’s obligation to render assistance is not absolute and is qualified by the italicised wordings: ‘in so far as he can do so without serious danger to the ship’; ‘in so far as such action can be reasonably expected of him’; ‘a ship at sea which is in a position to be able to provide assistance’; and, ‘so far as he can do so without serious danger to his vessel.’”

With an unmanned ship, the most that the SBC can do is to communicate the need for help to other vessels in the area and to the coastal authorities. Assuming the SBC can be regarded as the master for these purposes, their obligations cannot extend beyond this.¹⁴

The same is true of the two assistance obligations imposed under UK law by s.92 and s.93 of the Merchant Shipping Act 1995. In the event of a collision section 92 requires the master to render “such assistance as is practicable” to the other vessel. Section 93 requires the master “on receiving at sea a signal of distress [from an aircraft] or information from any source that [an] aircraft is in distress” to “[p]roceed with all speed to the assistance of the persons in distress the master to assist aircraft in distress “*unless he is unable* (emphasis added), or in the special circumstances of the case considers it unreasonable or unnecessary, to do so.” The italicised words again indicate that the SBC duty of assistance would be limited to one of communicating details of the aircraft in distress to other vessels in the area and the coastal authorities.

Similar issues arise with regards to the master’s powers and duties under the 1998 Convention for the Suppression of Unlawful Acts of Violence against the Safety of Maritime Navigation and its 2005 Protocol.¹⁵

The master’s documentary obligations

A variety of documentary obligations fall on the master under various international conventions. MARPOL provides reporting obligations in the event of oil spills and requires the keeping of various record books. The IMO civil liability conventions in force, the CLC 1969 and 1992, the Bunker Oil Pollution Convention 2001, the 2007 Nairobi Wreck Removal Convention, all contain mandatory insurance provisions with the requirement that a ‘blue card’ evidencing this be kept on board the vessel, as does EU Directive 2009/20/EC on the insurance of shipowners for maritime claims.¹⁶ The UK’s implementing legislation requires the certificate to be carried on board the ship and to be produced on demand by the master “to any officer of customs and excise or of the Secretary of State and, if the ship is a United Kingdom ship, to any proper officer”. Failure to do carry the certificate or to produce it as required renders the master liable on summary conviction to a fine not exceeding level 4 on the standard scale.¹⁷ Unmanned vessels cannot comply with these regulations and provisions will need to be made to allow the provision of these certificates to be made electronically.¹⁸

Watchkeeping

Article III of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended in 1995, 1997, and 2010 (‘STCW’) provides that “The Convention shall apply to seafarers serving on board seagoing ships entitled to fly the flag of a Party...” which would rule out its application to unmanned vessels. However, Regulation VIII/2(2) provides an obligation on flag administrations to: “require the master of every ship to ensure that watchkeeping arrangements are adequate for maintaining a safe watch

¹⁴ Similar problems arise with regard to the master’s obligations under

¹⁵ Article 8 and Article 8 bis of the 2005 Protocol.

¹⁶ The UK has implemented this through The Merchant Shipping (Compulsory Insurance of Shipowners for Maritime Claims) Regulations 2012, SI 2012 no 2267. Implementing EU Directive 2009/20/EC on the insurance of shipowners for maritime claims.

¹⁷ Section 163 (6).

¹⁸ The FAL Convention has made provision for the certificates it requires to be provided in electronic form but this does not affect the certification requirements in the IMO Civil Liability Conventions or in EU Directive 2009/20/EC on the insurance of shipowners for maritime claims.

or watches, taking into account the prevailing circumstances and conditions and that, under the master's general direction:1 officers in charge of the navigational watch are responsible for navigating the ship safely during their periods of duty, when they shall be physically present on the navigating bridge or in a directly associated location such as the chartroom or bridge control room at all times;” This clearly requires a physical presence on the vessel for watchkeeping and as matters currently stand the flag state administration would not be able to comply with the regulation with an unmanned vessel.

In the UK the STCW is implemented through the Merchant Shipping (Standards of Training Certification and Watchkeeping) Regulations 2015 (UK) 782. Part 2 of the regulations is concerned with training and certification and applies to a seafarer serving on board a sea-going ship registered in the UK, but part 4, which covers safe manning and watchkeeping apply to sea-going ships which are: (a) UK ships wherever they are; and (b) other ships when in UK waters. Part 4, regs 47-49, brings in the watch keeping requirements in Regulation VIII/2 of the STCW which require a physical presence on the navigating bridge or a directly associated location such as the chartroom or bridge control room at all times. Regulation 46 also brings in documentary requirements as to manning. A UK ship must have in force safe manning document issued by the Secretary of State in respect of the ship and the manning of the ship, which must be kept on board the ship at all times.¹⁹ The master must ensure that the ship does not proceed to sea unless there is on board a valid safe manning document issued in respect of the ship and the manning of the ship complies with that document. Neither requirement can be satisfied with an unmanned vessel.

However, regulation 50 provides that “The Secretary of State may grant on such terms, if any, as may be specified, exemptions from all or any of the provisions of this Part for classes of case or individual cases, and may amend or cancel any exemptions so granted.” Presumably exemptions could be granted in both cases provided the Secretary of State was satisfied as to the on shore virtual watchkeeping arrangements for the unmanned vessel, and was prepared to accept an electronic version of the safe manning document which would be accessible at all times to the relevant maritime authorities.

Labour law and seafarers

The SBC may undertake many of the functions of the master, but their employment will be entirely shore bound. The International Labour Organisation’s Maritime Labour Convention 2006 deals with the living and working conditions of seafarers, defined in art. 2(f) as “any person who is employed or engaged or works in any capacity on board a ship to which this Convention applies.” Clearly, the Convention will have no relevance to unmanned ships which have no crew on board. Similarly, the master’s lien for wages and disbursements will not be available to the SBC. The lien presupposes some onboard presence on the vessel by the master as part of the crew.²⁰ The provisions in Part III of the Merchant Shipping Act 1995 which

¹⁹ Merchant Shipping (Standards of Training Certification and Watchkeeping) Regulations 2015 (UK) 782. Part 4 Reg 46.

²⁰ See Clarke J in *The Ever Success* [1999] 1 Lloyd's Rep. 824, 832.

“In my judgment the authorities show that a master or a seaman is entitled to wages and thus to a co-extensive maritime lien if he renders the service appropriate to his rank. That is as, say, master, chief engineer or seaman. He must be part of the crew of the ship, but need not necessarily render the service on board the ship or live on board the ship, but the service must be in a real sense referable to the ship and the service must be rendered during a period when the particular claimant can fairly be said to be part of the crew of the ship.” The SBC can not be said to be part of the crew of the ship, as there is no crew.

apply to “masters and seamen employed *in* sea-going ships (emphasis added)” will also have no application to the SBC who is not employed in a sea-going ship.

The master’s civil liability

The master’s conduct of the vessel may expose them to liabilities in tort for damage or loss of property or for personal injury or death. There are three provisions in international conventions that may protect the master from such liability, either in full or by limiting their exposure. First, art.III (4) of the 1992 CLC provides for responder immunity for the following parties.

- (a) the servants or agents of the owner or the members of the crew;
- (b) the pilot or any other person who, without being a member of the crew, performs services for the ship;
- (c) any charterer (how so ever described, including a bareboat charterer), manager or operator of the ship;
- (d) any person performing salvage operations with the consent of the owner or on the instructions of a competent public authority;
- (e) any person taking preventive measures;
- (f) all servants or agents of persons mentioned in subparagraphs (c), (d) and (e); unless the damage resulted from their personal act or omission, committed with the intent to cause such damage, or recklessly and with knowledge that such damage would probably result.

If the SBC is employed by the owner they would fall within (a). If the SBC is an independent contractor they would most likely fall within heading (a) as an ‘agent of the owner’, or within heading (b) as a person who, without being a member of the crew, performs services for the ship or an ‘operator’ under heading (c).

Second, art. 1(4) of the 1976 LLMC provides: “If any claims set out in Article 2 are made against any person for whose act, neglect or default the shipowner or salvor is responsible, such person shall be entitled to avail himself of the limitation of liability provided for in this Convention.” If the SBC is employed by the shipowner, then they will be able to limit liability under the Convention. If, however, they are an independent contractor they will not be a person for whose, act neglect or default the shipowner or salvor is responsible, and will not, therefore, be able to limit liability.²¹

Third, art. IV(bis) of the Hague-Visby Rules provides protection for the servant or agent of the carrier if they are sued in respect of loss or damage to goods covered by a contract of carriage falling under the Hague-Visby Rules, by extending to them the benefit of the carrier’s defences and limits of liability under the Rules. This protection does not cover a servant or agent who is an independent contractor. If the SBC is employed by the owner they will be protected, but if they are an independent contractor they would have to rely on a ‘Himalaya’ clause in the bill of lading, whether the action be founded in contract or in tort.

Criminal law and the master

²¹ In *JD Irving Ltd v. Siemens Canada Ltd (The SPM 125)* 2016 FC 287 the Federal Court of Canada held that Article 1(4) would afford limitation to a person only if the shipowner or salvor has vicarious liability for the actions of that person. The claim was brought against a firm of marine consultants to prepare stability calculations in respect of the loading of a cargo of large industrial equipment on and off the barge *SPM125*. As the shipowner would not be vicariously liable for the defaults of an independent contractor, the marine consultants were unable to limit their liability under 1976 LLMC

The master may face criminal charges in respect of his operation of the vessel before the courts of a coastal state. A notorious example of this is the prison sentence imposed by the Spanish Courts on Captain Mangouras, the master of the 'Prestige', in connection with the oil spill from the vessel when it broke up in Spain's EEZ in 2002. In the UK the master can incur liability in respect of a failure with regard to the failure to have on board, or to produce for inspection, the 'blue card' in respect of mandatory liability provisions. The master, together with the owner, is guilty of an offence if a ship which is in a port in the United Kingdom, or is a United Kingdom ship and is in any other port, is dangerously unsafe²², and also for failure to carry an oil record book in a UK ship.²³ Discharges of oil into the sea when done with intent, (ii) recklessly, or (iii) with serious negligence attract the highest penal sanctions with the owner and master liable for a fine of up to £250,000.²⁴ It should be noted that unmanned ships make it much harder for a port state to get hold of the functional equivalent of the master who may be located in a distant state.²⁵

Part II. Maritime Contracts and the Master.

The navigational role of the master will be spread among two human participants, the programmer of the software for the vessel's autonomous operation on the voyage, and the SBC who will monitor the vessel's progress throughout its voyage and undertake navigation by remote operation for certain sections of the voyage. The programmer may or may not be the same person as the SBC, and programming may be performed by employees of the shipowner or by an independent contractor providing navigational services to owners of unmanned vessel. The master also has non-navigational functions. The master supervises the loading, stowing and discharge of the cargo carried on the vessel. The master signs bills of lading. These functions will require physical presence at the ports of loading and discharge, so cannot be assigned to the SBC. Owners will need to engage port agents to fulfil these functions. In this second section, I shall consider how charterparty forms will need to be adapted to accommodate the diffusion of the roles of the master to various land-based personnel. I shall take NYPE 2015 as a time charter example, and GENCON 1994 as a voyage charter.

NYPE 2015

Clause 2 imposes an obligation on owners that the vessel on delivery shall be seaworthy and in every way fit to be employed for the intended service, including the full complement of master, officers and ratings who meet the Standards for Training, Certification and Watchkeeping for Seafarers (STCW) requirements for a vessel of her tonnage. With an unmanned vessel these requirements will not be able to be satisfied even if the SBC could be regarded as the master, as the STCW requirements will not apply to onshore personnel. The

²² Section 98(1) of the Merchant Shipping Act 1995.

²³ Section 142 of the Merchant Shipping Act 1995.

²⁴ The Merchant Shipping (Prevention of Oil Pollution) Regulations 1996 Regulation 36A applying penalties to breaches of Regulations 12, 13 and 16. The Regulation gives effect to of MARPOL and the stricter implementation of these regulations in EU Directive 2009.

²⁵ Veal, R & Tsimplis, M, 'The integration of unmanned ships into the *lex maritima*', (2017) L.M.C.L.Q. 303, 318, write that "One option would be a representative of the unmanned shipping company in each country who would be criminally liable for the ship's actions, in addition to the shore-based "master" and the owner. Such an arrangement could be effected by coastal states as a condition of entry of unmanned ships into their ports." Effectively, the employment of a hostage in every port of call.

owners' obligations as regards crew reappear in cl. 6 which requires the vessel to have a full complement of master, officer and ratings.

Other navigational obligations appear in cl.12(b) obliging the master to comply with the reporting procedure of the Charterers' weather routing service and to follow routing recommendations from that service provided that the safety of the Vessel and/or cargo is not compromised. There is also cl.38 which gives the Charterers the right to give instructions to the master as to slow steaming and ultra slow steaming, and cl. 15 which provides for the Charterers to furnish the master from time to time with all requisite instructions and sailing directions, in writing, in the English language, and for the master shall keep full and correct deck and engine logs of the voyage or voyages. Cl. 30, the BIMCO Hull Fouling Clause for Charterparties provides for cleaning always to be under the supervision of the master.

Clause 8 contains three important obligations involving the master which are fundamental to the contractual structure of a time charter. The master is to perform the voyages with due despatch. The master is to be under the orders and directions of the Charterers as regards employment and agency.²⁶ Charterers are to perform all cargo handling, under the supervision of the master.²⁷ It is possible that three distinct entities perform these functions: the voyage programmer; the SBC; the owners' agent at the loading and discharge port. The form could be amended by replacing the reference to the master with a simple reference to owners, or to owners and their agents.

The master's involvement with cargo operations appear at various places in the form. In addition to the supervision of cargo handling by charterers referred to in cl.8, the master is entitled to refuse cargoes or, if already loaded, to unload them at the Charterers' risk and expense if the Charterers fail to fulfil their IMSBC Code or IMDG Code obligations as applicable.²⁸ The important matter of bills of lading is dealt with in cl.31 which reiterates the familiar obligation of the master to sign bills of lading or waybills for cargo as presented in conformity with mates' receipts. This is not a function that the SBC could perform, given that paper bills of lading will still be required. Alternatively, the Charterers or their agents may sign bills of lading or waybills on behalf of the but this is subject to the Owners'/master's prior written authority, always in conformity with mates' receipts. Provision of mates' receipts is probably not something that the SBC is going to be able to perform remotely and will fall to owners' port agents. The clause could be amended, as with cl.8 to replace 'the master' with 'owners' agents'. Clause 27 provides for cargo claims as between owners and charterers to be settled in accordance with the Inter-Club NYPE Agreement 1996 (as amended 1 September 2011), or any subsequent modification or replacement thereof.

²⁶ The nomination of ports is subject to an implied warranty that the port is prospectively safe. The obligation to nominate a safe port will extend to nomination of ports that have the facilities, such as sufficient internet access, to accommodate unmanned vessels.

²⁷ This will make charterers responsible for these operations. The addition of the words 'and responsibility' after 'supervision' will shift responsibility back to the shipowners.

²⁸ 29.Solid Bulk Cargoes/Dangerous Goods. "The Master shall be entitled to refuse cargoes or, if already loaded, to unload them at the Charterers' risk and expense if the Charterers fail to fulfil their IMSBC Code or IMDG Code obligations as applicable."

Similar amendments will also be needed to clauses giving the master discretion as regards entry into areas affected by war risks²⁹ and piracy³⁰ as well as cl. 37 which requires the master to notify charterers of stevedore damage to the vessel within 24 hours. The reference in the off-hire provisions in cl.17 to “time lost from deficiency and/or default and/or strike of officers or crew” becomes redundant unless redrafted to refer to “servants or agents of the owners involved in the performance of the charter.” Clause 33(a) incorporates the ‘both to blame collision clause’ with its reference to any act, neglect or default of the Master, Mariner, Pilot or the servants of the Owners in the navigation or in the management of the vessel”. This could still cover defaults of the SBC as the functional equivalent of the master but could be amended to so that it refers to ‘the servants or agents of the Owners in the performance of this charter’. Other clauses in the form will be redundant with an unmanned vessel, such as that part of cl.13 on the space available to charterers that refers to accommodation for supercargo, and the reservation of proper and sufficient space for the vessel’s master, officers, ratings, tackle, apparel, furniture, provisions, stores, cl.14 on charterer’s right to put a supercargo onboard, and cl.43 on smuggling by the master, other officers and ratings.

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The form refers to crew or master in the following places.

Clause.2 provides owners with a general exemption “even from the neglect or default of the Master or crew or *some other person employed by the Owners on board or ashore for whose acts they would but for this Clause*, be responsible or from unseaworthiness of the vessel... (emphasis added)”. The italicised words show that the exemption would continue to operate as regards errors by either the voyage programmer or the SBC.

Clause 5(c) provides for the master to give charterers notification of stevedore damage as soon as is reasonably possible and to endeavour to obtain stevedores’ written acknowledgment of liability. This is a function that could not be performed by the SBC and would have to be performed by owners’ agents at the ports of loading and discharge.

Clause.6 provides for “the vessel to give NOR if berth not available on vessel’s arrival on or off the port. Master to warrant that she is ready in all respects.” The SBC could give this warranty of readiness.

Clause. 10. Bill of lading to be signed by Master or by owners’ agents. There would be no problem here with the absence of a conventional onboard master as owners’ agents at the loading port could sign the bills.

²⁹ 34. BIMCO War Risks Clause CONWARTIME 2013

The Vessel shall not be obliged to proceed or required to continue to or through, any port, place, area or zone, or any waterway or canal (hereinafter “Area”), where it appears that the Vessel, cargo, crew or other persons on board the Vessel, in the reasonable judgement of the Master and/or the Owners, may be exposed to War Risks whether such risk existed at the time of entering into this Charter Party or occurred thereafter.

³⁰ 39. BIMCO Piracy Clause for Time Charter 717 Parties 2013

(a) The Vessel shall not be obliged to proceed or required to continue to or through, any port, place, area or zone, or any waterway or canal (hereinafter “Area”) which, in the reasonable judgement of the Master and/or the Owners, is dangerous to the Vessel, her cargo, crew or other persons on board the Vessel due to any actual, threatened or reported acts of piracy and/or violent robbery and/or capture/seizure (hereinafter “Piracy”), whether such risk existed at the time of entering into this Charter Party or occurred thereafter.

Clause 11 contains the “Both to blame collision clause” which could be amended to so that it refers to ‘the servants or agents of the Owners in the performance of this charter’.

There are then three clauses involving the role of the master or owners in the event of: strikes, cl.16 General strike clause; war, cl.17 War Risks clause, and; ice, cl.18 General ICE clause. The latter contains a reference to the master’s right to leave the loading port for fear of being frozen in, and this could be exercised by the SBC.

General Average

With an unmanned vessel jettison is unlikely to be a general average event, and expenses under rule XI for the wages and maintenance of crew in, to and at a port of refuge becomes otiose. The wages of the SBC during the vessel putting in to a port of refuge will not fall within this rule.

Salvage

The master appears in various places in the 1989 Salvage Convention. Article 6(2) provides: “The master shall have the authority to conclude contracts for salvage operations on behalf of the owner of the vessel. The master or the owner of the vessel shall have the authority to conclude such contracts on behalf of the owner of the property on board the vessel.” Should the SBC have this authority to conclude salvage contracts for the vessel owner? The provision is premised on there being an onboard master who is in a position to contract in an emergency. Once the master goes onshore, the need for this authority disappears. Owners can make salvage contracts as easily as the SBC. The master’s duty of assistance under article 10 has already been mentioned. Other provisions refer to the ‘master or owners’ and would not pose any problem with the operation of an unmanned vessel.³¹

Bills of lading.

This is the subject of another paper in the colloquium. In brief, the Hague and Hague-Visby Rules will operate as regards carriage of cargoes in bills of lading when carried in unmanned vessels. It is the contract of carriage between the carrier and the shipper, the fact of carriage by sea, and the existence, or contractual contemplation, of a bill of lading that determines the applicability of the Rules. The nature of the ship in which the goods are carried is of no import.³² Similarly COGSA 1992 will also operate as regards the vesting of rights and obligations under bills of lading, waybills and ships delivery orders.³³

³¹ Articles 8, 15 and 19.

³² The one change will be in relation to the operation of art. IV (2)(a) which provides the carrier with a defence in the event of loss or damage being caused by “Act, neglect, or default of the master, mariner, pilot, or the servants of the carrier in the navigation or in the management of the ship”. The absence of an on-board crew might be thought to remove this exception when the goods are being carried by an unmanned vessel. However, it is possible to regard the SBC as the functional equivalent of the master and therefore the carrier would still be able to rely on the exception in respect of loss or damage caused by any errors of navigation on their part. If the SBC is not regarded as the ‘master’ then they could constitute a ‘servant of the carrier’, although if the SBC is not employed by the carrier but is an independent contractor this would not be the case. It is doubtful whether negligence by the voyage programmer would fall within the exception as such negligence would render the vessel unseaworthy. Establishing the vessel’s seaworthiness will now need to take in both onboard conditions and shore-based conditions.

³³ The sole reference to the master in COGSA 1992 is in s.4 “A bill of lading which— (a) represents goods to have been shipped on board a vessel or to have been received for shipment on board a vessel; and (b) has been signed

Piracy

An unmanned vessel becomes effectively immune to attack by pirates. Control of the vessel may be obtained through hacking and taking control of its voyage software. This will not constitute piracy which is defined in art. 101 of UNCLOS as: “(a) any illegal acts of violence or detention, or any act of depredation, committed for private ends by the crew or the passengers of a private ship or a private aircraft, and directed: (i) on the high seas, against another ship or aircraft, or against persons or property on board such ship or aircraft; (ii) against a ship, aircraft, persons or property in a place outside the jurisdiction of any State;” This virtual means of taking control of a vessel will not involve any action “by the crew or the passengers of a private ship or a private aircraft.”³⁴

Pilotage

A pilot is a navigational advisor but the vessel remains under the command of the master and the shipowner is vicariously liable for any negligence on the part of the pilot, whether the pilotage be compulsory or not. The AAWA project contemplates that on entering or leaving a port the SBC will either choose to ‘take teleoperation type control or increase the supervision level of the vessel’.³⁵ It may, however, be the case that autonomous berthing will not be permitted by the port authority in which case some form of pilotage will be required.³⁶ This will involve a split in the remote operation of the vessel, assuming that the vessel cannot be boarded.³⁷ Luci Carey has identified various problems that this will entail.

The master is the person who remains responsible for the safety of the ship. If the ‘master’ is the SBO in another country, communicating with a pilot who may not be familiar with the operation of an autonomous ship, does the master really have command? Does the pilot have control? These concepts do not sit easily with the operation of an autonomous ship. The issue here is control. A pilot cannot take control of an autonomous ship unless the pilot is either able to instruct the SBO or board the ship and operate it manually. This assumes the pilot has not only local knowledge but also knowledge of how the autonomous ship operates. What happens if communications are lost? Who is liable for any loss that is incurred? Therefore it is crucial to identify the person that is ‘in command’ in relation to an autonomous ship. If the pilot has control of the autonomous ship, it may not be possible for the SBO, who is not only not

by the master of the vessel or by a person who was not the master but had the express, implied or apparent authority of the carrier to sign bills of lading, shall, in favour of a person who has become the lawful holder of the bill, be conclusive evidence against the carrier of the shipment of the goods or, as the case may be, of their receipt for shipment.” The italicised words show that the section will operate even when the bill is not signed by the master.

³⁴ The term ‘Pirates’ is defined in the Schedule to the Marine Insurance Act 1906 as including ‘passengers who mutiny and rioters who attack the ship from the shore.’ Carver’s Carriage by Sea (12th ed.), par. 183, has the definition: “Piracy is forcible robbery at sea, whether committed by marauders from outside the ship, or by mariners or passengers within it.” This was repeated in the fourth edition and was approved by Kennedy LJ in *Republic of Bolivia v. Indemnity Mutual Marine Assurance Co. Ltd.*, [1909] 1 K.B. 785,802.

³⁵ AAWA, ‘Remote and Autonomous Ships – The next steps’ (Position Paper, Rolls-Royce plc, 2016), 12. <https://www.utu.fi/en/units/law/research/research-projects/Pages/aawa.aspx> <accessed 17 August 2018>

³⁶ The AAWA project also suggests that either the SBC could become a licensed pilot for compulsory pilotage areas, or the autonomous ship could be given an exemption from the pilotage requirement. AAWA, ‘Remote and Autonomous Ships – The next steps’ (Position Paper, Rolls-Royce plc, 2016), 12.

³⁷ At common law there could be no pilotage in this situation as pilotage only begins once the pilot is ‘on board [emphasis added] at a particular place for the purpose of conducting a ship through a river, road or channel or from or into a port’. *The Adoni* [1918] P 14.

on board beside the pilot but quite possibly in another country altogether, to wrest control back again in the event the pilot appears to be in error.³⁸

If the pilot is in control, will the rule that the shipowner is vicariously liable for the pilot still apply?

Conclusion

Unmanned vessels will lead first to a fragmentation of the role of the master, and then to his disappearance. With level 3 autonomous operation, the SBC will be able to be regarded as the functional equivalent of the master for some purposes in that they are the human entity that is in command of the vessel's navigation through remote operation. However, it is unlikely that the SBC can be regarded as the functional equivalent of the master for all navigational purposes. Navigation of a vessel at level 3 involves three elements: (i) the voyage software; (ii) the programming of the voyage; (iii) the remote monitoring of the voyage and the assumption of remote navigational control where needed by the SBC. The second and third of these elements involve human agency but the demarcation between these two is an issue that needs to be addressed in determining "who is the master now?". Level 3 autonomy will see the 'part master'. Indeed, if the SBC is treated as the functional equivalent of the master, we will see a multiplicity of masters. The SBCs will be land based. Assume three shifts in a 24 hour period you will have three persons in remote control of the vessel during a day. With a long voyage SBCs in another time zone may also be used, which would bring the total number of potential masters up to six. Furthermore, each controller will probably be in remote control of more than one vessel in their shift. A far cry from the traditional practice of one ship, one master. When we reach level 4 with full automation the master will disappear and become the 'past master'.

The CMI has produced a spreadsheet in its submission to the IMO identifying provisions in the IMO regulations that will need clarification or amendment to deal with unmanned vessels, and identifies numerous provisions with the comment 'interpretation of the master'.³⁹ The issue of the documentation that needs to be carried on board vessels, such as the 'blue card' evidencing that mandatory liability insurance is in place, will also need to be addressed by allowing these requirements to be satisfied by electronic certificates. The STCW will need to be adapted to provide for training and certification standards for remote onshore controllers. There is also the need for the IMO to develop regulations on software security. BIMCO and the Comité International Radio Maritime, an organisation involved in the development of the marine electronics industry, have jointly prepared a proposed software maintenance standard that has been sent to the IMO for review. Its goal is to ensure software updates are secure and systematic for maintenance and to minimise hacking and malware problems.⁴⁰ The urgency of this issue was brought home by the disruption to Maersk's operation over ten days in the summer of 2017 as a result of collateral damage from the 'nopetya' programme which probably originated as a cyber attack by Russia on Ukraine by introducing malware into a popular Ukrainian accounting package called 'M.E.Doc'.⁴¹

³⁸ Luci Carey, All Hands Off Deck? The Legal Barriers to Autonomous Ships. NUS Law Working Paper No. 2017/011. NUS Centre for Maritime Law Working Paper 17/0626. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3025882 <accessed 17 August 2018>.

³⁹ ANNEX 2 to the CMI IWG Submission to MSC 99th Session.

⁴⁰ IMO was due to consider the standard at the NCSR meeting in February 2018. Pilot tests for the standard were carried out in 2017, and ISO has provisionally accepted the proposal. BIMCO said it expects a working group to complete the standard in 2021, when cyber security is due to become part of ISO standards.

⁴¹ IMO has issued [MSC-FAL.1/Circ.3 Guidelines on maritime cyber risk management](#) and the Maritime Safety Committee, at its 98th session in June 2017, also adopted [Resolution MSC.428\(98\)](#) - Maritime Cyber Risk Management in Safety Management Systems. The resolution encourages administrations to ensure that cyber risks

Contractually, the master's role will also undergo substantial change. There will be no onboard master to sign bills of lading, to supervise cargo operations, to receive instructions from time charterers as to the vessel's employment. It is unlikely that these functions will fall to the SBC and owners will have to fulfil them through employing port agents. However, this should not provide a serious problem for the contractual forms used in chartering and carriage of goods. Owners' contractual obligations will remain the same, irrespective of who is navigating the vessel and who is signing bills of lading. There is much to be said for the removal of all references to the master in charters and bills of lading and replacing them with a reference to 'owners'.

are appropriately addressed in existing safety management systems (as defined in the ISM Code) no later than the first annual verification of the company's Document of Compliance after 1 January 2021.

However,

Various regulations impose direct obligations on the master, as the person in charge of the vessel. On whom will these fall if there is no one on board the vessel? Do we need to impose such obligations? Could they fall simply on the vessel owner?

The software programming of the voyage must allow for alterations of the voyage, to cope with changes of port ordered by the charterer, or changes of destination after a charter is cancelled.

The obligation to nominate a safe port will extend to nomination of ports that have the facilities, such as sufficient internet access, to accommodate unmanned vessels.